NATURAL HERITAGE INVENTORY
OF SIGNIFICANT ANIMALS AND PLANTS
AND
CLASSIFICATION OF RIPARIAN PLANT ASSOCIATIONS

TIMPAS AND KIM GRAZING DISTRICTS

Prepared for:

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EXECUTIVE SUMMARY

In 1995, the Colorado Natural Heritage Program (CNHP) joined efforts through a Challenge Cost-Share Agreement with the Pike and San Isabel National Forests to conduct a Natural Heritage Inventory and concurrently to inventory and classify riparian and wetland plant associations on the Timpas and Kim Districts of the Comanche National Grassland. The Natural Heritage Inventory and the riparian inventory were conducted independently. The data are synthesized in this report to promote the understanding of what are inseparable aspects of the Comanche National Grasslands.

Natural Heritage Inventory

The goal of the Natural Heritage Inventory was to systematically identify the localities of rare, threatened, or endangered species and the locations of significant natural communities (as represented by plant associations) in the Timpas and Kim Grazing Districts, both of which are located in the Comanche National Grassland.

The Natural Heritage Inventory was conducted in seven steps:

1. Review topographic maps, soil maps, geological maps, and GIS riparian\wetland overlays..

2. Review the Colorado Natural Heritage Biological Conservation Database for known occurrences.

3. Gather existing information, such as published and unpublished reports, museum and herbarium records, maps, and personal communications with experts.

4. Determine and map the "Target Inventory Areas" (TIAs) from information gathered in steps 1, 2, and 3.

5. Perform initial ground surveys.

6. Complete a field inventory of the TIAs.

7. Compile the results and prepare a final report including recommendations for Conservation Sites.

At the completion of the inventory, CNHP has records of **seven** rare or imperiled vertebrate species, **zero** rare invertebrate species, **one** rare plant species, and **four** watch-listed animal species (Colorado Natural Heritage Program 1995). Twenty eight Targeted Inventory Areas (TIAs) were identified during preparatory stages of the inventory. Of these, **twelve** were found to support rare/imperiled species. New locational information as well as updated information for previously known locations has been entered into CNHP's Biological and Conservation Database. Additionally, **nine** Conservation Sites were identified from the riparian classification survey that support high quality occurrences.

Riparian Plant Association Inventory and Classification

Riparian[1] habitats on the Comanche National Grassland were sampled with 76 transects on sites ranging from ephemeral streams that are dry much of the growing season to perennially wet swales along major stream courses. The sampled stands were classified into 19 plant associations based on dominant species, species composition, and community structure. The 19 plant associations are classified into 11 alliances based on a single dominant species. The plant associations are placed in the context of The Nature Conservancy's Preliminary Vegetation Classification of the Western United States (Bourgeron and Engelking 1994), which is based on the UNESCO Physiognomic-Ecological Classification of Plant Formations of the Earth (1973) as revised by Driscoll *et al.* (1984).

For each plant association, this report describes its distribution in the state and region, vegetation composition, and environmental conditions where it is found (i.e., geomorphologic setting, hydrology, etc.). Plant association descriptions also include notes on successional status and management as well as a list of other wetland plant species with which it may be found. The relationship of each plant association to previously described associations is also discussed. A dichotomous key to the plant associations is provided.

The plant association descriptions provide a thorough picture of mesic and hydric areas on the Comanche National Grassland, especially since every site considered for sampling was visited. Unfortunately, little of our data can be used to formulate a natural vegetation baseline or an image of expected natural vegetation at a site. Our field survey results indicate that virtually every riparian site on the Grassland has been influenced to some notable degree by historic, post-settlement activities. More than 80% of the sites visited have been profoundly influenced by weed infestations, grazing, hydrological alterations, etc.

This report presents ideas relevant to the effects of cattle on riparian areas. It is based on information from existing literature and on the experience of the 1995 field season. The data gathered during the 1995 field season did not allow us to quantify the degree or exact nature of the effects of livestock grazing on mesic and hydric habitats. However , now that a complete classification of riparian areas is available, a study on the effects of various grazing regimes within vegetation types is possible and advised.

The results of the riparian inventory suggest that non-native adventitious plants, particularly cheatgrass and tamarisk, pose a major threat to the natural vegetation and associated fauna. At many of the sites sampled, these species dominate the plant association, while elsewhere weedy species dominate the understory beneath a native canopy.

In addition to riparian plant associations sampled, thirteen transects were sampled on slopes of canyons and arroyos that cannot be classified as riparian areas. These plant associations are briefly described in terms of species composition and habitat in order to provide a more complete portrait of the vegetation on the Comanche National Grassland. Since they are not riparian, these plant associations are were not formally classified.

Conservation Planning Areas and Recommendations

[1] Henceforth in this report, "riparian" will be used to refer to both riparian and wetland areas.

The completion of the Natural Heritage inventory and the riparian study resulted in 19 significant Conservation Sites which range in size from 80 to 1,200 acres. CNHP developed conservation planning boundaries for all 21 Conservation Sites. In developing these boundaries, CNHP scientists considered a number of factors including known occurrences, and the habitat needed to protect the significant ecological processes. When necessary, a buffer was included to protect the site from potentially detrimental land uses.

The delineation of conservation planning boundaries in this report does not confer any regulatory protection on recommended areas. These boundaries are intended to be used to support wise planning and decision-making for the conservation of these significant resources. CNHP encourages the Pike and San Isabel National Forests and Comanche National Grassland to take appropriate actions to protect these sites. CNHP offers its assistance in working with the Pike and San Isabel National Forests to ensure protection of these areas.

This report includes three recommendations for the Comanche National Grassland:

1. Facilitate the designation of appropriate areas as Special Management Areas, Special Interest Areas, or Research Natural Areas.

2. Properly manage all areas known to be inhabited by sensitive, rare, threatened, or endangered species, or the locations of significant natural communities to assure that these elements of natural diversity persist within the context of a natural ecosystem.

3. Continue inventory/survey and research efforts in the study area, particularly for rare, threatened, and endangered animal and plant species.

INTRODUCTION

In May 1995, the Colorado Natural Heritage Program (CNHP) was contracted by the Pike and San Isabel National Forests to conduct an inventory of the Timpas and Kim Grazing Districts within the Comanche National Grassland. The goal of the inventory was twofold: (1) to systematically identify those sites supporting natural heritage resources, and (2) to develop a classification of riparian plant associations on the Comanche National Grassland.

Natural heritage resources are defined as the rare, threatened, endangered, or sensitive species and significant natural communities (plant associations) that are monitored for their biodiversity significance by the CNHP (CNHP 1995). Significant natural communities include both rare communities and common communities in very good condition. The natural heritage resource inventory covered the full span of elements on the Grassland, including uplands and wetlands, canyons and plains. The results of this inventory are presented herein on both a species-by-species basis, and in the context of the sites where they are found.

The vegetation classification part of this study focused on riparian areas. Riparian areas are defined as the interface between the riverine aquatic ecosystem and the adjacent upland ecosystem (Gregory *et al*. 1991; Risser 1990; Knopf *et al*. 1988). These areas are affected by frequent flooding, fluctuating water tables, and/or seasonal saturation regimes. Riparian areas have notable differences in soils, plant species composition, and topography when compared to the adjacent upland (Elmore and Beschta 1987; Jones 1990). On the arid Comanche National Grassland, riparian areas include intermittent or ephemeral drainage draws, swales, channels, and arroyos as well as wet areas fed by springs. They also include areas along the only perennial stream in the study area, Timpas Creek. All areas sampled in this study receive substantial moisture in the spring and additional moisture with summer thunder storms and are different from the adjacent upland in soil, plant species composition, and, even if slightly in some cases, topography.

The non-riparian communities in the canyons and uplands were not sampled by CNHP. Although community ecologists from Colorado State University (CSU) did sample and classify the upland (non-riparian) communities on the open prairie. In order to ensure that the Comanche National Grassland had representative vegetation sampling from the full range of vegetation types in the study area, CNHP researchers filled this gap by sampling thirteen stands of canyon slope and bench vegetation. These stands were not formally classified as the riparian stands were, but a brief description of the stands is provided.

An important part of this type of classification work is both quantitative and qualitative information. This information is conveyed for specific and general plant associations throughout the classification section of this report. Another important aspect is the identification of sites with high natural heritage value. While most of the riparian areas on the Comanche National Grassland have been heavily influenced by management activities and adventive, exotic vegetation, several sites were identified as “the best of the rest,” i.e., the best remaining natural riparian vegetation.

The results of both the inventory and riparian classification are presented in this report. The introduction briefly outlines the mission and methodology of the CNHP followed by an overview of the natural condition of the study area. The next section of the report presents and discusses the methods and results of the natural heritage inventory. The report then describes and discusses the riparian vegetation of the study area. Finally, the significant Conservation Sites

identified during this study are described and future actions, including management and protection options, are introduced.

Colorado Natural Heritage Program

The Colorado Natural Heritage Program (CNHP) is building on a solid base of biodiversity information. In 1992, after 14 years of operation with the Division of Parks and Outdoor Recreation, CNHP was relocated in the University of Colorado Museum. Quickly outgrowing available space, CNHP transferred its offices to Colorado State University's College of Natural Resources in September 1994. CNHP has established a statewide repository for information on rare and imperiled species and significant natural communities in Colorado. The multi-disciplinary team of scientists and information managers gather information and incorporate it into their continually updated databases. CNHP is part of an international network of conservation data centers that use the Biological and Conservation Databases (developed by The Nature Conservancy). Concentrating on site-specific data for each element of natural diversity, the accurate status of each element is known. The mapped data illustrate sites that are important to the conservation of Colorado's natural heritage. By using the element ranks and the quality of each occurrence, priorities can be established for the protection of the most sensitive sites. It is by having an updated locational database and priority-setting system that CNHP can provide its most effective, proactive land-planning tools.

The information gathered by CNHP is on species, natural communities, and ecosystems. Each of these significant natural features (species and communities as represented by plant associations) is an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative degree of imperilment on a five-point scale (1 = critically imperiled; 5 = abundant; Table 3).

The primary criterion for ranking elements is the number of occurrences, i.e. the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, and threats. These ranks are assigned both in terms of the element's imperilment within Colorado (its State or S-rank) and the element's imperilment over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the conservation status of the element. Although most species protected under state or federal endangered species laws are imperiled, not all rare or imperiled species are listed as endangered or threatened, and **Natural Heritage ranks should not be interpreted as legal designations.**

The spot on the landscape that supports a particular population of a species or a specific stand of a given community type is an **element occurrence**. The CNHP has identified and mapped over 6,300 element occurrences in Colorado. Information on the location and quality of these element occurrences is also entered into the computerized Biological and Conservation Databases (BCD). This computer system, developed by The Nature Conservancy, is utilized by the international network of natural heritage programs and conservation data centers. All centers utilize the same methodology, allowing a unique, direct comparison of information throughout the area covered.

In addition to ranking each element in terms of imperilment, Natural Heritage staff scientists assign an **element occurrence rank** to each location of element so that protection

efforts can be aimed not only at the most imperiled elements, but at the best examples of each. Element occurrences are ranked in terms of the **quality** of the population or community, the **condition** or naturalness of the habitat, the long-term **viability** of the population or community, and the **defensibility** of the occurrence while considering the following:

quality: in comparison with other examples of the same element, size, connectedness to surrounding natural ecosystems, productivity, vigor; regeneration.
condition: abundance of non-native plant species, degree of soil compaction, degree of degradation, ability to recover.
viability: are intrinsic and extrinsic biological factors in place for the long-term persistence of the element?
defensibility: likelihood of long-term survival of the element based on social/political/biophysical factors, vulnerability.

For every location of an element each of these categories is ranked "A" (excellent) to "D" (poor), then synthesized into an overall element occurrence rank, also ranked "A" through "D". An "A" element occurrence rank indicates a nearly pristine element. A B-ranked element occurrence is in good shape but shows some signs of degradation. An element occurrence ranked "C" is in relatively poor shape, but is recoverable. A "D" element occurrence rank indicates that the element has declined to the point where restoration is impractical.

One of the ways that the Colorado Natural Heritage Program uses these element and element occurrence ranks is to assess the overall significance of a site, which may include one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity** (or B-) **rank**:

B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.
B2 Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.
B3 High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.
B4 Moderate Significance: good example of a community type, excellent or good occurrence of state-rare species.
B5 General Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

Overview of the Study Area

The study area for the field season of 1995 was restricted to the Timpas and Kim Grazing Districts located in the Comanche National Grassland of the Pike and San Isabel National Forests (Figure 1). The Comanche National Grassland consists of 435,028 acres within the Great Plains physiographic region. The Timpas and Kim Districts contain 205,663 and 67,466 acres, respectively (K. Falen-Romero pers. comm.). The Comanche National Grassland is within the Arkansas Tablelands Section in the Great Plains-Palouse Dry Steppe Province within the Temperate Steppe Division (Bailey *et al.* 1994).

Climate

The semiarid climate of the Comanche National Grassland is typical of the high plains, modified by the effects of the mountains to the west. Meager and variable precipitation from year to year, abundant sunshine, low humidity, wide temperature ranges, and considerable wind movement are characteristic. The average annual precipitation over the past 30 years is 11.01 inches for La Junta (Owenby and Ezell 1992). Temperatures can range from upper 100°s F to the low 60°s F during the summer months (June-August). The temperature range for the September through May are from the low 60°s F to the low 20°s F (Owenby and Ezell 1992).

Soils

The soils of the Timpas and Kim Grazing Districts are mainly comprised of: 1) Minnequa-Penrose association: nearly level to steep, well-drained to excessively drained, loamy soils that are moderately deep to very shallow over limestone or marl; on uplands, 2) Travessilla-Kim-Wiley association: very shallow, excessively drained, loamy soils on sandstone bluffs and deep, well-drained, loamy soils on bordering foot slopes and ridgetops and, 3) Rocky Ford-Numa-Kornman association: deep, nearly level, will-drained, loamy soils mainly on terraces (Larsen and McCullough 1972).

Geology

The geology of the Comanche National Grassland consists of ancient, Precambrian rocks which are overlain by various layers of rock that were deposited during the Mesozoic Era as shallow seas advanced and retreated. These younger, sedimentary rocks include: Pierre, Carlile, Graneros shale, Greenhorn limestone, and the Niobrara formation (Colorado Geologic Highway Map 1991).

Physiography, Relief, and Drainage

The Timpas and Kim Grazing Districts lie entirely within the Arkansas Tablelands Section in the Great Plains-Palouse Dry Steppe Province within the Temperate Steppe Division (Bailey *et al.* 1994). The area is drained by the Arkansas River and its tributaries: Apishapa River, Timpas Creek, Crooked Arroyo, Anderson Arroyo, and King Arroyo. All of these streams flow northward or northeastward and drain into the Arkansas River. The Purgatoire River is located in the southeastern part of Otero County and also drains into the Arkansas River. The Arkansas, Apishapa, and Purgatoire Rivers have continuous flows of water. Timpas Creek and Crooked Arroyo are tributary streams that have a small, continuous flow originating from subsurface return of irrigation waters in their lower reaches (Larsen and McCullough 1972).

Vegetation

Three distinct vegetation units are within the Timpas and Kim Grazing Districts: shortgrass prairie, shrubland, and woodland. The shortgrass prairie is the dominant vegetation unit within the Comanche National Grassland (see the riparian vegetation survey results for detailed description). The dominant grasses are *Bouteloua gracilis* (blue grama) and *Buchloe dactyloides* (buffalo grass). The dominant grassland associations are: *Bouteloua gracilis*/*Buchloe dactyloides*, *Bouteloua gracilis*/*Pascopyron smithii* (blue grama/western wheatgrass), *Hilaria jamesii*/*Sporobolus airoides* (galletagrass/alkaline sacaton), and *Stipa comata*/*Bouteloua gracilis* (needle and thread grass/blue grama). Other associated grasses were: *Aristida purpurea* (red three-awn), *Bothriochloa laguroides* (silver beardgrass), *Andropogon gerardii*/*Schizachyrium scoparium* (big bluestem/little bluestem), *Critesion pusillum* (foxtail barley), *Stipa neomexicana* (Mexican needle and thread grass) and *Schedonnardus paniculatus* (tumblegrass).

The dominant woodland association was: *Juniperus monosperma*/*Bouteloua gracilis* (one-seeded juniper/blue grama). Dominant shrubland associations were: *Atriplex canescens*/*Bouteloua gracilis* (four-winged saltbush/blue grama), *Sporobolus airoides*/*Bouteloua gracilis* (alkaline sacaton/blue grama, *Atriplex confertifolia*/*Hilaria jamesii* (four-winged saltbush/galletagrass), and *Sarcobatus vermiculatus*/*Distichlis stricta* (greasewood/saltgrass) (Bourgeron and Engelking 1994). Botanical nomenclature follows Weber and Whittman (1992).

Faunal Composition

Common fauna of the Timpas and Kim Districts consists of *Cynomys ludovicianus* (black-tailed prairie dog), *Spermophilus tridecemlineatus* (thirteen-lined ground squirrel), *Antilocapra americana* (antelope), *Canis latrans* (coyote), *Vulpes velox* (swift fox), *Lepus californicus* (black-tailed jack rabbit), *Tyrannus verticalis* (western kingbird), *Eremophila alpestris* (horned lark), *Calamospiza melanocorys* (lark bunting), *Callipepla squamata* (scaled quail), *Terrapene ornata* (western box turtle), *Holbrookia maculata* (lesser earless lizard), and *Crotaphytus collaris* (collard lizard).

METHODS--NATURAL HERITAGE INVENTORY

Prior to the summer field season, Colorado Natural Heritage Program scientists gathered existing information for the project. Label information on herbarium specimens from the Colorado State University herbarium was reviewed. The Biological Conservation Database (BCD) was utilized for information on target plant and animal species. Additionally, experts were consulted concerning the Comanche National Grassland and the targeted species. Target Inventory Areas (TIAs) were then determined from the information gathered. The TIA includes boundaries of potential habitat for the rare and threatened species and natural communities.

The Colorado Natural Heritage Program staff conducted the inventory for plants and animals on the Timpas and Kim Grazing Districts of the Comanche National Grassland between 10 June and 20 September 1995. Detailed information was collected on the presence and status of unique or exemplary natural communities and rare species that are present, the extent of the feature(s) that make the TIA significant, and the area that needs to be protected to preserve those features. Threats and past or present disturbances are also noted. Where significant elements of natural diversity were found, the data were transcribed onto Colorado Natural Heritage Program maps and entered into the BCD databases (See Appendix D for examples of Natural Heritage data forms).

Animal Survey

During the first part of summer, surveys were conducted for reptiles, amphibians, and insects. TIAs were located near seasonal water sources, springs, and canyons. During the late summer, mammal surveys were conducted at night using spotlighting methods. Each TIA search included prairie dog towns and permanent water sources. Equipment used for the surveys included: butterfly nets, rubber bands, snake sticks, Sherman traps and spotlights.

Small mammal surveys included choosing three sample plots for both the Timpas and Kim Districts. These plots consisted of a 50 square meter area on which 36 (6 x 6 grid) live capture traps were placed. Baited with rolled oats, Sherman traps were placed at the base of bushes and holes, and allowed to stay in place for 3 consecutive nights consisting of 108 trap nights per plot. The traps were checked daily and data recorded. To avoid redundancy in data, a small section of hair was removed from the backs of the captured animals; this allowed for identification of previously captured animals. However, no recaptures occurred. An Element Occurrence Record (EOR) was filled out upon location of a target animal (Appendix D). Topographical maps were then marked with the occurrence location and photographs of the individual species and their habitat were taken. All captured specimens were identified in the field using Fitzgerald, *et al* (1994).

Plant Survey

The Timpas and Kim Grazing Districts in the Comanche National Grassland were surveyed from June 10-July 19, 1995. The search areas for each of the target species were concentrated on USFS tracts with potential habitat, as determined from TIA analysis and review of existing records in the Biological Conservation Database of the Colorado Natural Heritage Program. Soil, geology, and topography, as well as known occurrences were considered in the TIA analysis stage. Specimens of target species were reviewed at the Colorado State University herbarium prior to the field season. Surveys were conducted by hiking through each target area, inspecting typical habitat as well as unusual edaphic or topographic features. An Element Occurrence Record (EOR) was filled out upon location of a target plant (Appendix C). Topographical maps were then marked with the occurrence location and photographs of the individual species and their habitat were taken. Identification of plants was made following Weber (1990) and Great Plains Flora Association (1986).

The following are plants from the R-2 Sensitive Species List that were surveyed for during the 1995 field season:

Adiantum capillus-veneris (Southern maidenhair fern)--found on dripping sandstone cliffs (Weber 1990).
Ambrosia linearis (streaked ragweed)-Colorado endemic found in seasonally moist habitats, e.g., playas, ponds, roadside ditches on the eastern plains (Weber 1990).
Asclepias uncialis (dwarf milkweed)-rare or inconspicuous on outwash mesas of the Front Range and plains (Weber 1990). *Epipactis gigantea* (giant helleborine)-found in hot springs and canyon seeps.
Muhlenbergia glomerata (marsh muhly)-found in moist areas in shortgrass prairie.
Chenopodium cycloides (sandhill goosefoot)-found in sand blowouts.
Frasera coloradoensis (Colorado green gentian)-found on limestone outcrops.

RESULTS--NATURAL HERITAGE INVENTORY

The results from the plant and animal inventory for the Timpas and Kim Grazing Districts on the Comanche National Grassland yielded the following data: 7 rare and imperiled vertebrate species, 0 rare invertebrate species, 1 rare plant species, and 4 watch-listed animal species (CNHP 1995). A total of 25 element occurrences (including watch-listed species) were documented, 22 vertebrate occurrences and 3 plant occurrences. These elements with their scientific and common names, Heritage Program ranks, and federal status are listed in Table 1. Table 2 explains the global and state ranks used by CNHP. The locations of these elements are shown in Figure 1 and Figure 2.

Description of Rare Animal Species Located on the Comanche National Grassland

Ambystoma tigrinum-tiger salamander G5S3S4B

The tiger salamander occurs in virtually any habitat, provided there is a body of water nearby for breeding. They are equally at home in clear water of lakes, glacial kettle ponds, and beaver ponds as well as in turbid ponds badly polluted with cow manure in the plains (Reese 1969; Pague pers. comm.). The tiger salamander population in Colorado was declining in the mid-1980s which was attributed possibly to acidic deposition (Harte and Hoffman 1989). However, the population exhibited good recruitment in subsequent years, suggesting that the decline may have been a temporary natural fluctuation. The tiger salamander occurs throughout much of North America, southern Canada to Mexico. It is the most common amphibian in Colorado, occurring at elevations up to 12,000 feet (CNHP 1996). The tiger salamander is considered a CNHP watch-listed species; it is included here due to its U.S. Forest Service sensitive status. CNHP interprets the currently available data to mean that, although some populations have apparently been lost or are in decline, the species remains common over most of its state range.

Arizona elegans elegans-Kansas glossy snake G5S3S4

The Kansas glossy snake ranges from southwestern and south-central U.S. to Mexico. It occurs throughout eastern Colorado below 5,000 feet (Hammerson 1982). There is no direct information available to suggest decline in range or population, but populations do appear stable in eastern Colorado. The glossy snake is common with over one hundred element occurrences recorded for Colorado (CNHP 1996).

Table 1. New records for the Timpas and Kim Grazing Districts in Comanche National Grassland (Figures 1 and 2) (Appendix D).
(* denotes species that did not occur in an identified TIA).

Scientific Name	Common Name	No. Locations	Global Rank**	State Rank**	Federal Status	Federal Sensitive
Ambystoma tigrinum	Tiger Salamander	1	G5	S5		Yes
Arizona elegans elegans	Kansas Glossy Snake	1	G5	S3S4		Yes
Athene cunicularia	Burrowing Owl	2	G5	S3S4B		Yes
Bassariscus astutus	Ringtail	1	G5	S5		Yes
Bufo debilis insidior	Western Green Toad	3	G5T5	S1		
Buteo regalis	Ferruginous Hawk	1	G4	S3B, S5N	C2	Yes
Frasera coloradensis	Colorado Green Gentian	3	G2	S2	C2	Yes
Notiosorex crawfordi *	Desert Shrew	2	G5	S3?		
Numenius americanus	Long-billed Curlew	2	G5	S2B, SZN		Yes
Phrynosoma cornutum	Texas Horned Lizard	2	G5	S2	C2	Yes
Sigmodon hispidus *	Hispid Cotton Rat	1	G5	S4		
Vulpes velox	Swift Fox	7	G5	S3?	C2	Yes

** for definition of global and state ranks see Table 2.

Table 2. Definition of Natural Heritage state and global rarity ranks.
Global rarity ranks are similar, but refer to a species' rarity throughout it range. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. Note that GA and GN are not used and GX means extinct. **These ranks should not be interpreted as legal designations.**

G/S1	Critically imperiled; usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
G/S2	Imperiled; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.
G/S3	Vulnerable; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
G/S4	Common; usually > 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
G/S5	Very common; demonstrably secure under present conditions.
SA	Accidental in the state.
SH	Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.
S#B	Same rank as the numbered S-series, but refers to the breeding season rarity of migrants.
S#N	Same rank as the numbered S-series, but refers to the non-breeding season rarity of migrants; where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
G/SU	Status uncertain, often because of low search effort or cryptic nature of the element.
G/SX	Apparently extinct.

Figure 1. Location of element occurrences in the Timpas District in the Comanche National Grassland.

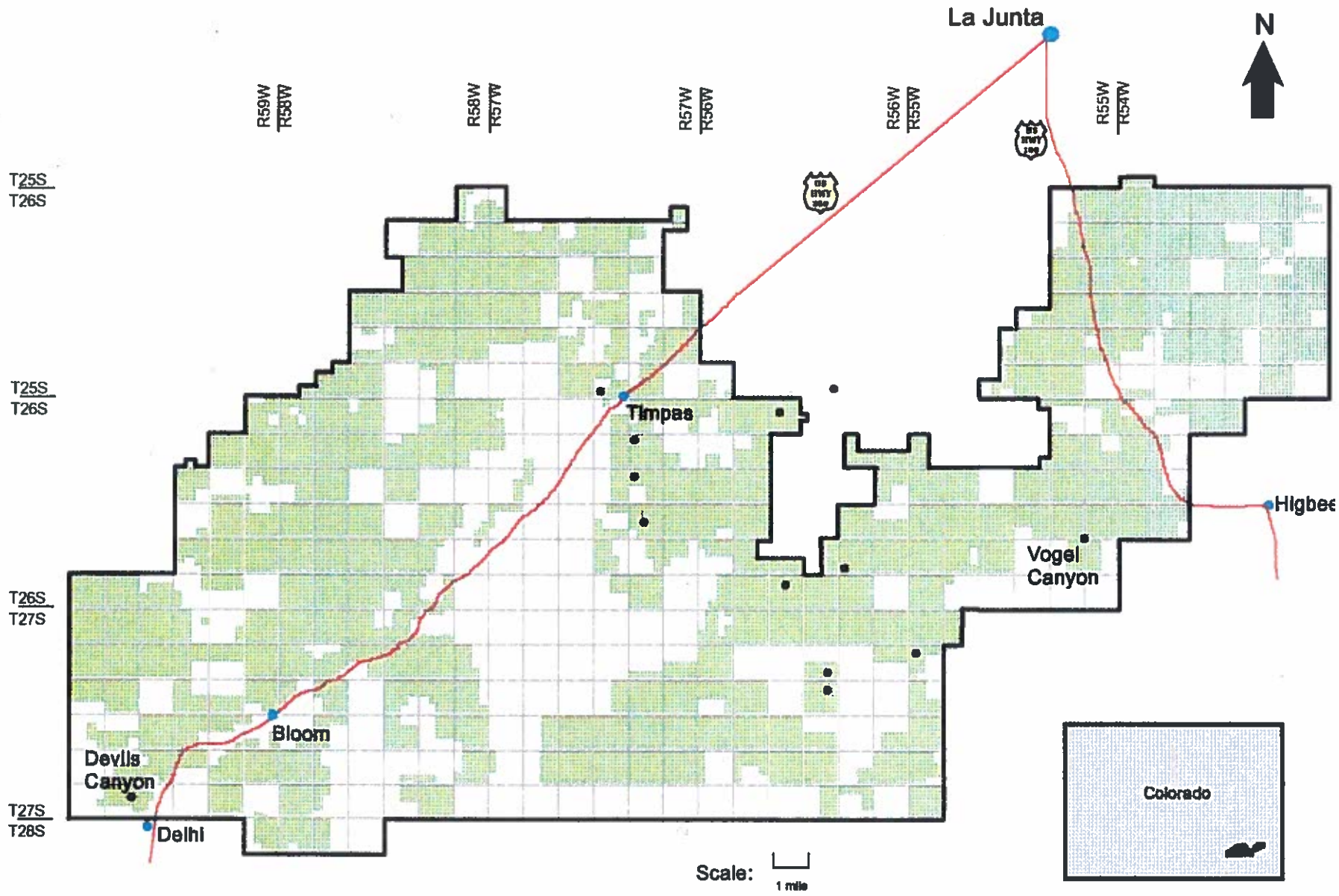


Figure 1. Location of plant and animal conservation sites (black dots) within the Timpas Grazing District, Comanche National Grassland.

Figure 2. Location of element occurrences in the Kim District in the Comanche National Grassland.

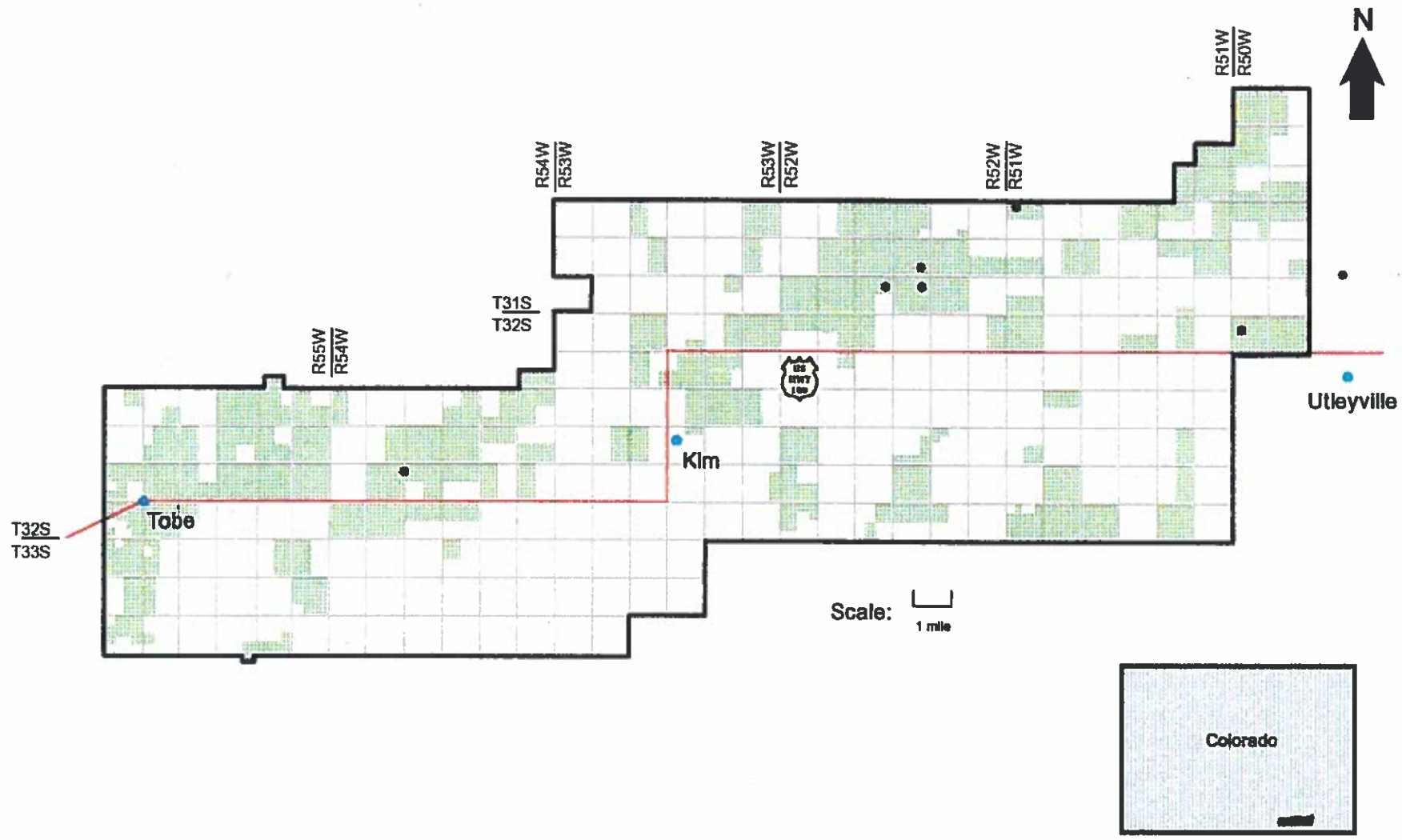


Figure 2. Location of plant and animal conservation sites (black dots) within the Kim Grazing Association, Comanche National Grassland.

Description of Rare Animal Species Located on the Comanche National Grassland (continued)

***Athene cunicularia*-burrowing owl G5S3S4B**

The burrowing owl is a locally uncommon to fairly common summer resident on the eastern plains (Andrews and Righter 1992). The species is declining in Colorado, being almost completely extirpated in some areas. Although loss of habitat may be responsible in some areas, there are sites with suitable habitat that no longer have owls, therefore other factors appear to be involved. The owls are usually tolerant of human activity, but vulnerable to predation by dogs, cats, and activities that destroy burrows (CNHP 1996).

***Bassariscus astutus*-ringtail G5S5**

The ringtail is locally common throughout western North America. It ranges as far north as southern Oregon, northern Nevada, northern Utah, southern Wyoming, and Colorado; south through California, Arizona, New Mexico, Texas, and Mexico to southern Baja California, Mexico. The ringtail is most common in the canyon country of the southwestern parts of Colorado (Fitzgerald *et al.* 1994). Ringtails are more widely distributed than was previously recognized, being present in roughlands at moderate elevations (to above 9,600 feet) on either side of the Continental Divide (Gavin and Richards 1993; Willey and Richards 1974).

***Bufo debilis insidor*-western green toad G5T5S1**

The western green toad ranges from northern Mexico through the south-central U.S., reaching its northern limit in Colorado and Kansas. Presently, known to occur only in Otero County at an elevation of about 4,500 feet (Hammerson 1982). There were 7 known occurrences and 5 historical records (CNHP 1996), after the 1995 field season there are 10 occurrences. All recent occurrences occur in Comanche National Grassland (CNHP 1996). Pesticides are harmful to this species (Collins 1982), as are fluctuation in water levels.

***Buteo regalis*-ferruginous hawk G4S3BS5N/C2**

The ferruginous hawk is a fairly common to common winter resident on the eastern plains and uncommon to rare in western valleys and mountain parks (Andrews and Righter 1992). Johnsgard (1990) estimated that about 1,200 birds winter in Colorado, second only to Arizona and comprising about 20 percent of the total winter population in the United States. This species has been increasing on Christmas bird counts in the Great Plains (Warkentin and James 1988). It is a rare to uncommon summer resident locally on eastern plains, and very locally in Moffat and Routt counties (Felger 1910; Hendee 1929; Martin *et al.* 1974), along the Book Cliffs and in the Grand Valley, Mesa County, and in the San Luis Valley. There are about 150 nest sites in Colorado, primarily on the eastern plains (Andrews and Righter 1992).

There have been local declines of ferruginous hawks, but a widespread decline was not evident as of the mid-1980s. The loss of grassland is not regarded as an immediate threat, though breeding range in southern Canada has been reduced due to intensive agriculture (CNHP 1996). This species is on the National Audubon Society Special Concern List (Tate 1986).

***Notiosorex crawfordi*-desert shrew G5S3?**

The desert shrew occupies various habitats in arid and semiarid regions of southwestern North America. Most often it occurs in semidesert shrublands but it has also been reported from riparian woodland, grasslands, piñon-juniper woodlands, piñon-ponderosa pine stands, and dry, rocky areas. It has been documented from southeastern, southwestern, and west-central parts of Colorado. The species is apparently not as rare as once suspected, and populations probably exist at moderate elevations on either side of the mountains (Fitzgerald *et al.* 1994).

***Numenius americanus*-long-billed curlew G5S2BSZN/C2**

The long-billed curlew was extirpated from eastern U.S. prairies by cultivation of native grasslands. Population declines in the western U.S. are local, but not widespread. It is a summer resident on southeastern plains. This species is most common in Baca County (McCallum *et al* 1977). Breeding occurs in Prowers and Kiowa counties, but is rare elsewhere on the eastern plains (Andrews and Righter 1992).

This species was formerly abundant throughout eastern Colorado (Bergtold 1928), and also nested in Middle and South Parks in the 1870s (Sclater 1912; McCallum *et al.* 1977). In the early 1900s it still occurred throughout the eastern plains west to Boulder and Adams counties (Felger 1909, Hersey and Rockwell 1909, Betts 1913). Nesting was recorded as late as 1931 in Douglas County (Niedrach and Rockwell 1939) and in 1956 in Arapahoe County (Bailey and Niedrach 1965). The long-billed curlew is considered imperiled in Colorado (CNHP 1996). This species is on the National Audubon Society Special Concern List (Tate 1986).

***Phrynosoma cornutum*-Texas horned lizard G5S2/C2**

The Texas horned lizard is imperiled in Colorado because of the rarity of documented occurrences. It has virtually disappeared from Texas east of a line from Fort Worth through Austin and San Antonio to Corpus Cristi. The cause of decline is uncertain, but possibly linked with the spread of fire ants and/or use of insecticides to control fire ants (Hammerson 1982). The Texas horned lizard occurs chiefly south of the Arkansas River at elevations below 6,000 feet in southeastern Colorado (CNHP 1996).

***Sigmodon hispidus*-hispid cotton rat G5S3**

Little is known about the hispid cotton rat in Colorado other than general observations. In Colorado it is associated usually with midgrass and tallgrass prairie or weedy areas in riparian zones that provide good canopy cover. The hispid cotton rat has been extending its range up the Arkansas River and its tributaries (Armstrong 1972; Hansen 1963). They are now a common species in suitable habitat (Fitzgerald *et al.* 1994). The data obtained during the course of this study has justified a change of status in this species from vulnerable to common (S3 to S4).

***Vulpes velox*-swift fox G5S3?/C2**

The swift fox was extirpated in the late 1800s and early 1900s over much of its range in North America, probably due to its susceptibility to poisoning and trapping activities aimed at wolves and coyotes (Fitzgerald *et al.* 1994). In Colorado, the species never reached the extreme low numbers experienced elsewhere. Cary (1911) and Warren (1942) indicated that populations were low but present. The density of swift foxes on some areas of the plains are apparently high (Fitzgerald *et al.* 1994). However, Covell and Rongstad (1990) reported difficulty in finding swift foxes on the Comanche National Grassland and in areas with high coyote density.

The swift fox is found in over 25 counties in eastern Colorado. Its abundance seems to vary depending on quality of habitat, but it is not considered rare in its range, and considered common in eastern plains and abundant in the Arkansas River drainage (Armstrong 1972). CNHP (1995) documents 26 element occurrences.

The swift fox has a variety of predators, principally coyotes and eagles (Fitzgerald *et al.* 1994) and humans are also important causes of mortality, due to road kill and deliberate harvest. Locally, populations have been reduced or exterminated by over-zealous hunting, trapping, and poisoning (Fitzgerald *et al.* 1994).

Presently, the swift fox is being reviewed for listing under the Endangered Species Act. In Colorado, the subspecies *Vulpes velox velox* can be expected from any county on the eastern plains where native prairie occurs.

Description of rare plant species located on the Comanche National Grassland

***Frasera coloradoensis*-Colorado green gentian G2S2/C2**

The Colorado green gentian is a Colorado endemic plant associated with surface outcrops or shallow-to-bedrock occurrences of Cretaceous rock formations, including Greenhorn limestone, Graneros shale (Thatcher limestone member), and Dakota sandstone (Naumann 1991). The global range of this species includes an area approximately 60 miles long and up to 25 miles wide. The species' entire range is apparently contained within four counties in the southeastern corner of Colorado (Baca, Las Animas, Bent, and Prowers). The Colorado green gentian is imperiled globally because of its rarity (CNHP 1996). There are 23 occurrences, 15 are on private lands, 4 on State lands, and 4 on the Comanche National Grassland. Threats to the Colorado green gentian include:roadside herbicide application, drought, and excessive grazing (CNHP 1996).

Small Mammal Survey

Results of the small mammal trapping yielded a total of 58 mammals during 108 trap nights (3 nights of trapping with 36 traps set each night) (Table 3). Three element occurrences for *Notiosorex crawfordi*, desert shrew, (G5S3?) and 1 element occurrence for *Sigmodon hispidus*, hispid cotton rat, (G5S3) were recorded. Other mammals trapped were: 7 *Perognathus flavescens*, plains pocket mouse, 1 *Perognathus* sp., pocket mouse, 7 *Chaetodipus hispidus*, hispid pocket mouse, 3 *Reithrodontomys megalotis*, western harvest mouse, 11 *Reithrodontomys montanus*, plains harvest, 2 *Peromyscus boylii*, brush mouse, and 23 *Peromyscus maniculatus*, deer mouse.

Table 3. Results of small mammal trapping on the Timpas and Kim Grazing Districts, Comanche National Grassland.

Species	Timpas One	Timpas Two	Timpas Three	Kim One	Kim Two	Kim Three
Perognathus flavescens	1	2	1	2	1	0
Perognathus sp.	0	1	0	0	0	0
Chaetodipus hispidus	2	2	1	2	0	0
Notiosorex crawfordi	2	0	0	1	0	0
Reithrodontomys megalogis	0	0	1	0	1	1
Reithrodontomys montanus	2	1	2	2	3	1
Peromyscus boylii	0	2	0	0	0	0
Peromyscus mainiculatus	5	3	3	4	6	2
Sigmodon hispidus	1	0	0	0	0	0

Timpas Plot One: T25S R54W Sec 15 NE 1/4
Timpas Plot Two: T26S R 57W Sec 19 NE 1/4, NE 1/4
Timpas Plot Three: T26S R58W Sec 35 SE 1/4, SE 1/4

Kim Plot One: T32S R55W Sec 27 SW 1/4
Kim Plot Two: T32S R53W Sec 20 NE 1/4
Kim Plot Three: T32S R51W Sec 29 NW 1/4

Twenty eight Target Inventory Areas (TIAs) were identified during preparatory stages of the inventory and are further discussed in Appendix A. Of these twenty eight, twelve were found to support CNHP or federally listed rare, threatened, or endangered species (Table 3). Appendix C includes the element occurrence records and maps of new or revisited records.

Table 4. Conservation sites identified by the Colorado Natural Heritage Program for Timpas and Kim Grazing Districts.
(Sites in bold depict B2 ranks). Detailed description of each site are included in Appendix B.

Conservation Site	**Biodiversity Rank**	**Significant Element(s)**	**USGS Quadrangle**
Devils Canyon	B4	Texas Horned Lizard	Delhi
Mustang Creek	**B2**	**Colorado Green Gentian**	**Andrix**
North Fork Jack Canyon	B5	Western Green Toad	Riley Canyon
Ou Creek	**B2**	**Colorado Green Gentian**	**Kim North**
Packers Gap	B5	Swift Fox	Packers Gap
Pasture 4A	B4	Long-billed Curlew, Ferruginous Hawk	Utleyville
Pasture 4X	B4	Long-billed Curlew	Utleyville
Pasture 10A	**B2**	**Colorado Green Gentian, Texas Horned Lizard**	**Dalerose Mesa/Kim South**
Shale Hills	B5	Swift Fox	La Junta SW
Stormy Point	B5	Burrowing Owl, Western Green Toad	Timpas
Timpas Site	B4	Ringtail, Tiger Salamander, Swift Fox, Kansas Glossy Snake	Timpas
Vogel Canyon	B4	Western Green Toad	La Junta SE

METHODS--RIPARIAN CLASSIFICATION

Site selection

This classification focused on areas in the Timpas and Kim Grazing Districts. GIS riparian delineations and range improvement maps provided by the US Forest Service were used to stratify the study area. Most areas heavily impacted by anthropogenic activities were avoided, such as those adjacent to highways or stock tanks. Intially, stratification was done to reduce the number of sample sites. However, as the summer progressed all delineated mesic sites were sampled. Selection of stands to be sampled was based on "subjective sampling without preconceived bias" as described by Mueller-Dombois and Ellenberg (1974). An attempt was made to avoid sampling in ecotones between communities, but some communities (e.g., wet sedge bands) are ecotonal in nature or highly localized. Stands of vegetation were sampled using 100 foot linear transects. Transect locations were marked with rebar and recorded with global positioning satellite units. Sites may encompass several stands of vegetation (several plant associations) and thus, may have been sampled with several transects.

Collection of vegetation and environmental data

The Comanche National Grassland personnel office in La Junta assisted with securing permission to enter private lands. All sites sampled are on public land or on private land within a grazing pasture managed by the Forest Service. The following data were collected at each site.

Variables estimated or measured at each site included (but not limited to):

- elevation
- valley slope gradient (from topographic maps)
- valley floor width (from topographic maps)
- stream gradient measured on site
- site location (latitude and longitude)
- dominant species or communities of area
- pasture number and grazing regime
- woody species regeneration (R2-2200-WS)(on Timpas Creek only)
- cross section composition (R2-2200-CS)(on Timpas Creek only)
- stewardship comments
- cross sectional and birds-eye drawings of area with community types signified

Variables estimated or measured at each transect included (but not limited to):

- plant species recorded in percent canopy cover per microplot (20cm by 50cm) at 5 ft. intervals along the transect (R2-2200-CF)
- percent ground cover of bare soil, litter, wood, water, plant basal vegetation, bryophyte and non-vascular plants
- percent ground cover of gravel, cobble, stone, boulder, bedrock (R2-2200-CF)
- shrub density (R2-2200-SD)
- line intercept cover (shrubs and trees only) (R2-2200- LI)
- community occurence size
- aspect (stream bearing)
- horizon angles (expressed in %)
- riparian width
- bankful channel width
- channel depth (when applicable)
- channel entrenchment
- Rosgen channel type (when applicable)
- stream gradient
- channel bed material
- height above the bank full channel
- distance from the bank full stage of channel
- modified general field data (R2-2200-GF)
- community occurence conservation ranking

Sample field forms are in Appendix F.

All plants not identified in the field were collected, pressed and identified later. All specimens were verified at the Colorado State University Herbarium in Ft. Collins, Colorado or the University of Colorado Herbarium in Boulder, Colorado. New county record specimens for Colorado State University Herbarium were deposited there, and all other voucher specimens will be deposited in the new herbarium to be located at the Forest Service office in La Junta. Nomenclature in this report follows Kartesz (1994). Appendix E lists the riparian plant species found at the study sites.

Data Analysis and Storage

Agglomerative cluster analysis in PC-ORD (McCune 1995) was utilized using Sorenson's distance (2W/A+B) and group average clustering method to determine groups of plots with similar species composition. Information concerning the succession and management of the various plant associations was drawn from both field data and literature reviews.

The original field forms will be submitted to the Comanche National Grassland, while copies will be kept with the Colorado Natural Heritage Program. Data entered in spreadsheet format will be stored on computer disk at the Colorado Natural Heritage Program.

Classification

Classification is based on existing, relatively undisturbed, natural vegetation. Plant associations, the finest unit in this hierarchical classification, are defined as relatively stable, existing natural vegetation with definite floristic composition, uniform physiognomy, and uniform habitat (Mueller-Dombois and Ellenberg 1974). Plant associations are considered a product of the prevailing environmental setting including natural disturbance regimes (such as fire, flooding, or bison grazing) and are "real, extant... kinds of vegetation, rather than a theoretical end point that is seldom reached on most sites" (Baker 1984). Flooding, fluvial sediment deposition, and scourinng are frequent disturbances that occur along riparian corridors. In this classification, riparian plant associations are considered either relatively stable, or at least predictable, vegetation units that depend on fluvial dynamics of the stream for long-term maintenance and regeneration (Winward and Padgett 1988).

The classificatin for the Comanche National Grassland is based on an existing vegetation composition, even if only highly localized, and dependant on seasonal moisture and/or available ground water. The classification includes weedy and disturbed sites in order to thoroughly describe the condition of the Comanche National Grassland's riparian areas.

Plant associations derived from the cluster analyses were compared with riparian plant association stand data and descriptions from riparian classificaton work in Colorado, New Mexico, Wyoming, Idaho and Utah. Also used for comparison were the community types from the Piñon Canyon Maneuver Site, south-central Colorado. Associations were considered either 1) synonymous (where associations matched species composition, constancy, average cover in most cases, and environment), 2) similar (when canopy structure, genera, and physical setting were similar, but differed slightly in species composition), 3) a new type not described in the literature, 4) an unclassified type either not previously described or not enough information to classify it, or 5) a commonly occurring plant association dominated by non-native adventitious species and not ranked by the Heritage Program.

Association names are based on each canopy stratum dominant or codominant plant species characterized by high constancy (frequency of species occurrence) and high relative abundance (percent canopy cover) values. High relative abundance was weighted more heavily. A slash separates canopy layers (e.g., tree/shrub/undergrowth). A dash indicates codominance within a given canopy layer (e.g., *Pascopyrum smithii - Panicum obtusum*). When plant associations were similar to those in the literature, the corresponding name was assigned..

Plant associations were placed into The Nature Conservancy's Preliminary Vegetation Classification of the Western United States (Bourgeron and Engelking 1994), which is based on the UNESCO Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974) as revised by Driscoll *et al.* (1984). This classification is outlined and crosswalked to the Classification of Wetland and Deepwater Habitats of the United States (Cowardin *et al.* 1979) in Table 5.

Table 5. Cross-reference of the UNESCO Plant Formations (Roman numerals) and Cowardin Wetland Types.

UNESCO	Cowardin
I.Closed forests	Palustrine system-Forested class
B. Mainly deciduous forests	Broad-leaved deciduous subclass
3.Cold-deciduous forests without evergreen trees	
d.Cold-deciduous alluvial forest	
1. Mainly broad-leaved	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
III.Shrublands	Palustrine System-Scrub-Shrub class
B. Mainly deciduous shrubland	Deciduous shrubland
3. Cold-deciduous shrublands	
c. Deciduous alluvial shrubland	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
V. Herbaceous communities	Palustrine-Emergent wetlands Persistent
B. Medium-tall grasslands	
4. Without woody layer	
a. Composed of sod forming species	
1. (Alliance)	(Dominance type)
2. (Plant Association)	
b. Composed of bunch grasses	
1. (Alliance)	(Dominance type)
a. (Plant Association)	
C. Short grasslands	
5. Without woody layer	
a. Composed of sod forming species	(Dominance type)
1. (Alliance)	
a. (Plant Association)	

RESULTS--RIPARIAN CLASSIFICATION

During the summer of 1995, 89 transects were sampled in the Timpas and Kim Grazing Districts on the Comanche National Grassland. Of these, 76 transects were riparian; the remaining 13 transects were sampled on slopes in the canyons and arroyos, to provide a brief description of these vegetation communities. General locations of riparian transects are shown in Figures 3 and 4. Detailed locations are shown in Table 27 and Table 28 (legal descriptions) and on USGS 7.5' quadrangles in Appendix D.

On the Comanche National Grassland, in the Kim and Timpas Grazing Districts, 19 riparian plant associations and 8 unclassified types were described. These range from cottonwood, willow and graminoid dominated areas, to tamarisk, saltbush and graminoid areas. The classification of these plant associations is shown in Table 7. The classification was based mainly on the results of the cluster analysis, shown as a dendrogram in Figure 5. The dendrograms canot be taken *prima facie* as the classification. Some clusters are an artifact of the clustering algoriths and do not necessarily represent community similarity. Final classification of plant associations was based on observed environmental conditions and other published descriptions, in addition to the cluster analysis.

Heritage Program element occurrence ranks (see p. 2) were assigned to each riparian stand sampled. These ranks provide a measure of the condition of the riparian plant associations. The distribution of these ranks among stands sampled is shown in Table 6. The B-ranked riparian sites, the best examples of riparian plant associations, were designated Conservation Sites. All Conservation Sites (including those designated in the Natural Heritage Inventory) are profiled in Appendix B.

Table 6. Distribution of Natural Heritage Community Element Occurrence Ranks for Riparian Stands Sampled on the Comanche National Grassland
(Note: This table does not include ranks for the 13 non-riparian communities sampled)

Rank	No. of Riparian Transects	Percent of Total
A (excellent)	0	0
B	13	17
C	40	53
D (poor)	23	30
Total number of transect	76	

The following sections of the report provide more detailed information about each plant association. A dichotomous key based on vegetation is included.

Plant association descriptions include: 1) synonyms or a discussion of similar plant associations from literature comparison, 2) regional, state, and local distributions, 3) site characteristics, 4) vegetation descriptions including dominant and characteristic species structure and composition, 5) adjacent vegetation compositions and trends and, 6) a brief discussion on successional trends and/or ecology of the association with management considerations regarding grazing impact and other information.

All descriptions of natural plant associations begin with the Heritage Program global and state rank (CNHP Rank, see Table 2, page 27). This rank indicates the degree of rarity and/or

imperilment of this community and is used for setting conservation priorities. Plant associations dominated by non-native adventitious species are not ranked because there is no need to set conservation priorities for them.

Stand tables are included with each plant association description. These tables provide percent canopy cover of diagnostic or dominant species, and grazing information including pasture number, grazing regime and grazing dates. Element occurrence ranks for each riparian stand are given in Table 27.

Figure 3. Location of riparian transects within the Timpas District, Comanche National Grassland, Colorado.

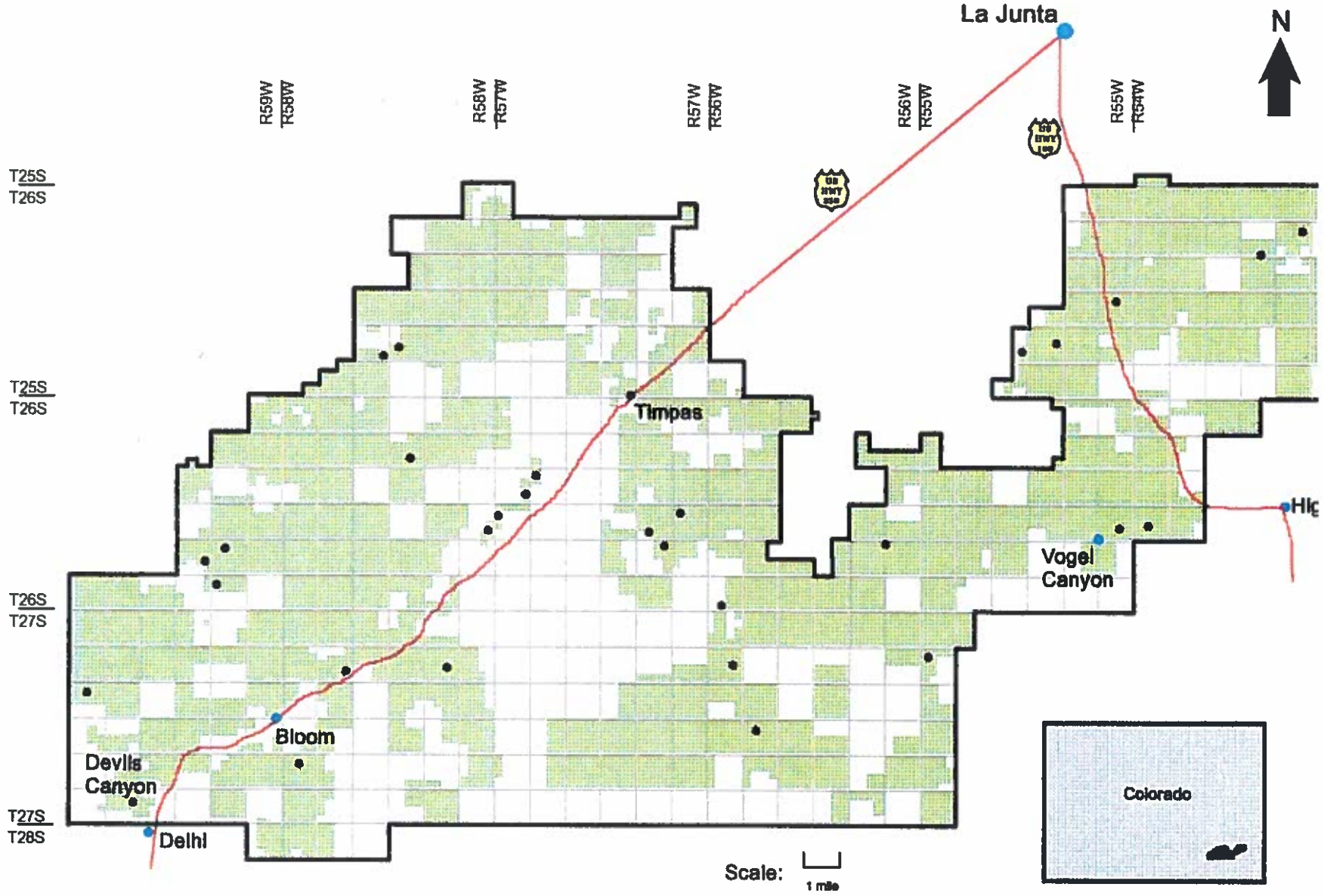


Figure 3. Location of riparian transects (black dots) within the Timpas Grazing District, Comanche National Grassland, Colorado.

Figure 4. Locations of riparian transects within the Kim District, Comanche National Grassland, Colorado.

Figure 4. Location of riparian transects (black dots) within the Kim Grazing Association, Comanche National Grassland, Colorado.

Table 7. Riparian Plant Associations of the Comanche National Grassland.
(UNESCO and Cowardin Classification classes are in parentheses, as listed in Table 5)

Broad-Leaved Deciduous Forest (cold-deciduous mainly broad-leaved forests; Palustrine broad-leaved deciduous forested wetlands)

- *Populus deltoides* Alliance
  - *Populus deltoides/Salix exigua*
  - *Populus deltoides/Rhus trilobata*
  - *Populus deltoides/Poa pratensis*
  - *Populus deltoides*: Unclassified
- *Populus angustifolia* Alliance
  - *Populus angustifolia*: Unclassified

Willow Shrublands (Cold-deciduous shrublands; Palustrine deciduous scrub-shrub wetlands)

- *Salix exigua* series
  - *Salix exigua/Eleocharis palustris*
  - *Salix exigua/Scirpus pungens*
  - *Salix exigua*/Barren soil

Needle-Leaved Deciduous Shrubland

- *Tamarix ramosissima* Alliance
  - *Tamarix ramosissima*/Mixed graminoids
  - *Tamarix ramosissima*/Sparse
  - *Tamarix ramosissima*: Unclassified

Cold Deciduous Scrub-shrub Shrubland (Cold-deciduous shrublands; Palustrine deciduous scrub-shrub wetlands)

- *Atriplex canescens* Alliance
  - *Atriplex canescens/Pascopyrum smithii*
  - *Atriplex canescens*: Unclassified

Herbaceous Plant Associations (Terrestrial herbaceous communities; Palustrine-emergent wetlands)

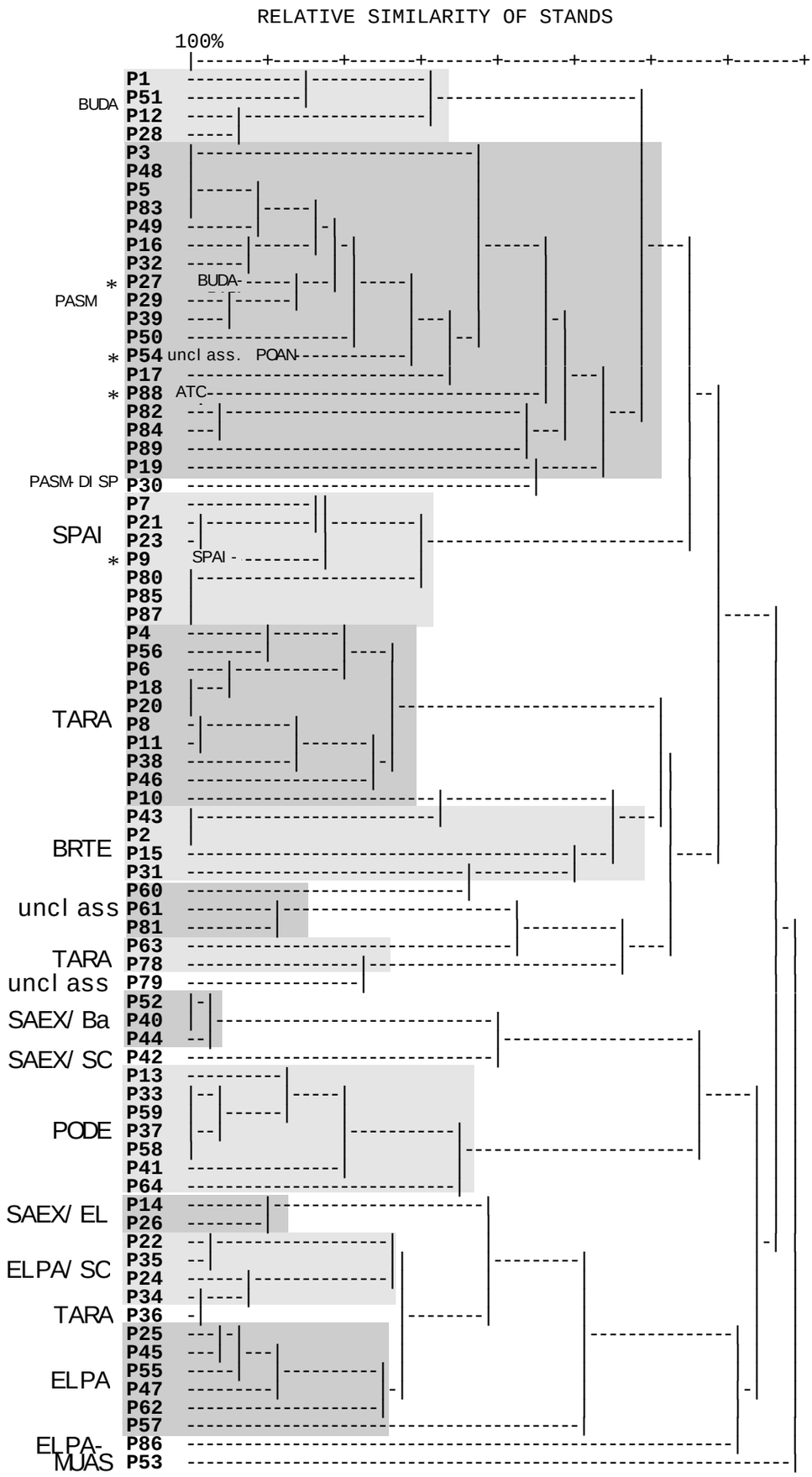
- *Eleocharis palustris* Alliance
  - *Eleocharis palustris*
  - *Eleocharis palustris-Scirpus pungens*
- *Pascopyrum smithii* Alliance
  - *Pascopyrum smithii*
  - *Pascopyrum smithii-Distichlis spicata*
- *Buchloe dactyloides* Alliance
  - *Buchloe dactyloides*
  - *Buchloe dactyloides-Pascopyrum smithii*
- *Sporobolus airoides* Alliance
  - *Sporobolus airoides*
  - *Sporobolus airoides-Distichlis spicata* (tentative type)
- *Muhlenbergia asperifolia* Alliance
  - *Muhlenbergia asperifolia* (tentative type)
- *Bromus tectorum* Alliance
  - *Bromus tectorum*

Miscellaneous Unclassified

Figure 5. Dendrogram illustrating relative similarity of riparian stands.
Similarity Coefficient: 2w/(a+b)
Cluster Analysis Method: Group Average

Notes:

1. Codes in capital letters refer to plant communities; see the plant association descriptions that follow for the names that correspond to these codes.
2. "unclass." refers to stands that were not classified. Some of these stands were classified to alliance but not to plant association).
3. "*" indicates stands that were classified outside the PASM group even though they were clustered within this group. The plant association name is to the right of the plot number.
4. The column of "PXX" on the left-hand edge of the figure indicates plot number.



Key To Comanche National Grassland Riparian Plant Associations

Note: All keys to plant associations should be viewed as general guidelines only. Within each plant association there is a certain amount of natural variability that may not be specifically represented in the key. Final determination of a community should be made only after carefully comparing plant composition and habitat with plant association descriptions, particularly stand tables.

This key is to individual plant associations. When these associations occur together as a mosaic, (e.g., tamarisk, willow and cottonwood mosaics along Timpas Creek) first determine what patches are present and use the key to identify each patch of the mosaic individually.

Key to Groups:

1. Tree overstory present, with at least 15% cover ..... **Group A**
1. Tree overstory not present..... **2**

    2. Shrubs dominate overstory..... **3**
    2. Shrubs are absent ..... **Group E**

3. Shrubs are tamarisk..... **Group C**
3. Shrubs have broad deciduous leaves..... **4**

    4. *Salix* spp. dominate the overstory with at least 15%..... **Group B**
    4. Other shrubs dominate the overstory ..... **Group D**

Key to Plant Associations:

Group A. Broad-Leaved Deciduous Forest

1. *Populus deltoides* is present..... **2**
1. *Populus angustifolia* dominates the overstory..... .
***Populus angustifolia*: Unclassified**

    2. Shrubs present in the next strata..... **3**
    2. Shrubs not present, graminoids (grass-like plants) dominant in understory..... **4**

3. *Salix exigua* is present..... .
***Populus deltoides/Salix exigua* p.a.**
3. *Rhus trilobata* is present..... .
***Populus deltoides/Rhus trilobata* p.a.**

    4. Undergrowth composed of *Poa pratensis*..... .
***Populus deltoides/Poa pratensis* p.a.**
    4. Undergrowth not composed of *Poa pratensis*..... .
***Populus deltoides*: Unclassified**

Group B. Willow Shrublands

1. Undergrowth is of mesic graminoids (grass-like plants)..... **2**
1. Undergrowth is nearly absent.....
***Salix exigua*/Barren soil p.a.**

2. Undergrowth is dominated by *Eleocharis palustris*.....
***Salix exigua/Eleocharis palustris* p.a.**
2. Undergrowth is dominated by *Scirpus pungens*.....
***Salix exigua/Scirpus pungens* p.a.**

Group C. Needle-Leaved Deciduous Shrubland

1. Undergrowth is dominated by graminoids (grass-like plants).....
***Tamarix ramosissima*/mixed graminoids p.a.**
1. Undergrowth is not dominated by graminoids **2**
2. Undergrowth is of sparse forbs and grasses .....
***Tamarix ramosissima*/Sparse p.a.**
2. Undergrowth has a variety of shrubs, grasses and/or forbs.....
***Tamarix ramosissima*: Unclassified**

Group D. Cold Deciduous Scrub-shrub Shrubland

1. *Atriplex canescens* dominates with *Pascopyrum smithii* .....
***Atriplex canescens/Pascopyrum smithii* p.a.**
1. *Atriplex canescens* has various undergrowth species .....
***Atriplex canescens*: Unclassified**

Group E. Herbaceous Plant Associations

1. Site is moist or has standing water; sedges (members of the Cyperaceae) dominate with at least 25% cover..... **2**
1. Site may be moist but otherwise not as above..... **3**

2. *Eleocharis palustris* dominates in high percentages.....
***Eleocharis palustris* p.a.**
2. *Eleocharis palustris* is co-dominating with *Scirpus pungens*.....
***Eleocharis palustris-Scirpus pungens* p.a.**

3. Site is dominated by either *Pascopyrum smithii* or *Bromus tectorum* **4**
3. Site is not as above **6**

4. *Pascopyrum smithii* dominates with at least 25% cover.....**5**
4. *Bromus tectorum* dominates over all other species.....
***Bromus tectorum* p.a.**

5. *Pascopyrum smithii* co-dominates with *Distichlis spicata*.....
***Pascopyrum smithii - Distichlis spicata* p.a.**
5. *Pascopyrum smithii* dominates or co-dominates.....
***Pascopyrum smithii* p.a.**

6. Site appears similar to upland in composition; dominant is graminoid **7**
6. Site is alkaline, not similar to upland **8**

7. *Buchloe dactyloides* dominates.....
***Buchloe dactyloides* p.a.**
7. *Buchloe dactyloides* co-dominates with Pascopyrum smithii .....
***Buchloe dactyloides - Pascopyrum smithii* p.a.**

8. Dominant is *Sporobolus airoides*.....**9**
8. Dominant is *Muhlenbergia asperifolia* .....
***Muhlenbergia asperifolia* p.a.**

9. *Sporobolus airoides* is sole dominant.....
***Sporobolus airoides* p.a.**
9. *Distichlis spicata* co-dominates .....
***Sporobolus airoides - Distichlis spicata* p.a.**

Plant Associations of the Riparian Vegetation in the Timpas and Kim Grazing Districts, Comanche National Grassland

A. BROAD-LEAVED DECIDUOUS FOREST

Populus deltoides Alliance

Plains Cottonwood/Coyote willow (*Populus deltoides/Salix exigua*) Plant Association (PODE/SAEX) transects 37 and 64

CNHP RANK: GUSU

Related Types: The *Populus deltoides/Salix exigua* community type described by Durkin *et al.* (1995) has similar dominant species to those found on the Comanche National Grassland. The *Populus deltoides/Salix exigua* described from the San Miguel River (Kittel and Lederer 1993) is also similar, however, *Populus deltoides* spp. *wislizenii* is the dominant cottonwood in that plant association, while *Populus deltoides* spp. *monilifera* is the plains cottonwood on the Comanche National Grassland.

Distribution: Similar types (see above) have been reported from northern and central New Mexico, and appear to be wide spread in the upper and middle Rio Grande Basin (Durkin *et al*. 1995). In Colorado, similar types occur on the San Miguel River (Kittel and Lederer 1993). On the Comanche National Grassland this plant association is located in the Timpas Creek exclosure and in Devils Canyon, pasture 23.

Site Characteristics: This plant association occurs on the floodplain of meandering, low to moderate gradient (0.4-3.0%), silt and sand-bed streams. Timpas Creek has steep eroding walls of loose shale and silt, while in Devils Canyon, the channel is slightly to moderately cut within the deep, sandstone canyon.

Vegetation: *Populus deltoides* (17-50%) and *Salix exigua* (2-17%) are the dominant woody species. The herbaceous understory is relatively sparse with *Eleocharis palustris* (creeping spikerush) (0-5%), *Scirpus pungens* (leafy bulrush) (0-15%), *Poa arida* (arid bluegrass) (0-8%), and numerous weedy forbs. See Table 8 for percent canopy cover of all dominant and diagnostic species.

Adjacent vegetation: *Tamarix ramosissima* (tamarisk) is a common associate within the riparian mosaic. Other vegetation types include patches of *Elymus canadensis* (Canada rye), *Pascopyrum smithii* (western wheatgrass) and *Melilotus alba* (white sweetclover) within the riparian zone. Juniper woodlands are common on the upslopes.

Succession/Management: The *Populus deltoides/Salix exigua* plant association is thought to be an early seral vegetation type. Growth and survival of cottonwoods and willows are dependent on natural flooding regimes and lateral channel migration. The Devils Canyon site has a low density of cottonwoods and willows which are in poor condition. This may be due to seasonal flows in the

spring, such that the plants are water-stressed throughout the rest of the growing season. The Timpas Creek stand has vigorous willow growth, likely due to year round moisture availability and reduced grazing pressure.

Table 8. Percent canopy cover of diagnostic or dominant species and grazing information for the *Populus deltoides/Salix exigua* plant association.

Transect Number	37	64
Species	**Canopy Cover (%)**	
Populus deltoides	50	17
Salix exigua	18	2
Tamarix ramosissima	0	1
Bothriochloa laguroides ssp. *torreyana*	0	2
Eleocharis palustris	5	0
Poa arida	8	0
Scirpus pungens	15	0
Grazing Information		
Pasture Number	exclosure	Timpas 23
Grazing Regime	none	varies
Grazing Dates	none	Dec1-May31

Plains cottonwood/Skunkbush (*Populus deltoides* spp. *monolifera/Rhus trilobata*) Plant Association (tentative type)
(PODE/RHTR) transect 13

CNHP RANK: GUSU

Related Types: This type appears to be similar to the *Populus deltoides* ssp. *wislizenii/Rhus trilobata* plant association described by Kittel and Lederer (1993), and CNHP (1996). However, *Populus deltoides* spp. *monolifera* is the cottonwood found on the Comanche National Grassland. This association has not been described in the literature.

Distribution: A western slope version (see above) of this plant association has been reported from the main stem of the Colorado River (CNHP 1996) and from the San Miguel River near Urvan (Kittel and Lederer 1993). On the Comanche National Grassland, this plant association is located on the west fork of Ou Creek in the Kim District pasture 11 Ane.

Site Characteristics: This association occurs within a moderately cut, rocky arroyo. It receives intermittent stream flow and has a gradient of 1.2%. The channel bed has large boulders and exposed bedrock. The adjacent slopes are relatively steep.

Vegetation: This stand has a high cover of *Rhus trilobata* (23%) with a *Populus deltoides* overstory of 39%. The understory is very weedy with *Bromus tectorum* (14%), *Elymus canadensis* (6%), and *Toxicodendron rydbergii* (poison ivy) (10%). See Table 9 for percent canopy cover of all dominant and diagnostic species.

Adjacent vegetation: Adjacent upslope consists of *Juniperus monosperma* (oneseed juniper) woodlands, *Artemisia frigida* (silver sage), and *Artemisia filifolia* (fringed sage) shrublands, as well as large patches of *Bromus tectorum* (cheatgrass).

Succession/Management: This occurrence is typical of arroyo riparian vegetation with vigorous growth. This plant association may be a late-seral stage of cottonwood on the Grassland, as the stand shows no sign of regeneration and is located on a dry, ephemeral wash. Grazing pressure at the site is not intense. This pasture is on a deferred rotation system June 23 through October 13.

Table 9. Percent canopy cover of diagnostic or dominant species and grazing information for the *Populus deltoides/Rhus trilobata* plant association.

Transect Number	13
Species	**Canopy Cover (%)**
Populus deltoides	39
Rhus trilobata var. *trilobata*	23
Bromus tectorum	14
Elymus canadensis	6
Toxicodendron rydbergii	10
Grazing Information	
Pasture Number	Kim 11 Ane
Grazing Regime	DR
Grazing Dates	Jun 23-Oct 13

DR = deferred rotation

Plains cottonwood/Kentucky bluegrass (*Populus deltoides/Poa pratensis*) Plant Association (tentative type)
(PODE/POPR) transect 59

CNHP RANK: GUSU

Related Types: This association appears to be similar to the *Populus deltoides/Poa pratensis* type described by Jones and Walford (1995) and Hansen *et al*. (1991). The stands on the Comanche National Grassland have a less abundant undergrowth, and lower species richness.

Distribution: This association is known from Montana, Wyoming and Colorado (Hansen *et al*. 1991; Jones and Walford 1995), and is likely to occur throughout the range of *Populus deltoides* spp. *monolifera*. On the Comanche National Grassland, the plant association is located in the Tecalote Canyon, Kim District pasture 12C.

Site Characteristics: This association occurs within the deeply cut channel in Tecalote Canyon. The soil is sandy, supporting small patches of herbaceous undergrowth. The channel receives intermittent stream flow with a gradient of 0.4%. The channel walls are steep and down cut. A wide terrace lies above, grading into gentle and moderate slopes that define the canyon.

Vegetation: The characteristic species of this plant association are *Populus deltoides* (61%) and *Poa pratensis* (3%). *Populus angustifolia* (15%) and *Juniperus monosperma* (1%) are also present. The sparse understory includes *Equisetum laevigatum* (horse tail) (0.25%). See Table 10 for percent canopy cover of all dominant and diagnostic species.

Adjacent Vegetation: Shortgrass prairie with *Yucca glauca* (yucca) and *Opuntia imbricata* (cholla) occupies the adjacent terraces while a juniper woodland occurs on the upslopes.

Succession/Management: The stand sampled has mature cottonwoods with no regeneration. This stand may be a result of a one-time storm event providing enough moisture for cottonwood survival. Due to the highly stochastic hydrologic regime of this draw, it is possible this cottonwood stand will not be replaced in the near future. The sandy soil is marked with hoof prints and cattle trails were observed on the adjacent terrace. This site is apparently dry and unproductive. Intensive grazing may further reduce site potential. This portion of pasture 12C is scheduled to be grazed from October 1 through November 15, however cattle were present in August and September, 1995.

Table 10. Percent canopy cover of diagnostic or dominant species and grazing information for the *Populus deltoides/Poa pratensis* plant association (tentative type).

Transect Number	59
Species	**Canopy Cover (%)**
Populus angustifolia	15
Populus deltoides	61
Juniperus monosperma	1
Poa pratensis	3

Grazing Information

Pasture Number	Timpas 23
Grazing Regime	varies
Grazing Dates	May and Dec 1-Feb 29

Populus deltoides: Unclassified
(PODE: UNCLASSIFIED) transects 33, 58 and 41

Two stands (transects 33 and 58) have a *Populus deltoides* (40-60%) overstory with a *Typha domingensis* (2-8%) and *Scirpus pungens* (2-12%) dominated understory. These stands occur within the active stream channel either near standing water or with intermittent stream flow. Few shrubs are present and include *Ribes aureum* (golden currant) (3%) and *Rhus trilobata* (skunkbush) (2%). The stand in Vogel Canyon (transect 33) has the only occurrence of *Sporobolus giganteus* (giant sacaton) sampled on the Grassland. *Pascopyrum smithii* grasslands and juniper woodlands occur adjacent to both site locations. Grazing pressure is moderate to heavy on both pastures. The Tecalote canyon sites are on a deferred rotation system and is slated for grazing from October 1 through November 15. However, cattle were observed in August and September, 1995. The grazing regime for the Vogel Canyon site (transect 58) is on a deferred rotation system, May 13 through May 26, and July 22 through August 11.

The third stand (transect 41) is dominated by *Populus deltoides* (31%) and *Tamarix ramosissima* (5%) with *Bromus tectorum* (cheatgrass) (8%) in the understory. Other species present are *Aster falcatus* (white prairie aster), with lower percentages of *Muhlenbergia asperifolia* (alkali muhly), *Pascopyrum smithii,* and a mixture of weedy annual forbs. This stand is located on the Timpas Creek near Mideman, pasture 20. While Timpas Creek has regenerating cottonwoods (over seventy saplings occurred along the transect), it seems likely that with channel migration away from the moist point bar, tamarisk will invade from the adjacent terrace and may eventually take over the cottonwood stand. This area is grazed for one month in the winter.

Populus angustifolia **Alliance**

<u>*Populus angustifolia*: Unclassified</u>
(POAN: UNCLASSIFIED) transect 54

In Plum Canyon, within the Timpas District pasture 23, the sampled stand is dominated by *Populus angustifolia* (narrow-leaf cottonwood) (14%) with an undergrowth of *Eleocharis palustris* (creeping spikerush) (11%) and *Pascopyrum smithii* (western wheatgrass) (13%). Other graminoid species include *Panicum obtusum* (vine mesquite) (9%), and *Schizachyrium scoparium* (little bluestem) (2%). Forbs include *Asclepias subverticillata* (milkweed) (1%), *Artemisia ludoviciana* (sagewort) (1%), and *Cirsium undulatum* (thistle) (<1%).

In addition, *Juniperus monosperma* is widely scattered within the riparian area and on the adjacent upslopes, but did not occur in the transect. Scattered shrubs (not occurring on the transect) include *Philadelphus microphyllus* (mock orange) and *Brickellia oblongifolia* (brickellia). Adjacent canyon slopes have stands of *Juniperus monosperma*, *Ribes* spp. (currant) and an occasional *Pinus edulis* (piñon pine).

A similar type, *Populus angustifolia/Elymus smithii*, has been described from eastern Wyoming by Jones and Walford (1995). *Elymus smithii* and *Pascopyrum smithii* are considered to be synonyms (Kartesz 1994). Another type, *Populus angustifolia-Juniperus scopulorum*, described from New Mexico by Durkin *et al.* (1995) is also similar in species composition. However, in New Mexico, *Juniperus monosperma* is replaced by *J. scopulorum* (see Durkin *et al.* 1995).

Other small stands of *Populus angustifolia* were observed on the Comanche National Grassland but they are uncommon and usually occur with *Populus deltoides*.

B. WILLOW SHRUBLANDS
Salix exigua Alliance

Coyote willow/Creeping spikerush (*Salix exigua*/*Eleocharis palustris*) Plant Association (SAEX/ELPA) transects 14 and 26

CNHP RANK: GUSU

Related Types: The *Salix exigua/Eleocharis palustris* community described by Durkin *et al.* (1995), the *Salix exigua*/mesic graminoid community described by Padgett *et al.* (1989) and the *Salix exigua*/mesic graminoid plant association described by Kittel and Lederer (1993) are similar in species composition to the plant association found on the Comanche National Grassland.

Distribution: Similar plant associations (see above) are widespread throughout Utah, New Mexico and southeastern Idaho (Padgett *et al*. 1989; Durkin *et al.* 1995). In Colorado, similar types (see above) are reported from the eastern plains and Colorado Front Range (Bunin 1985; Cooper and Cottrell 1990), and are thought to occur throughout the state (Kittell and Lederer 1993). On the Comanche National Grassland, this plant association occurs on Tobe Creek and in Kim pasture 11An.

Site Characteristics: The *Salix exigua/Eleocharis palustris* plant association occurs in channels and arroyos that receive intermittent stream flow and/or have standing water nearby. The stream gradient is low. Channel entrenchment is slight to moderate with stable stream banks. There is exposed bedrock near the channel banks.

Vegetation: *Salix exigua* is the characteristic overstory species of this plant association, but occurs in low abundance (5-7%). *Eleocharis palustris* dominates the understory with 13-20%. Common graminoid species include *Pascopyrum smithii* (western wheatgrass), *Juncus interior* (rush), *Bromus tectorum* (cheatgrass) and *Muhlenbergia asperifolia* (alkali muhly), (5-15%, collectively). The exotic, *Melilotus officinale* (yellow sweetclover), is the most common forb to occur (13%). See Table 11 for all diagnostic and dominant species.

Adjacent vegetation: Individual *Populus deltoides* trees commonly occur nearby. Adjacent uplands and terraces are dominated by shortgrass prairie or patches of *Bromus tectorum* (cheatgrass). Stands of *Opuntia imbricata* (cholla) may be found on adjacent terraces as well.

Succession/Management: This plant association is known to become established on recently deposited sand and gravel bars (Kittel and Lederer 1993). Water scarcity, weed competition and heavy grazing may be important factors limiting the distribution on the Comanche National Grassland. Cattle tend to concentrate in the channels and swales creating migration corridors for weedy species (Milchunas 1991). If conditions become drier or grazing levels increase, the community may convert into the coyote willow/ barren soil plant association (Padgett *et al*. 1989).

Table 11. Percent canopy cover of diagnostic or dominant species and grazing information for *Salix exigua/Eleocharis palustris* plant association.

Transect Number	14	26
Species	**Canopy Cover (%)**	
Salix exigua	5	7
Bromus tectorum	2	5
Eleocharis palustris	14	20
Juncus interior	0	4
Koeleria macrantha	0	4
Pascopyrum smithii	2	0
Melilotus officinale	13	0
Melilotus sp.	2	6
Grazing Information		
Pasture Number	Kim 11An	Kim 10E
Grazing Regime	SL DR	SL
Grazing Dates	Aug 1-Nov 15	May 11-Oct 15

DR = deferred rotation, SL = season long

Coyote Willow/Leafy Bulrush (*Salix exigua/Scirpus pungens*) Plant Association (SAEX/SCPU) transect 42

CNHP RANK: GUSU

Related Types: Recent taxonomic work suggests that *Scirpus pungens* and *S. americanus* are one species (Weber 1990; Soil conservation Service 1988). This plant association appears to be similar to the *Salix exigua/Scirpus americanus* community type described by Durkin *et al.* (1995).

Distribution: This plant association is widely spread through out the upper and middle Rio Grande of New Mexico and is also known from the Pecos River Basin (Durkin *et al*. 1995). On the Comanche National Grassland it occurs along Timpas Creek.

Site Characteristics: This plant association occurs on the floodplain of Timpas Creek, usually near standing water. The stand sampled is 2 feet above, and 70 feet from, the bank full channel mark, in a swale that collects water from lateral seepage. The stream gradient is low (2%) and the active channel's depth is only 0.7 feet deep. Severe down cut banks create the moderately wide canyon, characteristic of the Timpas Creek.

Vegetation: *Salix exigua* is the characteristic dominant species (16%). *Scirpus pungens* is the dominant understory species (33%). Common graminoid species are *Muhlenbergia asperifolia* (alkali muhly) and *Elymus canadensis* (Canada wildrye), while the most prominent forb is *Aster falcatus* (white prairie aster). See Table 12 for all diagnostic and dominant species.

Adjacent Vegetation: Dense stands of *Tamarix ramosissima* may occur adjacent to this plant association. *Populus deltoides* also occurs in this environment but in low numbers. Adjacent uplands are dominated by the characteristic shortgrass prairie with patches of *Lycium barbarum* (wolfberry) and *Opuntia imbricata* (cholla).

Succession and Management: *Salix exigua* is known to become established on recently deposited sand and gravel bars (Kittel and Lederer 1993). If moisture levels are maintained, *Scirpus pungens* will continue to regenerate (Johnston 1987). If conditions become drier or grazing levels are increased, the vegetation may convert to the *Salix exigua*/barren soil plant association (Padgett *et al*. 1989). Transect 42 is on a deferred rotation grazing system from November 1 through December 14.

Table 12. Percent canopy cover of diagnostic or dominant species and grazing information for *Salix exigua/Scirpus pungens* plant association.

Transect Number	42
Species	**Canopy Cover (%)**
Salix exigua	16
Bromus tectorum	7
Elymus canadensis	11
Muhlenbergia asperifolia	12
Scirpus pungens	33
Aster falcatus	5
Grazing Information	
Pasture Number	Timpas 20
Grazing Regime	DR
Grazing Dates	Nov. 1-Dec. 14

DR = deferred rotation

Coyote Willow/Barren Soil (*Salix exigua*/barren soil) Plant Association (SAEX/BARREN) transects 40, 44 and 52

CNHP RANK: G3QSU (Bourgeron and Engelking 1994)

Related Types: The *Salix exigua*/Barren community described by Padgett *et al.* (1989) and the *Salix exigua*/Sparse community type described by Durkin *et al.* (1995) are similar to this plant association on the Comanche National Grassland.

Distribution: The *Salix exigua*/Barren plant association is widespread in Utah and southeastern Idaho (Padgett *et al.* 1989). The *Salix exigua*/Sparse community is reported from the upper Rio Grande in northern New Mexico and through the Rio Grande Gorge (Durkin *et al*. 1995). On the Comanche National Grassland, this plant association is found along the Timpas Creek, in Devils Canyon Bloom Ponds site.

Site Characteristics: This plant association is usually found along Timpas Creek on fresh alluvium with a thin layer of silty loam over gravel and cobbles or on a similar substrate in intermittent channels. Channels of the Timpas Creek and Bloom Ponds sites are deeply entrenched with eroding silty walls. The stands occur within the active channel or immediately at the channel edge. The sparse understory appears to be due to recent flooding scour on one site (Devils Canyon), and a thick shaded overstory limiting sunlight at the other site (Timpas Creek). This plant association is very localized, occupying no more than 1,500 square feet at a time, and more commonly linear bands no larger than 200 square feet.

Vegetation: *Salix exigua* is the single dominating willow (36-66%) in this plant association. Herbaceous cover below the willow canopy is sparse, including *Sporobolus airoides* (alkali

sacaton), *Bothriochloa laguroides* (silver bluestem) and *Elymus canadensis* (Canada wildrye) with mixed weedy forbs such as, *Aster falcatus* (white prairie aster) and *Helianthus annuus* (annual sunflower). See Table 13 for all dominant and diagnostic species.

Adjacent vegetation: Timpas Creek has stands of *Populus deltoides* (plains cottonwood) and *Eleocharis palustris* (creeping spikerush) within the riparian mosaic. Stands of *Tamarix ramosissima* are also present. Upland slopes support the characteristic shortgrass prairie.

Succession/Management: *Salix exigua* is flood tolerant and an early seral pioneer of sand and gravel bars (Kittel and Lederer 1993). *Salix* spp. offer stream bank stability and stream shading (Padgett *et al*. 1989). The dense thickets of *Salix exigua* along Timpas Creek were usually devoid of *Tamarix ramosissima*, although tamarisk occurs on adjacent terraces. The active channel, which is flooded every year, supports thick stands of *Salix exigua*. Apparently *Tamarix* is not as flood tolerant as the native woody species (Stromberg *et al.* 1993) and is therefore restricted to adjacent, less frequently flooded surfaces (Siscoe 1993; Durkin *et al*. 1994).

In the absence of tamarisk invasion, this plant association could achieve a mesic graminoid or a mesic forb understory. If the area is drier, as in the Devils Canyon and Bloom Ponds sites, then *Poa pratensis* may become the dominant understory (Padgett *et al*. 1989). However, with continued annual flooding the *Salix exigua*/barren soil plant association will persist within the active channel (Durkin *et al*. 1995).

Table 13. Percent canopy cover of diagnostic or dominant species and grazing information for transects 40, 44, and 52 for *Salix exigua*/Barren soil plant association.

Transect Number	40	44	52
Species		**Canopy Cover (%)**	
Salix exigua	65	36	66
Bothriochloa laguroides ssp. *torreyana*	0	4	3
Elymus canadensis	1	2	1
Sporobolus airoides	0	2	12
Aster falcatus	0	6	0
Grazing Information			
Pasture Number	exclosure	Timpas 23	Timpas 23
Grazing Regime	none	varies	varies
Grazing Dates	none	Dec1-May31	May and

C. NEEDLE-LEAVED DECIDUOUS SHRUBLAND

Tamarix ramosissima Alliance

Note: The Colorado Natural Heritage Program does not assign an element rank plant association dominated by non-native, adventitious species such as this one. Since element ranks are used to determine conservation priorities, they are considered unnecessary for non-native plant associations.

Tamarisk/mixed graminoids (*Tamarix ramosissima*/mixed graminoids) Plant Association (TARA/GRAM) 6 transects (4,6,8,18,20,46)

CNHP Rank: not ranked (non-native association)

Related Types: Similar types, *Tamarix pentandra/Sporobolus airoides* community and *Tamarix pentandra/ Buchloe dactyloides*, have been described by Durkin *et al.* (1994).

Distribution: The *Tamarix pentandra* communities described by Durkin *et al.* (1994) borders playa lakes in southeastern New Mexico. On the Comanche National Grassland, this plant association was found in several Timpas District pastures.

Site Characteristics: This plant association occurs in gentle drainage draws, swales and channels, near bermed ponds or standing water. The soils are silty and able to support a herbaceous layer. The draws receive intermittent stream flow and have a low stream gradient.

Vegetation: Stands of this plant association have an overstory of *Tamarix ramosissima* ranging from 12% to 35%, with a graminoid undergrowth. Dominant graminoid species include *Sporobolus airoides* (0-9%), *Pascopyrum smithii* (1-18%) and *Bromus tectorum* (2-5%). Other species include *Distichlis spicata* (inland saltgrass), *Hilaria jamesii* (galleta grass), *Typha spp*. (cattail), *Sporobolus cryptandrus* (sacaton), *Panicum obtusum* (vine mesquite), *Hordeum jubatum* (foxtail barley), *Helianthus annuus* (annual sunflower), and *Psoralidium tenuiflora* (scurfy pea). See Table 14 for percent canopy cover for all diagnostic and dominant species.

Adjacent vegetation: Upland communities are usually short grass prairie.

Succession/Management: Members of the genus, *Tamarix* occur in southwestern United States and the Great Plains Region (Great Plains Flora Association 1991). *Tamarix* is an exceptional competitor in riparian areas and once established is almost impossible to eradicate (Durkin *et al*. 1995). *Tamarix ramosissima* is shade intolerant and establishes on moist, disturbed sites (Stevens 1987 as cited by Siscoe 1993). Many stands of *Tamarix* on the Comanche National Grassland occur around bermed ponds, where the moisture is retained, but scouring floods do not occur. Many stands also occur along streams and washes, but are restricted to low terraces and drier floodplains (see discussion under *Salix exigua*/barren soil p.a.). This suggests that tamarisk dominated plant associations do well in areas where moisture is retained, but disturbance by flooding is limited. Along streams, tamarisk has the opportunity to replace nearly all of the

native riparian vegetation for many miles. Tamarisk stands on isolated swales and bermed ponds, however, are not likely to spread or become significantly larger.

Table 14. Percent canopy cover of diagnostic or dominant species and grazing information for transects 4, 6, 18, 20, and 46 for *Tamarix ramosissima*/Mixed graminoids plant association.

Transect Number	4	6	8	18	20	46
Species			**Canopy Cover (%)**			
Tamarix ramosissima	20	19	35	12	19	22
Bromus japonicus	14	0	0	0	0	0
Bromus tectorum	1	18	6	18	17	3
Buchloe dactyloides	1	0	0	0	0	0
Hilaria jamesii	2	0	0	1	1	0
Hordeum jubatum	0	1	0	1	0	1
Panicum obtusum	0	0	0	6	0	9
Pascopyrum smithii	10	0	1	22	25	2
Scirpus pungens	0	3	0	0	0	0
Sporobolus airoides	2	1	1	2	5	0
Sporobolus cryptandrus	1	0	0	1	1	8
Helianthus annuus	0	0	2	2	0	1

Grazing Information

Pasture Number	Timpas	Timpas	Timpas	Timpas	Timpas	Timpas18
Grazing Regime	DR	varies	M-DR	exclosure	DR	varies
Grazing Dates	May24-Oct 31	May and Dec1-Feb29	Mar 1-Feb28	*fencing down	June 1-Mar 10	off season

DR = deferred rotation, M-DR = modified deferred rotation

Tamarisk/Sparse (*Tamarix ramosissima*/Sparse) Plant Association
(TARA/SPARSE) transects 11, 38, 56 and 78

CNHP Rank: not ranked (non-native association)

Related Types: This plant association is similar to *Tamarix chinensis*/Sparse community described by Durkin and others (1995), however, the species of *Tamarix* is different on the Comanche National Grassland.

Distribution: The genus *Tamarix* is widespread in southern United States and the Great Plains region (Great Plains Flora Association 1991). The community described by Durkin *et al.* (1995) is found in central New Mexico at low elevations and along the floodplains of the Rio Grande. Most stands found on the Comanche National Grassland occur in the Timpas District's active pastures, either on Timpas Creek and mesic arroyos. One stand occurs within the Timpas Creek grazing exclosure.

Site Characteristics: This association occurs along Timpas Creek, the only perennial stream in the Timpas grazing pasture, and in less dense bands localized in deep swales and arroyos where water collects annually. In general, soils are loose and sandy. Stream gradients are low ranging from 0.4% to 2%.

Vegetation: This plant association is dominated by *Tamarix ramosissima* (5-81%). Other species occur in low abundance: *Sporobolus airoides* (alkali sacaton), *Poa arida* (arid poa), *Elymus canadensis* (Canada wildrye), *Bromus tectorum* (cheatgrass), *Melilotus officinalis* (yellow sweetclover),and *Ratibida columnifera* (prairie coneflower). See Table 15 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: This plant association is found along the Timpas Creek within a mosaic of communities including stringer *Eleocharis* sp. (spikerush) bands, *Populus deltoides*, *Salix exigua* thickets and, unvegetated sand and gravel bars. The uplands of all sites observed have short grass prairies with patches of *Bromus tectorum* and shrublands.

Succession/Management: Thickets of tamarisk occur on the floodplain, but not within the active stream channel. The sparse undergrowth appears to be due to depositional flooding. Annual flooding may also explain why the percent canopy cover of this association is lower than in others. Annual flooding may be limiting tamarisk growth by the physical removal and damage of saplings, and by reducing soil salinity (Stromberg *et al.* 1993; Siscoe 1993). *Tamarix* sp. can tolerate high levels of salinity, and is known to actually increase soil salinity where stands occur (Siscoe 1993). This process enables *Tamarix* spp. to out compete native species where soil salinity is increasing. However, annual flooding of Timpas Creek may decrease the competitive advantage of tamarisk. Therefor, any alteration of the hydrology of Timpas Creek that results in reduced flooding may cause an increase in the abundance and further establishment of tamarisk on the Grassland.

Tamarisk is successfully occupying large areas of active floodplain on the Grassland. With stream channel migrations and flooding, new alluvial surfaces are created and areas usually

occupied by early seral communities are vulnerable to tamarisk invasion. Once established, it is almost impossible to eradicate (Durkin *et al.* 1995). Modes of removal are costly and sometimes not feasible such as long-duration inundation or bulldozing (Siscoe 1993).

Table 15. Percent canopy of diagnostic or dominant species and grazing information for transects 11, 38, 56, and 78 for *Tamarix ramosissima*/Sparse plant association.

Transect Number	11	38	56	78
Species		**Canopy Cover (%)**		
Tamarix ramosissima	23	81	15	5
Aristida purpurea	5	0	0	0
Bromus tectorum	3	2	0	1
Elymus canadensis	0	1	3	2
Pascopyrum smithii	0	1	3	1
Poa arida	0	7	0	0
Sporobolus airoides	0	0	8	2
Gutierrezia sarothrae	0	0	0	3
Helianthus annuus	0	1	1	0
Heterotheca canescens	0	0	0	4
Ratibida columnifera	0	4	1	1
Grazing Information				
Pasture Number	Timpas14	exclosure	Timpas2	Timpas24
Grazing Regime	M-DR	none	DR	DR
Grazing Dates	Jun1- Aug 16	none	Jun 1- Dec 1	May 1- Jul 31

DR = deferred rotation, M-DR = modified deferred rotation

Tamarix ramosissima: Unclassified

(TARA:UNCLASSIFIED) transect 63

Tamarix ramosissima and *Rhus trilobata* are the dominant species (8% each) on this stand sampled in Devils Canyon. Vegetation is sparse with *Bothriochloa laguroides* (silver bluestem) as the dominant understory species. *Krascheninnikovia lanata* (winter fat), *Opuntia imbricata* (cholla), *Bromus tectorum* (cheatgrass) and *Melilotus* spp. (sweet clover) are on the terraces adjacent to this site. There is evidence of tamarisk encroachment in the arroyo. The grazing regime is on a varied system between December 1 and May 31.

(TARA: UNCLASSIFIED) transect 36

Tamarix ramosissima (16%) is the dominant overstory species in the Timpas Creek exclosure site. *Typha domingensis* (cattail) is the dominant understory species (42%). *Eleocharis palustris* (creeping spikerush) (27%) and *Scirpus pungens* (leafy bulrush) 12%) are also abundant. The site is wet throughout the growing season, and may represent a cattail plant association being invaded by tamarisk. The banks of this small canyon are severely down cut and eroding. Short grass prairie occurs on the adjacent uplands. No grazing occurs within this riparian exclosure.

(TARA: UNCLASSIFIED) transect 10

This stand, located on the Timpas Creek in pasture 14, is dominated by *Tamarix ramosissima* (8%) and *Salix exigua* (coyote willow) (13%). Weedy species dominate the understory including *Bromus tectorum* (cheatgrass) (13%) and *Melilotus* sp.(sweetclover) (19%). This site is composed of a mosaic of communities including patches of spikerush (*Eleocharis* spp.) and *Bromus tectorum - Helianthus annuus* (cheatgrass - annual sunflower) patches. The site is within the shallow canyon with a degraded (weedy) shortgrass prairie on the adjacent upland. The grazing regime is on a modified deferred rotation system from June 1 through August 16.

D. COLD DECIDUOUS SCRUB-SHRUB SHRUBLAND
Atriplex canescens Alliance

Fourwinged salt bush/Western wheatgrass (*Atriplex canescens/Pascopyrum smithii*) Plant Association
(ATCA) transects 79 and 88

CNHP RANK: G5S5

Related Types: A similar type, *Atriplex canescens*/*Elytrigia smithii-Bouteloua gracilis* plant association, is listed by Johnston (1987). (*Elymus smithii* and *Pascopyrum smithii* are treated here as synonyms, (Kartesz 1994). Also similar is the *Atriplex canescens/Sporobolus airoides* plant community described by Shaw *et al.* (1989).

Distribution: The *Atriplex canescens/Elytrigia smithii-Bouteloua gracilis* plant association is reported to occur in southwest North Dakota (Johnston 1987). The *Atriplex canescens/Sporobolus airoides* plant community (see above) is reported to be widespread over the Piñon Canyon Maneuver Site in south central Colorado (Shaw *et al*. 1989). On the Comanche National Grassland, *Atriplex canescens* is widespread on the prairie, but more notably bordering drainage channels, and dotting stream-side terraces. One stand was sampled in Timpas District pasture 21 near Nemo Windmill.

Site Characteristics: This plant association is associated with drier sites, and grows in long, thickets along entrenched channel edges (6 feet above and 6 feet from the bank full channel). The channel receives intermittent stream flow with a gradient of 0.6%.

Vegetation: The dominant shrub is *Atriplex canescens* (36%) with *Pascopyrum smithii* (9%) dominating the understory. Another example of the *Atriplex canescens* plant association is observed adjacent to transect 32 (Sheep Canyon Arroyo) where *Atriplex canescens* occurs in a dense band about one mile long with *Lycium barbarum* (wolf berry) interspersed. See Table 16 for percent canopy cover of the diagnostic and dominant species.

Adjacent vegetation: The adjacent vegetation is shortgrass prairie with patches of *Bromus tectorum* (cheatgrass).

Succession/Management: *Atriplex canescens* achieves its highest densities on alluvial fans and along arroyos and intermittent streams (Shaw *et al*. 1989), and usually occurs on alkaline soils (Great Plains Flora Association 1991). This species is a good winter browse. The fruits are utilized by cattle and wildlife (Tipton 1994; Stubbendieck *et al.* 1992). With heavy winter grazing, however, *Atriplex canescens* and *Pascopyrum smithii* will decrease in abundance (Soil Conservation Service 1975).

Table 16. Percent canopy cover of diagnostic or dominant species and grazing information for transect 88 for *Atriplex canescens/Pascopyrum smithii* plant association.

Transect Number	88
Species	**Canopy Cover (%)**
Atriplex canescens	36
Pascopyrum smithii	8
Chenopodium berlandieri	5
Descurainia sophia	2
Ratibida columnifera	4
Grazing Information	
Pasture Number	Timpas21
Grazing Regime	Swing
Grazing Dates	off season

Atriplex canescens: Unclassified
(ATCA: UNCLASSIFIED) transect 79

One stand in Timpas District pasture 24, Bear Springs Arroyo, has a low canopy cover of *Atriplex canescens* (4%), *Sporobolus cryptandrus* (sand sacaton) (3%) and *Ratibida columnifera* (prairie coneflower) (2%). Adjacent vegetation is shortgrass prairie to the west and scattered juniper woodland to the east. The site is located in a moderate to slightly entrenched channel beneath a shale hill. The stand occurs on the active channel bed, which is vegetated with a variety of weedy species, interspersed with gravel, shale, and silt. The area appears to have been scoured by spring floods. Stream gradient is 0.5%. The grazing regime is a deferred rotation system, May 1 through October 31.

E. HERBACEOUS PLANT ASSOCIATIONS

Eleocharis palustris Series

Creeping spikerush (*Eleocharis palustris*) plant association
(ELPA) 7 transects (25,245,47,55,57,62)

CNHP Rank: G5S3S4 (Bourgeron and Engelking 1994)

Related Types: This association appears similar in dominant species to the *Eleocharis palustris* plant association described by Johnston (1987), Padgett *et al.* (1989), and Kittel and Lederer (1993).

Distribution: *Eleocharis palustris* plant association is widespread throughout Utah and southeastern Idaho (Johnston 1987; Padgett *et al*. 1989). In Colorado it is reported from the San Miguel/Dolores River Basin (Kittel and Lederer 1993) and the San Juan Mountains (Johnston 1987). On the Comanche National Grassland, the *Eleocharis palustris* plant association is common in draws and channels across the prairie and along the Timpas Creek floodplain.

Site Characteristics: This plant association occurs in highly localized bands, usually in or near standing water in isolated swales, gentle drainage draws, and arroyos. Most stands occur on the channel margin, but can also occur in isolated wet places, such as seeps and swales some distance from the riparian area (transect 62, Devils Canyon). Stream gradient varies from slight (1%) to high (8%). Channel entrenchments are slight to moderate.

Vegetation: This plant association is characterized by *Eleocharis palustris* (7-25%). Other graminoids commonly present are *Hordeum jubatum* (foxtail barley) (1-32%) and *Juncus* spp. (1-12%). *Tamarix ramosissima* is invading the West Dry Creek site (30% cover, transect 47). A few *Salix exigua* saplings occur within the upper Tobe Creek site (transect 26). See Table 17 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: It is common to observe a thin band of weedy species along the edges of this plant association. Adjacent upland vegetation is usually shortgrass prairie, including *Sporobolus airoides* (alkaline sacaton) and *Yucca glauca* (yucca).

Succession/Management: *Eleocharis palustris* is an early successional species that occurs in areas that support seasonally ponds. Although this type is considered a wetland community, it has the ability to survive when the water table drops below the surface (Padgett *et al*. 1989). Many of our sites exhibit this drier condition. Kittel and Lederer (1993) note this as an ephemeral community, able to survive annual spring scouring.

The *Eleocharis palustris* plant association of the Comanche National Grassland is associated with moist low areas that attract cattle, and many stands has signs of intense grazing and severe trampling.

Table 17. Percent canopy cover of diagnostic or dominant species and grazing information for *Eleocharis palustris* plant association.

Transect Number	25	45	47	55	57	62
Species			Canopy Cover (%)			
Tamarix ramosissima	0	0	29	0	0	0
Bothriochloa laguroides ssp. *torreyana*	0	1	0	0	0	10
Bromus tectorum	0	1	5	1	0	1
Echinochloa crus-galli	0	0	0	1	0	8
Eleocharis palustris	35	34	26	27	8	26
Hordeum jubatum	13	2	10	32	1	1
Juncus balticus var. *montanus*	3	0	0	0	0	0
Juncus interior	5	0	0	0	0	0
Juncus longistylis	12	0	0	0	0	0
Juncus torreyi	1	3	0	1	0	0
Koeleria macrantha	10	0	0	0	0	0
Muhlenbergia asperifolia	0	8	15	1	0	0
Panicum obtusum	0	4	0	0	3	0
Pascopyrum smithii	0	1	0	10	0	0
Polypogon monspeliensis	4	2	1	0	0	0
Scirpus pungens	0	0	0	2	1	0
Typha domingensis	1	2	0	4	0	0
Helianthus annuus	7	4	8	5	0	0

Grazing Information

Pasture Number	Kim 10E	Timpas18	Timpas21	Timpas9	Timpas2	Timpas23
Grazing Regime	SL	varies	Swing	DR varies	DR	varies
Grazing Dates	May 11-Oct5	off season	Oct 1-Feb28	in conj. w/Timp11	Jun1-Dec1	Dec1-May31

Creeping spikerush - leafy bulrush (*Eleocharis palustris - Scirpus pungens*) plant association (ELPA/SCPU) 5 transects (22,24,34,35,86)

CNHP Rank: G2G4SU (Bourgeron and Engelking 1994)

Related Types: This association appears to be synonymous to the *Scirpus americanus-Eleocharis palustris* community type described by Durkin *et al.* (1995). The *Eleocharis palustris* type described by Jones and Walford (1995) also appears similar in that *Scirpus pungens* is reported to reach substantial cover. In the Colorado literature, *Scirpus pungens* has been erroneously reported as *Scirpus americanus* (Soil Conservation Service 1988; Weber 1990).

Distribution: The *Scirpus americanus-Eleocharis palustris* plant association is widespread in the upper and middle Rio Grande of northern and central New Mexico (Durkin *et al*. 1995), central and north central Wyoming (Jones and Walford 1995), and Colorado (CNHP 1996). On the Comanche National Grassland, this association occurs in or near standing water of stream channels, arroyos, and prairie swales.

Site Characteristics: This plant association occurs on wet to mesic sites with standing water in slightly to moderately entrenched channels of canyons and arroyos. Channels receive intermittent stream flow and have low stream gradients.

Vegetation: *Eleocharis palustris* (18-67%) and *Scirpus pungens* (6-35%) are the dominant species in all but one of the stands sampled on the Comanche National Grassland. In one stand (transect 22, Timpas pasture 2), *Juncus arcticus* ssp. *ater* (arctic rush) is the dominant (48%) while *Scirpus pungens* (34%) and *Eleocharis palustris* (32%) are co-dominants. *Typha domingensis* (cattail) is occasionally present (0-15%). In general, total species richness is low within this plant association. See Table 18 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: Weedy species commonly occur along the edge of this association, and include *Helianthus annuus* (annual sunflower), *Xanthium strumarium* (common cocklebur), *Salsola* spp. (Russian thistle), *Sporobolus airoides* (alkaline sacaton), *Bothriochloa laguroides* (silvery bluestem), *Hordeum jubatum* (foxtail barley) and *Elymus canadensis* (Canada wildrye). Weedy species drop out and are replaced by short grass prairie and desert shrubs further away from the occurrence.

Succession/Management: *Eleocharis palustris* is an early seral species that requires saturated soils, and can inhabit areas of seasonal flooding. *Scirpus pungens* exists in areas of constant moisture (Johnston 1987). On the Comanche National Grassland *Scirpus pungens* occurs only when standing water is present, in dryer areas it is absent. Areas with greater moisture availability throughout the growing season have higher species diversity within individual plant associations, and tend to have a higher variety of plant associations within the riparian mosaic.

One stand (Seventh Meridian Timpas pasture 11, transect 86) shows severe disturbance by livestock. Canopy cover is very low with *Eleocharis palustris* (1%) and *Scirpus pungens* (4%). The site is scared by deep hoof prints in the mud, and has many barren areas (see

Appendix D, Seventh Meridian site photograph). Similar stand observations indicate this area was once was a shallow pond rimmed with bands of *Eleocharis palustris* and *Scirpus pungens*. Continued overuse by livestock will eliminate this plant association from the site. The grazing regime for pasture 11 varies in conjunction with pasture 9 and private property.

Table 18. Percent canopy cover of diagnostic or dominant species and grazing information for *Eleocharis palustris-Scirpus pungens* plant association.

Transect Number	22	24	34	35	86
Species			**Canopy Cover (%)**		
Bromus tectorum	4	1	1	1	0
Eleocharis palustris	34	18	23	68	1
Elymus canadensis	2	1	2	0	1
Hordeum jubatum	7	2	2	5	0
Juncus balticus var. *montanus*	49	0	0	0	0
Scirpus pungens	34	18	6	39	5
Sporobolus airoides	0	14	0	0	0
Typha domingensis	0	13	14	1	2

Grazing Information

Pasture Number	Timpas2	Timpas7	Timpas5	Timpas5	Timpas11
Grazing Regime	SLDR	SLDR	varies R	varies R	varies
Grazing Dates	Jun 1-Nov 1	May 6-Nov 16	May13-26 Jul 22-Aug 11	Apr29-May12 & Jul 1-21	in conj. w/Timp.9

Pascopyrum smithii Alliance

Western wheatgrass (*Pascopyrum smithii*) plant association
(PASM) 16 transects (3,5,16,17,19,27,29,32,39,48,49,50,82,83,84,89)

CNHP Rank: G3G5S1? (Bourgeron and Engelking 1994)

Related Types: This plant association is similar to the *Elymus smithii* (western wheatgrass) community described by Jones and Walford (1995), and the *Agropyron smithii/Bouteloua gracilis* communities of south central Colorado described by Shaw *et al.* (1989), except *Bouteloua gracilis* is not as abundant in the riparian areas on the Comanche National Grassland. The physical settings are similar for both south central Colorado and Comanche National Grassland sites. Note that western wheatgrass has several synonyms, including *Agropyron smithii* and *Elymus smithii* (Soil Conservation Service 1980).

Distribution: This plant association is reported from northeastern Wyoming (Jones and Walford 1995). The *Agropyron smithii/Bouteloua gracilis* plant association is widespread in the Piñon Canyon Maneuver Site, just north and west of the Comanche National Grassland (Shaw *et al*. 1989). *Flora of the Great Plains* (1991) notes that western wheatgrass is common and at times abundant on the prairies. In the Timpas and Kim Districts on the Comanche National Grassland, *Pascopyrum smithii* communities are widespread in the drainage draws, swales, and channels.

Site Characteristics: This plant association occurs on gentle draws, channels, and swales receiving intermittent stream flow. Channel entrenchment is slight and stream gradient low. Stands commonly occur within the active channel.

Vegetation: *Pascopyrum smithii* is the dominant species (4-62%). Associated species vary widely, including *Panicum obtusum* (vine mesquite), *Aristida purpurpea* (red threeawn), *Bouteloua gracilis* (blue grama), *Sporobolus airoides* (alkali sacaton) and *Bothriochloa laguroides* (silver bluestem). Stands with low amounts of *Pascopyrum smithii* usually contain significant cover of weedy species and bare ground, including *Helianthus annuus* (annual sunflower), *Xanthium strumarium* (common cocklebur), *Ratibida columnifera* (prairie coneflower), *Ambrosia psilostachya* var. *coronopifolia* (ragweed), *Aster falcatus* (white prairie aster) *a*nd others. Weedy stands with low *Pascopyron smithii* cover are included here because it is assumed they represent degraded occurrences of this plant association, and exhibited signs of heavy usage, such as cattle trails and severe trampling. See Table 19 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: Weedy species occur above the channels and draws of this plant association. Adjacent uplands are dominated by shortgrass prairie characterized by *Bouteloua gracilis, Buchloe dactyloides, Gutierrezia sarothrae* (broom snakeweed) and others.

Succession/Management: *Pascopyrum smithii* has rhizomatous roots, creating dense mats in channels and gentle drainages common on the Comanche National Grassland. It is a good range

plant and cures well, providing good winter forage (Stubbendieck *et al*. 1992). Since cattle tend to concentrate in mesic swales and low places on the prairie (Milchunas 1991), this association is commonly over-utilized. Observed stands have cattle trails and areas where cattle bedded down directly on mats of *Pascopyrum smithii*. In addition to trampling and potential over-utilization, cattle introduce many weedy species (Hansen *et al.* 1989).

Western wheatgrass is most palatable in the early spring, but care should be taken not to heavily graze this species as it will be replaced by less desirable plants. Under heavy grazing, *Pascopyrum smithii*, *Stipa comata* (needle and thread grass) and *Bouteloua curtipendula* (side oats grama) decrease in abundance, while *Bromus tectorum* (cheatgrass), *Xanthium strumarium* (common cocklebur), *Salsola australis* (Russian thistle), *Solanum rostratum* (buffalobur) and others may invade (Soil Conservation Service 1982; 1983a; 1984).

Aristida purpurea, a co-dominant in some areas, is poor forage for all grazing animals but may be grazed in its early development before awn production. It is considered an indicator of range deterioration (Stubbendieck *et al*. 1991). *Panicum obtusum* is fair to good forage and is able to withstand heavy grazing (Stubbendieck *et al.* 1992).

Table 19. Percent canopy cover of diagnostic or dominant species and grazing information for *Pascopyrum smithii* plant association.

Transect Number	3	5	16	17	19	29	32	39	48	49	50	82	83	84	89
Species	**Canopy Cover (%)**														
Aristida purpurea	0	2	1	28	0	0	0	0	0	0	0	0	0	0	0
Bouteloua gracilis	0	4	0	0	12	17	2	17	1	5	0	0	2	2	0
Bromus tectorum	0	0	7	0	3	7	5	1	2	0	0	0	0	0	0
Panicum obtusum	0	1	0	0	0	10	9	2	2	19	0	9	3	3	0
Pascopyrum smithii	43	13	19	17	14	10	14	14	62	21	12	4	13	4	3
Sporobolus airoides	7	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Sporobolus cryptandrus	0	0	0	0	2	2	1	0	0	0	0	0	0	1	0
Ambrosia psilostachya var. *coronopifolia*	0	2	1	1	0	5	0	0	0	0	7	0	0	0	0
Aster falcatus	0	0	1	0	2	0	0	2	4	0	0	0	0	0	1
Helianthus annuus	0	0	0	0	2	0	2	1	1	1	0	0	0	1	0
Ratibida columnifera	0	1	8	0	5	8	13	4	1	2	4	2	3	2	0

Grazing Information

Pasture Number	T1	T13	K12C	K12B	T10	T4	T20	E	T21	T20	K10D	T17	T17	T17	T21
Grazing Regime	N	DR	DR	DR	E	DR	DR	N	S	Dr	DRSL	C	C	C	varies
Grazing Dates	N	Mar 1-Feb28	May 16-Sep30	May 16-31	*F	May 20-Nov 15	Mar 1-Feb28	N	Oct 1-Feb18	Mar 1-Feb 28	May 16-Oct15	Sep 1-30	Sep 1-30	May 16-31	off season

DR = Deferred rotation, DRSL = Deferred rotation season long, E = Exclosure, *F = Fencing down, K = Kim, N = None, S = Swing, T = Timpas, C = Continuous

Western wheatgrass-Inland Saltgrass (*Pascopyron smithii - Distichlis spicata*) Plant Association (PASM-DISP) transect 30

CNHP Rank: GUSU

Related Types: The transect sampled on the Comanche National Grassland is similar to the *Distichlis spicata-Elytrigia smithii* plant association described by Johnston (1987). This plant association is also similar to the *Distichlis stricta* type described by Jones and Walford (1995). Note that *Distichlis stricta* is a synonym for *Distichlis spicata* (Weber 1990).

Distribution: The *Distichlis spicata-Elytrigia smithii* plant association occurs on alluvial lowlands, saline areas around lakes, and in flat narrow valleys with a slight slope (0 to 10%). These sites are reported from north central Nebraska, south Saskatchewan and Thunder Basin National Grassland (Johnston 1987). In eastern Wyoming, it is found in low elevations on intermittent, low-gradient, meandering streams (Jones and Walford 1995). We located one occurrence on the Comanche National Grassland in a gentle draw within pasture 4 of the Timpas District.

Site Characteristics: This plant association occurs within draws and swales with intermittent stream flow. The stand we sampled is between two headcuts of a draw. The channel is slightly entrenched and hardly distinguishable from the upland, with a low stream gradient (0.01%).

Vegetation: The characteristic dominant species are *Distichlis spicata* (8%) and *Pascopyrum smithii* (6%). *Sporobolus cryptandrus* (sand sacaton) is also present (7%). Forb species include *Lesquerella montana* (bladder pod) (5%) and *Tragopogon dubious* (salsify) (3%). See Table 20 for percent canopy cover of all diagnostic and dominant species.

Adjacent Vegetation: Short grass prairie with *Yucca glauca* (yucca) and *Bromus tectorum* (cheatgrass) occur on the adjacent upland.

Succession and Management: *Distichlis spicata* inhabits moist saline and alkaline soils (Johnston 1987). It is of poor forage quality, but livestock will graze it if other grasses are not available. It is highly resistant to trampling and will out compete other species in an overgrazed situation (Stubbendieck *et al*. 1992). Pasture 4 is on a deferred rotation grazing system from May 20 through November 15.

Table 20. Percent canopy cover of diagnostic or dominant species and grazing information for *Pascopyrum smithii-Distichlis spicata* plant association.

Transect Number	30
Species	**Canopy Cover (%)**
Bouteloua gracilis	3
Distichlis spicata	8
Panicum obtusum	2
Pascopyrum smithii	6
Sporobolus cryptandrus	7
Lesquerella montana	5
Tragopogon dubius	3

Grazing Information

Pasture Number	Timpas4
Grazing Regime	DR
Grazing Dates	May 20-Nov 15

Buchloe dactyloides Series

Buffalo grass (*Buchloe dactyloides*) plant association
(BUDA) transects 1, 12, 28 and 51

CNHP Rank: GUSU

Related Types: *Bouteloua gracilis* (blue grama) and *Buchloe dactyloides* are the two dominant species of the North American short grass prairie (Barbour and Billings 1988). Johnston (1987) describes two *Buchloe* dominated plant associations (*Buchloe dactyloides/Carex* ssp. and *Buchloe dactyloides/Elytrigia smithii*) from northern Colorado, southeastern Wyoming, the Dakotas and Nebraska. In stands sampled on the Comanche National Grassland, *Bouteloua gracilis* occurs at much lower abundance than those reported in the literature.

Distribution: The *Bouteloua gracilis-Buchloe dactyloides* short grass prairie has been documented to occur in Nebraska, Kansas, Wyoming, Colorado, and New Mexico (Midwest Heritage Task Force 1994; Johnston 1987; Bourgeron and Engelking 1994; Dick-Peddie 1993). The *Buchloe dactyloides* plant association is fairly common in the Kim District (pastures 4A, 10A, 10E, and 10G) of the Comanche National Grassland.

Site Characteristics: This plant association usually occurs in dry, slightly entrenched channels and gentle draws receiving intermittent stream flow. It is highly localized, occurring in a mosaic with *Bouteloua gracilis*, where *Buchloe dactyloides* will dominate in depressed patches as a dense sod. Occurrence size ranges from 23,760 to 86,400 square feet.

Vegetation: The characteristic species is *Buchloe dactyloides*, ranging from 12% to 52% cover. *Bouteloua gracilis* occurred in all but one of the measured stands (3-22%). Kim pasture 10G has a high cover (28%) of *Monroa squarrosa* (false buffalo grass). *Pascopyrum smithii* occurred in all of the sampled stands (2-4%). Forb species are numerous but never abundant. See Table 21 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: Shortgrass prairie usually dominates the adjacent communities. Juniper woodlands occur on adjacent upslopes of the Tobe Creek site (transect 28).

Succession/Management: Stands of nearly pure *Buchloe dactyloides* have been reported to occur in draws and on clay pans, forming dense mats of limited extent (Weaver 1954). However, it occurs most commonly occurs in association with *Bouteloua gracilis*, and is considered an important component of the North American short grass prairie (Weaver 1954; Barbour and Billings 1989). With heavy grazing, *Buchloe dactyloides* will increase (Knopf 1995; Brown 1989; Weaver 1954; Stubbendieck *et al.* 1992). This may be the reason for nearly pure stands of *Buchloe dactyloides* observed in lowland areas on the Comanche National Grassland.

With heavy grazing, *Buchloe dactyloides* becomes more sod-like, decreasing the biomass and forage value, but aiding in soil moisture retention and erosion stability (Soil Conservation Service 1984). Other species that may increase with grazing are *Aster falcatus* (white prairie aster), *Gutierrezia sarothrae* (broom snakeweed), and *Opuntia polycantha* (prickly pear) (Soil

Conservation Service 1984). The invasion of non-native species such as *Xanthium strumarium* (common cocklebur), *Salsola australis* (Russian thistle), *Bromus tectorum* (cheatgrass) and others also occur with heavy grazing (Soil Conservation Service 1984). The Kim Grazing District is on a deferred rotation grazing regime during May through October or November.

Table 21. Percent canopy cover of diagnostic or dominant species and grazing information for *Buchloe dactyloides* plant association.

Transect Number	1	12	28	51
Species		**Canopy Cover (%)**		
Aristida purpurea	1	4	3	0
Bouteloua gracilis	3	22	0	7
Bromus tectorum	0	1	1	1
Buchloe dactyloides	12	33	63	12
Monroa squarrosa	0	0	0	28
Pascopyrum smithii	4	2	3	5
Artemisia frigida	0	9	0	1
Gaura coccinea	1	1	1	1
Gutierrezia sarothrae	2	0	4	1

Grazing Information

Pasture Number	Kim 10A	Kim 4A	Kim 10E	Kim 10G
Grazing Regime	SL	DR	DR	DR
Grazing Dates	May 15-Nov 16	May 16-Sep 30	May 11-Oct 5	May 16-Nov 15

DR = deferred rotation, SL = season long

Buffalo grass - Western wheatgrass (*Buchloe dactyloides - Pascopyrum smithii*) plant association (BUDA-PASM) transect 27

CNHP Rank: GUSU

Related Types: The *Buchloe dactyloides/Elytrigia smithii* and the *Buchloe dactyloides/Carex* spp. plant associations described by Johnston (1987) are similar to Comanche National Grassland stands.

Distribution: The *Buchloe dactyloides/Elytrigia smithii* plant association is reported from western North Dakota, South Dakota and Nebraska National Grasslands (Johnston 1987). *Buchloe dactyloides/Carex* spp. is reported from Pawnee National Grassland (Colorado) and southeastern Wyoming (Johnston 1987). The stand sampled on the Comanche National Grassland is located on Tobe Creek in the Kim District pasture 10E.

Site Characteristics: This plant association occurs on an elevated terrace at the mouth of Tobe Creek canyon. The occurrence is 10 feet from the channel edge, and occurs about 3 feet above the bank full channel. The channel receives intermittent stream flow and has much exposed bedrock.

Vegetation: The dominant species of this plant association are *Buchloe dactyloides* (16%) and *Pascopyrum smithii* (15%). *Bouteloua gracilis* is another prominent species with 9% cover. See Table 22 for percent canopy cover of all diagnostic and dominant species.

Adjacent Vegetation: Weedy forbs are scattered in the channel adjacent to this plant association. Shortgrass prairie and juniper woodlands occur on nearby canyon slopes.

Succession and Management: *Buchloe dactyloides* and *Bouteloua gracilis* tend to increase initially under heavy grazing while *Pascopyrum smithii* will decrease (Soil Conservation Service 1984). Stands sampled on the Grassland did not appear to be over utilized, as they have few weedy species and good cover of decreaser species. The Kim District pasture 10E has a May 11 through October 5 deferred rotation grazing regime.

Table 22. Percent canopy cover of diagnostic or dominant species and grazing information for *Buchloe dactyloides-Pascopyrum smithii* plant association.

Transect Number	27
Species	**Canopy Cover (%)**
Bromus tectorum	5
Buchloe dactyloides	16
Pascopyrum smithii	15
Sporobolus cryptandrus	3
Ambrosia psilostachya var. *coronopifolia*	10

Grazing Information

Grazing Regime	DR
Pasture Number	Kim 10E
Grazing Dates	May 11-Oct15

Sporobolus airoides Series

Alkali sacaton (*Sporobolus airoides*) plant association
(SPAI) 6 transects (7,21,23,80,85,87)

CNHP Rank: G2?SU (Bourgeron and Engelking 1994)

Related Types: The stands sampled on the Comanche National Grassland are similar in species composition, but not abundances, to the *Sporobolus airoides-Buchloe dactyloides* of New Mexico (Durkin *et al.* (1994), the *Sporobolus airoides/Hilaria jamesii* of Colorado (Shaw *et al.* 1989), the *Sporobolus airoides/Agropyron smithii* described by Johnston (1987), and the *Sporobolus airoides* plant association described by Kittel and Lederer (1993).

Distribution: The *Sporobolus airoides* plant association and related types have been documented from the Pecos River Basin in New Mexico (Durkin *et al.* 1994), heavier textured soils of alluvial fans on the Piñon Canyon Maneuver Site in south central Colorado (Shaw *et al.* 1989), and south western Colorado (Kittel and Lederer 1993). Stands of *Sporobolus airoides* plant associations have been reported from the Comanche National Grassland and Cimarron National Grasslands along floodplains and depressions by Johnston (1987).

Site Characteristics: All stands sampled on the Comanche National Grassland occur in swales and stream channels that receive intermittent stream flow. Channels tend to be moderately entrenched. Within the North Fork Jack Canyon site (Transect 23) this plant association occurs 15 feet from the bank full channel, but is still within the entrenched floodplain. Stream gradients are low, ranging from 0.01 to 1.2%.

Vegetation: The dominant grass, *Sporobolus airoides* (5-42%) characterizes this plant association, with *Pascopyrum smithii* ranging in cover from 1-11%. *Hordeum pusillum* (foxtail barley) is consistently present, while *Hilaria jamesii* (galleta grass) and *Buchloe dactyloides* (buffalo grass) occur infrequently (2 of 6 stands, transects 80 and 23). See Table 23 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: A band of weedy species *Helianthus annuus* (annual sunflower), *Xanthium strumarium* (common cocklebur), *Ratibida columnifera* (prairie coneflower), *Melilotus* spp. (sweet clover), and others occur along the edge of channels and draws near this association. Adjacent upland terraces include patches *Yucca glauca* (yucca), *Opuntia imbricata* (cholla), *Sporobolus airoides*, *Bouteloua gracilis* (blue grama) and others.

Succession/Management: The *Sporobolus airoides* plant association is early seral, occurring in wetland and floodplain locations (Durkin *et al*. 1994; Kittel and Lederer 1993). As sites become drier, additional *Sporobolus airoides* may invade from adjacent bottomlands. In wetter seasons, the stand may become dominated by *Panicum obtusum* (vine mesquite) (Durkin *et al*. 1994).

Sporobolus airoides can occur on slightly alkaline substrates (Stubbendieck *et al*. 1992). With increased salinity, however, *Sporobolus airoides* will decrease. If moderate salinity is maintained, the species can form hummocks, creating micro-habitats where non-alkaline tolerant species can become established (Ungar 1974, as cited by Johnston 1987).

If sites are disturbed, *Hilaria jamesii* may increase in abundance (Shaw *et al*. 1989). With continuous heavy grazing, *Sporobolus airoides*, *Pascopyrum smithii* and *Panicum obtusum* will decrease (Soil Conservation Service 1983b). In addition, *Bouteloua gracilis* and *Hilaria jamesii* may increase initially, followed by the invasion and increased abundance of weedy species, such as *Helianthus annuus*, *Xanthium strumarium* (common cocklebur), *Kochia scoparia* (kochia), *Convolvulus* spp. (bindweed) and, possibly, *Tamarix* (tamarisk) (Soil Conservation Service 1983b).

The Timpas pasture 11 and 9 have varying grazing regimes in conjunction with adjacent private lands. Other pastures sampled are on a deferred rotation system for either most of the year or at least spring through fall.

Table 23. Percent canopy cover of diagnostic or dominant species and grazing information for *Sporobolus airoides* plant association.

Transect Number	7	21	23	80	85	87
Species			**Canopy Cover (%)**			
Bouteloua gracilis	0	4	11	0	1	0
Buchloe dactyloides	0	0	3	0	0	0
Distichlis spicata	1	9	0	0	0	0
Hordeum pusillum	1	5	3	1	1	0
Pascopyrum smithii	6	11	8	1	1	1
Sporobolus airoides	42	13	13	5	9	13
Aster falcatus	0	7	2	4	3	4

Grazing Information

Pasture Number	Timpas13	Timpas10	Timpas7	Timpas11	Timpas11	Timpas
Grazing Regime	M-DR	DR	SLDR	varies in	varies in	varies in
Grazing Dates	Mar 1- Feb 28	Jun 1- Mar 10	May 6- Nov 16	conj. w/ Timpas9	conj. w/ Timpas9	conj. w/ Timpas9

Alkali sacaton - Inland saltgrass (*Sporobolus airoides - Distichlis spicata*) Plant Association (tentative type)
(SPAI-DISP) transect 9

CNHP Rank: G3G5SU (Bourgeron and Engelking 1994)

Related Types: This plant association is similar to the *Sporobolus airoides-Distichlis stricta* plant association listed by Bourgeron and Engelking (1994) and to the *Distichlis stricta* type described by Jones and Walford (1995), where the dominance is shared by *Sporobolus airoides* on occasion. The *Distichlis spicata/Sporobolus airoides-Elytrigia smithii* plant association listed by Johnston (1987) is also comparable to the Comanche National Grassland stands. Note that *Distichlis stricta* is a synonym for *Distichlis spicata* (Weber 1990).

Distribution: This and similar plant associations (see above) have been reported from the Pawnee National Grassland, in northeastern Colorado, Thunder Basin National Grassland, in central Nebraska, and from north central Kansas, north central Oklahoma and northwestern Utah. The *Distichlis stricta* type described by Jones and Walford (1995) occurs throughout eastern Wyoming. We sampled stands on the Comanche National Grassland in a drainage draw of the Timpas District pasture 13.

Site Characteristics: This plant association occurs along an intermittent draw dividing two rolling hills. The riparian area ranges from a wide mesic meadow to a narrow restricted channel with little floodplain development. Stream gradient is low at 0.9%. The site is mesic with

sedges and mesic grasses, appearing to be hydrologically intact, an unusual condition on the Comanche National Grassland.

Vegetation: The characteristic dominant species are *Sporobolus airoides* (18%), *Distichlis spicata* (11%), and *Eleocharis palustris* (creeping spikerush) (11%). *Pascopyrum smithii* (western wheatgrass) and *Polygonum* spp. (buckwheat) are present but in low abundance. See Table 24 for percent canopy cover of all diagnostic and dominant species.

Adjacent Vegetation: Short grass prairie occurs on adjacent uplands.

Succession and Management: *Distichlis spicata* and *Sporobolus airoides* generally inhabit saline areas. The rhizomatous roots of *Distichlis spicata* enable it to resist trampling and increase in abundance when there is less competition from other species (Stubbendieck *et al*. 1992). *Sporobolus airoides* will decrease under heavy grazing (Soil Conservation Service 1983b). *Eleocharis palustris* is another rhizomatous species of mesic areas, usually not palatable to cattle. This plant association occurs in moderate to good condition in Timpas pasture 13 where the area is grazed year round on a deferred rotation system.

Table 24. Percent canopy cover of diagnostic or dominant species and grazing information for *Sporobolus airoides-Distichlis spicata* plant association.

Transect Number	9
Species	**Canopy Cover (%)**
Distichlis spicata	11
Eleocharis palustris	11
Sporobolus airoides	18

Grazing Information

Pasture Number	Timpas13
Grazing Regime	DR
Grazing Dates	Mar 1-Feb 28

Muhlenbergia asperifolia Series

Alkali muhly (*Muhlenbergia asperifolia*) Plant Association (tentative type)
(MUAS) transect 53

CNHP Rank: GUSU

Related Types: This plant association is similar to the *Muhlenbergia asperifolia* plant association (tentative type) described by Kittel and Lederer (1993).

Distribution: This association is reported from the Yampa River Basin (Kittel and Lederer 1993). On the Comanche National Grassland, this association was found below the last pond berm at the Bloom Ponds site. The species, *Muhlenbergia asperifolia*, is widespread in swales and channels across the Comanche National Grassland.

Site Characteristics: The Comanche National Grassland stand we sampled lies in a low, mesic, gentle sloping area, marking the beginning of the draw that drains the Bloom Ponds site. The stand is within the channel that receives intermittent stream flow, below a bermed pond.

Vegetation: *Muhlenbergia asperifolia* dominates the stand with a cover of 51% with *Pascopyrum smithii* and *Sporobolus airoides* as the only other species with a cover of 1% and 4%, respectively. See Table 25 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: *Typha* spp.(cattail) stands occur in adjacent standing water, and shortgrass prairie occurs on nearby uplands.

Succession/Management: *Muhlenbergia asperifolia* is strongly rhizomatous, occurring in low, moist soils (Great Plains Flora Association 1991). Weber reports the species to be abundant in roadside ditches and on alkaline flats (1990).

On the Comanche National Grassland, the species is widespread in low abundances. It is believed that this plant association is unusual for the area.

Table 25. Percent canopy cover of diagnostic or dominant species and grazing information for *Muhlenbergia asperifolia* plant association.

Transect Number	53
Species	**Canopy Cover (%)**
Muhlenbergia asperifolia	51
Pascopyrum smithii	1
Sporobolus airoides	4

Grazing Information

Pasture Number	Timpas23
Grazing Regime	varies
Grazing Dates	May and Dec1- Feb29

***Bromus tectorum* Series**

Cheatgrass (*Bromus tectorum*) Plant Association
(BRTE) 4 transects (2,15,31,43)

CNHP Rank: not ranked (non-native association)

Related Types: The *Bromus tectorum* community type described by Roberts (1994), is similar to stands on the Comanche National Grassland.

Distribution: The cheatgrass (*Bromus tectorum)* community type is reported to occupy a great deal of what once was a salt desert shrub community type in the BLM Salt Lake District, Utah (Roberts 1994). *Bromus tectorum* is widely distributed across the Comanche National Grassland and large stands were observed on the uplands as well as within riparian areas. In addition, the Timpas District has significantly more areas dominated by *Bromus tectorum* than the Kim District.

Vegetation: *Bromus tectorum* (5-28%) is the diagnostic dominant species of this plant association. Other common grasses are *Sporobolus* spp., *Bothriochloa laguroides* (silver bluestem) (1%), *Hilaria jamesii* (galleta grass) (0-4%) and *Elymus canadensis* (Canada wildrye) (1%). *Melilotus officinalis* (yellow sweetclover), *Ratibida columnifera* (prairie coneflower) and *Helianthus annuus* (annual sunflower) are exotics commonly present. See Table 26 for percent canopy cover of all diagnostic and dominant species.

Adjacent vegetation: This plant association is often surrounded by weeds such as *Melilotus officinalis*, and *Helianthus annuus.* Adjacent uplands have stands shortgrass prairie, or juniper woodlands.

Succession/Management: *Bromus tectorum* is a serious invasive weed, noted in the literature to be invading nearly all western rangelands, and severely reducing range quality (Weber 1990; Whitson *et al*. 1992). *Bromus tectorum* germinates and greens early in the growing season, giving the appearance of lush forage, hence the name "cheatgrass". However, as an annual, it quickly produces seed heads, dries up and becomes poor forage by mid-summer (Stubbendieck *et al*. 1992).

Heavily grazed areas are prone to cheatgrass invasion. Desirable grasses decrease and *Bromus tectorum*, finding excellent germination sites in the hoof prints of cattle, increases. It is a prolific seed-producer, and becomes a significant part of the seed bank.. Fire may reduce current cheatgrass biomass, but regeneration of the area will again be dominated by *Bromus tectorum* (Billings 1994). Even more frequent fires results in more *Bromus tectorum* (Roberts 1994).

Bromus tectorum can reach a steady state condition on rangelands as a vegetation type, and it has been proven that a reduction in grazing pressure, or even the absence of grazing, has no effect on cheatgrass abundances (Laylock 1991, as cited in Sanders 1994). A winter and early spring grazing regime in areas heavily invaded with *Bromus tectorum* has been shown to improve range quality (Tipton 1994). Cattle find forage value in the leftover seed heads that contain much protein. In the spring, cattle can eat the early ephemerals, and when *Bromus tectorum* begins to green, the cattle switch to this forage. If *Bromus tectorum* is being utilized, fuel is being reduced, and regrowth and re-establishment of other, more desirable, perennial species is favored by reducing competition and grazing pressure in late spring and summer. All of these factors may lead to a slow range improvement (Tipton 1994).

Adequate fencing and water distribution in uniform pastures may be used to graze cheatgrass dominated pastures on an intense, short-term rotational regime or "flash grazed" in the spring (Tipton 1994).

A revised grazing regime that utilizes heavy spring or winter-only grazing during particularly wet springs, may be beneficial to cheatgrass dominated areas on the Comanche National Grassland.

Table 26. Percent canopy cover of diagnostic or dominant species and grazing information for *Bromus tectorum* plant association.

Transect Number	2	15	31	43
Species		Canopy cover (%)		
Bouteloua gracilis	0	0	3	0
Bromus tectorum	23	5	5	28
Hilaria jamesii	1	0	4	3
Pascopyrum smithii	0	1	1	1
Ambrosia psilostachya var. *coronopifolia*	1	3	1	1
Gutierrezia sarothrae	4	1	3	3

Grazing Information

Pasture Number	Timpas23	Kim 12C	Timpas20	Timpas23
Grazing Regime	off season	DR	DR	varies
Grazing Dates	May and Dec1-Feb29	May 16- Dec 20	Mar 1- Feb 28	Dec 1 - May 31

DR = deferred rotation

MISCELLANEOUS UNCLASSIFIED STANDS

Golden aster-red threeawn (*Heterotheca villosa-Aristida purpurea*) unclassified
(HETI-ARPU) transect 60

One stand dominated by *Heterotheca villosa* (golden aster) and *Aristida purpurea* (red threeawn) occurred along a terrace in Tecalote Canyon, Kim District pasture 12C (transect 60). The stand is located below a canyon slope and above the channel, cutting through a moderately deep canyon. This stand has low overall canopy cover, with *Heterotheca villosa* cover at 11% and *Aristida purpurea* at 8%. *Artemisia filifolia* (fringed sage) and *Bromus tectorum* (cheat grass) also occur on the terrace. Adjacent to this stand is a sparsely vegetated channel and a sloping juniper woodland.

Aristida purpurea is a common species on the upland prairie and slopes, occasionally becoming abundant in swales and drainage draws. This species is not palatable to cattle unless it is grazed before awn production and its presence is considered a sign of range deterioration (Stubbendieck *et al*. 1992). This population seems to be stable on the alluvial terrace.

Silver bluestem-white prairie aster (*Bothriochloa laguroides-Aster falcatus)* unclassified
(BOLA-ASFA) transects 61 and 81

Bothriochloa laguroides (silver bluestem) and *Aster falcatus* (white prairie aster) dominate two stands located in Devils Canyon, Timpas pasture 23, and West Branch Crooked Arroyo, Timpas pasture 11. These stands have low total canopy cover with Silver bluestem (5%-9%) and white prairie aster (3%-4%). Shortgrass prairie and juniper woodlands occur on adjacent upslopes.

Aster falcatus is not considered a problem weed (Whitson *et al*. 1992). *Bothriochloa laguroides* is a caespitose grass offering a fair forage value and can not withstand grazing pressure in the early spring when sprouts and seedlings are vulnerable (Stubbendieck *et al*. 1992).

Canyon Slope Plant Community Descriptions for the Timpas and Kim Grazing Districts, Comanche National Grassland

Rocky outcrops and canyon slopes offer a different and unique habitat for both plant and animal species on the prairie. The canyon slope communities were sampled to document the vegetation of this significant part of the prairie's ecosystem. Thirteen transects from five sites were sampled on the Comanche National Grassland. Sites include Christian Canyon, Devils Canyon, Plum Canyon, Tecalote Creek canyon and Tobe Creek canyon (see Appendix D for transect locations).

The canyon slope survey revealed three distinct communities. *Juniperus monosperma* (oneseed juniper) is dominant or co-dominant in all three. *Gutierrezia sarothrae* (broom snakeweed), *Rhus trilobata* (skunkbush), and *Opuntia imbricata* (cholla) are the three dominant shrubs defining the communities. In general, the undergrowth varies from bunch grasses to various sage species (*Artemisia* sp.). Specifically, *Bromus tectorum* (cheatgrass) and *Stipa comata* (needle and thread grass) are commonly found with the *Juniperus monosperma* and *Opuntia imbricata* community. Two stands had no juniper occurring on the transect but were located nearby. One of these sites, Tobe Creek canyon, has the only occurrence of *Quercus grissea* (oak) sampled on the Grassland.

Juniper woodlands rarely occur with *Pinus edulis* (piñon pine), although a few individuals were documented at the Plum Canyon site. *Pinus ponderosa* (ponderosa pine) is also infrequent, however a few individuals were documented at the Tecalote Canyon site.

Due to the limited access to the canyon slopes, evidence of cattle activity is minimal. It is interesting to note that *Opuntia imbricata* (cholla) occurs on gently sloping terrace ecotones; these areas are more accessible to cattle and appear to favor the establishment of the cholla.

Most of the canyon slope sites sampled are ranked B. Relative to the riparian areas sampled on the Comanche National Grassland, the canyon slopes are in good condition. Site locations and Heritage ranks for the canyon slope sites are located in Appendix D. Original field forms and data sheets are available for further information regarding these sites.

DISCUSSION--RIPARIAN INVENTORY AND CLASSIFICATION

The 89 stands of vegetation sampled by the Colorado Natural Heritage Program (CNHP) and the corresponding classification of plant associations provide the most current information available on the status of riparian areas for the Timpas and Kim Districts on the Comanche National Grassland. The collection and analysis of data from these stands have yielded not only information about their current status, but also insights into the ecological and anthropogenic processes driving the vegetation. Since grazing activities are one of the primary concerns of the grasslands, it is particularly interesting to view the riparian vegetation in light of cattle use. At the same time, grazing should not be isolated as the single over-riding factor governing the condition of riparian areas (Anderson 1990). It is our hope that information provided by this study can be used to manage grazing activities in a manner that is responsive to all aspects of ecosystem management.

A classification of plant associations is the primary tool CNHP uses to assess the status of vegetation relative to what may be expected at a particular site. Through the use of CNHP's Biodiversity Conservation Database and existing literature cited in that database, we can determine the relative abundance of a particular plant association on the landscape, under what environmental conditions that plant association should occur, and what plant species structure and composition can be expected. Yet the level of confidence with which we can discuss the Comanche National Grasslands' riparian areas is necessarily limited by the amount of research that has been done on similar communities. Now that a classification is in place, the Comanche National Grasslands can proceed with narrower questions that apply to particular riparian types.

Unfortunately, unlike plants and animals, plant associations do not have centuries of classification history. Only occasional anecdotal information from early settlers and travelers is available to tell us how vegetation on the Comanche National Grassland appeared before being affected profoundly by human management and exploitation. There can be little question that the grasslands experienced important changes over a century of agricultural activities, especially grazing and water manipulation. The dustbowl years prompted desperate attempts to exploit water which resulted in major changes especially to playas. Only recently are land managers and ecologist beginning to discover and understand the role fire played historically in the Great Plains ecosystems and how it interacts with grazing regimes, climatic cycles, and other environmental factors. The unrelenting weed invasion in riparian areas is one factor that we can at least quantify easily, but in general it is difficult if not impossible to speculate on the plant composition present before the weed presence became overwhelming.

Lack of historical information notwithstanding, information in the CNHP database (CNHP 1996), research literature, and historical literature provide sufficient information to assess the riparian condition for the areas visited. Heritage Program community occurrence ranks (the ranks are detailed on page 3 in the Introduction) provide one measure of the condition of the plant associations sampled during the 1995 field season. Quality and condition, including size, presence of weeds, regeneration of vegetation, and productivity were among the most important factors considered when assigning these ranks.

The fact that no sites were ranked "A" according to Heritage Program ranking clearly demonstrates the effects of the past 100 years and testifies to the complete absence of entirely natural riparian vegetation on the Comanche National Grassland. The lack of natural vegetation precludes development of a true baseline by which to judge management of these areas. Only 17

percent of the sites sampled were even ranked "B," a ranking that can reasonably be called "relatively undisturbed." With over 80% of the sites ranked "C" (53%) or "D" (30%), it is clear that most riparian areas on the Comanche National Grasslands are far removed from what could be expected as natural vegetation.

The classification presented here could potentially be used as a "pseudo-baseline" of riparian vegetation, but its use is limited because: (a) the relatively undisturbed areas are a small subset of the riparian areas in the study area, and (b) the B-ranked sites tend to be a certain type, willow (*Salix exigua*) and/or creeping spikerush (*Eleocharis palustris)* stands, so they represent only a small section of the full range of variation among environmental settings. Based on existing data, a more accurate baseline of natural vegetation could be developed either through knowledgeable speculation or through modeling, but it may suffice to choose other criteria by which to measure the condition of a riparian area. Maximizing native vegetation (and especially minimizing pernicious weeds) and allowing/restoring natural hydrologic regimes are two objectives that will lead to riparian vegetation in good condition. Application of such criteria across the entire grassland may be unfeasible, but the criteria could be applied to the riparian Conservation Sites (i.e., the highest quality riparian areas) described in Appendix B.

At the beginning of this project, the Comanche National Grassland expressed particular interest in knowing if the vegetation structure and composition is being altered by the livestock in the riparian areas. The fact that cattle concentrate in mesic areas on the grassland (Milchunas 1991) suggests strongly that they do affect the vegetation, but the degree of effect remains open to question. CNHP attempted to statistically analyze the effects of grazing with respect to the plant community present on the site, but our only conclusion was that the grazing regime within a pasture does not adequately quantify levels of grazing within the riparian area. Levels of grazing within a single pasture vary greatly because mesic areas tend to be much more heavily grazed than adjacent upland areas (Milchunas 1991; Vallentine 1990). With a riparian plant association classification now complete for the Grassland, a research project could now specifically target certain vegetation types, quantify cattle use in a more precise way, and possibly then discern the effects of cattle use on the plant association.

By combining our experience in the Timpas and Kim Districts with existing information, we can draw some tentative conclusions about the effects of grazing within the study area. The concentration of cattle in mesic sites results in these areas being affected to a relatively greater extent than nearby upland areas, but the effects may or may not be deleterious. In areas where cattle are grazed only during a short period during the summer, as in Vogel Canyon, riparian vegetation appears to recover adequately each spring from the heavy, short-term impacts of the grazing period. In certain ephemeral pools, however, vegetation is entirely absent, apparently due to heavy trampling (Vallentine 1990) (see Seventh Meridian site photo, Appendix D). These observations suggest that grazing should be more carefully monitored and controlled in ephemeral, less-resilient riparian areas. Perennially wet areas dominated by rushes and spikerushes appear to tolerate grazing impacts better, especially when concentrated in a short period later in the growing season (Hansen *et al.* 1991).

A definite correlation exists between adventitious weeds and mesic sites on the Comanche National Grassland. Weedy bands of vegetation are often associated with the channel banks and edges. In these same areas cattle trails and cattle concentration is evident. Cattle may promote the spread of weeds by importing seeds from other areas and by preparing the disturbed soil that many adventitious species need to become established (Vallentine 1990). Once weeds

are established, cattle may preferentially graze native species, giving further competitive advantage to the weedy species (Vallentine 1990). Despite this circumstantial evidence, the results of this study do not allow us to make definitive statements concerning the role of cattle in weed proliferation in riparian areas of the Comanche National Grassland, especially considering that many Eurasian weeds simply grow better in mesic areas (Whitson *et al*. 1992) irrespective of cattle use.

Cattle may in some cases help limit the spread of weeds (Tipton 1994). It was noted that in the Kim District where most of the buffalo grass (*Buchloe dactyloides*) plant associations were sampled, cheatgrass did not appear as abundant as in the Timpas District. Perhaps this is partially due to the spring grazing that is common in most of the Kim District pastures. Although lower in weed abundance, these buffalo grass stands still may not resemble the historic, natural community on these sites, as this grass has the tendency to become more sod-like under extensive domestic grazing (Soil Conservation Service 1984).

Grazing in pre-settlement times helped organize and maintain the vegetation on the prairie, but extensive domestic grazing systems usually favor a weedy species increase and a native species decrease. Additionally, livestock may be a significant factor in the decline of native species (Anderson 1990; Higgins 1986). However, Hatch *et al.* (1990) state that after the removal of grazing on weed dominated areas of the California prairie, reversion back to a native perennial state is rare. Sanders (1994) also states that the removal of grazing never promotes the healing of the grassland. These are important considerations that may apply to the restoration or enhancement of riparian areas.

Even without regard to cattle, adventitious weeds are a serious problem in many of the riparian areas on the Comanche National Grassland. Cheatgrass (*Bromus tectorum*), a Mediterranean invader, occurs extensively on the uplands as well as in riparian areas. Certain types of grazing may promote this invasion (Stubbendieck 1992), but strategic grazing may offer a tool for battling this troublesome weed (Tipton 1994). As explained in the *Bromus tectorum* plant association description, intense spring grazing during wet springs favorable to cheatgrass and a winter long graze may help to reduce cheatgrass while still favoring the perennial grass regeneration (Tipton 1994). As noted earlier, in the Kim District, where most of the buffalo grass (*Buchloe dactyloides*) plant association transects are located, cheatgrass did not appear to be as abundant.

Tamarisk is one of the most serious threat to riparian plant associations on the Grassland. It is an extremely aggressive and prolific weed that has the potential to displace native riparian vegetation (Siscoe 1993). Once this exotic is established it is difficult, costly and nearly impossible to eradicate (Durkin *et al.* 1994; 1995). Unlike cheatgrass, tamarisk rarely grows outside mesic areas. In the case of this noxious species, alterations of hydrologic regimes appears to be a much more important factor in its spread than the local grazing regime. Once established, tamarisk will increase the salinity levels of the local area, out competing the native species (Siscoe 1993).

During this study, tamarisk was often found where constructed bergs intermittently collect water (most of these sites were sampled when mesic to dry, not with standing water). The altered hydrology provides tamarisk the mesic condition needed to establish and survive in these characteristic sites. The Timpas pasture 13 (Gravel Pit Site), is an example of a site that exhibits a stand of tamarisk (*Tamarix ramosissima*) below a berm (see Gravel Pit site photograph, Appendix D). The channel below the berm is entrenched, demonstrating signs of erosion. There

are several stands similar to this one, including the Packers Gap riparian exclosure site, Timpas Radio Tower site, and others (see plant association description *Tamarix ramosissima*/Sparse).

Tamarisk is abundant on the Timpas Creek as well, occurring in a mosaic of plains cottonwood (*Populus deltoides*) and coyote willow (*Salix exigua*) stands. The slow and shallow, moderately sinuous Timpas Creek provides the flooding regime needed for open silt beds favorable to cottonwood and willow regeneration. Regenerating stands of these species were noted and sampled on the Timpas Creek, but the pervasive tamarisk thickets on the adjacent floodplain may threaten these stands.

Tamarisk was found also in the Devils Canyon (a major fork of the Timpas Creek), but was much less abundant compared to the dense thicket occurring on the Timpas Creek. It may not be as much of an immediate threat in these sites, and perhaps preventative actions in this area could help keep this area tamarisk-free. Mature and decadent cottonwoods are not abundant in Devils canyon, but regenerating saplings were common in parts of the channel that were deeply cut with exposed sand and silt. The occasional flooding and scouring that occurs in the canyon may create the habitat for cottonwoods and willows.

Domestic livestock use and weed infestations are important factors governing the condition of riparian areas on the Comanche National Grasslands, but it is important not to think of these factors independently, apart from the larger context of the prairie. The evolution of the shortgrass prairie was a result of several environmental factors, with climate (especially prolonged drought), fire, and grazing being the most influential (Dyer *et al*. 1982; Anderson 1982; 1990). Other factors--among them soil development, topography, natural disturbances and hydrology--also influence the plant community in a particular spot. Management decisions must integrate all of these factors together, considering, for example, weed proliferation in light of both grazing (including wildlife) and fire regimes as well as other environmental factors (Anderson 1990).

Fire was and is important to the organization of the prairie's ecosystems (Brown 1989; Anderson 1982 and 1990; Higgins 1986), but how fire organized particular ecosystems is more difficult to discern. Historical fire records help fill gaps in understanding, yet information on historical accounts is sometimes incomplete, difficult to obtain, and biased toward the particular journalist's interest and modes of travel (Higgins 1989; Jamie Kingsbury pers. comm. Comanche National Grassland USFS).

With evolutionary factors, land managers must keep history in mind. With fire, for example, its use by the native peoples, causative agents, seasonality, extent, and effects must all be considered (Higgins 1986). It is known that in pre-settlement times, on the Comanche National Grassland, Indians started fires for hunting (Jamie Kingsbury pers. comm. Comanche National Grassland USFS). It follows that the seasonality of these fires was somewhat different than wildfires started by lightening strikes, because the fires used for hunting followed the bison (*Bison bison*) habits and migrations (Higgins 1986). Spring burns started by humans may have helped to keep trees and shrubs from invading the grasslands in pre-settlement times. Wildfires usually occur in times of drought or dormancy as do most modern day prescribed burnings. Prescribed burnings also occur under predictable conditions where factors such as wind won't send fires out of control (Anderson 1990). In contrast to pre-settlement times, wildfires are controlled, according to the National Forest policy (Jamie Kingsbury, pers. comm. Comanche National Grassland USFS). It may be worth investigating how the Comanche National

Grasslands would respond to evolutionary patterns of burning that once occurred on the grasslands (Anderson 1990).

Grazing and browsing by wild animals is another major factor in the organization of the prairie's ecosystem (Anderson 1982 and 1990, Higgins 1986). Bison roamed the plains in pre-settlement times, their migratory and grazing habits affecting the evolution and maintenance of the shortgrass prairie (Brown 1989; Allen 1967). Bison would concentrate in small areas for a brief period, trampling and grazing the area to barren ground. Rhizomatous grasses such as buffalo grass (*Buchloe dactyloides*) would then reclaim the area, with ample time for establishment since the bison would not revisit the area for one to several years (Allen 1967; Anderson 1990). The trampled habit also created a window for woody species invasion (Higgins 1986; Anderson 1990), although the grassland's integrity was maintained for the most part, possibly by the fire regime of the time (Anderson 1990).

As suggested by Anderson (1990), resource managers must take into consideration all factors simultaneously affecting the grassland's evolution and maintenance when applying any management system. These factors include both evolutionary forces as discussed above, as well as more recent phenomenon such as weed invasion and potential global climate change. With the riparian plant association classification now in place, researchers working on the Comanche National Grasslands can focus on the effects of each of these factors, and their combined effects, in the various vegetation types.

PROTECTION OF SIGNIFICANT BIODIVERSITY AREAS

Of the 28 TIAs identified during the study, 16 were dropped from consideration (Appendix A) because there were no species of concern found during field surveys. The remaining 12 TIAs were found to support rare, threatened, or endangered species. These sites are retained as TIAs and are recommended to the Forest Service as areas in need of special protection. The CNHP in no way implies that areas that were studied but not considered Conservation Sites are not of importance for conservation purposes. The ranking system used ranks sites for protection relative to the rarity of known significant features. Therefore, the sites identified herein comprise the highest priority sites, based on known information, for the conservation of the study area's natural diversity.

Once a significant area has been identified, the first step in protecting the sensitive species or communities is to delineate a conservation planning boundary for the site. In developing these boundaries, CNHP staff and contract scientists consider a number of factors. These include, but are not limited to:

• the extent of current and potential habitat for natural heritage resources, considering the ecological processes necessary to maintain or improve existing conditions;

• species movement and migration corridors;

• maintenance of surface water quality within the site and the surrounding watershed;

• maintenance of the hydrologic integrity of the groundwater, e.g., by protecting recharge zones;

• land intended to buffer the site against future changes in the use of surrounding lands;

• exclusion or control of invasive exotic species; and

• land necessary for management or monitoring activities.

As the label "conservation planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection goals for natural heritage resources and sensitive species. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels. Fortunately, all of the study area is largely managed by the Forest Service, an agency mandated to administer its lands under a policy known as Ecosystem Management. Such policies combined with special land designations (e.g., Special Management Areas, Special Interest Areas, and Research Natural Areas) provide the Forest Service with ample tools to assure the long term viability of each candidate natural area (see Protection Tools below). Maps showing these preliminary boundaries are included in Appendix B.

Figures 1 and 2 (pages 11 and 12) shows the locations of the 12 Conservation Sites identified during this survey. While many of the natural areas are known to support one rare species, others support several. The Conservation Sites also range greatly in their significance (Appendix A).

Protection Tools

Intensive land use in Colorado and multiple demands for many areas contribute to the continual degradation of many natural communities, endangered species habitat, and other types of natural areas. Best management practices can help protect critical buffers, but may not of itself be adequate in the protection of sensitive species and sites. The first and most significant and proactive tool for protection is the identification of locations of rare species, natural communities, and the ecosystems that support them. Only with this information can informed decision-making occur.

This document provides a base-level of information to begin a planned protection effort of the significant biodiversity features within those portions of the Comanche National Grassland included in the study area. By using appropriate U. S. Forest Service protection tools, careful planning, and a monitoring program, the significant elements of natural diversity identified herein will be adequately conserved. We have used Forest Service guidelines to make recommendations for protection of each significant Conservation Site (Appendix B).

Recommendations

1. **Develop an implementation plan for designations of areas the Forest Service determines fulfill criteria for protection**.

This inventory has documented the existence of 12 sites determined to be significant for the protection of Colorado's and the Forest's natural diversity. The Forest should consider including this report's recommendations and advice from the CNHP, TNC, the Colorado Natural Areas Program, and other knowledgeable agencies and organizations in the Forest Plan's most recent revision. For those sites recommended for RNA status, review should be conducted by the RNA ecologist.

2. **Include the Colorado Natural Heritage Program and other knowledgeable organizations in the review of projects in or near areas identified as significant**.

The areas identified in this study are known to support unique or exemplary natural communities and rare species. As proposed Forest activities are considered, they should be compared to the maps presented herein (Appendix B). The CNHP staff considers this contract the establishment of a continuing partnership and offer their expertise in reviewing project proposals that may affect the significant area or species. Since the early stages of the planning process typically offer the greatest flexibility and are the most proactive, it is important to contact CNHP at the earliest possible time.

3. **Expand public awareness of the need for protecting areas determined to be significant to the Forest's natural diversity**.

Given the wide range of uses of the National Grasslands, natural lands are becoming ever more scarce. Rare species may continue to decline if not given appropriate protective measures. Increasing the public's knowledge of the remaining significant areas will build support for the programmatic initiatives necessary to protect them. Such activities could be done through interpretive facilities, conferences or meetings to stimulate public involvement, information pamphlets, and others. Finally, the Forest Service should promote any protection designations to the public and scientific community to build awareness of the commitment to New Perspectives and Ecosystems Management policies.

4. **Increase cooperation among pertinent organizations.**

The long-term protection of the Forest's natural diversity will be facilitated with the cooperation of many organizations. The Forest Service has played a leadership role in attempting to incorporate diverse opinions in the planning process. Efforts to this end should continue, providing the Forest with stronger ties among federal, state, local and private interests involved in the protection or management of natural lands.

5. **Properly manage significant elements of natural diversity within the Comanche National Grassland study area**.

The first step in accomplishing this recommendation would be the appropriate designation of deserving sites. In doing so, the development of management plans would be a necessary component of the designations. The CNHP and TNC are willing to assist the Forest in developing management plans. We would also encourage the development of partnerships that could research and develop techniques for maintaining or restoring Conservation Sites to aid in the preservation of rare, threatened, or endangered species or significant natural communities.

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LITERATURE CITED

Allen, D.L. 1967. The Life of Prairies and Plains. McGraw-Hill Book Company: New York, NY. 232 pp.

Anderson, R.C. 1982. An evolutionary model summarizing the roles of fire, climate, and grazing animals in the origin and maintenance of grasslands: An end paper. In: Grasses and Grasslands: Systematics and Ecology, Estes, J.R., R.J. Tyrl, and J.N. Brunken, eds. 1982. University of Oklahoma Press: Norman, OK. 312 pp.

Anderson, R.C. 1990. The historic role of fire in the North American grassland. In: Fire in North American Tallgrass Prairies, Collins, S.L. and L.L. Wallace, eds. 1990. University of Oklahoma Press: Norman and London. 175 pp.

Andrews R. and R. Righter. 1992. Colorado Birds, A Reference to their Distribution and Habitat. Denver Museum of Natural History, Denver, CO.

Armstrong, D.A. 1972. Distribution of Mammals in Colorado. Monograph of the Museum of Natural History No. 3, The University of Kansas, Lawrence, KS.

Bailey, A.M. and R.J. Niedrach. 1965. Birds of Colorado. Denver Museum of Natural History 2 Vols, Denver, CO.

Bailey, R.G., P.E. Avers, T. King, and W. H. McNab. 1994. Ecoregions and subregions of the United States. USDA. Forest Service.

Baker, W.L. 1984. A preliminary classification of the natural vegetation of Colorado. Great Basin Naturalist 44(4):647-676.

Barbour, M.G. and W.D. Billings. 1988. North American Terrestrial Vegetation. Cambridge University Press: New York, NY. 434 pp.

Bergtold, W.H. 1928. A Guide to Colorado birds, Smith-Brooks Printing Co., Denver, CO.

Betts, N.D. 1913. Birds of Boulder County, Colorado. University of Colorado Studies 10:177-232.

Billings, W.D. 1994. Ecological impacts of cheatgrass and resultant fire on ecosystems in the western Great Basin. In: Proceedings-Ecology and Management of Annual Rangelands. Monsen, S.B. and S.G. Kitchen, eds. U.S. Forest Service Intermountain Region Station, General Technical Report INT-GTR-313, September 1994. 416 pp.

Bourgeron, P.S. and L.D. Engelking. eds. 1994. A preliminary vegetation classification of the Western United States. Unpublished report prepared by the Western Heritage Task Force for The Nature Conservancy, Boulder, CO.

Brown, L. 1989. Grasslands. The Audubon Society Nature Guides, New York. Alfred A. Knopf, Inc.

Bunin, J.E. 1985. Vegetation of the City of Boulder, Colorado open space lands. Report prepared for the City of Boulder, Real Estate/Open Space, Boulder, Colorado. 114 pp.

Cary, M. 1911. A biological survey of Colorado. North America Fauna, 33:1-256.

Collins, J.T. 1982. Amphibians and Reptiles in Kansas, second edition. University of Kansas Museum Natural History, Pub. Ed. Ser. 8., Lawrence, KS.

Colorado Geologic Highway Map. 1991. Western GeoGraphics, Canon City, CO.

Colorado Natural Heritage Program (CNHP). 1996. Biological and Conservation Data (BCD) System. [Data from field surveys.] Colorado Natural Heritage Program, Fort Collins, CO.

Colorado Natural Heritage Program. 1995. Rare and imperiled animals, plants, and natural communities. Vol. 1 (1). Ft. Collins, CO.

Cooper, D.J. and T.R. Cottrell. 1990. Classification of riparian vegetation in the northern Front Range. Unpublished final report prepared for The Nature Conservancy's Colorado Field Office, Boulder, Colorado. 115 pp.

Covell, D.F, and O.J. Rongstad. 1990. 1989 annual report, ecology of swift fox on Piñon Canyon maneuver site. Environmental Energy and Natural Resources Division, Fort Carson, CO.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79/31. 131 pp.

Dick-Peddie, W.A. 1993. New Mexico Vegetation: Past, Present, and Future. University of New Mexico Press: Albuquerque, NM. 244 pp.

Driscoll, R.S., D.L. Merkel, D.L. Radloff, D.E. Snyder, and J.S. Hagihara. 1984. An ecological land classification framework for the United States. USDA Forest Service Miscellaneous Publication Number 1439. U.S. Government Printing Office, Washington, D.C. 56 pp.

Durkin, P., M. Bradley, E. Muldavin and P. Mehlhop. 1994. A Riparian/Wetland Vegetation Community Classification of New Mexico: Pecos River Basin. Unpublished report for New Mexico Environment Department Surface Water Quality Bureau.

Durkin, P., M. Bradley, S.E. Carr, E. Muldavin and P. Mehlhop. 1995. Riparian/Wetland Vegetation Communities of the Rio Grande: A Classification and Site Evaluation. Unpublished final report for New Mexico Environment Department Surface Water Quality Bureau.

Dyer, M.I., J.K. Detling, D.C. Coleman, and D.W. Hilbert. 1982. The role of herbivores in grasslands. In: Grasses and Grasslands: Systematics and Ecology, Estes, J.R., R.J. Tyrl, and J.N. Brunken, eds. 1982. University of Oklahoma Press: Norman, OK. 312 pp.

Elmore, W. and R.L. Beschta. 1987. Riparian Areas: Perceptions in Management. Rangelands. Vol. 9, No. 6.

Falen-Romero, K. 1995. Personal communication. Comanche National Grassland, U.S. Forest Service: La Junta, CO.

Felger, A.H. 1909. Colorado notes. Auk 26:85-86.

Felger, A.H. 1910. Birds and mammals of northwestern Colorado. University of Colorado Studies 7:132-146.

Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History, University Press of Colorado, Niwot, CO.

Gavin, B.R., and R.E. Richards. 1993. Distribution update for Colorado ringtails (Carnivora: *Bassariscus astutus*): 1982- 1993. J. Colorado-Wyoming Academy of Science 25(1):30.

Great Plains Flora Association. 1991. Flora of the Great Plains. University Press of Kansas, Lawrence, KS.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. Bioscience 41(8):540-551.

Hammerson, G.A. 1982. Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver, CO.

Hansen, P., K. Boggs, R. Pfister, and J. Joy. 1991. Classification and management of riparian and wetland sites in Montana. Draft Version 1. Montana Riparian Association and Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula. 478 pp.

Hansen, R.M. 1963. Cotton rat from Kiowa County, Colorado. J. Mamm., 44:126.

Harte, J. and E. Hoffman. 1989. Possible effects of acidic deposition on a Rocky Mountain population of the tiger salamander *Ambystoma tigrinun*. Conservation Biology 3:149-158.

Hatch, D., J.W. Bartolome, and D. Hillyard. 1990. Testing a Management Strategy for Restoration of California's Native Grasslands. In: Yosemite Centennial Symposium Proceedings, Natural Areas and Yosemite: Prospects for the Future, A Global Issues Symposium Joining the 17th Annual Natural Areas Conference with the Yosemite Centennial Celebration, October 13-20, 1990. 667 pp.

Hendee, R.W. 1929. Notes on birds observed in Moffat Couty, Colorado. Condor 31:24-32.

Hersey, L.J. and R.B. Rockwell. 1909. An annotated list of the birds of the Barr Lake district, Adams County, Colorado. Condor 11:109-122.

Higgins, K.F. 1986. Interpretation and Compendium of Historical Fire Accounts in the Northern Great Plains. U.S. Department of the Interior, Fish and Wildlife Service, Resource Publication 161: Washington, D.C. 39pp.

Johnsgard, P.A. 1990. Hawks, Eagles, and Falcons of North America. Smithsonian Institution Press, Washington, D.C.

Johnston, B.C. 1987. Plant Associations for Region Two. Edition 4. USDA Forest Service, Rocky Mountain Region. R2-Ecol-87-2 429 pp.

Johnston, B.C. and F. Reed. 1991. Ecological inventory of Picket Wire Canyonlands. USDA Forest Service internal report. Unpublished.

Jones, G. 1990. Workplan for a Uniform Statewide Riparian Vegetation Classification. Wyoming Natural Diversity Database, The Nature Conservancy, Laramie, Wyoming.

Jones, G.P. and G.M. Walford. 1995. Major Riparian Vegetation Types of Eastern Wyoming. Wyoming Natural Diversity Database: Laramie, WY.

Kartesz, J.T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. Second edition (2 vol.). Timber Press: Portland, Oregon.

Kingsbury, J. 1996. Personal communication. Comanche National Grasslands, U.S. Forest Service: La Junta, CO.

Kittel, G.M. and N. Lederer. 1993. A Preleminary Classification of the Riparian Vegetation of the Yampa and San Miguel/Dolores River Basins. Unpublished final report for The Colorado Department of Health and the Environmental Protection Agency.

Knopf, F. 1995. Slide presentation, Native Plant Society Annual Meeting. Colorado State University, Ft. Collins, Colorado.

Knopf, F.L., R.R. Johnson, T. Rich, F.B. Samson, and R. Szaro. 1988. Conservation of riparian ecosystems in the United States. Wilson Bull. 100(2):272-284.

Larsen, R.J. and M.B. McCullough. 1972. Soil survey of Otero County, CO. USDA Soil Conservation Service, CO Agricultural Experiment Station.

Martin, S.G., P.H. Baldwin, and E.B. Reed. 1974. Recent records of birds from the Yampa Valley, northwestern Colorado. Condor 76:113-116.

McCallum, D.A., W.D. Graul, and R. Zaccagnini. 1977. The breeding status of the long-billed curlew in Colorado. Auk 94:599-601.

McCune, B., and M.J. Mefford. 1995. PC-ORD. Multivariate Analysis of Ecological Data, Version 2.0. MjM Software Design, Gleneden Beach, Oregon, USA.

Midwest Heritage Task Force. 1994. The Nature Conservancy national community classification; North Dakota, South Dakota, Nebraska, and Kansas. The Nature Conservancy. Unpublished.

Milchunas, D.G. 1991. Effects of grazing on grassland community structure. Unpublished dissertation. Colorado State University, Fort Collins, CO.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. Wiley, New York. 547 pp.

Naumann, T. 1991. Revised status report for *Frasera coloradensis*. Colorado Natural Areas Program, Division of Parks and Outdoor Recreation, Denver, CO.

Niedrach, R.J. and R.B. Rockwell. 1939. Birds of Denver and Mountain Parks. Denver Museum of Natural History Popular Series No. 5.

Owenby, J.R. and D.S. Ezell. 1992. Monthly station normals of temperature, precipitation, and heating and cooling degree days, 1961-1990. U.S. Department of Commerce, NOAA. Asheville, NC.

Padgett, W.G., A.P. Youngblood, A.H. Winward. 1989. Riparian Community Type Classification of Utah and Southeastern Idaho. U.S. Forest Service Intermountain Region. R4-Ecol-89-01. 191 pp.

Pague, C. 1995. Personal communication. Colorado Natural Heritage Program: Fort Collins, CO.

Reese, R.W. 1969. The taxonomy and ecology of the tiger salamander (*Ambystoma tigrinum*) of Colorado, Ph.D. thesis, Univ. Colorado, Boulder, CO.

Risser, P. 1990. The Ecological importance of land-water ecotones. In: The Ecology and Management of Aquatic-Terrestrial Ecotones. R.J. Naimann and H. Decamps, eds. UNESCO, Paris. 303 pp.

Roberts, T.C. 1994. Resource impacts of cheatgrass and wilfires on public lands and livestock grazing. In: Proceedings-Ecology and Management of Annual Rangelands. Monsen, S.B. and S.G. Kitchen, eds. U.S. Forest Service Intermountain Region Station, General Technical Report INT-GTR-313, September 1994. 416 pp.

Sanders, K.D. 1994. Can annual rangelands be converted and maintained as perennial grasslands through grazing management? In: Proceedings-Ecology and Management of Annual Rangelands,

Monsen, S.B. and S.G. Kitchen, eds, U.S. Forest Service Intermountain Region Station, General Technical Report INT-GTR-313, September 1994. 416 pp.

Sclater, W.H. 1912. A history of the Birds of Colorado. Witherby and Co., London, England.

Shaw, R.B., S.L. Anderson , K.A. Schulz and V.E. Diersing. 1989. Plant Communities, Ecological Checklist, and Species List for the U.S. Army Piñon Canyon Maneuver Site, Colorado. Colorado State University, Department of Range Science, 71 pp.

Sherman, M. 1996. Personal communication. Colorado Natural Heritage Program: Fort Collins, CO.

Siscoe, J. 1993. A Comparison of an Invasive Riparian Shrub Species *Tamarix pentandra* with a Native Species *Salix exigua*. A thesis submitted to the Graduate School in partial fulfillment of the requirements for the Degree of Master of Science, New Mexico State University.

Soil Conservation Service. 1975. Range Site #9, Range Site Description for Siltstone Plains. U.S.D.A. Soil Conservation Service, Colorado Field Office.

Soil Conservation Service. 1982. Loamy Plains #1, Range Site Description MLRA 72. U.S.D.A. Soil Conservation Service, Colorado Field Office.

Soil Conservation Service. 1983a. Loamy Plains #6, ECO-Site Description MLRA 69A & 69B. U.S.D.A. Soil Conservation Service, Colorado Field Office.

Soil Conservation Service. 1983b. Salt Meadow #30, ECO-Site Description MLRA 69A & 69B. U.S.D.A. Soil Conservation Service, Colorado Field Office.

Soil Conservation Service. 1984. Plains Swale #10, ECO-Site Description MLRA 67 & 72. U.S.D.A. Soil Conservation Service, Colorado Field Office.

Soil Conservation Service. 1988. Western Wetland Flora: Field Office Guide to Plant Species. U.S. Department of Agriculture, Soil Conservation Service West National Center.

Stromberg, L.C., B.D. Richter, D.T. Patten, and L.G. Wolden. 1993. Response of a Sonoran riparian forest to a 10-year return flood. Great Basin Naturalist 53(2):118-130.

Stubbendieck, J., S.L. Hatch, and C.H. Butterfield. 1992. North American Range Plants. University of Nebraska: Lincoln and London. 493 pp.

Tate, J., Jr. 1986. The blue list for 1986. American Birds 40:227-236.

Tipton, F.H. 1994. Cheatgrass, livestock, and rangeland. In: Proceedings-Ecology and Management of Annual Rangelands, Monsen, S.B. and S.G. Kitchen, eds. U.S. Forest Service Intermountain Region Station, General Technical Report INT-GTR-313, September 1994. 416 pp.

UNESCO. 1973. International classification and mapping of vegetation. United Nations Educational, Scientific and Cultural Organization, Geneva, Switzerland. 37 pp.

Vallentine, J.F. 1990. Grazing Management. Academic Press: San Diego, CA. 533 pp.

Warkentin, I.G. and P.C. James. 1988. Trends in winter distribution and abundance of ferruginous hawks. Journal of Field Ornithology 59:209-214.

Warren, E.R. 1942. The Mammals of Colorado, second edition. Univ. Oklahoma Press: Norman, OK.

Weaver, J.E. 1954. North American Prairie. Johnsen Publishing Company: Lincoln, NA.

Weber, W. A. 1990. Colorado Flora, Eastern Slope. University Press of Colorado. Niwot, CO.

Weber, W.A. and R.C. Wittman. 1992. Catalog of the Colorado flora. University Press of Colorado. Niwot, CO.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 1992. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities Cooperative Extension Services. 630 pp.

Willey, R.B. and R.E. Richards. 1974. The ringtail (*Bassariscus astutus*): vocal repertoire and Colorado distribution. Journal Colorado-Wyoming Academy of Science 7(5):58.

Winward, A.K. and W.G. Padgett. 1989. Special considerations when classifying riparian areas. Pages 176-179, *in*: Proceedings-Land Classifications Based on Vegetation: Applications for Resource Management, Moscow, ID, November 17-19, 1987. USDA Forest Service Intermountain Research Station, General Technical Report INT-257.

APPENDIX A

Target Inventory Areas (TIAs)
Timpas and Kim Grazing Districts
in the Comanche National Grassland

TIMPAS GRAZING DISTRICT

TIA #	TIA NAME	QUADRANGLE	STATUS*
1	Bloom Ponds	Delhi	A
2	Brown Reservoir	Timpas	O
3	Christian Canyon	Delhi	A
4	**Devils Canyon**	Delhi	C
5	**North Fork Jack Canyon**	Riley Canyon	C
6	King Arroyo	Higbee	O
7	Mindeman Siding	Bloom	O
8	**Packers Gap**	Packers Gap	C
9	Pasture 1	Thompson Arroyo	O
10	Prairie Land Reservoir 1	Timpas NE	A
11	Round Top	Timpas	O
12	**Shale Hills**	La Junta SW	C
13	Sheep Canyon	Sheep Canyon	A
14	**Stormy Point**	Timpas	C
15	**Timpas Townsite**	Timpas	C
16	West Dry Creek	Timpas	O
17	**Vogel Canyon**	La Junta SE	C

KIM GRAZING DISTRICT

TIA #	TIA NAME	QUADRANGLE	STATUS
18	**Mustang Creek**	Andrix	C
19	**Ou Creek**	Kim North	C
20	**Pasture 4A**	Utleyville	C
21	Pasture 4N	Andrix	A
22	**Pasture 4X**	Utleyville	C
23	Pasture 9A	Kim North	O
24	Pasture 9B	Kim North	O
25	Pasture 9C	Dalerose Mesa	O
26	Pasture 9E/9B North	Kim North	O
27	Pasture 9C	Dalerose Mesa	O
28	**Pasture 10A**	Kim South	C

*Target Inventory Areas in **boldface** have been included as a Conservation Sites. Detailed information on each site is found in **Appendix B**.

O = Omitted from the study as Conservation Sites. This designation does not imply the lack of conservation value; rather, such sites are prioritized lower than sites known to have rare, sensitive, threatened, or endangered species or exemplary natural communities.

A = Although no natural heritage resources are known to occur at these sites, additional work is warranted prior to exclusion as a Conservation Site. One of the most common reasons for this designation is the presence of high quality examples of common natural community types. Until further comparative work is done on these communities, the possibility of their exemplary nature will not be known. Another reason for an "A" designation is the presence of suitable habitat for a cryptic animal or plant species.

C = Conservation sites that are known to have one or more occurrences of a natural heritage resource. These are Target Inventory Areas that have proven to have conservation significance. Detailed information on each of these sites are included in **Appendix B** along with preliminary conservation planning boundaries.

X = TIA found to be no longer in a natural state. No such sites were found in this study.

APPENDIX B

Conservation Sites

The 28 TIAs identified during the Natural Heritage Inventory (Appendix A) were surveyed and subsequently categorized as: (1) omitted from further consideration; (2) considered in need of additional survey prior to the need for conservation attention; and (3) designated as a Conservation Site. A Conservation Site is any site which contains one or more occurrences, believed to be viable, of an imperiled species or significant natural community. Therefore, Conservation Sites have known values for conserving the natural biological diversity of the Timpas and Kim District within the Comanche National Grassland. There are 9 additional Conservation Sites described that were identified from the riparian classification survey.

The Conservation Sites are described in a standard site report and appear in alphabetical order by Conservation Site name. A color copy of the 7.5 minute topographical quadrangle containing the site follows each description. The sections of these reports and their contents are outlined and explained below.

SIZE: The approximate acreage included within the conservation planning boundary for the Conservation Site.

BIODIVERSITY RANK: The overall (global) significance of the Conservation Site in terms of rarity of the natural heritage resources and the quality (health, abundance, etc.) of their occurrences. These ranks range from B1 (Outstanding Significance) to B5 (General Biodiversity Significance).

- B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.
- B2 Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.
- B3 High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.
- B4 Moderate Significance: good example of a community type, excellent or good occurrence of state-rare species.
- B5 General Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

LOCATION: Directions, USGS 7.5' quadrangle, county, legal description, elevation.

GENERAL DESCRIPTION: A brief narrative picture of the topography, vegetation, and current use of the Conservation Site. Scientific names are included in the text in parentheses following the common name.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A synopsis of the rare species that occur on the Conservation Site. Many rare species and some natural communities are sensitive to disturbance or may be sought out by collectors; therefore, the exact locations of each element are not shown on the maps. Requests for additional information should be addressed to the CNHP.

CURRENT STATUS: A summary of the ownership (in this case largely USFS owned), degree of protection currently afforded the Conservation Site, and threats to the site or natural heritage resources as determined to date.

BOUNDARY JUSTIFICATION: The conservation planning boundary delineated in this report includes all known occurrences of natural heritage resources and the adjacent lands required for their protection.

PROTECTION AND MANAGEMENT CONSIDERATIONS: A summary of the major issues and factors that are known or likely to affect the protection and management of the Conservation Site.

DEVILS CANYON

SIZE: ca. 320 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: Devils Canyon is located 30 miles southwest of La Junta and 1 mile northwest of Delhi. **USGS Quadrangle:** Delhi, Otero County. **Legal Description:** T27S R59W sec 32:e2, sec 33:nw4, sec 29:se4, sec 28:w2. **Elevation:** 4,900-5,150 feet.

GENERAL DESCRIPTION: The canyon walls are steep sandstone cliffs with a relief of 150 feet. The canyon bottom vegetation is dominated by cheatgrass (*Bromus tectorum*), western wheatgrass (*Agropyron smithii*), shadscale (*Atriplex canescens*), candelabra cactus (*Opuntia imbricata*), yucca (*Yucca glauca*), and blue grama (*Bouteloua gracilis*). A fork of Timpas Creek flows through Devils Canyon for approximately 2 miles. The stream channel is narrow and moderately entrenched. The stream varies from reaches that are completely dry to reaches with standing water. Cottonwood (*Populus deltoides*) is scattered along the gully bottom with areas of dense regeneration. Tamarisk (*Tamarix ramosissima*) is scattered and infrequent. A few stands of coyote willow (*Salix exigua*) are established along the canyon bottom. Cheatgrass (*Bromus tectorum*) dominates the streamside terrace and gully. A seep is found along the northwest wall of the canyon The seep area is dominated by poison ivy (*Toxicodendron rydbergii)* and marbleseed (*Onosmodium molle* var. *occidentale*). The canyon ridge vegetation is dominated by oneseeded juniper (*Juniperus monosperma*), mountain mahogany (*Cercocarpus montanus*), and skunkbush (*Rhus trilobata*).

There is a two-track road that is located along the eastern ridge that circles around and ends at the north end of the canyon. There is evidence, e.g., cow manure, trampling, cattle trails, of moderate to heavy cattle use. Devils Canyon is located in Pasture 23 and the grazing rotation is termed "off-season" and continuous.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Devils Canyon site supports one B-ranked stand represented by transect 62 a creeping spikerush (*Eleocharis palustris)* G5S3S4 plant association. The following transects were also located in Devils Canyon: 43, 64, 44, 61, 65, 66, and 63. This plant association was located next to pools of water created by the Timpas Creek fork. The riparian area has water for most of the year and also supports a population of willow (*Salix exigua*) and plains cottonwood (*Populus deltoides*). The seep area, although highly disturbed by grazing and invasion of exotic plants, is the only known seep that occurs on Forest Service lands in the Comanche National Grassland. Although no target plants were located, it is the habitat for the giant helleborine (*Epipactis gigantea*), and the Southern maidenhair fern (*Adiantum capillus-veneris*). Additionally, the cardinal flower (*Lobelia cardinalis* ssp. *graminea*), an uncommon wildflower was located next to the seep.

The Texas Horned Lizard (*Phrynosoma cornutum*) G5S2C2 species was located along the road to Devils Canyon. A nesting pair of prairie falcons (*Falco mexicanus*) and a prairie rattlesnake (*Crotalus viridis viridis*) were also observed.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

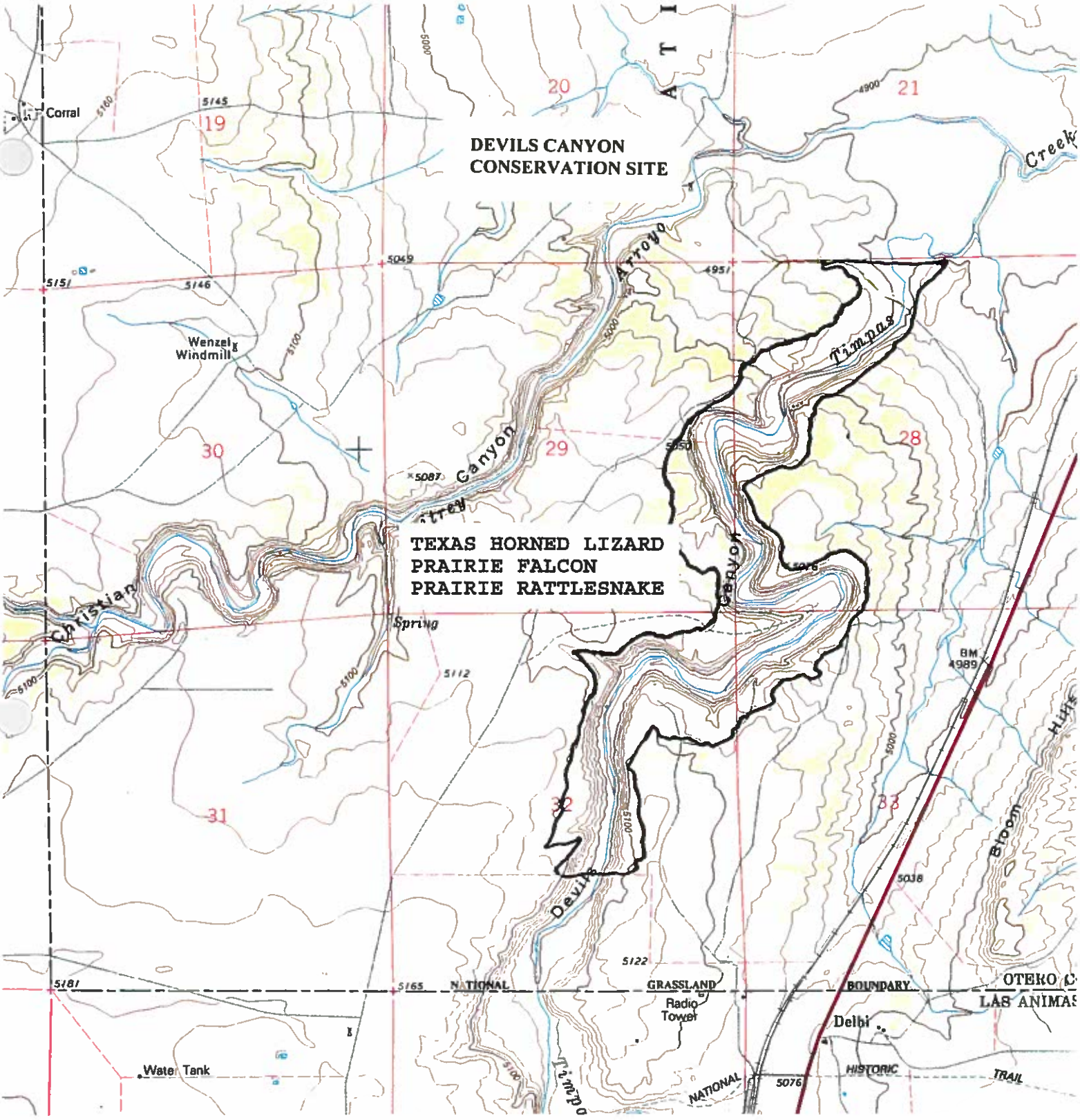
BOUNDARY JUSTIFICATION: The conservation boundary presented is intended to designate an area within which threats to the identified elements and riparian communities should be managed and within which the local ecological processes necessary to the long-term viability of the identified elements are contained. This boundary encompasses the identified riparian and seep communities. A buffer has been added that includes the juniper and mountain mahogany community on the ridgetop. This buffer is meant to protect the canyon's lower reaches from further weedy invasion, and to prevent fragmentation of the habitat. The nearby existence of tamarisk (*Tamarix ramosissima*) along the streambank may be of concern due to their tendency to locally deplete water tables (Siscoe 1993).

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the Devils Canyon site would need to maintain the current hydrology for the seep and riparian communities to ensure long-term viability. Management also needs to consider the expansion of weedy species especially, cheatgrass (*Bromus tectorum*) and tamarisk (*Tamarix ramosissima*) which dominate the streamside terrace and canyon's lower reaches. Short, intensive grazing in the canyon bottom may be used as a management tool for control of cheatgrass and other weedy species (Johnston and Reed 1991).

The existence of tamarisk in the riparian area may be of concern. Tamarisk is difficult to manage and will present long-term challenges to land managers (Johnston and Reed 1991).

Research needs to assure the long-term viability of the site including the impacts of weedy species and the role of grazing in the management of the natural communities of Devils Canyon.

Little is known regarding the Texas horned lizard's (*Phrynosoma cornutum*) reproduction in Colorado. Management should include continual monitoring of populations in southeastern Colorado to determine if range or population numbers are declining.



USGS Quadrangle: Delhi, Otero County. **Legal Description:** T27S, R59W, sec 32:e2, sec 33:nw4, sec 29:se4, sec 28:w2. **Elevation:** 4900-5100 feet.

MUSTANG CREEK

SIZE: ca. 160 acres **BIODIVERSITY RANK:** B2

LOCATION: Directions: Mustang Creek site is located 4 miles north of Andrix. **USGS Quadrangle:** Andrix, Las Animas County. **Legal Directions:** T31S R51W sec18:sw4; sec19:nw4. **Elevation:** 5,260 feet.

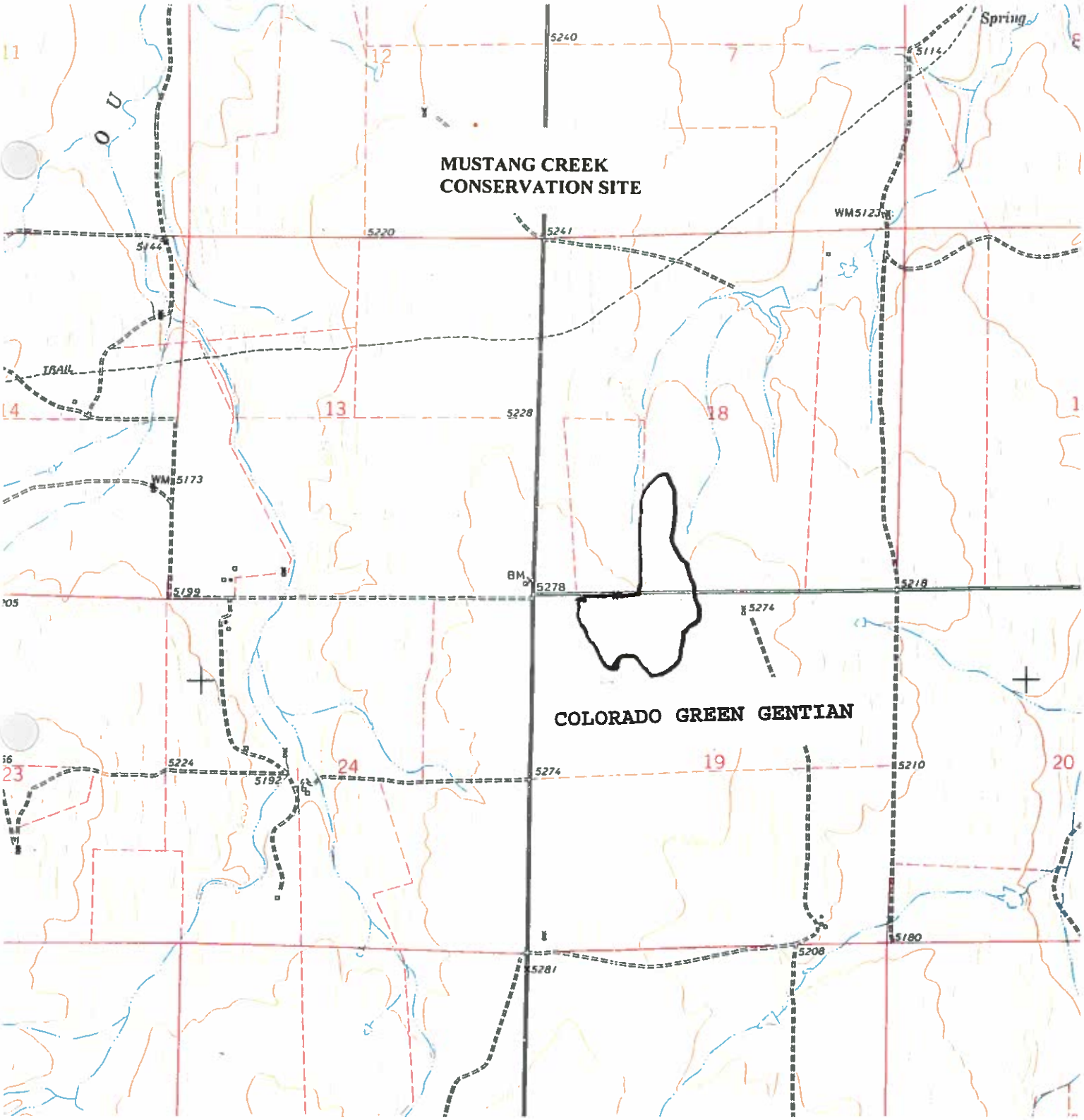
GENERAL DESCRIPTION: The Mustang Creek site is dominated by needle and thread grass and New Mexico feathergrass (*Stipa comata* and *S. neomexicana*), snakeweed (*Gutierrezia sarothrae*), and blue grama (*Bouteloua gracilis*). The site is located in Pasture 11F which utilizes a 3 unit deferred rotation grazing system. It is located on both private and USFS lands.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Mustang Creek site supports a population of the G2S2/C2 species, Colorado green gentian (*Frasera coloradensis*) was recorded. This population was first documented in 1981 and revisited in 1990. There were an estimated 700 plants in 1990. During the 1995 inventory, approximately 250 flowering plants and 50 rosettes were recorded. There was evidence of moderate grazing.

CURRENT STATUS: The area is located on private lands and lands within the National Grassland boundary, which is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary includes the entire population in both private and USFS lands. There is a buffer of 1,000 feet to prevent further disturbance from grazing activities.

PROTECTION AND MANAGEMENT CONSIDERATIONS: There are only four populations of the Colorado green gentian on the Comanche National Grassland and they all occur in designated pastures. The entire global range for this species is 600-1200 square miles with 15 of the 23 occurrences located on private lands. The evident decline of these occurrences could be a result of grazing pressure and trampling of rosettes. The greatest threat to the Colorado green gentian appears to be from cattle grazing in mid-to late-summer. If little other forage is available, the gentians may be consumed before they can produce mature seed. Future management plans should monitor populations for reproductive success and overall number of plants.



USGS Quadrangle: Andrix, Las Animas County. **Legal Directions:** T31 S R51W sec18:sw4; sec19:nw4. **Elevation:** 5260 feet.

NORTH FORK JACK CANYON

SIZE: ca. 160 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: North Fork Jack Canyon is located 17 air miles south of La Junta, directly east of Rourke Road. **USGS Quadrangle:** Riley Canyon, Otero County. **Legal Directions:** T27S R55W sec7:nw4; sec12:ne4. **Elevation:** 4,490 feet.

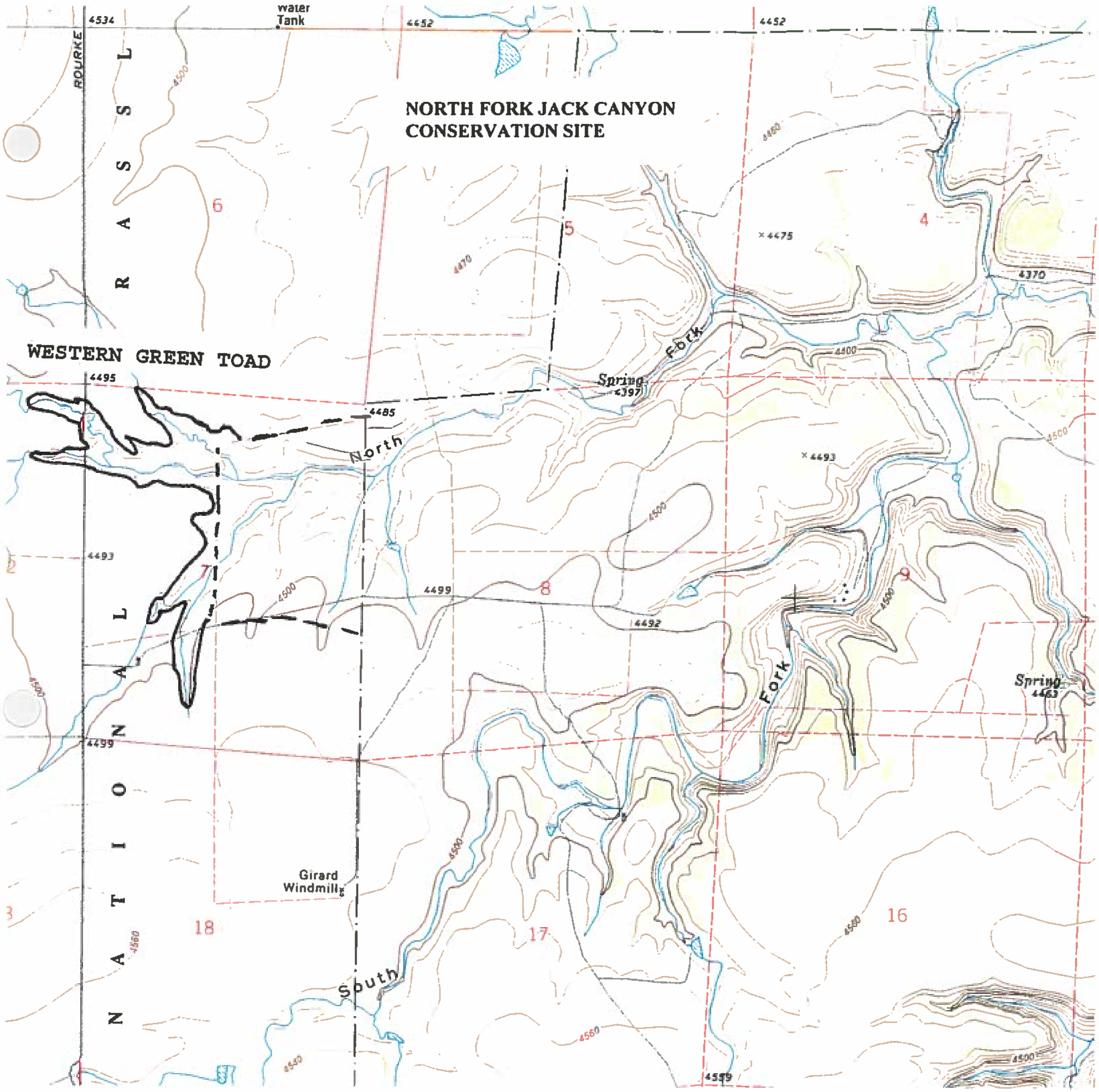
GENERAL DESCRIPTION: The North Fork Jack Canyon site contains an intermittent stream meandering from and through rolling hills down toward a small canyon. The gully bottom is dry and dominated by western wheatgrass (*Agropyron smithii*) and cheatgrass (*Bromus tectorum*). The flood plain is dominated by blue grama (*Bouteloua gracilis*), galletagrass (*Hilaria jamesii*), candelabra cactus (*Opuntia imbricata*,) and snakeweed (*Gutierrezia sarothrae*). Rourke Road bisects the site on the western edge. There was evidence of light to moderate grazing. North Fork of Jack Canyon is located in Pasture 7 and utilizes a continuous grazing rotation.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The North Fork Jack Canyon site supports one element occurrence of the western green toad (*Bufo debilis insidor*) a G5S1 (no federal status). Additionally, two B-ranked stands represented by transect 23, an alkaline sacaton (*Sporobolus airoides*) G2?SU plant association located on a terrace next to the main channel and transect 24, a creeping spikerush (*Eleocharis palustris*) GUSU plant association located in the main channel near standing water were documented.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary includes the western portion of North Fork of Jack Canyon located on USFS land. The boundary is drawn to include the canyon's bottom and ridgetop to protect the element and the riparian community from direct disturbance.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the North Fork Jack Canyon site would need to maintain the current hydrology to ensure the long-term viability of the riparian community and the western green toad. There are only 7 previously known occurrences for the western green toad in Colorado. Management plans for the western green toad should address the impact of grazing, use of pesticides, and fluctuations to water sources on the reproduction success of the western green toad. Management of the site would also need to consider the invasion of cheatgrass (*Bromus tectorum*), white clover (*Melilotus alba*), and Russian thistle (*Salsola australis*) along the streambank.



USGS Quadrangle: Riley Canyon, Otero County. **Legal Directions:** T27S R55W sec7:nw4; sec12:ne4. **Elevation:** 4490 feet.

OU CREEK

SIZE: ca. 660 acres **BIODIVERSITY RANK:** B2

LOCATION: Directions: Ou Creek site is located 8 air miles northeast of Kim. **USGS Quadrangle:** Andrix and Kim North, Las Animas County. **Legal Description:** T31S R52W sec 27:e2; sec34:e2; sec33:ne4. **Elevation:** 5,300 feet.

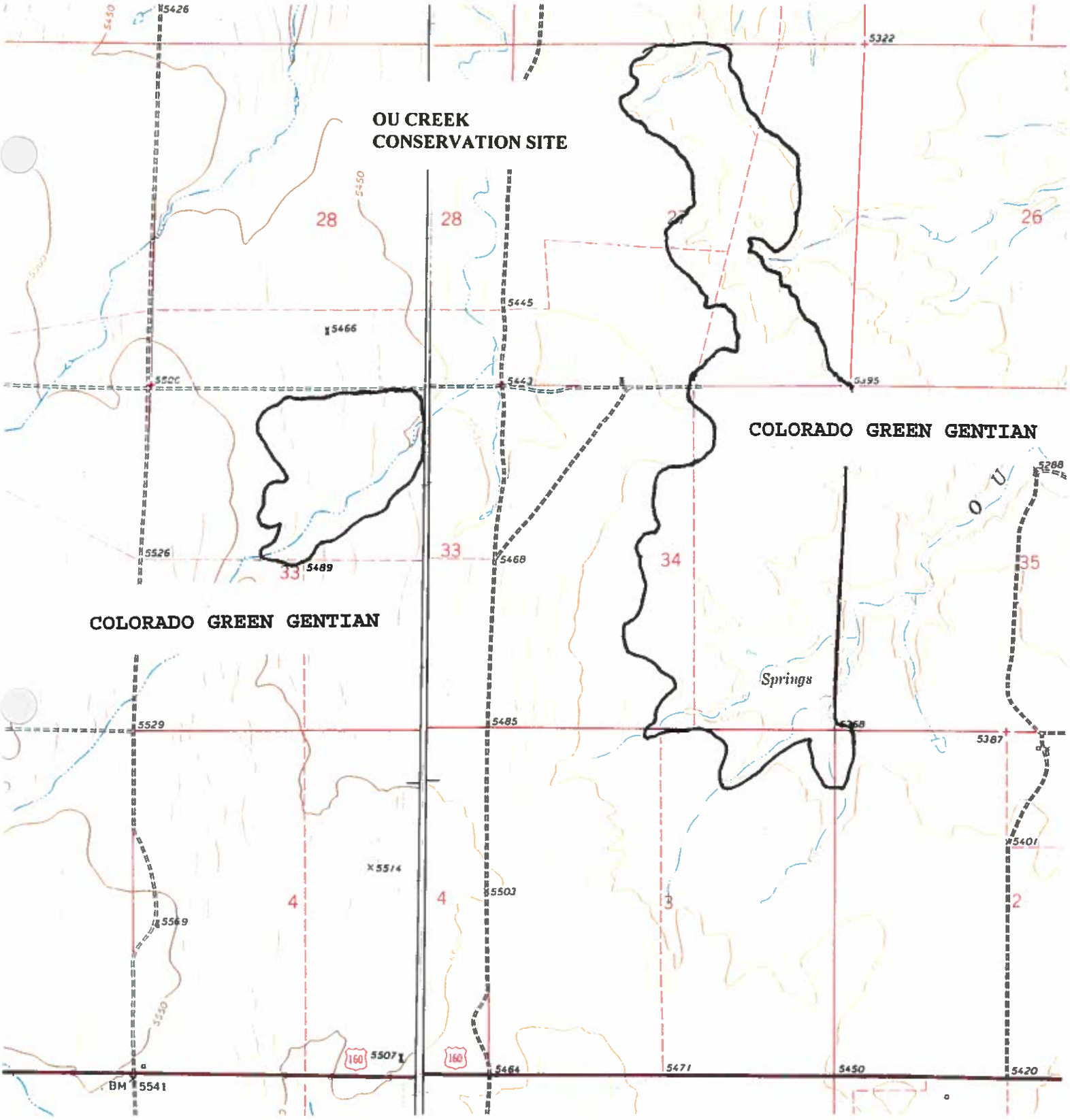
GENERAL DESCRIPTION: The Ou Creek site is located on pasture 11ANE in Comanche National Grassland. Ou Creek flows north through the site from an elevation of 5,400 feet to 4,950 feet before its confluence with Mustang Creek. The site is in the shortgrass prairie that is dominated by snakeweed (*Gutierrezia sarothrae*), cheatgrass (*Bromus tectorum*), blue grama (*Bouteloua gracilis*), needle and thread grass (*Stipa comata*), and sand sagebrush (*Artemisia frigida*). There are frequent outcrops of Greenhorn limestone throughout the site. The site is the location of the headwaters of Ou Creek, a narrow, intermittent gully that contains cottonwood (*Populus deltoides*), Canada ryegrass (*Elymus canadensis*), and poison ivy (*Toxicodendron rydbergii*). There is only one two-track road that bisects the site and it is 2 miles form Highway 160. It is lightly grazed and there are few exotics. It is one of the better examples of shortgrass prairie on the Comanche National Grassland.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A high quality occurrence of *Frasera coloradoensis* (G2S2) was located in this site. The population of over 500 flowering plants and rosettes extended for 2 miles on sparsely vegetated limestone outcrops. This was the highest quality occurrence for *Frasera coloradoensis* that was observed during the 1995 field season. There was no sign of physical disturbance of the site except for light to moderate grazing. This population was first documented in 1947 and therefore has been viable for 48 years. The population appears to be healthy and tolerant of disturbance. This is one of four populations that are documented on the Comanche National Grassland.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary includes the known element occurrence and an extension of 1000 feet of buffer which includes potential habitat.

PROTECTION AND MANAGEMENT CONSIDERATIONS: The entire global range for this species is 600-1200 square miles with 15 of the 23 occurrences located on private lands. All occurrences of this species on USFS lands are located in pastures with no special protection. Future management should consider the impacts of grazing and trampling on the viability of the species. The greatest threat to the Colorado green gentian appears to be from cattle grazing in mid-to late-summer. If little other forage is available, the gentians may be consumed before they can produce mature seed. Future management plans should monitor the occurrence at this site for reproductive success and overall number of plants.



USGS Quadrangle: Andrix and Kim North, Las Animas County. **Legal Description:** T31S R52W sec 27:e2; sec34:e2; sec33:ne4. **Elevation:** 5300 feet.

PACKERS GAP

SIZE: ca. 1200 acres **BIODIVERSITY RANK:** B5

LOCATION: Directions: Packers Gap is located approximately 16 air miles southwest of La Junta. **USGS Quadrangle:** Packers Gap, Otero County. **Legal Description:** T26S R56W sec 33:ne4; T27S R56W sec 15:4ne; sec 10:2s. **Elevation:** 4,720 feet and 4,670 feet, respectively.

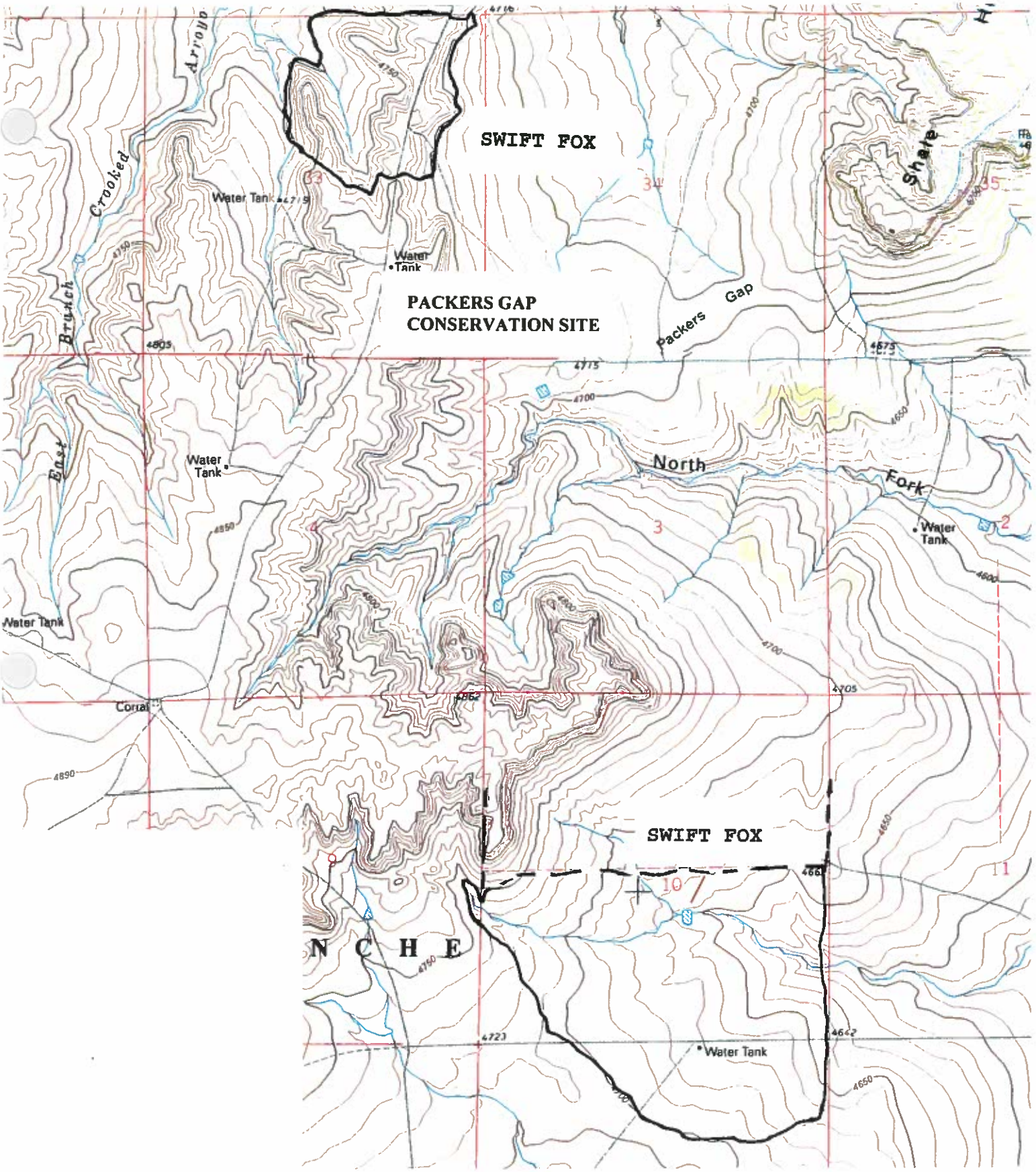
GENERAL DESCRIPTION: An ephemeral fork of Crooked Arroyo with areas of standing water flows through area. The dry gully is dominated by blue grama (*Bouteloua gracilis*) and three-awn (*Aristida purpurea*) with yucca (*Yucca glauca*) and alkaline sacaton (*Sporobolus airoides*) dominating the upslope. Packers Gap site is located in Pasture 10 (section 33) and Pasture 9 (section 15) and the grazing rotation varies.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Packers Gap site supports two element occurrence records for the swift fox (*Vulpes velox*), a G5S3/C2.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary is intended to designate an area which, given the available data regarding the ecological processes that support these elements, is believed necessary. At this time, it is suggested that the boundary encompass all of the local breeding habitat for the swift fox (*Vulpes velox*). The boundary should also include corridors between the two designated sites in the Packers Gap site.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future research needs to determine the impact of grazing on the reproduction success of swift foxes and their long-term survivability. There appears to be little active management for this species in Colorado. It is still a legal game species and although the take is regulated, actual mortality is poorly known. Land managers need to assure the protection of the swift fox and potential den sites.



USGS Quadrangle: Packers Gap, Otero County. **Legal Description:** T26S R56W sec 33:ne4; T27S R56W sec 15:4ne; sec 10:2s.
Elevation: 4720 feet and 4670 feet, respectively.

PASTURE 4A

SIZE: ca. 320 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: Pasture 4A is located 2 miles west of Utleyville. **USGS Quadrangle:** Utleyville, Baca County. **Legal Description:** T32S R50W sec 6:n2. **Elevation:** 5,229 feet.

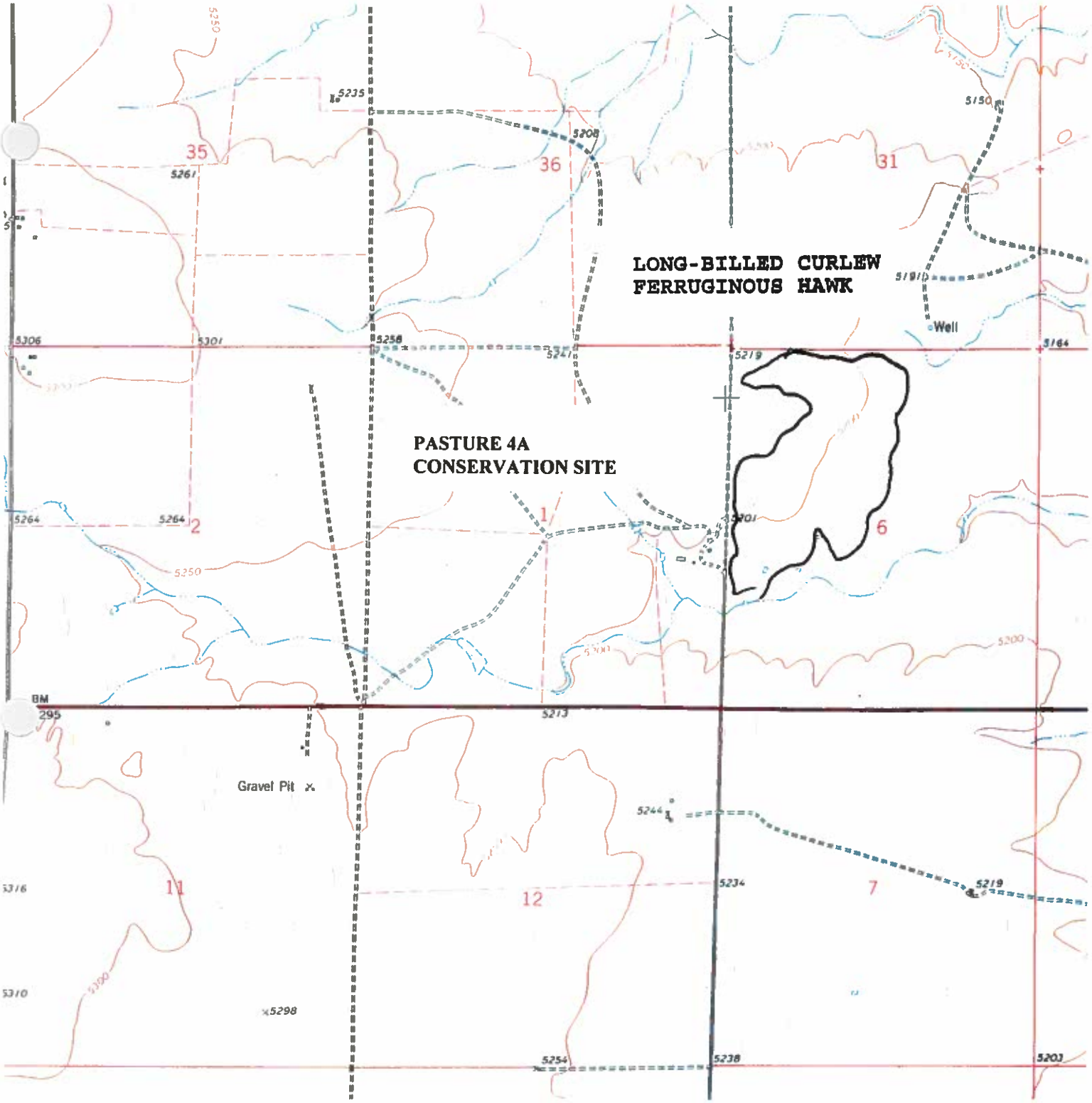
GENERAL DESCRIPTION: Pasture 4A is dominated by blue grama (*Bouteloua gracilis*) and western wheatgrass (*Agropyron smithii*). It is located in Pasture 4A which utilizes a 2 unit deferred rotation grazing system.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Pasture 4A site supports one element occurrence record for the long-billed curlew (*Numenius americanus*), G5S2BSZN, USFS sensitive status and one element occurrence for nesting pair of ferruginous hawks (*Buteo regalis*), G4S3BS5N/C2.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary is intended to designate an area which is necessary to support the element occurrences. The boundary should encompass all of the local breeding habitat for the long-billed curlew (*Numenius americanus*) and ferruginous hawks (*Buteo regalis*), at a minimum of 0.5 mile radius (Mike Sherman pers. comm.). Therefore, the boundary encompasses all of Pasture 4A.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management plans for the long-billed curlew would need to consider the problem of reduced productivity associated with grazing and dragging (breaking up cow manure) during nesting, field fertilization, and early season grazing. Also, human visitations to nests with eggs may increase probability of egg loss to predators by leaving a scent trail. Ferruginous hawks are sensitive to disturbance by humans during incubation and will desert nest if disturbed. Both species are on the National Audubon Society Special Concern List (Tate 1986).



USGS Quadrangle: Utleyville, Baca County. **Legal Description:** T32S R50W sec 6:n2. **Elevation:** 5229 feet.

PASTURE 4X

SIZE: ca. 80 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: Pasture 4X is located 2 air miles northwest of Utleyville. **USGS Quadrangle:** Utleyville, Baca County. **Legal Description:** T31S R50W sec 29:se4; sec 28:se4; sec 33:nw4. **Elevation:** 5,110 feet.

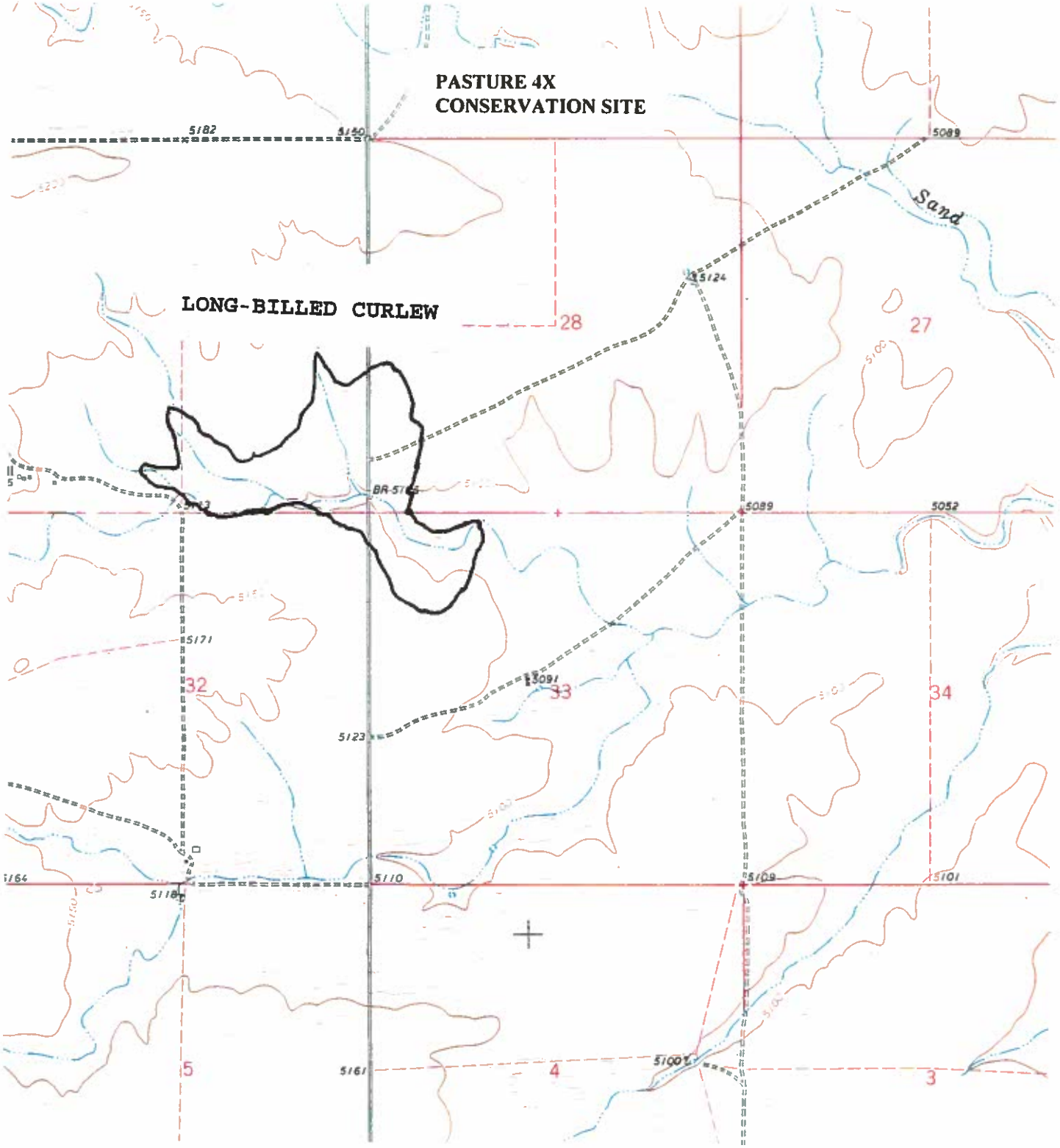
GENERAL DESCRIPTION: Pasture 4X is dominated by blue grama (*Bouteloua gracilis*), buffalo grass (*Buchloe dactyloides*), yucca (*Yucca glauca*), and candelabra cactus (*Opuntia imbricata*). It is located in Pasture 4X (unknown rotation system).

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Pasture 4X site supports one element occurrence record of long-billed curlew (*Numenius americanus*) G5S2C2. There were 4 adults observed feeding in the pasture.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary includes the known element occurrence and a buffer of 0.5 mile radius to include potential breeding habitat.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management plans for the long-billed curlew need to consider the problem of reduced productivity associated with grazing and dragging (breaking up cow manure) during nesting, field fertilization, and early season grazing. Also, human visitations to nests with eggs may increase probability of egg loss to predators by leaving a scent trail. The long-billed curlew is on the National Audubon Society Special Concern List (Tate 1986).



USGS Quadrangle: Utleyville, Baca County. **Legal Description:** T31S R50W sec 29:se4; sec 28:se4; sec 33:nw4. **Elevation:** 5110 feet.

PASTURE 10A

SIZE: ca. 160 acres **BIODIVERSITY RANK:** B2

LOCATION: Directions: Pasture 10A is located 8 air miles southeast of Kim. **USGS Quadrangle:** Dalerose Mesa, Las Animas County. **Legal Description:** T32S R54W sec29:nw4,sw4; sec28:ne4. **Elevation:** 5,800 feet.

GENERAL DESCRIPTION: Pasture 10A is dominated by needle and thread grass (*Stipa comata*), blue grama (*Bouteloua gracilis*), and yucca (*Yucca glauca*). A two track road bisects the site which leads to a stock tank located north of the site. Site is located in Pasture 10A which utilizes a 2 unit deferred rotation grazing system.

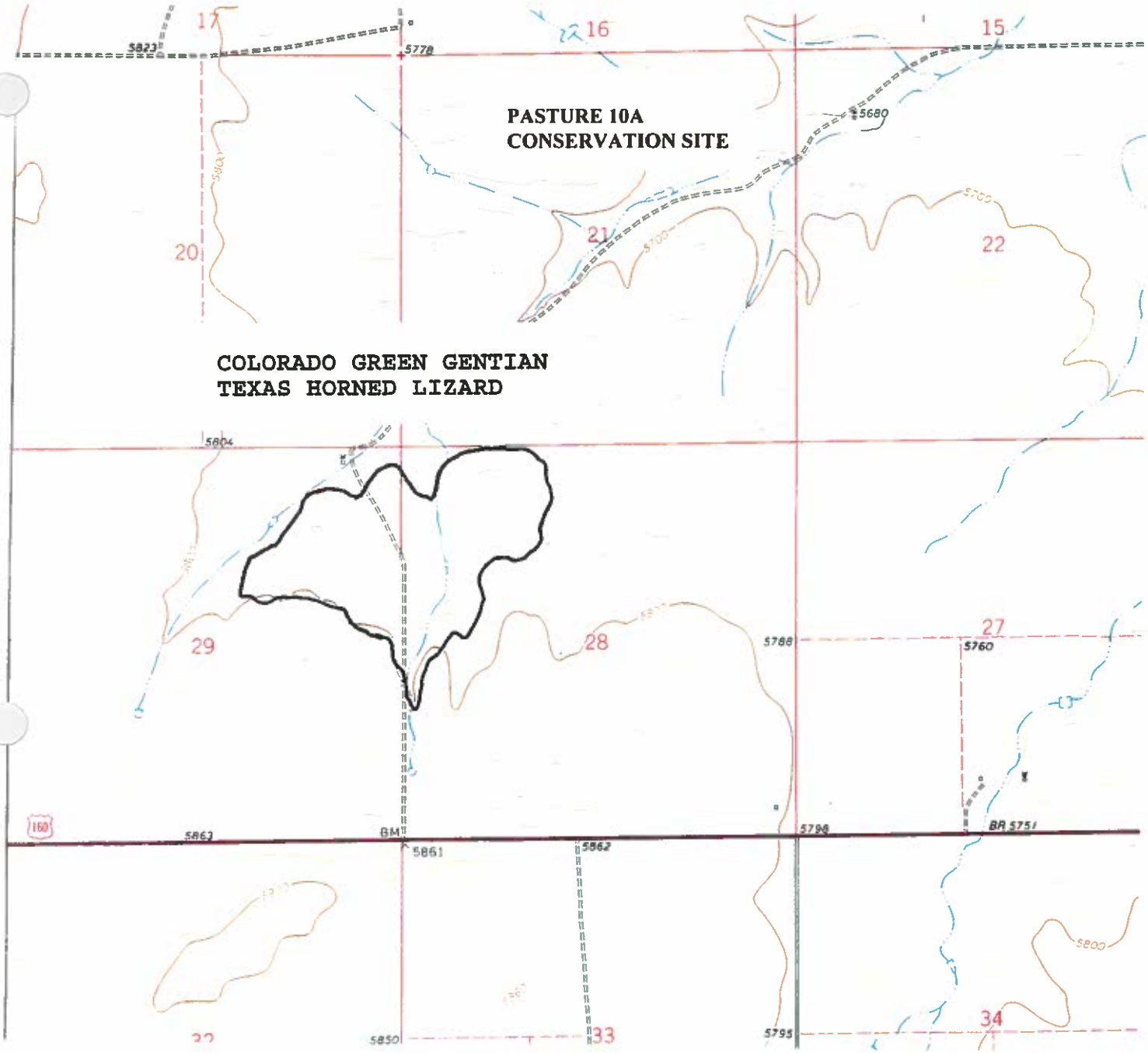
NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Pasture 10A site supports a population of the G2S2/C2 species, Colorado green gentian (*Frasera coloradensis*). One element occurrence for Texas horned lizard (*Phrynosoma cornutum*) G5S2C2 was also recorded.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary includes the occurrence of the Colorado green gentian (*Frasera coloradensis*) and 1,000 feet of buffer which includes the limestone outcrop.

PROTECTION AND MANAGEMENT CONSIDERATIONS: This population of Colorado green gentian is located in a moderate to heavily grazed pasture. It is located approximately 500 feet from a stock tank. There are several cattle trails that bisect the site, as does a two-track road. Future management of this site should consider these impacts on the occurrence of *Frasera coloradoensis*. This is only one of occurrences of this species located on the Comanche National Grassland. *Frasera coloradoensis* is a narrow range endemic that occurs only in a southeastern Colorado. The entire global range for this species is 600-1200 square miles. This species is tolerant of grazing, but there is evidence that cattle will consume it when there is little other forage available. This population needs to be monitored and reproductive success documented.

Little is known regarding the Texas horned lizard's (*Phrynosoma cornutum*) reproduction in Colorado. Management should include continual monitoring of populations in southeastern Colorado to determine if range or population numbers are declining.



USGS Quadrangle: Dalerose Mesa, Las Animas County. **Legal Description:** T32S R54W sec29:nw4,sw4; sec28:ne4. **Elevation:** 5800 feet.

PLUM CANYON

SIZE: ca. 120 acres **BIODIVERSITY RANK:** B3

LOCATION: Directions: Plum Canyon is 27 air miles southwest of La Junta. **USGS Quadrangle:** Delhi, Otero County. **Legal Description**: T27S R59W sec 18:se4s2. **Elevation:** 5,000-5,100 feet.

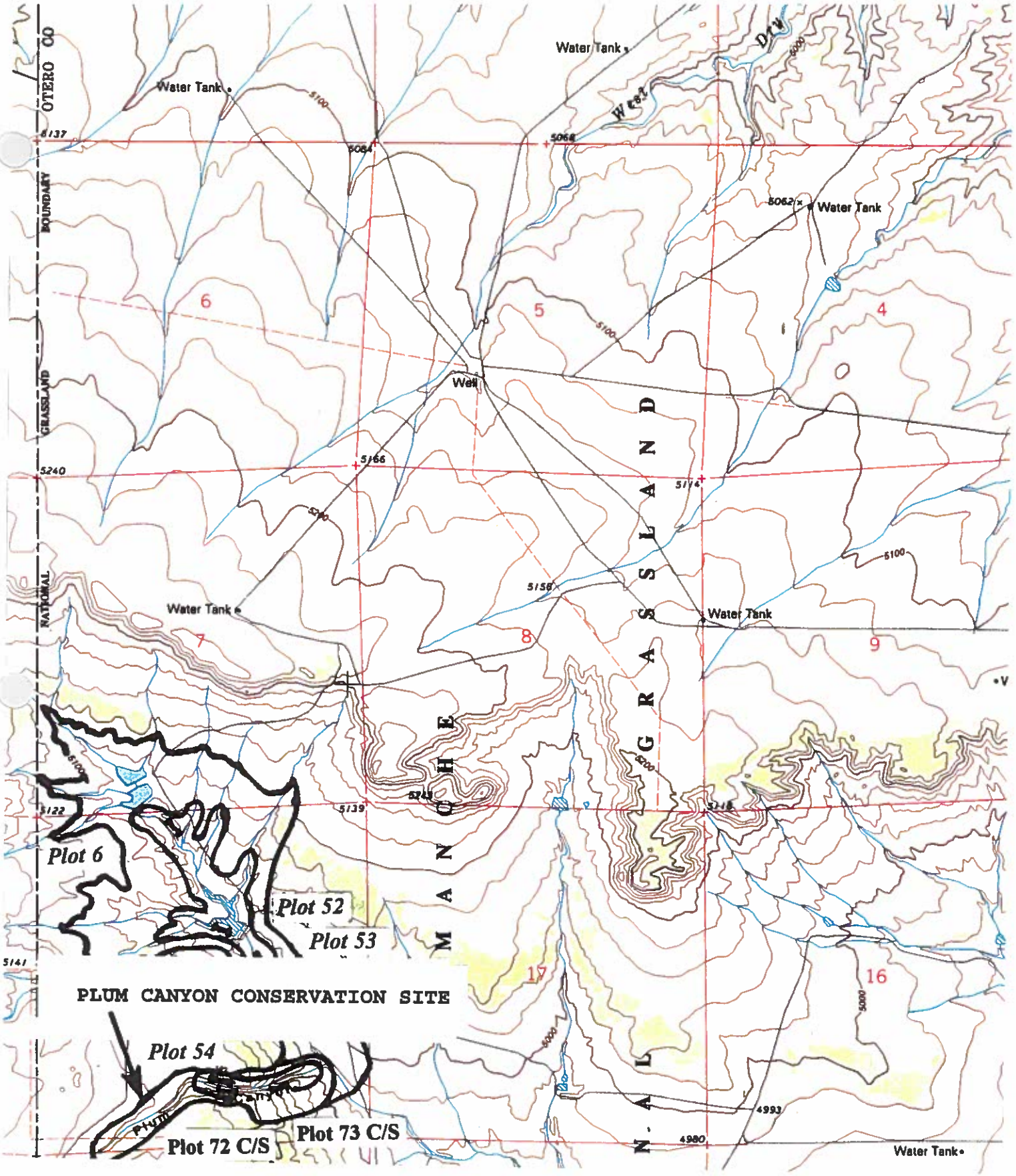
GENERAL DESCRIPTION: Plum Canyon is a narrow to moderately wide canyon with steep, washed sandstone walls with a relief of 100 feet. The site contains exposed bedrock and large boulders scattered throughout the channel. The plunge pools created by steep drops provide a place for standing water which support highly localized riparian communities. The canyon ridge is dominated by a variety of shrubs including single seed juniper (*Juniperus monosperma*), mock orange (*Philadelphus microphyllus*), currants (*Ribes* spp.), brickellia (*Brickellia oblongifolia*) and a few piñon pines (*Pinus edulis*). The riparian zone supports spikerushes (*Eleocharis* spp.), cattails (*Typha domingensis*) and an occasional cottonwood tree (*Populus* spp.). This site is within Timpas pasture 23, which is grazed off season in spring and winter.

NATURAL HERITAGE SIGNIFICANCE: The Plum Canyon site supports a high quality occurrence of a B-ranked community represented by transect 54 which contains narrow-leafed cottonwood (*Populus angustifolia*), creeping spikerush (*Eleocharis palustris*) and western wheatgrass (*Pascopyrum smithii*). Transects 72 and 73 along the canyon slope are also located within this site. The site had few weedy species, there were only small patches of cheat grass (*Bromus tectorum*) documented and no tamarisk (*Tamarix ramosissima*). Additionally, a great blue heron (*Ardea herodias*) and an owl (species unknown) were observed in Plum Canyon.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary encompasses the identified riparian and plunge pool communities . A buffer has been added that includes the juniper and mock orange community along the ridgetop. This buffer is meant to protect the canyon's lower reaches from weedy invasion and to prevent habitat fragmentation.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the Plum Canyon site would need to maintain the current hydrology for the pool areas to ensure continued viability for this high quality riparian community. Presently, the site demonstrates little evidence of disturbance due to its limited access. Because of the high quality of this site, it is suggested that this area be considered as a designated protected area for future research.



LOCATION: **Directions:** Plum Canyon is 27 air miles southwest of La Junta. **USGS Quadrangle:** Delhi, Otero County. **Legal Description:** T27S R59W sec 18:se4s2. **Elevation:** 5,000-5,100 feet.

SHALE HILLS

SIZE: ca. 160 acres **BIODIVERSITY RANK:** B5

LOCATION: Directions: The Shale Hills are located approximately 15 air miles southwest of La Junta. **USGS Quadrangle:** La Junta SW, Otero County. **Legal Description:** T26S R56W sec 26:ne4; sec 4:nw4, sec 5;ne4; T25S R56W sec34:se4. **Elevation:** 4,725 feet.

GENERAL DESCRIPTION: The Shale Hills site contains an ephemeral stream dominated by cheatgrass (*Bromus tectorum*), alkaline sacaton (*Sporobolus airoides*), snakeweed (*Gutierrezia sarothrae*), and blue grama (*Bouteloua gracilis*).

The Shale Hills are located in Pasture 11 and 10 where the grazing rotation varies.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Shale Hill site supports three element occurrences of swift fox (*Vulpes velox*), G5S3/C2, and one element occurrence of the burrowing owl (*Athene cunicularia*) G5S3S4B/C2.

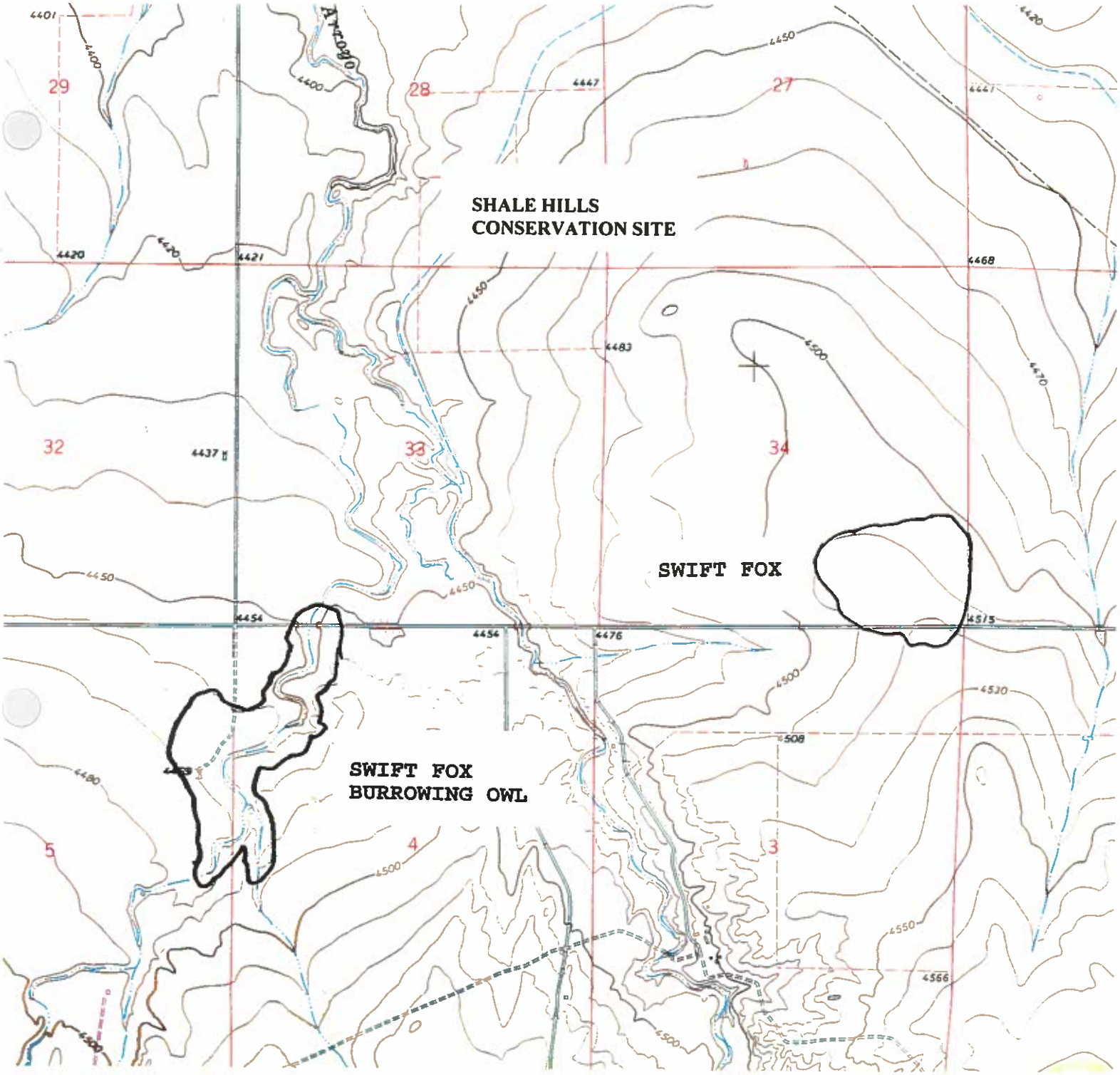
CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The conservation boundary for the Shale Hills site is difficult to define because of the nature of territory for the swift fox, where both adult and juveniles were observed, denoting a den site.

However, a preliminary conservation boundary can be drawn for the burrowing owl occurrence. It is intended to designate an area which, given the available data regarding the ecological processes that is necessary for the protection of both the burrowing owl and swift fox. This includes the draw south of Rourke Road and west of the Round Ranch Road in sections 4 and 5.

PROTECTION AND MANAGEMENT CONSIDERATIONS: As stated for the Packers Gap site, future research needs to determine the impact of grazing and harvesting on the long-term survivability of the swift fox. Land managers also need to assure the protection of the swift fox and potential den sites from accidentally poisoning intended for coyotes.

The burrowing owl populations have declined due to the eradication of prairie dogs and conversion of rangeland to irrigated agricultural land. However, the owls have responded positively to the creation of artificial nest burrows and periodic burning of desert grasslands (Andrews and Righter 1992). Managers need to continue to monitor the reproduction success and population numbers of the owls, especially in potential nest sites.



USGS Quadrangle: La Junta SW, Otero County. **Legal Description:** T26S R56W sec 26:ne4; sec 4:nw4, sec 5;ne4; T25S R56W sec34:se4. **Elevation:** 4725 feet.

STORMY POINT

SIZE: ca. 160 acres **BIODIVERSITY RANK:** B5

LOCATION: Directions: Stormy Point is located 15 air miles southwest of La Junta. **USGS Quadrangle:** Timpas, Otero County. **Legal Description:** T26S R57W sec23:s2; sec14:nw4; sec26:e2. **Elevation:** 4,760 feet.

GENERAL DESCRIPTION: The Stormy Point site contains an open, mesic draw dominated by needle and thread grass (*Stipa comata*), three-awn (*Aristida purpurea*), tansy mustard (*Descurainia pinnata*), western wheatgrass (*Agropyron smithii*) and blue grama (*Bouteloua gracilis*). It is located in Pasture 13 and the grazing is deferred rotation.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Stormy Point site supports one element occurrence for the burrowing owl (*Athene cunicularia*) G5S3S4B/C2 and one element occurrence for the western green toad (*Bufo debilis insidor*) G5T5S1 (no federal listing).

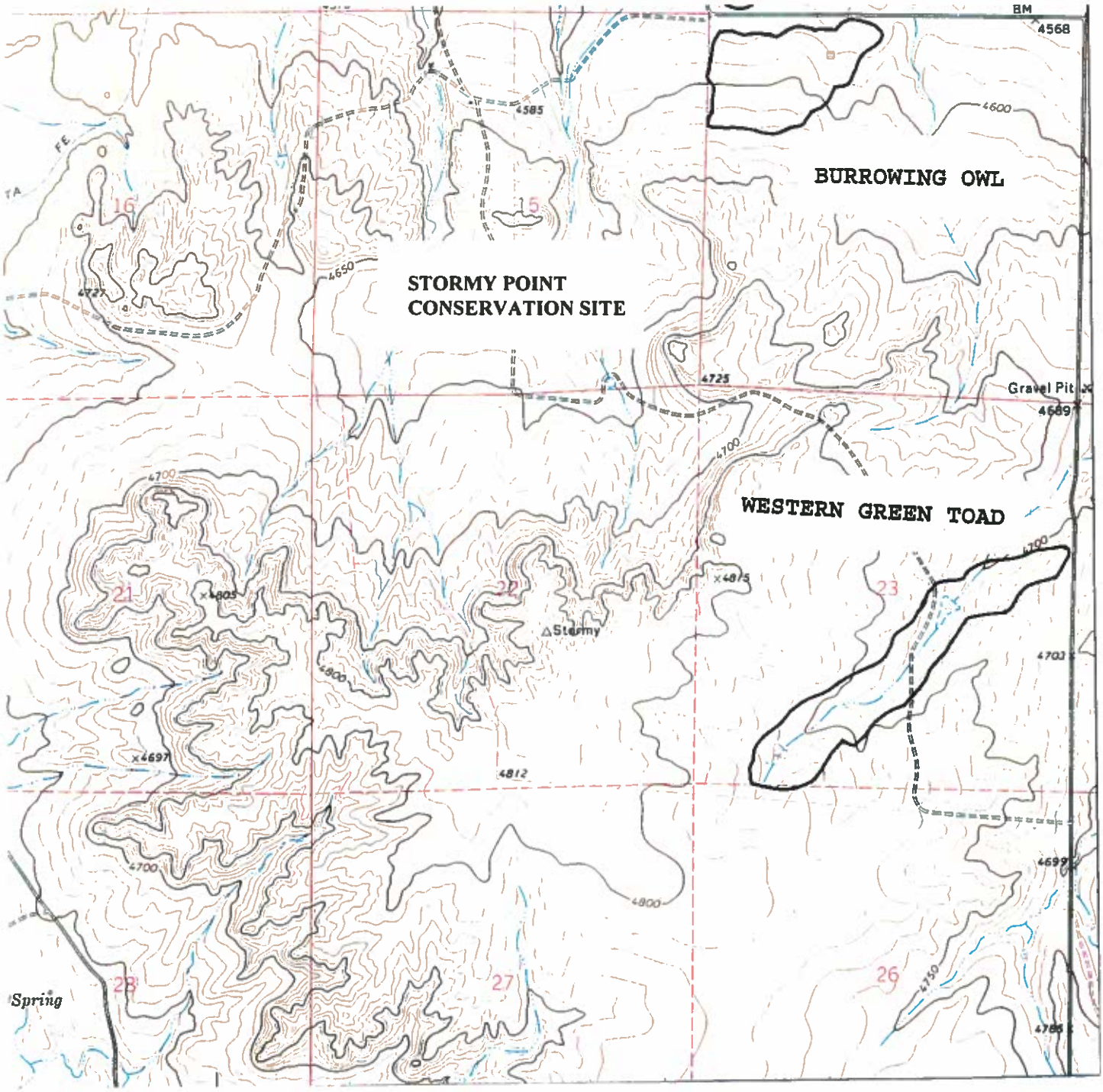
One B-ranked stand represented by transect 9 an alkaline sacaton/salt grass (*Sporobolus airoides*/*Distichlis spicata*) G3G5SU plant association was documented.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: There are three designated areas within this site which are presented. All three elements, burrowing owl (section 14), western green toad (section 23), and the alkaline sacaton/salt grass plant association (section 26) have denoted areas which are intended to provide protection to the ecological processes that support the elements.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the Stormy Point site would need to maintain the current hydrology to ensure long-term viability for the identified elements. Managers need to continue to monitor the reproduction success and population numbers of the owls, especially in potential nest sites. Burrowing owl populations have declined due to the eradication of prairie dogs and the conversion of rangeland to irrigated agricultural land. However, the owls have responded positively to the creation of artificial nest burrows and periodic burning of desert grasslands (Andrews and Righter 1992).

Management for the western green toad need to consider the impact of grazing, use of pesticides, and fluctuations to water sources on the reproduction success. There are only 7 previously known occurrences for the western green toad in Colorado.



USGS Quadrangle: Timpas, Otero County. **Legal Description:** T26 R57W sec23:s2; T26W R57W sec14:nw4. **Elevation:** 4760 feet.

TIMPAS CREEK EXCLOSURE

SIZE: ca. 320 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: The Timpas Creek exclosure is located 15 air miles southwest of La Junta. **USGS Quadrangle:** Timpas, Otero County. **Legal Description:** T26S R58W sec24:se4; T26S R57W sec19:n2; sec18:se4. **Elevation:** 4,525 feet.

GENERAL DESCRIPTION: Timpas Creek flows through a moderately wide to narrow canyon with canyon walls ranging from downcut silt to eroding shale. The creek is a moderately sinuous and shallow for most of the year with a low gradient and velocity. Sand and gravel bars are common within the channel. The site's riparian area supports a mosaic of vegetation patches including cottonwood (*Populus deltoides*), coyote willow (*Salix exigua*), tamarisk (*Tamarix ramosissima*), spikerush (*Eleocharis* sp.) and cattail (*Typha domingensis*). Upland grasses and weedy forbs are also found in the drier areas of the riparian zone.

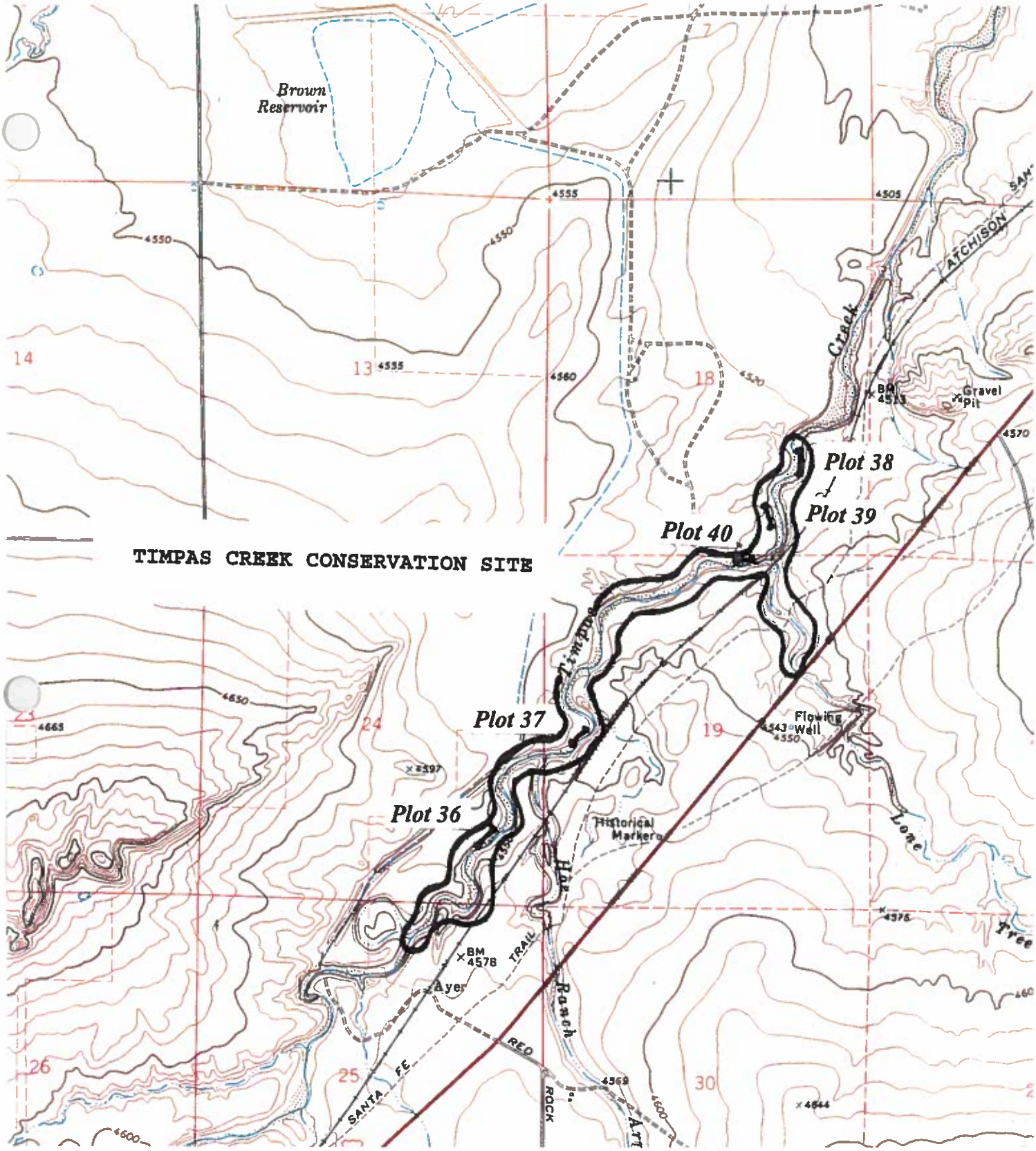
NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Timpas Creek Exclosure site supports two B-ranked stands represented by transect 37, a cottonwood/coyote willow *(Populus deltoides/Salix exigua)* GUSU plant association and transect 40, a coyote willow (*Salix exigua*)/barren soil a G3QSU plant association. Transects 36, 38, and 39 are also located within this site. Timpas Creek is a perennial stream, affording habitat that is uncommon on the Comanche National Grassland. The stream supports some of the best regenerating cottonwood (*Populus deltoides*) and coyote willow (*Salix exigua*) communities on the Comanche National Grassland.

CURRENT STATUS: The area is within the National Grassland boundary and a fenced exclosure.

BOUNDARY JUSTIFICATION: The conservation boundary includes the existing exclosure which encompasses the cottonwood/coyote willow *(Populus deltoides/Salix exigua)* and coyote willow (*Salix exigua*)/barren soil plant associations.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Present management of the exclosure is adequate, however it is observed that the fence on the north end of the exclosure is washed out and there is evidence of livestock within the exclosure (7/29/95).

The establishment of tamarisk (*Tamarix ramosissima*) along the streambank may be of concern due to their tendency to locally deplete water tables and out compete native vegetation. Management should address the further establishment of tamarisk.



LOCATION: **Directions:** The Timpas Creek exclosure is located 15 air miles southwest of La Junta. **USGS Quadrangle:** Timpas, Otero County. **Legal Description:** T26S R58W sec24:se4; R57W sec19:n2; sec18:se4. **Elevation:** 4,525 feet.

TIMPAS CREEK/MINDEMAN

SIZE: ca. 160 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: Timpas Creek near Mindeman is located 21 air miles southwest of La Junta. **USGS Quadrangle:** Bloom, Otero County. **Legal Description:** T27S R58W sec 8:ne4; sec 9:nw4sw4. **Elevation:** 4,700 feet.

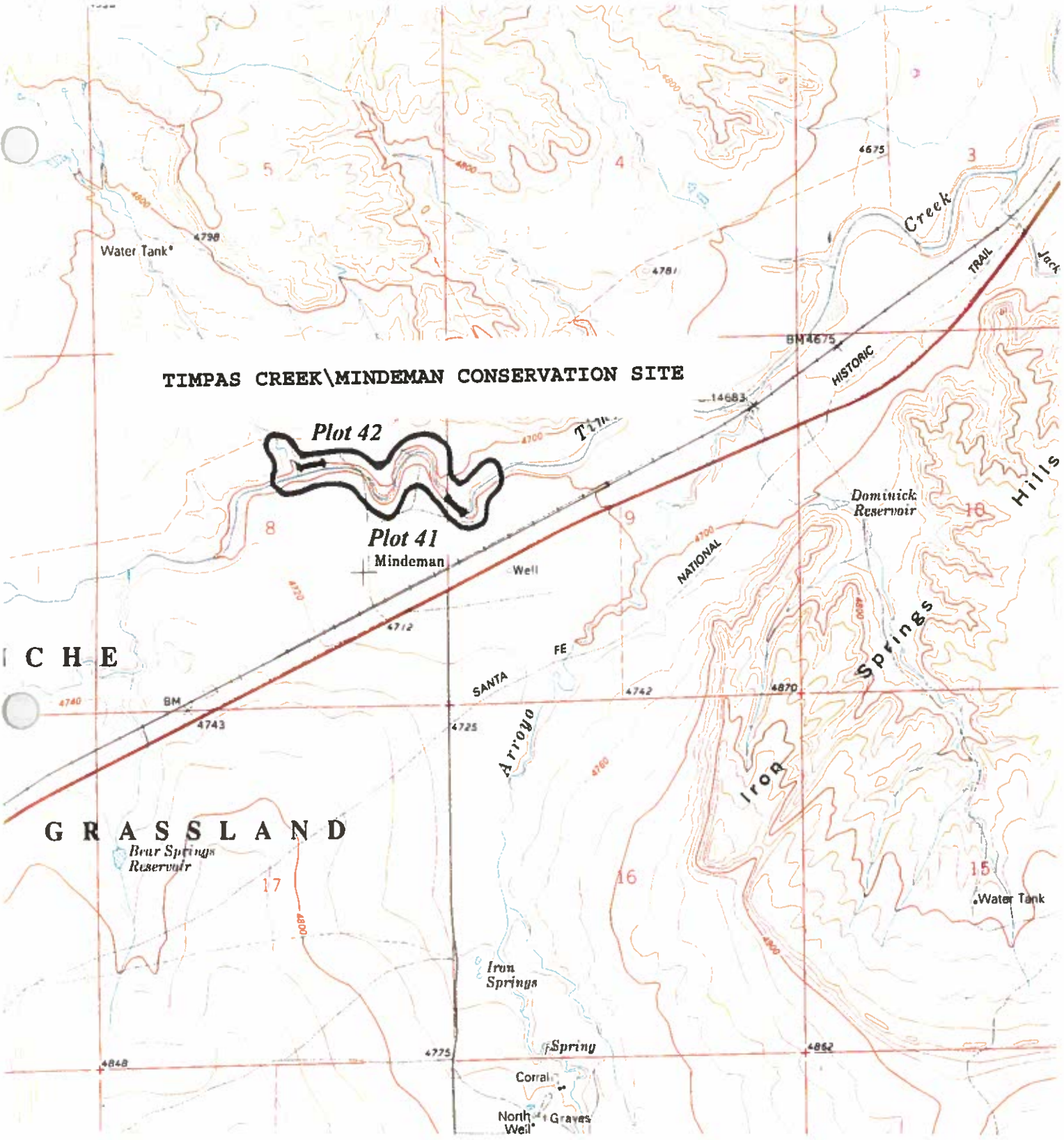
GENERAL DESCRIPTION: Timpas Creek flows through a moderately wide to narrow canyon with canyon walls ranging from downcut silt to eroding shale. The creek is only moderately sinuous and shallow for most of the year with a low gradient and velocity. Sand and gravel bars are common within the channel. The riparian area supports a mosaic of communities, including cottonwood (*Populus deltoides*), coyote willow (*Salix exigua*), tamarisk (*Tamarix ramosissima*), spikerush (*Eleocharis* sp.), and cattail (*Typha domingensis*). Upland grasses and weedy forbs are also found in the drier areas of the riparian zone. The site is within Timpas pasture 20 and is grazed on a deferred rotation system November 1 - December 14.

CURRENT STATUS: The area is within the National Grassland Boundary and is given no special designation.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Timpas Creek/Mindeman site supports one B-ranked stand represented by transect 42, a coyote willow/leafy bulrush (*Salix exigua/Scirpus pungens*), GUSU plant association. Transect 41 is also located within this site. Timpas Creek is a perennial stream, providing habitat that is uncommon on the Comanche National Grassland. The stream supports some of the best regenerating cottonwood (*Populus deltoides*) and coyote willow (*Salix exigua*) communities on the Comanche National Grassland.

BOUNDARY JUSTIFICATION: The conservation boundary encompasses the identified riparian community and a buffer has been added that includes 0.5 miles upstream and 0.5 miles downstream. This buffer is meant to protect the streamside from further degradation from intensive grazing and continued weedy invasion. The establishment of tamarisk along the streambank is of concern due to their tendency to locally deplete water tables.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the Timpas Creek/Mindeman site would need to maintain the current hydrology for the riparian community to ensure long-term viability. Management needs to consider the expansion of weedy and exotic species especially, cheatgrass (*Bromus tectorum*) and tamarisk (*Tamarix ramosissima*) which are becoming established along the creek. A riparian exclosure is suggested that is similar to the existing Timpas Creek riparian exclosure.



LOCATION: **Directions:** Timpas Creek near Mindeman is located 21 air miles southwest of La Junta. **USGS Quadrangle:** Bloom, Otero County. **Legal Description:** T27S R58W sec 8:ne4; sec 9:nw4sw4. **Elevation:** 4,700 feet.

TIMPAS SITE

SIZE: ca. 160 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: Timpas Townsite is located 15 miles southwest from La Junta. **USGS Quadrangle:** Timpas, Otero County. **Legal Description:** T26S R57W sec 3:nw4; sec 11:w2; sec 2:sw4; T25S R57W sec 34:se4. **Elevation:** 4,500 feet.

GENERAL DESCRIPTION: The Timpas Townsite includes the Timpas bridge and cemetery. Timpas Creek is a perennial stream that flows through the site. The streamside is dominated by sandbar willow (*Salix exigua*) and tamarisk (*Tamarix ramosissima*). The floodplain is dominated by blue grama (*Bouteloua gracilis*), three-awn (*Aristida purpurea*), yucca (*Yucca glauca*), and snakeweed (*Gutierrezia sarothrae*). Timpas Site is located in Pasture 13 which utilizes a continuous grazing rotation.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Timpas site supports one element occurrence of the ringtail (*Bassariscus astutus*) a G5S5, USFS sensitive status, one element occurrence for the tiger salamander (*Ambystoma tigrinum*) G5S5, USFS sensitive status, two element occurrences for the swift fox (*Vulpes velox*) G5S3/C2, and one element occurrence for Kansas glossy snake (*Arizona elegans*) a G5S3S4, USFS sensitive status/Kansas state threatened species.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

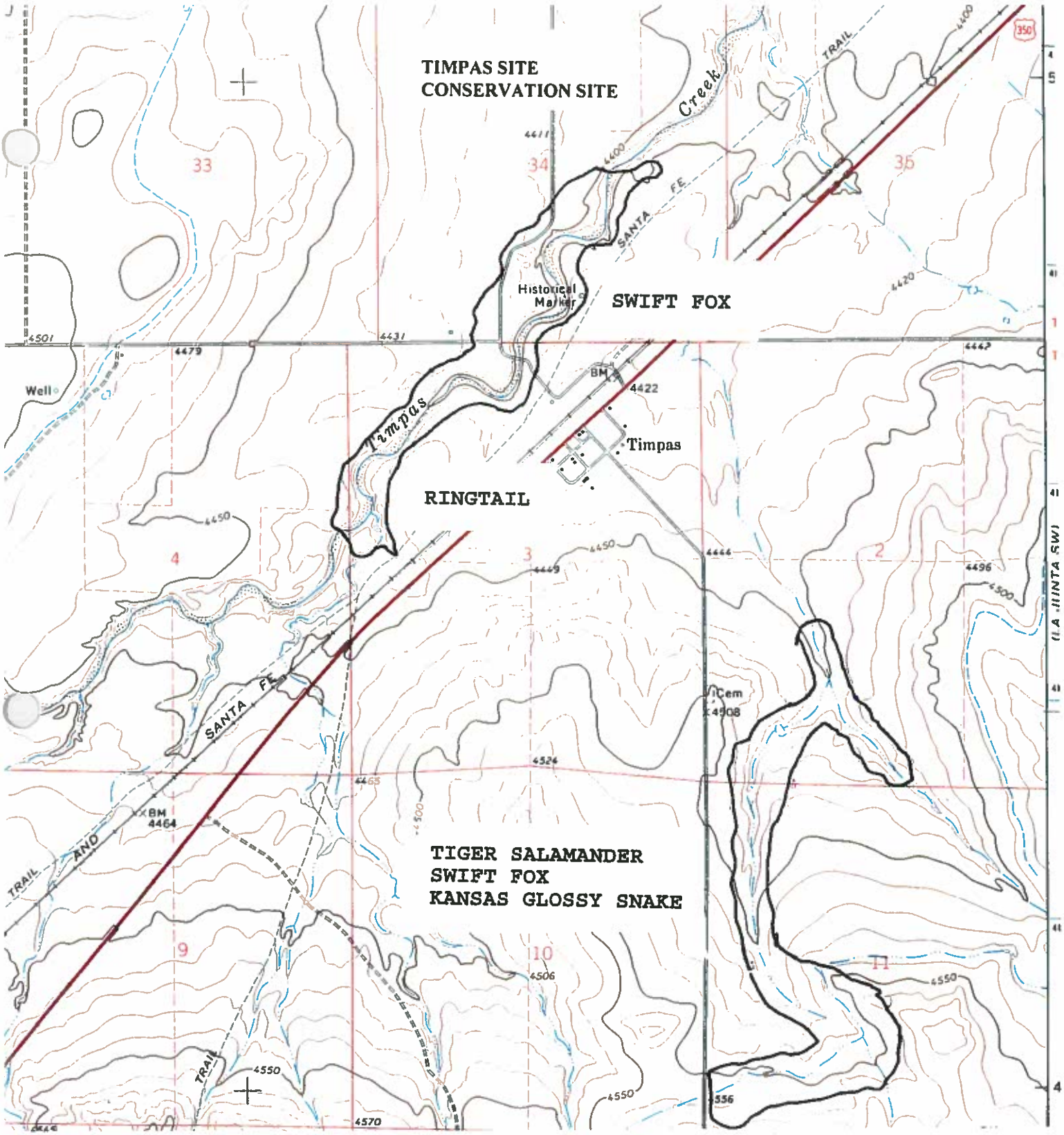
BOUNDARY JUSTIFICATION: The conservation boundaries encompass two areas: Timpas Creek and Timpas cemetery. The boundary for the Timpas Creek site is intended to protect the occurrences of the ringtail and swift fox. The Timpas cemetery boundary is designed to protect the occurrences of the tiger salamander and the glossy snake.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future research needs to determine the impact of grazing on the reproduction success of swift foxes and their long-term survivability. There appears to be little active management for this species in Colorado. It is still a legal game species and although the take is regulated, actual mortality is poorly known. Land managers need to assure the protection of the swift fox and potential den sites.

The Timpas Townsite should address the protection of ringtail habitat by regulating grazing and related impacts.

The tiger salamander population warrants effective protection of breeding populations which include the aquatic breeding site and a terrestrial buffer of at least two hundred meters.

Invasion of tamarisk (*Tamarix ramosissima*) and cheatgrass (*Bromus tectorum*) along the stream should also be addressed within the site management plan.



USGS Quadrangle: Timpas, Otero County. **Legal Description:** T26 R57 W sec 3:nw4; sec 11:w2; sec 2:sw4; T25S R57W sec 34:se4. **Elevation:** 4500 feet.

VOGEL CANYON

SIZE: ca. 320 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: Vogel Canyon is located 13 miles south of La Junta. **USGS Quadrangle:** La Junta SE, Otero County. **Legal Description:** T26S R55W sec24:s2; sec 30:nw4; sec 23:sw4; sec 19:se4. **Elevation:** 4,300-4,400 feet.

GENERAL DESCRIPTION: Vogel Canyon is a moderately wide canyon with an ephemeral stream that has two permanent springs in the lower reaches of the canyon. The standing water is dominated by cattail (*Typha domingensis*) and bulrush (*Schoenoplectus pungens*) with infrequent stands of cottonwoods (*Populus deltoides*), and tamarisk (*Tamarix ramosissima*). The mesic meadow is dominated by western wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*) and sideoats grama (*Bouteloua curtipendula*). The ridgetop is dominated by one-seeded juniper (*Juniperus monosperma*) and skunkbush (*Rhus trilobata*). Vogel Canyon is located in Pasture 5 which is grazed seasonally on a rotation basis.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: Vogel Canyon possesses a seasonal riparian area that supports a population of willow and cottonwood and is one of the most diverse riparian ecosystems observed on Forest Service lands on the Comanche National Grassland. The Vogel Canyon site supports one B-ranked stand represented by transect 35, a creeping spikerush/bulrush (*Eleocharis palustris*/*Scirpus pungens*) G2G4SU plant association. This plant association is a localized community that repeats in the riparian areas near standing water.

The western green toad (*Bufo debilis insidor*), a G5S1 (USFS status unknown) species was recorded in Vogel Canyon.

CURRENT STATUS: The area is within the National Grassland boundary and is a designated picnic and camping area.

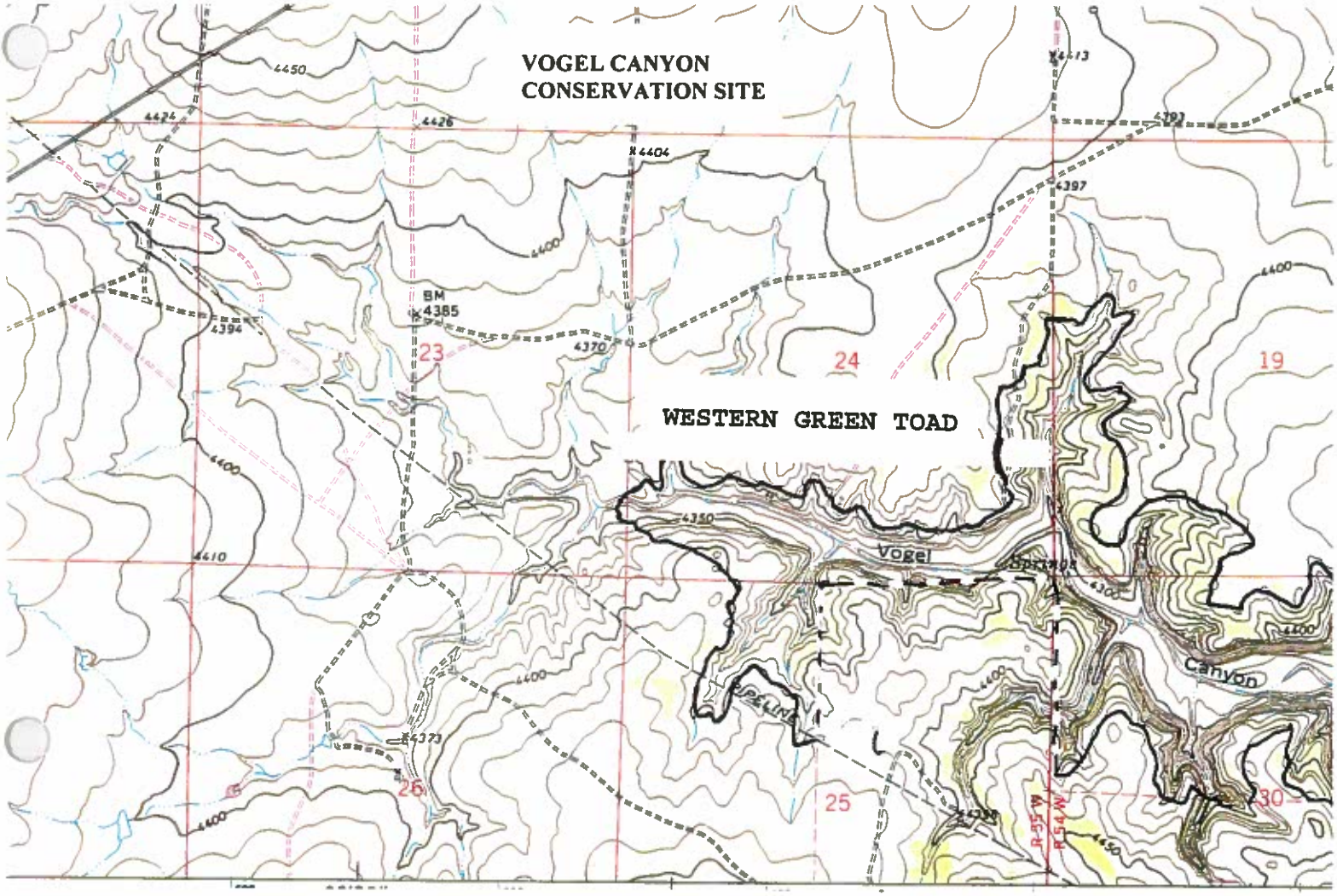
BOUNDARY JUSTIFICATION: The conservation boundary follows the natural features, encompassing the canyon ridgetop, the shrub-dominated slopes, and Vogel Canyon. The boundary is intended to protect the occurrences of the elements of concern, habitat for potential element occurrences, communities of concern and the ecological processes that supports them. The site is contained entirely within the USFS lands.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the Vogel Canyon site needs to maintain the current hydrology to ensure the long-term viability of the elements. Also, management needs to consider the expansion of weedy species especially, cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola australis*)and tamarisk (*Tamarix ramosissima*) which dominates the canyon bottom and stream banks. Short, intensive grazing in the canyon bottom may be used as a management tool for control of cheatgrass and other weedy species (Johnston and Reed 1991).

The existence of tamarisk in the riparian area may be of concern. Tamarisk is difficult to manage and will present long-term challenges to land managers (Johnston and Reed 1991).

Cattle activities have been concentrated in the riparian area around the springs and standing water. Management plans need to address this impact to assure the long-term viability of this water source. Research needs to assure the viability of the site including the impacts of weedy species and the role of grazing in the maintenance of the natural communities of Vogel Canyon.

There are only 7 previously known occurrences for the western green toad in Colorado. Future management plans for the western green toad should address the impact of grazing, use of pesticides, and fluctuations to water sources on its reproduction success.



USGS Quadrangle: La Junta SE, Otero County. **Legal Description:** T26S R55W sec24:s2; sec 30:nw4; sec 23:sw4; sec 19:se4.
Elevation: 4300-4400 feet.

WEST DRY CREEK

SIZE: ca. 120 acres **BIODIVERSITY RANK:** B4

LOCATION: Directions: West Dry Creek is located 23 air miles southwest of La Junta. **USGS Quadrangle:** Bloom, Otero County. **Legal Description:** T26S R59W sec 34:ne4w2; sec 27:se4w2. **Elevation:** 4,800 feet.

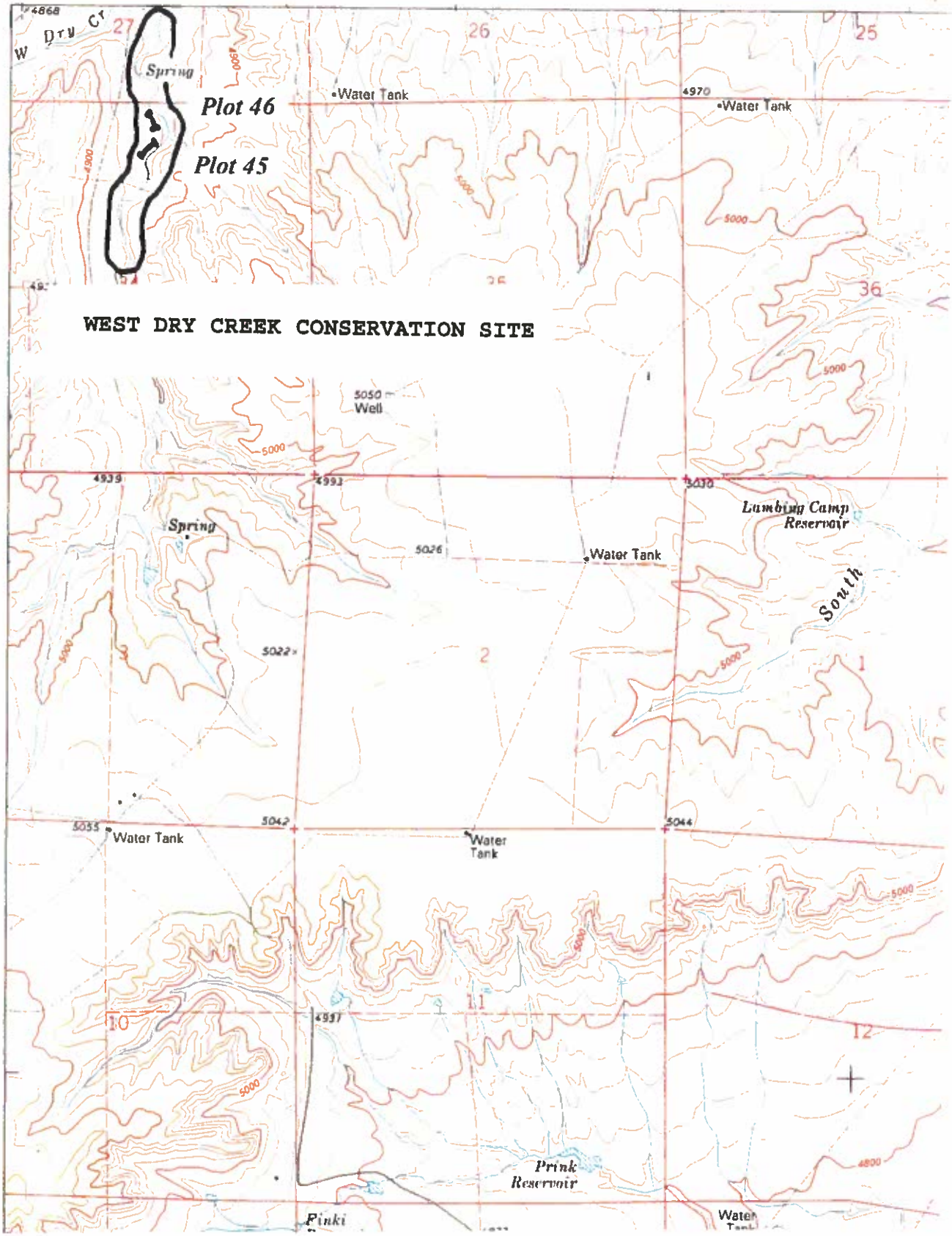
GENERAL DESCRIPTION: West Dry Creek is an ephemeral stream meandering through level to gently rolling hills. A two track road bisects the site, near a natural spring. The swale is slight to moderate, dominated by scattered tamarisk (*Tamarix ramosissima*) and annual sunflower (*Helianthus annuus*) with cattail (*Typha domingensis*) and spikerush (*Eleocharis* sp.) communities. Blue grama (*Bouteloua gracilis*) and side oats grama (*Bouteloua curtipendula*) approach the riparian area from the adjacent upland. This site is within Timpas pasture 18 which is grazed during the off season.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The West Dry Creek site supports one B-ranked stand represented by transect 45, a creeping spikerush (*Eleocharis palustris*) G5S3S4 plant association. Transect 46 is also located within the site. The site contains a natural spring that drains into the nearby draw and one of the few mesic areas observed on Forest Service lands on the Comanche National Grassland. Additionally, there were few exotics and weedy species documented.

CURRENT STATUS: The area is within the National Grassland boundary and is given no special designation.

BOUNDARY JUSTIFICATION: The boundary encompasses the creeping spikerush plant association and the standing water resulting from the natural occurring spring. A buffer of 500 feet which would encompass the mesic area is added to protect the riparian area from intensive grazing and subsequent trampling.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the West Dry Creek site would need to maintain the current hydrology for the spring and riparian communities to ensure long-term viability. It is observed that creeping spikerush (*Eleocharis palustris*) is tolerant of moderate disturbance, however intensive grazing pressure would be detrimental to the long-term viability of the riparian area. There is only one established tamarisk (*Tamarix ramosissima*) within the riparian area. The removal of this single tree would maintain the current hydrology of the site.



LOCATION: **Directions:** West Dry Creek is located 23 air miles southwest of La Junta. **USGS Quadrangle:** Bloom, Otero County. **Legal Description:** T26S R59W sec 34:ne4w2; sec 27:se4w2. **Elevation:** 4,800 feet.

WILLOW NO. 2

SIZE: ca. 80 acres **BIODIVERSITY RANK:** B4

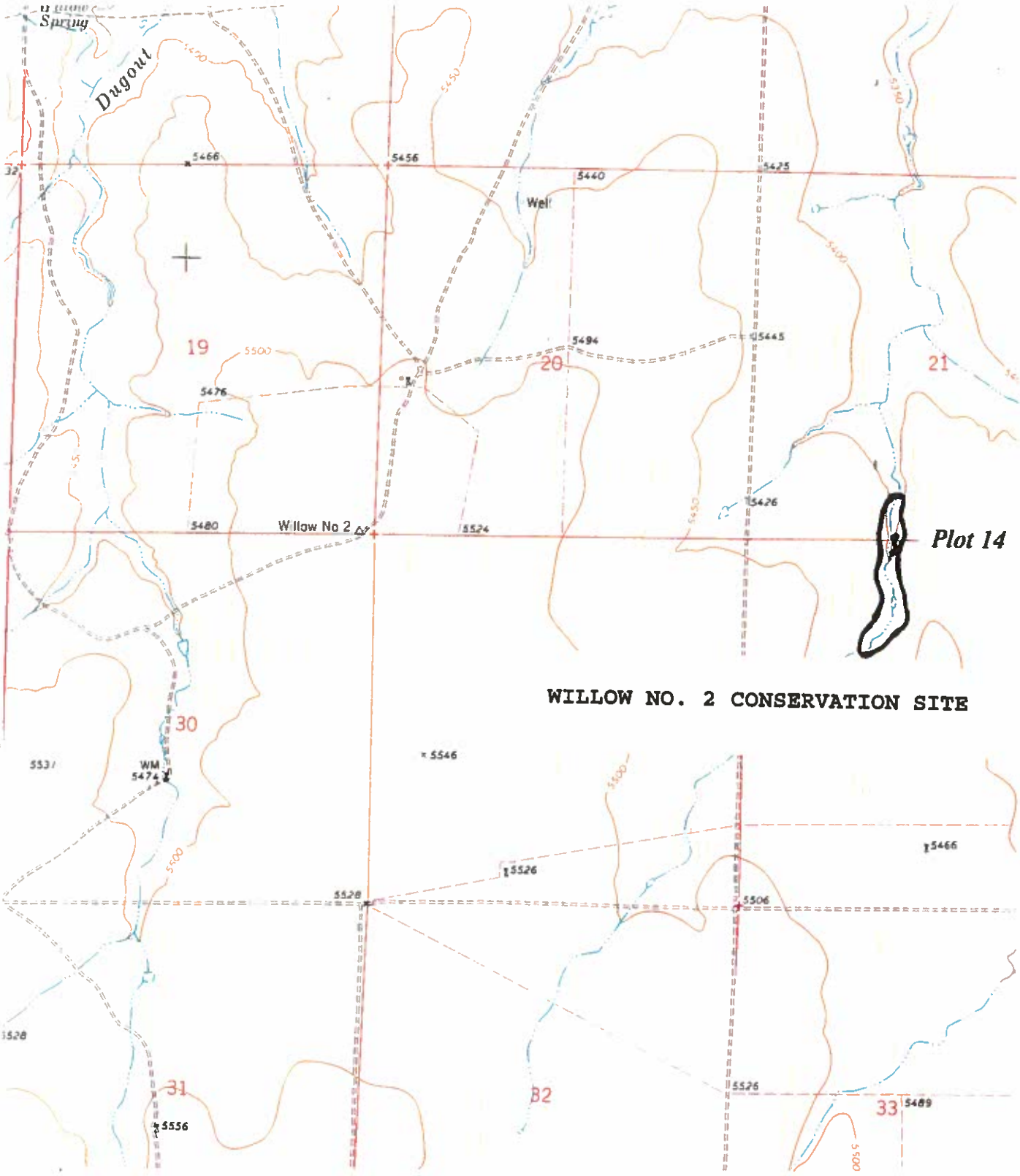
LOCATION: Directions: The Willow No. 2 site is located 6 miles northeast of Kim. **USGS Quadrangle:** Kim North, Las Animas County. **Legal Description:** T31S R52W sec 28:nw4ne2; sec 21:sw4se4. **Elevation:** 5,400 feet.

GENERAL DESCRIPTION: Willow No. 2 site contains a channel with rocky outcrops with level to rolling hills occurring upslope. The channel is moderately entrenched with some exposed bedrock and standing water. The rocky outcroppings support skunkbush (*Rhus trilobata*) and the channel vegetation is dominated by coyote willow (*Salix exigua*), yellow sweet clover (*Melilotus officinalis*), and creeping spikerush (*Eleocharis palustris*). The site is located in Kim pasture 11 Ane which is grazed lightly on a deferred rotation system in the fall.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: Willow No. 2 site supports a B-ranked stand represented by transect 14, a coyote willow/creeping spikerush (*Salix exigua/Eleocharis palustris*) GUSU plant association. The site had few weedy species, with only small patches of cheat grass (*Bromus tectorum*) documented and no tamarisk (*Tamarix ramosissima*). In general, riparian communities are uncommon in the Kim District, therefore this site is unique for this district of the Comanche National Grassland.

BOUNDARY JUSTIFICATION: The boundary encompasses the identified riparian community; coyote willow/creeping spikerush (*Salix exigua/Eleocharis palustris*). A buffer has been added that includes the adjacent uplands. This buffer is meant to protect the channel from weedy invasion and to ensure the integrity of the water source.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the Willow No. 2 site would need to maintain the current hydrology of the pool and surrounding riparian area. Management also needs to consider the invasion of yellow sweet clover (*Melilotus officinalis*). The rocky outcroppings and the pools that are created are uncommon for the Kim District, therefore its long-term viability should be a consideration by management.



WILLOW NO. 2 CONSERVATION SITE

LOCATION: Directions: The Willow No. 2 site is located 6 miles northeast of Kim. **USGS Quadrangle:** Kim North, Las Animas County. **Legal Description:** T31S R52W sec 28:nw4ne2; sec 21:sw4se4. **Elevation:** 5,400 feet.

APPENDIX C

COLORADO NATURAL HERITAGE ELEMENT OCCURRENCE PRINTOUTS

APPENDIX D

RIPARIAN INVENTORY AND CLASSIFICATION SITE AND TRANSECT LOCATIONS

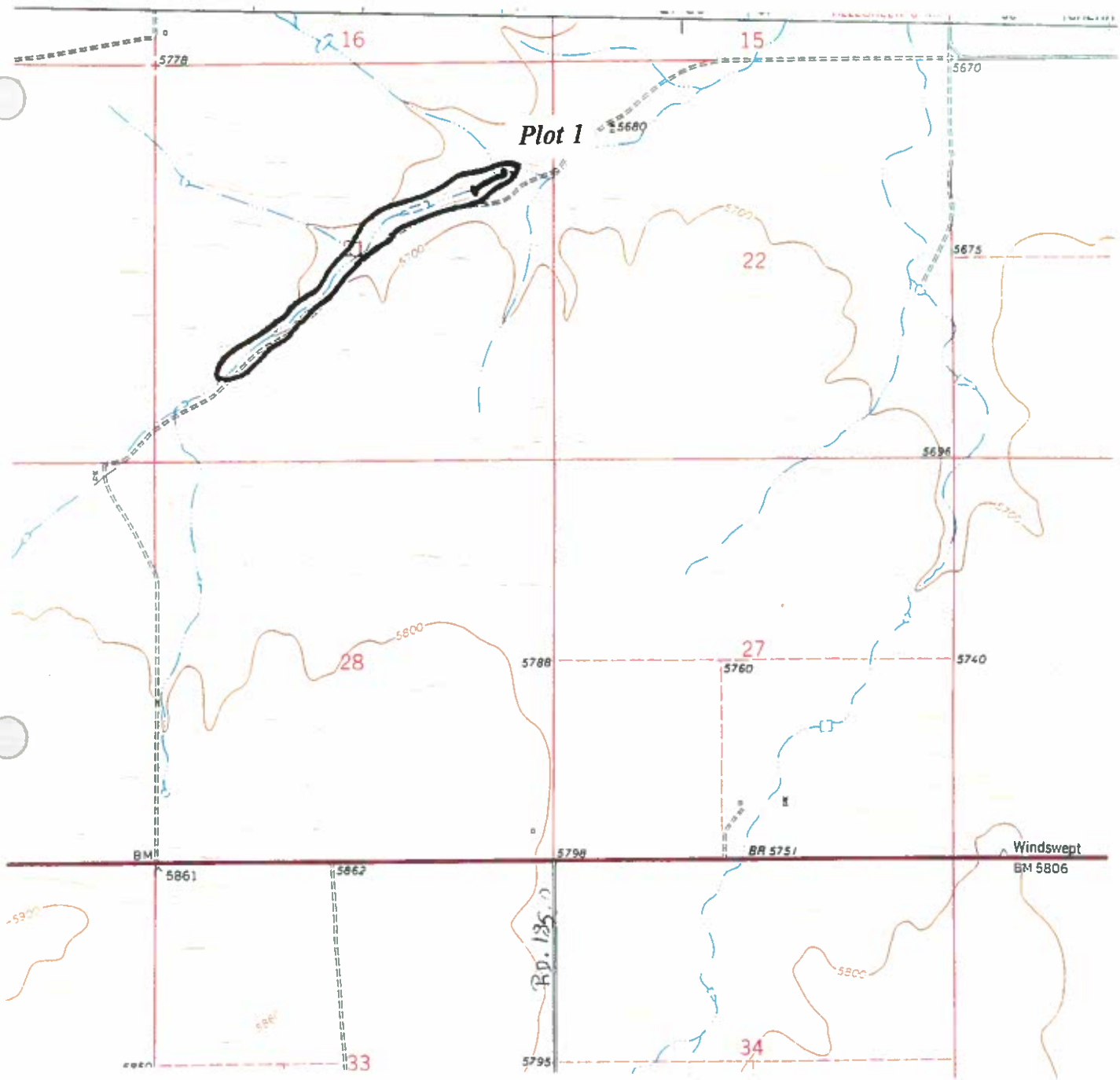
Table 27. Locations of Riparian Sites and Transects.

Transect #	Site Name	County	Quad Name	Township Range Section	CNHP Rank
1	Kim Pasture10A	Las Animas	DaleRoseMesa	T32SR54WS21NE1/4SE4/4	D
2	Christian Canyon	Otero	Delhi	T27SR59WS20SE1/4SW4/4	D
3	Timpas Pasture exclosure	Otero	ThompsonArroyo	T25SR54WS10SE1/4SW4/4	C
4	Timpas1 radio tower	Otero	ThompsonArroyo	T25SR54WS11NE1/4SE1/4	D
5	Storm Mountain	Otero	Timpas	T26SR57WS33SW1/2	C
6	Bloom Ponds	Otero	Delhi	T27SR59WS18NW1/4NE4/4	D
7	Gravel Pit	Otero	LaJunta SW	T26SR57WS24NW1/4NE4/4	C
8	Gravel Pit	Otero	LaJunta SW	T26SR57WS24NW1/4NE4/4	D
9	Stormy Point	Otero	Timpas	T26SR57WS26NE1/4SW4/4	B
10	Timpas Creek	Otero	Timpas	T25SR57WS34SE1/4SW4/4	C
11	Timpas Creek	Otero	Timpas	TT25SR57WS34SE1/4SW4/4	D
12	Middle Fork	Baca	Utleyville	T32SR50WS5NW1/4NE4/4	C
13	W Fork of OU Creek	LasAnimas	Andrix	T31SR52WS34SE1/4SW4/4	C
14	Willow No.2	LasAnimas	Kim North	T31SR52WS28NW1/4NE4/4	B
15	Pintada Creek	LasAnimas	Pintada Creek	T32SR52WS22SE1/4NE4/4	D
16	Pintada Creek	LasAnimas	Pintada Creek	T32SR52WS22SE1/4NE4/4	D
17	Pintada Creek South	LasAnimas	Pintada Creek	T32SR51WS32SW1/4SE1/4	C
18	Packers Gap exclosure	Otero	LaJunta SW	T26SR56WS26NE1/4SE4/4	C
19	Packers Gap exclosure	Otero	LaJunta SW	T26SR56WS26NE1/4SE4/4	C
20	Packers Gap exclosure	Otero	LaJunta SW	T26SR56WS26NE1/4SE4/4	C
21	Packers Gap exclosure	Otero	LaJunta SW	T26SR56WS26NE1/4SE4/4	C
22	McMahon Arroyo	Otero	Higbee	T26SR54WS17NE1/4SW4/4	B
23	N Fork Jack Canyon	Otero	Riley Canyon	T27SR55WS7NW1/4SE4/4	B
24	N Fork Jack Canyon	Otero	Riley Canyon	T27SR55WS7NW1/4SE4/4	B
25	Tobe Creek	LasAnimas	Tobe	T33SR55WS6NE1/4NE4/4	C
26	Tobe Creek	LasAnimas	Tobe	T22SR55WS6NE1/4NE4/4	D
27	Tobe Canyon	LasAnimas	Miners Peak	T32SR56WS31SW1/4NW4/4	C
28	Tobe Canyon	LasAnimas	Miners Peak	T32SR56WS31SW1/4NW4/4	C
29	Valley View	Otero	LaJunta SE	T25SR55WS24NW1/4NE4/4	C
30	Valley View	Otero	LaJunta SE	T25SR55WS24NW1/4NE4/4	D
31	Sheep Canyon Arroyo	Otero	Sheep Canyon	T27SR58WS11SE1/4NW4/4	D
32	Sheep Canyon Arroyo	Otero	Sheep Canyon	T27SR58WS11SE1/4NW4/4	D
33	Vogel Canyon	Otero	LaJunta SE	T26SR54WS30NW1/4NW4/4	C
34	Vogel Canyon	Otero	LaJunta SE	T26SR54WS19SW1/4SW4/4	C
35	Vogel Canyon	Otero	LaJunta SE	T26SR54WS24SW1/4SE4/4	B
36	Timpas Exclosure	Otero	Timpas	T26SR58WS24SE1/4SE4/4	C
37	Timpas Exclosure	Otero	Timpas	T26SR57WS19SW1/4NW4/4	B
38	Timpas Exclosure	Otero	Timpas	T26SR57WS18SE1/4SE4/4	D
39	Timpas Exclosure	Otero	Timpas	T26SR57WS18SE1/4SW4/4	C
40	Timpas Exclosure	Otero	Timpas	T26SR57WS19NE1/4NW4/4	B
41	Timpas Creek Mindeman	Otero	Bloom	T27SR58WS9NW1/4SW4/4	C
42	Timpas Creek Mindeman	Otero	Bloom	T27SR58WS8NE1/4SW4/4	B
43	Devils Canyon	Otero	Delhi	T27SR59WS32NE1/4SW4/4	C
44	Devils Canyon	Otero	Delhi	T27SR59WS33NW1/4NW4/4	C

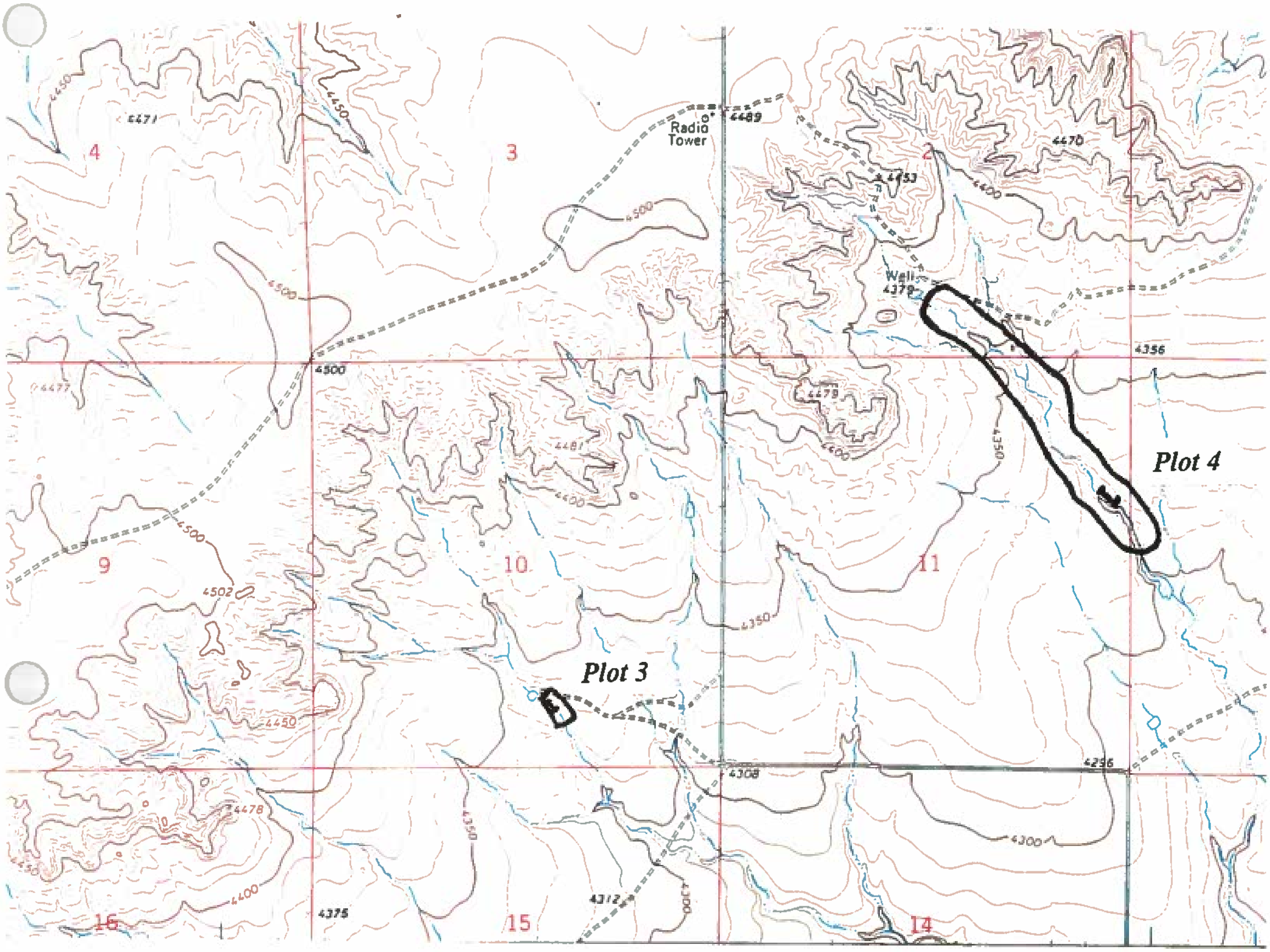
Transect #	Site Name	County	Quad Name	Township Range Section	CNHP Rank
45	West Dry Creek	Otero	Bloom	T26SR59WS34NE1/4NW4/4	B
46	West Dry Creek	Otero	Bloom	T26SR59WS34NW1/4SE4/4	D
47	West Dry Creek north	Otero	Timpas SW	T26SR59WS27SE1/4NE4/4	C
48	West Dry Creek north	Otero	Timpas SW	T26SR59WS27NE1/4NW4/4	C
49	Smith Reservoire	Otero	Timpas SW	T26SR59WS24NE1/4NW4/4	D
50	Poitrey Creek	Otero	Tobe	T32SR55WS1NW1/4SE4/4	D
51	Plum Creek (Kim)	Las Ani	Tobe	T32SR54WS31NE1/4SW4/4	C
52	Bloom Ponds	Otero	Delhi	T27SR59WS18NE1/4SW4/4	C
53	Bloom Ponds	Otero	Delhi	T27SR59WS18NE1/4SW4/4	C
54	Plum Canyon	Otero	Delhi	T27SR59WS18SE1/4SW4/4	B
55	Pasture 9 burm pond	Otero	Packers Gap	T27SR56WS20NW1/4NW4/4	C
56	Anderson Arroyo	Otero	La Junta SE	T25SR55WS28SE1/4NW4/4	D
57	Anderson Arroyo	Otero	La Junta SE	T25SR55WS27SE1/4NW4/4	D
58	Tecalote Creek	LasAnimas	Kim South	T32SR52WS31SE1/4NE4/4	D
59	Tecalote Creek	LasAnimas	Kim South	T32SR52WS31NE1/4SW4/4	D
60	Tecalote Creek	LasAnimas	Kim South	T32SR52WS31NW1/4SW4/4	C
61	Devils Canyon	Otero	Delhi	T27SR59WS29SE1/4NE4/4	C
62	Devils Canyon	Otero	Delhi	T27SR59WS29NE1/4SE4/4	B
63	Devils Canyon	Otero	Delhi	T27SR59WS28NW1/4SW4/4	C
64	Devils Canyon	Otero	Delhi	T27SR59WS32NE1/4NE4/4	C
78	Bear Springs Arroyo	Otero	Bloom	T27SR58WS30NW1/4SE4/4	D
79	Bear Springs Arroyo	Otero	Bloom	T27SR58WS30NW1/4NE4/4	D
80	West Branch Crooked	Otero	Packers Gap	T27SR56WS7NE1/4SW4/4	B
81	West Branch Crooked	Otero	Packers Gap	T27SR56WS7NE1/4SW4/4	C
82	Haight Wells	Otero	Timpas SW	T26SR58WS10SW1/4NE4/4	C
83	Haight Wells	Otero	Timpas SW	T26SR58WS10SW1/4NW4/4	C
84	Haight Wells	Otero	Timpas SW	T26SR58WS10SW1/4NE4/4	D
85	Seventh Meridian	Otero	Packers Gap	T26SR56WS31SW1/4SW4/4	C
86	Seventh Meridian	Otero	Packers Gap	T26SR56WS31SW1/4SW4/4	C
87	Seventh Meridian	Otero	Packers Gap	T26SR56WS31SW1/4SW4/4	C
88	West Dry Creek, Nemo	Otero	Timpas SW	T25SR58WS28SE1/4N4/4	C
89	West Dry Creek, Nemo	Otero	Timpas SW	T25SR58WS28SE1/4N4/4	C

Table 28. Locations of Non-riparian Sites and Transects

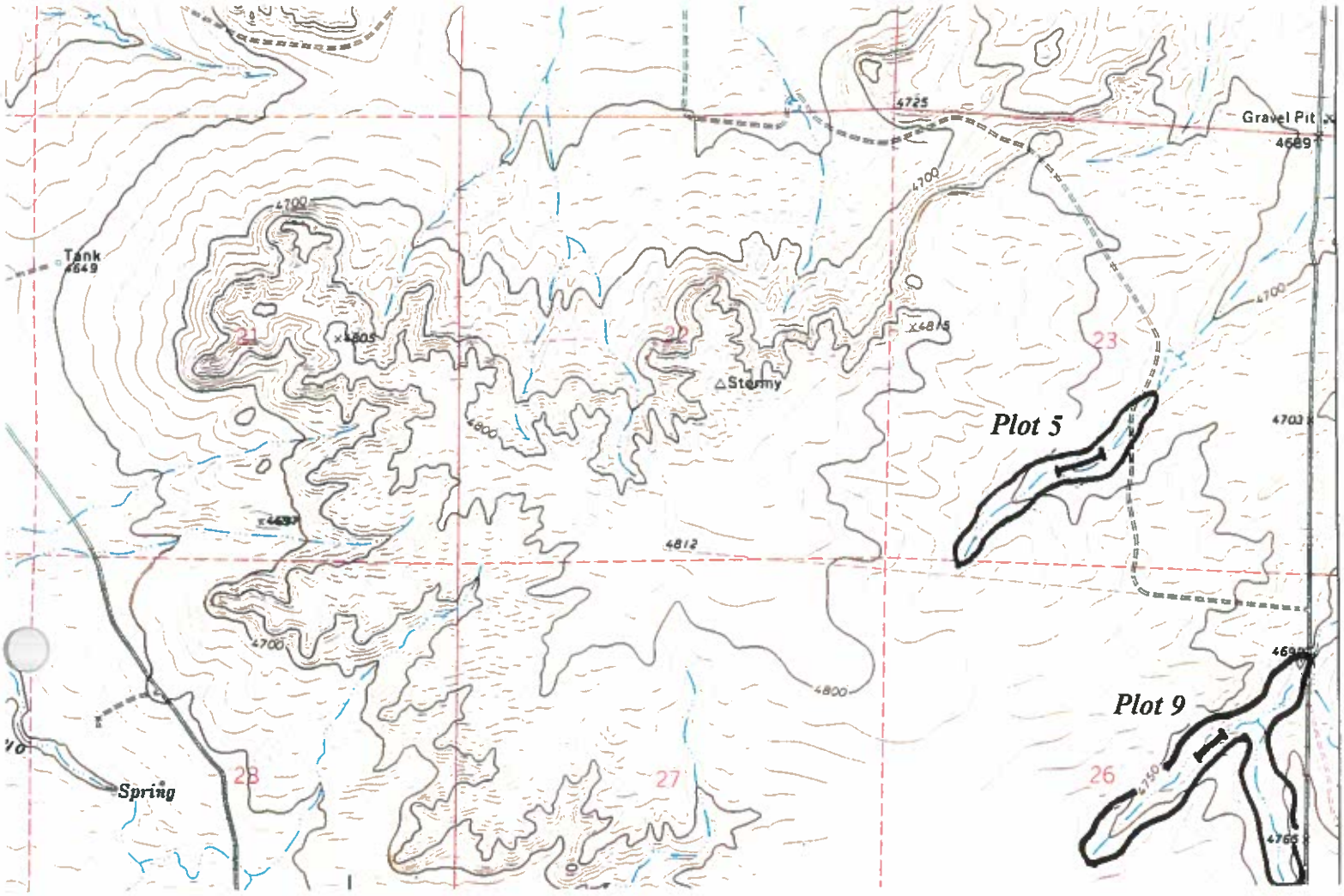
Tran.#	Site Name	County	Quand Name	Township Range Section	CNHP Rank
74	Vogel Canyon C/S	Otero	LaJunta SE	T26SR54WS30NW1/4NW4/4	B
75	Vogel Canyon C/S	Otero	La Junta SE	T26SR54WS19SW1/4BW4/4	B
67	Tecalote Creek C/S	LasAnimas	Kim South	T32SR52WS31NE1/4SW4/4	C
68	Tecalote Creek C/S	LasAnimas	Kim South	T32SR52WS31NW1/4SW4/4	C
69	Tecalote Creek C/S	LasAnimas	Kim South	T32SR52WS31NW1/4SW4/4	C
65	Devils Canyon Too C/S	Otero	Delhi	T27SR59WS28NW1/4SW4/4	B
66	Devils Canyon Too C/S	Otero	Delhi	T27SR59WS28NW1/4SW4/4	C
70	Tobe Canyon C/S	LasAnimas	Miners Peak	T32SR56WS36SE1/4NW4/4	B
71	Tobe Canyon C/S	LasAnimas	Miners Peak	T32SR56WS36SE1/4NW4/4	C
72	Plum Canyon C/S	Otero	Delhi	T27SR59WS18SE1/4SW4/4	B
73	Plum Canyon C/S	Otero	Delhi	T27SR59WS18SE1/4SW4/4	B
76	Christian Canyon C/S	Otero	Delhi	T27SR59WS20SE1/4SE4/4	C
77	Christian Canyon C/S	Otero	Delhi	T27SR59WS20SE1/4SW4/4	C



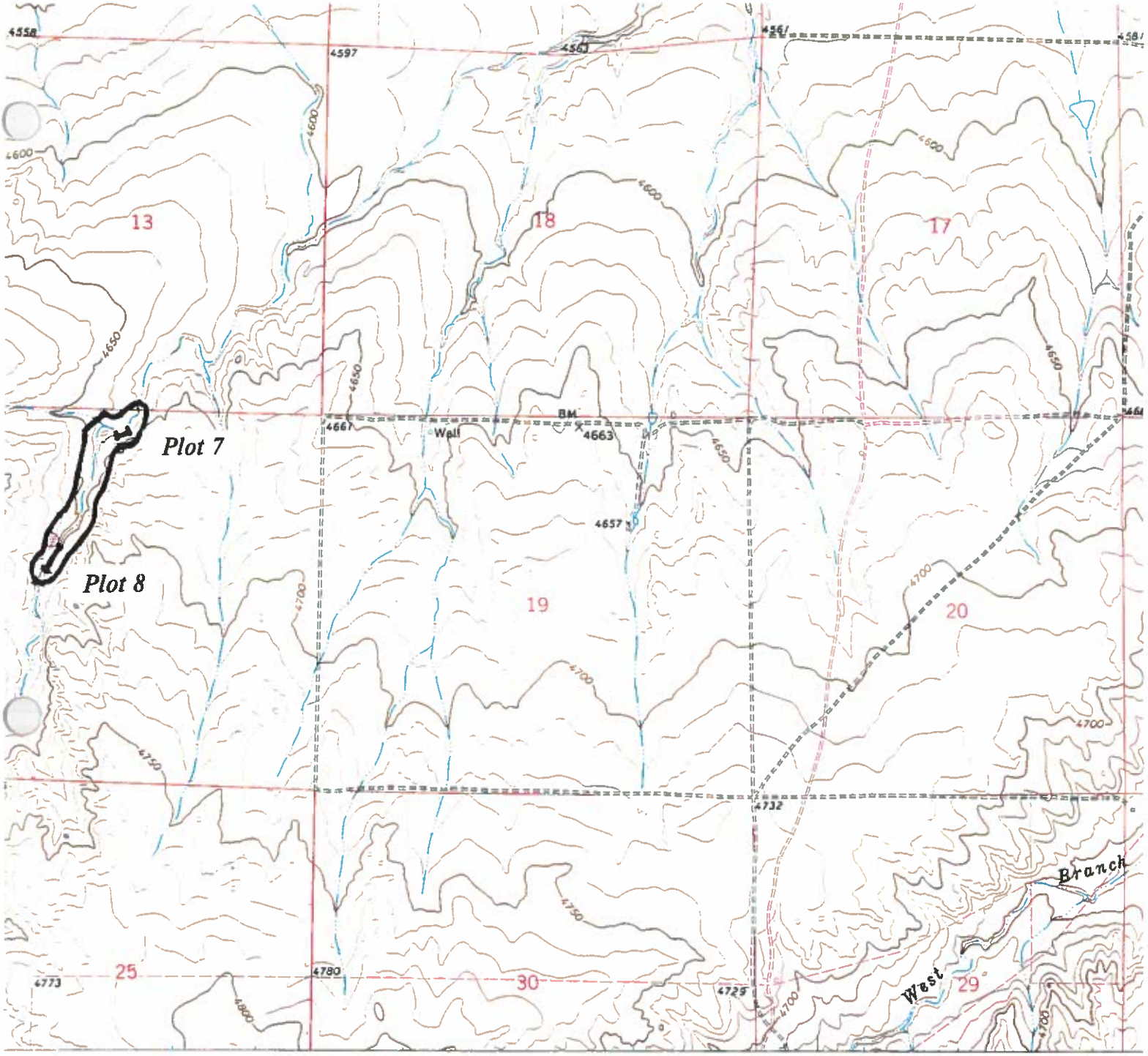
DALEROSE MESA QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



THOMPSON ARROYO QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

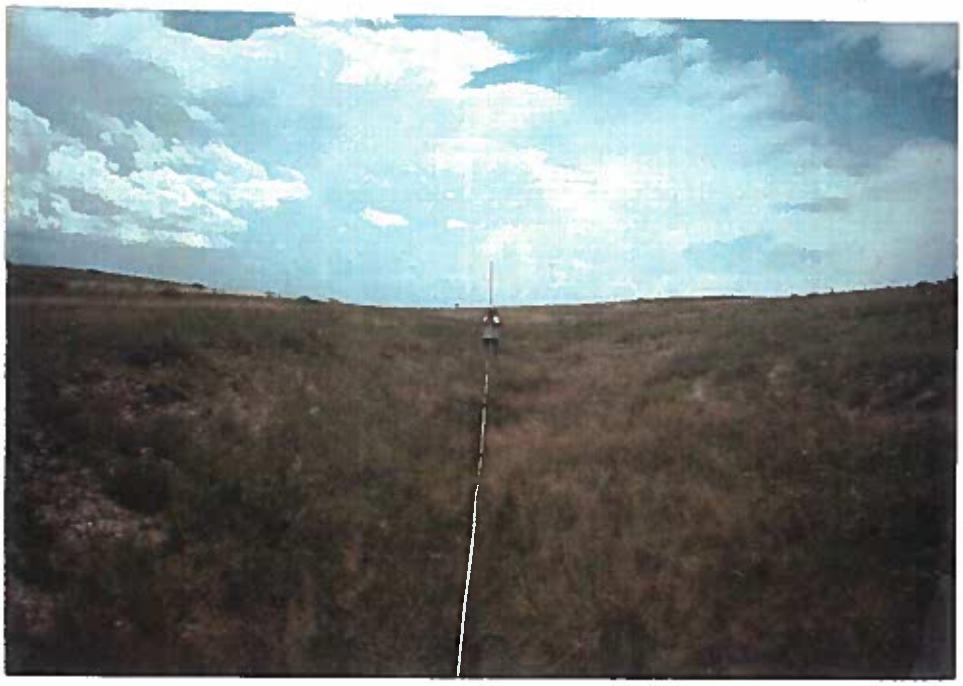


TIMPAS QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

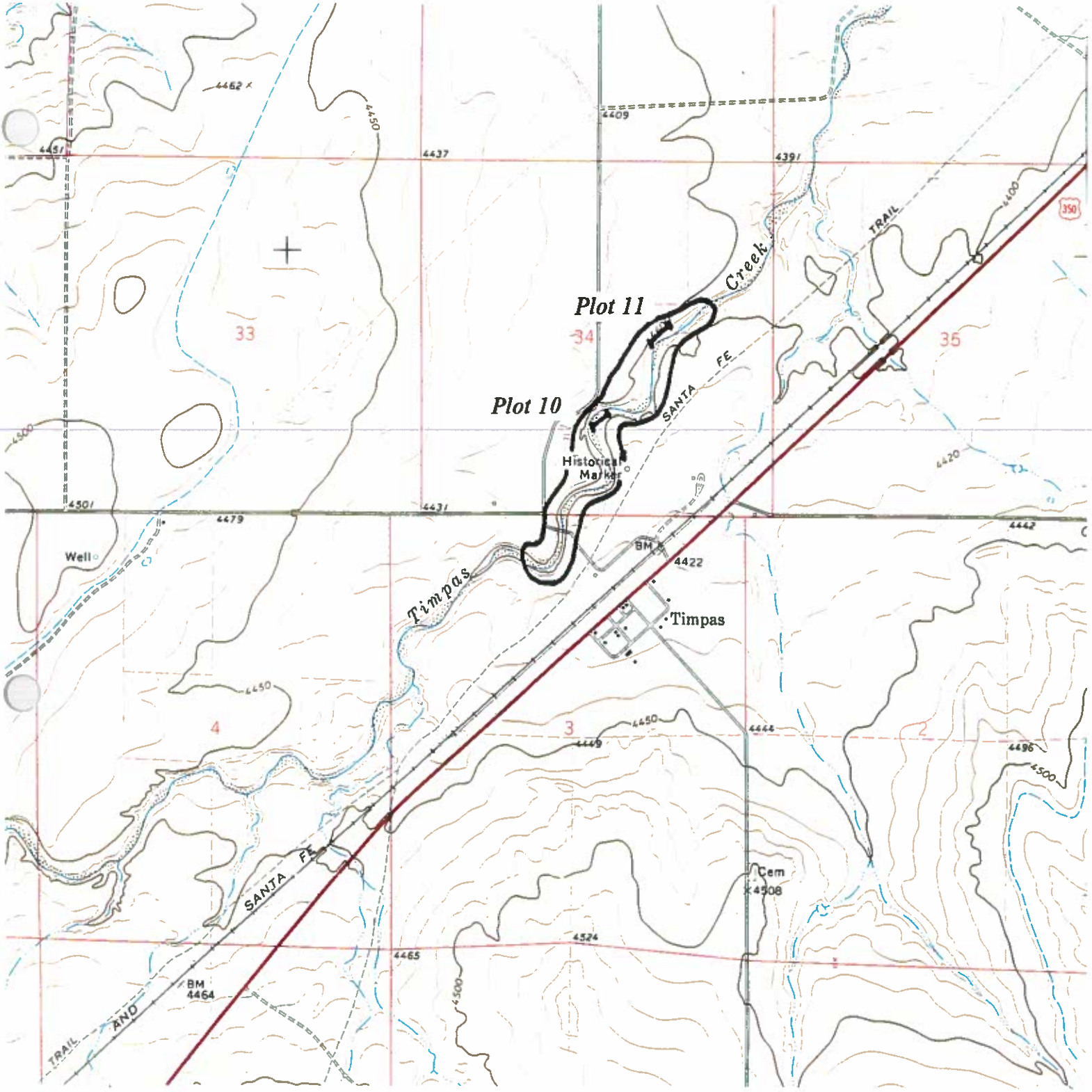


LA JUNTA SW QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

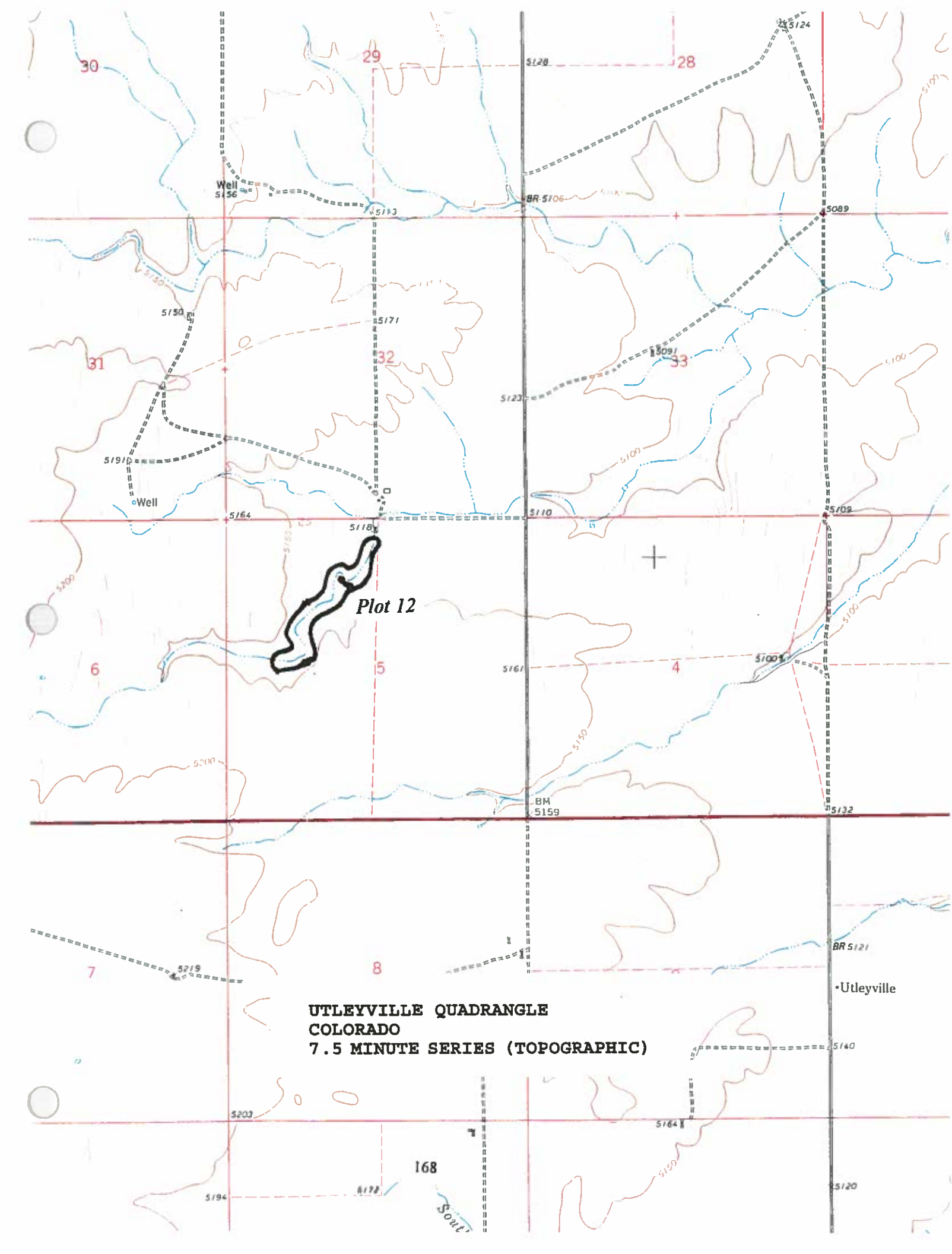
Tamarix ramosissima plant association-unclassified
Transects 7 and 8; Gravel Pit Site with altered hydrology
La Junta SW 7.5 min quad
T26S R57W sec 24 nw4ne4

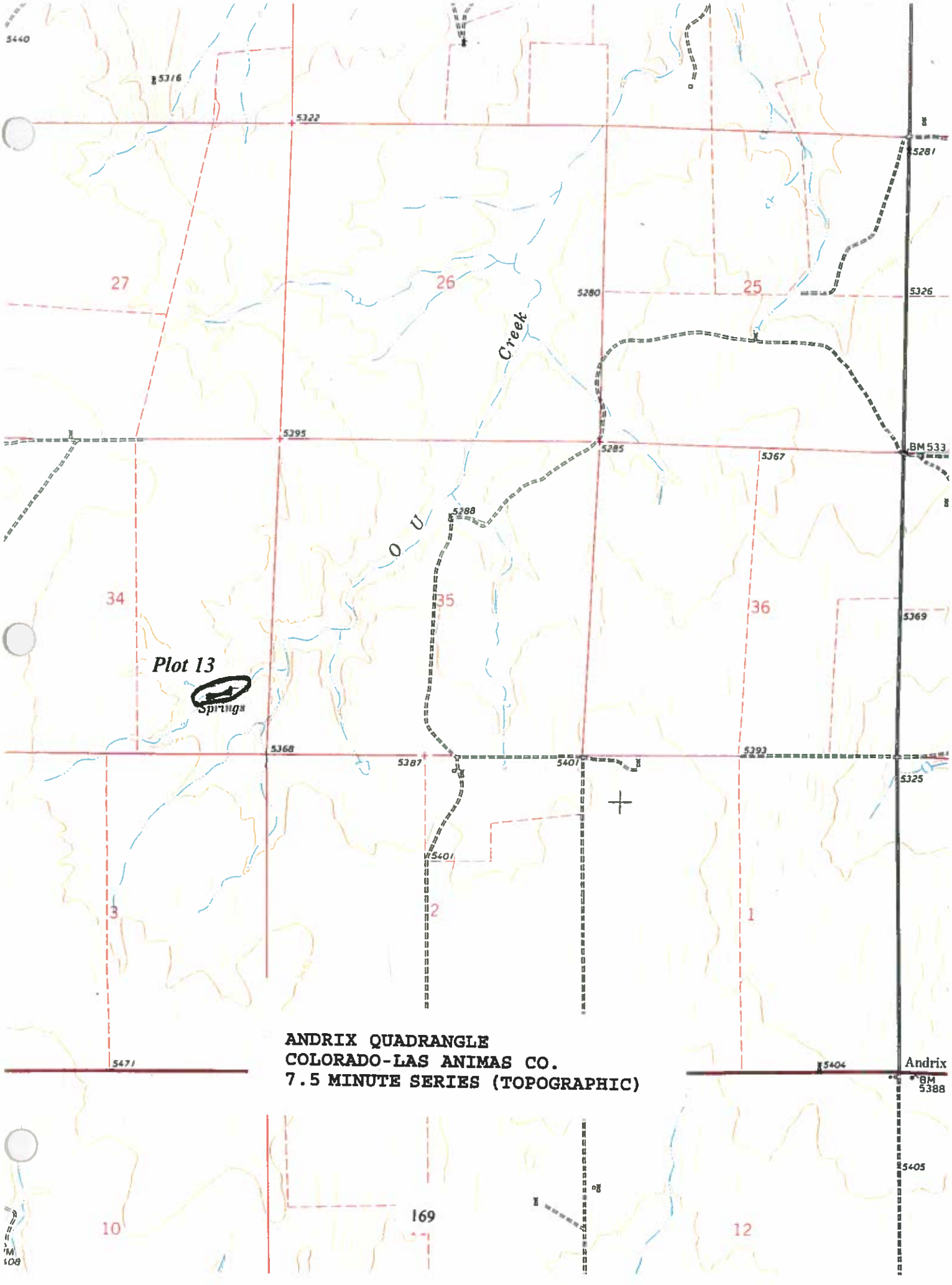


Sporobolus airoides\Distichlis spicatata plant association-G3G5SU
Transect 9; Stormy Point Site
Timpas 7.5 min quad
T26S R57W sec 26 ne4sw4



TIMPAS QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

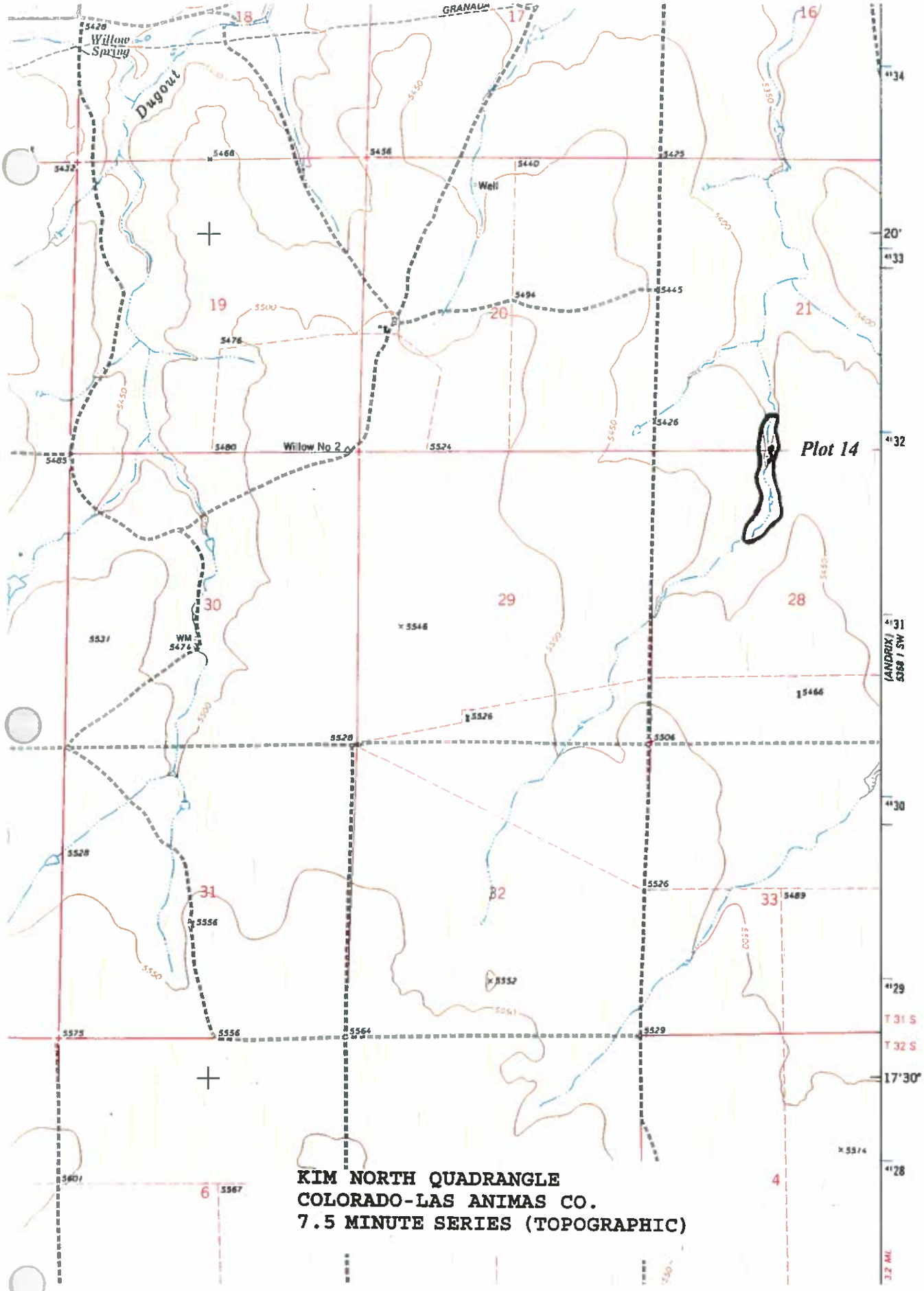

Plot 12
Well
Well
BM 5159
BR 5106
BR 5121
•Utleyville
UTLEYVILLE QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

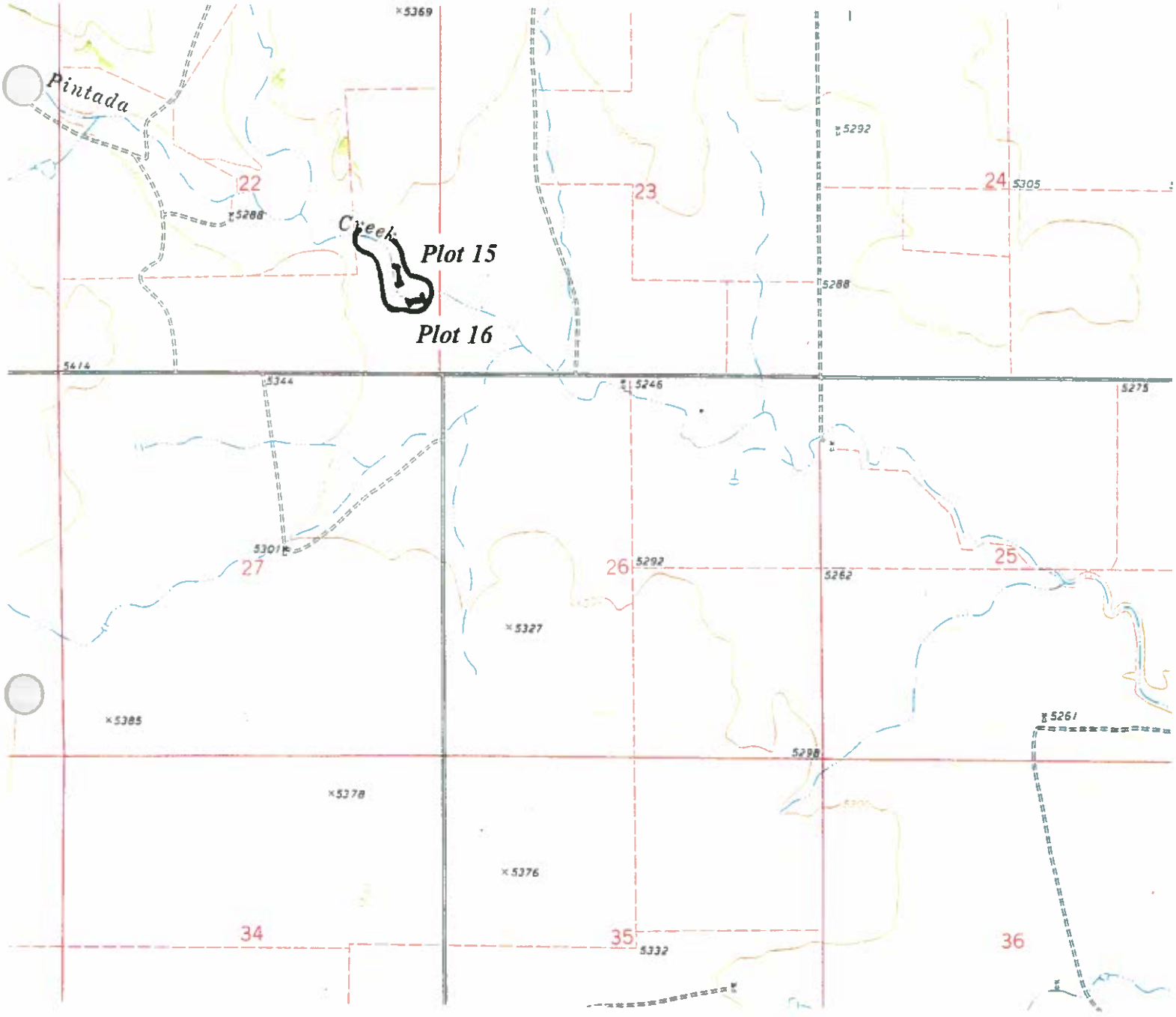


ANDRIX QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Buchloe dactyloides plant association-GUSU
Transect 12; Middle Fork Site
Utleyville 7.5 min quad
T32S R50W sec 5 nw4ne4

Populus deltoides plant association-unclassified
Transect 13; W Fork of Ou Creek Site
Andrix 7.5 min quad
T31SR52W sec 34 se4sw4

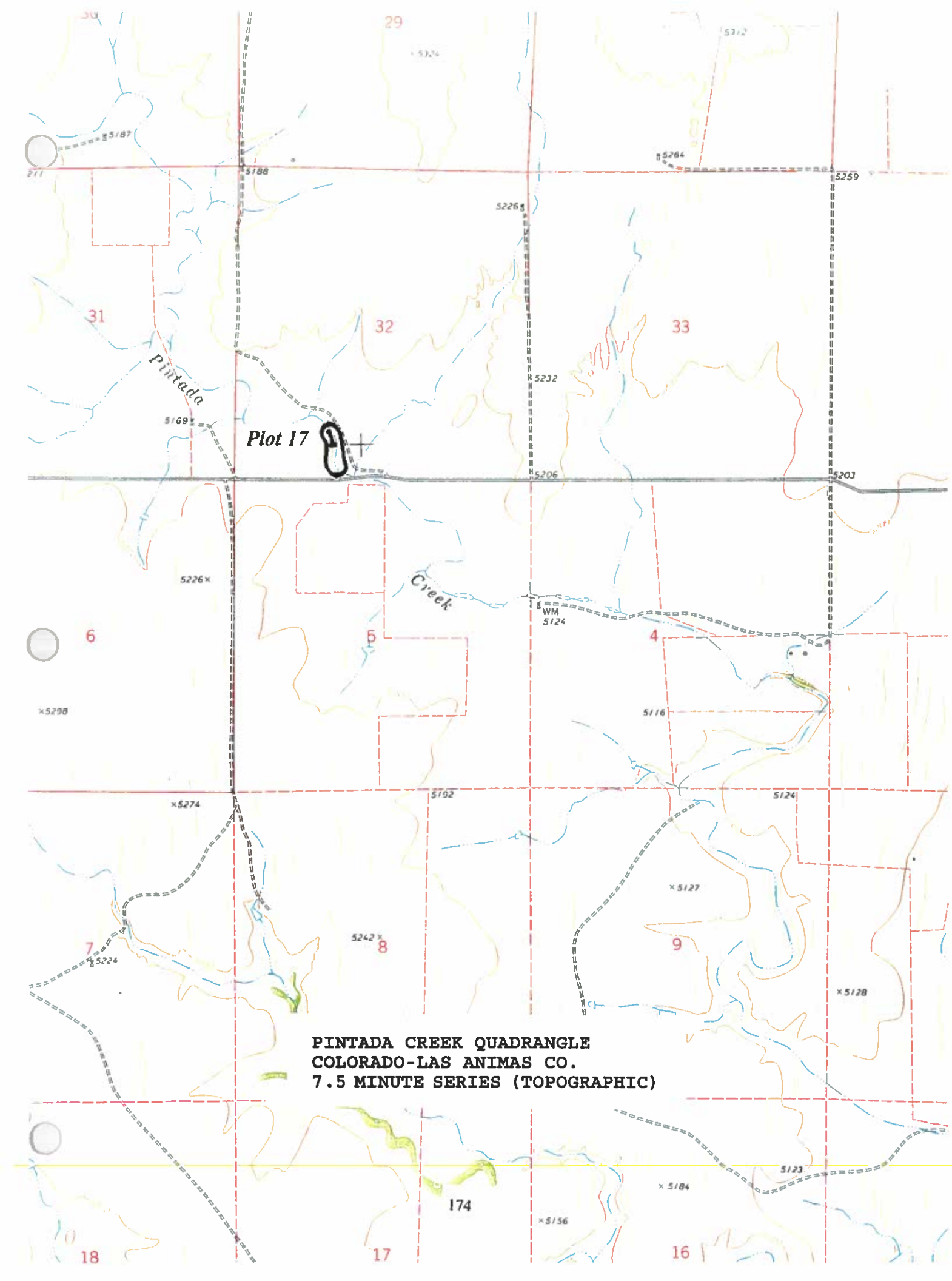

Willow Spring
Dugout
Well
Willow No 2
Plot 14
KIM NORTH QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

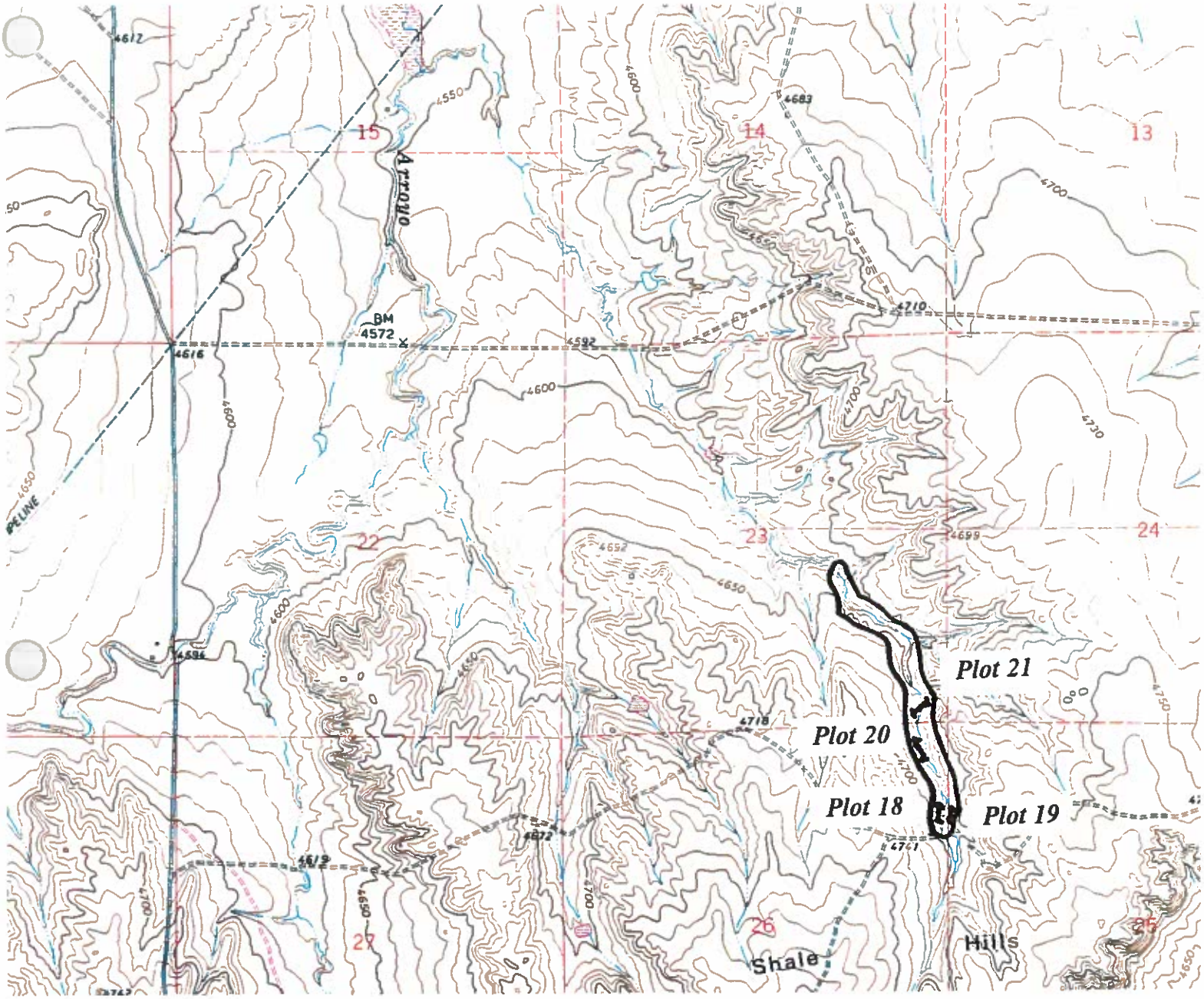


PINTADA CREEK QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

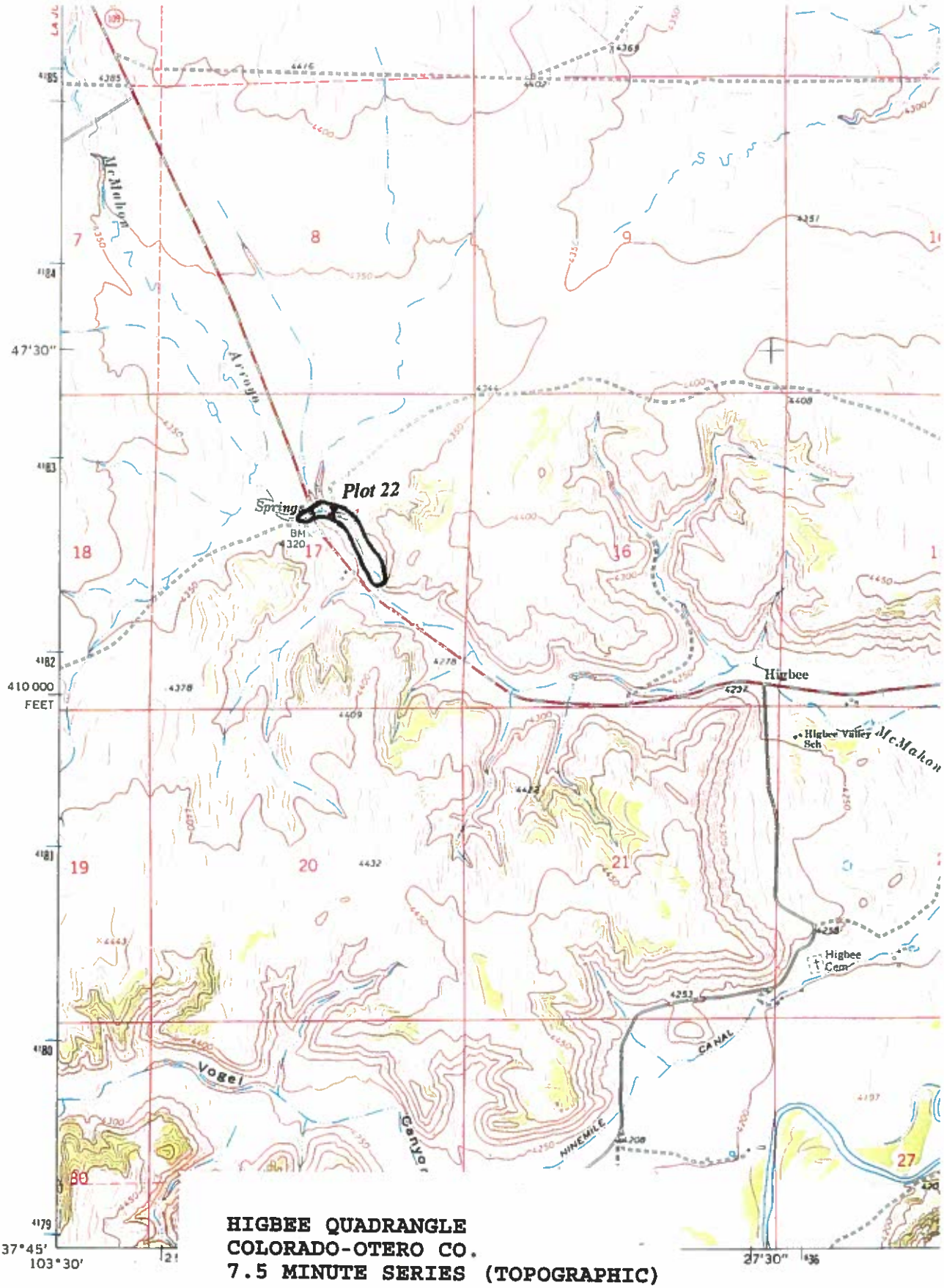
*Salix exigua**Eleocharis palustris* plant association-GUSU
Transect 14; Willow No. 2 Site
Kim North 7.5 min quad
T31S R52W sec 28 nw4ne4

Pascopyrum smithii plant association-G3G5S1?
Transect 16; Pintada Creek Site
Pintada Creek 7.5 min quad
T32S R52W sec 22 se4ne4


Plot 17
Pintada
Creek
PINTADA CREEK QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



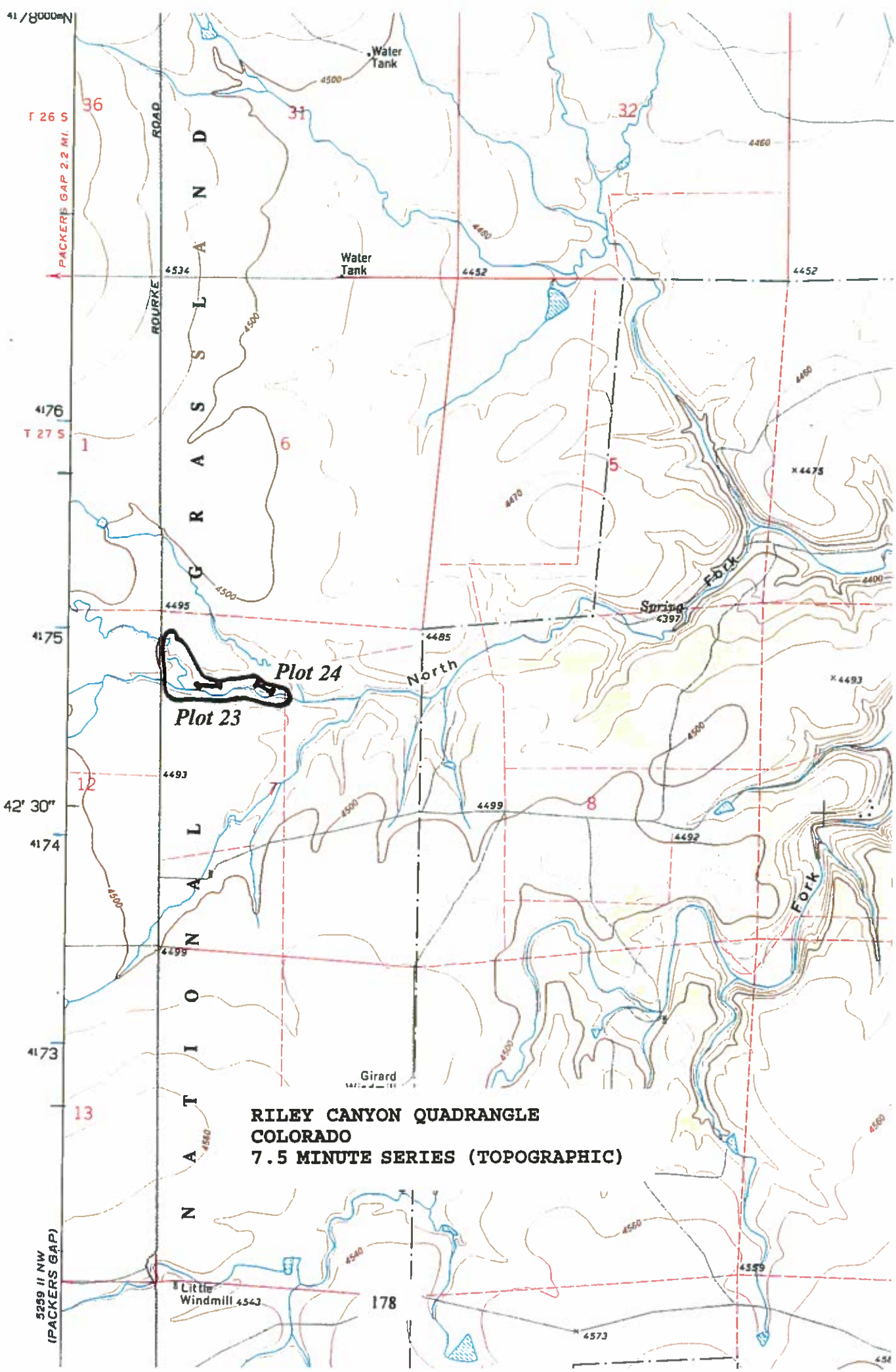
LA JUNTA SW QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

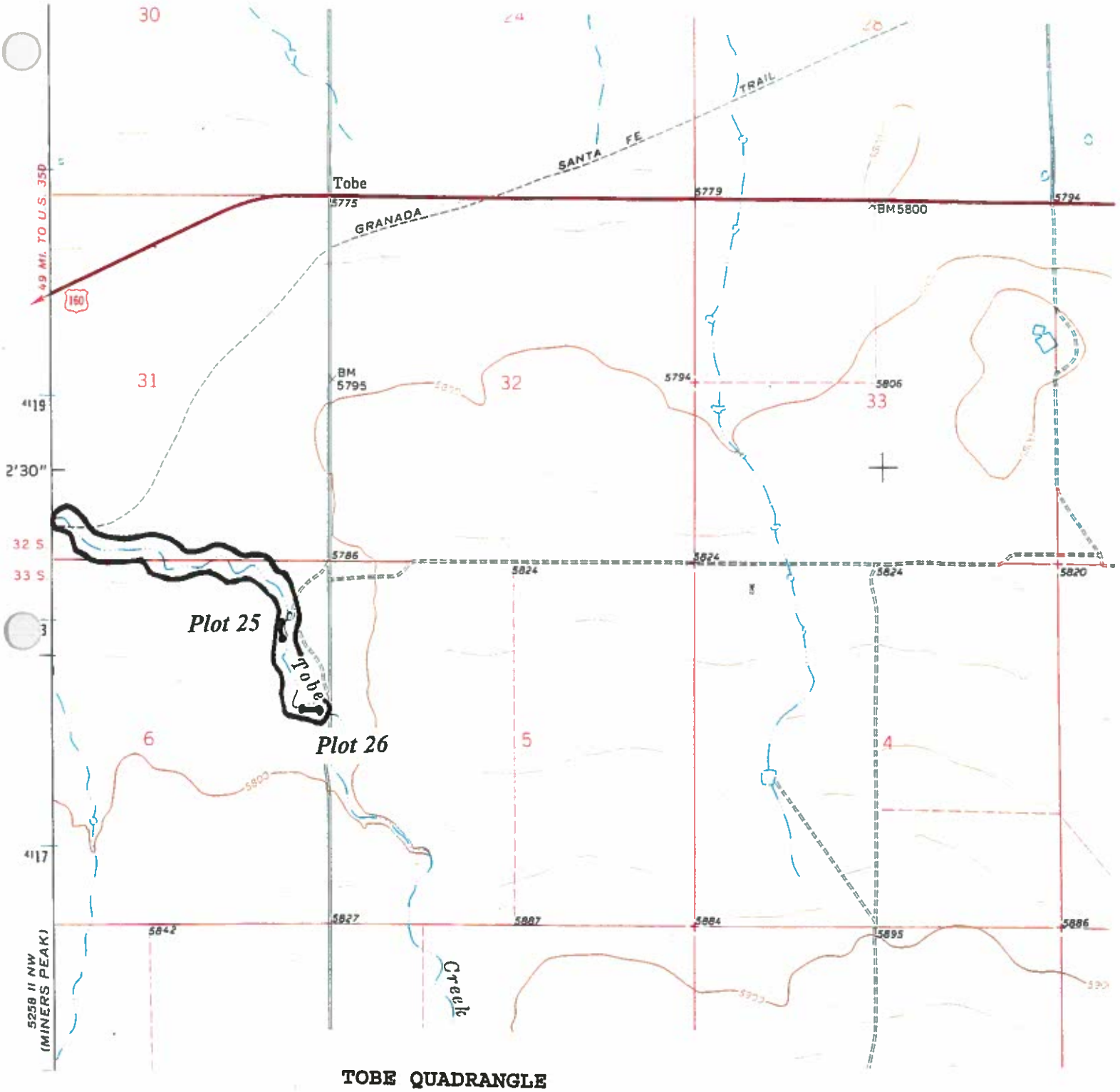


HIGBEE QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Pascopyrum smithii plant association-G3G5S1?
Transect 17; Pintada Creek South Site
Pintada Creek 7.5 min quad
T32S R51W sec 32 sw4se4

Eleocharis palustris\Scirpus pungens plant association-G2G4SU
Transect 22; McMahon Arroyo Site
Higbee 7.5 min quad
T26S R54W sec 17 ne4sw4

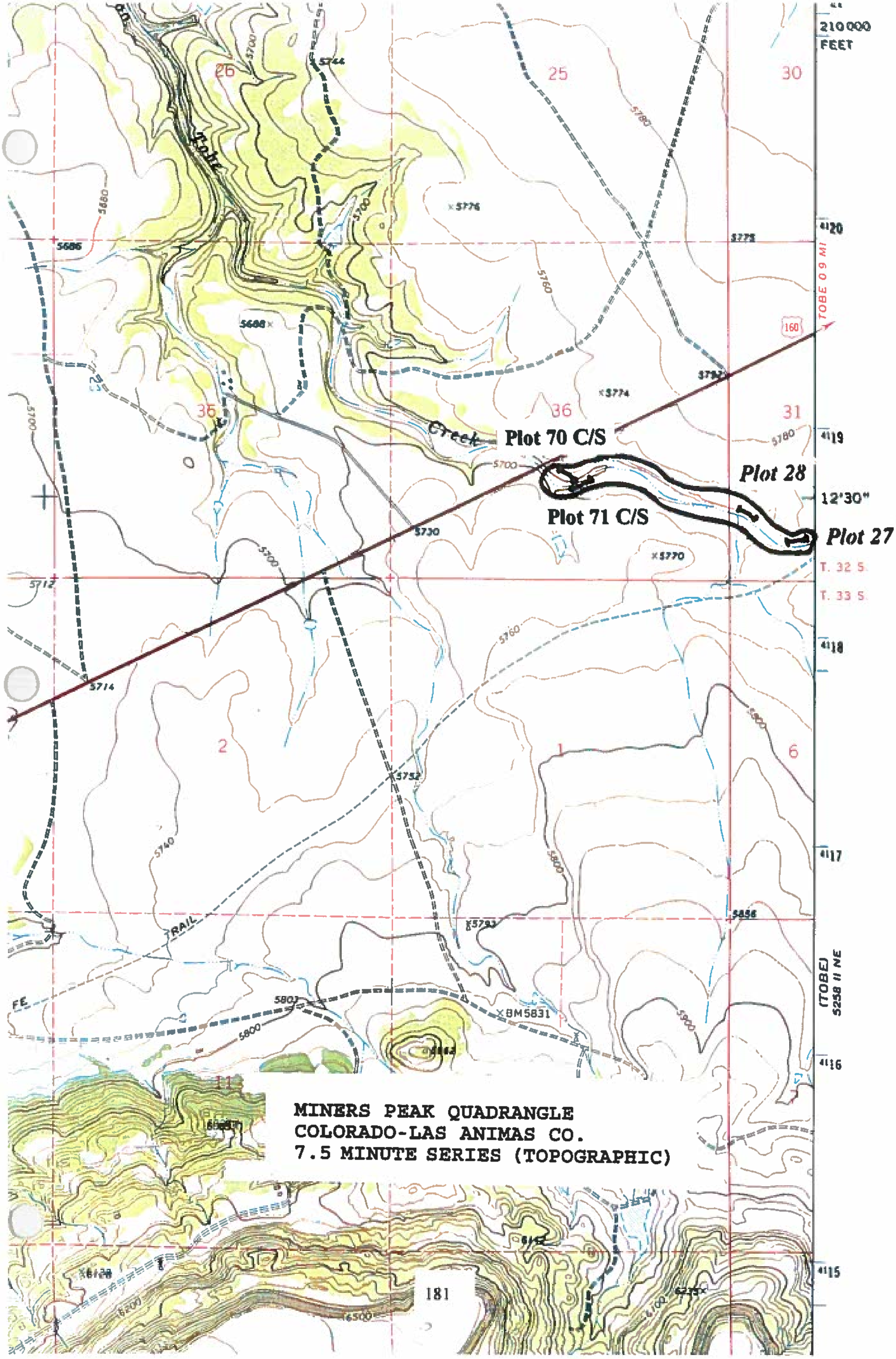

Plot 24
Plot 23
RILEY CANYON QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)
GRASSLAND
ROURKE ROAD
PACKERS GAP 2.2 MI.
Water Tank
Water Tank
North Fork
Spring
Girard
Little Windmill
5259 II NW (PACKERS GAP)
T 26 S
T 27 S
42° 30"
36
31
32
1
6
5
12
7
8
13
178

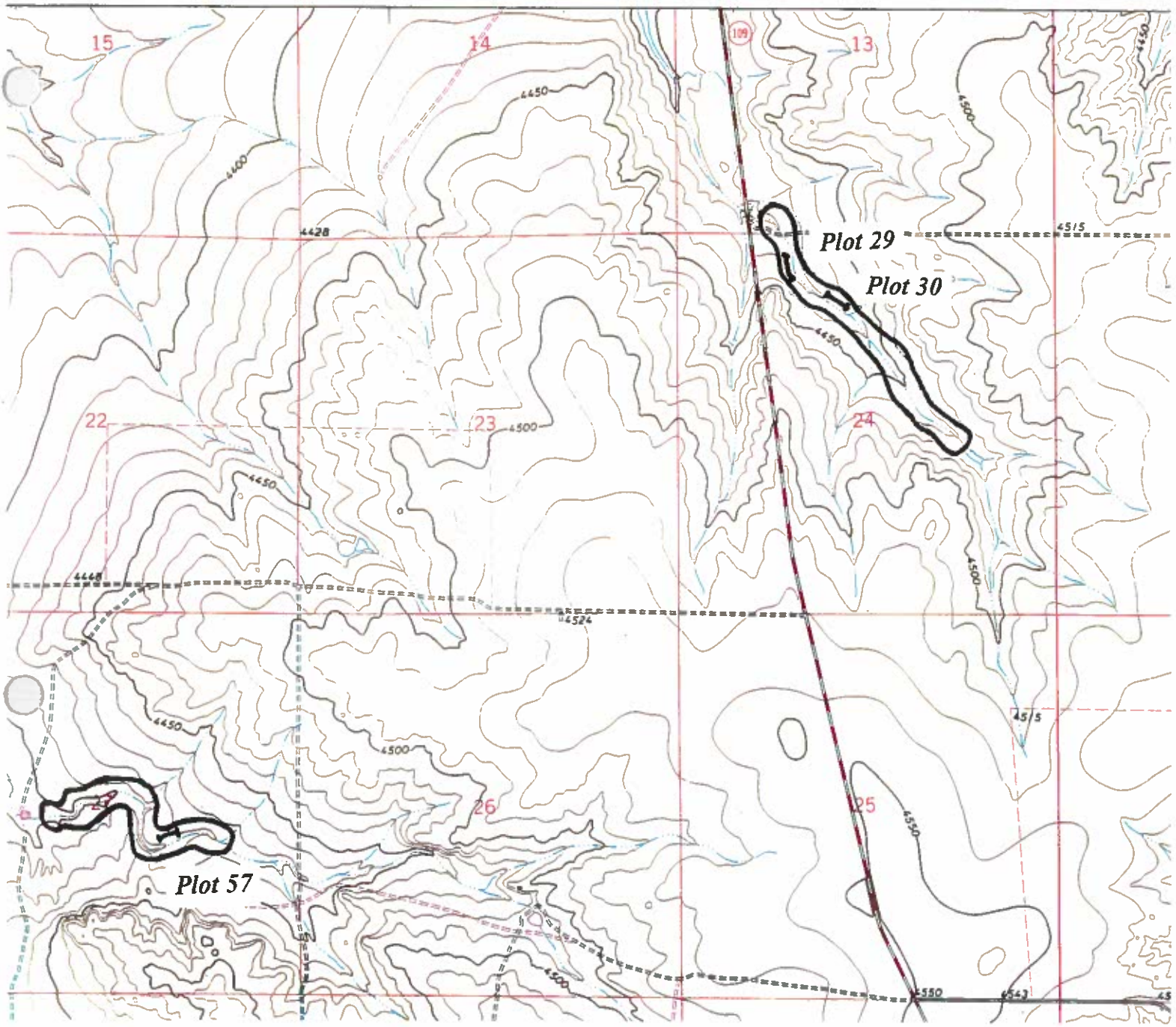


TOBE QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Sporobolus airoides plant association-G2?SU
Transect 23; North Fork Jack Canyon Site
Riley Canyon 7.5 min quad
T27S R55W sec 7 nw4se4

Salix exigua\Eleocharis palustris plant association-GUSU
Transect 26; Tobe Creek Site
Tobe 7.5 min quad
T22S R55W sec 6 ne4ne4

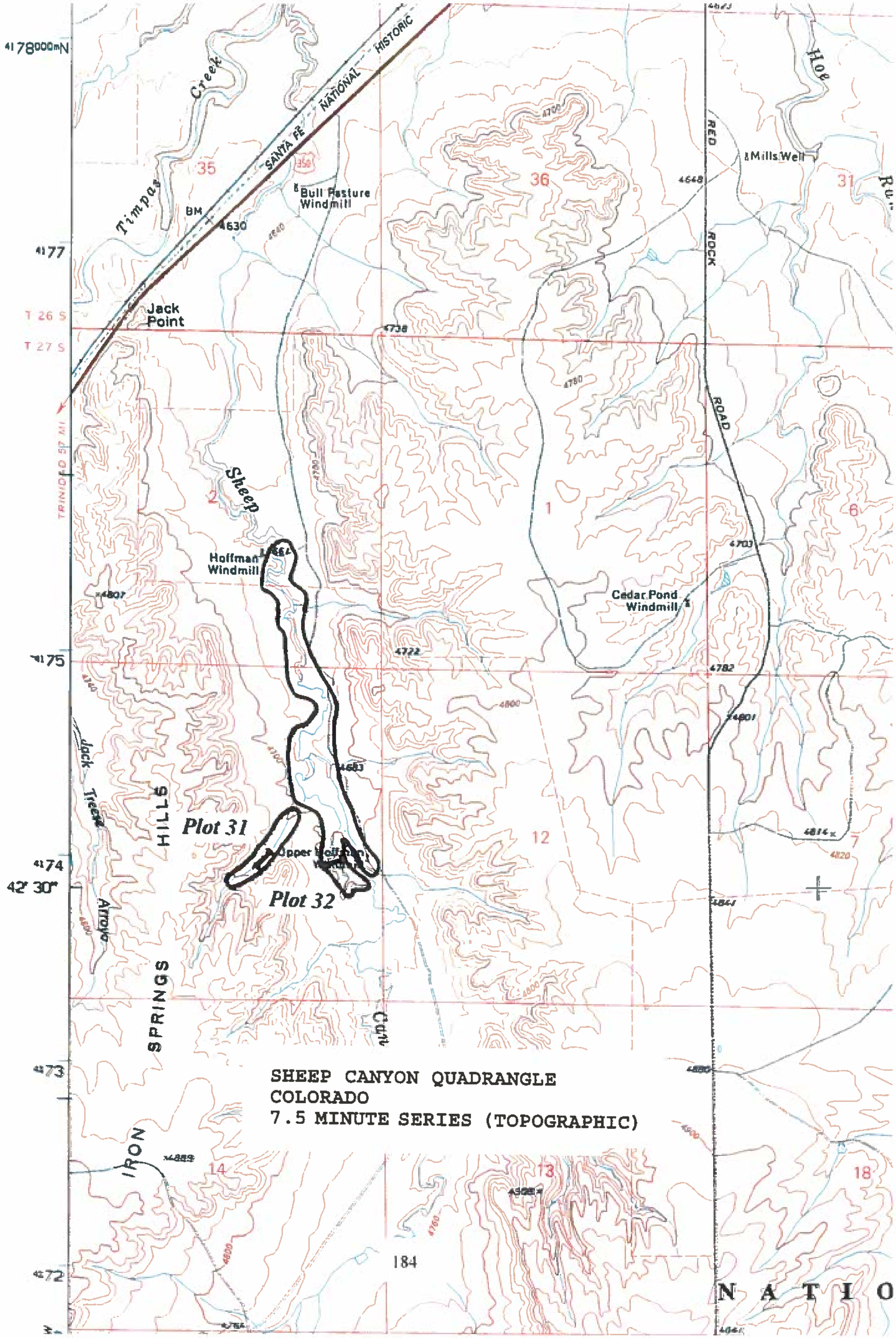

Plot 70 C/S
Plot 71 C/S
Plot 28
Plot 27
Creek
210000 FEET
T. 32 S.
T. 33 S.
TRAIL
MINERS PEAK QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



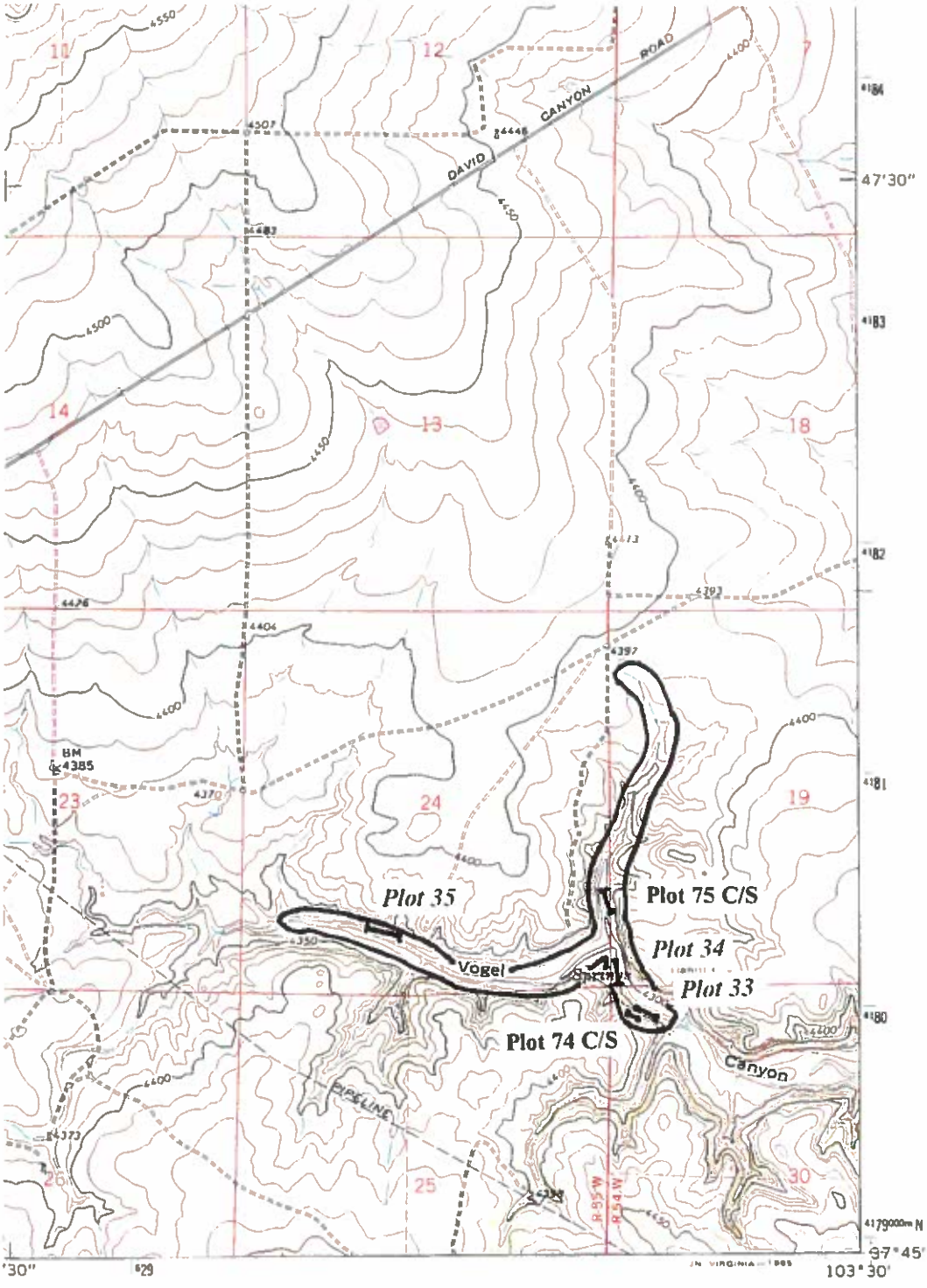
LA JUNTA SE QUDRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES
(TOPOGRAPHIC)

Buchloe dactyloides\Pascopyrum smithii plant association-GUSU
Transect 27; Tobe Canyon Site
Miners Peak 7.5 min quad
T32S R56W sec 31 sw4nw4

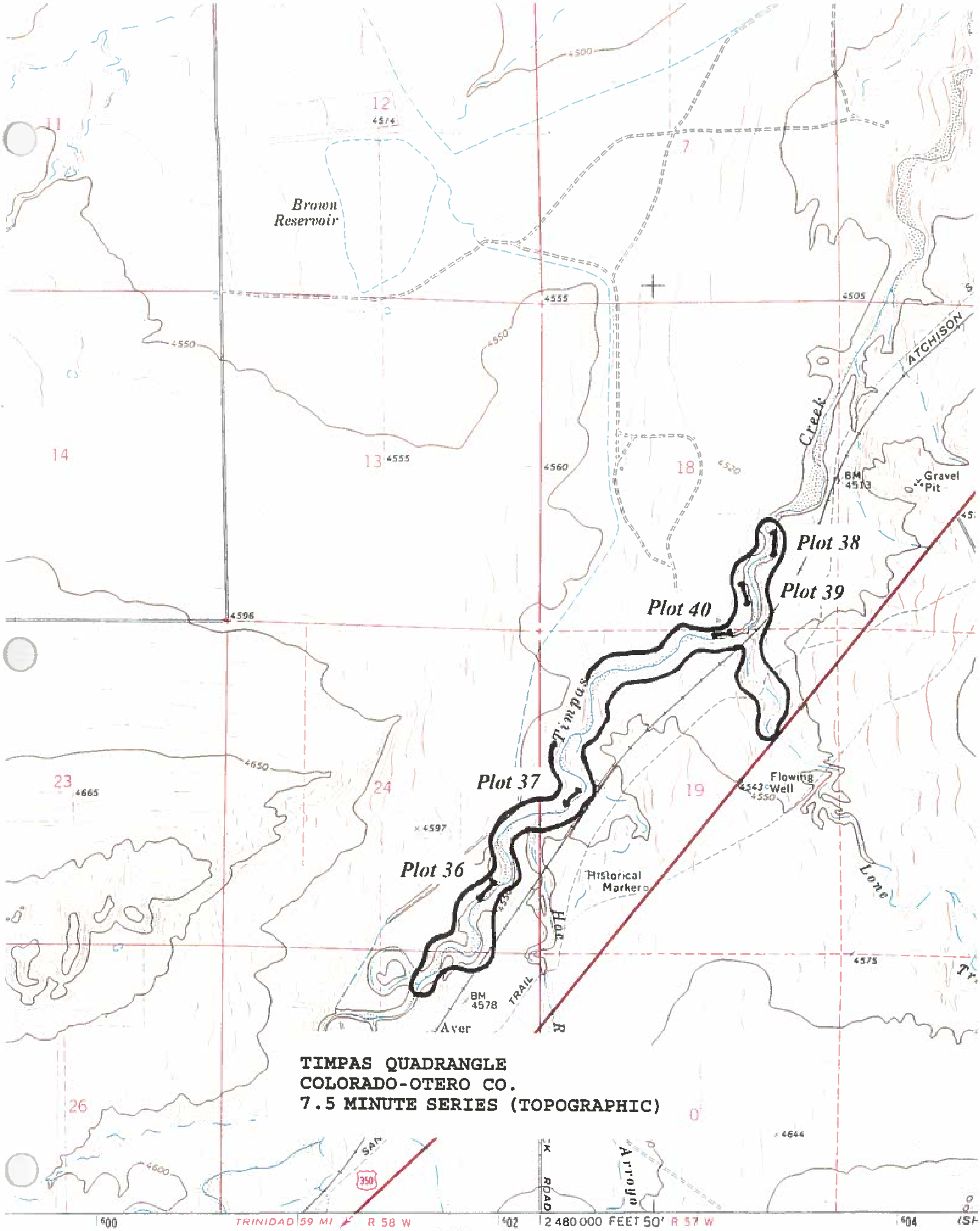
Pascopyrum smithii\Distichlis spicata plant association-G3G5SU
Transect 30; Valley View Site
LaJunta SE 7.5 min quad
T25S R55W sec 24 nw4ne4



SHEEP CANYON QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)



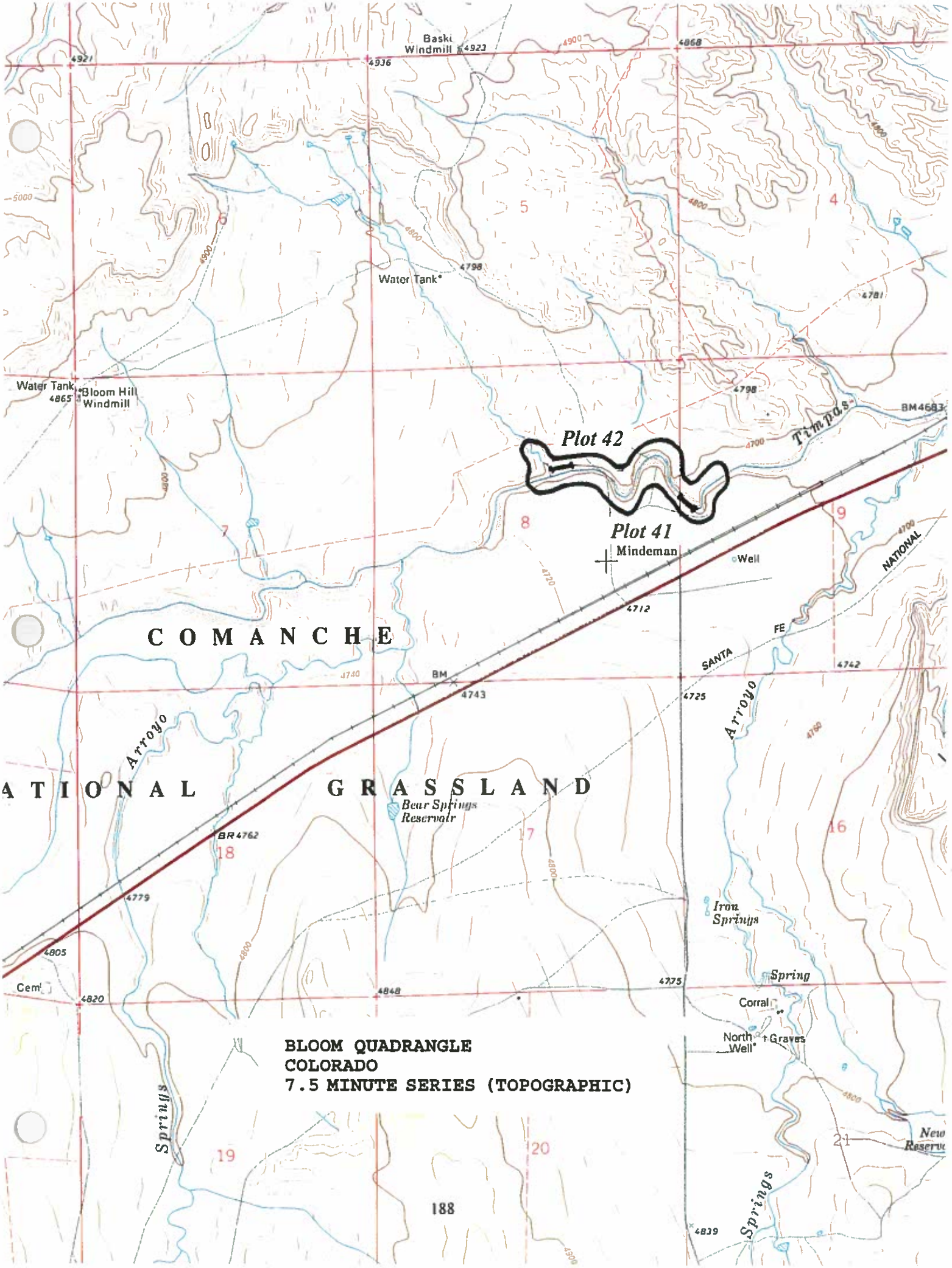
LA JUNTA SE QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES(TOPOGRAPHIC)



TIMPAS QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Eleocharis palustris\Scirpus pungens plant association-G2G4SU
Transect 35; Vogel Canyon Site
La Junta SE 7.5 min quad
T26S R54W sec 24 sw4se4

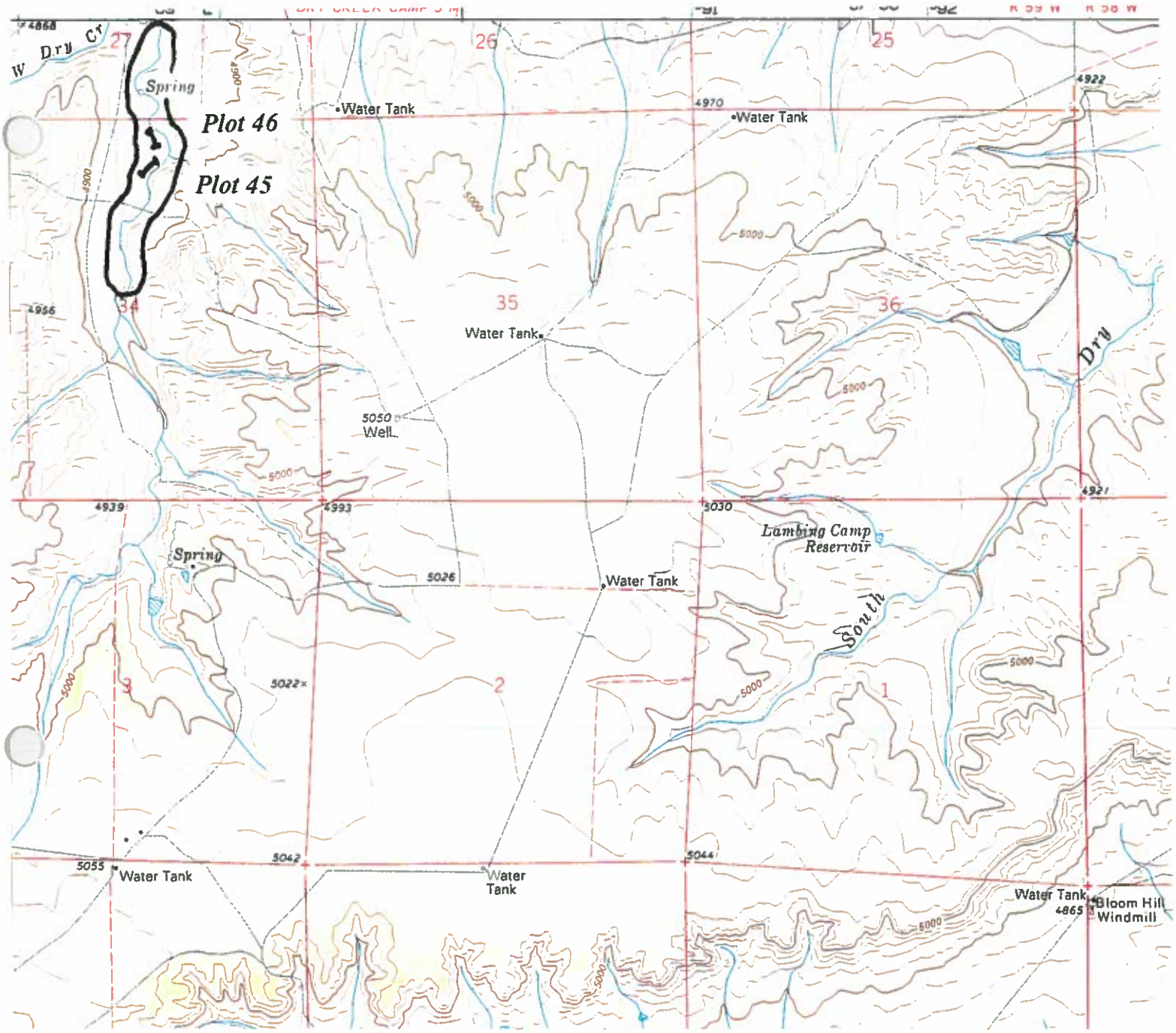
Populus deltoides\Salix exigua plant association-GUSU
Transect 37; Timpas Exclosure Site
Timpas 7.5 min quad
T26S R57W sec 19 sw4nw4



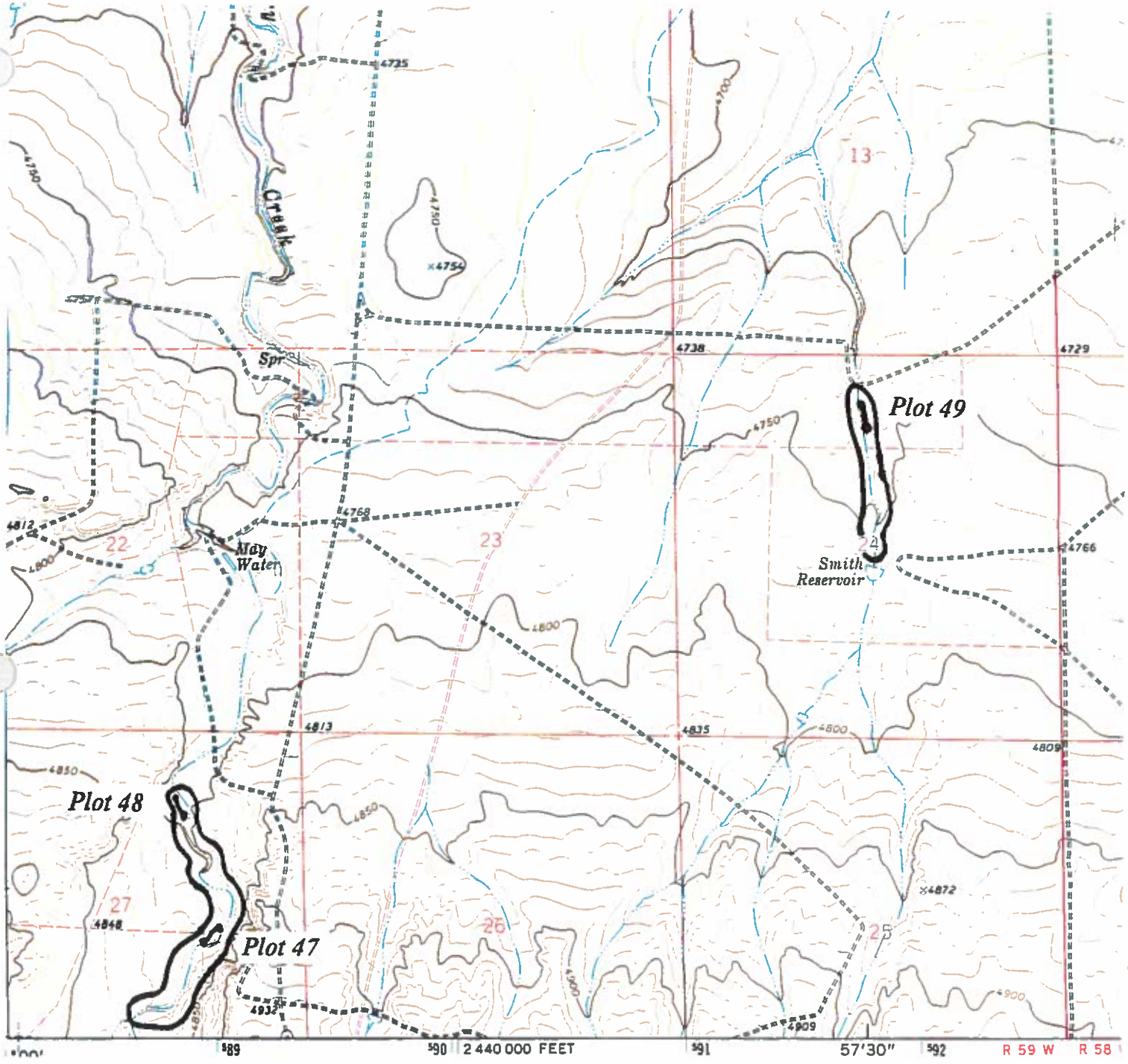
BLOOM QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

Tamarix ramosissima\sparse plant association-unclassified
Transect 38; Timpas Exclosure Site
Timpas 7.5 min quad
T26S R57W sec 18 se4se4

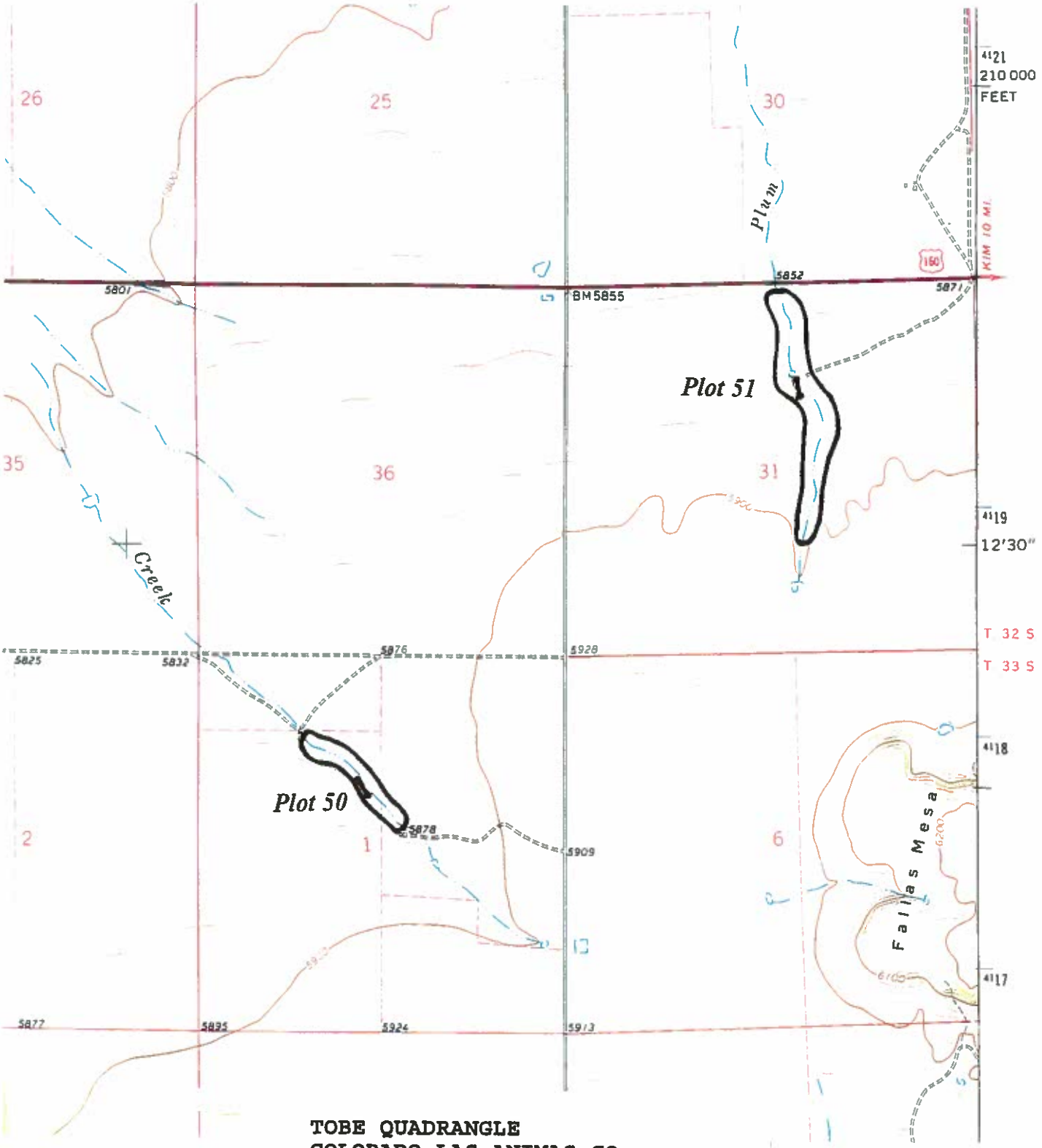
*Salix exigua**Scirpus pungens* plant association-GUSU
Transect 42; Timpas Creek, Mindeman Site
Bloom 7.5 min quad
T27S R58W sec 8 ne4sw4



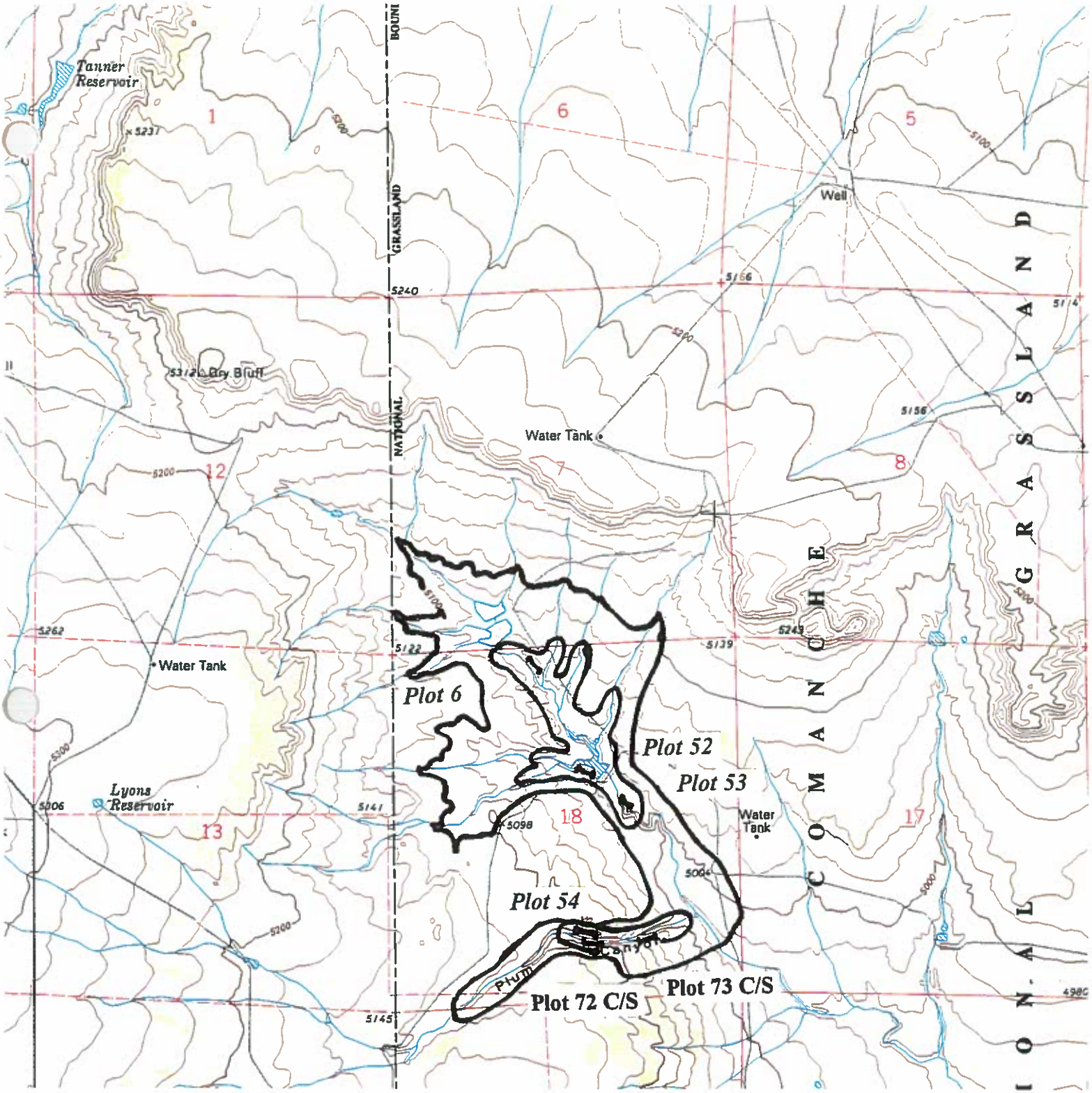
BLOOM QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)



TIMPAS SW QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



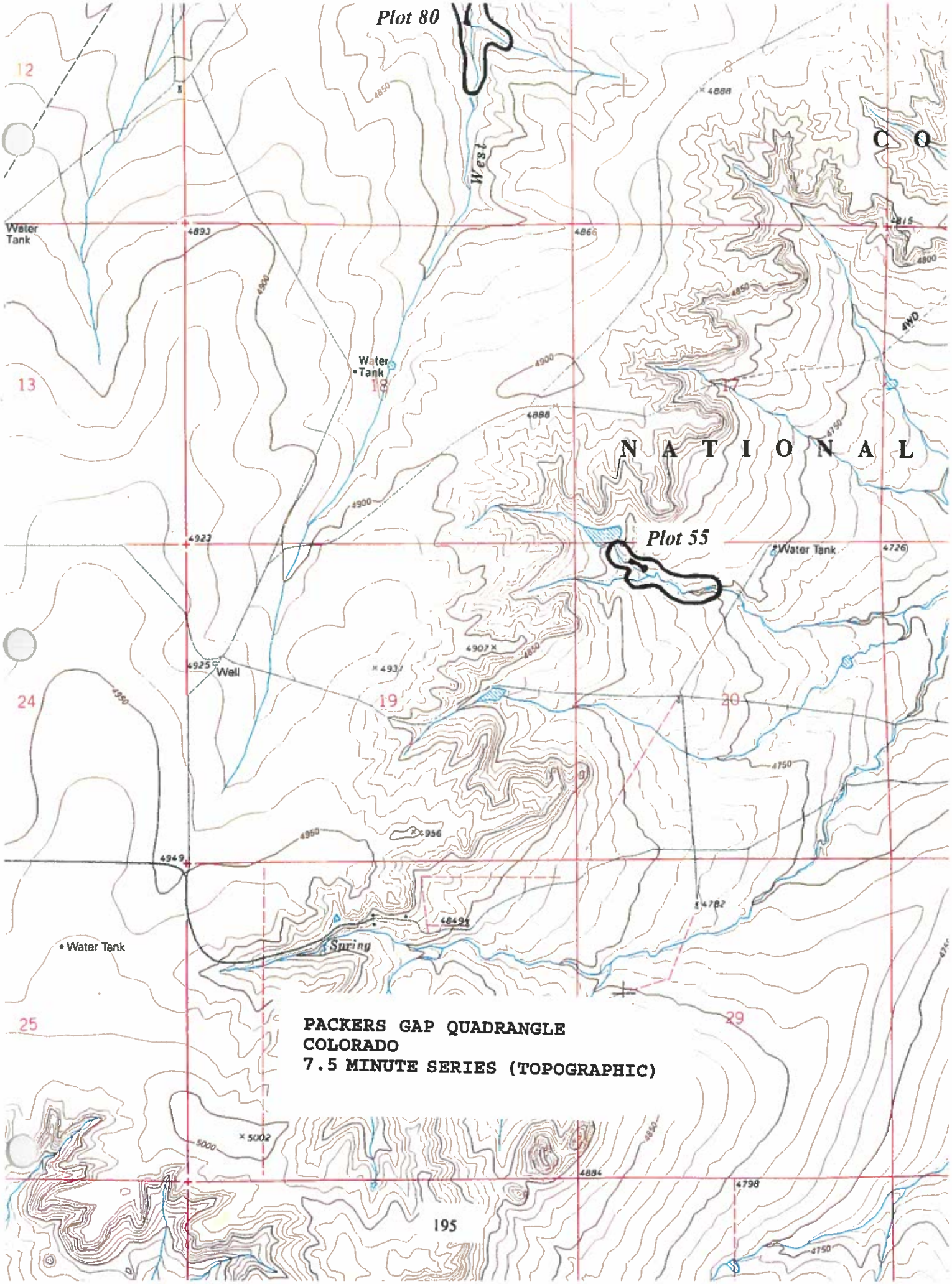
TOBE QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

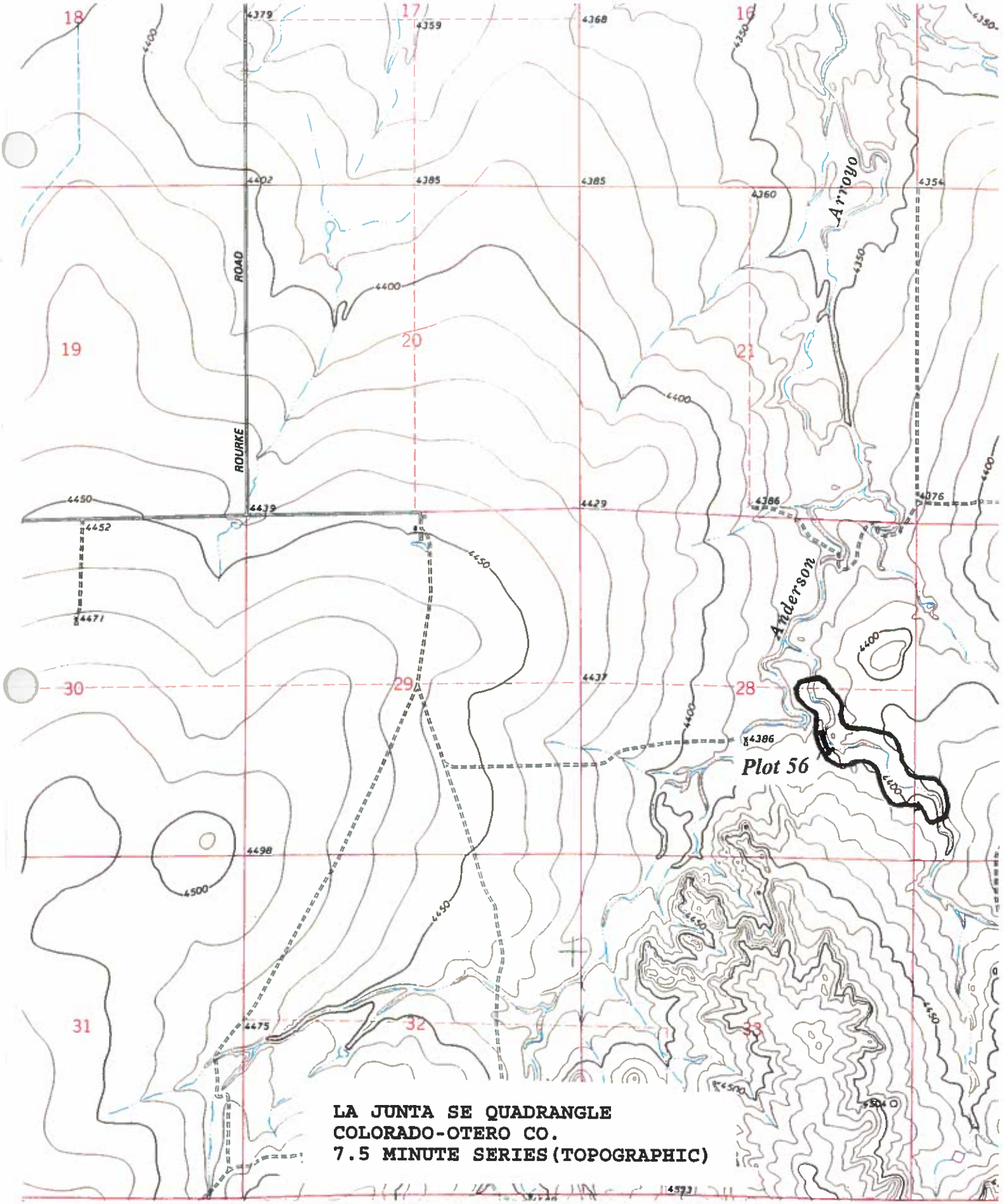


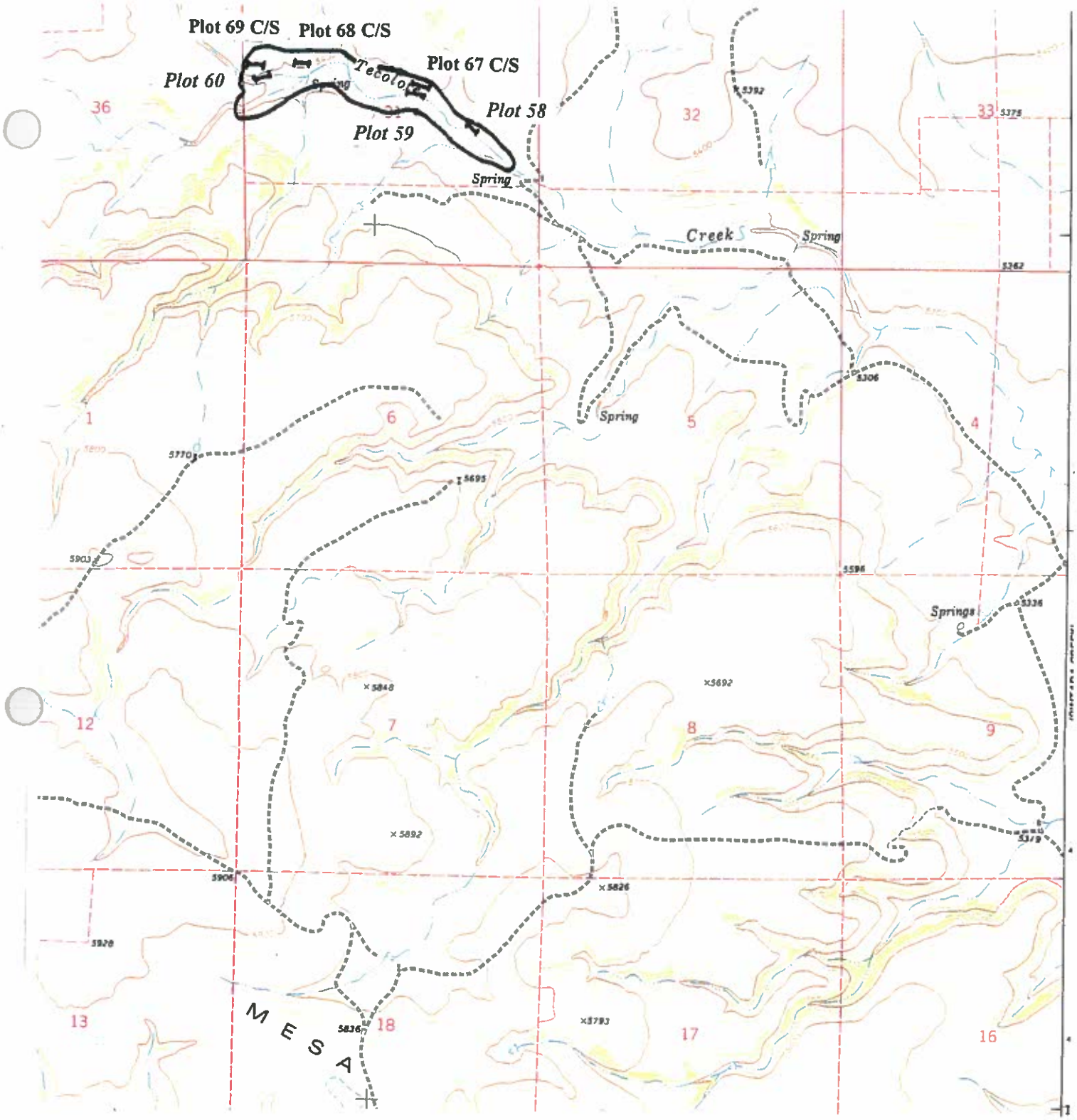
DELHI QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

Populus angustifolia plant association-unclassified
Transect 54; Plum Canyon Site
Delhi 7.5 min quad
T27S R59W sec 18: se4sw4

Populus angustifolia plant association-unclassified
Transect 54; Plum Canyon Site
Delhi 7.5 min quad
T27S R59W sec 18: se4sw4


Plot 80
Plot 55
Water Tank
Water Tank
Water Tank
Well
Spring
NATIONAL
C O
PACKERS GAP QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

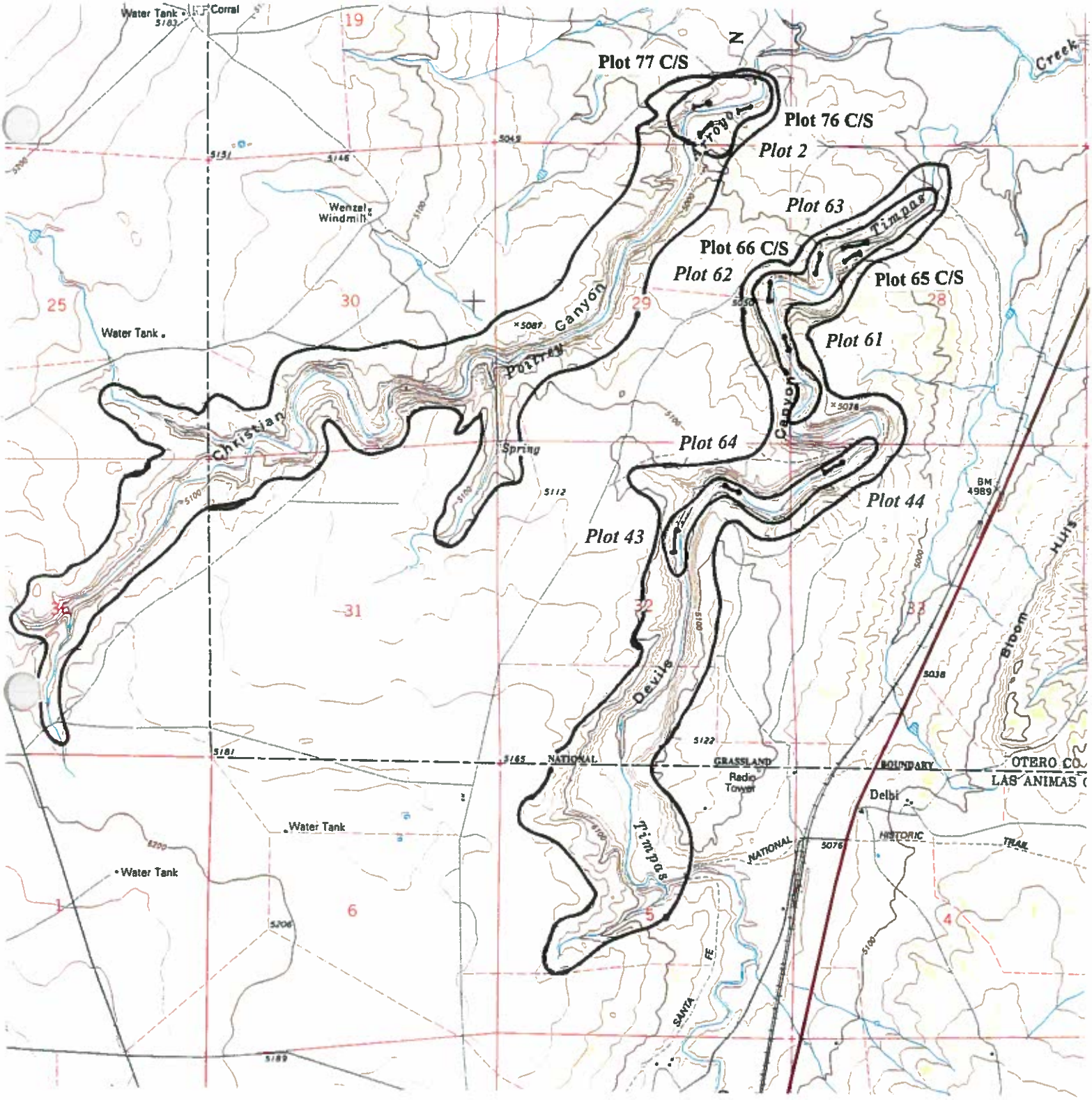

ROAD
ROURKE
Arroyo
Anderson
Plot 56
LA JUNTA SE QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES(TOPOGRAPHIC)



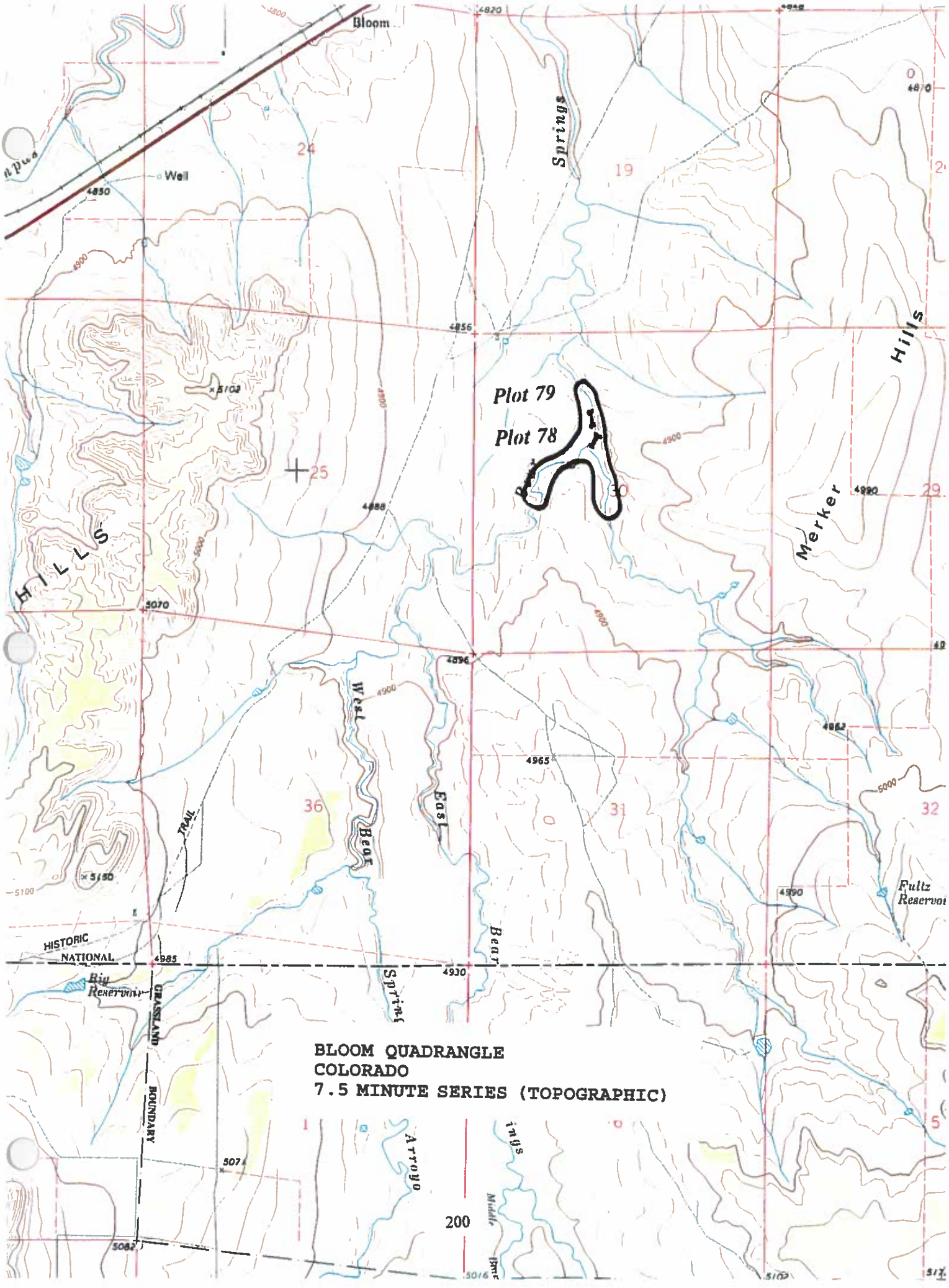
KIM SOUTH QUADRANGLE
COLORADO-LAS ANIMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Eleocharis palustris plant association-G5S3S4
Transect 55; Pasture 9\Burm Pond Site
Packers Gap 7.5 min quad
T27S R56W sec 20 nw4nw4

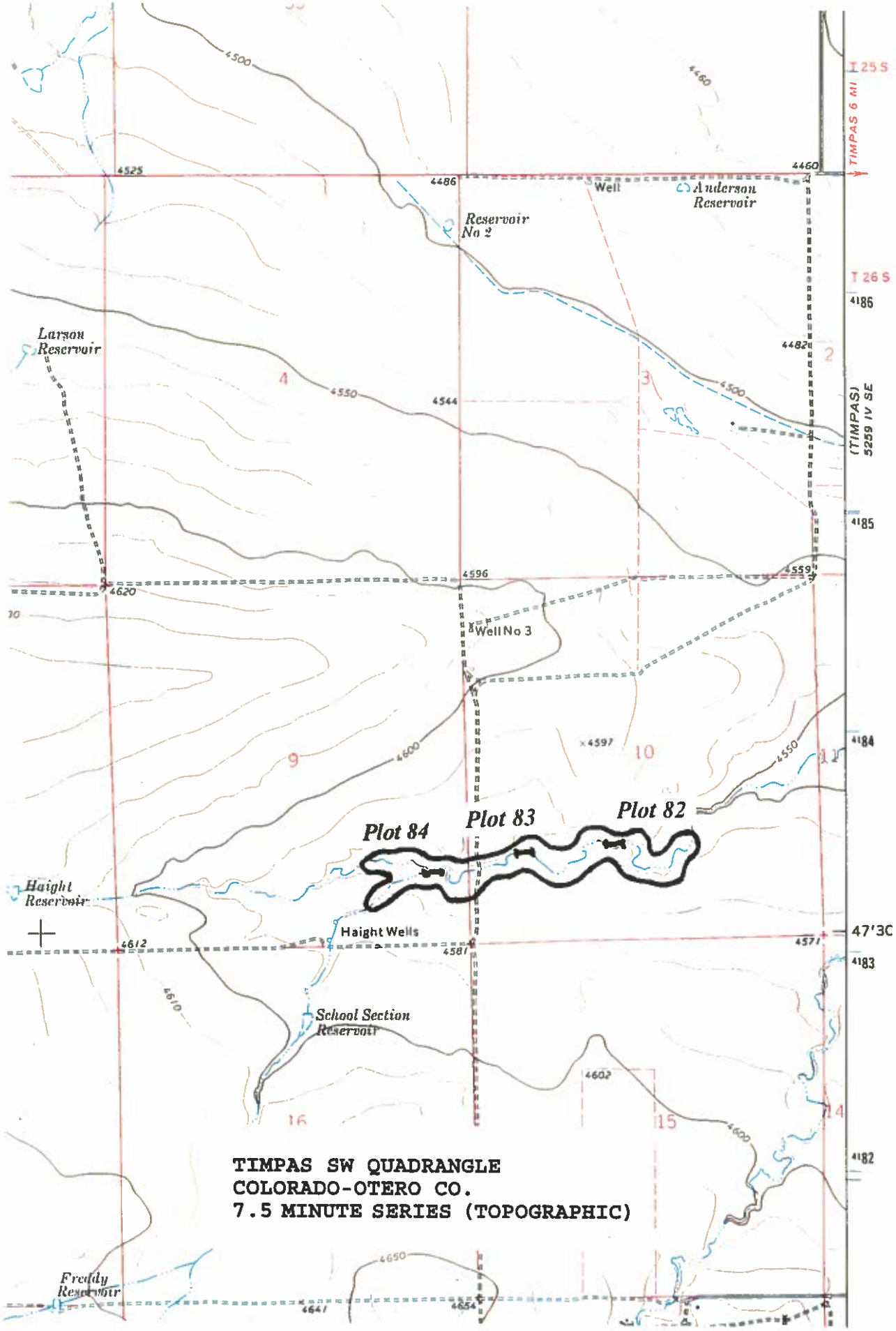
Populus deltoides plant association-unclassified
Transects 58,59,60; Tecolate Canyon Site
Kim South 7.5 min quad
T32S R52W sec 31



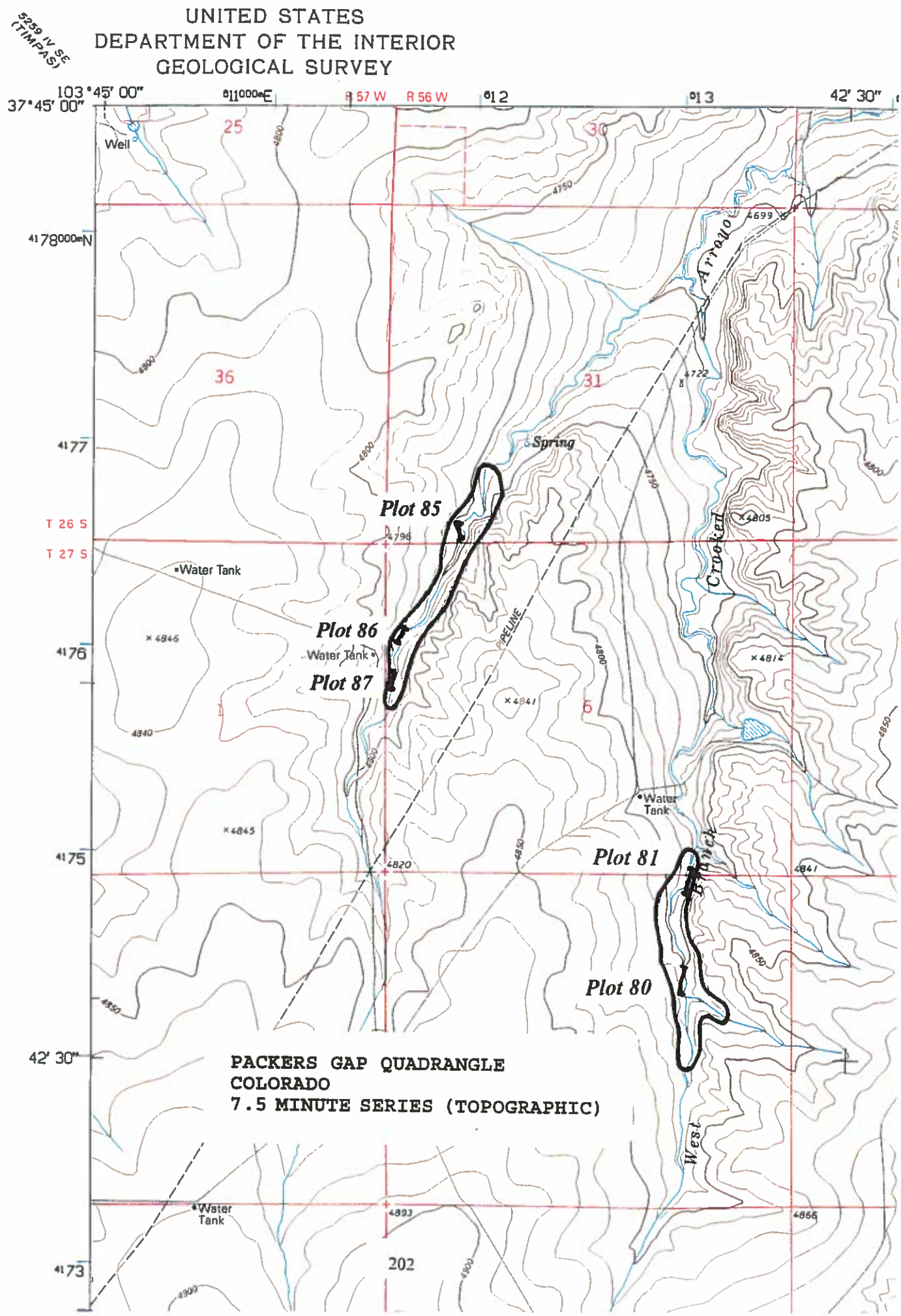
DELHI QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)

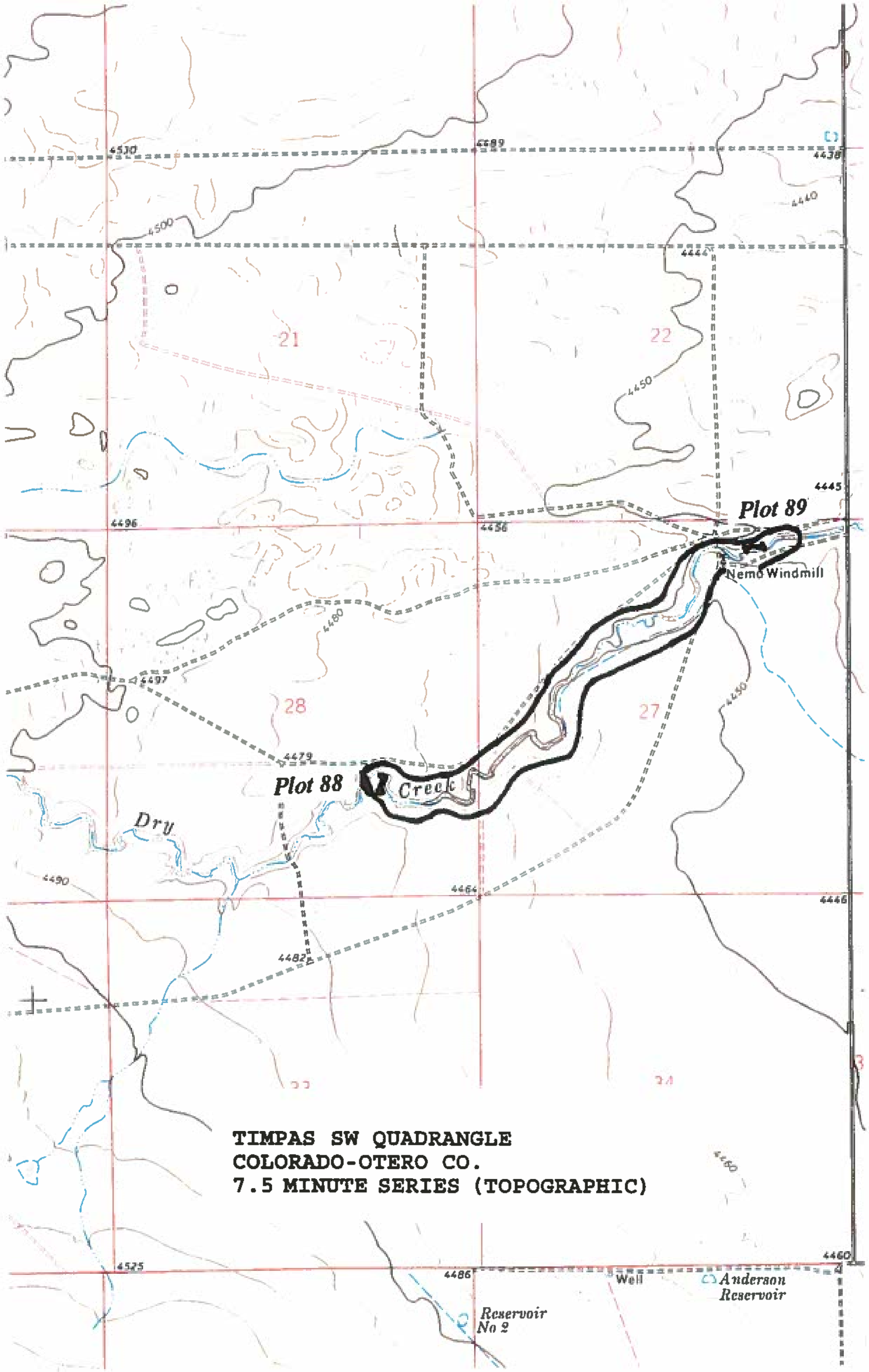


BLOOM QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)



TIMPAS SW QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)


5259 IV SE
(TIMPAS)
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
103°45' 00"
37°45' 00"
611000mE
R 57 W
R 56 W
612
613
42' 30"
Well
25
30
4178000mN
36
31
4177
Spring
Arroyo
Crooked
Plot 85
T 26 S
T 27 S
Water Tank
Plot 86
Water Tank
Plot 87
PIPELINE
4176
6
Water Tank
Plot 81
Plot 80
4175
West
PACKERS GAP QUADRANGLE
COLORADO
7.5 MINUTE SERIES (TOPOGRAPHIC)
42' 30"
Water Tank
4173
202


Plot 89
Nemo Windmill
Plot 88
Dry
Creek
21
22
27
28
4530
4489
4438
4440
4500
4444
4450
4445
4496
4456
4480
4497
4479
4490
4464
4446
4482
4525
4486
4460
Well
Anderson
Reservoir
Reservoir
No 2
TIMPAS SW QUADRANGLE
COLORADO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

General site-dry trampled mud
Transect 85 and 86; Seventh Meridan Site
Packers Gap 7.5 min quad
T26S R56W sec 31 sw4sw4

*Atriplex canescens**Pascopyrum smithii* plant association-G5S5
Transect 88; W Dry Creek, Nemo Windmill Site
Timpas SW 7.5 min quad
T25S R58W sec 28 se4ne4

General site-with burm and evidence of trampling
Thompson Arroyo Site

General Site
Timpas Exclosure
Timpas 7.5 min quad

APPENDIX E

CHECKLIST OF VASCULAR PLANTS, INCLUDING COMMON NAMES, FOR THE RIPARIAN TRANSECTS LOCATED ON THE TIMPAS AND KIM DISTRICTS, COMANCHE NATIONAL GRASSLAND

Scientific Name	Common Name
PTERIDOPHYTA	
EQUISETACEAE	
Equisetum laevigatum (A. Braun) Farwell	scouring-rush
GYMNOSPERMAE	
CUPRESSACEAE	
Juniperus monosperma (Englemann) Rydb.	one-seeded juniper
ANGIOSPERMAE	
AGAVACEAE	
Yucca glauca Nutt.	yucca
ANACARDIACEAE	
Rhus trilobata (Nutt.) var. *trilobata*	skunkbush
Toxicodendron rydbergii (Small) Greene	poison ivy
ASCLEPIADACEAE	
Asclepias arenaria Torrey	milkweed
Asclepias hallii Gray	Hall's milkweed
Asclepias subverticillata (Gray) Vail	milkweed
ASTERACEAE	
Ambrosia psilostachya D.C. var. *coronopifolia* (T & G) Farwell	ragweed
Artemisia filifolia Torr.	sand sagebrush
Artemisia frigida Willd.	fringed sagebrush
Artemisia ludoviciana Nutt.	sagewort
Aster ericoides L.	aster
Aster falcatus Lindl.	white prairieaster
Aster hesperius Gray	aster
Brickellia oblongiflora Nutt. var. *linifolia* (D.C. Eat.) Robinson	brickellia
Chrysothamnus viscidiflorus (Hooker) Nutt.	rabbitbrush
Carduus nutans L. subsp. *macrolepis* (Peterm.) Kazmi.	musk thistle
Cirsium undulatum (Nutt.) Spreng.	thistle

Scientific Name	Common Name
Conyza canadensis (L.) Cronq.	sow thistle
Dyssodia papposa (Vent.) Hitchc.	fetid marigold
Gnaphalium canescens D.C.	cudweed
Grindellia squarrosa (Pursh) Dun.	gumweed
Gutierrezia sarothrae (Pursh) Britt.&Rusby	snakewed
Helianthus annuus L.	sunflower
Heterotheca canescens (D.C.) Shinners	purple aster
Heterotheca villosa (Pursh) Shinners	golden aster
Iva axillaris Pursh.	poverty weed
Kuhnia chlorolepis Woot. & Standl.	false boneset
Lactuca serriola L.	lettuce
Liatris punctata Hooker	gay feather
Lygodesmia juncea (Pursh) Hook.	skeleton weed
Machaeranthera pinnatifida (Hooker)Shinners	tansy aster
Picradeniopsus oppositifolia (Nutt.) Rydb.	
Prionopsis ciliata (Nutt.) Nutt.	
Ratibida columnifera (Nutt.) Woot.&Standl.	prairie coneflower
Senicio douglasii D.C. var. *longilobus* (Benth.) Benson var. *longilobus* (Benth.) Benson	groundsel
Solidago mollis Bartling	goldenrod
Solidago nana Nutt.	goldenrod
Taraxacum officinale Weber	dandelion
Thelesperma megapotamica (Spreng) Kuntze	nippleseed
Tragapogon dubius Scop.	salisfy
Xanthium strumarium Nutt.	cocklebur
Zinnia grandiflora Nutt.	zinnia
BORAGINACEAE	
Asperugo procumbens L.	madwort
Cryptantha crassisepala (T.& G.) Greene	miner's candle
Onosmodium molle Michaux ssp. *occidentale* (Mack.) Cochrane	marbleseed
BRASSICACEAE	
Alyssum deseratorum Stapf.	alyssum
Camelina microcarpa D.C.	false flax
Chorispora tenella (Pall.) DC.	purple mustard
Descurania sophia (L.) Webb *ex* Prantl.	tansy mustard
Lesquerella fendleri (Gray) S. Wats.	bladder pod
Lesquerella montana (Gray) S. Wats.	bladder pod
Stanleya pinnata (Pursh) Britt.	prince's plum
CACTACEAE	

Scientific Name	Common Name
Coryphantha vivipara (Nutt.) Britton & Rose var. *vivipara*	nipple cactus
Opuntia fragilis (Nutt.) Haw.	brittle cactus
Opuntia imbricata (Haw.) DC.	cholla
Opuntia polyacantha Haw.	prickly pear
Pediocactus simpsonii (Engel.) Britton&Rose var. *minor* (Engel.) Cockerell	ball cactus
CAMPANULACEAE	
Lobelia cardinalis L. ssp. *graminea* (Lamarck) McVaugh	cardinal flower
CHENOPODIACEAE	
Atriplex canescens (Pursh) Nutt.	four-winged saltbush
Atriplex confertifolia (Torr.&Frem.)S. Wats.	saltbush
Bassia hyssopifolia (Pall.) O. Ktze.	ironweed
Chenopodium album L.	goosefoot
Chenopodium berlandieri Moq.	goosefoot
Chenopodium pratericola Rydb.	goosefoot
CHENOPODIACEAE (continued)	
Chenopodium leptophyllum (Moq.) Nutt. *ex* S. Wats	goosefoot
Kochia scoparia (L.) Schrad.	kochia
Krascheninnikovia lanata (Pursh)Guldenstaedt	winterfat
Salsola kali L. ssp. *tragus* (L.) Aellen	russian thistle
Salsola collina Pallas	russian thistle
CONVOLVULACEAE	
Calystegia macounii Greene	hedge bindweed
Convolvulus arvensis L.	creeping jenny
Convolvulus equitans Benth.	bindweed
CUCURBITACEAE	
Cucurbita foetidissima Kunth	stinking calabazilla
CYPERACEAE	
Carex brevoir (Dew.) Mack. *ex* Lunell.	sedge

Scientific Name	Common Name
Eleocharis palustrus (L.) Roemer&Schultes	spikerush
Eleocharis parvula (R & S) Link var. *anacheata* (Torrey) Svenson	spikerush
Scirpus maritimus L. var. *paludosus* (Nels.) Kukenth.	bulrush
Scirpus pungens Vahl.	leafy bulrush
Scirpus validus Vahl.	bulrush
EUPHORBIACEAE	
Chamaesyce fendleri (T. & G.) Small	
Chamaesyce revoluta (Engel.) Small	Fendler's euphorb
Chaemesyce serpyllifolia (Pers.) Small	thyme-leaved spurge
Croton texenis (Kl.) Muell.-Arg.	Texas croton
Euphorbia dentata Michx.	toothed spurge
Euphorbia marginata Pursh.	snow-on-the-mountain
Tragia ramosa Torrey	noseburn
FABACEAE	
Amorpha fruticosa L. var. *angustifolia* Pursh.	leadplant
Astragalus sp.	milk vetch
Caesalpina jamesii (T. & G.) Fisher.	James's rush pea
Dalea purpurea Ventenat	purple prairie flower
Desmanthus illinoensis (Michx.) MacM.	
Glycorhizza lepidota Pursh.	wild licorice
Lathryus sp.	peavine
Medicago sativa L.	alfalfa
Melilotus alba Medikus.	white sweetclover
Melilotus officianale (L.) Pallas	yellow sweetclover
Psoralidium tenuiflora (Pursh) Rydb.	
Trifolium sp.	clover
Vicia americana Muhl. *ex* Willd.	vetch
FAGACEAE	
Quercus grisea Liebm.	oak
GROSSULARIACEAE	
Ribes aureum Pursh	golden current
Ribes cereum Douglas	current
Ribes sp.	current
HIPPURIDACEAE	

Scientific Name	Common Name
Hippuris vulgaris L.	mare's tail
HYDRANGEACEAE	
Philadelphus microphyllus Gray	mock-orange
JUNCACEAE	
Juncus balticus Willd. var. *montanus* Engelm.	rush
Juncus bufonius L.	rush
Juncus interior Wiegand.	rush
Juncus longistylis Torr.	rush
Juncus torreyi Coville	rush
LAMIACEAE	
Marrubium vulgare L.	horehound
Teucrium laciniatum Torrey	germander
LEMNACEAE	
Lemnaceae sp.	duckweed
LINACEAE	
Linum rigidum (Pursh) Love & Love	orange flax
LOASACEAE	
Mentzelia nuda (Pursh) Torr. & Gray	blazingstar
MALVACEAE	
Malva sp.	mallow
Sphaeralcea angustifolia (Cav.) G. Don var. *cuspidata* (Gray) Kearney	globemallow
Sphaeralcea coccinea (Nutt.) Rydb.	globemallow
NYCTAGINACEAE	
Mirabils linearis (Pursh) Heimerl	four-o'-clock
ONAGRACEAE	

Scientific Name	Common Name
Gaura cocciniea Nutt.	butterfly weed
Gaura parviflora Dougal.	butterfly weed
PEDALIACEAE	
Proboscidea louisianica (P. Mill.) Thellung	devil's claw
PLANTAGINACEAE	
Plantago patagonica Jacq.	plaintain
POACEAE	
Agrostis stolonifera L.	bentgrass
Alopecurus aequalis Sobol.	foxtail
Andropogon gerardii Vitman	big bluestem
Aristida purpurea Nutt.	three-awn
Bothriochloa laguroides (D.C.) Herter ssp. *torreyana* (Steudl) A.& G.	silver beardgrass
Bouteloua curtipendula (Michx.) Torr.	sideoats grama
Bouteloua gracilis (Willd. *ex* Kunth) Lag. *ex* Griffiths	blue grama
Bouteloua hirsuta Lag.	hairy grama
Bromus japonicus Thumb. *ex* Murr.	Japanese brome
Bromus tectorum L.	cheat grass/downy brome
Buchloe dactyloides (Nutt.) Engelm.	buffalograss
Distichlis spicata (L.) Greene	saltgrass
Echinochloa crus-galli (L.) Beauv.	barnyard grass
Elymus canadensis L.	Canada rye
Elymus elymoides (Raf.) Swezey	ryegrass
Elymus longifolius (Smith) Gould	squirreltail
Elytrigia intermedia (Host) Nevski	intermediate wheatgrass
Hilaria jamesii (Torr.) Benth.	galletagrass
Hordeum jubatum L. ssp. *breviaristatum* Bowden	foxtail barley
Hordeum pusillum Nutt.	foxtail barley
Koeleria macrantha (Ledeb.) Schultes	Junegrass
Lycurus phleoides Kunth	wolftail
Monroa squarrosa (Nutt.) Torrey	false buffalograss
Muhlenbergia asperifolia (Nees & Meyen *ex* Trin.) Parodi	muhly
Muhlenbergia cuspidata (Torr.ex Hook) Rydb.	muhly
Muhlenbergia racemosa (Michx.) B.S.P.	muhly
Oryzopsis hymenoides (R. & S.) Ricker *ex* Piper	ricegrass
Panicum obtusum Kunth	panicgrass
Pascopyron smithii Rydb.	Western wheatgrass
Poa arida Vasey	arid bluegrass
Poa fendleriana (Steudel) Vasey	bluegrass

Scientific Name	Common Name
Poa pratensis L.	Kentucky bluegrass
Polypogon monspeliensis (L.) Desf.	rabbitfoot grass
Schedonnardus paniculatus (Nutt.) Trel.	tumblegrass
Schizachyrium scoparium (Michaux.) Nash	little bluestem
Sporobolus airoides (Torr.) Torr.	alkaline sacaton
Sporobolus cryptandrus (Torr.) Gray	sand sacaton
Sporobolus giganteus Nash	giant sacaton
Stipa comata Trin. & Rupr.	needle and threadgrass
Stipa neomexicana (Thurb.*ex* Coult.) Scrib.	Mexican needlegrass
Stipa viridula Trin.	needlegrass
Torreyochloa pallida (Torr.) Church var. *pauciflora* (J.Presl) J.I.Davis	weak mannagrass
Vulpia octoflora (Walter) Rydberg	sixweeks fescue
POLEMONIACEAE	
Phlox longifolia Nutt.	phlox
POLYGONACEAE	
Eriogonum effusum Nutt.	buckwheat
Eriogonum jamesii Betham var. *flavescens* S. Watson	buckwheat
Eriogonum tenellum Torrey	*delicate buckwheat*
Polygonum ramosissimum Michaux.	knotweed
POLYGONACEAE (continued)	
Rumex crispus L.	sorrel/dock
RHAMNACEAE	
Rhamnus cathartica L.	buckthorn
ROSACEAE	
Cercocarpus montanus Raf.	mountain mahogony
Rubus deliciousus James	raspberry
RUTACEAE	
Ptelea trifoliata L.	hoptree
SALICAEAE	
Populus angustifolia James	narrowleaf cottonwood

Scientific Name	**Common Name**
Populus deltoides Bartr. *ex* Marshall ssp. *monilifera* (Aiton) Eckenwalder	cottonwood
Salix exigua Nutt.	coyote willow
SCROPHULARIACEAE	
Verbascum thapsus L.	mullein
SOLANACEAE	
Chamaesaracha coronopus (Dunal) Gray	
Lycium barbarum L.	wolfberry
Solanum elaeagnifolium Cav.	nightshade
Solanum rostratum Dunal.	buffaloberry
TAMARICACEAE	
Tamarix ramosissima Ledeb.	tamarisk
TYPHACEAE	
Typha angustifolia L.	cattail
Typha domingensis Pers.	cattail
ULMACEAE	
Celtis laevigata Willd. var. *reticulata* (Torr.) L. Benson	hackberry
VERBENACEAE	
Phlya cuneifolia (Torrey) Greene	fogfruit
Verbena bracteata Lag.& Rodr.	vervain
Verbena stricta Vent.	vervain

APPENDIX F

SAMPLE FIELD FORMS