

Current Knowledge and Conservation Status of *Phacelia parishii* A. Gray (Hydrophyllaceae) in Nevada.

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SUMMARY: *Phacelia parishii* was first collected by S. B. and W. F. Parish in 1882 on a dry alkaline lake near Rabbit Springs in San Bernardino County, California. The species was named and published by Asa Gray in 1883. Prior to this survey *P. parishii* was known to occur in 22 sites in Nevada, four sites in San Bernardino County, California, and one site in Mohave County, Arizona. Because of its rarity in California and potential vulnerability to military and development projects in its known habitat, *P. parishii* was classified as a category-2 candidate for listing under the Endangered Species Act, which requires that more information be obtained before a listing decision can be made. In California two sites, the Rabbit Springs and the Calico populations, are thought to be extirpated. Field surveys were undertaken in Nevada during the summer of 1995 to relocate historical populations, discover additional populations, and document the biology, ecology, and conservation status of the plant. This report summarizes the results of these surveys, reviews all previous knowledge of the species, and recommends conservation and recovery actions designed to prevent it from becoming a threatened or endangered species.

Field surveys in the summer of 1995 yielded six new Nevada sites totaling an estimate of over 3 million plants covering about 1941 acres and one new site in California with approximately 200 plants on about 5 acres. In Nevada, *Phacelia parishii* is known from 12 sites under federal, military, and private management. These populations are found at Baking Powder Flat and north of South Bastian Spring in White Pine County; Desert Lake and Lake Valley in Lincoln County; the White River Valley and Pahrump Valley in Nye County; and Indian Springs Valley and Three Lakes Valley in Clark County. In Nevada, a total of over 37

million plants on 4617 acres has been documented. Potential habitat that has not been surveyed remains in Nevada as well as in California and Arizona. The species commonly occurs in the valley floor within a desert scrub community and in playas on lakebed deposits.

Preliminary review of plants collected from the 11 historical sites of *Phacelia parishii* on the Nevada Test Site suggests that these plants are not *P. parishii*, but an undescribed taxon. This new taxon is closely related to *P. parishii* and *P. beatleyae*. The most distinctive character that separates these three taxa is the morphology of the seeds. Duane Atwood of Brigham Young University, an expert on *Phacelia*, is currently in the process of examining plant specimens of *P. parishii* and other species in the subgenus *Eutoca* for the North American Flora Project. Duane Atwood will make his final determination concerning the status of *P. parishii* on the Nevada Test Site after he reviews the type material as well as other collections of plants that have been identified as *P. parishii*.

Based on current knowledge, *Phacelia parishii* remains a species of conservation concern. Listing the species as threatened or endangered could be avoided by careful monitoring of known sites and minimizing impacts to known populations. The Parish phacelia could possibly be removed from the candidate list by documenting additional populations in its entire range, obtaining more information about the reproductive biology, and developing appropriate management plans and conservation agreements.

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I. CLASSIFICATION AND NOMENCLATURE

Scientific Name: *Phacelia parishii* A. Gray (1883)

Original Publication: Gray, A. 1883. *Proceedings of the American Academy of Arts and Sciences* 19: 88.

Type Specimen: CALIFORNIA, San Bernardino County: dry alkaline lake near Rabbit Springs, May 1882, S. B. & W. F. Parish 1314 (holotype GH; isotypes DS, F, NY, UC, US).

Synonym(s): *Phacelia salina* M. E. Jones (invalid as it was never published).

Vernacular Name(s): Parish phacelia, playa phacelia

Family: Hydrophyllaceae (waterleaf family)

MAJOR GROUPS:	Cronquist (1988)	Thorne (1992)
Class	Magnoliopsida (Dicotyledoneae)	Magnoliopsida (Angiospermae)
Subclass	Asteridae	Magnoliidae (Dicotyledoneae)
Superorder	[Solanaeae?]	Solanaeae
Order	Solanales	Solanales
Suborder	[Polemoniineae?]	Boraginineae

Review of Alternative Taxonomic Treatments:

Preliminary review of plants collected on the Nevada Test Site from 1941 to 1995 that were initially identified as *Phacelia parishii* may not be *P. parishii* but an undescribed taxon. The new taxon is closely related to *P. parishii* and *P. beatleyae*. The seeds of these three species are distinct: the seeds of *P. parishii* are mostly roundish-oblong in shape with shallow pits; the seeds of the new taxon are angular in shape, pointed at the tips and deeply pitted; and the seeds of *P. beatleyae* are angular in shape, round at the tips and deeply pitted. Furthermore, the leaves of *P. beatleyae* are strongly revolute. This is not so in the new taxon nor in *P. parishii*. The stems of *P. beatleyae* and the undescribed taxon are always leafy, but some stems of *P. parishii* can be leafless. Also, the stems of *P. beatleyae* are erect and in the new taxon and *P. parishii* the plants are usually branched. The most significant differences among the species are the seed shape and appearance of the seed coats (See Appendix 2, Figures 1, 2, and 3). The undescribed taxon occurs on the Nevada Test Site, Nellis Air Force Base, and the Desert National Wildlife Refuge. A revision of this group of *Phacelia* is being undertaken by Duane Atwood of Brigham Young University for the Flora of North American Project. The most recent monograph of this group was done by John Thomas Howell in 1943.

II. TAXON HISTORY

1882. First discovered and collected in San Bernardino County, California at Lucerne Dry Lake near Rabbit Springs by S.B. Parish and W.F. Parish in May.
1883. Named and published by Asa Gray.
1891. First collected in Nevada by Marcus Jones near Sunnyside in Nye County.
1941. Collection at the type location in California was made by Ripley and Barneby at Lucerne Dry Lake, below Rabbit Springs.
1984. Presumed extinct in California (Smith 1984).
1988. Still extinct in California (Smith and Berg 1988).
1989. Rediscovered at a new location in California by Mark Bagley southeast of Coyote Lake in San Bernardino County.
1993. First discovered in Arizona by John Anderson and Marc Baker in Mohave County growing on lakebed

deposits along Burro Creek with the endangered Arizona cliffrose.

1995. Preliminary review of the collections of *Phacelia parishii* from the Nevada Test Site suggest these plants may be a new taxon.

1995. First collected in Inyo County, California in Stewart Valley by the author near the Nevada/California border just southwest of Pahrump, Nevada.

1995. Six new sites discovered in east central and southern Nevada.

III. PRESENT LEGAL OR OTHER FORMAL STATUS

International: The Nature Conservancy (TNC) ranks sensitive taxa at state, national, and global levels on a scale of 1 to 5, 1 being the most vulnerable and 5 the most secure. *Phacelia parishii* has a global rank (G) of 2 and a state (S) rank of 1 (Morefield and Knight, 1992). Based on the 1995 survey, the author concurs with the current rank of G2S1.

Federal: *Phacelia parishii* until recently was a category-2 candidate for listing as Endangered or Threatened under 16 U.S.C. 1531 *et seq.*, the Endangered Species Act as amended in 1988 (USDI Fish and Wildlife Service 1993, p. 51180).

State: Nevada: no legal status; Northern Nevada Native Plant Society's Delete List (Morefield and Knight 1992). California: CEQA consideration mandatory; California Native Plant Society List 2 R-E-D code 3-3-1 (Skinner and Pavlik 1994).

IV. DESCRIPTION

Non-technical: Low annual, branched at or near the base and more or less spreading; stems up to about 15 cm long; leaves chiefly at or near the base, but sometimes some of them well removed, elliptic or elliptic-ovate in shape, margins entire or coarsely few-toothed; corolla small and inconspicuous, only shortly exceeding the calyx, lavender above a pale yellow base; seeds roundish-oblong, brown or black.

Technical: Low annual, branched at or near the base and more or less spreading; stems up to about 15 cm long, stipitate-glandular or glandular-puberulent; leaves borne chiefly at or near the base, but sometimes some of them well removed, glandular-puberulent and hispidulous, with elliptic or elliptic-ovate, entire or coarsely few-toothed blade, in well developed plants 1-3 cm long and 0.5-2 cm wide, the petiole shorter than or up to about as long as the blade; naked helicoid cymes terminal (sometimes some of them leaf-opposed), tending to be well removed from the leafy base of the plant, sometimes paired on a common naked peduncle, compact even in fruit, the fruiting pedicels up to about 2 mm long; calyx 3.5-4.5 mm long in flower, 6-7.5 mm in fruit, with relatively broad, oblanceolate to spatulate or spatulate-oblong segments, these at maturity of about the same length but of unequal width, the wider ones ca. 2 mm (or even to 4 mm) wide, all shortly but evidently united at the base; corolla small and inconspicuous, only shortly exceeding the calyx, lavender above an ochroleucous base, tubular-campanulate, 4-6 mm long and about 3 mm wide; stamens included; style 1.5-2 mm long, with short branches; ovules numerous 30-40; fruit surpassed by the calyx; seeds roundish-oblong, more or less numerous, pitted-reticulate, 0.9-1.3 mm long (Cronquist et al. 1984 and modified by Frank Smith).

Field Characters:

Phacelia parishii is most closely related to *Phacelia beatleyae* and the undescribed taxon. *P. parishii* can be separated from similar species that occur in Nevada by the following key (Cronquist et al. 1984, and modified by Frank Smith):

- 1 Ovules and seeds numerous, more than 25.
 - 2 Principal leaves rounded-cordate to somewhat reniform, about as wide as long, usually more or less evidently toothed other *Phacelia* species
 - 2 Principal leaves narrower, evidently longer than wide, variously toothed.
 - 3 Corolla marcescent-persistent; seeds shallowly reticulate-pitted or nearly smooth, 0.3-0.5 mm long..... *Phacelia saxicola*

- 3 Corolla soon deciduous; seeds evidently reticulate-pitted, often more than 0.5 mm long.
- 4 Plants low, very widely branched with the principal leaves at the base.
 - 5 Seeds roundish-oblong and shallowly reticulate pitted *Phacelia parishii*
 - 5 Seeds angular and deeply reticulate pitted *Phacelia sp. nov.*
- 4 Plants more erect (though sometimes bushy-branched) with leaves more or less well distributed along the stems.
 - 6 Leaves, or many of them more or less evidently toothed *Phacelia lemmonii*
 - 6 Leaves all or nearly all entire or nearly so.
 - 7 Leaves strongly revolute; herbage, or at least the stem and petioles, very finely glandular, without longer hairs *Phacelia beatlyae*
 - 7 Leaves not strongly revolute; herbage more loosely glandular hairy *Phacelia incana*

Character states differentiating closely related *Phacelia* taxa from *Phacelia parishii*.

Differential Character State	<i>parishii</i>	<i>beatlyae</i>	sp. nov.
<u>Stems:</u>			
More or less branching at base	+		+
Erect from the base		+	
<u>Basal rosette:</u>			
Lacking		+	
Present	+		+
<u>Seeds:</u>			
Mostly roundish-oblong; 0.9-1.1 mm long	+		
Short angular; round at tips; 0.6-1.0 mm long		+	
Long angular; more pointed at tips; 1.3-1.5 mm long			+
<u>Stem Leaves:</u>			
Upper stem leaves generally petiolate		+	+
Upper stem leaves generally not petiolate	+		

Photographs and Line Drawings:

Photographs of the plant and its habitats are found in Appendix 2, Figures 1 through 9. No other photographs are known to have been published in any other form. Line drawings are published in Cronquist et al. (1984, p.171), Hickman (1993, p 707), Abrams (1951, p.513), Atwood (1976, p.42) and Skinner and Pavlik (1994, p.224). The illustration in Atwood (1976, p.42) appears to be the undescribed taxon. A line drawing is presented in Appendix 2, Figure 10.

V. SIGNIFICANCE OF TAXON

Natural: *Phacelia parishii* is unique in its ability to survive in extreme environmental conditions such as high temperatures, poor soil quality, and periodic high water content. The species grows in habitats where the surface of the soil can be saturated with water for extended periods of time. Plants only germinate when there is sufficient precipitation. Time and duration of water evaporation and temperature are also critical factors.

Human: *Phacelia parishii* has no documented human significance.

VI. GEOGRAPHIC DISTRIBUTION

Geographic Range: (Appendix 1, Tables 1A-B; Appendix 2, Figure 11) In Nevada, *Phacelia parishii* is known from 12 sites in Baking Powder Flat and north of South Bastian Spring in White Pine County; Desert Lake and Lake Valley in Lincoln County; White River Valley and Pahrump Valley in Nye County; and Indian Springs Valley and Three Lakes Valley in Clark County. In Arizona, the species is found at Red Lake in Mohave County and Burro Creek in Mohave and Yavapai counties. In California, the species has been documented near Coyote Dry Lake, Rabbit Springs, Yermo and Calico in San Bernardino County, and in Stewart Valley in Inyo County. The Rabbit Springs and the Calico locations are thought to be extirpated.

Precise Occurrences:

Historical site(s) rediscovered or recently known extant:

Sites 1-6 were rediscovered and resurveyed for this report. These six sites consist of over 33 million plants on about 2676 acres. See Appendix 1, Table 1A: Sites 1-6; Appendix 2, Figures 12-16.

New site(s) discovered:

Sites 7-12 comprising over 3 million plants on about 1941 acres, were newly discovered and documented for this report. See Appendix 1, Table 1A: Sites 7-12; Appendix 2, Figures 16-19. In California, the author discovered the Parish phacelia in Stewart Valley in Inyo County near the California/Nevada border. This site is comprised of about 200 plants on about 5 acres and is a new county record for the species. See Appendix 1, Table 1B: Site CA5.

Historical site(s) searched for but not rediscovered:

Site 13 was not rediscovered in the city of Las Vegas. This site was surveyed on May 1, 1995 and only a couple of small unidentified *Phacelias* were observed. The author initially thought that these plants may be the undescribed species. The *Phacelia parishii* collection by Patrick Leary in 1979 at this site is deposited at the herbarium at the University of Nevada in Las Vegas. This collection should be re-examined for a final determination. The Marcus Jones collection near Muncy (Site 14) was not relocated due to the vagueness of the sites location description. The area surveyed at Muncy Creek was thought by the author to be very marginal habitat for *P. parishii*. See Appendix 1, Table 1A: Sites 13-14; Appendix 2, Figure 20.

Other site(s) searched where not discovered:

Sites A1-A21, comprising about 4507 acres at an elevation between 2570-5620 feet, were surveyed for this report without encountering *Phacelia parishii*. See Appendix 1, Table 1A: Sites A1-A21.

Historical site(s) known or suspected to be erroneous reports:

Sites B1-B10 and B13 on the Nevada Test Site have been identified as *Phacelia parishii*, but review of various plants collected from these sites suggests that these populations are not *P. parishii* but an undescribed taxon. On May 1, 1995, a site visit to locate *P. parishii* on the Nevada Test Site was made by the author and Kevin Blomquist of EG&G Energy Measurements. Plants observed appeared not to be *P. parishii*, but the undescribed taxon. The collection of the Parish phacelia by Rupert Barneby #2917 (CAS, RSA) at Site B11 on a arid gravelly slope of the Pintwater Range may also be the new taxon, since

P. parishii is generally not found growing on gravelly soils. In May of 1941, Alice Eastwood and John Thomas Howell (Site B12) collected *P. parishii* (Specimen at UTC) near Las Vegas. This collection was past flowering but contained mature seeds. The seeds of this collection match those of the undescribed taxon. Site B14 located on the east side of Hot Creek Valley is also probably a misidentification as *P. parishii*. Duane Atwood of Brigham Young University is in the process of examining plant specimens of *P. parishii* and species that are closely related in an attempt to resolve the taxonomic status of the Parish phacelia. See Appendix 1: Table 1C.

Historical site(s) known or assumed extirpated: In California, sites CA1 at Rabbit Springs and CA2 at Calico are thought to be extirpated. See Appendix 1: Table 1B; Sites CA1 and CA2.

Historical site(s) where present status unknown: In Nevada, the Hiko (RSA herbarium, Ripley and Barneby collection #3475) and Caliente (RSA herbarium, Ripley and Barneby collection #3496; Pomona College, Jones collection #4/29/04) (WESTEC 1980), sites have not been relocated.

Potential site(s) meriting future field surveys:

Twelve known locations of *Phacelia parishii* should be resurveyed in an effort to extend the existing location boundaries. Areas in the vicinities of the known populations may yield new populations. Also, the Hiko and Caliente areas should be surveyed to relocate previously documented populations of the Parish phacelia. The sites that were searched for this report where no plants were found may be capable of supporting *P. parishii* if growing conditions were optimum.

Biogeography and Phylogeny:

The genus *Phacelia* comprises about 150 species native to the New World, best developed in the western United States and northern Mexico (Cronquist et al. 1984). The most recent monograph places *Phacelia parishii* in the subgenus *Eutoca* (Howell 1943). This subgenus is characterized by plants chiefly annual (3 species perennial) with leaves entire to shallowly lobed, corollas tubular or tubular-campanulate, stamens shorter than the corolla, style bifid or at most parted 1/3 its length, and capsule generally elliptic or oblong and obtuse or truncate below the terminal apiculation. In Nevada, the nearest relatives of *P. parishii* are *Phacelia beatleyae* and the undescribed taxon.

VII. HABITAT CHARACTERISTICS

Environment and Habitat Summary:

In Nevada, *Phacelia parishii* occurs on playas and in the valley floors in desert scrub communities on lakebed deposits. The elevations range from 2560 to 5605 feet. In Arizona, the species is found growing on outcrops of gypsum and a playa (Anderson 1995). The California sites have been documented on playas and the valley floor. These habitats are mostly barren with few associated species. Generally *P. parishii* is the dominant species. In Nevada, the vegetation at *P. parishii* sites consists of shrubs and annual forbs and grasses. Commonly associated species include *Atriplex confertifolia*, *Atriplex canescens*, *Sarcobatus vermiculatus*, *Bromus rubens*, *Poa nevadensis*, *Phacelia fremontii*, and *Monolepis nuttalliana*.

Physical Characteristics:

Physiography: The species occurs in the Great Basin Section (Nevada and California), Mohave Desert Section (California), and Mexican Highland Section (Arizona) of the Basin and Range Province. The subdivisions within the Great Basin Section include the Central Area and the Southern Area. The Central Area is characterized by having valleys that are over 5000 feet in elevation. The Southern Area resembles the Central Area but is lower, both structurally and topographically (Hunt 1974).

Climate: The following temperature and precipitation data are from the Pahrump and Sunnyside climatic stations. The Sunnyside Station represents the climate for the northern sites, and the Pahrump Station represents climate for the southern sites of *Phacelia parishii*. The climatic records are from 1948 to 1961, and were supplied by the Utah Climate Center at Utah State University.

The Sunnyside Station occurs in White River Valley in northeastern Nevada, and is at an elevation of 5300 feet. At the station, the average maximum temperature is 66.5°F and the average minimum temperature is 33.2°F. The highest daily temperature recorded was 104°F, and the lowest daily temperature was -20°F. The average annual precipitation is 9.44 inches. The greatest annual precipitation was 17.11 inches and the least annual was 5.73 inches. The greatest daily precipitation was 1.53 inches and occurred in July of 1979.

The Pahrump Station occurs in Pahrump Valley in southern Nevada at an elevation of 2670 feet. At the station, the average maximum temperature is 78.6°F and the average minimum temperature is 44.9°F. The highest daily temperature was recorded at 115°F, and the lowest daily temperature was -2°F. The average annual precipitation is 4.78 inches. The greatest annual precipitation was 9.12 inches and the least annual was 1.58 inches. The greatest daily precipitation was 2.40 inches and occurred in February of 1979.

Geology: The *Phacelia parishii* sites are found in the valley floor on lakebed deposits and playas.

Soils: Three soil samples were collected in 1995 at known sites of *Phacelia parishii*. These were analyzed at Utah State University Analytical Laboratories. A sample was collected from the surface down to approximately 10 inches in depth.

The following is the result of the 1995 soil tests. The electrical conductivity is measured in mmhos/cm.

SITE	PERCENT ESTIMATED					pH	EC (mmhos/cm)
	>2mm	Sand	Silt	Clay	Texture		
1	0	4	39	57	Clay	8.5	1.6
5	0	3	37	60	Clay	9.2	1.4
7	0	4	39	57	Clay	8.1	21.0

SITE	Sodium Adsorption Ratio	Ca	Mg	Na
		meq/L		
1	4.4	1.7	1.8	6.4
5	31.9	0.2	0.1	13.4
7	18.5	34.8	20.1	83.8

Hydrology: Based on observation, *Phacelia parishii* grows on lakebed deposits that are vernal saturated. For *P. parishii* to grow, the water must be at the surface for a specific amount of time. After the water evaporates, the plants then germinate and grow.

Geomorphology: In Nevada, the species occurs on playas that are flat and level and barren, and on lakebed deposits that are flat and hummocking.

Aspect and slope: Plants grow mostly on open sites which are flat, but they also may occur on gentle slopes. Aspect does not appear to be a primary habitat factor for *Phacelia parishii*.

Biological Characteristics:

Community physiognomy: At the playa sites which are flat and level, the plant cover was mostly *Phacelia parishii*. The shrub, grass and forb component is very sparse and is generally concentrated in small areas on the playa. The grasses and forbs that occur are annual species.

In the greasewood/shadscale, fourwing saltbush, and shadscale communities, the plant composition is mostly a shrub cover, with a low percent of forbs and grasses. All the forbs observed in the community were annual species. The grass species in the Mohave Desert were all annuals and in the Great Basin the grasses associated with Parish phacelia were all perennials.

The Rocky Mountain juniper site (See Appendix 2, Site 11, Figure 19) is composed of scattered juniper with a shrub and herbaceous layer. The herbaceous layer is dominated by grass species with few forb species.

Vegetation type: The species occurred in a fourwing saltbush community at Sites 1 and 7. At Sites 2, 3, 4, and 9, the plants were growing on a playa. *Phacelia parishii* was found in a shadscale community at Sites 7 and 8. The species was also found growing in a greasewood/shadscale community at Sites 5, 6, 10, and 12. At Site 11, the plants occur in association with scattered swamp cedar, a rare ecotype of Rocky Mountain juniper.

Associated species: Appendix 1, Table 2 provides a list of plant species observed at known sites of the Parish phacelia. The common shrubs include *Atriplex canescens*, *Atriplex confertifolia*, and *Sarcobatus vermiculatus*. Common grasses include *Bromus rubens*, *Elymus elymoides*, and *Poa nevadensis*. Some common forbs include *Atriplex argentea*, *Descurainia* sp., *Lappula* sp., *Lepidium flavum*, *Monolepis nuttalliana*, *Phacelia fremontii*, and *Plagiobothrys salsus*.

In California, at the Coyote Dry Lake site the most common plants found in association with *Phacelia parishii* are *Atriplex argentea* and *Monolepis nuttalliana*. Other annual species present included *Phacelia pachyphylla*, *Schismus* sp., *Plantago insularis*, *Gilia* sp., *Camissonia* sp., and *Lepidium flavum* (Rutherford and Bransfield 1991).

In Arizona, at Burro Creek on the foothill gypsum outcrops the common annual associates include *Chaenactis fremontii*, *Eriogonum depressum*, and *Monolepis nuttalliana*. At Red Lake on the playa the Parish phacelia occurs with *Atriplex canescens* and the annuals *Atriplex argentea* and *Monolepis nuttalliana* (Anderson 1995).

Other endangered, threatened, and sensitive species: One new population of *Asclepias eastwoodiana* was discovered during the survey of this report. The species was found near a *Frasera gypsicola* population west of Sunnyside in Nye County. For the names and status of other sensitive species occurring with or near *Phacelia parishii*, contact the Nevada Natural Heritage Program.

Land Management: In Nevada, *Phacelia parishii* occurs on private, state, Department of Defense (Nellis Air Force Bombing and Gunnery Range), U.S. Fish and Wildlife Service, and Bureau of Land Management land. See Appendix 1, Table 1A for specific ownership at each site.

The Bureau of Land Management manages its lands under the multiple use concept. The Ely and Las Vegas

District offices are responsible for the rare plants which occur on lands within their jurisdiction. The state lands (Wayne Kirsch Wildlife Management Area) are managed for waterfowl and fisheries. The Nevada Division of Forestry is responsible for rare plants on state lands. The private lands are managed for livestock use and land development. The Department of Defense (Nellis Air Force Bombing and Gunnery Ranges) manages its lands for military activities. The Desert National Wildlife Refuge is managed by the U.S. Fish and Wildlife Service for recreation use and hunting. The U.S. Fish and Wildlife Service and Nellis Air Force Base are jointly responsible for the rare plants which occur on land that is owned and managed by both agencies.

VIII. BIOLOGY

Population Summary: In Nevada, *Phacelia parishii* is known from Clark, Nye, Lincoln, and White Pine counties. The species is found in the Mohave and Great Basin Deserts and occurs on playas and in the valley floors on lakebed deposits, with elevations ranging from 2494 to 5750 feet. Twelve sites were documented during the 1995 survey covering a total area of about 4617 acres. Sites ranged from a low of about 20,000 plants (Site 4) to a maximum of over 30 million individuals (Site 2). The total population documented was well over 35 million plants.

In Arizona, the species is found at one site in Red Lake and three sites at Burro Creek in Mohave and Yavapai counties. John Anderson of the Bureau of Land Management in Arizona documented over 50,000 individuals at Burro Creek, but only 200 individual plants at Red Lake were documented during the 1995 field season. Sites ranged in elevation from 2300 to 2760 feet.

In California, the species has been documented at four sites in San Bernardino County and one site in Inyo County. The San Bernardino populations include Rabbit Springs in Lucerne Valley, Waterman's near Calico, in the vicinity of Yermo, and south Fort Irwin near Coyote Lake. The Inyo County site is located in Stewart Valley. The species was thought to be extirpated in California until it was rediscovered by Mark Bagley in 1989 south of Fort Irwin near Coyote Lake. Bagley documented several thousand plants occurring in dense patches scattered over a playa on about 5 acres. The U.S. Fish and Wildlife Service conducted a survey in 1991 and expanded the Coyote Dry Lake site. The population was estimated to be 200 million plants on about 247 acres (Rutherford and Bransfield 1991). In 1993, a new site was discovered on the "Powerline road near Surprise Canyon road off-ramp, Yermo, California" (RSA herbarium, accession #562325 taken from Blomquist et al. 1995). No information is available on number of individual plants and acreage. In 1995, the author discovered the Parish phacelia in Stewart Valley in Inyo County, California. This population consists of about 200 individual plants on about 5 acres.

Demography: No long-term monitoring has been conducted for *Phacelia parishii* populations to determine demographic trends. In June of 1979, Bertrand Harrison and Kaye Thorne documented several thousand plants at Site 5 in White River Valley. In June of 1995 the author and Michael Curto found over 20,000 plants at this location. At the same time, the author and Michael Curto estimated over one million plants at the Site 6 in Lake Valley. Bertrand Harrison had previously documented only 67 plants at this site. The large discrepancy in numbers of individual plants at these two sites is probably due to the fact that the survey that was conducted in 1995 was very extensive and thorough. See Appendix 1, Table A1 for number of individual plants found at each site.

In California, at site CA1 Mark Bagley documented several thousand plants on about 5 acres in April of 1989. In April of 1991 the site was revisited by Connie Rutherford and Ray Bransfield of the U.S. Fish and Wildlife Service and they estimated the population to be over 200 million plants on about 247 acres. It is probable that only a fraction of the plants produced seed (pers. comm. Rutherford 1997). Rutherford and Bransfield expanded the size of the population by about 242 acres.

Phenology: Plants are in flower from April to July. In the Mohave Desert flowering occurs from April to May, and in the Great Basin Desert plants flower from May to July. By late April at Sites 1, 2, 7, and 8 plants in the Mohave Desert were about 95 percent in fruit and 5 percent in flower. In early June at sites 3,4,5,6 and 10 in the Great Basin Desert, plants were about 50 percent in bud and 50 percent in the flowering stage.

Reproduction and Dispersal: There has been no study of the reproductive biology of the species. The species reproduces sexually and depends on the wind and rain for seed dispersal.

On April 21, 1995, several bees were collected on the Parish phacelia that may play a role in the pollination of the species in Pahrump Valley (Site 1). The bees were all identified as *Proteriades (Hoplitina) mojavensis* (Michener) by Terry Griswold, USDA, Bee Biology and Systematics, Utah State University. Also, moths were seen at the Indian Springs Valley population (Site 5). They may play some role in the pollination of the species.

Hybridization: None known.

Pathology: None observed.

Predation: At Pahrump Valley (Site 1), Indian Springs Valley (Site 2) and Desert Lake (Site 3) caterpillars were feeding on the flowers and fruits. Moths were observed at the Indian Springs Valley (Site 2) and may also be feeding on the plants.

Competition: At Site 5 in Lake Valley the non-native grass *Elymus junceus* was spreading into a small portion of the *Phacelia parishii* habitat. At the present time *E. junceus* is restricted to a relatively small area. This site should be monitored on an annual basis to determine if *E. junceus* should be controlled or possibly eradicated while it still is found in low numbers.

Other Interactions: None noted.

IX. EVIDENCE OF THREATS TO SURVIVAL

Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range: In Pahrump Valley, Sites 1, 7, and 8 are all or partially privately owned and the Parish phacelia could be affected by land developments. In Indian Springs Valley (Site 2), the largest known population, and Three Lakes Valley (Site 9) military activity such as tank maneuvers or bombing missions on the playas could have a negative impact on the species. A potential threat to all of the sites may be off-road vehicle use, either for recreation or agricultural use. Vehicle tracks were observed at sites 2, 3, and 7. Cattle signs were present at some of the sites, but there did not appear to be an impact on the species. At Site 2 in Indian Springs Valley numerous plants were growing in the tire tracks. In some situations disturbance may enhance germination and growth.

In California, at Site CA4 near Coyote Lake military activity originating at Fort Irwin could possibly be detrimental to the survival of the species. Potential threats at this site include habitat destruction by tanks and other heavy vehicles during training exercises (Bagley 1989, Rutherford and Bransfield 1991). The population occurs near a major dirt road used by the military which could alter the surface hydrology, which in turn could affect the existence of the species (pers. comm. Rutherford 1995). In 1996, after the winter rains, ORV activity was observed by Raymond Bransfield of the U.S. Fish and Wildlife Service on the playa and it is unsure if the activity was recreational or military (pers. comm. Bransfield 1997).

In Arizona, at Site AZ2 along the south side of Burro Creek most of the plants are growing on gypsum outcrops that have been impacted by mining exploration in the past with bulldozed slopes, scrapes, and pits (Anderson 1995).

Over-utilization for Commercial, Recreational, Scientific, or Educational Purposes: None known.

Disease or Predation: Caterpillar predation was evident at Pahrump Valley (Site 1), Indian Springs Valley (Site 2), and at Desert Lake (Site 3) on the flowers and fruits as well as the leaves of the plant. Also moths were observed at Site 2.

Inadequacy of Existing Regulatory Mechanisms: No enforceable protective designations, conservation

agreements, or approved management plans are known to exist for *Phacelia parishii* or its habitat. Unless it is listed as Endangered or Threatened (50 CFR 17.61, 17.71) and occurs within federal jurisdiction, a plant has no formal protection under the federal Endangered Species Act (ESA), except for regulatory determinations by some federal land management agencies (Forest Service, BLM) that candidate species will be managed as if they were listed. No federal protection currently extends to plants under non-federal jurisdiction unless they are listed as Endangered and removing, cutting, digging up, damaging, or destroying them would be "in knowing violation of any law or regulation of any state or . . . of a state criminal trespass law" [ESA Sect. 9(a)2(B)], and unless that law extended to non-federal jurisdictions. It should also be noted that the Endangered Species Act, and federal regulations and policies implementing it, are in direct conflict with provisions of the 1872 mining law, and are therefore of uncertain protective value when mineral-related projects are involved.

Phacelia parishii is not listed as "Critically Endangered" under Nevada Revised Statute (NRS) 527.270. Such listing provides that ". . . no member of its kind may be removed or destroyed at any time by any means except under special permit issued by the state forester firewarden" on any lands in Nevada. The adequacy of this law, however, depends on informed and cooperative landowners, or on some form of deterrent enforcement. Such enforcement does not now exist. It also depends on the state forester firewarden's discretion in issuing or withholding permits, and in placing protective conditions on permits that are issued. To date, very few requests for such permits are known to have been denied. Nevada law does not require the continued survival of any plant species which it declares to be in danger of extinction.

USDI Bureau of Land Management policy provides that the agency "shall carry out management, consistent with the principles of multiple use, for the conservation of candidate species and their habitats and shall ensure that actions authorized, funded, or carried out do not contribute to the need to list any of these species as Threatened or Endangered." If *Phacelia parishii* occurred entirely on federal lands, BLM policy would further require that the candidate species be included as a priority species in land use plans, and that range-wide or site-specific management plans be prepared "that identify specific habitat and population management objectives designed for recovery, as well as the management strategies necessary to meet those objectives" (BLM Manual Section 6840).

Other Natural or Man-made Factors: The main threats to the Parish phacelia are the lack of adequate precipitation during the growing season and major land disturbances. Local droughts longer than seed viability may lead to local extinction. It is unknown how long seed viability is for the Parish phacelia in the soil. At present, no data are available on the life history stages such as germination and establishment for the species.

X. GENERAL ASSESSMENT AND RECOMMENDATIONS

General Assessment: *Phacelia parishii* is known from 12 populations in Nevada. Populations have been documented in Clark, Lincoln, Nye, and White Pine counties. The species occurs both in the Mohave Desert and the Great Basin Desert. In the Mohave Desert five populations have been found consisting of over 30 million plants on about 3107 acres. The seven populations in the Great Basin Desert consist of over 3 million plants on about 1510 acres. The total number of individual plants is over 37 million. The total acreage of all twelve sites is about 4617 acres.

In California, *Phacelia parishii* is found in the Mohave Desert. There are two sites in San Bernardino County and one site in Inyo County that are extant. Two sites previously documented in San Bernardino County (Rabbit Springs in Lucerne Valley and Waterman's near Calico) are believed to be extirpated. The total number of plants that has been documented at the Coyote Lake site in San Bernardino County and the Stewart Valley site in Inyo County is over 200 million plants. The total acreage for these sites is about 252. The acreage and plant numbers are unknown for the Yermo site.

In Arizona, there are four sites in Mohave and Yavapai counties. The species occurs at Red Lake in the Mohave Desert, and three sites are found at Burro Creek at the northern edge of the Sonoran Desert. The total number of individual plants is over 50,000. The total acreage of these sites is about 49.

Globally there are 21 known sites of *Phacelia parishii* consisting over 200 million plants on about 4869 acres. *P. parishii* is an annual species and the number of individual plants varies from year to year depending on the timing and the amount of precipitation. The potential of discovering new populations in Nevada as well as in Arizona and California remains.

Though *Phacelia parishii* was quite abundant during the 1995 survey, the number of individuals is not always a good indicator of the continued existence of the species. A very low percentage of the plants at the sites in the Mohave Desert (Sites 1, 2, 7, 8 & 9) completed their entire life cycles. Of the 30 million plants probably only one million actually produced seed to help to restore the seed bank. It may take years for the populations to restore the seed bank to produce millions of plants again. The species appeared to have a very high mortality rate--many plants made it to the flowering and seedling stages but no fruits were produced. Caterpillar predation, hot/cold temperatures, and the drying out of plants by wind were possible factors in the poor reproductive success of the species. Because the numbers of annual species can vary greatly from year to year, the total acreage of habitat is a more important gauge of population level (Anderson 1995). It is difficult to assess the vigor and trends of populations of *P. parishii* without understanding the life history of the species.

Plants on the Nevada Test Site (NTS) that have previously been identified as *Phacelia parishii* now appear to be an undescribed taxon. Seeds that were sent to the author by Kevin Blomquist of EG&G Energy Measurements from a *P. parishii* location on the NTS match the seed characteristics of the undescribed taxon collected during the 1995 survey at Desert Lake and Three Lakes Valley. For the present time it is assumed all the locations identified as the Parish phacelia on the NTS are populations of an undescribed *Phacelia*. Duane Atwood of Brigham Young University is currently in the process on reviewing the *Eutoca* group of phacelias. He has examined plant material of the new taxon, and his initial thoughts are that it is a new taxon. Before he makes a final determination he wants to look at all the species in the group. The present distribution of the undescribed taxon is the NTS in Nye County, Nellis Air Force Range/Desert National Wildlife Refuge in Clark County, and the Desert National Wildlife Refuge in Lincoln County. This plant occurs in the Mohave Desert and in a transitional area of the Mohave and Great Basin Deserts in Nevada.

Currently there are no legal provisions for protection of *Phacelia parishii*, but with proper management the species' continued existence should be ensured. Military activity and land development are the most probable human-made threats to the species while the most evident natural threats to the survival of the species are environmental factors such as timing and amount of precipitation, temperature, light, and substrate removal. Most populations occur on federal lands where protection of the habitat can occur through conservation agreements among the managing agencies.

Status Recommendations: *Phacelia parishii* is currently classified as a category-2 candidate species for listing by the U.S. Fish and Wildlife Service and is considered globally vulnerable by The Nature Conservancy. The plant is on the Watch List of the Northern Nevada Native Plant Society and is on List 2 of the California Native Plant Society with R-E-D code of 3-3-1.

Based on this survey the author recommends that the federal status be retained as category-2 candidate. Most populations surveyed this year are stable, but there are some potential threats such as housing and/or industrial development in Pahrump Valley (Sites 1,7, and 8) and military activity at Nellis Air Force Base (Site 3) where the largest known population of over 30 million individual plants occurs.

Critical Habitat Recommendations: None. If critical habitat were ever designated through the provisions of the Endangered Species Act, it should include all of the sites (see Appendix 2, Figures 12-19). It is recommended that this critical habitat not be formally designated if it would subject *Phacelia parishii* to increased threats to its survival.

Conservation and Recovery Recommendations:

1. A formal conservation agreement should be made between the Bureau of Land Management, Department of Defense, U.S. Fish and Wildlife Service, and the Nevada Division of Wildlife as well as other interested parties such as The Nature Conservancy and the Northern Nevada Native Plant Society to ensure no further destruction of

the species and its habitat. A habitat management plan should be developed for the existing populations.

2. All 12 Nevada populations should be evaluated on an annual basis to monitor impacts or disturbances to the species.
3. A monitoring effort should be established to study the biology and ecology of the species. Some possible areas of study are soil requirements, seed production, genetic structure, spatial distribution, seed dispersal, seed bank composition/dynamics, seed bank ecology, plant community structure and seed viability. Permanent plots should be established at the sites of study.
4. A study should be undertaken to determine the nature and role of pollinators in the reproductive success of the species.
5. Efforts to inventory potential unsearched habitat for new populations of *Phacelia parishii* should continue.
6. Private landowners should be informed of the importance of protecting the species.
7. A phylogenetic study should be conducted to determine the relationship between *Phacelia parishii* and other species such as *Phacelia beatleyae* and the undescribed *Phacelia*.
8. A determination of the taxonomic status of the plants identified as *Phacelia parishii* on the Nevada Test Site should be conducted.

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 Third Butte West, Nevada (1986 provisional edition)
 White Blotch Springs NE, Nevada (1987 provisional edition)
 Yelland Dry Lake, Nevada (1986 provisional edition)

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 Quinn Canyon Range, Nevada (1978), BLM, Planimetric Series, Surface-Minerals Management Status
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BLM 1:500,000 Topographic Series, Surface Management Status: Nevada (State of) (1990)

Field Research: 22 April-1 May 1995, 6 May-7 May 1995, 13 May 1995, 15 May-17 May 1995, 28 May 1995, 14 June-17 June 1995, 24 June 1995, 4 September-7 September 1995.

Specimens:

Site Number and Name	Collector and Number	Date	Disposition*
1 Lesile & Mesquite	<i>Smith 3850</i>	25 April 1995	UTC
2 Indian Springs Valley	<i>Smith 3856 & Watkins</i>	29 April 1995	UTC
3 Desert Lake	<i>Smith 3846 & Schofield</i>	22 April 1995	UTC
	<i>Smith 3855 & Sheldon</i>	23 April 1995	UTC
	<i>Smith 3881 & Ackerman</i>	16 May 1995	UTC
	<i>Curto 1313 & Smith</i>	13 June 1995	UTC
4 White River Valley	<i>Barneby 14405</i>	10 June 1966	UTC
	<i>Williams 78-161-5</i>	27 June 1978	UTC
	<i>Harrison & Thorne 13212</i>	17 August 1979	UTC
	<i>Harrison & Thorne 13152</i>	5 June 1979	UTC

Site Number and Name	Collector and Number	Date	Disposition*
5 Lake Valley	<i>Curto 1324 & Smith</i>	15 June 1995	UTC
	<i>Smith 3904 & Curto</i>	15 June 1995	UTC
	<i>Smith 3905 & Curto</i>	15 June 1995	UTC
6 Baking Powder Flat	<i>Tiehm & Williams 7206</i>	17 June 1982	UTC
	<i>Curto 1326 & Smith</i>	15 June 1995	UTC
	<i>Smith 3906 & Curto</i>	15 June 1995	UTC
7 Pahrump Valley	<i>Smith 3851</i>	26 April 1995	UTC
8 Pahrump Valley	<i>Smith 3853</i>	26 April 1995	UTC
9 Three Lakes Valley	<i>Smith 3857 & Watkins</i>	30 April 1995	UTC
	<i>Smith 3865 & Watkins</i>	13 May 1995	UTC
10 Lake Valley	<i>Smith 3905 & Curto</i>	15 June 1995	UTC

* Abbreviations according to Holmgren et al. 1990.

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Table 1A. Actual and potential sites searched for *Phacelia parishii* in Nevada.

Site#	NV EO	Fig	Site Name, Map Quadrangle (yr), Legal Description	Est. Acres	Elevation Range (ft)	Est. Plants	Land Mgmt*
<u>SITES WHERE PHACELIA PARISHII WERE REDISCOVERED</u>							
1	001	12	Leslie & Mesquite, Sixmile Spring Quad (1984) Nye Co., T19S R53E S31/32	1.2	2572	500,000	p
2	002	13	Indian Springs Valley, Indian Springs NW Quad (1973), Heavens Well (1973), Quartz Peak SW Quad (1973) Clark Co., T14S R56E S10/11/14/15/22/23/24/26/27	1388	3014-3020	30 million	dr
3	003 015	14	Desert Lake, Mule Deer Ridge NW Quad (1969) Lincoln Co., T11S R60E S25/36	73	3206-3210	300,000	r
4	004	12	White River Valley, Sunnyside Quad (1969) Nye Co., T7N R61E S26/35	86	5164-5170	20,000	es
5	005	15	Lake Valley, Gouge Eye Well Quad (1973), Milk Ranch Spring Quad (1978) Lincoln Co., T9N R65E S36 Lincoln Co., T8N R65E S1/12	709	5915-5922	1 million	ep
6	006	16	Baking Powder Flat, Baking Powder Flat Quad (1986) White Pine Co., T12N R67E S20/21/29	384	5750	2 million	e
<u>NEW SITES WHERE PHACELIA PARISHII WERE DISCOVERED</u>							
7	007	17	Pahrump Valley, Sixmile Spring Quad (1984) Nye Co., T20S R52E S23/25/26 Nye Co., T20S R53E S30/31 Nye Co., T21S R52E S25/26	1388	2490-2552	1 million	lp
8	008	16	Pahrump Valley, Sixmile Spring Quad (1984) Nye Co., T20S R53E S33	120	2572-2585	500,000	lp
9	009	18	Three Lakes Valley, Indian Springs SE Quad (1973) Clark Co., T15S R57E S26	186	3035-3039	1 million	dr
10	010	18	Lake Valley, Gouge Eye Well Quad (1973) Lincoln Co., T8N R65E S13/24 Lincoln Co., T8N R66E S18/19	164	5918	700,000	e
11	011	19	N of South Bastian Spring, South Bastian Spring Quad (1986) White Pine Co., T16N R67E S28/29/32/33	72	5598-5605	25,000	ep
12	012	19	North Millick Spring, Yelland Dry Lake (1986) White Pine Co., T17N R67E S25	25	5578-5585	300,000	ep
12	13		---SUBTOTALS---	4596	2490-5922	>37 mil.	epldrs
<u>HISTORICAL SITES SEARCHED FOR BUT NOT REDISCOVERED</u>							
13	013	20	Las Vegas, Las Vegas NW Quad (1967) Clark Co., T20N R61E S7/18	24	2190-2200		p
14	014	20	Muncy, Big Hard Pan Quad (1986) White Pine Co., T20N R66E S13	48	5750		e
2	2		---SUBTOTALS---	72	2190-5750		ep

(continued)

Table 1A (continued). Actual and potential sites searched for *Phacelia parishii* in Nevada.

Site#	NV EO	Fig	Site Name, Map Quadrangle (yr), Legal Description	Est. Acres	Elevation Range (ft)	Est. Plants	Land Mgmt*
<u>OTHER SITES SEARCHED WHERE PHACELIA PARISHII WAS NOT DISCOVERED</u>							
A1		21	Pahrump Valley, Sixmile Spring Quad (1984) Clark Co., T20S R53E S19	8	2570		lp
A2		16	Pahrump Valley, Sixmile Spring Quad (1984) Clark Co., T20S R53E S34 Clark Co., T21S R53E S3/4	23	2607		lp
A3		22	Dry Lake, Dry Lake Quad (1986), Dry Lake NW Quad (1986) Clark Co., T17S R63E S13/24/25 Clark Co., T17S R64E S18/19/20/30	1435	1966-1980		l
A4		21	Dog Bone Lake, Dog Bone Lake South Quad (1973) Clark Co., T13S R58E S9/16	519	3417		d
A5		23	Three Lakes Valley, Dog Bone Lake South Quad (1973) Clark Co., T14S R58E S4/5	70	3460		d
A6		23	Indian Springs Valley, Tim Spring Quad (1973) Clark Co., T13S R56E S13/14/23/24	275	3040		dr
A7		24	Tikaboo Valley, Desert Hills SW Quad (1983) Lincoln Co., T9S R58E S13/24/25	190	3835-3844		d
A8		25	Tikaboo Valley, Desert Hills NW Quad (1983) Lincoln Co., T10S R59E S6/7	39	3867		d
A9		14	Desert Lake, Mule Deer Ridge NW Quad (1969) Lincoln Co., T11S R60E S13/24	128	3205		r
A10		25	Desert Lake, Lower Pahranaagat Lake SW Quad (1969) Lincoln Co., T11S R60E S1/12	57	3205		r
A11		26	Kawich Valley, Lambs Pond Quad (1987), Sundown Reservoir Quad (1988) Nye Co., T5S R51E S13/24 Nye Co., T5S R52E S18/19/20	557	5320		d
A12		26	Kawich Valley, Lambs Pond Quad (1987) Nye Co., T5S R52E S7/8	161	5334		d
A13		27	Sand Spring Valley, White Blotch Springs NE Quad (1987) Lincoln Co., T3S R55E S10	260	4731		l
A14		27	Coal Valley, Murphy Gap SE Quad (1985) Lincoln Co., T1S R60E S17	200	4940-4942		l
A15		12	White River Valley, Sunnyside Quad (1969) Nye Co., T7N R61E S23/26	145	5170-5180		e
A16		28	White River Valley, Moorman Spring SE Quad (1969) Nye Co., T9N R61E S26	76	5275-5285		e
A17		19	N of Bastian Spring, South Bastian Spring Quad (1986) White Pine Co., T16N R67E S33/34	107	5600-5620		e
A18		28	S of Yelland Dry Lake, Yelland Dry Lake Quad (1986) White Pine Co., T16N R67E S33	17	5565		e

(continued)

Table 1A (continued). Actual and potential sites searched for *Phacelia parishii* in Nevada.

Site#	NV EO	Fig	Site Name, Map Quadrangle (yr), Legal Description	Est. Acres	Elevation Range (ft)	Est. Plants	Land Mgmt*
A19		29	Yelland Dry Lake, Sixmile Canyon Quad (1984), Yelland Dry Lake Quad (1993) White Pine Co., T17N R68E S7 White Pine Co., T17N R68E S13/14	143	5550-5600		e
A20		29	Spring Valley, Third Butte West Quad (1986) White Pine Co., T18N R67E S7/8	60	5565-5575		e
A21		30	Spring Valley, Third Butte West Quad (1986) White Pine Co., T18N R67E S10/15	37	5565-5570		e
21			---SUBTOTALS---	4507	1966-5620		eldr
35	9		--- TOTAL SITES EXAMINED ---	9175	1966-5922	>37mil.	epldrs

* Land Management: e = Ely District, BLM; l = Las Vegas District, BLM; d = Department of Defense; r = Desert National Wildlife Refuge; s = state; p = private

NV EO = Element Occurrence number in the Nevada Natural Heritage Program Database.

Fig = Figure in Appendix 2

Table 1B. Arizona and California sites of *Phacelia parishii*.

Site#	Site Name, Map Quadrangle (yr), Legal Description	Est. Acres	Elevation Range (ft)	Est. Plants	Land Mgmt*
<u>SITES OF PHACELIA PARISHII IN ARIZONA</u>					
AZ1	W of Burro Creek, Greyback Mts. Quad (1980) Mohave Co., T14N R11W S1/12	15	2400-2600	>50,000 ^a	k
AZ2	E of Burro Creek, Greyback Mts. Quad (1980) Mohave Co., T14N R10W S5/7/8	7	2300-2360		ps
AZ3	N of Burro Creek, Greyback Mts. Quad (1980) Mohave Co./Yavapai Co., T14N R10W S28/29/31	7	2480-2760		k
AZ4	Red Lake, Red Lake Quad (1968) Mohave Co., T26N R17W S4NWNWSW	20	2755	200	k
4	---TOTAL ARIZONA SITES---	49	2300-2760	>50,000	kps
<u>SITES OF PHACELIA PARISHII IN CALIFORNIA</u>					
CA1	Rabbit Springs ^b , Lucerne Valley Quad San Bernardino Co., T4N R1W S34		2900		u
CA2	Calico ^b , Yermo Quad, Nebo Quad San Bernardino Co., T10N R1E S27		2800		u
CA3	Yermo, San Bernardino Co.,				u
CA4	Coyote Dry Lake, Alvord Mtn. West Quad San Bernardino Co., T11N R3E S27	247	1770	>200 million	t
CA5	Stewart Valley ^c , Sixmile Spring Quad Inyo Co., T24N R58E S26	5	2508	200	u
5	---TOTAL CALIFORNIA SITES---	252	1770-2900	>200 million	ut

* **Land Management:** t = Barstow Resource Area; k = Kingman Resource Area, BLM; p = private; s = state; u = unknown

^a = total population estimate for AZ1 - AZ3

^b = extirpated

^c = county record

Table 1C. Historical sites of *Phacelia parishii* that are known or suspected to be erroneous reports.

Site #	Quad	Last Observed	County	Land Mgmt*	Directions
B1	Specter Range NW	1976-05-05	Nye	e	Nevada Test Site, East Rock Valley. 200m off the NW side of Road 28-03, 1.5 km from Jackass Flats Road. AND White volcanic knolls NW of Rd 28-03, 0.8 mi NE of JTN with Jackass Hwy, E Rock Valley, 3500 ft.
B2	Specter Range NW	1976-05-05	Nye	e	Nevada Test Site, East Rock Valley. 0.35 miles off the SE side of Road 28-03, 1.1 miles from Jackass Flats Road.
B3	Camp Desert Rock	1976-06-02	Nye	e	Nevada Test Site, East Rock Valley. On the old dirt road that branches from the NE side of Jackass Flats Road at a point 2.1 miles NW of "Jakes Junction" and leads north to Road 28-03. Off both sides of this road, 2.4 miles S of road 28-03.
B4	Camp Desert Rock	1976-06-02	Nye	e	Nevada Test Site. On the ridge that separates Mercury Valley from East Rock Valley. On the old dirt road that branches from the NE side of Jackass Flats Road at a point 2.1 miles NW of "Jakes Junction" and leads north to Road 28-03. Off the west side of this road, 3.2 miles S of Road 28-03.
B5	Camp Desert Rock	1976-06-02	Nye	e	Nevada Test Site. On the ridge that separates Mercury Valley from East Rock Valley. On the old dirt road that branches from the NE side of Jackass Flats Road at a point 2.1 miles NW of "Jakes Junction" and leads north to Road 28-03. Off the west side of this road, 3.4 miles S of Road 28-03.
B6	Camp Desert Rock	1976-06-02	Nye	e	Nevada Test Site. On the ridge that separates Mercury Valley from East Rock Valley. On the old dirt road that branches from the NE side of Jackass Flats Road at a point 2.1 miles NW of "Jakes Junction" and leads north to Road 28-03. 0.2 miles off the east side of this road, 3.4 miles S of Road.
B7	Camp Desert Rock	1976-06-08	Nye	e	Nevada Test Site. In the south-western-most part of Frenchman Flat. 0.67 miles ESE of Pink Holes Hill, off the SW and NE side of the dirt road that crossed through the area and leads to an abandoned section of the old Mercury Highway, 3340 ft.
B8	Specter Range NW	1978-04-26	Nye	e	Nevada Test Site. W side of low hills 1.0 mi S of Little Skull Mtn, W of Jackass Flat Road, Rock Valley, 3650 ft. (Presume they used the pass as Little Skull Mtn).

Table 1C (continued). Historical sites of *Phacelia parishii* that are known or suspected to be erroneous reports.

Site #	Quad	Last Observed	County	Land Mgmt*	Directions
B9	Specter Range NW	1978-05-09	Nye	e	Nevada Test Site, Rock Valley. On the east side of the Jackass Highway, 3.7 miles west of Road 28-03.
B10	Mercury	1978-04-28	Nye	e	Nevada Test Site. Southern Frenchman Flat. 1.7 miles NW of Checkpoint Pass on the low hills north of the old Mercury Highway. AND off the E side of Burma Rd, 1.4 mi NW of Mercury Hwy below Mercury Pass, NW slopes of Mercury Ridge-Red Mtn, S Frenchman Flat drainage. 3800 ft.
B11	Tim Spring	1940-04-12	Clark	d	Arid gravelly slope at S base of Pintwater Mtns. 3200 ft.
B12		1941-05-08	Nye	p	Alluvial flats near Las Vegas
B13	Frenchman Lake	1941-05-13	Nye	e	Nevada Test Site, on the southern edge of Frenchman Lake, 3200 ft, site now occupied by a gravel pit (Rhoads 1977). Foothills of Spotted Range, toward Frenchman Flat, 13 mi N of Hwy 95, 3200 ft (Collectors).
B14	Palisade Mesa	1969-06-12	Nye	b	East side of Hot Creek Valley, Palisade Mesa, near Iceberg Spring

* Land Management: b = Battle Mountain District, BLM; d = Department of Defense; e = Department of Energy; p = private

Table 2. Plant species observed at selected sites searched for *Phacelia parishii*.

Life Form Taxon	Average Elevation (ft); Sites:	SITE NUMBERS FROM TABLE 1A								
		2565 1	3017 2	5167 4	5920 5	5750 6	2522 7	3035 9	5602 11	
Trees:										
<i>Juniperus scopulorum</i>										+
Shrubs:										
<i>Artemisia tridentata</i>					+					
<i>Atriplex canescens</i>		+	+		+		+			
<i>Atriplex confertifolia</i>			+	+	+	+	+			+
<i>Chrysothamnus nauseosus</i>					+					
<i>Chrysothamnus</i> sp.										+
<i>Sarcobatus vermiculatus</i>				+		+				+
<i>Suaeda torreyana</i>									+	
Succulents: None										
Graminoids:										
<i>Bromus rubens</i>			+					+	+	
<i>Distichlis spicata</i>				+						+
<i>Elymus cinereus</i>					+					
<i>Elymus elymoides</i>					+	+				+
<i>Elymus junceus</i>					+					
<i>Hordeum murinum</i>		+							+	
<i>Poa nevadensis</i>				+	+	+				+
<i>Puccinellia lemmonii</i>				+						
<i>Sporobolus airoides</i>										+
Forbs:										
<i>Allenrolfea occidentalis</i>				+						
<i>Amsinckia</i> sp.		+								
<i>Atriplex argentea</i>			+					+	+	
<i>Camissonia brevipes</i>								+		
<i>Camissonia claviformis</i>							+			
<i>Cirsium</i> sp.										+
<i>Comandra umbellata</i>										+
<i>Descurainia sophia</i>		+							+	
<i>Gilia</i> sp.										
<i>Hutchinsia procumbens</i>				+						
<i>Iva axillaris</i>										+
<i>Lappula</i> sp.			+						+	

Table 2 (continued). Plant species observed at selected sites searched for *Phacelia parishii*.

		SITE NUMBERS FROM TABLE 1A								
Life Form	Average Elevation (ft):	2565	3017	5167	5920	5750	2522	3035	5602	
Taxon	Sites:	1	2	4	5	6	7	9	11	
(continued)										
Forbs (continued):										
<i>Lepidium flavum</i>		+	+					+		
<i>Lepidium montanum</i>						+				
<i>Lepidium perfoliatum</i>		+								
<i>Mentzelia</i> sp.							+			
<i>Monolepis nuttalliana</i>				+	+	+		+		
<i>Phacelia fremontii</i>		+	+				+	+		
<i>Phacelia lutea</i>					+	+				
<i>Plagiobothrys salsus</i>				+		+				
<i>Thelypodium sagittatum</i>						+				

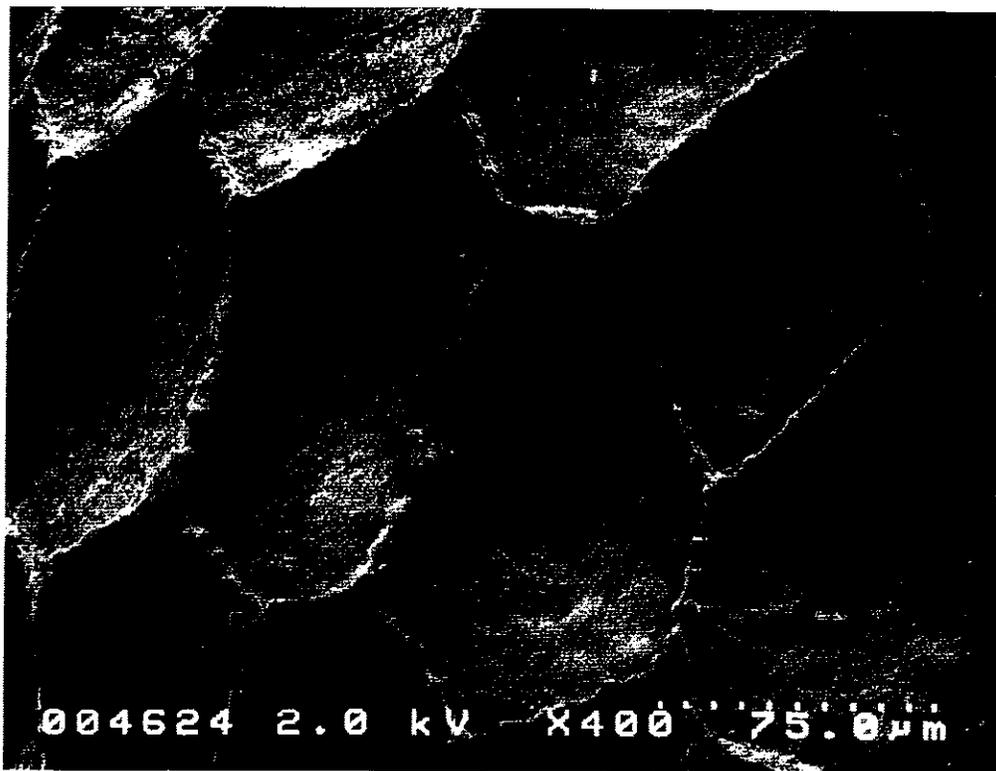


Figure 1. SEM seed micrographs of *Phacelia parishii*. Above, whole seed. Below, seed coat. (William McManus photo).

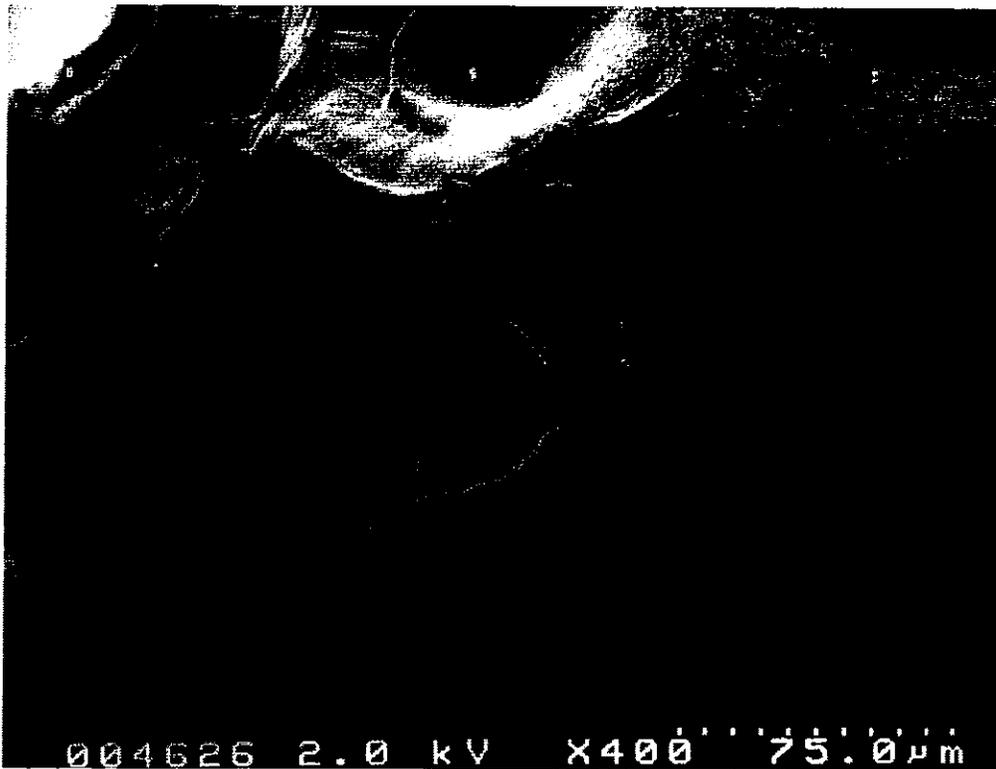


Figure 2. SEM seed micrographs of *Phacelia beatleyae*. Above, whole seed. Below, seed coat. (William McManus photo).

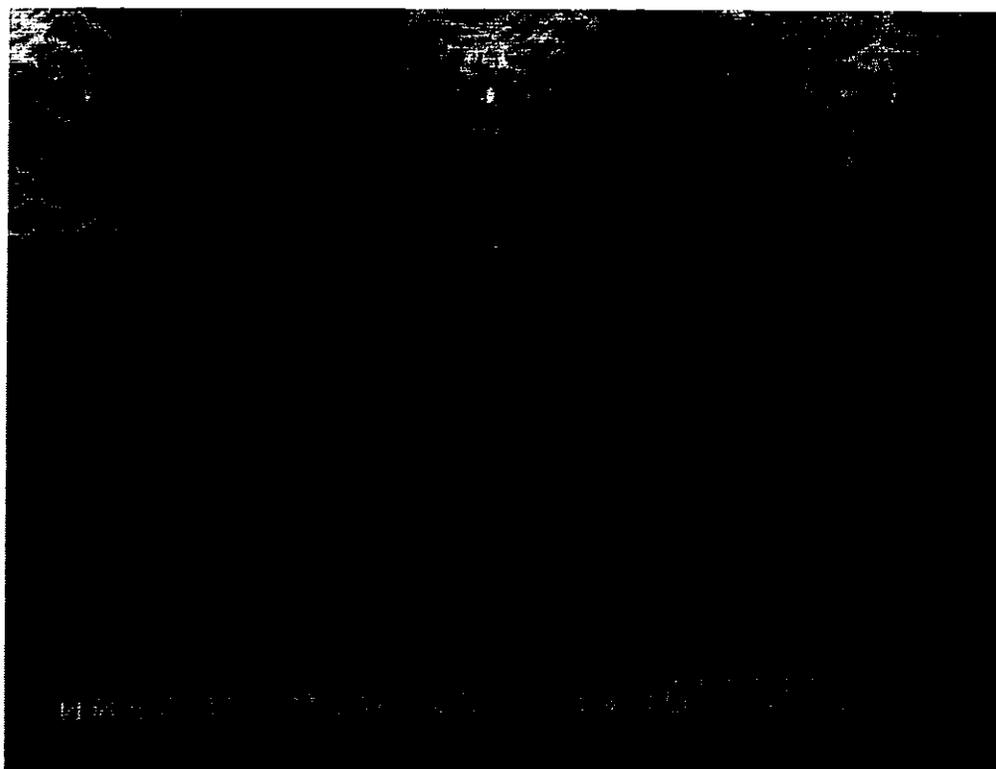


Figure 3. SEM seed micrographs of *Phacelia* sp. nov. Above, whole seed. Below, seed coat. (William McManus photo).



Figure 4. *Phacelia parishii* in flower (Frank Smith photo).



Figure 5. Close-up of flowers of *Phacelia parishii* (Frank Smith photo).

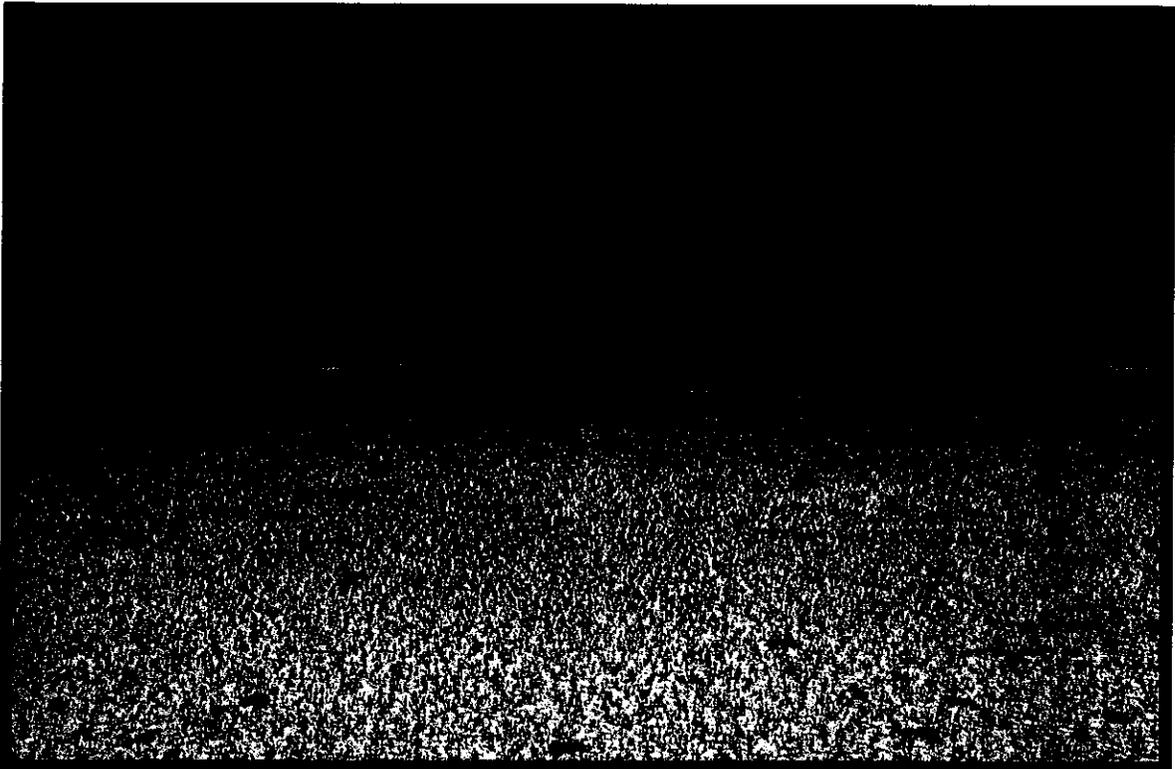


Figure 6. *Phacelia parishii* growing in a playa at Site 2 in Indian Springs Valley (Frank Smith photo).



Figure 7. *Phacelia parishii* growing in a shadscale community at Site 7 in Pahrump Valley (Frank Smith photo).

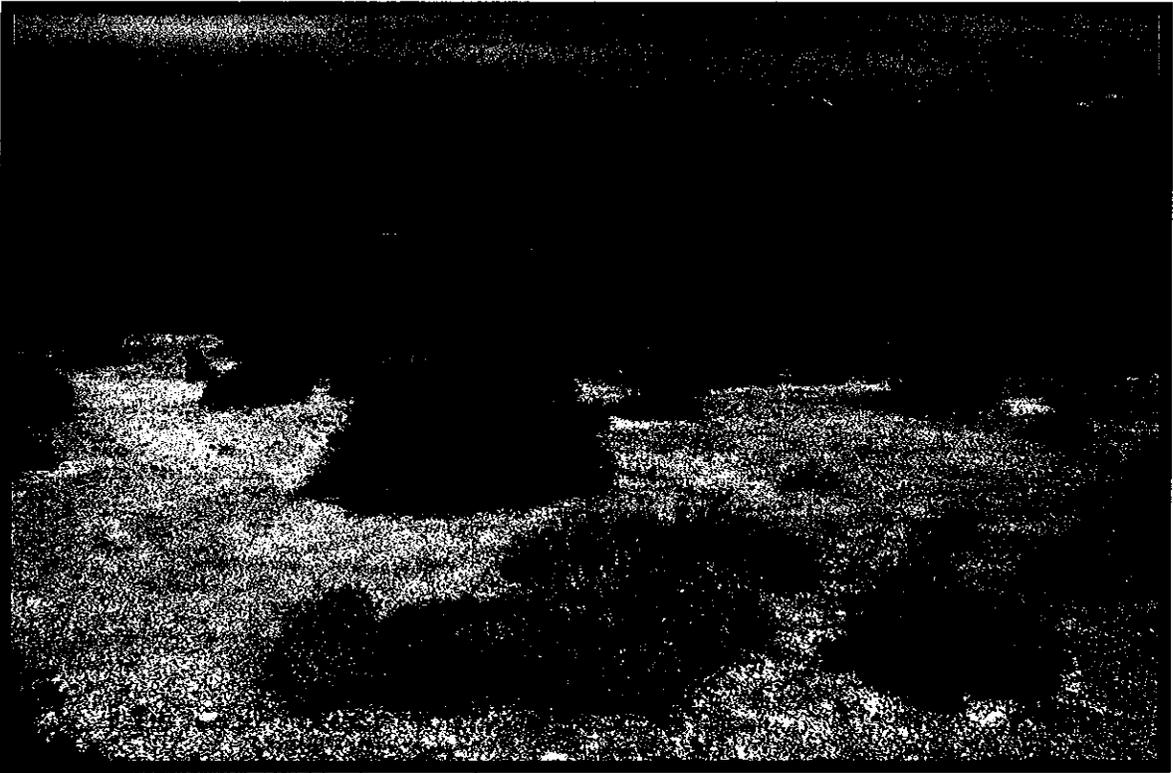


Figure 8. *Phacelia parishii* growing in a greasewood/shadscale community at Site 10 in Lake Valley (Frank Smith photo).



Figure 9. *Phacelia parishii* growing in an ecotype of Rocky Mountain juniper ("swamp cedar") at Site 11 in Spring Valley (Frank Smith photo).

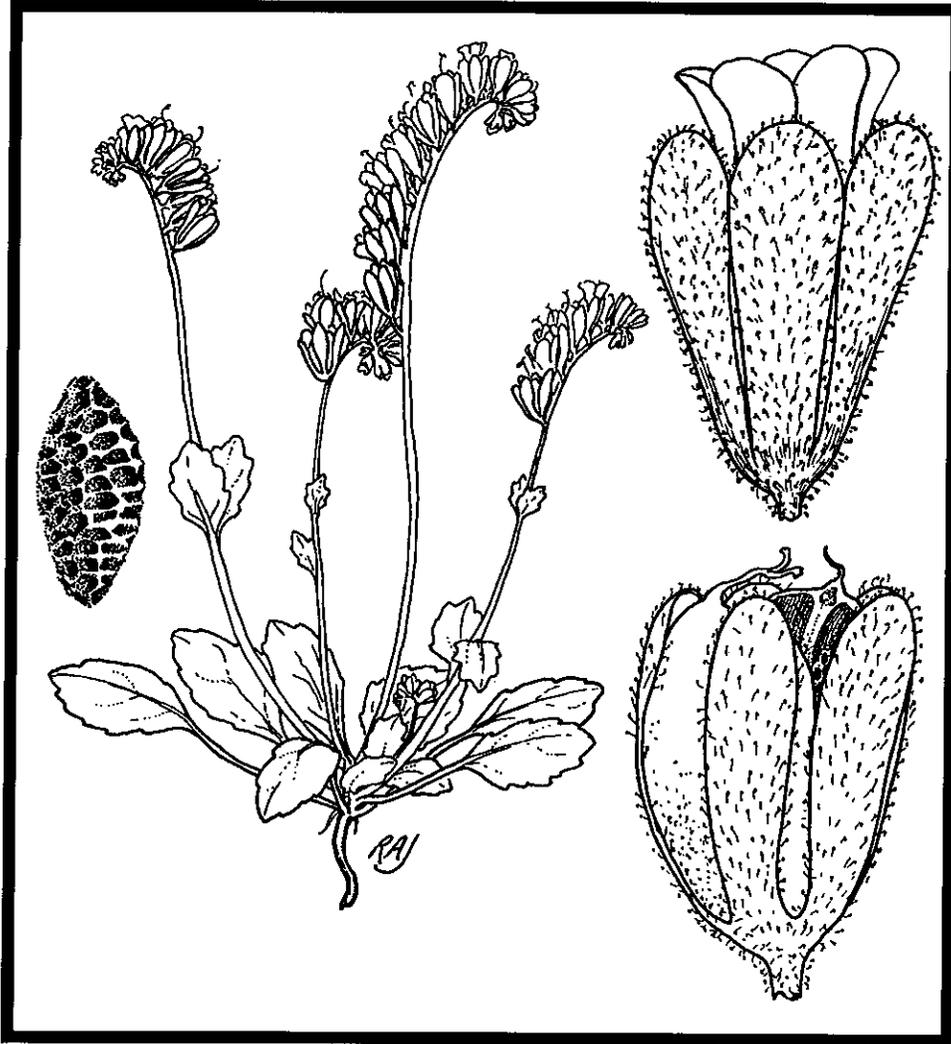


Figure 10. Line drawing of *Phacelia parishii* by Robin Jess (from Cronquist *et al.*, 1984).

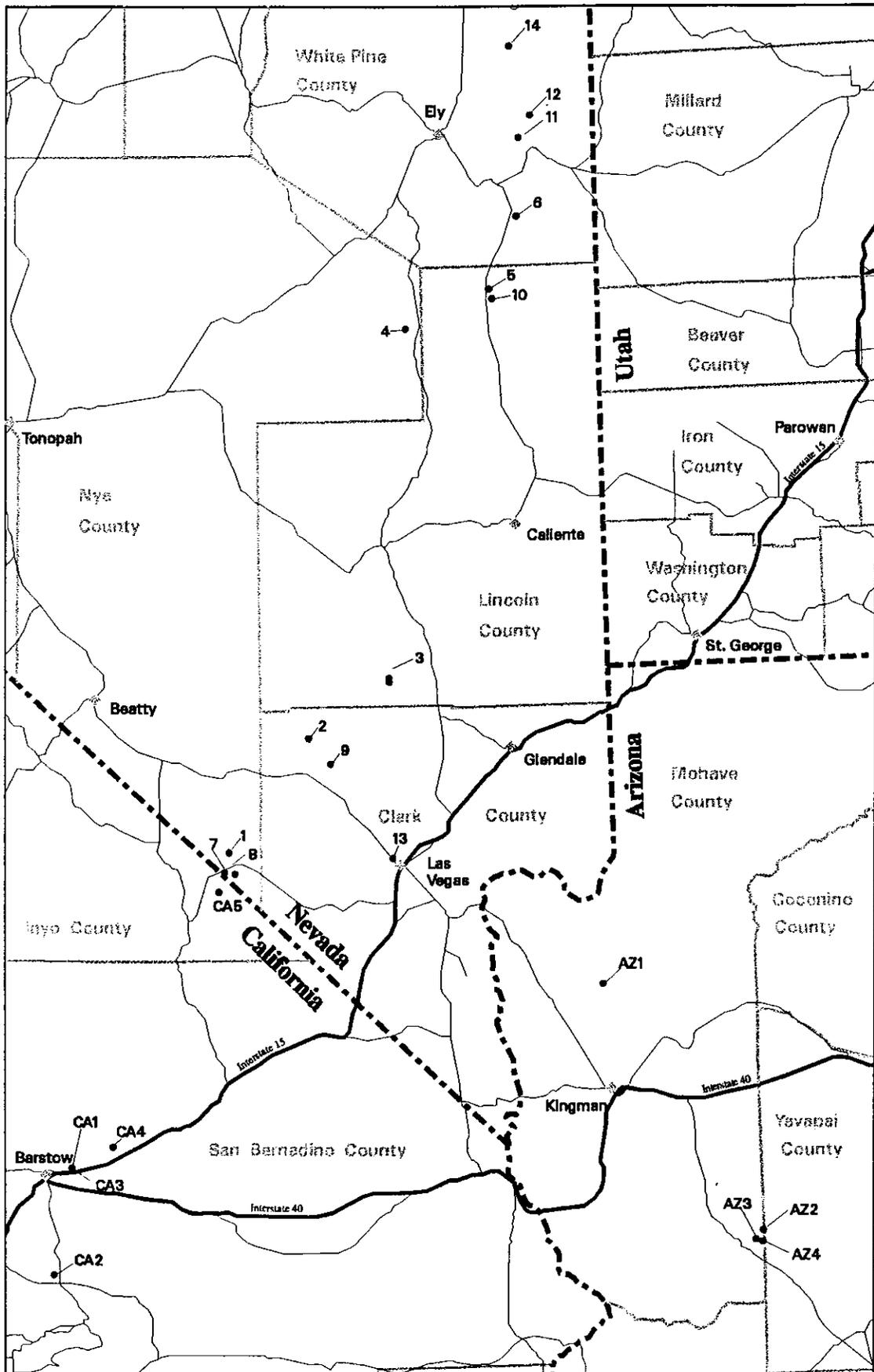
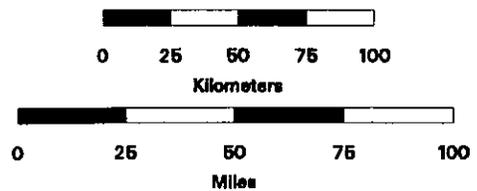


Figure 11.
Known Distribution of
Phacelia parishii



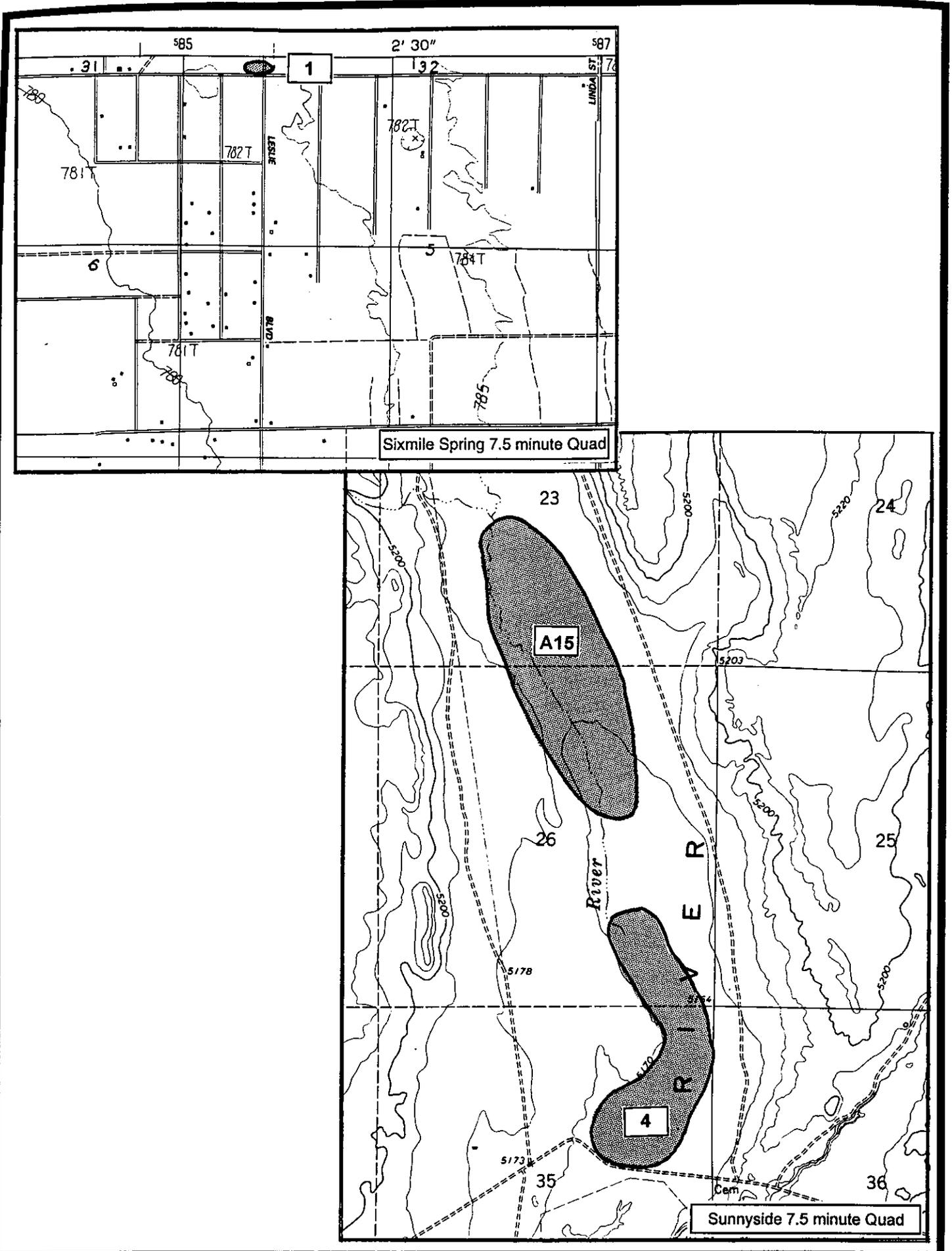


Figure 12. Known sites (1 and 4) of *Phacelia parishii* in Nevada. Site A15 searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

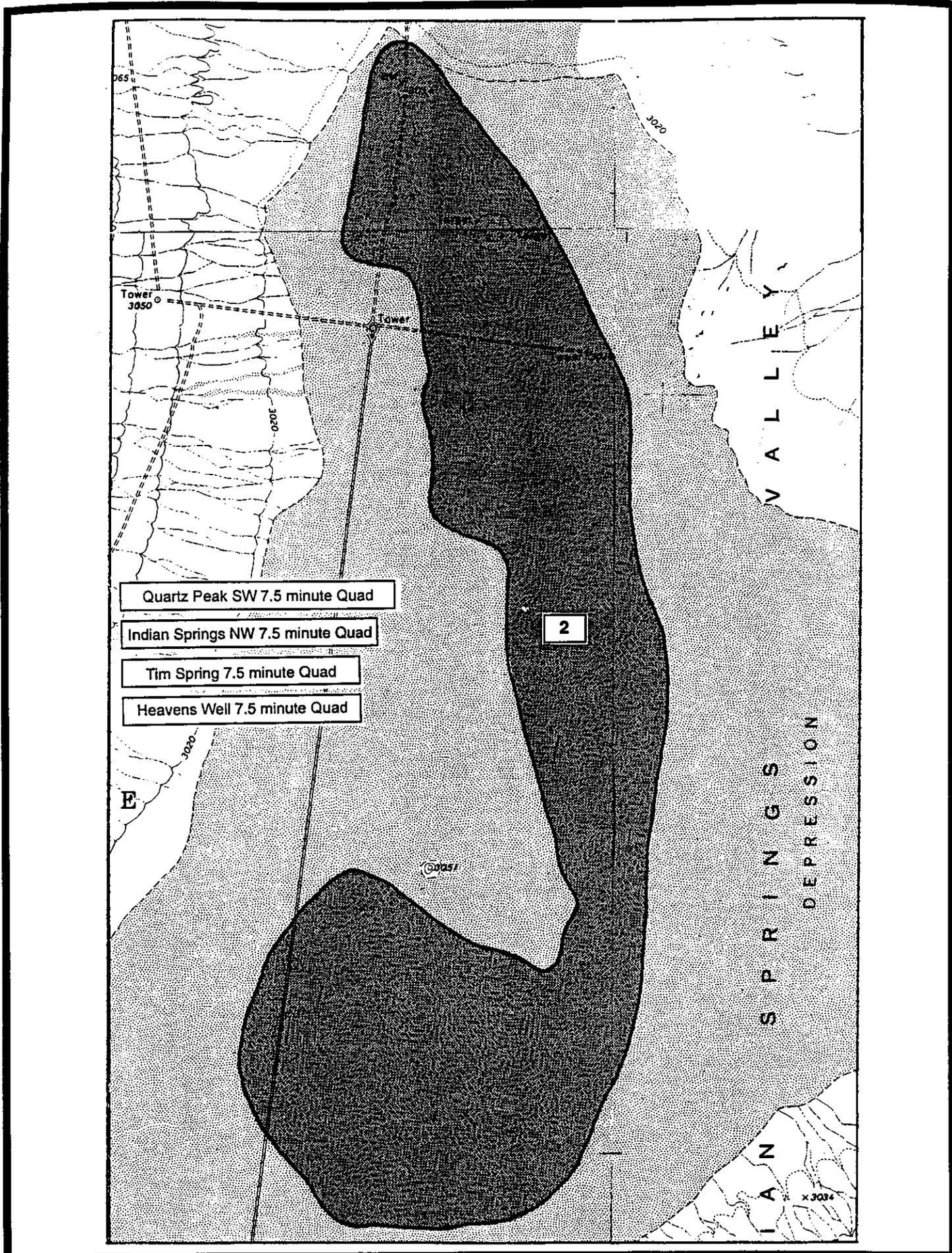


Figure 13. Known site (2) of *Phacelia parishii* in Nevada. See Appendix I, Table 1A for description.

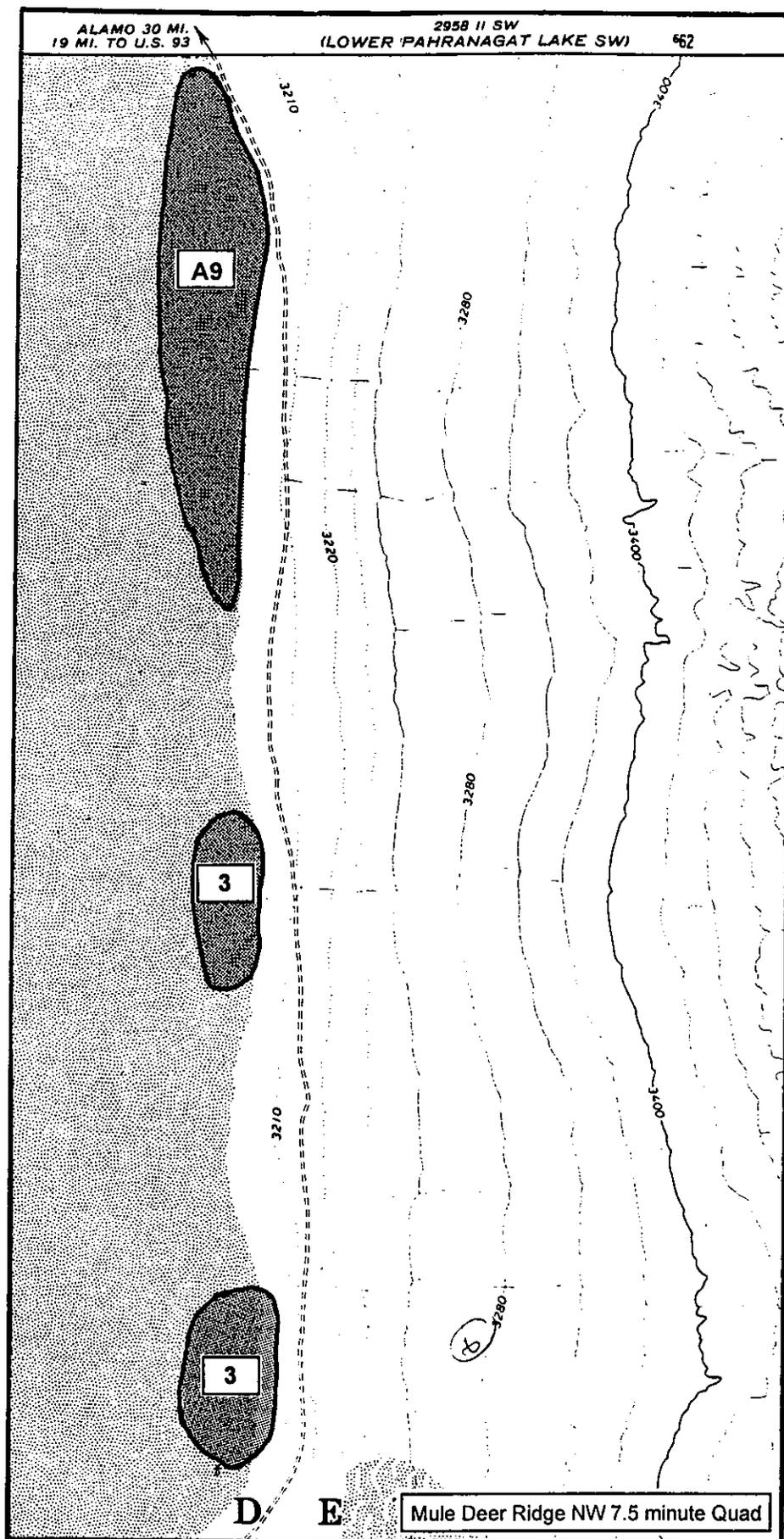


Figure 14. Known site (3) of *Phacelia parishii* in Nevada. Site A9 searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

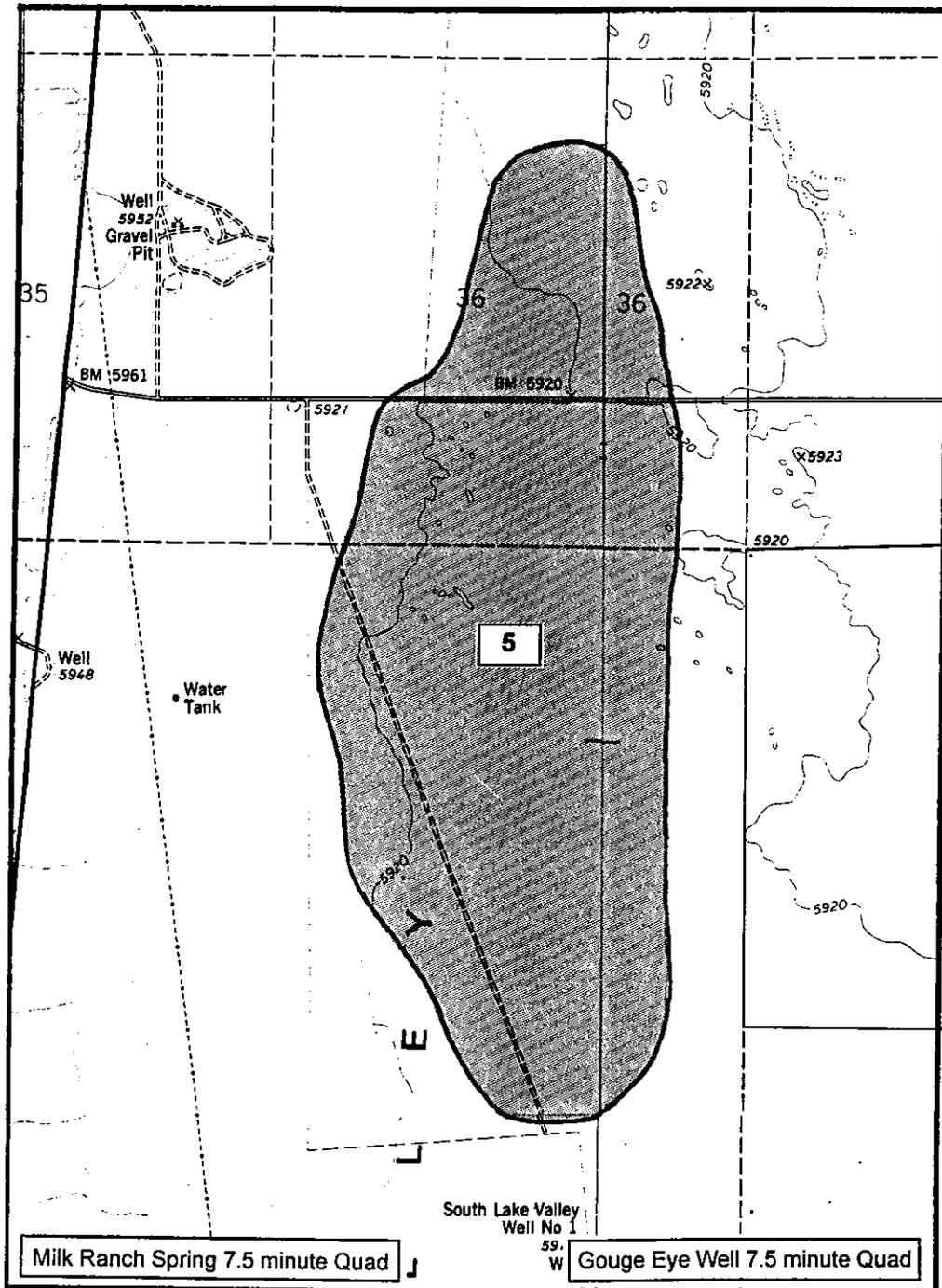


Figure 15. Known site (5) of *Phacelia parishii* in Nevada. See Appendix I, Table 1A for description.

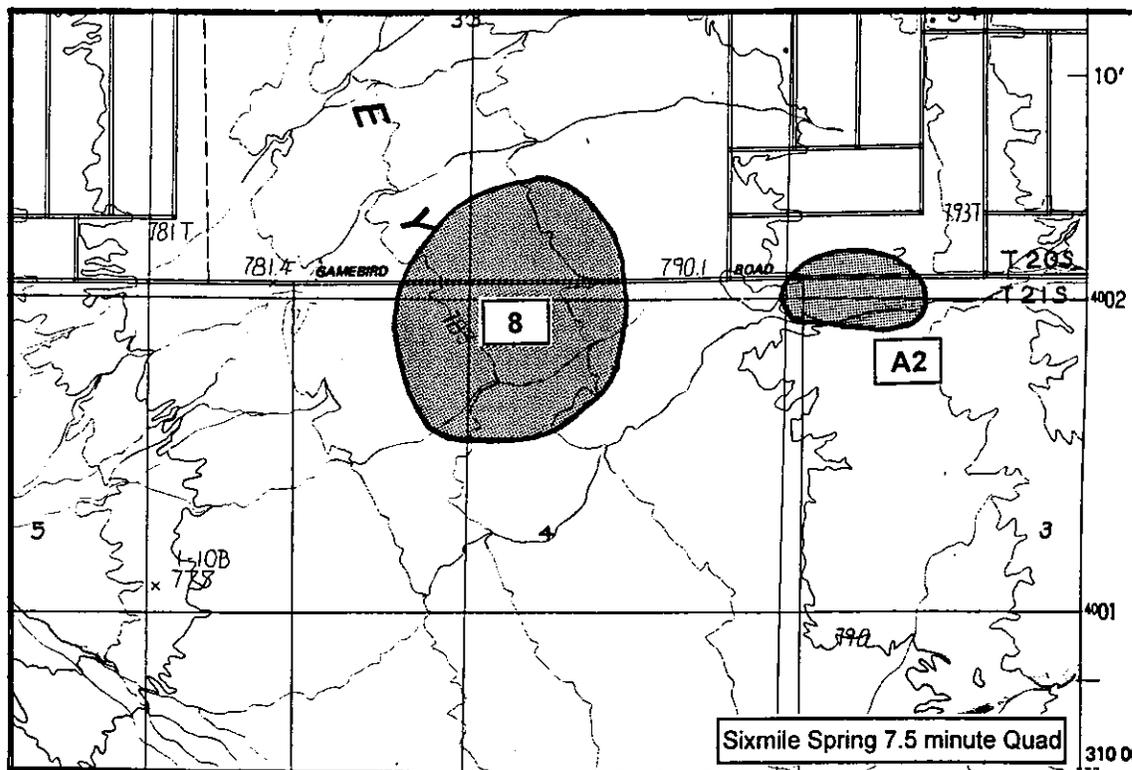
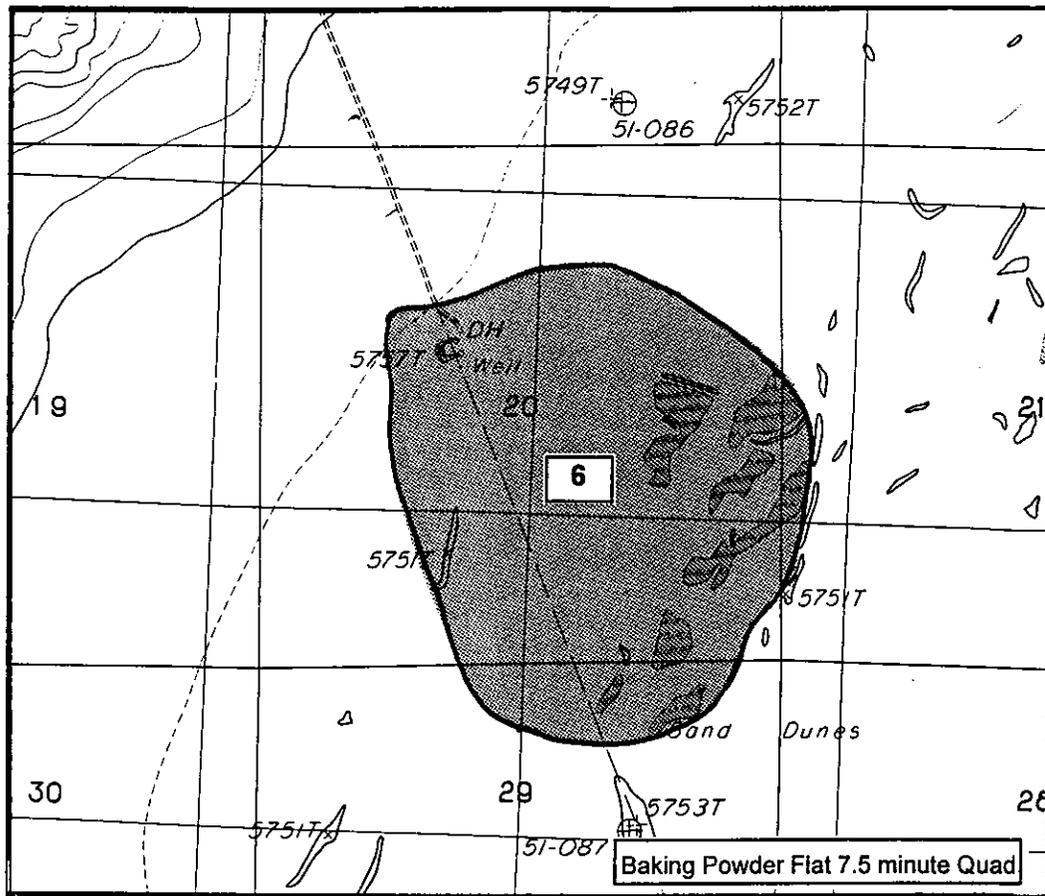


Figure 16. Known sites (6 and 8) of *Phacelia parishii* in Nevada. Site A2 searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

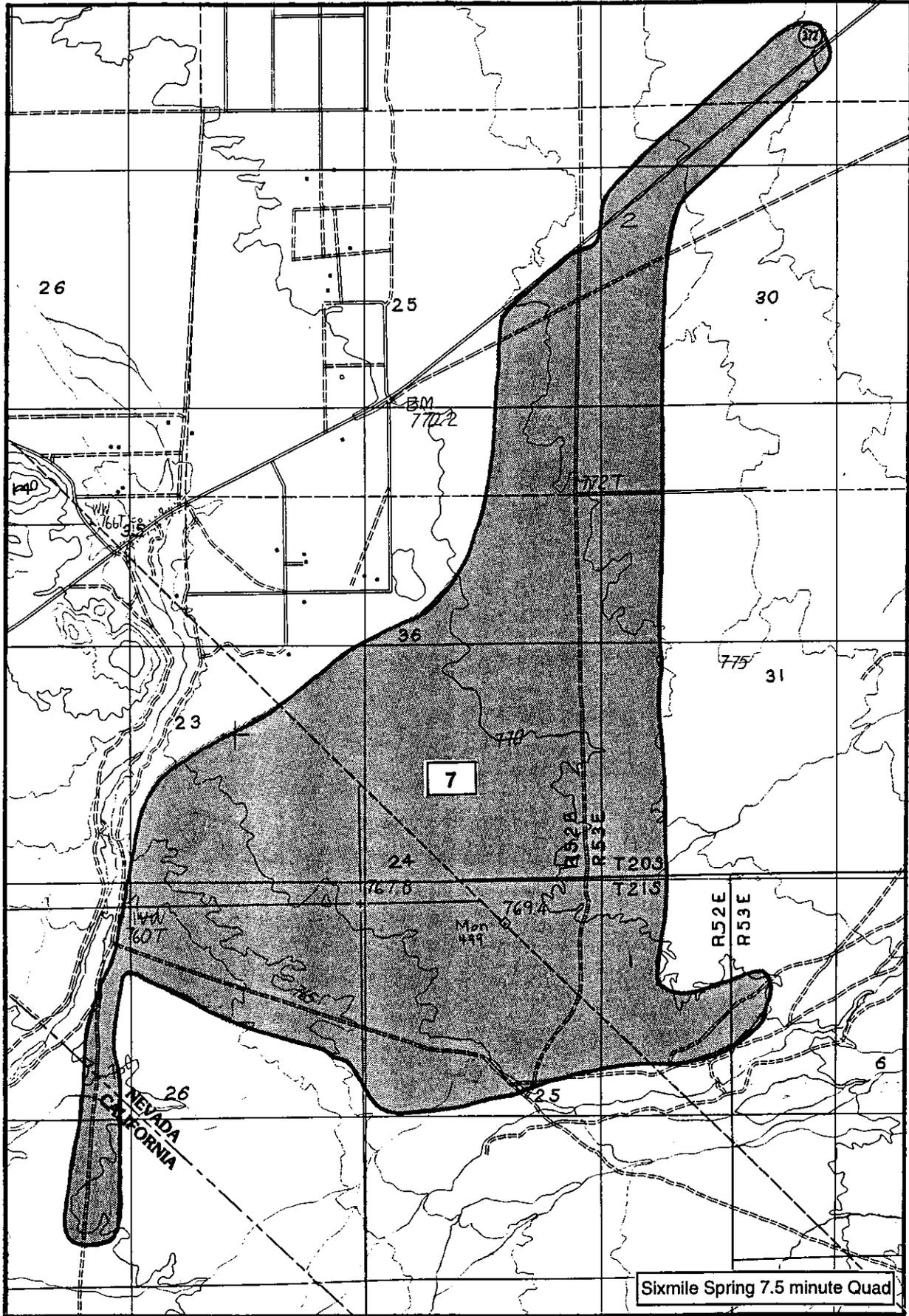


Figure 17. Known site (7) of *Phacelia parishii* in Nevada. See Appendix I, Table 1A for description.

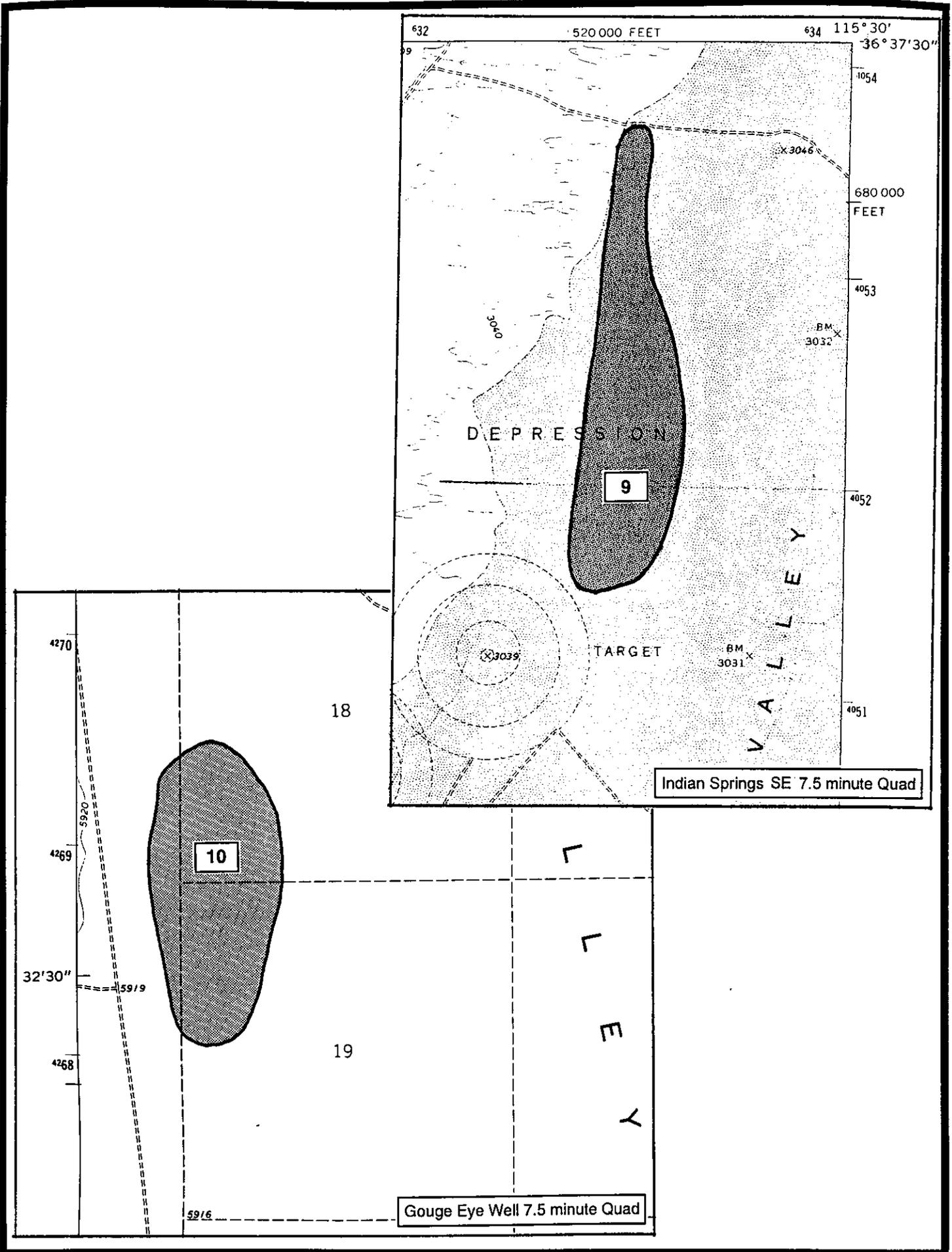


Figure 18. Known sites (9 and 10) of *Phacelia parishii* in Nevada. See Appendix I, Table 1A for description.

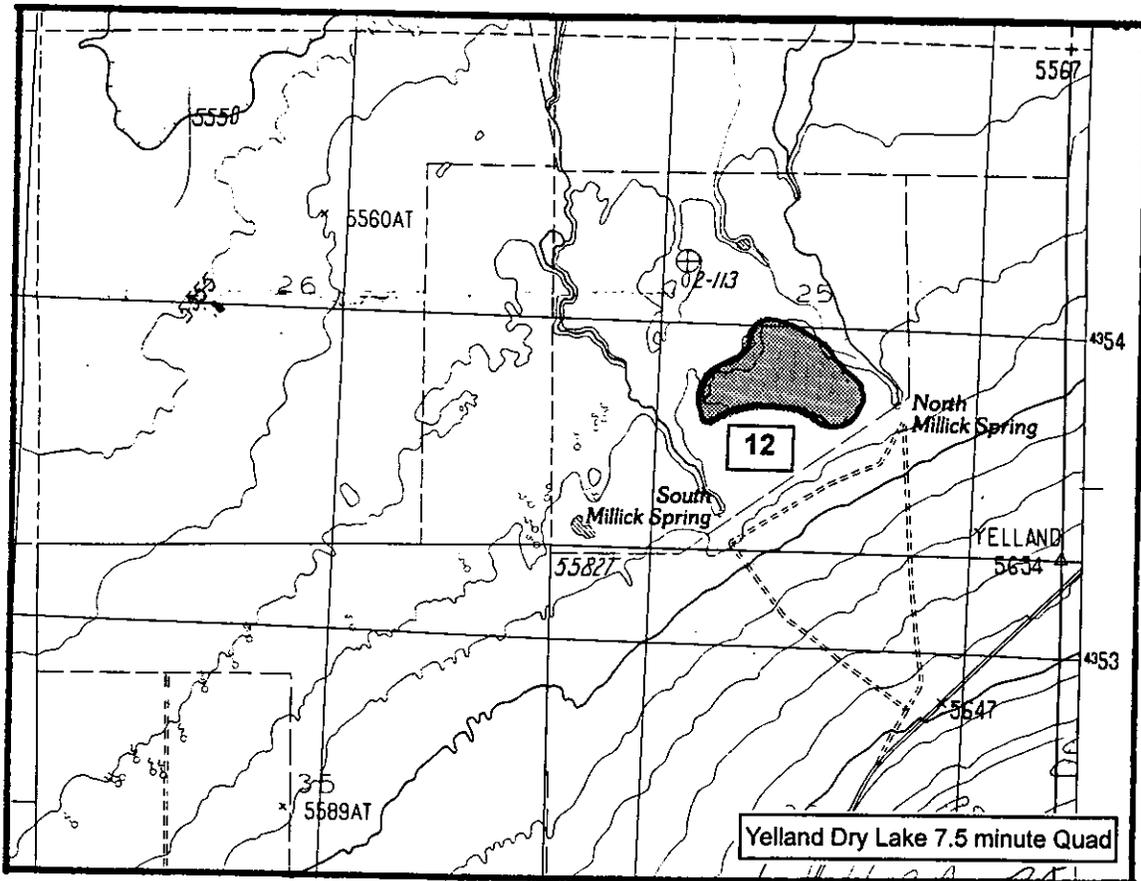
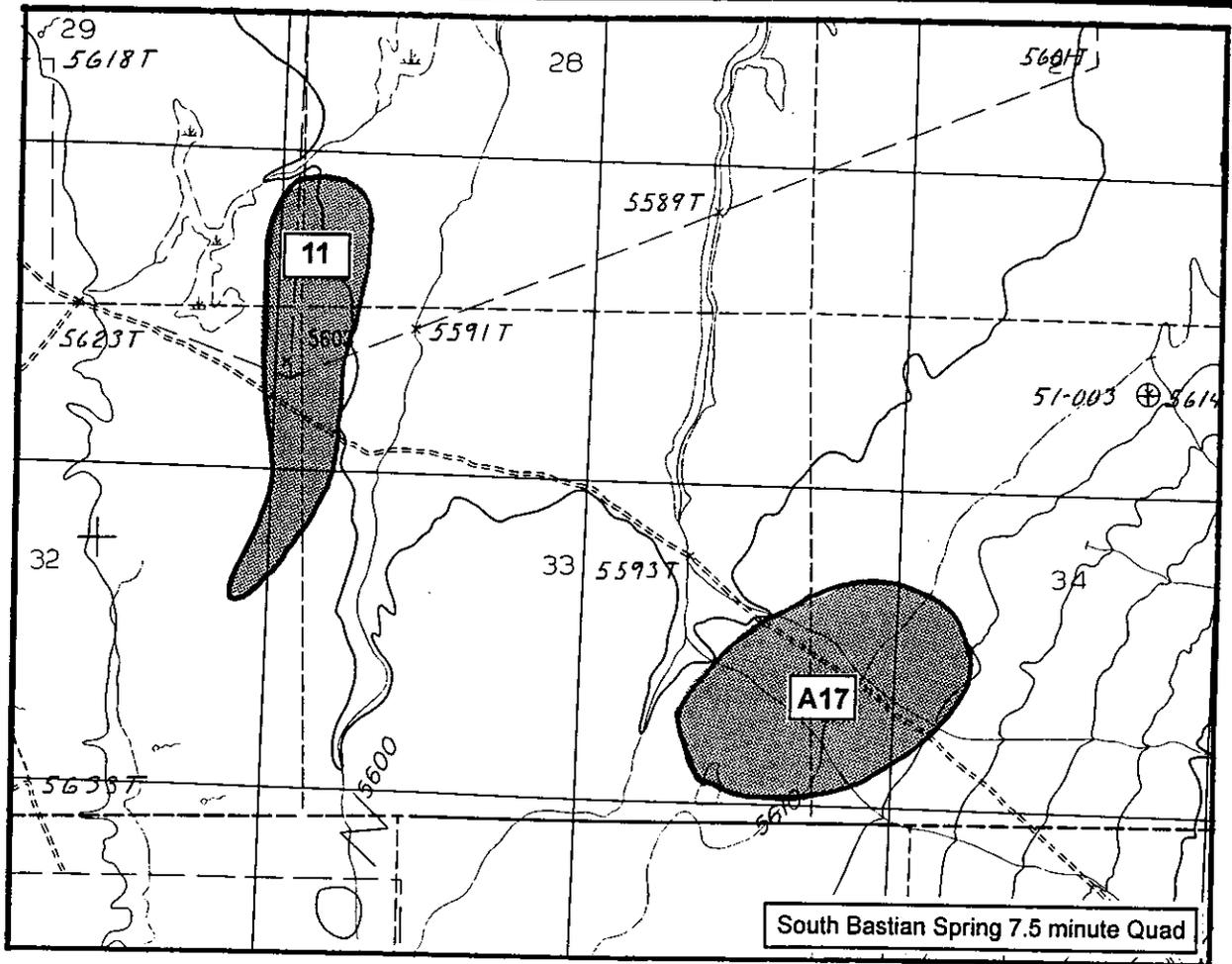


Figure 19. Known sites (11 and 12) of *Phacelia parishii* in Nevada. Site A17 searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

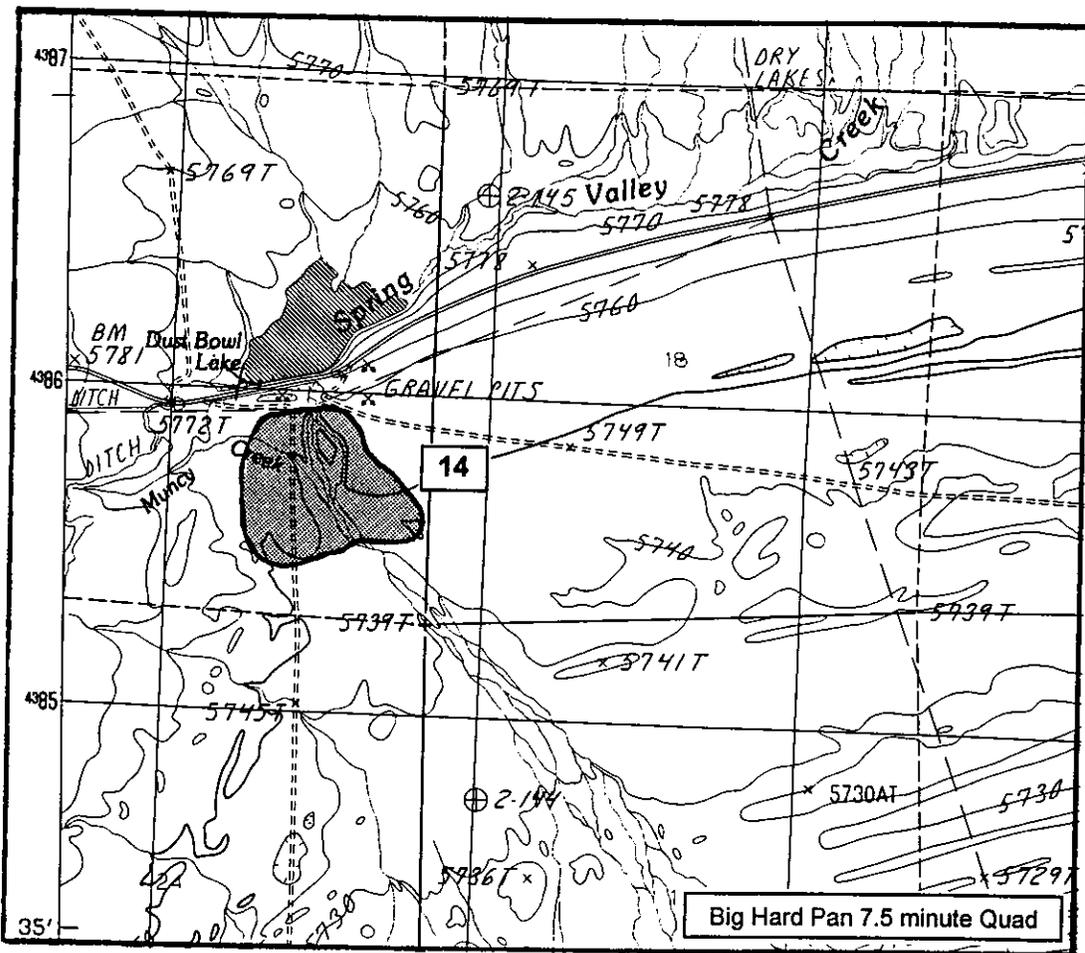
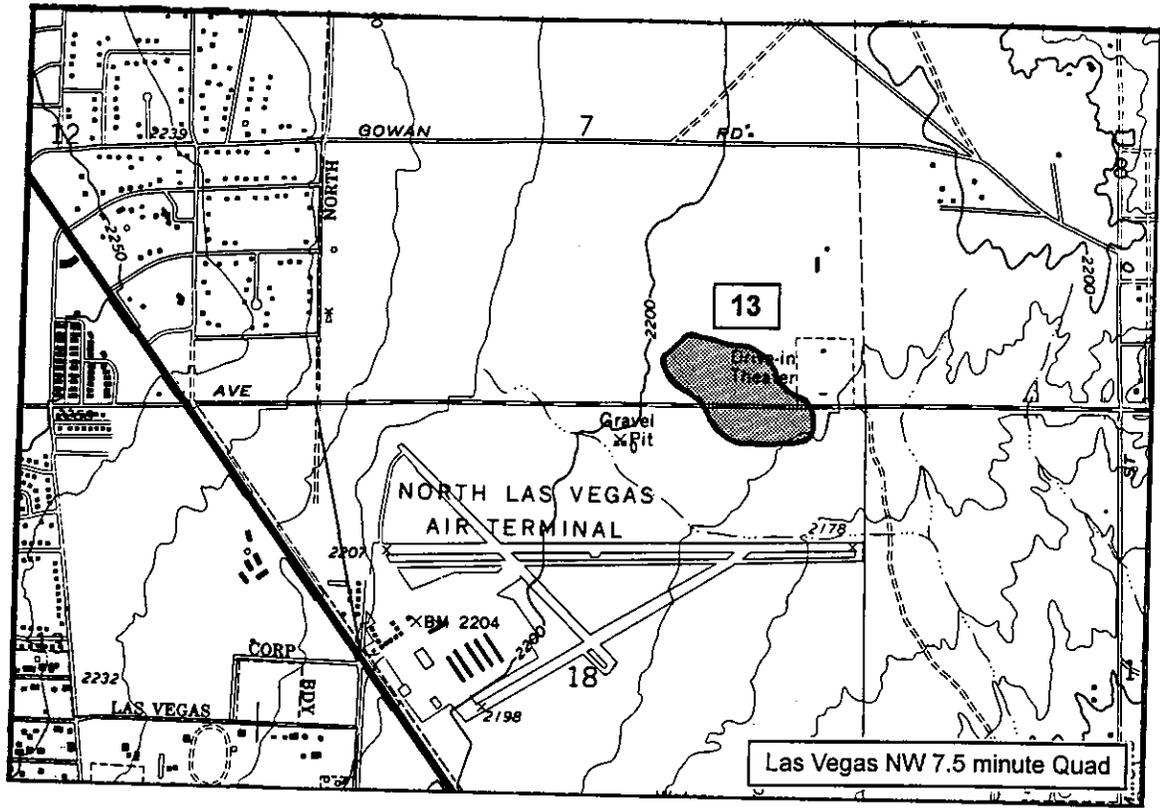


Figure 20. Historical sites (13 and 14) where no *Phacelia parishii* was found in Nevada. See Appendix I, Table 1A for description.

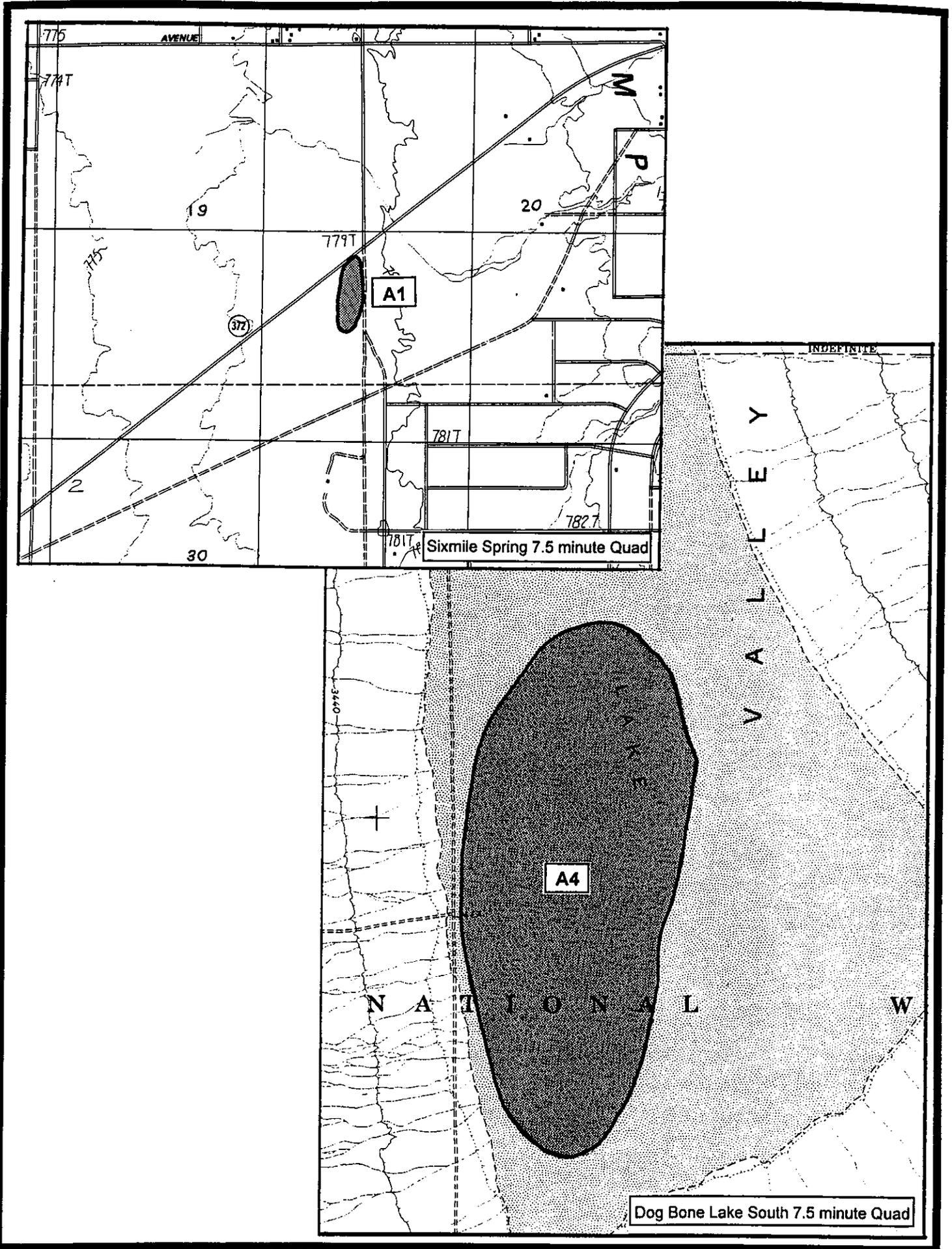


Figure 21. Sites (A1 and A4) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

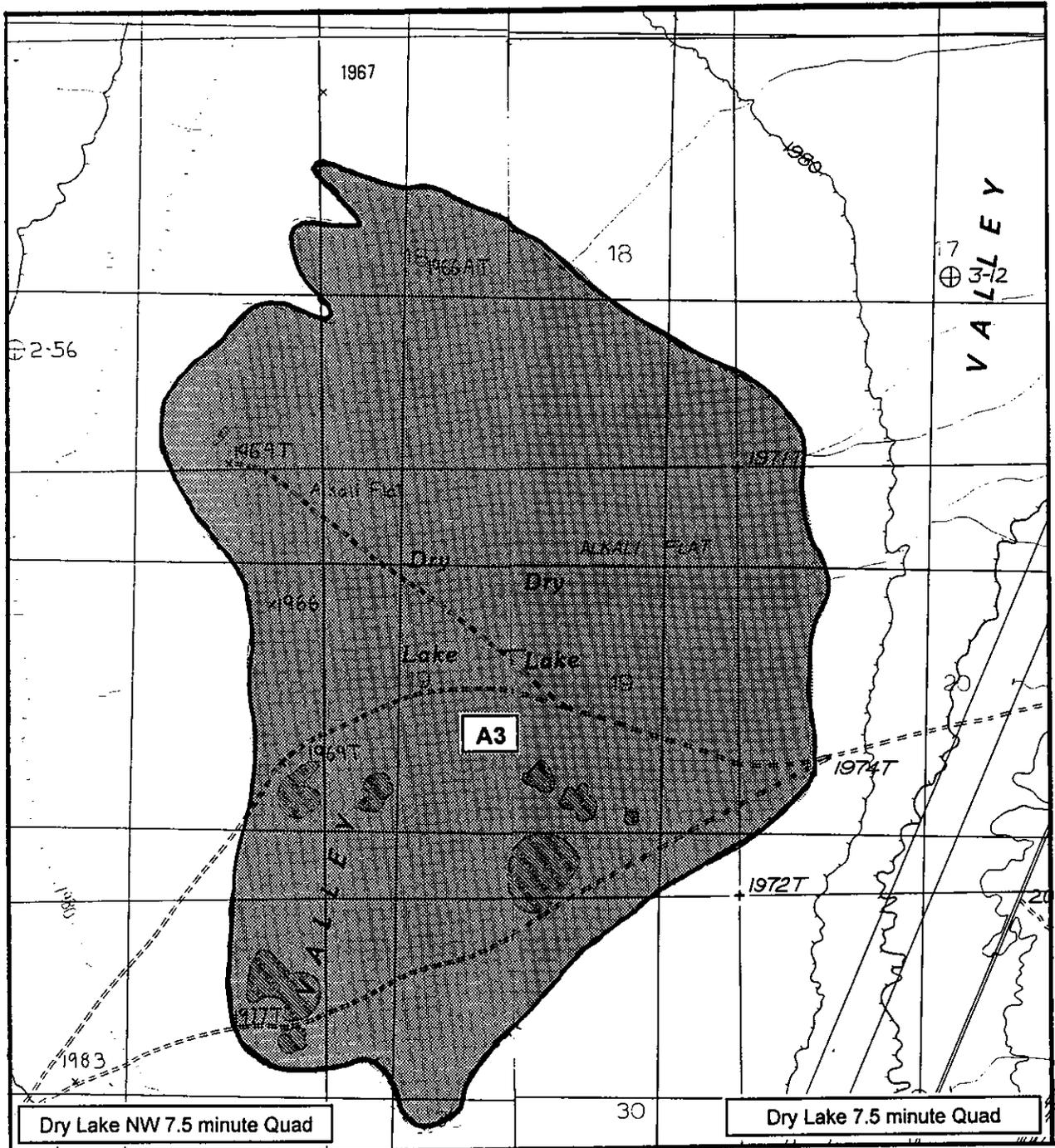


Figure 22. Site (A3) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

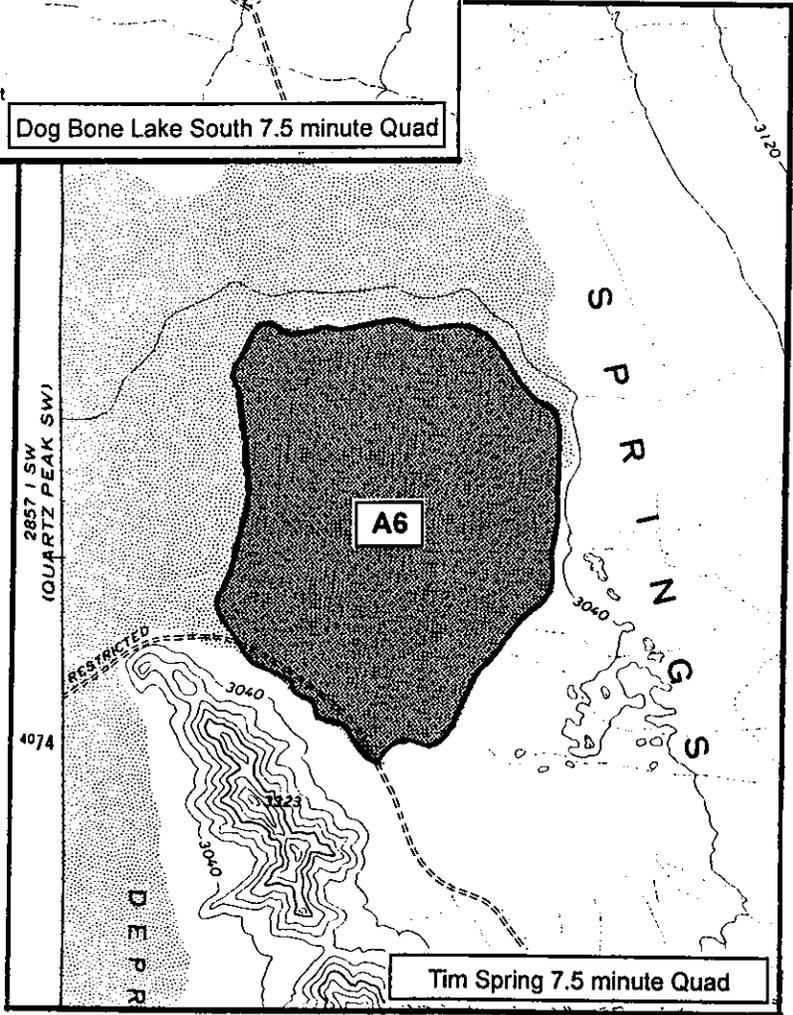
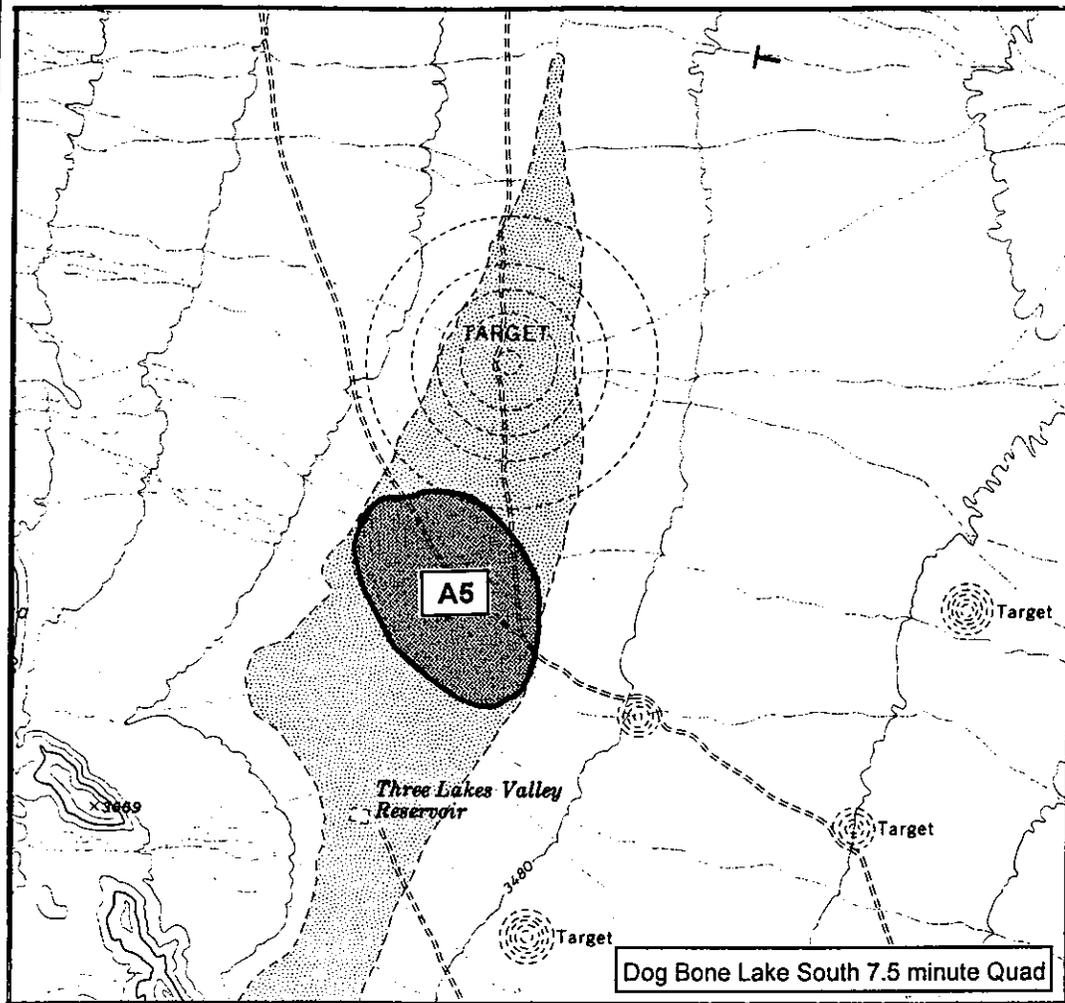


Figure 23. Sites (A5 and A6) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

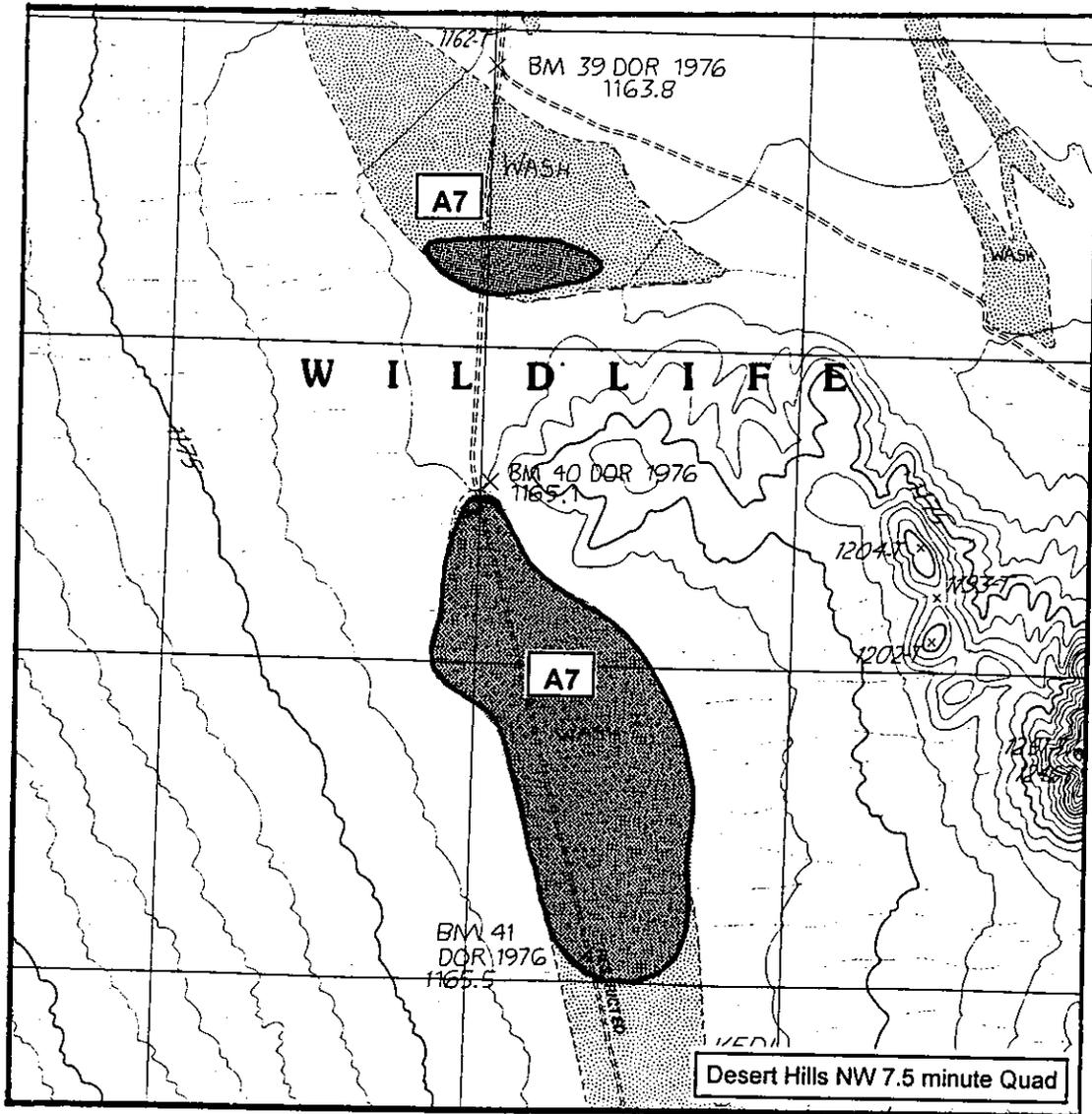


Figure 24. Site (A7) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

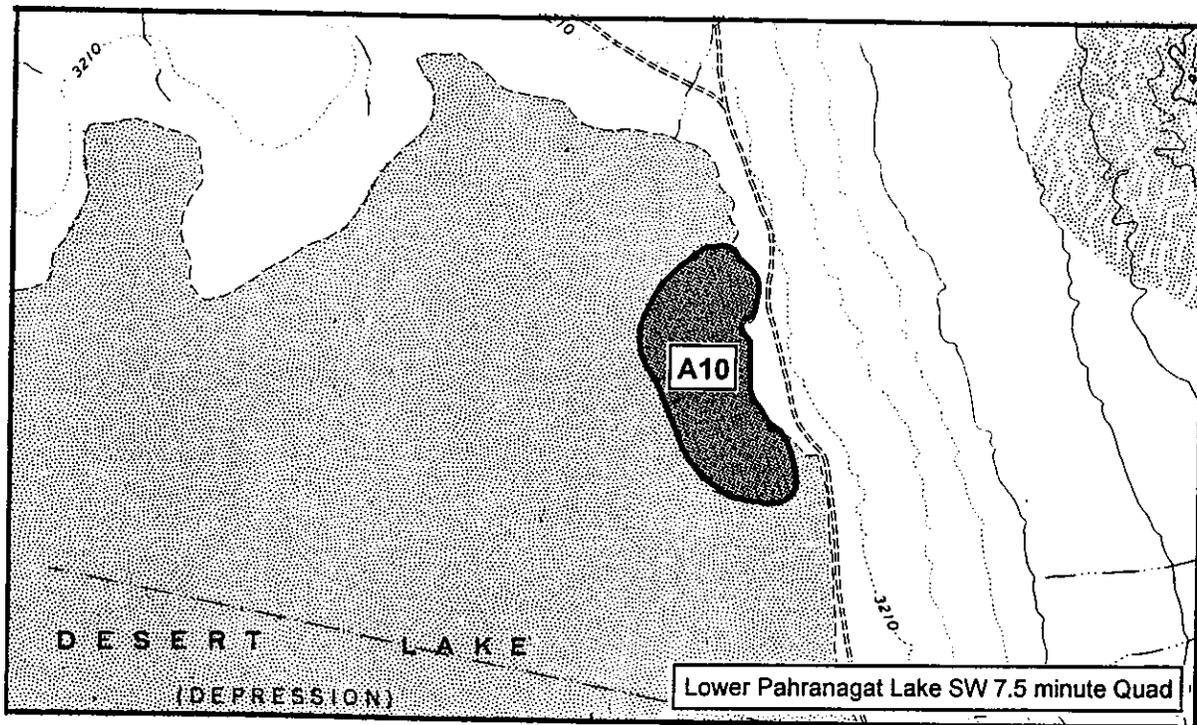
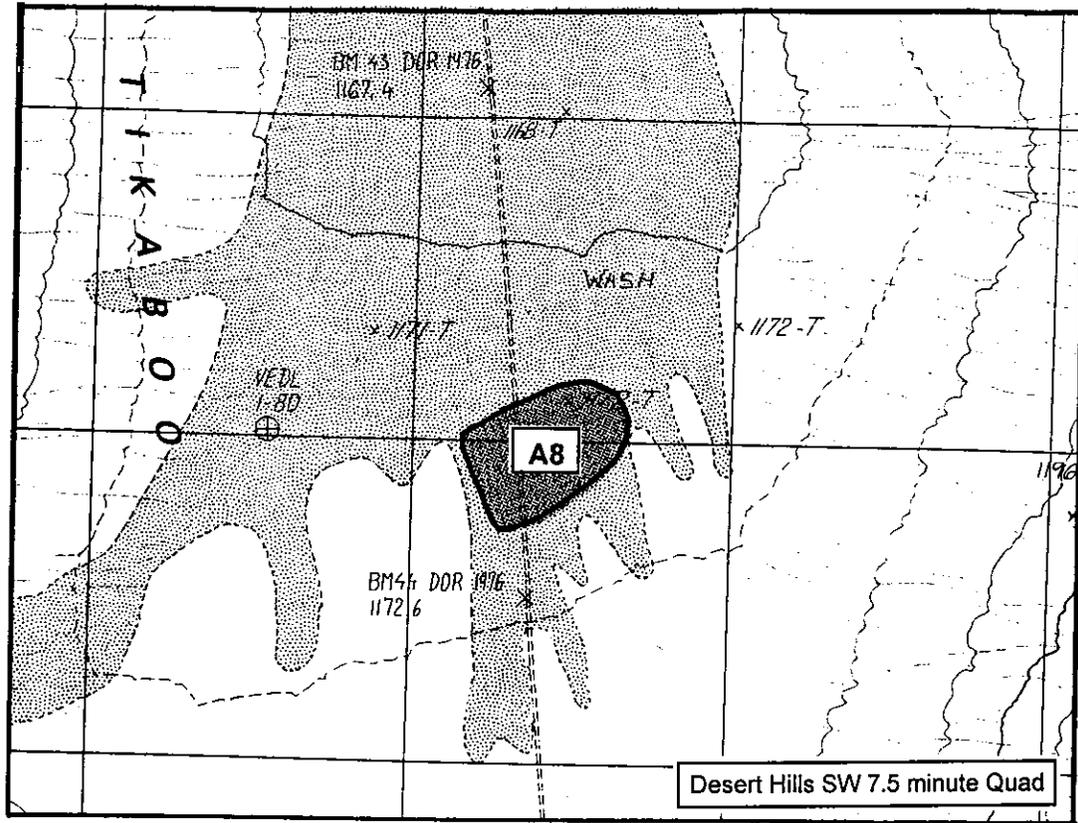


Figure 25. Sites (A8 and A10) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

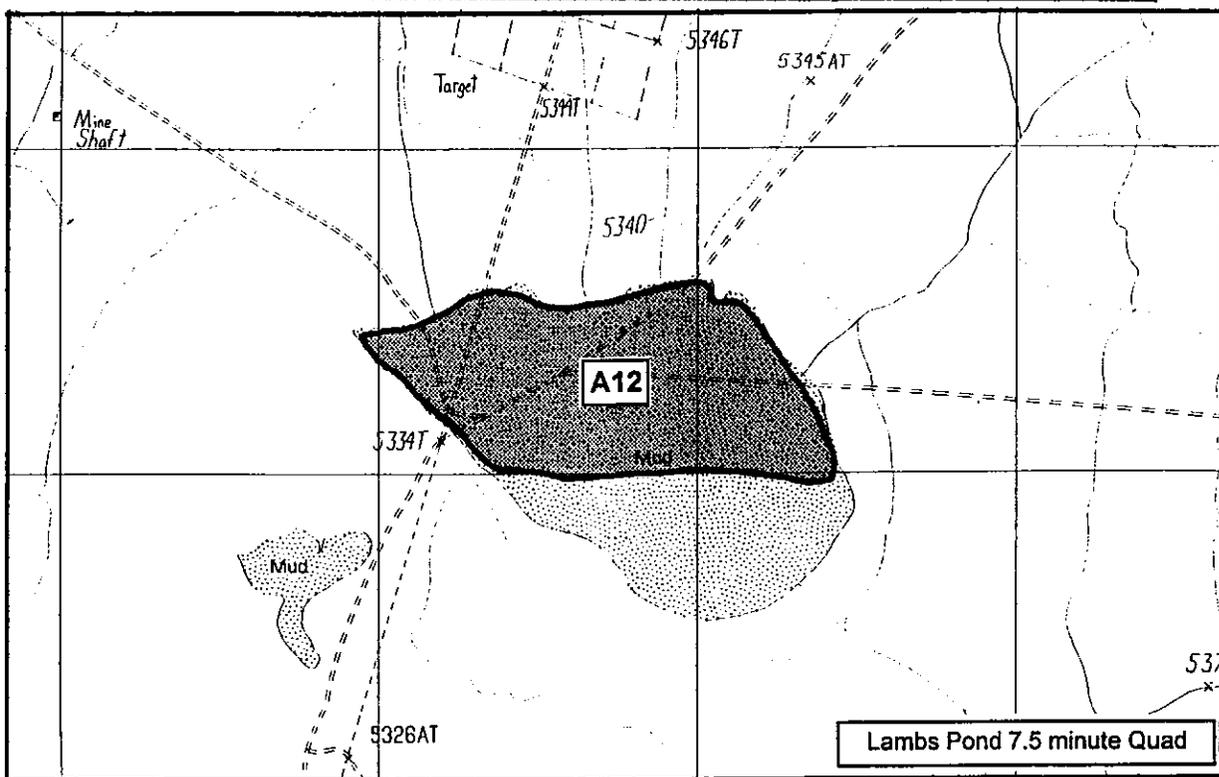
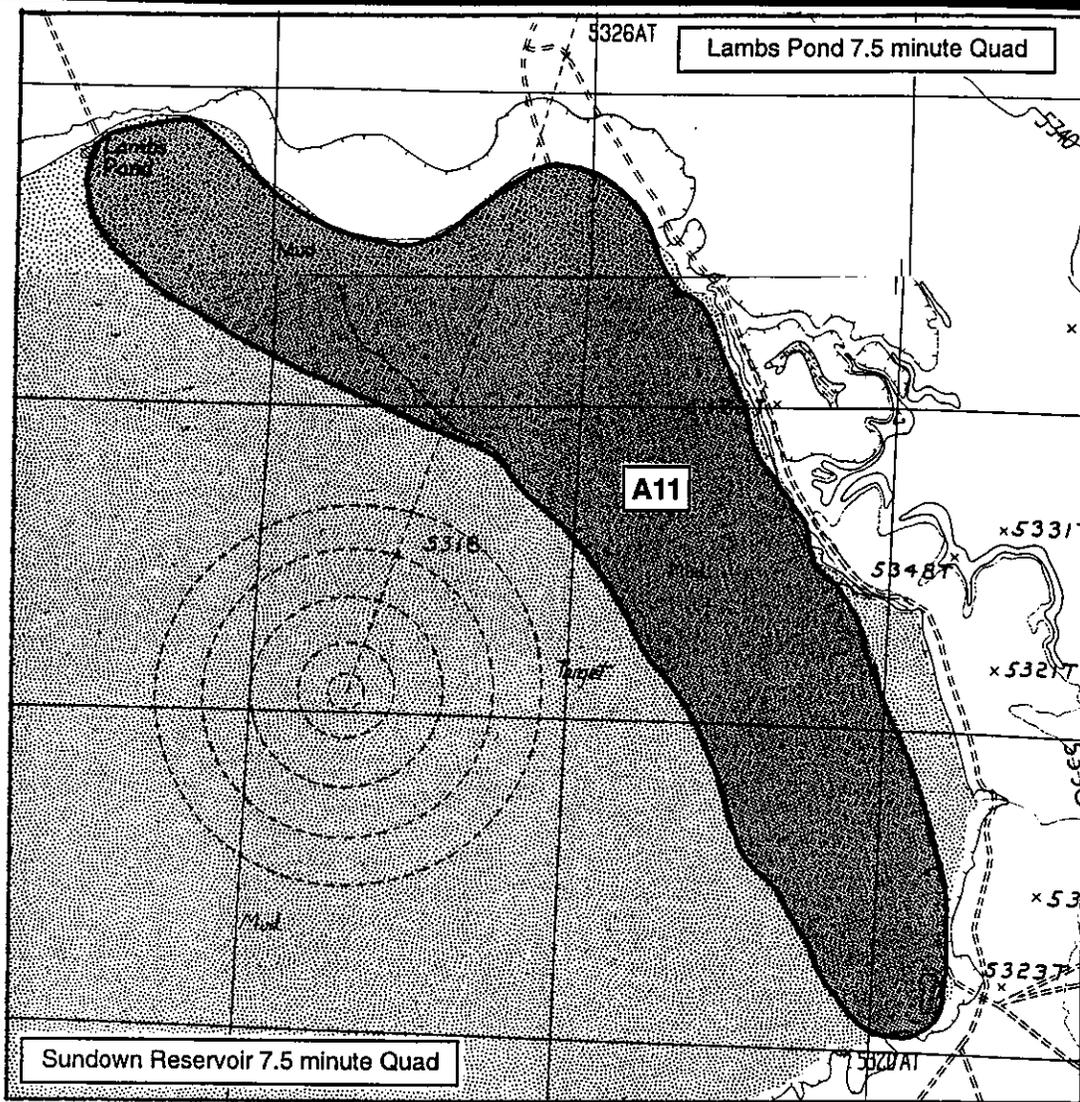


Figure 26. Sites (A11 and A12) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

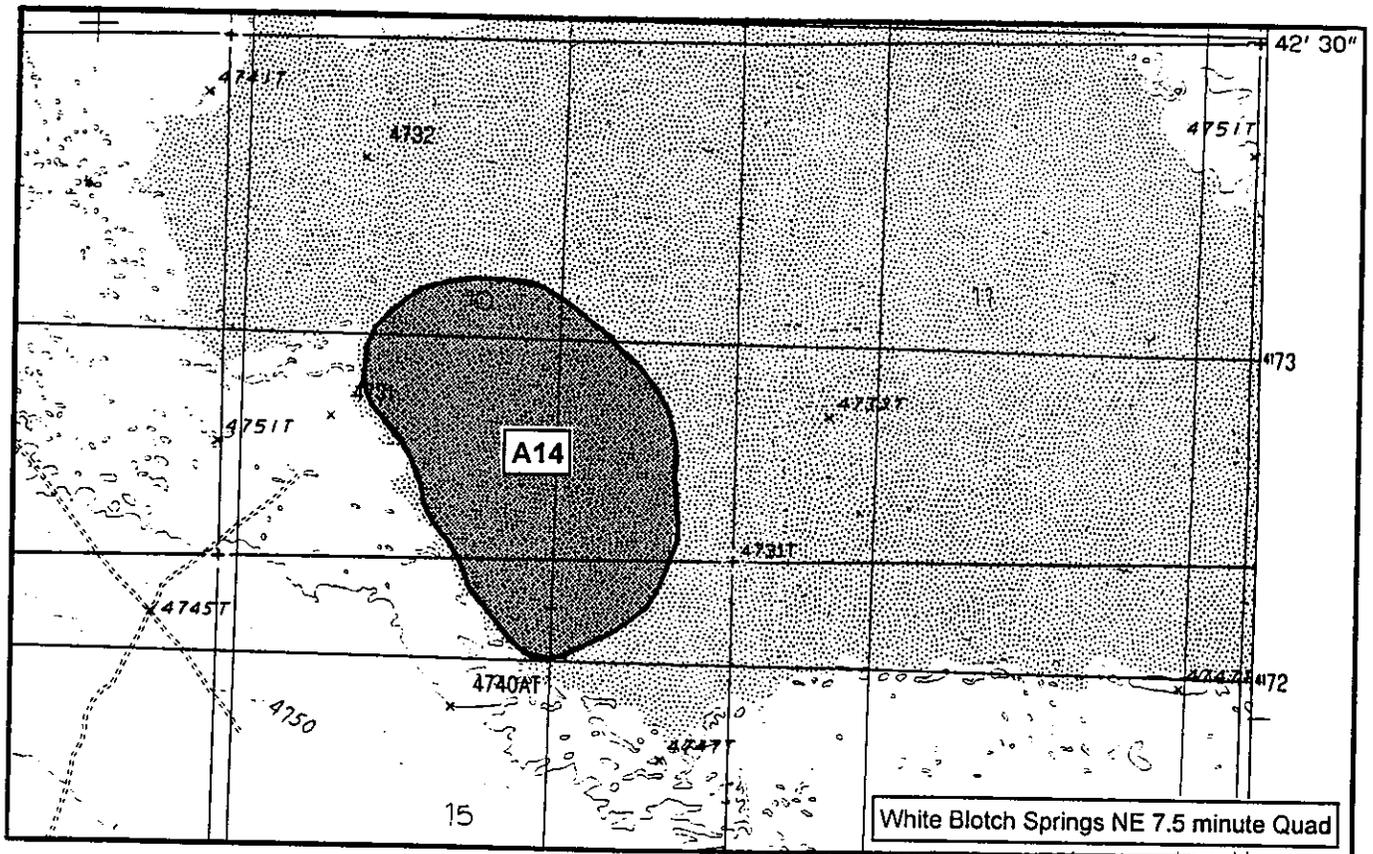
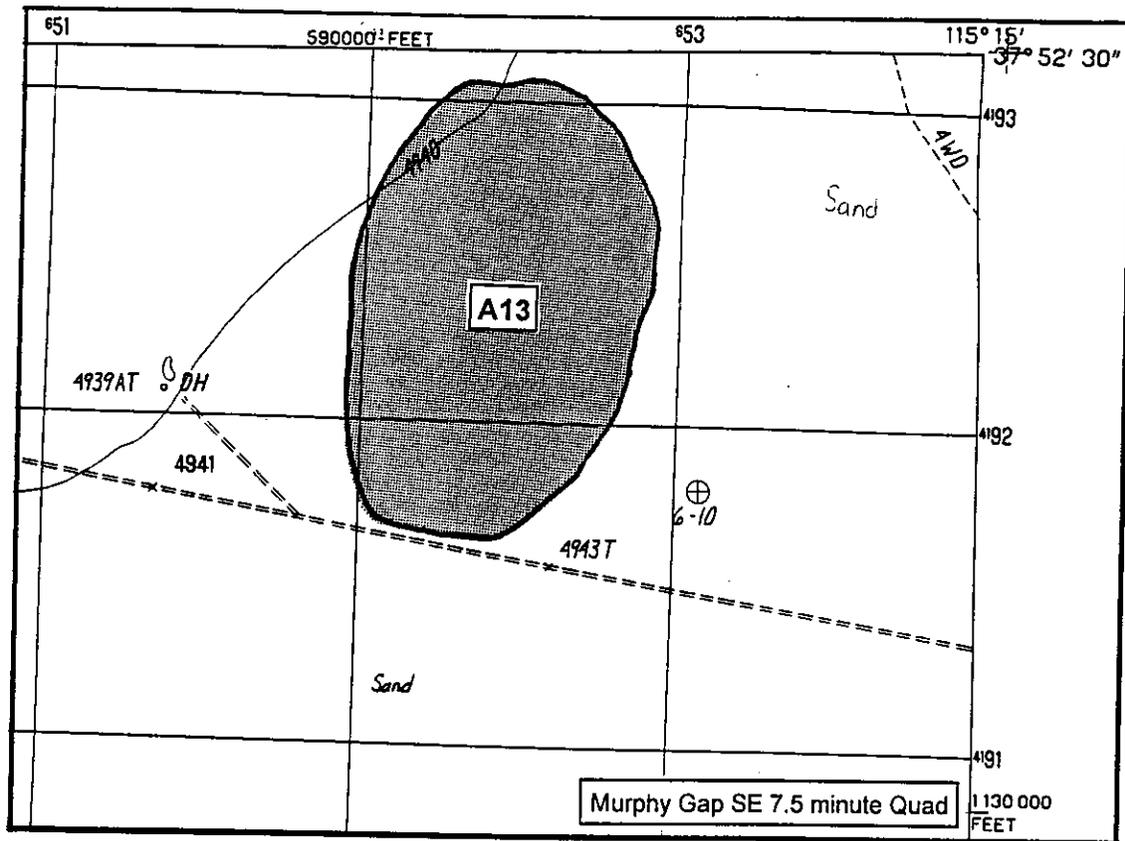


Figure 27. Sites (A13 and A14) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

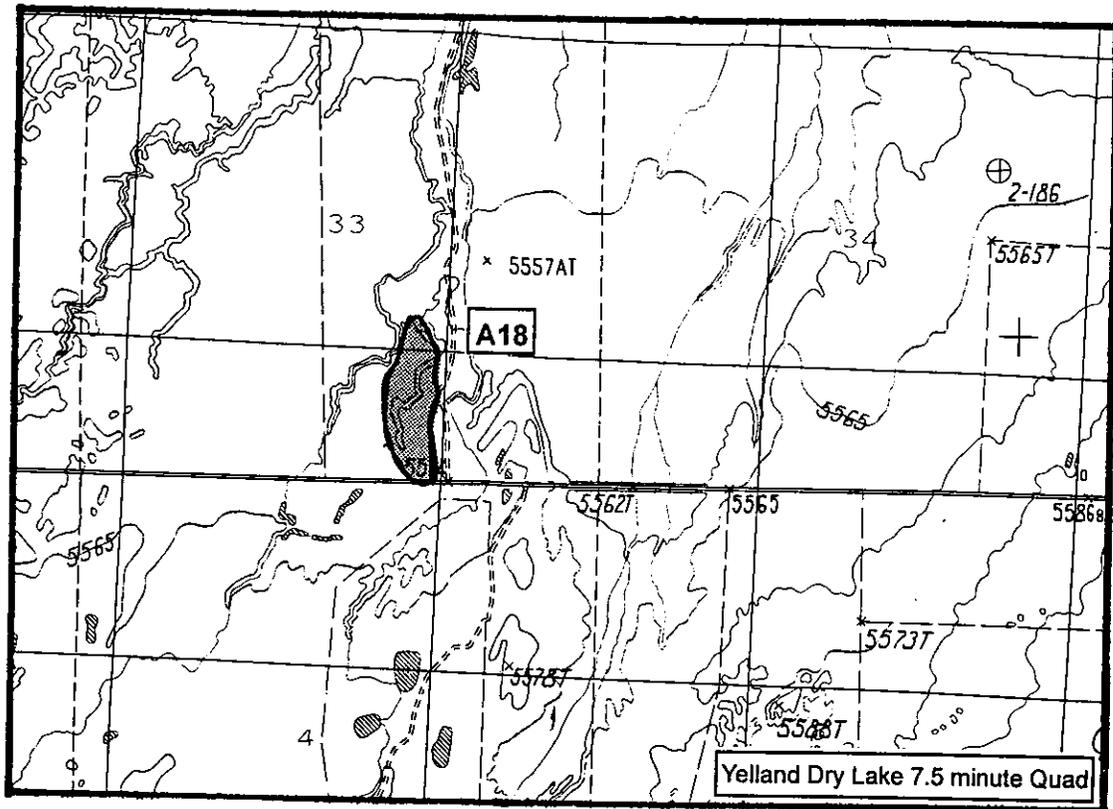
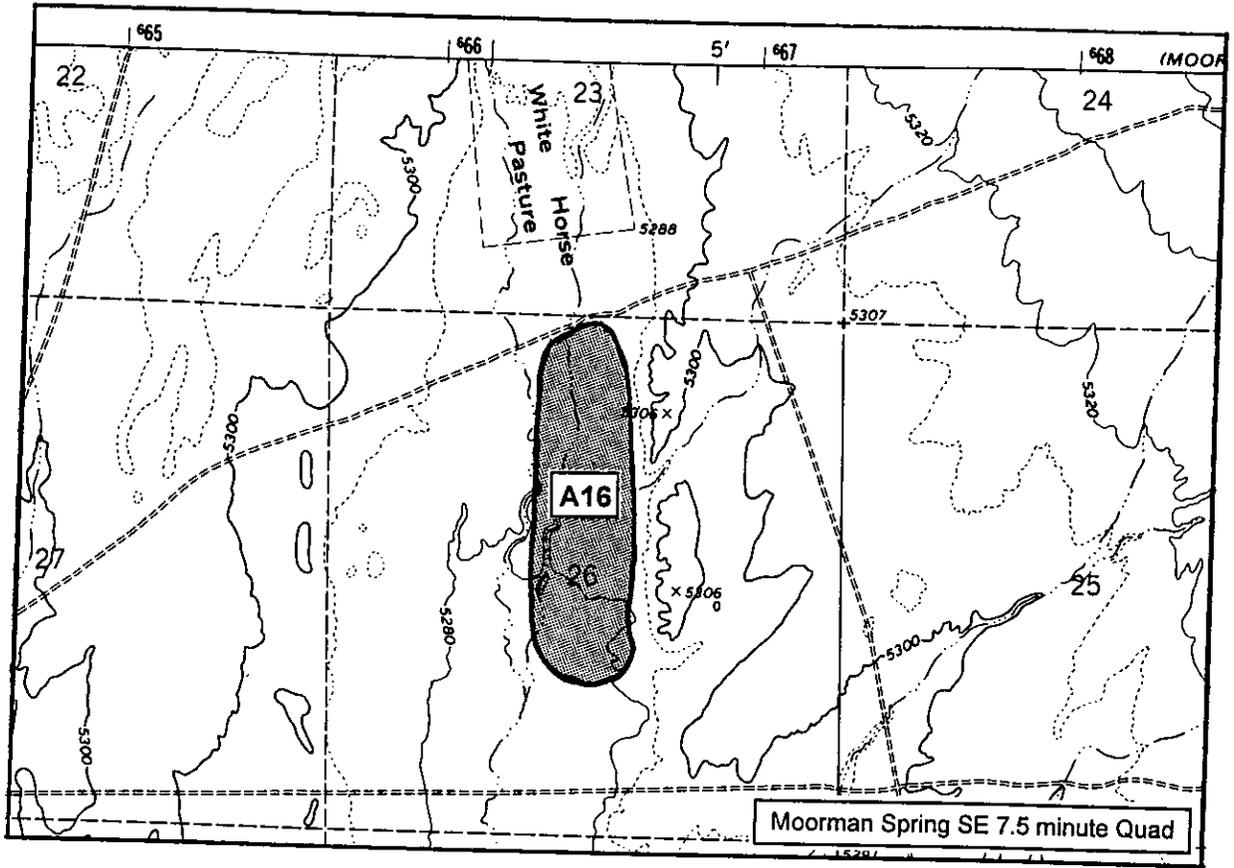


Figure 28. Sites (A16 and A18) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

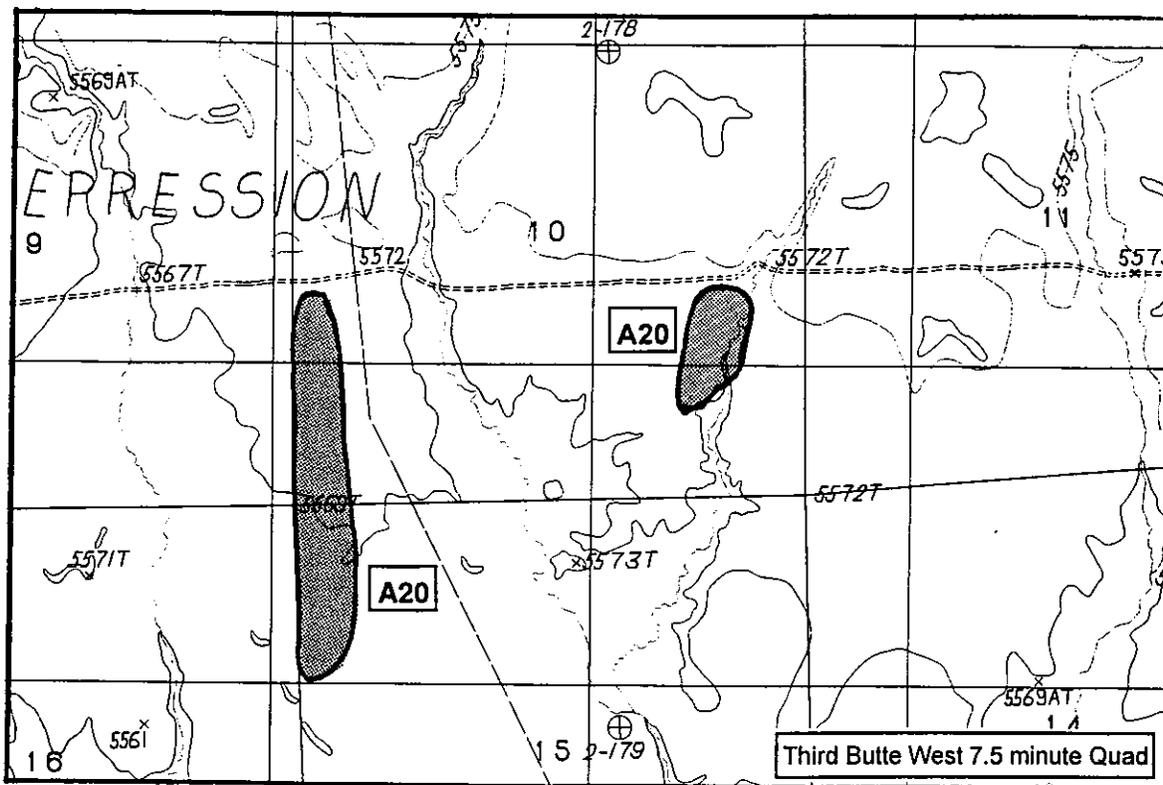
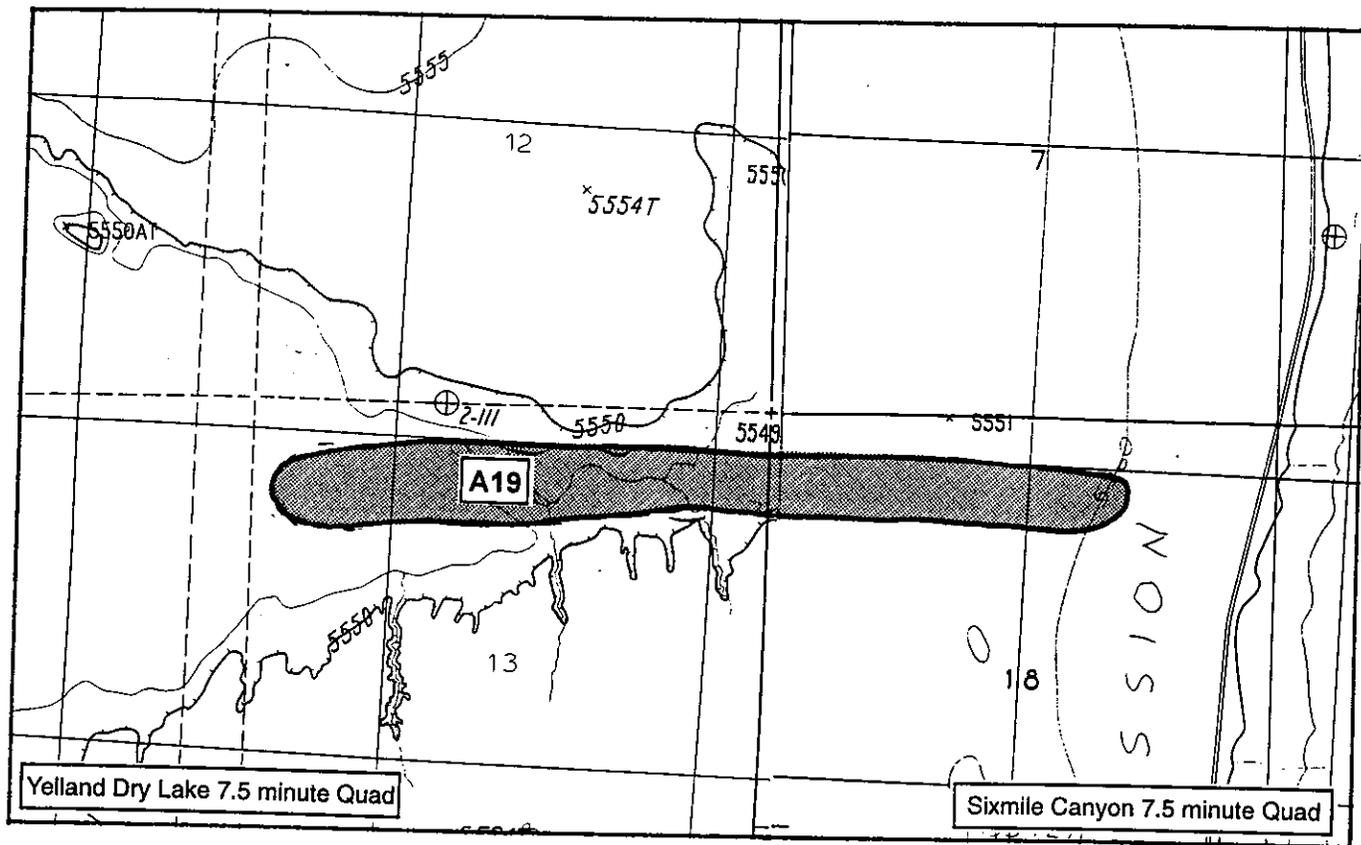


Figure 29. Sites (A19 and A20) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.

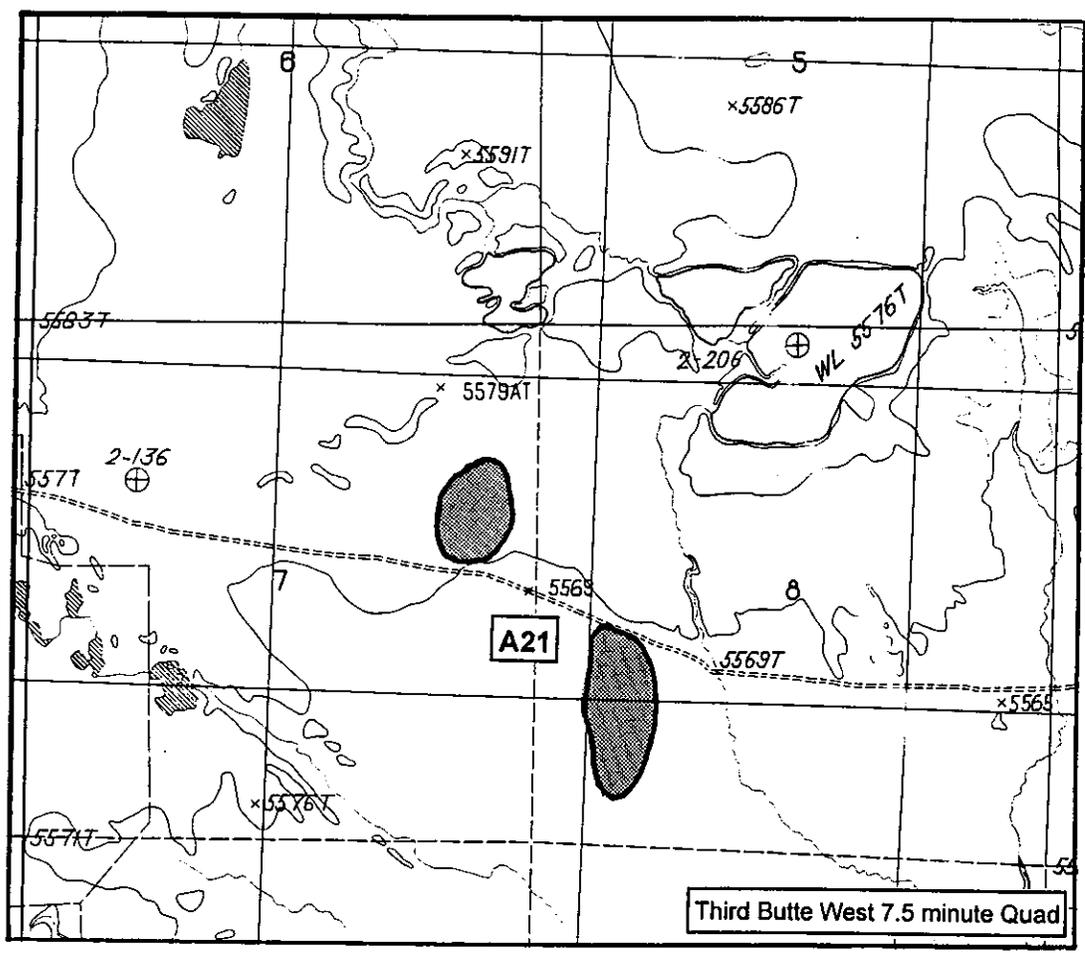


Figure 30. Site (A21) searched where no *Phacelia parishii* was found. See Appendix I, Table 1A for description.