

STATUS REPORT ON  
Phlox opalensis  
IN SOUTHWESTERN WYOMING  
AND NORTHEASTERN UTAH

Prepared for the Bureau of Land Management  
Wyoming State Office  
and Rock Springs District

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## I. INTRODUCTION

Opal phlox (Phlox opalensis) was first collected by Aven Nelson near Carter, Wyoming in 1898. Nelson, however, failed to recognize his specimen as a new taxon, and it remained in the collections of the Rocky Mountain Herbarium (RM) for over 90 years under the name P. bryoides (P. muscoides) (Fertig 1993 a). Robert Dorn relocated this phlox near Opal, Wyoming in May 1990 and described it as a new species in 1992 (Dorn 1992).

Until recently, Phlox opalensis was known from fewer than 10 locations, all within a restricted geographic area in southwestern Wyoming. Due to its limited range and concerns about its status, the species was listed as a Category 2 candidate for listing under the Endangered Species Act by the US Fish and Wildlife Service (USFWS) in 1993. Under Bureau of Land Management (BLM) Manual 6840, the BLM is directed to manage USFWS candidate species in such a manner that these species and their habitats are conserved and to ensure that agency actions do not contribute to the need to list these species as Threatened or Endangered (Willoughby et al. 1992). P. opalensis is currently managed as a Special Status plant species by the BLM Rock Springs District (Amidon 1994).

In 1995, the BLM Wyoming State Office and Rock Springs District contracted on a cost-share basis with The Nature Conservancy's Wyoming Natural Diversity Database (WYNDD) to conduct field surveys for Phlox opalensis on public lands in southwestern Wyoming. The objectives of this project were to collect information on the biology, distribution, habitat use, population size, and potential threats to this species to be used in guiding management decisions.

## II. METHODS

Information on habitat and distribution of Phlox opalensis was obtained from secondary sources, including WYNDD files and computer databases, RM collections, the literature, and knowledgeable individuals. USGS topographic maps, geologic maps (Love and Christiansen 1985), and BLM land status maps were used to identify areas of potential habitat for ground survey.

Field surveys were conducted by the author from mid May to early June, 1995 (survey routes and collection sites are indicated in Appendix B). Data on biology, habitat, population size, and management needs were collected using WYNDD plant survey forms (Appendix C). Locations of occurrences were mapped on 7.5' USGS topographic maps. If populations were sufficiently large, voucher specimens were collected for deposit at the RM and the Rock Springs District herbarium. Color photographs were taken of phlox plants and their habitats at each site. Information

gathered in the field was entered into the computerized Element Occurrence database of WYNDD.

Due to the observed abundance of Phlox opalensis in 1995, permanent demographic monitoring transects were not established. Sites recommended for future monitoring are discussed in Appendix D.

### III. SPECIES INFORMATION

#### A. CLASSIFICATION

1. SCIENTIFIC NAME: Phlox opalensis Dorn (Dorn 1992, pp. 304-306).
2. SYNONYMS: None.
3. COMMON NAME: Opal phlox.
4. FAMILY: Polemoniaceae (Phlox family).
5. SIZE OF GENUS: Wherry's (1955) monograph recognized 67 taxa of Phlox, many of which have since been reduced to synonymy. More recent treatments recognize 50-60 species, restricted to western North America and northern Asia (Cronquist et al. 1984; Gleason and Cronquist 1991). Ten species are listed for Wyoming by Dorn (1992). An eleventh species, Phlox albomarginata, was discovered in the state in 1994 (Hartman and Refsdal 1995). Two additional undescribed taxa allied with P. andicola and P. pungens may occur in southwest Wyoming (R. Dorn, personal communication; W. Fertig, unpublished records).
6. PHYLOGENETIC RELATIONSHIPS: Dorn (1992) notes that Phlox opalensis may be derived from P. muscoides, a species with smaller flowers, more densely pubescent herbage, and more densely matted stems. Observations in the field in 1995 suggest that P. opalensis may have a stronger affinity with P. hoodii. Intermediates between the two species are occasionally found, suggesting potential hybridization or introgression. Based on its presumed affinities, P. opalensis belongs in section Occidentales with other caespitose, solitary-flowered western taxa of Phlox (Grant 1959).
7. TAXONOMIC CONSIDERATIONS: The caespitose Phlox complex in Wyoming, including P. opalensis, is in need of

critical evaluation using modern biosystematic techniques (such as DNA and isozyme studies). The occurrence of individuals morphologically intermediate between P. opalensis and P. hoodii may ultimately result in the treatment of these taxa as varieties of one species. Due to priority in nomenclature, P. opalensis would then have to be treated as a variety of P. hoodii.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. NATIONAL:

- a. LEGAL STATUS: In 1993, Phlox opalensis was listed as a Category 2 (C2) species by the USFWS under the name "Phlox sp. nov./ined (WY)" (US Fish and Wildlife Service 1993). Unfortunately, it was incorrectly listed as a synonym for P. pungens, another recently described C2 plant (Fertig 1993 b). Category 2 includes taxa for which there is current evidence of vulnerability, but for which USFWS lacks sufficient biological data to support a listing proposal.

On 19 July 1995, USFWS revised its policy on candidate species and replaced the C2 designation with a new category "Species at Risk" (Davis 1995). Species in this new category are no longer considered candidates for listing. At present, no official Species at Risk list has been developed for Wyoming.

P. opalensis is designated as a Special Status plant by the  
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- b. HERITAGE RANK: Prior to 1995, Phlox opalensis was ranked G1 in The Nature Conservancy's Natural Heritage Network system (Fertig 1994). G1 species are considered critically imperiled because of extreme rarity (often with 5 or fewer extant occurrences or very few individuals) or some factor of the species' life history making it especially vulnerable to extinction. Surveys in 1995 resulted in the discovery of over two dozen new and large populations, prompting a change in rank to G3 (Fertig 1996). G3 species are rare or local throughout their range, or are

found in a restricted geographic area (usually with 21-100 extant populations).

2. STATE:

- a. LEGAL STATUS: None.

- b. HERITAGE RANK: Phlox opalensis was formerly listed as S1, indicating that it was critically imperiled in the state because of extreme rarity or some factor of its life history making it extremely vulnerable to extinction (Fertig 1994). Based on surveys in 1995, its status has been dropped to S3, reflecting its greater abundance in the state (Fertig 1996).

C. DESCRIPTION

1. GENERAL NON-TECHNICAL DESCRIPTION: Phlox opalensis is a perennial herb that forms loose mats of semi-erect stems typically less than 2 3/4 inches (7 cm) high (Figures 1-2). Internodes of the stem are elongate, whitish-transparent (hyaline), and have long, crinkly, spreading hairs. The leaves are 1/16-3/8 inches (2-10 mm) long, less than 1/32 inches (1 mm) wide, abruptly tapered to a sharp tip, and crinkly-pubescent (but not glandular) at the base. Flowers are white or occasionally pink and strongly aromatic. The corolla is 9/16-11/16 inches (12-15 mm) wide when fresh and has 5,

(rarely 6), wedge-shaped lobes. Dried herbarium material may have corollas as little as 1/2 inch (10 mm) in diameter. The calyx is 3/8 inches (6-8 mm) long and crinkly-pubescent with 5 sharp-tipped, triangular to linear lobes that are typically shorter than the fused calyx tube (Dorn 1992; Fertig et al. 1994).

2. TECHNICAL DESCRIPTION: Perennial herb forming loose mats 7 cm or less high; internodes pubescent with crinkly multicellular hairs; leaves mostly lanceolate, 2-10 mm long, mostly 0.4-1 mm wide, mucronate, papillate, pubescent mostly toward base with crinkly multicellular hairs; calyx 6-8 mm long, pubescent with crinkly multicellular hairs, the tube longer than the lobes; corolla white, the tube 10-12 mm long, the limb 5-7 mm long, 12-16 mm in diameter; anthers about 1 mm long; style 6-9 mm long; seeds about 3.5 mm long, the surface roughened (Dorn 1992).

Figure 1. Line drawing of Phlox opalensis from Fertig et al.  
1994. Illustration by Jane L. Dorn (originally from Dorn  
1992).

3. LOCAL FIELD CHARACTERS: Phlox opalensis can be recognized in the field by its loosely-matted growth form and prominent white-hyaline internodes that give the plant a distinctive silvery-green appearance. The species can also be distinguished by its large flower size (typically well over 12 mm wide in the field), extremely narrow leaves, and short calyx lobes.

Like most low-growing species of Phlox, P. opalensis can show a wide range of variability, making specimen determinations difficult in some cases (Cronquist et al. 1984). Four main variants have been detected in field and herbarium studies of P. opalensis. Occasional individuals (including the type specimen and Nelson's 1898 Carter collection) exhibit a short-leaved, densely woolly growth form that approaches P. muscoides (differing most notably in flower size). Small-flowered forms of P. opalensis resembling P. hoodii are more commonly encountered, but usually can be distinguished by their elongate internodes and less congested growth habit. Rare forms with extremely long internodes, erect stems, and long leaves resemble P. andicola, but probably only represent an environmentally-induced growth response in less severe microhabitats. P. opalensis plants from the Ross Butte area (WY Occ. # 039) have slightly wider leaves than average. These plants grow intermixed with the "Ross Butte" morph of Phlox pungens, a possibly new and undescribed taxon.

4. SIMILAR SPECIES: Phlox muscoides is densely matted and has shorter, woolly leaves and smaller flowers (5-10 mm wide when fresh, even smaller when dried). P. hoodii has a more congested growth form, lacks elongate internodes, and has smaller flowers that rarely exceed 8 mm in diameter. P. andicola typically has longer and narrower leaves that gradually taper to a sharp point and has papillate or rarely short-hairy internodes. The "Uinta County" phase of P. andicola has broad-based leaves with prominently thickened margins and coarser pubescence. P. albomarginata and P. pungens have broader leaves with thickened leaf margins and are prominently glandular. Each of

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Figure 2 (page 7). Phlox opalensis on a shaley-clay roadside adjacent to Business Route 80 northeast of Lyman, Uinta Co.,

Wyoming. WYNDD photograph by W. Fertig, 4 June 1995.



these species also differs from P. opalensis in its habitat requirements (Cronquist et al. 1984; Dorn 1992; Fertig et al. 1994).

#### D. GEOGRAPHICAL DISTRIBUTION

1. RANGE: Phlox opalensis is a regional endemic of the lower Green River and Bridger basins and the adjacent foothills of the Uinta Mountains in southwestern Wyoming (Lincoln, Sublette, Sweetwater, and Uinta counties) and northeastern Utah (Daggett County) (Figure 3).

2. EXTANT SITES: Prior to 1994, Phlox opalensis was known from five extant occurrences and one historical population, all in the state of Wyoming. Surveys in 1994-95 resulted in the relocation of four of the six known sites (including the historical population) and the discovery of 24 additional sites in Wyoming and three in northeastern Utah. Range-wide, P. opalensis is currently known from 33 extant populations.

Exact locations of extant populations are listed in Table 1. More detailed information is provided in the Element Occurrence Records and maps in Appendix A.

3. HISTORICAL SITES: Based on annotated specimens from the RM, Phlox opalensis was known from two historical collections: Aven Nelson's 1898 specimen from Carter, Wyoming, and Louis Williams' 1932 collection south of Manila, Utah. Both of these occurrences were relocated in 1995 and found to be extant. No other historical sites are presently known.

4. UNVERIFIED/UNDOCUMENTED REPORTS: Five additional occurrences of Phlox opalensis have been reported by Juli Crane and Oliver Grah of Ecotone Environmental Consulting. These reports are based on field work conducted in late summer and fall, 1994, after plants completed flowering. Voucher specimens were not collected to confirm these reports. Four other sites reported by Crane and Grah in 1994 were relocated and verified by Charmaine Refsdal and Walter Fertig in 1995.

A population reported for Slate Creek Butte (Occurrence # 033) by Crane in August, 1994, could not be relocated during a visit in May, 1995. All

Figure 3. Distribution of Phlox opalensis in Wyoming and Utah, circa 1995. Inset map shows known distribution in 1994 (Fertig et al. 1994).

Table 1. Location Information for Known Populations of Phlox opalensis in Southwestern Wyoming and Northeastern Utah.

Note: Due to the combination of some records, there are no Wyoming occurrences under #s 005, 006, 015, 016, and 025. Unconfirmed reports (occurrence #s 026, 027, 030, 032, and 033) are not listed here, but are included in Appendix A.

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I. Wyoming

1. Green River Basin

Occurrence # 001

County: Lincoln.

Legal Description: T21N R113W S9 (SE4 of NE4), 17 (SW4 of SE4), and 21 (N2 of NW4). T21N R114W S25

(NW4), 26 (N2 of NW4), and 27 (NW4).

Latitude: 41° 46' 33" N (centrum).

Longitude: 110° 18' 13" W (centrum).

Elevation: 6500-6800 ft (1980-2075 m).

USGS 7.5' Quad: Opal and Cow Hollow Creek.

Location: Ridge on north side of US Highway 30 just north of Opal, extending from the pumping

station just west of WY State Highway 240 east ca 6 air miles to Cow Hollow Creek.

Occurrence # 002

County: Lincoln.

Legal Description: T20N R115W S11 (SE4 of NE4) and 14 (SE4).

Latitude: 41° 44' 03" N (centrum).

Longitude: 110° 22' 25" W (centrum).

Elevation: 6680-6800 ft (2040-2075 m).

USGS 7.5' Quad: Roberson Creek.

Location: Ca 4 air miles southwest of Opal, ca 3 air miles south of US Highway 30 and the Ham's

Fork River on the Wagonwheel Road.

Occurrence # 003

County: Lincoln.

Legal Description: T19N R116W S16 (NE4 of SE4).

Latitude: 41° 37' 40" N.

Longitude: 110° 31' 11" W.

Elevation: 6900 ft (2100 m).

USGS 7.5' Quad: Elkol.

Location: Ca 12 air mi south of Kemmerer and ca 2.5 air mi east of Highway 189.

Occurrence # 004

County: Uinta.

Legal Description: T17N R115W S28 (E4 of NW4 & SW4 of NE4).

Latitude: 41° 25' 40" N.  
Longitude: 110° 24' 50" W.  
Elevation: 6700 ft (2040 m).  
USGS 7.5' Quad: Carter.  
Location: Ridge on south side of Muddy Creek, ca 1 mile southeast of  
Carter, on east side of WY  
State Highway 412.

Occurrence # 007  
County: Sweetwater.  
Legal Description: T21N R109W S4 (NW4). T22N R109W S32 (SE4).  
Latitude: 41° 49' 45" N.  
Longitude: 109° 46' 55" W.  
Elevation: 6230-6300 ft (1900-1920).  
USGS 7.5' Quad: Lombard Buttes.  
Location: 1.5 miles south of confluence of Green and Big Sandy rivers (on  
east side of Green  
River).

Table 1. (continued)

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Occurrence # 008  
County: Sweetwater.  
Legal Description: T13N R110W S1 (S2), 2 (SE4 & NE4 OF NW4), and 4 (SE4).  
T14N R110W S27 (S2  
of SE4) 34 (NE4 of NE4), 35 (W2 of NW4, S2 of NE4, N2 of SE4, & SW4) and 36  
(W4 of W4).  
Latitude: 41° 09' 03" N (centrum).  
Longitude: 109° 46' 30" W (centrum).  
Elevation: 6740-7100 ft (2055-2165 m).  
USGS 7.5' Quad: Black Spring Reservoir.  
Location: Southwest flank of Black Mountain and border of Twin Buttes Road  
for ca 2 road miles  
southeast of County Rd 1. Also on west slope of Twin Buttes, ca 3 air miles  
east of County Rd 1, ca 5 air miles north of Henry's Fork River.

Occurrence # 009  
County: Sweetwater.  
Legal Description: T19N R111W S6 (SE4 of SE4). T20N R112W S27 (S2 of SW4),  
28 (E2 of SE4), and  
34 (SW4).  
Latitude: 41° 40' 07" N (centrum).  
Longitude: 110° 03' 05" W (centrum).  
Elevation: 6400-6500 ft (1950-1980 m).  
USGS 7.5' Quad: Moxa and Sevenmile Gulch.  
Location: Vicinity of Moxa on the east side of the Ham's Fork River east of  
US Highway 30, ca 18.3  
miles east of junction of US 30 and WY State Highway 240. Also on ridge ca  
3 miles east of Lincoln-Sweetwater county line.

Occurrence # 010  
County: Sweetwater.  
Legal Description: T21N R107W S18 (S2 & S2 of NE4). T21N R108W S31 (S2).  
Latitude: 41° 47' 31" N (centrum).  
Longitude: 109° 34' 55" W (centrum).  
Elevation: 6600-6850 ft (2010-2090 m).  
USGS 7.5' Quad: Austin Ranch and Chrisman Ranch  
Location: Blue Rim, ca 0.5 miles north of junction of Sweetwater County Rds  
4 and 5, and on banks  
of North Branch Water Gap Wash, ca 7 air miles east-northeast of the "Big  
Island" of the Green River. Also in vicinity of Blue Rim Peak, 0.8  
miles south of the junction of county roads 5 and 14.

Occurrence # 018  
County: Sweetwater.  
Legal Description: T15N R109W S20 (SW4 of SE4) and 29 (NW4 of NE4). T15N  
R110W S26 (S2 of  
SE4), 35 (NE4 of NW4), and 36 (W2 of NW4).  
Latitude: 41° 14' 40" N (centrum).

Longitude: 109° 46' 30" W (centrum).  
Elevation: 6350-6680 ft (1935-2040 m).  
USGS 7.5' Quad: Black Spring Reservoir and Halfway Hollow West.  
Location: Southwest slope of unnamed shaley mountain just northeast of the junction of Cedar Mountain Road and Dry Creek Road, ca 1.5 air miles northwest of Sweetwater County Road 1, ca 7.5 miles southwest of McKinnon Junction. Also on east side of County Road 1 4.5 road miles southwest of McKinnon Junction.

Occurrence # 019  
County: Sweetwater.  
Legal Description: T12N R108W S6 (NE4 of NE4). T13N R108W S31 (SE4 of SE4).  
Latitude: 41° 03' 25" N (centrum).  
Longitude: 109° 37' 10" W (centrum).  
Elevation: 6200 ft (1890 m).  
USGS 7.5' Quad: Haystack Buttes South.  
Location: Slopes adjacent to WY State Highway 530, ca 0.25 miles south of Twin Buttes Draw, ca 1 mile west-southwest of Flaming Gorge Reservoir.

Table 1. (continued)

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Occurrence # 020  
County: Sweetwater.  
Legal Description: T14N R109W S1 (SE4 of SE4).  
Latitude: 41° 13' 08" N (centrum).  
Longitude: 109° 38' 17" W (centrum).  
Elevation: 6240-6280 ft (1900-1915 m).  
USGS 7.5' Quad: Devils Playground.  
Location: Badlands on northeast foothills of the Devils Playground on the west side of WY State  
Highway 530, 2 road miles south of the turnoff to South Buckboard Crossing, ca 1.75 miles west of Flaming Gorge Reservoir.

Occurrence # 021  
County: Sweetwater.  
Legal Description: T14N R111W S23 (NW4 of NE4).  
Latitude: 41° 11' 10" N.  
Longitude: 109° 53' 30" W.  
Elevation: 7060 ft (2150 m).  
USGS 7.5' Quad: Horse Ranch.  
Location: Adjacent to Cedar Mountain Road and Little Dry Creek on northeast flank of Mass Mountain,  
ca 11 air miles north of McKinnon.

Occurrence # 022  
County: Sweetwater.  
Legal Description: T18N R112W S1 (SE4).  
Latitude: 41° 33' 55" N (centrum).  
Longitude: 110° 00' 30" W (centrum).  
Elevation: 6320-6400 ft (1925-1950 m).  
USGS 7.5' Quad: Verne.  
Location: Moss Agate Knoll, ca 2 air miles southwest of Granger, ca 1 mile south of Blacks Fork  
River.

Occurrence # 023  
County: Sweetwater.  
Legal Description: T15N R110W S30 (S2 of NW4 & N2 of SW4). T15N R111W S21 (NE4), 22 (NW4 of NW4), 25 (NE4), and 26 (N2).  
Latitude: 41° 15' 27" N (centrum).  
Longitude: 109° 52' 25" W (centrum).  
Elevation: 6550-6720 ft (1995-2050 m).  
USGS 7.5' Quad: Needle Reservoir and Winter Fat Reservoir.  
Location: Slopes on banks of tributary of Big Dry Creek, ca 2.5 air miles northeast of north end of  
Cedar Mountain, ca 5 air miles west-northwest of highway to McKinnon. Also in badlands along Dry Creek Road at the north end of Cedar Mountain, ca 17 air miles north of McKinnon.

Occurrence # 031  
County: Sublette.  
Legal Description: T27N R106W S29 (SW4).  
Latitude: 42° 15' 58" N.  
Longitude: 109° 29' 15" W.  
Elevation: 6800 ft (2075 m).  
USGS 7.5' Quad: Big Sandy Reservoir.  
Location: 2 miles west of Big Sandy Reservoir (on west side of US Highway 191).

Occurrence # 034  
County: Lincoln.  
Legal Description: T21N R114W S1 (N2). T22N R113W S31 (S2 of NE4) and 32 (S2 of NW4).  
Latitude: 41° 50' 42" N (centrum).  
Longitude: 110° 16' 00" W (centrum).  
Elevation: 6680-6800 ft (2035-2075 m).  
USGS 7.5' Quad: Opal.  
Location: Northwest end of Opal Bench (on summit), ca 1.5 miles south of county road to Exxon  
Plant. Also on east side of WY State Highway 240, ca 4.1 miles north of Opal.

Table 1. (continued)

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Occurrence # 035  
County: Sweetwater.  
Legal Description: T16N R109W S27 (NW4), 29 (SW4), and 30 (SE4).  
Latitude: 41° 20' 33" N (centrum).  
Longitude: 109° 41' 25" W (centrum).  
Elevation: 6240-6360 ft (1900-1940 m).  
USGS 7.5' Quad: Halfway Hollow West.  
Location: 13.5-15.2 air miles southwest of Green River, 2.5-3.5 air miles northwest of McKinnon Junction.

Occurrence # 036  
County: Lincoln.  
Legal Description: T19N R113W S12 (SW4). T20N R113W S32 (SE4) and 33 (SW4).  
Latitude: 41° 40' 13" N (centrum).  
Longitude: 110° 11' 33" W (centrum).  
Elevation: 6460-6500 ft (1970-1980 m).  
USGS 7.5' Quad: Church Butte NW.  
Location: Benchland between Ziegler's Wash and Dry Muddy Creek, 9-13 air miles west-northwest of Granger, ca 22-24.5 air miles southeast of Kemmerer.

Occurrence # 037  
County: Sweetwater.  
Legal Description: T16N R110W S29 (SW4), 30 (SE4), 31 (E2), and 32 (NW4).  
Latitude: 41° 19' 53" N.  
Longitude: 109° 50' 45" W.  
Elevation: 6400-6480 ft (1950-1975 m).  
USGS 7.5' Quad: Winter Fat Reservoir.  
Location: ca 19 air miles southwest of Green River, 12.6 miles west of WY State Highway 530 on gravel access road.

Occurrence # 038  
County: Sweetwater.  
Legal Description: T13N R108W S4 (SW4 of SW4), 5 (SE4), 8 (E2) and 9 (W2 of W2 & NE4 of NW4). T13N R109W S3 (W2 of NW4) and 4 (E2 of NE4 of SE4). T14N R108W S31 (NW4 & SW4 of NE4). T14N R109W S25 (SW4 of SE4), 26 (SW4 of SW4), 27 (SW4 & S2 of SE4), 28 (E4 of SW4, W4 of SE4, & SE4 of NW4), 33 (W2 of NE4), 34 (SW4 of SW4) and 36 (NE4).  
Latitude: 41° 09' 15" N (centrum).  
Longitude: 109° 38' 15" W (centrum).  
Elevation: 6140-7300 ft (1870-2225 m).  
USGS 7.5' Quad: Devils Playground, Haystack Buttes North, and Haystack Buttes South.  
Location: West side of Flaming Gorge Reservoir, extending from the

southeast flank of Black  
Mountain to the south end of Haystack Buttes and the intervening basin  
following the Black Mountain Road for ca 5.5 miles west of WY State  
Highway 530.

Occurrence # 039  
County: Sublette.  
Legal Description: T30N R109W S23 (W2).  
Latitude: 42° 33' 15" N.  
Longitude: 109° 48' 35" W.  
Elevation: 7100 ft (2165 m).  
USGS 7.5' Quad: Olsen Ranch.  
Location: East end of Ross Ridge (Blue Rim, in vicinity of Burma Peak).

Occurrence # 040  
County: Sweetwater.  
Legal Description: T26N R108W S7 (W2).  
Latitude: 42° 14' 35" N.  
Longitude: 109° 44' 23" W.  
Elevation: 6900 ft (2100 m).

Table 1. (continued)

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USGS 7.5' Quad: Twelvemile Knoll.  
Location: ca 17 air miles north-northwest of Farson (ca 3 miles east of East Buckhorn Draw, ca 14 air miles west of US Highway 187).

2. Bridger Basin

Occurrence # 011  
County: Uinta.  
Legal Description: T16N R114W S13 (SW4).  
Latitude: 41° 21' 57" N.  
Longitude: 110° 12' 58" W.  
Elevation: 6540-6580 ft (1995-2005 m).  
USGS 7.5' Quad: Turtle Hill.  
Location: Ridge adjacent to Business Route 80, 1.5 air miles south of Interstate 80, ca 4.5 road miles northeast of Lyman.

Occurrence # 012  
County: Sweetwater.  
Legal Description: T18N R111W S27, 30 (SE4), and 31 (N2).  
Latitude: 41° 30' 40" N (centrum).  
Longitude: 109° 59' 17" W (centrum).  
Elevation: 6500-6740 ft (1980-2055 m).  
USGS 7.5' Quad: Granger.  
Location: Badlands on northwest side of Interstate 80 at exit 61 (Cedar Mountain Road exit), ca 5 road miles southwest of Granger Junction and on south side of Interstate 80, ca 1 mile southeast of US Highway 30.

Occurrence # 017  
County: Uinta.  
Legal Description: T15N R114W S26 (SW4 of SE4), 35 (NW4 of NE4), and 36 (NE4 of SW4).  
Latitude: 41° 14' 40" N (centrum).  
Longitude: 110° 13' 36" W (centrum).  
Elevation: 6600-6680 ft (2010-2040 m).  
USGS 7.5' Quad: Reed Reservoir.  
Location: Badlands on north side of WY State Highway 414, in basin on west side of Cottonwood Bench, ca 6 air miles east-southeast of Mountain View and along Leavitt Creek along south end of Cottonwood Bench.

Occurrence # 024  
County: Uinta and Sweetwater.  
Legal Description: T17N R112W S15 (SW4 of SE4), 17 (W2), 22 (NW4 of NE4 & E2 of NW4), and 30 (SE4).  
T16N R113W S1 (S2), 12 (NE4 of SW4 & NW4 of SE4), 13 (E2), 26 (N2 of NW4),

27 (NW4 of SE4 of NE4).  
Latitude: 41° 22' 47" N (centrum).  
Longitude: 110° 05' 42" W (centrum).  
Elevation: 6680-6980 ft (2040-2130 m).  
USGS 7.5' Quad: Butcher Knife Draw, Turtle Hill, and Wildcat Butte.  
Location: Ridge system extending from Wildcat Butte and Blumel Draw (just north of Interstate 80) south-southwest ca 7.5 miles to Mud Spring Hollow, paralleling the Church Butte Road.

Occurrence # 028  
County: Uinta.  
Legal Description: T15N R112W S17 (SW4 of NE4) and 32 (NW4).  
Latitude: 41° 17' 03" N.  
Longitude: 110° 03' 57" W.  
Elevation: 6725-6820 ft (2050-2080 m).  
USGS 7.5' Quad: Butcher Knife Draw and Soap Holes Reservoir.  
Location: North side of Dry Wash Road, ca 2 miles southwest of Butcher Knife Draw and ca 1.5 miles east of Shutliff Spring. Also on west side of Dry Creek and Big Hollow Bench, ca 11 air miles southeast of Lyman on Burnt Fork-Cedar Mountain Road.

Table 1. (continued)

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Occurrence # 029  
County: Uinta.  
Legal Description: T18N R113W S23 (E2) and 26 (NE4 of SE4 of NW4).  
Latitude: 41° 30' 51" N.  
Longitude: 110° 08' 35" W.  
Elevation: 6430-6700 ft (1960-2040 m).  
USGS 7.5' Quad: Church Butte.  
Location: Ridge system on east side of Blacks Fork River, ca 8-9 air miles southwest of Granger, ca 0.75-1.5 miles north of the Church Butte Historical Monument.

3. Northern Foothills of the Uinta Mountains

Occurrence # 013  
County: Sweetwater.  
Legal Description: T13N R111W S27 (SW4 of SW4) and 28 (SE4).  
Latitude: 41° 04' 30" N (centrum).  
Longitude: 109° 55' 27" W (centrum).  
Elevation: 7000-7060 ft (2130-2150 m).  
USGS 7.5' Quad: McKinnon.  
Location: Ridge crossing Sweetwater County Road 1, ca 2 road miles north of the crossing of the Henry's Fork River.

Occurrence # 014  
County: Uinta.  
Legal Description: T13N R113W S4, 8 (NE4 of NE4 & NE4 of SW4, 9 (NW4), 18 (N2 of SE4), 22 (SW4 of SE4), 27 (NE4 of NW4 & NW4 of NE4). T14N R113W S20 (NW4 of SW4 & SW4 of SE4).  
Latitude: 41° 07' 03" N (centrum).  
Longitude: 110° 10' 30" W (centrum).  
Elevation: 7100-7700 ft (2165-2345 m).  
USGS 7.5' Quad: Lonetree and Reed Reservoir.  
Location: Badlands paralleling WY State Highway 414 in the valley between Sage Creek, Hickey, and Cedar mountains and on the lower foothills of these mountains.

II. Utah

Occurrence # 1  
County: Daggett.  
Legal Description: T2N R24E S23 (NW4).  
Elevation: 5500-5700 ft (1675-1740 m).  
USGS 7.5' Quad: Clay Basin.  
Location: Brown's Park, ca 11 air miles east of Dutch John on the north side of the Green River.

Occurrence # 2

County: Daggett.

Legal Description: T3N R20E S30 (W2).

Elevation: 6350 ft (1935 m).

USGS 7.5' Quad: Manila.

Location: Adjacent to State Highway 44 1.2 road miles south of junction of Highways 44 and 43 in

Manila, ca 2 miles south of the Wyoming state line.

Occurrence # 3

County: Daggett.

Legal Description: T3N R20E S26 (NW4).

Elevation: 6080-6280 ft (1855-1920 m).

USGS 7.5' Quad: Manila.

Location: Ca 4 air miles east of Manila.

of the phlox plants observed at the site were identified as P. hoodii or P. muscoides. Occasional P. muscoides plants were found to have large flowers (10-12 mm), approaching P. opalensis size. Additional study is needed to confirm if P. opalensis is truly present.

5. AREAS SURVEYED BUT SPECIES NOT LOCATED: Surveys in 1995 focused primarily on clay-shale badlands in the southern Green River and Bridger basins from Kemmerer and Opal south to the Utah state line. Brief and mostly unsuccessful searches were also conducted on the east side of Flaming Gorge, the Baxter Basin area south of Rock Springs, the Jack Morrow Hills Ecosystem on the west rim of the Great Divide Basin, the foothills of the Overthrust Belt south of Kemmerer, the foothills of the Uinta Mountains, and the White Mountain area. Survey routes are shown in Appendix B.

#### E. HABITAT

1. ASSOCIATED VEGETATION: Phlox opalensis typically occurs in open desert shrub or cushion plant communities on fine-textured clay-shale flats, slopes, and rims (Figure 4). These sites often have a surface of chert or reddish sandstone gravel that accounts for 50% or more of the total cover.

P. opalensis is most often encountered in communities dominated by Atriplex gardneri and Chrysothamnus nauseosus. While both of these shrubs are widespread in Wyoming, they are rarely reported together in the literature (Jones 1992). These communities are usually found on gentle slopes, rims, or flats with deep soils covered by desert pavements of chert or sandstone. Individual stands may have high cover of Oryzopsis hymenoides, Poa secunda, Artemisia spinescens,

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Figure 4. (page 17) Habitat of Phlox opalensis on badlands slopes on the southwest side of Sage Creek Mountain, east of WY State Highway 414 (Uinta County). P. opalensis occurs primarily on pinkish-colored clay-shale slopes covered with a surface layer of reddish sandstone and chert. Scattered plants may also be found in openings among sagebrush dominated by Atriplex gardneri and Chrysothamnus nauseosus. It is rare or absent from areas of high sagebrush cover or barren clay slopes. WYNDD photograph by W. Fertig, 14 May 1995.



Artemisia tridentata var. wyomingensis, Kochia americana,  
and Xylorhiza glabriuscula.

A. gardneri stands are typically replaced by cushion plant communities on rocky, windswept ridges with thin soils covered by shale or sandstone gravel, flakes, or cobbles. P. opalensis is often locally dominant at these sites, or shares dominance with Arenaria hookeri, Haplopappus armerioides, or, occasionally, Artemisia pedatifida. At a few locations these cushion plants form the understory in open woodlands of Juniperus osteosperma.

P. opalensis may also occur in communities dominated by Artemisia tridentata var. wyomingensis and Chrysothamnus nauseosus. These stands are often found on lower slopes and may be replaced by Atriplex gardneri communities on upper slopes. Occasional stands are characterized by unusually low surface rock cover or high shrub density. Hybrid clusters of P. opalensis and P. hoodii have been found in these communities.

A few colonies of P. opalensis are found in sites locally dominated by Sarcobatus vermiculatus, Artemisia pedatifida, Kochia americana, or Sphaeromeria argentea. As with most other communities, these stands are found primarily on clay-shale soils with abundant surface gravel.

P. opalensis is notably rare or absent from sites with dense cover of sagebrush or graminoids and on barren clay slopes lacking surface gravels. It is largely replaced by P. hoodii on sandier soils with higher cover and by P. muscoides on more calcareous sites.

## 2. FREQUENTLY ASSOCIATED SPECIES:

Allium textile (Textile onion)  
Arenaria hookeri (Hooker's sandwort)  
Artemisia pedatifida (Birdsfoot sagebrush)  
Artemisia spinescens (Bud sagewort)  
Artemisia tridentata var. wyomingensis (Wyoming big  
sagebrush)  
Astragalus chamaeleuce (Cicada milkvetch)  
Astragalus flavus (Yellow milkvetch)  
Astragalus jejunus var. jejunus (Starveling milkvetch)  
Astragalus megacarpus (Great bladderly milkvetch)  
Astragalus spatulatus (Spoonleaf milkvetch)  
Atriplex gardneri (Gardner saltbush)

Castilleja angustifolia var. dubia (Desert paintbrush)  
Chrysothamnus nauseosus (Rubber rabbitbrush)  
Chrysothamnus viscidiflorus (Green rabbitbrush)  
Cryptantha caespitosa (Tufted cat's-eye)  
Cymopterus acaulis (Plains spring-parsley)  
Cymopterus bulbosus (Onion spring-parsley)  
Cymopterus lapidosus (Echo spring-parsley)  
Cymopterus undescribed taxon  
Elymus elymoides [Sitanion hystrix] (Squirreltail)  
Eriogonum ovalifolium (Cushion buckwheat)  
Haplopappus acaulis (Stemless goldenweed)  
Haplopappus armerioides (Thrift goldenweed)  
Haplopappus nuttallii (Nuttall's goldenweed)  
Juniperus osteosperma (Utah juniper)  
Kochia americana (Gray molly)  
Krascheninnikovia lanata [Ceratoides lanata]  
(Winterfat)  
Lomatium foeniculaceum (Fennel-leaved desert- parsley)  
Oryzopsis hymenoides (Indian ricegrass)  
Phacelia scopulina (Prostrate phacelia)  
Phlox hoodii (Hood's phlox)  
Phlox longifolia (Long-leaved phlox)  
Phlox muscoides (Squarestem phlox)  
Poa secunda (Sandberg's bluegrass)  
Sarcobatus vermiculatus (Greasewood)  
Stenogonum salsuginosum (Stenogonum)  
Trifolium gymnocarpon (Hollyleaf clover)  
Xylorhiza glabriuscula (Woodyaster)

3. TOPOGRAPHY: Phlox opalensis is found primarily on low to moderately steep slopes and rims on all aspects (Figure 5). Colonies often extend onto adjacent colluvial fans or shallow basins. Populations may also be found in deep erosional channels on otherwise barren clay-shale slopes. These channels typically have a high cover of Atriplex gardneri, Artemisia tridentata, Sarcobatus vermiculatus, and a variety of desert forbs.

Known occurrences of P. opalensis in Wyoming range in elevation from 6200-7700 feet (1890-2345 m). Populations in Utah occur from 5500-6350 feet (1675-1935 m).

4. SOIL RELATIONSHIPS: Populations of Phlox opalensis are found primarily on fine-textured, light colored clays and shales derived from the Bridger

Figure 5. Topographic position of Phlox opalensis on the landscape. Ill. by W. Fertig.

or Green River Formations (Love and Christiansen 1985). These soils are characterized by low infiltration and high albedo. The abundance of Atriplex gardneri in P. opalensis habitat suggests that these soils are also relatively saline (Knight 1994). Some colonies of P. opalensis have been found on seleniferous soils.

5. REGIONAL CLIMATE: Average annual precipitation in the range of Phlox opalensis is 8-10 inches (200-250 mm), with peak levels in April and May. Mean annual temperature is 38-42° F (4.4° C), with mean maximum and minimum temperatures in January of 29° and 4° F (- 1.6° and - 15.5° C) and mean maximum and minimum temperatures in July of 83° and 46° F (28.3° and 7.8° C) (Martner 1986).

6. LOCAL MICROCLIMATE: Phlox opalensis populations are typically found on exposed, open slopes or rims exposed to strong winds and high levels of solar radiation. These sites are probably drier and have higher surface temperatures than adjacent, more sheltered or highly vegetated areas. Some populations are found within deep erosional channels which may be more mesic than surrounding slopes.

#### F. POPULATION BIOLOGY AND DEMOGRAPHY

1. PHENOLOGY: Flowering occurs from mid April to late June or early July, depending on seasonal moisture conditions. Mature fruits may be present from mid May to early July. Plants appear to produce flowers and fruits earlier on more open, exposed sites than in sheltered areas. At one site in the badlands north of Cedar Mountain, Wyoming, 70% of the P. opalensis plants were in flower and 5-10% in fruit in exposed areas in early June, while only 40% were in flower or fruit in sheltered microsites.

2. POPULATION SIZE AND CONDITION: Phlox opalensis is currently known from 33 extant populations in Wyoming and Utah. Occurrences range in size from under 1 acre to over 500 acres. Individual populations are typically subdivided into smaller subpopulations restricted to pockets of suitable habitat.

Census data are available for 18 occurrences in Wyoming and one in Utah (Table 2). Populations range in size from 20 to over 500,000 rosettes.

Table 2. Demographic information for surveyed populations of Phlox opalensis in Southwestern Wyoming and Northeastern Utah.

Note: This table contains only those occurrences surveyed by WYNDD in 1995. For additional information, see Appendix A.

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I. Wyoming

1. Green River Basin

Occurrence # 001

Area: 25 + acres.

Number and Age of Plants: 400-1000 plants (estimated) in 4 colonies surveyed in 1995. Found in 12 discrete colonies in all.

Density: Distribution patchy. Plants may be locally abundant in limited areas of suitable habitat.

Evidence of Reproduction: Plants observed in flower in spring 1990, 1994, and 1995. Fruits observed in 1990 and 1995.

Population Trends: Surveys in 1994 and 1995 have greatly expanded the known range of the species at this site.

Occurrence # 004

Area: 10 acres.

Number and Age of Plants: Population estimated at 800-1000 plants in 1995. Many additional plants are present that may be hybrids between P. opalensis, P. muscoides, and P. hoodii. Approximately 15% in flower on 13 May.

Density: P. opalensis plants exhibit a clumped distribution pattern.

Evidence of Reproduction: Plants observed in flower in June, 1898 and May, 1995.

Population Trends: The colony found in 1995 is believed to be the same as one reported by Aven Nelson in 1898.

Occurrence # 008

Area: 360 acres.

Number and Age of Plants: Population conservatively estimated at over 150,000 plants in two large colonies in 1995. 85-95% of all plants in flower or fruit.

Density: Plants range from being locally dominant in areas of suitable habitat to sparse and widely scattered on less favorable microsites.

Evidence of Reproduction: Plants observed in flower and fruit on 6 June 1995.

Population Trends: Site first documented in 1993. Surveys in 1995 have greatly expanded the known

range of P. opalensis at this site.

Occurrence # 009

Area: 20 + acres.

Number and Age of Plants: Population estimated at 2000-5000 plants in one large colony in 1995.

Four smaller colonies are known in the immediate vicinity, but no population estimates are available.

Density: Observed to be locally abundant and dense in suitable habitat; otherwise rare or absent.

Evidence of Reproduction: Plants observed in flower and fruit in May and June, 1995.

Population Trends: Site first reported in 1994. Surveys in 1995 have expanded the known range of

P. opalensis at this site.

Occurrence # 010

Area: 50 + acres.

Number and Age of Plants: Population estimated at 10,000-20,000 plants at Water Gap Wash in 1995.

No census data are available for a second colony (Blue Rim Peak) included in this occurrence.

Density: Densities as high as 12 plants per square meter were observed in 1995. Overall

distribution is patchy at this site.

Evidence of Reproduction: Plants observed in flower and fruit in June, 1995.

Population Trends: Not known.

Table 2. (continued)

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Occurrence # 018

Area: 200 + acres.

Number and Age of Plants: Population estimated at 80,000-100,000 plants in 1995. This figure is probably low based on the large amount of unsurveyed potential habitat in the immediate vicinity.

Density: Plants range from locally dominant to sparse and scattered.

Evidence of Reproduction: 60% in flower on 15 May 1995. In flower and fruit on 14 June 1995.

Population Trends: Not known.

Occurrence # 019

Area: 12 acres.

Number and Age of Plants: Population estimated at 1000-2000 plants in 1995.

Density: Distribution patchy on flats, more dense in draws.

Evidence of Reproduction: 60-80% in flower and fruit on 3 June 1995.

Population Trends: Not known.

Occurrence # 020

Area: 10 acres.

Number and Age of Plants: Population estimated at 2000-3000 plants in 1995.

Density: Locally abundant in suitable microhabitats; otherwise absent or sparse.

Evidence of Reproduction: 80% in flower or fruit on 1 June 1995.

Population Trends: Not known.

Occurrence # 021

Area: 1 + acre.

Number and Age of Plants: Population estimated at 50-100 plants in very brief survey in 1995. Much additional unsurveyed habitat in vicinity.

Density: Not known.

Evidence of Reproduction: In flower on 14 May 1995.

Population Trends: Not known.

Occurrence # 023

Area: 200 + acres.

Number and Age of Plants: Two large colonies observed in 1995 with an estimated 50,000-60,000 and 170,000-200,000 plants respectively.

Density: Densities vary from very sparse on bare slopes to extremely dense in narrow draws and flats.

Evidence of Reproduction: 40-70% in flower and 5-10% in fruit on 15 May 1995. Observed in flower and fruit on 14 June 1995.

Population Trends: Not known.

Occurrence # 034

Area: 25 + acres.

Number and Age of Plants: Population estimated at 2500-3000 plants in 1995.

Additional unsurveyed  
habitat exists in the adjacent area.

Density: Locally common in areas of suitable microhabitat, absent or sparse  
in between.

Evidence of Reproduction: In flower on 11 May 1995 and in flower and fruit  
on 30 June 1995.

Population Trends: Not known.

Occurrence # 038

Area: 500 + acres.

Number and Age of Plants: Population estimated at 480,000-520,000  
individuals in nine approximately  
continuous colonies.

Density: Abundance varies from locally dominant to widely scattered.

Exhibits a clumped, non-  
random distribution pattern.

Evidence of Reproduction: 85-90% in flower and fruit on 3 June 1995.

Population Trends: Not known.

Table 2. (continued)

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2. Bridger Basin

Occurrence # 011

Area: 5+ acres.

Number and Age of Plants: Population estimated at 5000 plants in 1995.

Much additional, unsurveyed habitat is present in the vicinity.

Density: Locally common on suitable microsites.

Evidence of Reproduction: 75% in flower and 90% in fruit on 4 June 1995.

Population Trends: Not known. May be recolonizing formally disturbed barrow pits along a paved highway.

Occurrence # 012

Area: 15 + acres.

Number and Age of Plants: Population estimated at 7000-10,000 plants at one of three known colonies in 1995.

Density: Widely scattered to locally dominant, depending on microhabitat.

Evidence of Reproduction: 85% in flower and fruit on 4 June 1995.

Population Trends: This site was first located in 1980. Surveys in 1995 have resulted in an expansion of its known range at this site.

Occurrence # 017

Area: 15 + acres.

Number and Age of Plants: Population estimated at 60,000-80,000 plants at one of two known colonies in 1995.

Density: Plants exhibit a clumped, non-random distribution pattern.

Evidence of Reproduction: Approximately 95% in flower on 13 May 1995. In flower and fruit on 18 June 1995.

Population Trends: Not known.

Occurrence # 024

Area: 150 + acres.

Number and Age of Plants: Population estimated at 53,000-60,000 plants in three large colonies in 1995. No data are available for six other colonies included in this occurrence.

Density: Plants exhibit a clumped, non-random distribution pattern and vary from locally dominant to sparse.

Evidence of Reproduction: 90% in flower and fruit on 4 June 1995.

Population Trends: This site was first reported in 1994. Surveys in 1995 have greatly expanded the known range and size of this population.

### 3. Northern Foothills of the Uinta Mountains

Occurrence # 013

Area: 25 acres.

Number and Age of Plants: Locally abundant, but no population estimate made.

Density: Not recorded.

Evidence of Reproduction: 85-90% in flower or fruit.

Population Trends: Not known.

Occurrence # 014

Area: 100 + acres.

Number and Age of Plants: Three large colonies observed in 1995 containing 30,000-40,000, 120,000, and 80,000-100,000 individuals respectively.

Density: Densities as high as 11 rosettes per square meter recorded at some sites. Overall,

density varies from locally abundant to sparse.

Evidence of Reproduction: 40-80% in flower on 14 May 1995.

Population Trends: Not known.

Table 2. (continued)

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II. Utah

Occurrence # 1

Area: 0.1 acres.

Number and Age of Plants: 20 plants observed in brief survey in 1995.

Density: Plants exhibit a clumped, non-random distribution pattern.

Evidence of Reproduction: Observed in flower on 3 June 1995.

Population Trends: Not known. This colony may be the same as one discovered by

Louis Williams in 1932.

Total Estimated Population Size (1995):

Wyoming: 1,303,750-1,480,100

Green River Basin: 948,750-1,065,100

Bridger Basin: 125,000-155,000

N. Foothills of the Uintas: 230,000-260,000

Utah: Not known.

Based only on these surveyed occurrences, the total population of P. opalensis is estimated to be between 1,300,000 and 1,500,000 rosettes. Given the amount of additional, unsurveyed habitat and the lack of census data for 15 of the known occurrences, these estimates are probably conservative.

P. opalensis plants vary from being locally dominant to sparse and widely scattered, depending on the microhabitat. At favorable sites, densities of 11-12 rosettes per square meter have been observed. Populations exhibit a clumped, non-random distribution pattern.

No census information exists for populations found prior to 1995, and thus no trend data are available. The perennial nature and abundance of this species at most sites suggests that populations are probably stable at present.

Populations studied in 1995 were found to consist primarily of mature flowering and fruiting rosettes. Seedlings or undersized, presumably young, plants were rarely observed. The lack of younger plants may reflect poor establishment in the drought year of 1994.

### 3. REPRODUCTIVE BIOLOGY:

a. TYPE OF REPRODUCTION: Phlox opalensis is a perennial that reproduces sexually by seed. The plant may also spread vegetatively by underground caudex branches.

b. POLLINATION BIOLOGY: Most phlox species are pollinated by butterflies and moths (Grant 1959), although long-tongued bees are reported to pollinate Phlox muscoides (Cronquist et al. 1984). The large tubular flowers and strong fragrance of P. opalensis probably serve to attract long-tongued insect pollinators. Brownish-grey diurnal moths and hairy, pollen-feeding beetles (Family Melyridae) were observed on P. opalensis flowers in 1995.

c. SEED DISPERSAL AND BIOLOGY: Seeds of Phlox opalensis are about 3.5 mm long and have roughened surfaces (Dorn 1992). The dispersal agent for these seeds is not known, although wind may be responsible for some short range

dissemination.

Seedling establishment in the hostile desert environment of P. opalensis is probably episodic. The longevity of seeds, presence of a seed bank, and germination requirements are not currently known.

#### G. POPULATION ECOLOGY

1. GENERAL SUMMARY: Phlox opalensis occurs primarily on fine-textured clay-shale soils with a surface layer of chert or reddish sandstone in open, desert shrub or cushion plant communities. Populations range from sparse to locally dominant, depending on the suitability of the microhabitat.

2. COMPETITION: This species is found primarily in open areas with low (15-35%) vegetative cover. Phlox opalensis is often rare or absent from sites with dense cover of shrubs and graminoids, suggesting that it is not tolerant of shading or competition for space and resources. Plants growing in deep, erosional channels, however, may exist under taller and denser cover than normal.

3. HERBIVORY: Leaves, stems, and flowers of Phlox opalensis showed little to no evidence of herbivory from livestock or native grazers in 1995. Fruits and seeds, however, may be consumed by rodents or insects. Plants in the Blue Rim area (north of Green River, Wyoming) were found to be infected by a rust fungus, Puccinia yosemitana, in 1995 (Baxter 1995).

4. HYBRIDIZATION: There is strong evidence to suggest that Phlox opalensis can hybridize with P. hoodii and P. muscoides when they grow together. These species appear to lack reproductive, spatial, and temporal isolating mechanisms to prevent interbreeding, relying instead on ecological barriers. Hybridization is often observed in areas where different substrates are in close proximity. For example, hybrid clusters are found near Carter and Moxa (WY EO #s 004 and 009) on sites with a mosaic of clay-shale, sand, and limey-sandstone soils. Most putative hybrid plants have the loosely matted growth form and long internodes of P. opalensis combined with smaller flowers or pubescence features typical of P. hoodii or P. muscoides.

#### H. LAND OWNERSHIP

1. BLM: 28 of the 30 confirmed occurrences of Phlox opalensis in Wyoming are found wholly or partly on lands managed by the BLM Rock Springs District (Table 3). Five additional populations have been reported, but not confirmed, from District lands. One Utah occurrence is found within the BLM Vernal District.
2. US FOREST SERVICE: A small portion of the Haystack Buttes-SE Black Mountain population (WY Occ. # 038) and Utah occurrence # 3 are found within Flaming Gorge National Recreation Area, managed by Ashley National Forest.
3. STATE OF WYOMING: Wyoming Occurrence # 003 is found within a state section 12 miles south of Kemmerer. The small population along Utah State Highway 44 south of Manila appears to be on a highway department right-of-way.
4. PRIVATE: One entire Wyoming population and parts of eight others are found on private sections within the BLM-private lands checkerboard paralleling the Union Pacific Railroad in southwestern Wyoming.
5. OTHER: Part of one occurrence is found within Seedskaadee National Wildlife Refuge, north of Green River, Wyoming.
6. SPECIAL MANAGEMENT AREAS: The population found on Seedskaadee National Wildlife Refuge is the only occurrence of P. opalensis currently found within a designated special management area. Two Wyoming populations west of Flaming Gorge are contained within the Black Mountain and Twin Buttes BLM Wilderness Study Areas.

#### IV. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. POTENTIAL THREATS TO CURRENTLY KNOWN POPULATIONS: The following potential threats were observed during field surveys in 1995:

1. MINERAL DEVELOPMENT: At least nine confirmed or reported occurrences of Phlox opalensis are found within active oil and gas fields or along pipeline routes. Most of the plants within these populations are found on steep, unstable, gravelly clay-shale slopes that are not suitable for road,

Table 3. Land Management Status of Known Occurrences of Phlox opalensis.

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1. BLM Rock Springs District

A. Green River Resource Area

- WY Occ. # 007 (Confluence of Green and Big Sandy rivers) in part
- WY Occ. # 008 (Twin Buttes-SW Black Mountain)
- \* WY Occ. # 010 (Blue Rim)
- WY Occ. # 013 (Sweetwater Co Rd 1, 2 mi N of Henry's Fork)
- WY Occ. # 014 (Valley of WY Hwy 414 between Sage Creek, Cedar, and Hickey mountains)
- WY Occ. # 018 (McKinnon Junction SW)
- WY Occ. # 019 (Twin Buttes Draw S)
- WY Occ. # 020 (Devils Playground)
- WY Occ. # 021 (NE Mass Mountain)
- WY Occ. # 023 (Dry Creek Road, N of Cedar Mountain)
- WY Occ. # 031 (Big Sandy Reservoir W)
- \* WY Occ. # 037 (Big Dry Creek N) in part
- WY Occ. # 038 (Haystack Buttes-SE Black Mountain) in part
- WY Occ. # 040 (East Buckhorn Draw)

B. Kemmerer Resource Area

- \* WY Occ. # 001 (Opal)
- \* WY Occ. # 002 (Wagonwheel Road)
- WY Occ. # 004 (Carter)
- \* WY Occ. # 009 (Moxa)
- WY Occ. # 011 (Lyman NE)
- WY Occ. # 012 (Granger Junction SW)
- WY Occ. # 017 (Cottonwood Bench)
- \* WY Occ. # 024 (Wildcat Butte SW)
- WY Occ. # 026 (Turtle Hill SE)
- WY Occ. # 027 (Cottonwood Creek)
- WY Occ. # 028 (Butcher Knife Draw SW)
- WY Occ. # 029 (Church Butte Historical Monument N)
- WY Occ. # 030 (Yellow Point Fork)
- WY Occ. # 032 (Opal Bench E)
- WY Occ. # 033 (Slate Creek Butte)
- \* WY Occ. # 034 (Opal Bench NW)
- \* WY Occ. # 035 (McKinnon Junction NW)
- WY Occ. # 036 (Ziegler's Wash)
- \* WY Occ. # 037 (Big Dry Creek N) in part

C. Pinedale Resource Area

- WY Occ. # 039 (Ross Ridge)

2. BLM Vernal District

- UT Occ. # 1

3. Ashley National Forest

WY Occ. # 038 (Haystack Buttes-SE Black Mountain) in part  
UT Occ. # 3 (4 miles E of Manila)

4. Seedskaadee National Wildlife Refuge

WY Occ. # 007 (confluence of Green and Big Sandy rivers) in part

5. State

WY Occ. # 003 (2.5 mi E of US Highway 189, 12 mi S of Kemmerer)

UT Occ. # 2 (Manila S)

\* Also occurs on adjacent private lands within BLM checkerboard.

well pad, or pipeline construction. Plants on lower slopes or adjacent flats are more at risk from ground disturbances associated with drilling and exploration. In the absence of continued disturbance however, it appears that this species is able to recolonize open areas. For example, a colony on the lower slopes of Wildcat Butte (WY Occ. # 024) appears to be gradually expanding into a disturbed pipeline corridor and trash dump area. Other colonies have been found in the vicinity of gas field access roads and barrow pits that are not being continually trampled. In all of these cases, areas of undisturbed habitat are present in the vicinity to serve as seed sources for recolonization.

2. RECREATION: Off road use of recreational vehicles is a potential threat to some populations of P. opalensis through trampling of individual rosettes, soil compaction, and soil erosion. Several colonies in the Bridger Basin of Wyoming occur on slopes that appear to be regularly used to race dirt bikes. Plants have managed to persist, however, at these and some other deeply rutted roadside sites. Roadside disturbances may create potential habitat for recolonization, provided that sufficient time is allowed for recovery and an undisturbed seed source is in the vicinity. Other recreational activities do not appear to have any impact on this species.

3. WEEDS: Weedy, exotic annuals such as Ranunculus testiculatus (hornseed buttercup) and Chorispora tenella (blue mustard) were locally abundant on more mesic microsites within several colonies of P. opalensis in 1995. Whether these species are actively expanding their range or were merely responding to the favorably moist spring of 1995 remains to be determined. The heavy soils and dry conditions of most P. opalensis habitat may be unsuitable for these and other weedy species to become permanently established.

4. GRAZING: Most of the habitat of P. opalensis on BLM lands is managed for cattle or sheep grazing. No evidence of herbivory on stems, leaves, or flowers of P. opalensis could be detected in 1995. Cattle are probably unable to forage on the low-growing rosettes of this species. Overall use of P. opalensis micro-habitat by cattle appears to be low due to the paucity of available forage and

water. This species is probably not preferred forage for sheep due to its spiny-tipped leaves.

B. MANAGEMENT PRACTICES AND RESPONSE: No experimental data exist on the response of this species to management actions, such as prescribed burning or herbicide treatment. Observations in 1995 suggest that P. opalensis is not adversely impacted by livestock grazing. The presence of individuals on disturbed roadsides and slopes suggests that P. opalensis is tolerant of some disturbance or is capable of recolonizing open areas.

### C. CONSERVATION RECOMMENDATIONS

1. RECOMMENDATIONS REGARDING PRESENT OR ANTICIPATED ACTIVITIES: Most potential threats associated with Phlox opalensis have been found to be less severe than originally anticipated. In large part this is due to the plant's ability to colonize areas of bare habitat (provided the appropriate substrate is present). Although existing evidence is mostly based on untested observations, it appears that P. opalensis is able to recolonize formerly disturbed sites if "refugia" of undisturbed habitat are present in the vicinity to serve as a seed source.

Southwest Wyoming is predicted to become the major natural gas producing region in the United States by the year 2015. The key to ensuring the long-term survival of P. opalensis in this increasingly industrialized landscape will be to provide adequate areas of undisturbed habitat from which this plant can expand into new areas in the future. At present, such refugia are provided on steep, unstable slopes adjacent to existing oil and gas facilities. If such habitats are kept undisturbed this species is likely to persist through the coming gas boom.

2. AREAS RECOMMENDED FOR PROTECTION: Two of the largest known occurrences of Phlox opalensis are found within the Twin Buttes and Black Mountain BLM Wilderness Study Areas on the west side of Flaming Gorge Reservoir. The population on the southwest flank of Black Mountain and Twin Buttes is also located within the proposed extension of the Pine Creek Area of Critical Environmental Concern (ACEC) (USDI Bureau of Land Management 1992). Colonies found on the clay-shale badlands on the flanks of Sage Creek and Hickey mountains could be included within expanded boundaries of the

proposed Candidate Plant Species ACEC recommended for Thelesperma pubescens (USDI Bureau of Land Management 1992). Establishment of these proposed special management areas would protect some of the best known P. opalensis habitat from additional surface disturbing activities.

D. STATUS RECOMMENDATIONS: Phlox opalensis was formerly designated as a C2 candidate for listing as Threatened or Endangered. Based on surveys in 1995, this species is now known to be more widespread and far more abundant in Wyoming and Utah than formerly recognized. Threats to the species are also less severe than once thought. For these reasons, P. opalensis no longer warrants USFWS candidate status.

P. opalensis is currently listed as a Special Status plant species by the BLM Rock Springs District and has been recommended for BLM state-wide Sensitive status. In light of recent survey findings, this species is in far less immediate danger than once thought. Nevertheless, some form of protective status is desirable given the plant's small global range and narrow ecological amplitude. Designation of sufficient areas of undisturbed habitat as ACECs or Wilderness Areas, and avoidance of populations on unstable slopes within oil and gas fields is needed to ensure the long-term survival of P. opalensis. If these management actions are taken, this species will not require designation as Sensitive.

E. SUMMARY: Phlox opalensis is a recently described species restricted to southwestern Wyoming and extreme northeastern Utah. It appears to be closely related to P. hoodii and P. muscoides, differing primarily in its larger flower size, longer internodes, and habitat preferences. Prior to 1994, it was known from only five extant occurrences and one historical population (all in Wyoming). Surveys in 1994-95 resulted in the discovery of 24 new occurrences in Wyoming. Herbarium and field studies also confirmed the presence of this species at three locations in Utah for the first time. Populations were often found to be locally abundant within sparsely vegetated desert shrub (especially Atriplex gardneri-Chrysothamnus nauseosus) and cushion plant communities on fine-textured clay-shale slopes, flats, and rims with a cover of reddish sandstone or chert. Based on surveys of 19 occurrences, the total population of the species is estimated at 1,300,000 to 1,500,000 individuals. P. opalensis colonies on steep, unstable clay slopes were observed to be minimally

impacted by existing oil and gas development, recreation, and grazing. Plants were observed on formerly disturbed areas such as pipelines and roadsides, suggesting that recolonization is possible if a seed source is present in the vicinity. Only a small portion of one occurrence is currently within a formally designated special management area (Seedskaadee National Wildlife Refuge). Three large populations are within or immediately adjacent to proposed BLM Wilderness Study Areas or ACECs. Due to its new-found abundance and low degree of threat, P. opalensis is no longer recommended for USFWS candidate status.

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Appendix A.  
Element Occurrence Records  
and  
Population Maps  
for Phlox opalensis  
in Wyoming

Appendix B.  
1995 Survey Routes

Appendix C.

WYNDD

Special Plant Survey Form

## Appendix D.

### Potential Monitoring Locations

For the last several years, BLM and WYNDD have worked cooperatively to establish long term demographic monitoring studies of selected high priority rare plant species. Plans were made in 1995 to establish monitoring plots for Phlox opalensis at 2-3 sites in southwest Wyoming. Surveys in mid May 1995 quickly established that this species was far more widespread and abundant than originally thought. The decision was made not to establish permanent plots, but instead to focus limited energy on documentation of the full range of the species.

If such plots are desired in the future, the following locations are recommended:

1. WY Occurrence # 008 (Twin Buttes-SW Black Mountain). The clayey-shale flats and low slopes east of Twin Buttes Road contain a large population of P. opalensis in a variety of micro-habitats. This area is contained within the Twin Buttes BLM Wilderness Study Area and is technically off-limits to motorized vehicles. One of the more accessible areas would be in the center of Section 35 (T14N R110W).
2. WY Occurrence # 014 (valley of WY Highway 414). The east slopes of Hickey Mountain contain a large population of P. opalensis in a range of habitats. The area is less pristine than occurrence # 008 and contains some oil and gas access roads. Plots in this site could be useful in determining possible impacts from mineral development. The best locations for transects in lower valleys would be in the southeast corner of section 18 (T13N R113W). For comparison, plots could also be established in more inaccessible steep slope areas of the northeast corner of section 8.
3. WY Occurrence # 017 (Cottonwood Bench). This is one of the most severely disturbed sites occupied by P. opalensis. The shaley slopes of the site are deeply rutted from off-road vehicle use and the area is used as a trash dump. Nevertheless, P. opalensis is relatively abundant here. Plots established here could be used to gauge the impact of heavy recreational use on this species. It may be difficult to establish permanent plots however, due to likely

disturbance from recreationalists.

4. WY Occurrence # 018 (McKinnon Junction SW). This is one of the largest and least threatened occurrences known and would be a suitable location for a series of demographic plots. The site includes colonies on steep slopes, rims, and colluvial fans. The best location would be on the south side of the unnamed shaley mountain in sections 35 or 36 (T15N R110W).

Demographic monitoring plots should be established following the protocol of Lesica (1987).

Appendix E.

Slides