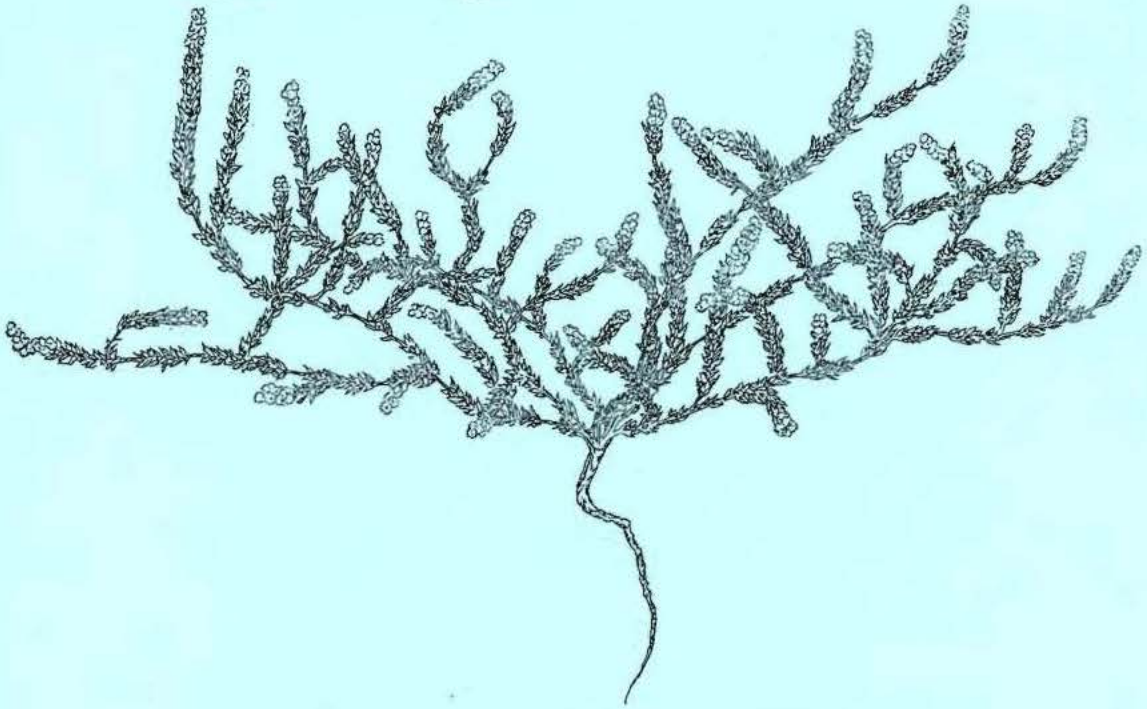
A Flora of the

Sacramento National Wildlife Refuge



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Vernon H. Oswald

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U.S. Department of the Interior
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THE COVER: The plant on the cover is vernal-pool saltbush, *Atriplex persistens*. This rare plant was described in 1993 from specimens collected at the Sacramento National Wildlife Refuge. Drawing by Robert Gamette.

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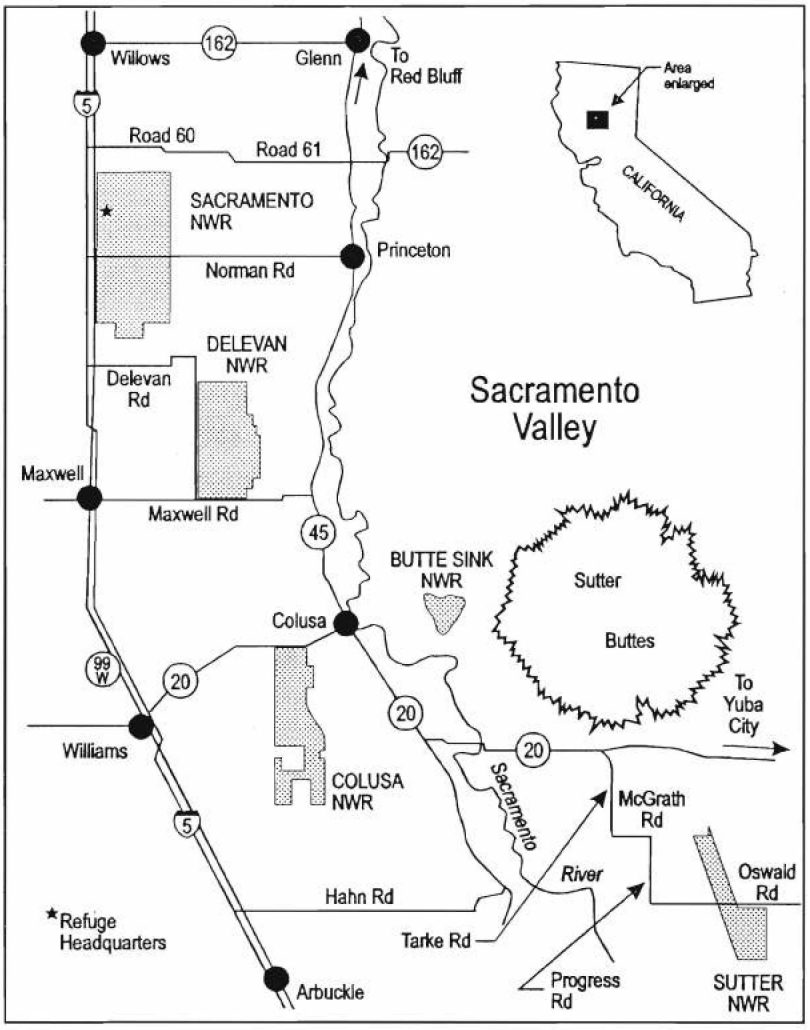

FIGURE 1. Location of the Sacramento National Wildlife Refuge in Northern California.

A Flora Of The Sacramento National Wildlife Refuge

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The Sacramento National Wildlife Refuge (SNWR) is a parcel of 10,783 acres located on the west side of the Sacramento Valley between Willows and Maxwell (Figure 1). The refuge was established in 1937 and is the first in a series of land acquisitions that now make up the Sacramento National Wildlife Refuge Complex. Other units of the complex include Delevan NWR, Colusa NWR, Sutter NWR, Butte Sink NWR, and Sacramento River NWR. This flora is concerned only with the SNWR. The SNWR occupies all of the sections of land in the east half of T18N R3W, with the exception of the south halves of sections 34 and 36 (Figure 2). Most of the land lies in Glenn County, with the southern tip of the refuge extending into Colusa County. The land is an essentially flat plain, sloping from an elevation of slightly over 100 ft in the northwest corner to somewhat less than 70 ft in the southeast corner of the refuge. Natural drainage is provided by Logan Creek, which flows from the northwest to the southeast corners of the refuge, and Hunters Creek, which flows from west to east near the south boundary.

The refuge lies in the northwestern part of the Colusa Plains in an area of poorly drained Riz silt loam, Riz silty clay loam, and Willows clay, all of which are slightly to strongly saline/alkaline with a pH range of 8.5–9.7. The climate of the area is "Mediterranean, warm summer," which applies to all of the Sacramento Valley. Dry warm to hot summers are followed by a cool, wet winters. Rainfall averages eighteen inches per year, the rainy season usually running from October to April.

History[2]

There is no record of any explorers or trappers crossing the northwest portion of the Colusa Plains before 1850. It was not until the start of construction of the westside railroad to Oregon in 1871 that settlement of the Colusa Plains north of the town of Colusa took place. Early travelers described the Colusa Plains as "a swamp," or "a vast, treeless prairie", or "worthless alkali" (Hall, 1975). In his history of Colusa County published in 1880, William S. Green described the land lying a little east and then south of Willows, which would include the SNWR, as poor land "so flat that the water does not run off it readily, and it is alkali." The term "gooselands" was widely applied to this area because of the large numbers of geese that wintered on these alkaline plains.

Norman D. Rideout bought the land now occupied by the refuge in 1877. He attempted to grow summer-fallow wheat, a successful crop on some parts of the Colusa Plains. Because of the poor soil, lack of summer water, and depredation by geese, Rideout's ventures in wheat farming ended in failure. Cattle grazing on the Rideout Ranch also proved to be unsuccessful, at least in part due to competition by geese for forage.

Z.L. Spalding acquired the Rideout Ranch in 1900. The Spalding Ranch was more successful and became the largest agricultural operation in Glenn and Colusa counties between 1920 and 1935. Cattle, horses, mules, sheep, pigs, and turkeys were all pastured on the ranch at one time or another. After a series of artesian wells was developed, alfalfa was grown in the northwest portion of the ranch between 1910 and 1915. The first

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[2] Historical information is primarily from Hall (1975).

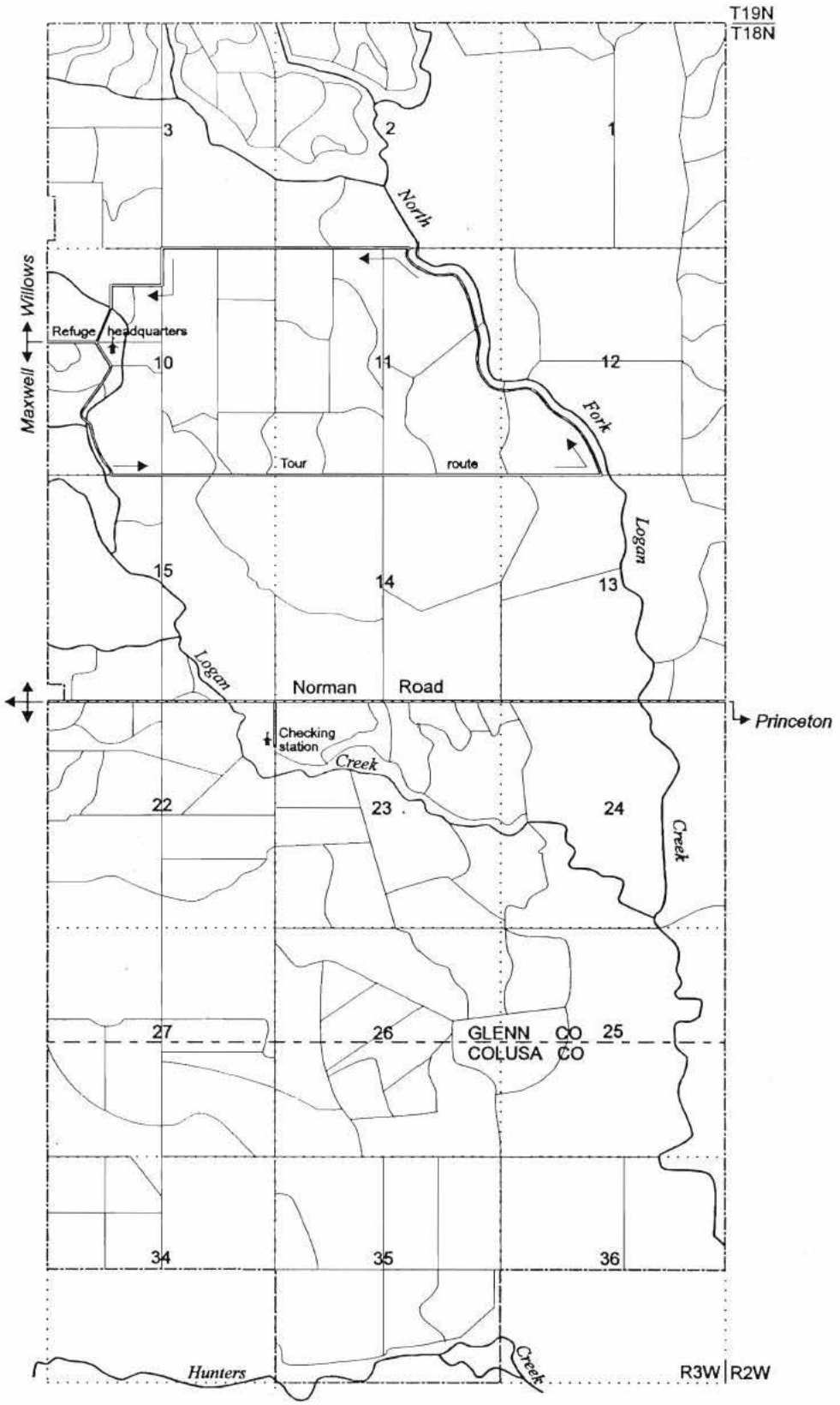

FIGURE 2. The Sacramento National Wildlife Refuge in relation to certain topographic features.

rice was also grown during this time. With the development of a private irrigation system in 1916, rice culture became the dominant agricultural activity on the Spalding Ranch. However, irrigation water, which was responsible for the success of the ranch, also eventually led to the financial collapse of the operation. In 1919, landowners of the area established the Glenn-Colusa Irrigation District and a new drainage district, the 2047 Reclamation District. The cost of irrigation water from the former and annual assessments of the latter eventually produced the collapse of the Spalding agricultural enterprise.

Ownership of the Spalding Ranch was transferred to the federal government in January, 1937. Changes occurred rapidly on the new Sacramento Migratory Waterfowl Refuge (now the SNWR). Since the country was still in the grips of the Great Depression, manpower was readily available. Camp Sacramento, a unit of 150 men of the Civilian Conservation Corps, was established at Spalding Ranch headquarters on May 15, 1937. In a relatively short period of time, roads, water control structures, levees, dikes, and jetties were constructed; channels were cleared and cleaned; lakes and ponds were developed; and other projects involving dwellings, fencing, signs, and monuments were carried out. In 1938, 80 acres of rice and 115 acres of millet (*Echinochloa crus-galli*) were planted expressly for waterfowl with amazing success—over one-half million ducks consumed every seed and blade of vegetation in these fields during three consecutive nights in October! Farming for waterfowl continued for many years on the refuge. Wheat and barley were the primary crops grown in upland fields, and millet and rice become the dominant aquatic crops. Upland farming was largely phased out of the management program in the 1950's, and the last rice was grown in 1988. However, certain tracts are still managed for millet, a weedy aquatic grass that readily volunteers and is highly attractive to waterfowl.

The Flora

The agricultural activities on the Rideout and Spalding ranches, followed by the extensive land leveling, impounding, farming, and other wildlife management activities on the SNWR, has resulted in major changes in the natural communities and native vegetation at the refuge. Hall (1975) could only speculate on the original nature of the northwestern Colusa Plains. The area would probably have been a low dry plain periodically inundated by major flooding of the Sacramento River and its feeder streams. Plant communities may have included Valley Grassland, Freshwater Marsh, and Alkali Sink. Four old photographs of goose hunting on the Spalding Ranch are reproduced in Hall's thesis (1975). These pictures, taken about 1918, show a flat landscape without a single tree or shrub from the foreground to the distant horizon. Tufts of grasses and low herbs are scattered over mostly barren, probably alkaline soil. Today only small areas of up to several hundred square meters of vegetation resembling these original "gooselands" are scattered on the upland tracts of the refuge.

The refuge land is now divided into separate "tracts" and "pools," most of which are subdivided into "cells" (Figures 2 and 3). Most of these units can be independently managed for water levels and food plants, resulting in seasonally-flooded marsh, watergrass (millet) impoundments, permanent ponds, and uplands (Mensik and O'Halloran, 1990). Riparian strips and borders occur along streams and waterways throughout the complex. Small stands of cottonwood-type riparian woodland occur in the northeast corner of Tract 31 and along the north border of Tract 37. The latter serves as an egret and heron rookery. Lower depressions in some of the upland units regularly develop into shallow vernal pools during the winter rainy season. Only the north portion of Tract G remains as an unplowed and relatively unmodified piece of the original Alkali Sink community that covered most of the refuge lands in presettlement times. Even here, drainage from surrounding fields and invasion of alien species has clouded the picture of the pristine vegetation.

One of the first botanists to collect on the northwestern Colusa Plains was Joseph Burtt-Davy, an English forester and taxonomist who served as an agrostologist (grass specialist) at The University of California from 1892 to 1902. In May 1898, he collected African pricklegrass (*Crypsis vaginiflora* = *C. niliaca*) near Norman, the first record of this grass in North America. On the same trip Burtt-Davy collected a grass, which he named *Stapfia colusana* (= *Neostapfia colusana*), "near Princeton...bordering rain pools on hard uncultivated alkali 'goose-lands,' beside the stage road to Norman." Hall (1975) speculates that the type specimen of Colusa grass was collected near the Norman-Princeton Road in what is now Tract G of the refuge, but it was probably collected further to the east in habitat now obliterated by rice culture. Additional plants collected by Burtt-Davy in the Norman-Willows area include the spineless variety of bur-clover (*Medicago polymorpha*) and coyote-thistle (*Eryngium vaseyi*). Willis Lynn Jepson also collected in the Willows area (e.g., *Trifolium albopurpureum* var. *olivaceum*, *Jepson 13,657*). In his *Manual of the Flowering Plants of California* (1925), Jep-

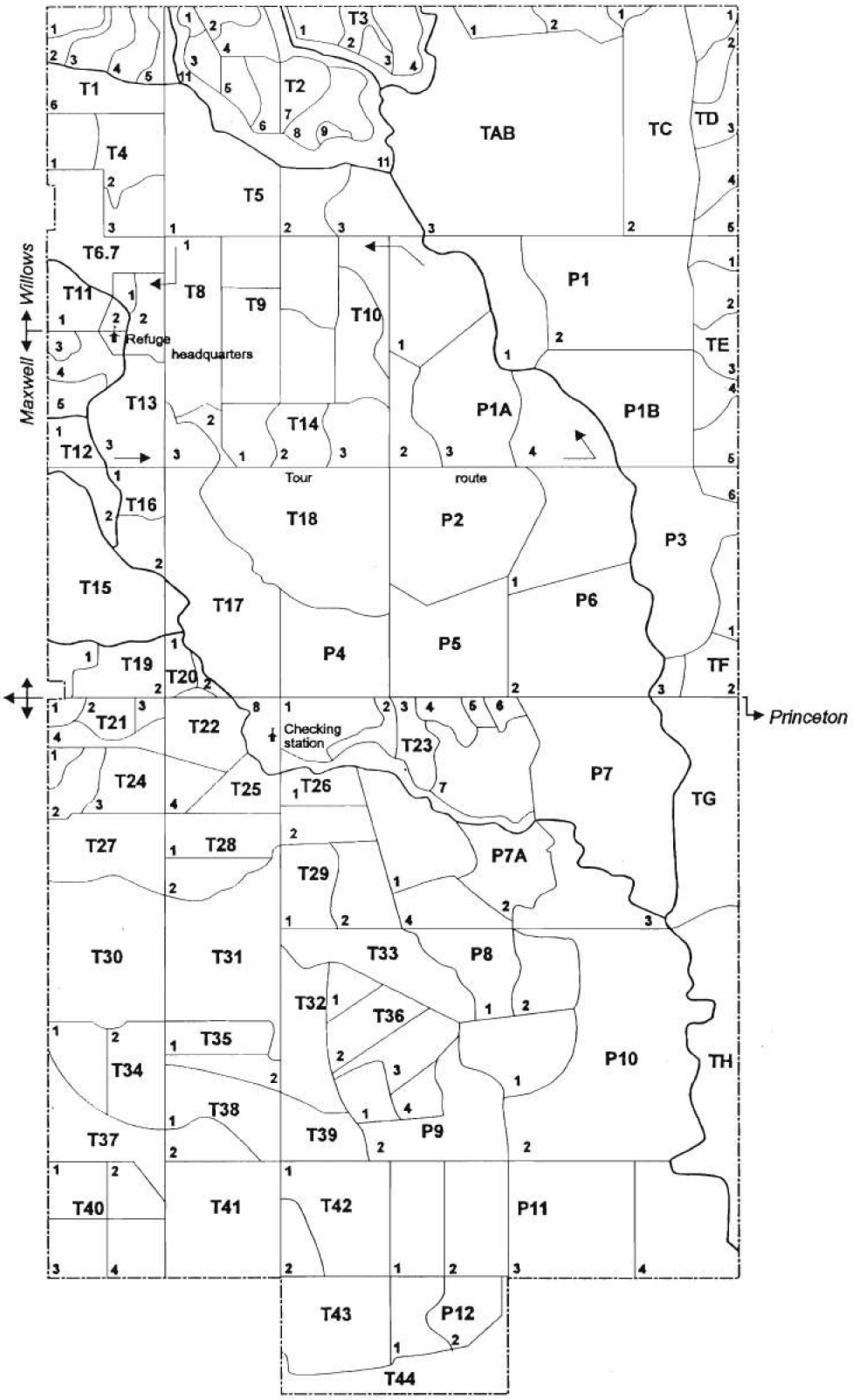

FIGURE 3. Plot map of the Sacramento National Wildlife Refuge.

son lists *Atriplex fruticulosa* as occurring on the "goose lands" of Glenn Co.—whether this record is based upon his own collections or that of some other collector, e.g., Burtt-Davy, is not known.

The first attempt to survey the plants on the SNWR was conducted by Harry Anderson from June 1937 into May 1938. Mr. Anderson was a member of the newly-established "Camp Sacramento." In the preface to a hand-written list of plants (SNWR files), Anderson remarks that "This being my first experience at plant collecting, my first plants were taken without roots; too few of a species were taken; certain plants molded. During the first part of the work, I had to walk half a day, often carrying the plants nearly the whole time. Such plants were almost invariably dried and withered when I returned and were useless." However, a series of 110 numbered specimens, with accompanying notes on abundance and distribution, was eventually prepared. Unfortunately, Anderson's collections have either been misplaced or destroyed and could not be examined for this study. In 1988, Anderson's handwritten notes were transcribed and organized into a typewritten list entitled "Sacramento Refuge Herbarium" (SNWR files).

Since Anderson's survey, additional collections have been made by Ross C. Hanson (1949–53), David B. Marshall (1951–1962 but mostly 1954), Eugene Kridler (1956 & 1960), Edward J. O'Neill (1961), S.R. Wilbur (1961–62), and Marguerite Hills (1982). These specimens, which are stored in the refuge herbarium, were examined and are incorporated into this study. Annotations indicate that Herbert L. Mason examined at least some, if not all, of the Marshall collections while he was preparing his *Flora of the Marshes of California*. Collections made at some of the other units of the Sacramento National Wildlife Refuge Complex and stored in the refuge herbarium are not been included in this study.

The survey forming the basis for this flora was conducted between April 23, 1993 and September 6, 1994 (30 visits). During this interval, 323 species, subspecies, and varieties of vascular plants were documented. An additional 14 species represented by vouchers in the SNWR herbarium have been studied and are included in the annotated plant list. Anderson's collections from 1937–38 present a problem—twenty-five of the plants in his list have not been found during this study. Some of his plants are probably misidentified, but most were surely collected on the refuge. Our best judgment has been used in including or excluding these unvouchered records in the annotated plant list. Thus the total flora since the establishment of the SNWR in 1937, as treated in the annotated plant list, includes 351 species and subspecific taxa in 207 genera distributed among 68 families (Table 1). No study of this type is ever complete—additional plants are still to be documented on the refuge!

TABLE 1. Numerical analysis of the vascular flora of the Sacramento National Wildlife Refuge.

FAMILIES	GENERA	SPECIES	ADDITIONAL VARIETIES	TOTAL TAXA	NON-NATIVE	CNPS LISTED
68	207	345	6	351	147 (42%)	13

[1] Includes both varieties and subspecies.

Non-native species comprise 42 percent of the refuge flora. This number does not include certain plants that have been deliberately introduced on the refuge, e.g., Monterey cypress (*Cupressus macrocarpa*) and big saltbush (*Atriplex lentiformis*), which are native to other places in California. The large proportion of non-native plants is correlated to the highly disturbed nature of the refuge and is typical of similar areas in the northern Sacramento Valley. Forty-two percent of the plants at Harter's Cherokee Ranch in central Butte County were also found to be aliens (Oswald, 1988), and 48 percent of the flora of The Butte Sink Unit of Gray Lodge Wildlife Area in Butte County consists of non-native species (Oswald, 1989). Of interest is the relatively short period of time in which alien plants can colonize a disturbed area. Anderson's plant list indicates that at least 34 alien species (33% of the plants he collected) were already growing on the newly established refuge in 1937.

Thirteen of the refuge plants are listed in the *CNPS Inventory of Rare and Endangered Vascular Plants of California* (Skinner & Pavlik 1994). All except two of these are in List 1B, plants that are rare, threatened, or endangered in California and elsewhere (see Appendix I). The only significant populations of Ferris' milk-vetch (*Astragalus tener* var. *ferrisiae*) remaining in California grow on SNWR in the northwest corner of Tract AB. Before being discovered on SNWR in 1994, only two populations of Heckard's pepper-grass (*Lepidium latipes* var. *heckardii*) were known from Yolo County. When Stutz and Chu described *Atriplex*

persistens in 1993 (Madroño 40:209–213), the only viable populations were known from vernal pools on SNWR. Hoover's spurge (*Chamaesyce hooveri*), hairy orcuttgrass (*Orcuttia pilosa*) and Greene's tuctoria (*Tuctoria greenei*) also grow in vernal pools on the refuge and illustrate the importance of preserving this rapidly disappearing habitat.

Nomenclature in the annotated plant list which follows is based upon *The Jepson Manual* (Hickman 1993). Some synonyms used in older floras or in refuge plant lists are also indicated in brackets. Author abbreviations follow Brummit and Powell (1992) and may deviate from those in *The Jepson Manual*. There are no accepted standards for common (English) plant names. When available, common names correspond to those in *The Jepson Manual* and in the 5th edition of the *CNPS Inventory* (Skinner and Pavlik 1994). The remaining common names are mostly those of Abrams (1923-60). Words describing the abundance of a species on the refuge such as rare, common, abundant, etc., are entirely subjective.

Voucher specimens of most of the plants found during this study have been prepared. These are deposited in the herbarium of California State University, Chico (CHSC), and a nearly complete duplicate set is in the herbarium of the Sacramento National Refuge Complex. In the annotated plant list, vouchers are indicated by collector(s) and collection number (e.g., *Oswald & Silveira 6000*). If a record is based on an observation without an accompanying voucher, the observer's name is not italicized. Abbreviations are used to indicate the location of the collection: P = pool, T = tract, a superscripted number indicates the cell in a pool or tract. For example, "$T1^{6}$" and "$P1A^{3}$" would be interpreted as "Cell 6 of Tract 1" and "Cell 3 of Pool 1A," respectively.

Keys have been modified from various sources and are simplified as much as possible. Some plants are included in the keys with the notation "at SNWR?"—these are plants that are not documented for SNWR but are known to grow in similar habitat in the northern Sacramento Valley.

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ANNOTATED PLANT LIST [1]

KEY TO THE MAJOR PLANT GROUPS

1 Plants without seeds or flowers, reproducing by 1-celled spores borne in sporangia ..... FERN ALLIES (page 1)
1 Plants with seeds produced in cones or by flowers.
2 Plants without flowers; seeds borne on the surface of a cone scale or berry-like structures. ..... GYMNOSPERMS (page 1)
2 Plants producing flowers; seeds borne inside a fruit developing from the ovary of the flower.
3 Leaves net-veined; flowers usually on a plan of 4 or 5, embryonic leaves 2 ..... DICOT FLOWERING PLANTS (page 1)
3 Leaves mostly parallel-veined; flowers mostly on a plan of 3; embryonic leaf 1 ..... MONOCOT FLOWERING PLANTS (page 18)

FERN ALLIES

1 Plants floating on quiet water of ponds and streams or growing on wet soil at dry-down; leaves small, sessile, with overlapping blades ..... *Azollaceae*
1 Plants rooted in mud of shallow ponds or becoming terrestrial as the pond dries; leaves either resembling a 4-leaved clover or thread-like and lacking a blade ..... *Marsileaceae*

AZOLLACEAE – MOSQUITO FERN FAMILY

Azolla filiculoides Lam. – LARGE MOSQUITO FERN. Common and widespread small, floating plant in quiet waters of ponds and ditches, often forming a solid greenish-red mass (*Anderson 5*; *Hanson 11-51*). Plants reproduce vegetatively during most of the year.

MARSILEACEAE – MARSILEA FAMILY

1 Leaves with a slender petiole and 4-leaved clover-like blade ..... *Marsilea*
1 Leaves thread-like, without an expanded blade ..... *Pilularia*

Marsilea vestita Hook & Grev. ssp. ***vestita***– HAIRY WATER-CLOVER . Apparently uncommon plant of vernal pools, flooded depressions, and along drains and canals (*Anderson 61*, without a specific location; *Hanson* in 1951, without a specific location; *Oswald 5362*, $T2^{11}$). During the winter and early spring, it can be recognized by the floating clover-like leaves. It becomes terrestrial at dry-down, resembling *Oxalis* (to which it is referred in Anderson's 1937–38 list). Sporocarps, which are needed to determine the species, are formed in the spring. [*M. mucronata* A.Braun]

Pilularia americana A.Braun – AMERICAN PILLWORT. Common but inconspicuous grass-like plant growing in vernal pools and seasonally flooded marshes (*Oswald 5315*, TD^3), becoming stranded on mud at dry-down. The plant can be readily identified once it is dug out of the mud by its basal, pea-like sporocarps.

GYMNOSPERMS

1 Leaves scale-like, thickly covering the branches ..... *Cupressaceae*
1 Leaves needle-like, in bundles of 2–5 ..... *Pinaceae*

CUPRESSACEAE – CYPRESS FAMILY

1 Foliage gray; outer leaf surface with a conspicuous gland; bark smooth, thin, peeling in thin strips or plates, cherry red ..... *Cupressus arizonica*
1 Foliage green; outer leaf surface without a conspicuous gland; bark fibrous, rich brown aging ash-gray ..... *Cupressus macrocarpa*

Cupressus arizonica Greene ssp. ***arizonica*** – ARIZONA CYPRESS. A gray-foliaged shrubby tree with the bark peeling in small plates is planted in several locations at the headquarters complex (*Oswald 5812*). This tree is native to Arizona, northern and central Mexico, and northern Baja California. It is a rare native in the Cuyamaca Mtns. of southern California, but is widely planted in California as a windbreak.

Cupressus macrocarpa Gordon – MONTEREY CYPRESS. A shrubby tree with green foliage and fibrous bark grows on the margin of the woodlot in the northeast corner of Tract 31, where it was planted (*Oswald 5810*). Native to the coast of California, Monterey cypress is widely planted elsewhere.

PINACEAE – PINE FAMILY

Pinus halepensis Mill. – ALEPPO PINE. Several 2-needle pines, native to the Mediterranean region, have been planted at the headquarters complex (*Oswald & Silveira 5801*).

DICOT FLOWERING PLANTS

KEY TO FAMILIES

1 Petals lacking or not evident (calyx sometimes petal-like).
2 Woody trees, shrubs, or vines.
3 Leaves compound.
4 Leaves alternate; fruit a nut ..... *Juglandaceae*
4 Leaves opposite; fruit winged, indehiscent ..... *Oleaceae* (Fraxinus)
3 Leaves simple.
5 Juice more or less milky (break petiole of young leaf); akenes in a highly modified multiple fruit (fig, mulberry, osage orange) ..... *Moraceae*
5 Juice watery; fruit not as above.
6 Flowers, at least the male, in catkins or catkin-like inflorescences ..... *Salicaceae*
6 Flowers not in catkins.
7 Leaves of mature branches opposite ..... *Oleaceae*
7 Leaves of mature branches alternate ..... *Myrtaceae* (Eucalyptus)
2 Herbaceous plants, sometimes slightly woody at the base only.
8 Aquatic plants, growing more or less submerged or on wet mud as water level drops.
9 Leaves dissected, whorled ..... *Ceratophyllaceae*
9 Leaves entire, opposite (the terminal ones sometimes crowded into rosettes) ..... *Callitrichaceae*
8 Land plants, sometimes growing in wet places.
10 Both sepals and petals absent; flowers staminate or pistillate, borne in clusters surrounded by an involucre resembling a perianth; capsule 3-lobed; sap milky ..... *Euphorbiaceae*
10 Sepals present (sometimes petal-like).
11 Style and stigma single.
12 Calyx 5–6 parted; stamens 6–7 ..... *Euphorbiaceae* (Eremocarpus)
12 Calyx mostly 4-parted; stamens 4 ..... *Urticaceae*
11 Styles and stigmas more than 1.
13 Leaves palmately compound ..... *Cannabaceae* (Cannabis sativa L.)
13 Leaves simple.
14 Ovary more than 1-chambered ..... *Molluginaceae*
14 Ovary 1-chambered.
15 Ovules or seeds more than 1; fruit a capsule; leaves opposite ..... *Caryophyllaceae*
15 Ovule or seed solitary; fruit mostly an akene or utricle.
16 Leaves with evident stipular sheath above each node. *Polygonaceae*
16 Leaves without stipular sheath.
17 Calyx 6-cleft ..... *Polygonaceae*
17 Calyx lobes or sepals 1, 4, or 5.
18 Bracts subtending the flowers not scarious; plants mealy, glandular-pubescent, or glandular-resinous .. *Chenopodiaceae*
18 Bracts subtending the flowers scarious; plants not mealy, glandular-pubescent, or glandular-resinous .... *Amaranthaceae*
1 Petals present, evident.
19 Petals separate.
20 Stamens numerous, more than twice as many as petals.
21 Woody shrubs ..... *Rosaceae*
21 Herbaceous plants.
22 Sepals 2 ..... *Portulacaceae*
22 Sepals more than 2.
23 Plants not succulent, not covered with papillae; leaves not cylindrical ..... *Ranunculaceae*

[1] Non-native plants are indicated by an italic, non-serif typeface (*Conium maculatum*); plants that appear in non-italic boldface (**Chamaesyce hooveri**) are listed in the 5th edition of the CNPS Inventory (Skinner and Pavlik, 1994).

23 Plants succulent, covered with papillae; leaves cylindrical ..... *Aizoaceae*
20 Stamens fewer, not more than twice as many as the petals.
24 Pistils more than 1, nearly or quite separate.
25 Plants fleshy, at least the leaves so ..... *Crassulaceae*
25 Plants not fleshy.
26 Stamens attached below the ovary; small herbaceous plants with long tail-like spike of pistils ..... *Ranunculaceae* (Myosurus)
26 Stamens attached to a floral tube; refuge plants with woody, prickly stems ..... *Rosaceae*
24 Pistil 1, of 1 or more carpels that are more or less united.
27 Plants trailing or climbing by means of tendrils; leaves palmately veined ..... *Vitaceae*
27 Plants not climbing by means of tendrils.
28 Styles 2–5, separate to near the base or fused in lower third.
29 Plants well-developed trees or shrubs.
30 Leaves small, scale-like, appressed; flowers minute, in large clusters ..... *Tamaricaceae*
30 Leaves well developed ..... *Anacardiaceae*
29 Plants either herbaceous or more or less woody vines.
31 Plants submerged or on wet mud flats and rooting at the nodes ..... *Elatinaceae*
31 Plants terrestrial.
32 Ovary more or less inferior; fruit dry, splitting into 2 carpels (mericarps) ..... *Apiaceae*
32 Ovary superior.
33 Leaves compound, with 3 leaflets ..... *Oxalidaceae*
33 Leaves simple.
34 Sepals 2 ..... *Portulacaceae*
34 Sepals 3 or more.
35 Plants not salty tasting when touched to the tongue; capsule 3–10-valved or -toothed; placenta largely central ..... *Caryophyllaceae*
35 Plants salty tasting when touched to the tongue; capsule 2–4-valved; placenta basal but parietal ..... *Frankeniaceae*
28 Style 1, sometimes more or less divided at the apex.
36 Ovary inferior ..... *Onagraceae*
36 Ovary superior, but sometimes appearing inferior because it is enclosed in but not fused to the floral tube.
37 Plants well developed shrubs or trees; flowers pea-like; fruit a legume ..... *Fabaceae*
37 Plants herbaceous.
38 Sepals 2 or 3 ..... *Portulacaceae*
38 Sepals 4 or 5, sometimes more.
39 Flowers pea-like ..... *Fabaceae*
39 Flowers nearly or quite regular.
40 Leaves compound, the leaflets entire.
41 Leaves opposite; leaflets 10–16 ..... *Zygophyllaceae*
41 Leaves alternate; leaflets 3 ..... *Oxalidaceae*
40 Leaves simple or if compound, the leaflets toothed.
42 Ovary appearing inferior (actually superior and free in a floral tube) ..... *Lythraceae*
42 Ovary clearly superior
43 Sepals and petals 4 ..... *Brassicaceae*
43 Sepals and petals 5.
44 Style persistent in fruit, each carpel with a tail-like appendage ..... *Geraniaceae*
44 Style not persistent in fruit, each carpel (unless aborted) developing into a rounded nutlet ..... *Limnanthaceae*
19 Petals more or less fused, often markedly grown together, not pea-like.
45 Ovary inferior or partly so.
46 Stamens united by the anthers.
47 Flowers in involucrate heads; stamens fused to the corolla ..... *Asteraceae*
47 Flowers not in involucrate heads; stamens free from corolla ..... *Campanulaceae*
46 Stamens distinct.
48 Ovary 1-chambered; flowers in short spikes or involucral heads ..... *Dipsacaceae*
48 Ovary 2-5 chambered; flowers not arranged as above.
49 Herbs ..... *Rubiaceae*
49 Shrubs ..... *Caprifoliaceae*
45 Ovary superior.
50 Stamens more than 5.
51 Leaves simple ..... *Malvaceae*
51 Leaves 3-foliate ..... *Oxalidaceae*
50 Stamens not more than 5.
52 Plants lacking chlorophyll; twining yellowish stems with no connection to the ground ..... *Cuscutaceae*
52 Plants with chlorophyll.
53 Corolla more or less irregular.
54 Fruit of 2–4 nutlets; leaves opposite.
55 Ovary 4-lobed; style arising between the ovary lobes, cleft at the apex ..... *Lamiaceae*
55 Ovary not lobed; style apical, entire ..... *Verbenaceae*
54 Fruit a capsule.
56 Plants aquatic or on mud; leaves with urn-shaped bladders for trapping prey ..... *Lentibulariaceae*
56 Plants terrestrial, the leaves not modified for trapping prey.
57 Ovary 1-chambered; capsule ending in a long dehiscent horn ..... *Martyniaceae*
57 Ovary 2-chambered; capsule not as above.
58 Woody vine with large orange-red flowers ..... *Bignoniaceae*
58 Annual to perennial herbs; flowers various ..... *Scrophulariaceae*
53 Corolla regular.
59 Plants with milky juice ..... *Asclepiadaceae*
59 Plants without milky juice.
60 Corolla small, veinless, dry-scarious ..... *Plantaginaceae*
60 Corolla with veins, not dry-scarious.
61 Ovary 4-chambered, commonly 4-lobed, each lobe forming a nutlet unless aborted); inflorescence usually a coiled cyme ..... *Boraginaceae*
61 Ovary 1-, 2-, or 3-chambered.
62 Style 3-cleft; ovary 3-chambered; capsule 3-valved ..... *Polemoniaceae*
62 Style not 3-cleft; ovary 1- or 2-chambered.
63 Calyx 4–5 toothed or cleft; style 1, entire ..... *Solanaceae*
63 Calyx of 5 distinct sepals or sepals united only at their base; styles 2 or 1, usually partly divided.
64 Plants twining or trailing or, if erect, in alkaline places; corolla with flat folds in bud ..... *Convolvulaceae*
64 Plants erect or diffuse; corolla without flat folds in bud.
65 Leaves mostly alternate, inflorescence often coiled ..... *Hydrophyllaceae*
65 Leaves opposite; inflorescence variable, not coiled ..... *Gentianaceae*

AIZOACEAE – FIG-MARIGOLD FAMILY

Mesembryanthemum nodiflorum L. – SLENDER-LEAVED ICEPLANT. Represented by a single waif growing in gravel on the edge of Parking Lot D on Norman Rd. at Logan Creek (*Oswald 6215*). This annual is a native of southern Africa. In California it is typically found on coastal bluffs and margins of saline wetlands from San Francisco Bay southwards. Spring.

AMARANTHACEAE – AMARANTH FAMILY

1 Inflorescence of compact axillary clusters.
2 Plant erect; sepals of the pistillate flowers about equal ..... *Amaranthus albus*
2 Plant prostrate; sepals of pistillate flowers very unequal, 1 well developed, 2 much reduced or even lacking ..... *Amaranthus californicus*
1 Inflorescence of terminal spikes ..... *Amaranthus retroflexus*

Amaranthus albus L. – TUMBLEWEED. Common and often locally abundant weedy annual along roads and on the dry beds of vernally wet pools and depressions (*Marshall* in 1954; *Oswald 5494*, NW corner of T16[1]). Late spring and summer.

Amaranthus californicus (Moq.) S.Watson – CALIFORNIA AMARANTH. Locally abundant annual on the dry beds of seasonally flooded marshes (*Oswald 5770*, T4[2]). Summer.

Amaranthus retroflexus L. – RED-ROOTED AMARANTH. Uncommon weed around headquarters and on road beds in 1937 (*Anderson 66*). No plants were found during the 1993–94 survey. Native to tropical America. Late summer.

ANACARDIACEAE – SUMAC FAMILY

Toxicodendron diversilobum (Torr. & A.Gray) Greene – PACIFIC POISON-OAK. Known only from the woodlot in the northeast corner of Tract 31 south of Norman Rd. (Oswald in 1993). Spring. [*Rhus diversiloba* Torr. & A.Gray]

APIACEAE – CARROT FAMILY
[*Umbelliferae*]

1 Inflorescence head-like, not umbellate; leaves spiny ..... *Eryngium*
1 Inflorescence a distinct umbel although the secondary umbels may be head-like; leaves not spiny.
2 Ovary and fruit bearing prickles or bristles.
3 Fruit with a beak ..... *Anthriscus*
3 Fruit lacking a beak.
4 Rays 1–12, involucre none or of 1 linear bract ..... *Torilis*
4 Rays numerous; involucral bracts pinnate (at SNWR?) ..... *Daucus carota* L.
2 Ovary and fruit glabrous.
4 Fruit circular in cross section or flattened somewhat laterally; lateral ribs not conspicuously winged.

5 Flowers yellowish; stems not purple-dotted; herbage with a strong odor of anise ..... *Foeniculum*
5 Flowers white; stem purple-dotted; herbage with an unpleasant odor (CAUTION! DEADLY IF INGESTED) ..... *Conium*
4 Fruit flattened dorsally; lateral ribs conspicuously winged ..... *Lomatium*

Anthriscus caucalis M.Bieb. – BUR-CHERVIL. Locally abundant weedy annual along the banks of ponds, dikes, and other disturbed places, often growing in the shade of shrubs or tall weeds(*Oswald 6027*, NE corner T3[4]). Native to Eurasia. Spring. [*A. neglecta* Boiss. & Reut. var. *scandix* (Scop.) Hyl.; *A. scandicina* (Weber) Mansf.; *A. vulgaris* (L.) Pers.]

Conium maculatum L. – POISON-HEMLOCK. Common and widespread European biennial along roads, ditches, and ponds (*Oswald 6111*, NW corner TAB[3]). The juice of the fresh leaves and green fruits contains highly toxic alkaloids. Spring.

Eryngium vaseyi J.M.Coult. & Rose – COYOTE-THISTLE . Common and widespread herbaceous perennial of vernal pools, marsh edges, and vernally wet, grassy fields (*Oswald 5404*, TAB[3]; *Oswald 5492*, T13[3]). Late spring to early summer.

Foeniculum vulgare Mill. – FENNEL. Occasional to locally abundant herbaceous perennial along creeks and ponds (*Oswald 5694*, Logan Creek bordering P1A[3]; Oswald, S edge of T23; Oswald, along Hunters Creek). Native to southern Europe. Late spring and summer.

Lomatium caruifolium (Hook. & Arn.) J.M.Coult. & Rose var. ***denticulatum*** Jeps. – ALKALI-PARSNIP. A few plants were reported as scattered along the west boundary in 1938 (*Anderson 73*). The plant is inconspicuous and, if it still survives, was overlooked during the 1993–94 survey. Early spring. [*L. humile* (J.M. Coult. & Rose) Hoover ex Mathias & Constance]

Torilis nodosa (L.) Gaertn. – KNOTTED HEDGE-PARSLEY. Common weedy annual in disturbed soil along ditches, roads, and levees (*Oswald 5368*, ditch along E side of TAB[3]). Spring.

ASCLEPIADACEAE – MILKWEED FAMILY

1 Hoods about as long as stamens and stigma; pods smooth ..... *Asclepias fascicularis*
1 Hoods 2–3 times as long as the stamens and stigma; pods prickly ..... *Asclepias speciosa*

Asclepias fascicularis Decne. – NARROW-LEAVED MILKWEED. Herbaceous perennial forming colonies along creeks and in vernally wet, grassy depressions (*Anderson 51*, rare along Logan Creek E of headquarters; *Oswald 5573*, NE corner of T41). Summer. [*A. mexicana* Cav., misapplied]

Asclepias speciosa Torr. – SHOWY MILKWEED. Reported as rare in the NE¼ of the NE¼ of section 12 (in or near present-day Cell 1 of Tract E) in 1937 (*Anderson 40*). Attempts to relocate this species during the 1993–94 survey were unsuccessful. Summer.

ASTERACEAE – SUNFLOWER FAMILY
[*Compositae*]

1 Plants thistle-like; sap not milky.
2 Leaves not prickly on the margins ..... *Centaurea*
2 Leaves prickly on the margins.
3 Leaves white-mottled along the veins ..... *Silybum*
3 Leaves not white-mottled ..... *Cirsium*
1 Plants not thistle-like or, if spiny, with milky sap.
4 Corollas all strap-shaped, 5-toothed at apex; sap milky or colored.
5 Flowers blue or purple.
6 Flowers blue; pappus of membranous scales, the akenes not beaked ..... *Cichorium*
6 Flowers purple; pappus of feathery bristles, the akenes conspicuously beaked ..... *Tragopogon*
5 Flowers yellow to creamy white.
7 Pappus of membranous scales that are gradually or abruptly awned above.
8 Akenes < 3 mm long; scales 2 mm long or less ..... *Microseris elegans*
8 Akenes > 3 mm long.
9 Pappus scales linear-lanceolate, mostly smooth or lightly scabrous, tapering evenly into the awn ..... *Microseris acuminata*
9 Pappus scales lanceolate to circular, scabrous or more often hairy, gradually or abruptly tipped by an awn ..... *Microseris douglasii*
7 Pappus of bristles.
10 Akenes (at least the inner) with a slender beak.
11 Plants without a leafy stem, the flowering stems with small bracts only ..... *Hypochoeris*
11 Plants with a leafy stem.
12 Flowers yellow; surface of leaves with coarse, barbed, usually pustulate-based bristles ..... *Picris*
12 Flowers creamy to whitish; surface of leaves smooth, spines, if present restricted to the midribs and margins of the leaves.
13 Leaves linear-lanceolate or pinnately cut with linear-lanceolate lobes, the margins entire or with distantly-spaced small teeth; panicle spike-like, with short ascending branches ..... *Lactuca saligna*
13 Leaves oblong or elliptic in outline, the margins conspicuously spiny-toothed; panicle open, with widely spreading branches ..... *Lactuca serriola*
10 Akenes without a beak.
14 Auricles of leaves rounded; akenes smooth at least between the ribs ..... *Sonchus asper*
14 Auricles of leaves acute; akenes finely wrinkled or tuberculate between the ribs ..... *Sonchus oleraceus*
4 At least some corollas tubular; marginal strap-shaped corollas, when present, 2-3-toothed; sap watery.
15 Rays absent or vestigial.
16 Pappus absent.
17 Male and female flowers in separate, distinctive heads, the male heads usually uppermost.
18 Phyllaries of male heads distinct; involucre of female heads becoming a stout spiny bur.
19 Leaves with conspicuous 3-forked spines in their axils ..... *Xanthium spinosum*
19 Leaves without spines in axils ..... *Xanthium strumarium*
18 Phyllaries of male heads united; female heads not a stout bur ..... *Ambrosia*
17 Male and female flowers not in separate heads.
20 Phyllaries lacking, the heads subtended by involucre-like leaves.
21 Leaves surrounding base of head about equaling head ..... *Psilocarphus brevissimus*
21 Leaves at base of head much surpassing head ..... *Psilocarphus oregonus*
20 Phyllaries in 2 or more usually overlapping series.
22 Heads in a paniculate or spicate inflorescence ..... *Artemisia*
22 Heads solitary or in head-like clusters.
23 Akenes, especially the marginal, on stalks ..... *Cotula*
23 Akenes sessile.
24 Akenes shed readily from head at maturity; top of akene entire, the sides with 2 glandular lines that extend the length of the akene ..... *Chamomilla suaveolens*
24 Akenes remaining attached to head at maturity, removed with difficulty; top of akene with two short lobes, each with an elliptic to obovate gland extending less than half the length of the akene ..... *Chamomilla occidentalis*
16 Pappus present.
25 Pappus of 2 downwardly barbed awns ..... *Bidens*
25 Pappus of capillary bristles, rarely with additional outer scales.
26 Phyllaries completely scarious or transparent; herbage more or less white woolly.
27 Clusters of heads leafy-bracted; plants rarely as much as 3 dm high ..... *Gnaphalium palustre*
27 Clusters of heads not leafy-bracted; plants usually 2–10 dm high.
28 Older leaves green, at least above ..... *Gnaphalium californicum*
28 Leaves permanently tomentose.
29 Disk flowers reddish to pinkish ..... *Gnaphalium luteo-album*
29 Disk flowers distinctly yellow ..... *Gnaphalium stramineum*
26 Phyllaries herbaceous or only partly scarious or transparent; herbage not white-woolly.
30 Leaves coarsely toothed to pinnately lobed ..... *Senecio*
30 Leaves entire or finely toothed.
31 Involucre glabrous or nearly so ..... *Conyza canadensis*
31 Involucre copiously hairy.
32 Phyllaries often whitish on inner face when reflexed; head 1 cm across when pressed ..... *Conyza bonariensis*
32 Phyllaries usually red-brown on inner face when reflexed; heads less than 1 cm across when pressed ..... *Conyza floribunda*
15 Rays present.
33 Pappus absent (or present only on sterile disk akenes).
34 Rays white.
35 Leaves highly dissected; herbage not glandular ..... *Anthemis*
35 Leaves entire; herbage copiously dark-glandular ..... *Hemizonia congesta*
34 Rays yellow.

36 Spring-flowering plants; bracts between disk flowers sharp-pointed at tip ..... *Hemizonia pungens*
36 Summer and fall flowering plants; bracts between disk flowers fleshy at tip, not sharp-pointed ..... *Hemizonia parryi*
33 Pappus present on some or all of the fertile akenes.
37 Akenes with a pappus of scales or of stiff awns (deciduous in *Helianthus*).
38 Receptacle chaffy throughout or with a circle of chaffy bracts surrounding the disk flowers.
39 Involucre of several overlapping series of phyllaries ..... *Helianthus*
39 Involucre of 1 series of phyllaries.
40 Rays conspicuous, basally yellow with a white outer half; pappus not of conspicuous silvery scales. ..... *Layia*
40 Rays inconspicuous, yellow turning crimson; pappus of conspicuous silvery scales ..... *Achyrachaena*
38 Receptacle not chaffy.
41 Perennial, often woody at the base; leaves alternate, broad; heads gummy, the tip of the phyllaries sharply reflexed or looped ..... *Grindelia*
41 Delicate spring annuals; leaves opposite; heads not gummy, the tip of the phyllaries not looped.
42 Pappus parts of 2 kinds, consisting of slender awns gradually widening to the base, interspersed between small, nearly square, irregularly cleft scales; leaves usually pinnately lobed.
43 Leaves filiform; akenes less than 1.5 mm long; plants forming bright yellow bands along vernal pools and vernally wet drainages ..... *Lasthenia fremontii*
43 Leaves linear, the undivided portion 2–11 mm broad; akenes more than 2 mm long; plants growing in ditches and on moist alkaline flats ..... *Lasthenia minor*
42 Pappus parts of 1 kind, plants often on better drained upland .....
44 Leaves all essentially entire; corolla turning dark red in alkali (solution of NaOH, e.g., Drano® or KOH) ..... *Lasthenia californica*
44 Leaves, especially the middle ones, usually pinnately lobed or cleft; corolla not turning red in alkali ..... *Lasthenia platycarpha*
37 Akenes with a pappus of soft capillary bristles.
45 Rays yellow ..... *Euthamia*
45 Rays white, blue, or purplish.
46 Rays white, inconspicuous.
47 Involucre glabrous or nearly so ..... *Conyza canadensis*
47 Involucre copiously hairy.
48 Phyllaries often whitish on inner face when reflexed; head 1 cm across when pressed ..... *Conyza bonariensis*
48 Phyllaries usually red-brown on inner face when reflexed; heads less than 1 cm across when pressed ..... *Conyza floribunda*
46 Rays purplish to blue, short but more or less conspicuous ..... *Aster*

Achyrachaena mollis Schauer – BLOW-WIVES. Occasional to locally abundant annual in grassy places along roads and in upland fields (*Anderson 94*, abundant almost everywhere in 1938; *Hanson* in 1950, without a location; *Oswald 5351*, NE corner T4[2]). Spring.

Ambrosia psilostachya DC. – WESTERN RAGWEED. Common perennial forming spreading colonies along the edges of roads, ponds, and fields, especially in the southern part of the refuge (*Anderson 10*, SE corner Sect. 35 in 1937; *Oswald & Silveira 5804*, T44). Late summer and fall. [Includes var. *californica* (Rydb.) S.F.Blake]

Anthemis cotula L. – MAYWEED. Occasional to locally abundant weedy annual along roads, in parking lots, and in grassy fields (*Wilbur* in 1961; *Oswald 5465*, Parking Lot B, NW corner T32). Native to Europe. Late spring and early summer.

Artemisia douglasiana Besser – MUGWORT. Herbaceous perennial forming colonies along creeks and drainages (*Oswald 5809*, edge of Parking Lot C, NE corner T41). It is not common on the refuge. Late summer and fall.

Aster subulatus Michx. var. ***ligulatus*** Shinners – ANNUAL SALTMARSH ASTER. Common in dry to moist fields, marsh edges, and depressions (*Marshall* in 1954; *Oswald 5940*, Wetlands Hiking Trail in T11[1]). Late summer and fall. [*A. exilis* Elliott]

Bidens frondosa L. – STICKTIGHT. Common annual on the edge of marshes and pools and on the banks of sloughs and other waterways (*Wilbur* in 1961; *Oswald 5769*, T4[2]). Late summer and fall.

Centaurea solstitialis L. – YELLOW STAR-THISTLE. This annual weed was already common over most of the area in 1937 (*Anderson 52*). It remains widespread, and locally abundant along roads, ditches, and in dry fields (*Hanson* in 1951). Native to southern Europe. Spring into late autumn.

Chamomilla occidentalis (Greene) Rydb. – VALLEY PINEAPPLE-WEED. Widespread and locally abundant weedy annual in dry soil on levees, along roads, and in other disturbed places (*Oswald 5366*, levee road bordering TC[1]). Not listed from the Sacramento Valley in *The Jepson Manual*. Spring. [*Matricaria occidentalis* Greene]

Chamomilla suaveolens (Pursh) Rydb. – COMMON PINEAPPLE-WEED. Apparently uncommon annual on the refuge and known only from a single waif in gravel of Parking Lot B at the northwest corner of Tract 32 (*Oswald 5466*). There is some question as to whether pineapple-weed is native to California (it is listed as an alien in *The Jepson Manual*). Spring. [*Matricaria suaveolens* (Pursh) Buch.; *M. matricarioides* (Less.) Porter]

Cichorium intybus L. – CHICORY. Perennial weed with attractive blue flowers that is found in localized infestations along some of the roads on the refuge (Oswald, near the woodlot S of the Checking Station; Oswald, N side of P1). Native to Europe. Summer.

Cirsium vulgare (Savi) Tenore – BULL THISTLE. Common annual weed in moist places along marshes and waterways (*O'Neill* in 1961). Summer and fall. [*C. lanceolatum* (L.) Scop.]

Conyza bonariensis (L.) Cronquist – SOUTH AMERICAN HORSEWEED. Uncommon annual weed in roadside gravel along Norman Rd. (*Oswald & Ahart 5421*). Native to South America. Late spring. [*Erigeron linifolius* Willd.]

Conyza canadensis (L.) Cronquist var. ***glabrata*** (A. Gray) Cronquist – CANADIAN HORSEWEED. Common annual of dry fields, margins of ponds, and roadsides (*Anderson 38*, sparse near the entrance gate in 1937; *Oswald 5775*, N edge of T2[3]; *Marshall* in 1962). Although weedy in habit, Cronquist (Vasc. Plants of the Pac. NW, 5:145. 1955) considers our western plants with nearly glabrous stems to be native. The eastern phase of the species with spreading stiff-hairy stems sometimes occurs in California as an introduction. Late summer and fall. [Varieties not recognized in *The Jepson Manual*.]

Conyza floribunda Humb., Bonpl., & Kunth – MANY-FLOWERED HORSEWEED. Common tall, weedy annual along trails, roads, and levees (*Oswald 5887*, Wetland Hiking Trail in T11[1]). Native to S. America. Late summer and fall.

Cotula coronopifolia – COMMON BRASS-BUTTONS. Common and widespread weedy annual in

wet clay soils along ponds, in shallow ditches, and in other vernally wet places (*Marshall* in 1955, without a location; *Oswald 5306*, T2[3]). Not listed from the Sacramento Valley in *The Jepson Manual*. Native to south Africa. Spring.

Euthamia occidentalis Nutt. – WESTERN GOLDENROD. Locally common along creeks and in low fields (*Oswald 5889*, T44 on the N side of Hunters Creek). Late summer and fall. [*Solidago occidentalis* (Nutt.) Torr. & A.Gray]

Gnaphalium californicum DC. – CALIFORNIA CUDWEED. Uncommon biennial along the branch of Logan Creek running through Refuge Headquarters (*Oswald 5467*, T11[2]). Late spring.

Gnaphalium luteo-album L. – WEEDY CUDWEED. Locally common annual in wet soil along ditches and ponds (*Oswald 5468*, ditch on the west edge of T11[3] near Refuge Headquarters; in TC[1] near the Gravel Pit). Spring into fall.

Gnaphalium palustre Nutt. – LOWLAND CUDWEED. Annual forb forming large localized populations in vernal pools, on the dry bed of marshes, and along the edge of flooded fields (*Wilbur* in 1961; *Oswald 5304*, T2[3]). Spring.

Gnaphalium stramineum Humb., Bonpl. & Kunth – COTTON-BATTING PLANT. Known only from an old collection (*Wilbur* in 1961) from the edge of a flooded millet (watergrass) field. [*G. chilense* Spreng.]

Grindelia camporum Greene var. ***camporum*** – GREAT VALLEY GUMPLANT. Common and widespread perennial in dry fields, dry margins of vernal pools, and similar vernally wet but summer dry places (*Anderson 53*, over most of the area; *Hanson 10-51* without a location; *Oswald 4408*, N side T18). Plants are often woody at the base, sometimes becoming well-developed shrubs. Summer into late fall.

Helianthus annuus L. – COMMON SUNFLOWER. Uncommon in grassy fields bordering drying ponds (*Oswald 5642*, TD[2]). Summer. [Includes ssp. *jaegeri* (Heiser) Heiser; ssp. *lenticularis* (Douglas) Cockerell; var. *macrocarpus* (DC.) Cockerell]

Hemizonia congesta DC. ssp. ***luzulifolia*** (DC.) Babc. & H.M.Hall – HAYFIELD TARWEED. Locally abundant annual of dry grassy fields, especially in the southern part of the refuge (*Anderson 26*, NE quarter Sect. 13; *Oswald 5808*, NE corner of T41; *Marshall* in 1954, dike along P1B). The plant has a strong balsamic odor. Late summer and fall.

Hemizonia parryi Greene ssp. ***rudis*** (Greene) D.D. Keck – PAPPOSE SPIKEWEED. Common and widespread annual along roads, on marsh edges, and in upland fields (*Hanson 21-51*; *Oswald 5689*, T11[3] near the viewing pond at the entrance to the refuge). This is probably the spikeweed referred to *H. fitchii* [= *Centromadia fitchii*] by Anderson in 1937. Late spring into fall. [*H. rudis* Greene; *Centromadia pungens* (Torr. & A.Gray) Greene var. *parryi* (H.M.Hall) Jeps.]

Hemizonia pungens (Hook. & Arn.) Torr. & A.Gray ssp. ***septentrionalis*** Keck – COMMON SPIKEWEED. Locally abundant on the margins of drying vernally wet flats and drainages (*Oswald 5369*, NE corner of TAB[3]). Spring. [*Centromadia pungens* (Torr. & A.Gray) Greene]

Hypochoeris glabra L. – SMOOTH CAT'S-EAR. Uncommon annual in grassy fields and in disturbed soil of roadways (*Oswald 6096*, N side of Norman Rd.; *Oswald 6102*, NW corner of P7A[4]). Native to Europe. Spring.

Lactuca saligna L. – WILLOW-LEAVED LETTUCE. Occasional to locally abundant annual in dry, grassy places (*Oswald 5631*, northwest corner T10[2]). Native to Europe. Late spring and summer.

Lactuca serriola L. – PRICKLY LETTUCE. Locally abundant weedy European annual in grassy fields (e.g., TG). Leaves vary from deeply pinnately-lobed to strap-shaped. Late spring to fall. [Includes var. *integrata* Gren. & Godr. = forma *integrifolia* Bogenh., the form with strap-shaped rather than pinnately-lobed leaves; *L. scariola* L.]

Lasthenia californica Lindl. – CALIFORNIA GOLDFIELDS. Widespread and locally abundant in grassy uplands and on vernally moist alkaline flats (*Oswald 5331*, TG). Early Spring. [*Baeria chrysostoma* Fisch. & C.A. Mey., including ssp. *gracilis* (DC.) Ferris]

Lasthenia fremontii (Torr. ex A.Gray) Greene – FREMONT'S GOLDFIELDS. Common and widespread annual, forming bright yellow rings around vernal pools and turning more shallow depressions and drainages into solid masses of yellow in late spring (*Hanson* in 1952; *Marshall* in 1954; *Oswald 5298*, NE corner T1[6]). Spring. [*Baeria fremontii* (Torr. & A.Gray) A.Gray]

Lasthenia minor (DC.) Orndoff – WOOLLY GOLDFIELDS. Uncommon annual growing in moist roadside ditches (*Oswald 6029*, NE corner T1[5]). Spring. [*Baeria minor* (DC.) Ferris]

Lasthenia platycarpha (A.Gray) Greene – ALKALI GOLDFIELDS. Often growing with *Lasthenia californica*, the latter forming large patches of yellow on vernally moist, alkaline flats (*Oswald 6003*, TAB[3]). Early spring. [*Baeria platycarpha* (A.Gray) A.Gray]

Layia chrysanthemoides (DC.) A.Gray – SMOOTH TIDYTIPS. Apparently rare annual of grassy fields (*Hanson* in 1953; *Oswald 6103*, E side of P10[2]). Spring. [Includes ssp. *maritima* Keck]

Microseris acuminata Greene – SIERRA FOOTHILLS MICROSERIS. Inconspicuous annual in grassy fields (*Oswald & Silveira 6025*, NW corner of TAB[3]). Early spring.

Microseris douglasii (DC.) Sch.Bip. ssp. ***douglasii*** – DOUGLAS' MICROSERIS. Scattered to locally abundant annual in grassy fields (*Oswald 5986*, S side of T18; *Os-*

wald 6032, W edge of T1[6]; *Oswald 6038*, TG; *Oswald 6094*, old rice fields on S side of T17). Early spring.

Microseris elegans Greene ex A.Gray – ELEGANT MICROSERIS. Inconspicuous annual growing in grassy upland (*Oswald 6030*, W edge of T1[6]; *Oswald 6037*, TG). Early spring.

Picris echioides L. – BRISTLY OXTONGUE. Common and widespread annual or biennial weedy forb in moist soil along marshes and ditches (*Wilbur* in 1962; *Hills* in 1982). Native to Europe. Late spring into autumn.

Psilocarphus brevissimus Nutt. var. ***brevissimus*** – DWARF WOOLLYHEADS. Common and often locally abundant woolly annual on the drying bottoms of shallow vernal pools, seasonally flooded marshes, and drainage depressions (*Oswald 5311*, P1[1]; *Oswald 5364*, NW corner TAB[3]). Spring.

Psilocarphus oregonus Nutt. – OREGON WOOLLYHEADS. Occasional annual forming large populations along the edge of seasonally flooded marshes, in shallow vernal pools, and along vernally wet drainages (*Oswald 5336*, TG). Spring.

Senecio vulgaris L. – OLD-MAN-OF-SPRING. Common weedy annual along roads and in other disturbed places (*Anderson 74*, common on the N part of the refuge in 1938; *Oswald 5970*, NW edge TG). Native to Eurasia. Early spring.

Silybum marianum (L.) Gaertn. – MILK-THISTLE. Common and widespread noxious annual or biennial weed along roads and on dikes bordering ponds and canals (*Hanson* in 1952). Native to the Mediterranean region. Spring.

Sonchus asper (L.) Hill – SPINY-LEAVED SOW-THISTLE. Common Eurasian annual weed along roads, edges of seasonally flooded marshes, and on high spots in other marshy places (*Anderson 29*, E of gravel pit and along roads in 1937; *Wilbur* in 1962; *Oswald & Ahart 5422*, ditch along Norman Rd.). Spring and summer.

Sonchus oleraceus L. – COMMON SOW-THISTLE. European weed reported as sparse from around the gravel pit and a pond in the NE¼ of section 13 (near present-day Cell 6 of Tract E) in 1937 (*Anderson 41*). Summer.

Tragopogon porrifolius L. – SALSIFY. Uncommon biennial on dikes and along roads and creeks (*Oswald 6162*, Norman Rd. near Logan Creek). Native to Europe. Spring.

Xanthium spinosum L. – SPINY COCKLEBUR. In Anderson's 1937 collections, spiny cocklebur is listed as a rare plant about old straw stacks and in other scattered areas (*Anderson 27*). No populations were found during the current study. Summer.

Xanthium strumarium L. – ROUGH COCKLEBUR. Widespread and locally abundant weedy annual along the edge and on dry beds of ponds and ditches (*Oswald 5498*, T18). Late spring and summer. [Includes vars. *canadense* (Mill.) Torr. & A.Gray and *glabratum* (DC.) Cronquist]

BIGNONIACEAE – BIGNONIA FAMILY

Campsis radicans Seem. – TRUMPET-CREEPER. Woody vine with large orange-red flowers planted at the headquarters complex (*Oswald 6211*). It decorates the old arch that early on marked the entrance to the refuge. Native to the eastern U.S. Summer.

BORAGINACEAE – BORAGE FAMILY

1 Flowers white (sometimes with colored veins or central areas or crests).
  2 Flowers sessile and barely separated in dense, one-sided, curved spikes, the older corollas with yellow- or purple-veined centers ..... *Heliotropium*
  2 Older flowers and fruits at least several mm apart in the inflorescence; corollas without colored veins.
    3 Flowers present near base of stem, the pedicels stout, recurved in fruit ..... *Plagiobothrys scriptus*
    3 Flowers usually not present near base of stem, the pedicels not stout.
      4 Plants prostrate; calyx usually strongly bent, turning the corolla skyward; nutlets minutely bristled or not ..... *Plagiobothrys leptocladus*
      4 Plants ascending to erect; calyx not strongly bent; nutlets not bristled.
        5 Corolla 5–12 mm broad ..... *Plagiobothrys stipitatus* var. *stipitatus*
        5 Corolla 2–3(4) mm broad ..... *Plagiobothrys stipitatus* var. *micranthus*
1 Flowers other than white.
  6 Corolla yellow to orange.
    7 Stamens and stigma included about two-thirds of the way down the tube; top of tube with intruding hairy bumps ..... *Amsinckia lycopsoides*
    7 Stamens and stigma near the top of the tube, the anthers easily visible; top of tube without intruding hairy bumps ..... *Amsinckia menziesii* var. *intermedia*
  6 Corolla bluish ..... *Heliotropium*

Amsinckia lycopsoides Lehm. – BUGLOSS FIDDLENECK. Locally abundant annual in disturbed places at Refuge Headquarters, in grassy fields, and along levee roads (*Marshall* in 1954; *Hanson* in 1954; *Oswald 5307*, T2[3]). Spring. [In older plant lists, usually referred to either *A. douglasiana* DC., *A. douglasiana* var. *campestris* (Greene) Jeps., or misidentified as *A. intermedia* Fisch. & C.A.Mey.]

Amsinckia menziesii (Lehm.) A.Nelson & J.F. Macbr. var. ***intermedia*** (Fisch. & C.A.Mey.) F.R.Ganders – COMMON FIDDLENECK. Uncommon at the refuge and known only from along trails and roads near the headquarters complex (*Oswald 6041*, W boundary at the main entrance). Early spring. [*A. intermedia* Fisch. & C.A.Mey.]

Heliotropium curassavicum L. – WILD HELIOTROPE. Uncommon perennial forming localized populations on alkaline soil of vernally wet depressions in grassy fields, on the beds of vernal pools, and along roads (*Anderson 49*, rare at Grimes Lake (approximated by present-day Pool 2) in 1937; *Oswald 5494*, center of T18; *Oswald 5950*, TAB[3]). Late spring and summer. [Includes var. *oculatum* (A.Heller) I.M.Johnst.]

Plagiobothrys leptocladus (Greene) I.M.Johnst. – SMOOTH-STEMMED POPCORN-FLOWER. Occasional annual in vernally wet depressions and drainages in upland grasslands and on drying mud of shallowly flooded fields (*Oswald 5330*, TG; *Oswald 5341*, T28[2]). It is superficially similar to the more common *P. stipitatus* var. *micranthus*, but it has a more prostrate habit and the nutlets are bristly-hairy. Spring.

Plagiobothrys scriptus (Greene) I.M.Johnst. – SCRIBE'S POPCORN-FLOWER. Inconspicuous annual on drier hummocks in grassy fields and in hard-packed soil of roads and parking areas (*Oswald 5964*, Parking Area D in NE corner P7; Oswald, T18). Early spring.

Plagiobothrys stipitatus (Greene) I.M.Johnst. var. ***stipitatus*** – LARGE-FLOWERED STIPITATE POPCORN-FLOWER. Common annual forb forming white bands and patches in vernal pools and in vernally wet fields (*Hanson* in 1950; *Marshall* in 1954). This large-flowered variety often grows with the small-flowered var. *micranthus*. Anderson reports stipitate popcorn-flower as very common in all sections of the refuge in early 1938. Spring. [*Allocarya stipitata* Greene]

Plagiobothrys stipitatus var. ***micranthus*** (Piper) I.M.Johnst. – SMALL-FLOWERED STIPITATE POPCORN-FLOWER. A small-flowered variety of the previous plant and sometimes growing with it. It is usually found in shallow vernal pools or along the margins of deeper pools, forming bands or patches of white, but it is also found among grasses in vernally wet upland fields. Spring. [*Allocarya stipitata* var. *micrantha* J.F.Macbr.]

BRASSICACEAE – MUSTARD FAMILY
[*Cruciferae*]

1 Fruit breaking transversely into seed-bearing indehiscent joints; flowers white, pale purple or pale yellow with obvious veins (at SNWR?) ..... *Raphanus* sp.
1 Fruit not breaking into joints but dehiscent by valves.
2 Fruit less than 4 times longer than wide, not linear (a silicle).
3 Fruit turgid or inflated, not flattened; style long ..... *Cardaria*
3 Fruit obviously flattened; style short.
4 Fruit inverted-triangular, broad at the summit ..... *Capsella*
4 Fruit orbicular to oval with a terminal notch.
5 Upper stem leaves encircling the stem ..... *Lepidium perfoliatum*
5 Upper stem leaves not encircling the stem.
6 Lower leaves with a broad blade ..... *Lepidium latifolium*
6 Leaves linear, often once to twice deeply divided into narrow segments.
7 Fruits in compact clusters about as wide as long.
8 Stems prostrate to ascending, branched at or near the base; racemes usually shorter than the basal leaves ..... *Lepidium latipes* var. *latipes*
8 Stem erect, branched above the base; racemes well above the basal leaves ..... *Lepidium latipes* var. *heckardii*
7 Fruits well spaced in an open inflorescence.
9 Surface of mature pod smooth (at SNWR?) ..... *Lepidium nitidum* Nutt.
9 Surface of mature pod with net-like venation.
10 Wings broad and not divergent. *Lepidium dictyotum* var. *dictyotum*
10 Wings narrow, divergent ..... *Lepidium dictyotum* var. *acutidens*
2 Fruit usually at least 4 times longer than wide, usually linear (a silique).
11 Fruit much wider than its dividing partition; racemes leafy ..... *Tropidocarpum*
11 Fruit as wide as its dividing partition; racemes leafless.
12 Basal leaves forming definite rosettes, from which arise the flowering stems.
13 Leaves pinnate with definite leaflets; seeds wingless ..... *Cardamine*
13 Leaves deeply pinnately lobed; seeds winged (at SNWR?) ..... *Sibara virginica* (L.) Rollins
12 Basal leaves not forming definite rosettes.
14 Fruits with a relatively long indehiscent beak.
15 Beak flattened, winged (at SNWR?) ..... *Sinapis arvensis* L.
15 Beak cylindrical, conical.
16 Plants perennial, more or less canescent with coarse, shaggy hairs; beak of fruit 1-seeded ..... *Hirschfeldia*
16 Plants annual, sparsely pubescent or subglabrous; beak of fruit empty ..... *Brassica*
14 Fruits without a beak, dehiscent to the tip.
17 Pubescence simple or wanting ..... *Sisymbrium*
17 Pubescence of forked hairs (need ca. 20X magnification to see) ..... *Erysimum*

Brassica nigra (L.) W.D.J.Koch – BLACK MUSTARD. Reported as an uncommon weed along boundaries of the refuge in 1938 (*Anderson 79*). It is now an abundant and widespread European annual, forming dense stands along dikes and ditches (*Oswald 5962*, W boundary at main entrance). Most months but especially in spring.

Capsella bursa-pastoris (L.) Medik. – SHEPHERD'S-PURSE. Anderson found shepherd's-purse to be common over most of the refuge in 1937 (*Anderson 13*). Today it seems to be a relatively uncommon annual in weedy places (*anon.* in 1952, on dike; *D.B. Marshall* in 1954; *Oswald 6042*, W boundary at the main entrance; Oswald, dike at NE corner of T31). Native to Eurasia. Spring.

Cardaria chalepensis (L.) Hand.-Mazz. – LENS-PODDED HOARY-CRESS. Noxious weed collected long ago in Tract 15 (*O'Neill* in 1961). Native to east Asia. Early Mar (in fruit).

Cardamine oligosperma Nutt. – WESTERN BITTER-CRESS. Inconspicuous annual in grassy fields (*Oswald 6033*, NW corner of $T5^1$; Oswald, NW corner TAB^3). Early spring.

Erysimum cheiranthoides L. – WORMSEED-MUSTARD. Known from a single waif growing in the gravel of Parking Lot B (*Oswald 6213*). Native to Eurasia. Spring.

Hirschfeldia incana (L.) Lagr.-Foss. – MEDITERRANEAN MUSTARD. Occasional biennial to short-lived perennial along the edge of marshes and in dry fields (*Oswald 5632*, southwest corner of $T5^3$). Native to the Mediterranean area. Summer.

Lepidium dictyotum A.Gray var. ***dictyotum*** – ALKALI PEPPER-GRASS. Locally abundant annual on moist alkaline flats and in grassy fields, often growing near *L. dictyotum* var. *acutidens* (*Hanson* in 1950; *Marshall* in 1954; *Oswald 5994*, NE side of $P10^2$; *Oswald 6001*, TAB^3; *Oswald 6035*, TG; *Oswald 6028*, W edge of $T2^1$). Late winter to early spring.

Lepidium dictyotum var. ***acutidens*** A.Gray – SHARP-TOOTHED PEPPER-GRASS. Uncommon to locally abundant annual on vernally wet grassy flats and near vernal pools and depressions in grassy fields (*Oswald 5324*, TG; *Oswald 5995*, NE side of $P10^2$), sometimes growing near *L. dictyotum* var. *dictyotum*. This is probably the pepper-grass referred to *L. oxycarpum* and reported as very common over the entire refuge by Anderson in 1938. Early spring. [*L. oxycarpum* Torr. & A.Gray var. *acutidens* (A.Gray) Jeps.]

Lepidium latifolium L. – BROAD-LEAVED PEPPER-GRASS. Tall, weedy Eurasian perennial forming spreading colonies along ditches (north leg of Tour Route) and parking lots (*Oswald 5463*, Checking Station S of Norman Rd.). Spring.

Lepidium latipes Hook. var. ***latipes*** – DWARF PEPPER-GRASS. Occasional to locally abundant prostrate annual on vernally wet grassy flats and near shallow vernal pools in grassy fields (*Oswald 5323*, TG; *Oswald 5996*, E side of $P10^2$). Early spring.

Lepidium latipes var. **heckardii** Rollins – HECKARD'S DWARF PEPPER-GRASS. Uncommon on the refuge

but sometimes locally abundant in alkaline soil of vernally moist, grassy fields (*Oswald 5985, Oswald & Silveira 6000*, S side T18; *Oswald 6031*, W edge of T1[6]; *Oswald 6036*, TG; Oswald, on N side of P4). Early spring. CNPS Inventory 1B.

Lepidium perfoliatum L. – CLASPING PEPPERGRASS. Common and sometimes locally abundant annual forb along the edges levees and roads (*Kridler* in 1960; *Oswald 5314*, between TAB & P1[2]). Native to Eurasia. Spring.

Sisymbrium orientale L. – ORIENTAL HEDGE-MUSTARD. Occasional annual along roads and trails (*Oswald 5452*, T11[4], Wetlands Hiking Trail; *Oswald 6090*, Tour Route along N edge T16[1]). Native to Europe. Spring and summer.

Tropidocarpum gracile Hook. – SLENDER TROPIDOCARPUM. Reported as sparse along the west boundary near the railroad tracks in 1938 (*Anderson 82*). It was not found during the 1993–94 survey. Spring.

CALLITRICHACEAE – WATER-STARWORT FAMILY

Callitriche marginata Torr. – WINGED WATER-STARWORT. Common in vernal pools and in flooded fields, the aquatic phase with floating rosettes of leaves. As the ponds dry down in late spring, the plant becomes terrestrial, forming green cushions on wet mud (*Oswald 5316*, TD[1]). Winter and spring. [Includes *C. longipedunculata* Morong, the aquatic phase]

CAMPANULACEAE – BELLFLOWER FAMILY

1 Anther tube strongly bent downward so as to be almost vertical to the filaments ..... *Downingia insignis*
1 Anther tube almost in line with the filaments, not strongly bent.
2 Upper corolla lobes reflexed, curving backward into a ring ..... *Downingia ornatissima*
2 Upper corolla lobes more or less erect, not curving backward into a ring ..... *Downingia bella*

Downingia bella Hoover – HOOVER'S DOWNINGIA. Annual forb, uncommon but sometimes locally abundant and covering the entire beds of smaller vernal pools and "hog wallows" (*Oswald 6158*, T11[5]; *Oswald 5325*, TG; *Oswald 6049*, SW corner of TAB[3]). It frequently grows with *D. insignis*. Spring.

Downingia insignis Greene – HARLEQUIN DOWNINGIA. Common and widespread annual forb in drying mud of vernal pools and vernally wet depressions, often forming blue rings around deeper pools or turning shallow pools into a solid mass of blue (*Anderson 106* [as *D. elegans*(Lindl.) Torr., misapplied], abundant in almost any wet place and low spot in 1938; *Marshall* in 1955, without a specific location; *Oswald 5296*, NE corner T1[6]). Spring.

Downingia ornatissima Greene – FOLDED DOWNINGIA. Uncommon at the refuge but sometimes locally abundant on drying mud of vernal pools and depressions in grasslands, often growing with *D. insignis* (*Oswald 6093*, old rice fields on S side of T17; *Oswald & Silveira 6110*, SW side of TH). Spring.

CAPRIFOLIACEAE – HONEYSUCKLE FAMILY

Sambucus mexicana C.Presl ex DC. – BLUE ELDERBERRY. Uncommon shrub along the edge of levee roads (Oswald, P1[2]). Spring. [*S. glauca* Nutt.; *S. velutina* Dur. & Hilg.; *S. cerulea* Raf.]

CARYOPHYLLACEAE – PINK FAMILY

1 Fruit a 1-seeded indehiscent utricle; petals absent ..... *Herniaria*
1 Fruit a several to many seeded capsule; petals usually present.
2 Scarious stipules present.
3 Plants perennial; flowers large, white ..... *Spergularia macrotheca*
3 Plants annual; flowers small, pinkish to white.
4 Leaves densely fascicled; stipules lance acuminate ..... *Spergularia rubra*
4 Leaves not fascicled; stipules deltoid.
5 Stamens 6–10 (at SNWR?) ..... *Spergularia bocconei*
5 Stamens 2–5 ..... *Spergularia marina*
2 Stipules absent.
6 Leaves broad, lanceolate to ovate.
7 Capsule cylindrical; stem lacking a longitudinal line of hairs ..... *Cerastium*
7 Capsule ovoid or ellipsoid; stem with a longitudinal line of hairs ..... *Stellaria*
6 Leaves narrowly linear; capsule ovoid or ellipsoid ..... *Sagina*

Cerastium glomeratum Thuill. – MOUSE-EARED CHICKWEED. Common annual forb in grassy fields, on levees, and in waste places (*Oswald 5987*, levee between T18 & P4). Spring. [*C. viscosum* L., misapplied]

Herniaria hirsuta L. ssp. *hirsuta* – HAIRY HERNIARIA. Occasional weed in roadside gravel along the Tour Route (*Oswald 5455*, near the viewing platform), probably introduced in the stream gravel hauled into the area. Native to southern Europe, northern Africa, and southwestern Asia. Spring.

Sagina decumbens (Elliott) Torr. & A.Gray ssp. ***occidentalis*** (S.Watson) G.E.Crow – WESTERN PEARLWORT. Inconspicuous but locally abundant annual on grassy and gravelly flats (*Oswald 5998*, field W of checking station). Early spring.

Spergularia macrantha (Hornem.) Heynh. var. ***leucantha*** (Greene) B.L.Rob. – WHITE-FLOWERED SANDSPURRY. Scattered to locally abundant herbaceous perennial in alkaline soils of grassy fields (*Anderson 93*, common E of Logan Creek; *Hanson* in 1950, without a location; *Oswald 5321*, TG; Oswald in NE corner of TAB[3]). Spring.

Spergularia marina (L.) Griseb. – SALT-MARSH SANDSPURRY. Common and locally abundant in alkaline soils of vernally wet places in grassy fields, and on mud of drying vernal pools and drying ponds (*Oswald 5312*, P1[1]). The plant has small but attractive pinkish flowers that open around mid-day on sunny days. A more robust form of this plant is locally common in gravel in the parking lot at the Checking Station (*Oswald 5462*). Spring. [Includes var. *tenuis* (Greene) R.Rossbach]

Spergularia rubra (L.) J.Presl & C.Presl – RUBY SANDSPURRY. Occasional weedy annual in parking lots and other disturbed places (*Oswald 6160*, parking area at viewing platform). Native to Europe. Spring.

Stellaria media (L.) Vill. – COMMON CHICKWEED. Uncommon annual weed of roadsides and disturbed places (*Anderson 90*, along a drain near headquarters in

1938; *Oswald 5991*, between T41 & T38[1]). Native to southwest Europe. Spring.

CERATOPHYLLACEAE – HORNWORT FAMILY

Ceratophyllum demersum L. – HORNWORT. Submersed aquatic represented by an old collection in the SNWR herbarium (*Hanson* in 1951), without a specific location. It was not found during the 1993–94 survey. Collected in Sept.

CHENOPODIACEAE – GOOSEFOOT FAMILY

1 Leaves not or scarcely flattened, either fleshy and sublinear or scaly or spiny.
  2 Leaves scaly, the stems and branches fleshy.
    3 Branches and flower clusters opposite ..... *Salicornia*
    3 Branches and flower clusters alternate ..... *Allenrolfea*
  2 Leaves not scaly, either fleshy and nearly linear or spine-tipped.
    4 Leaves tipped with a spine ..... *Salsola*
    4 Leaves fleshy, not tipped with a spine;
      5 Plant annual; calyx lobes unequal ..... *Suaeda calceoliformis*
      5 Plant perennial; calyx lobes equal ..... *Suaeda moquinii*
1 Lower leaves flattened, foliaceous.
  6 Flowers imperfect, the female enclosed in a pair of leaf-like bracts that enlarge in fruit.
    7 Shrubby perennials; staminate and pistillate flowers in separate plants (rarely in the same plant).
      8 Leaf blade oblong to narrowly oblanceolate, usually 2–4 mm wide; twigs slender, becoming spiny ..... *Atriplex polycarpa*
      8 Leaf blade ovate to deltate, usually 10–50 mm wide; stems not distinctly slender nor spiny ..... *Atriplex lentiformis*
    7 Herbaceous annuals or non-shrubby perennials; plant with both staminate and pistillate flowers.
      9 Leaves green on both surfaces, glabrous to sparsely scaly, triangular.
        10 Fruiting bracts of two sizes, rounded, without teeth or tubercles ..... *Atriplex heterosperma*
        10 Fruiting bracts similar in size, triangular, short-tubercled and finely toothed ..... *Atriplex triangularis*
      9 Leaves white to gray, densely and finely scaly, especially below, not distinctly triangular.
        11 Plants perennial.
          12 Stems prostrate, not dying back to the rootcrown in the summer; fruiting bracts fleshy, reddish ..... *Atriplex semibaccata*
          12 Stems decumbent to more or less erect, dying back to the rootcrown; fruiting bracts not fleshy or reddish ..... *Atriplex fruticulosa*
        11 Plants annual.
          13 Fruiting bracts in dense, terminal spikes; stems striate ..... *Atriplex joaquiniana*
          13 Fruiting bracts in leaf axils, not in dense, terminal spikes; stems not striate.
            14 Leaves sessile or nearly so.
              15 Leaves ovate, heart-shaped, ascending ..... *Atriplex cordulata*
              15 Leaves narrower, the upper lance-ovate, the blade bent and nearly paralleling the stem (at SNWR?) ..... *A. coronata* Jeps. var. *coronata*
            14 Leaves, at least the lower, with petioles.
              16 Fruiting bracts widest at or above the middle; more or less rounded, the sides usually conspicuously appendaged ..... *Atriplex argentea*
              16 Fruiting bracts widest below the middle, ovate, deltate, or diamond-shaped, the sides sharply tubercled or not.
                17 Leaves wavy-toothed; coarse, erect plants 4–15 dm tall ..... *Atriplex rosea*
                17 Leaves entire; delicate plants less than 4 dm tall, the stems prostrate to decumbent.
                  18 Male flowers in terminal clusters; fruiting bracts persistent on the stems ..... *Atriplex persistens*
                  18 Male flowers not in terminal clusters; fruiting bracts readily shed ..... *Atriplex depressa*
  6 Flowers perfect, sometimes also female, and not enclosed in a pair of bracts.
    19 Calyx lobes with stout hooked spines ..... *Bassia*
    19 Calyx lobes without hooked spines.
      20 Plants more or less glandular-pubescent or resinous-glandular, with a strong medicinal odor ..... *Chenopodium ambrosioides*
      20 Plants mealy, not glandular-pubescent, without a medicinal odor.
        21 Leaves shining on upper surface ..... *Chenopodium murale*
        21 Leaves dull on upper surface ..... *Chenopodium album*

Allenrolfea occidentalis (S.Watson) Kuntze – IODINE-BUSH. A single but large shrub grows on the northwest corner of Cell 3, Tract 23 on the south side of Norman Rd. (*Oswald 5954*), where it was probably planted long ago. Iodine-bush is native from eastern San Francisco Bay southward into the deserts of Southern California. Summer and fall.

Atriplex argentea Nutt. var. ***mohavensis*** M.E.Jones. – SILVERSCALE. Common and widespread annual of roadsides, levees, dry beds of seasonally flooded pools, and grassy fields (*Oswald 5773*, T1[6]; *Oswald 5957*, Wetlands Hiking Trail between T11[4 & 5]). Late summer and fall.

Atriplex cordulata Jeps. – HEARTSCALE. Locally abundant in alkaline soil of vernally wet flats, in hard dry soil of old rice fields which have reverted to upland, and along levee roads built up with alkaline soil (*Oswald 5461*, N end of TG; Silveira & Oswald, E side of T21[4] & W side of T22; *Oswald 5641*, south corner of TC[1]; *Oswald 5771*, T1[6]). CNPS Inventory List 1B. Late spring and summer.

Atriplex depressa Jeps. – BRITTLESCALE. Occasional locally common annual along the margins of vernal pools and in the adjacent vernally wet upland (*Oswald 5778*, NE¼ of TAB[3]; Oswald & Silveira, W side P7A[3]). CNPS Inventory List 1B. Late summer and fall. [*A. parishii* S.Watson in part (Munz, Calif. Flora)]

Atriplex fruticulosa Jeps. – BALL SALTBUSH. Common herbaceous perennial from a branching, woody caudex. It is found in vernally wet grassy fields, along the dry margins of vernal pools, and on roads (*Oswald 5365 & 5370*, NE corner TAB[3]; *Oswald 5413*, NW edge of TAB[3]; Oswald & Silveira, TH). Although Jepson (Flora Calif. 1:435. 1914) lists this plant as occurring on "alkali flats of the Great Valley from the 'gooselands' of Glenn County south to the San Joaquin," there have apparently been no recent collections from this area since *The Jepson Manual* lists it only as far north as the southern Sacramento Valley. Spring.

Atriplex heterosperma Bunge – VARIABLE-SEEDED SALTBUSH. Common annual in dry fields and along roads and levees (*Oswald 5938*, Wetlands Hiking Trail). Native to Eurasia. Late summer and fall.

Atriplex joaquiniana A.Nelson – SAN JOAQUIN SPEARSCALE. Locally common annual in grassy fields, along levee roads, and near vernal pools (*Marshall* in 1954; *Oswald 5412*, N edge TAB[3]; Silveira, W edge of P10[1]). CNPS Inventory List 1B. Although this plant was collected near Willows by Jepson (Flora of Calif. 1:438. 1914), *The Jepson Manual* lists it as occurring only from the southern Sacramento Valley southward into the San Joaquin Valley and along the east slope of the Inner South Coast Ranges. Late spring. [*A. spicata* S.Watson; *A. patula* L. ssp. *spicata* (S.Watson) H.M.Hall & Clements]

Atriplex lentiformis (Torr.) S.Watson ssp. ***lentiformis*** – BIG SALTBUSH. Locally common shrub in dry upland (*Oswald 5774*, T2[11]). Although big saltbush is not native this far north in the Great Valley, seedlings and young plants indicate that the plant can spread in the areas where it was planted long ago. Late summer and fall.

Atriplex persistens Stutz & G.L.Chu – VERNAL-POOL SALTBUSH. A small, annual *Atriplex* with the male flowers clustered at the branch tips is locally common in

alkaline soil on the dry beds of vernal pools at several locations on the refuge (*Oswald & Silveira 5230*, P1[1]; *Oswald 5640*, TC[2]; Oswald, TAB[3]). Under favorable growing conditions, it sometimes forms large, green mats. Although this species and *A. depressa* are probably the Glenn County material referred to *A. parishii* in Munz, it has recently been recognized as new (Madroño 40:209. 1993). Although described too late to be included in the 5th edition of the CNPS Inventory, it qualifies as a List 1B plant. Summer and fall.

Atriplex polycarpa (Torr.) S.Watson – MANY-FRUITED SALTBUSH. A dioecious shrub native to the San Joaquin Valley and Southern California (*Oswald & Silveira 5802, Oswald 5943*, headquarters complex, T13[2]). The plants show no indication of having spread in the area where they were planted. Late summer and fall.

Atriplex rosea L. – TUMBLING ORACLE. Uncommon annual in weedy upland fields (*Oswald 5773*, T1[6]). Native to Eurasia. Late summer.

Atriplex semibaccata R.Br. – AUSTRALIAN SALTBUSH. Common perennial forming low mounds along roads and levees (*Marshall* in 1954; *Oswald 4028*, SE corner P1A[4]; *Oswald 5944*, SW corner T5[1]). Native to Australia. Spring and summer.

Atriplex triangularis Willd. – SPEARSCALE. Common annual in dry ditches and along the edge of ponds (*Marshall* in 1954; *Oswald 5939*, Wetlands Hiking Trail). According to Anderson's list, this plant (as *A. patula* var. *hastata*) was uncommon along the border of dirt roads and fence rows in 1937. There is some question as to Anderson's identification since the roadside and fence-row habitats are more characteristic of the vegetatively similar *A. heterosperma*. Late summer and fall. [*A. hastata* L., misapplied; *A. patula* L. ssp. *hastata* (L.) H.M.Hall & Clem., misapplied]

Bassia hyssopifolia (Pallas) Kuntze – HYSSOP-LEAVED BASSIA. Common and widespread annual in alkaline soils along levee roads, on the dry margins of vernal pools, and in vernally wet fields (*Anderson 32*, roads, borders of dry alkali spots; *Anon.* in 1951; *Oswald 5410*, NE quarter of TAB[3]). Native to Eurasia. Late spring. [*Echinopsilon hyssopifolium* (Pall.) Moq.]

Chenopodium album L. – LAMB'S-QUARTERS. Annual weed that is locally common along roads (*Anderson 25 & 58*, dry lake beds and roadsides; *Oswald 5491*, near the beginning of the Tour Route). Probably native to Europe. Late spring and summer.

Chenopodium ambrosioides L. – MEXICAN-TEA. Annual native of tropical America that is found along the edge of marshes (*Oswald 5937*, Wetlands Hiking Trail; Oswald, E leg of the Tour Route). Summer and fall. [Includes vars. *anthelminthcum* (L.) A.Gray and *vagans* (Standl.) J.T.Howell]

Chenopodium murale L. – NETTLE-LEAVED GOOSEFOOT. This European weed was found around old ranch buildings in 1937 (*Anderson 37*), a typical habitat for the species. It was not found during the 1993–94 survey. Summer.

Salicornia subterminalis Parish – PICKLEWEED. A single clump of this perennial of salt marshes and alkali flats was found along the west side of a summer-dry flat in Cell 2, Pool 11 (*Oswald 5572*). Summer.

Salsola tragus L. – RUSSIAN-THISTLE. Common weedy roadside annual in the North Valley but fairly uncommon at the refuge (*Oswald 5695*, edge of Norman Rd.; Oswald, Tour Route between the parking lot and Pole Line Rd.). Native to Eurasia. Summer into fall. [*S. australis* R. Br.; *S. iberica* Sennen & Pau; *S. kali* L. var. *tenuifolia* Tausch, all misapplied; the correct name may be *S. pestifera* A.Nelson (see Munz Suppl., p. 75)]

Suaeda calceoliformis (Hook.) Moq. – HORNED SEABLITE. Common and locally abundant succulent annual on the margins of drying alkaline pools and on alkali scalds (*Oswald 5329*, TG; *Oswald 5945*, NW corner T5[2]). Spring and summer. [*S. depressa* (Pursh) S.Watson var. *erecta* S.Watson; *S. depressa* var. *depressa* misapplied]

Suaeda moquinii (Torr.) Greene – BUSH SEEPWEED. Locally common subshrub in the southwest corner of Cell 3, Pool 7A (*Oswald & Silveira 5643*) and in the middle of the W side of the same pool (Silveira), the only known locations on the refuge. The plant has a foul odor. Spring and summer. [*S. torreyana* S.Watson including var. *ramosissima* (Standl.) Munz; *S. fruticosa* (L.) Forssk., misapplied]

CONVOLVULACEAE – MORNING-GLORY FAMILY

1 Styles 2, distinct; flowers less than 1 cm long ..... *Cressa*
1 Style 1; flowers more than 1 cm long ..... *Convolvulus*

Convolvulus arvensis L. – BINDWEED. Common weedy perennial vine of roadsides and marsh edges (*Anderson 50*, W of headquarters and in section 22; *Hanson* in 1950, without a location; *Oswald 5353*, NE corner T41). Native to Europe. Late spring into fall.

Cressa truxillensis Kunth – ALKALI-WEED. Common and widespread herbaceous perennial in alkaline soils of vernally wet upland fields, on the drying beds of vernal pools and seasonally flooded marshes, and along roads (*Anderson 20*, common in dry alkali beds in 1937; *Oswald 5405*, TAB[3]). At the refuge, alkaline-weed is commonly infected with a rust pathogen, causing the plants to develop enlarged, yellow-green leaves. Pustules are scattered on the lower epidermis of the leaves from which orange-colored spores are released. Late spring. [Includes var. *vallicola* (A.Heller) Munz; *C. cretica* L.]

CRASSULACEAE – STONECROP FAMILY

1 Carpels (1)2-seeded; plants of moist to dry places.
  2 Leaves and sepals blunt or gradually narrowed to a slender tip; flowers 3–5 merous ..... *Crassula connata*
  2 Leaves and sepals obviously hair-tipped, the plant mossy looking; flowers 3-merous ..... *Crassula tillaea*
1 Carpels 3 or more-seeded; plants of shallow water and wet places.
  3 Seed surface wrinkled, dull ..... *Crassula aquatica*
  3 Seed surface smooth, shiny (at SNWR?) ..... *Crassula solieri* (Gay) F.Meigen

Crassula aquatica (L.) Schoenl. – WATER PIGMYWEED. Common but inconspicuous annual forb, often forming large populations in shallow water and later on drying mud of vernal pools and seasonally flooded marshes (*Oswald 5344*, NW corner T31). Spring. [*Tillaea aquatica* L.]

Crassula connata (Ruiz & Pav.) A.Berger – PYGMYWEED. Inconspicuous annual forming localized populations along roads, in parking areas, and on dry, barren spots in grassy fields (*Anderson 81*, near the Gravel Pit in 1938); *Oswald 5337*, TG; *Oswald 6091*, road along N edge of T16[1]). Spring. [*Tillaea erecta* Hook & Arn.]

Crassula tillaea Lest.-Garl. – MOSSY PIGMYWEED. Locally common annual on hard-packed soil of parking lots and roadsides, and in dry openings in fields (*Oswald 5993*, parking lot in NE corner T41; *Oswald 6092*, road along N edge of T16[1]). Often growing near the previous species. Native to the Mediterranean region. Spring. [*Tillaea muscosa* L.]

CUSCUTACEAE – DODDER FAMILY

1 Corolla with obvious fringed, scale-like appendages attached to the tube below the stamens.. ..... *Cuscuta salina*
1 Corolla without fringed, scale-like appendages at the base of the filaments..... ..... *Cuscuta californica*

Cuscuta californica Hook. & Arn. var. ***californica*** – CALIFORNIA DODDER. A common parasite of *Hemizonia parryi* (*Oswald 5568*, parking lot at the Checking Station S of Norman Rd.; *Oswald 5772*, T1[6]). Summer.

Cuscuta salina Engelm. var. ***papillata*** Yunck. – ALKALINE DODDER. Locally abundant parasite of *Frankenia* (*Oswald 5496*, NE ¼ T18; *Oswald 5777*, NE ¼ TAB[3]) and less often of *Suaeda* and *Bassia* on alkaline soils of vernally wet flats and margins of vernal pools. Late spring and summer.

DIPSACACEAE – TEASEL FAMILY

1 Bracts of head ending in a straight spine, the spines flexible even when dry *Dipsacus fullonum*
1 Bracts of head ending in a recurved spine, the spines stiff..... *Dipsacus sativus*

Dipsacus fullonum L. – WILD TEASEL. Weedy perennial forming colonies along ponds and ditches (*Wilbur* in 1962, without a location; *Oswald 5692*, Tour Route near the viewing platform). Late spring and summer; some plants blooming again in the fall on new growth on old stems. [*D. sylvestris* Huds.]

Dipsacus sativus (L.) Honck. – FULLER'S TEASEL. Weedy perennial forming colonies along ponds and ditches (*Oswald 5457*, E edge of P1A[3]). This is the species that was used to raise the nap on woolen cloth. Late spring and summer. [*D. fullonum* L. & *D. sylvestris* Huds., misapplied]

ELATINACEAE – WATERWORT FAMILY

1 Plants glandular-pubescent; flower parts in 5's; sepals pointed, with a thickened midrib; dry bottoms of vernally wet places ..... *Bergia*
1 Plants glabrous; flower parts in 2's, 3's, or 4's; sepals blunt, without a midrib; aquatic or semiaquatic.
2 Flower parts in 4's; stamens 8; pedicels elongating in fruit; seeds curved like the letter "C" ..... *Elatine californica*
2 Flower parts in 3's (or sepals reduced to 2); stamens 3 or varying from 1–6; seeds only slightly curved.
3 Flowers subsessile to distinctly pedicelled; fruit turning to one side at maturity; sepals 3, equal in size ..... *Elatine ambigua*
3 Flowers sessile, erect; sepals 2 or 3, when 3 then 1 of them reduced... *Elatine chilensis*

Bergia texana (Hook.) Seub. – TEXAS BERGIA. Coarse annual growing in hard dry soil of depressions that held standing water in the spring (*Oswald 6413*, near the SW corner of the Tour Route). Summer.

Elatine ambigua Wight – RICEFIELD WATERWORT. Delicate annual forming localized populations on mud on the bottom of drying ponds and marshes (*Oswald 5451*, T11[1]; S edge of T14[3]). Native to eastern and southern Asia. Spring.

Elatine californica A.Gray – CALIFORNIA WATERWORT. Tiny and inconspicuous annual forb in shallow water and later on drying mud of pools (*Oswald 5334*, TG; *Oswald 5356*, T29[1]). Spring.

Elatine chilense Gay – CHILEAN WATERWORT. Inconspicuous annual on mud of seasonally flooded marshes (*Oswald 5357*, T29[1]), sometimes growing in the same pond as *E. californica*. Spring.

EUPHORBIACEAE – SPURGE FAMILY

1 Plant silvery-hairy; flowers with a calyx, not borne within an involucre (cyathium)... ..... *Eremocarpus*
1 Plant green; flowers lacking a true calyx, borne within a cup-shaped involucre (cyathium) surrounding several reduced male flowers and a female flower with a 3-lobed pistil.
2 Ovary and capsule hairy ..... *Chamaesyce maculata*
2 Ovary and capsule glabrous.
3 Appendages of glands deeply parted into 3–5 ligule-like structures 1 mm long; plants in and about drying vernal pools ..... *Chamaesyce hooveri*
3 Appendages entire to slightly lobed ..... *Chamaesyce serpyllifolia*

Chamaesyce hooveri (Wheeler) Koutnik – HOOVER'S SPURGE. Discovered on the Sacramento Refuge by Joseph Silveira in 1992, Hoover's spurge is locally common to abundant on summer-dry mud on the bottom of certain vernal pools (*Silveira in 1992*, P1[1]; *Silveira in 1992*, TC[2]; *Silveira in 1992 & Oswald 5951*, TAB[3]; *Oswald 5691*, NE corner of T18]. CNPS Inventory List 1B. Summer. [*Euphorbia hooveri* Wheeler]

Chamaesyce maculata (L.) Small – SPOTTED SPURGE. Locally abundant annual weed on the edge of the Visitor's Parking Area (*Oswald 5942*). [*Euphorbia maculata* L.; *E. supina* Raf.]

Chamaesyce serpyllifolia (Pers.) Small – THYME-LEAVED SPURGE. Uncommon annual on the bank of Hunters Creek (*Oswald & Silveira 5803*, T44). Summer and fall. [*Euphorbia serpyllifolia* Pers.]

Eremocarpus setigerus (Hook.) Benth. – TURKEY-MULLEIN. Reported as common on barren spots and along dirt roads in 1937 (*Anderson 60*). Today this common weedy native of roadsides in the North Valley is surprisingly uncommon at the refuge, being found only occasionally in dry fields (*Wilbur* in 1962; *Oswald 5808*, T44). Late spring and summer.

FABACEAE – LEGUME FAMILY
[*Leguminosae*]

1 Leaves trifoliate or palmately compound.
2 Leaves palmately compound.
3 Flowers pinkish; keel ciliate on upper margins near the claws .... *Lupinus microcarpus*

3 Flowers blue with some white; keel ciliate on upper margins toward the apex or not ciliate at all ..... *Lupinus polycarpus*
2 Leaves trifoliate.
4 Flowers in ovoid to oblong heads; corolla persistent after flowering.
5 Head without an involucre at base of flowers (with a reduced trifoliate leaf at base of head in *T. hirtum*).
6 Individual flowers on pedicels, reflexed in age.
7 Calyx minutely ciliate on the lobes with short flat appendages ..... *Trifolium ciliolatum*
7 Calyx lobes not ciliate but sometimes hairy ..... *Trifolium bifidum*
6 Individual flowers sessile, not reflexed in age.
8 Head sessile, with a reduced trifoliate leaf at its base ..... *Trifolium hirtum*
8 Head on a distinct peduncle ..... *Trifolium albopurpureum*
5 Heads with an involucre at the base of the flowers.
9 Corolla conspicuously inflated in age (cowbag clovers), bracts of involucre separate.
10 Flowers small (5–8 mm long), whitish in ours ..... *Trifolium depauperatum*
10 Flowers large (12–25 mm long), cream-colored becoming pinkish in age ..... *Trifolium fucatum*
9 Corolla not or only slightly inflated in age; involucral bracts united into a disk or cup.
11 Involucre flat ..... *Trifolium variegatum*
11 Involucre bowl-shaped ..... *Trifolium microcephalum*
4 Flowers in spikes or racemes; corolla deciduous.
12 Pods curved or spirally coiled; style awl-shaped ..... *Medicago*
12 Pods ovoid, straight; style thread-like.
13 Flowers white ..... *Melilotus alba*
13 Flowers yellow ..... *Melilotus indica*
1 Leaves pinnately compound.
14 Axis of leaf prolonged into a tendril or a short seta.
15 Flowers 1–4 in the leaf axils, sessile or almost so ..... *Vicia sativa*
15 Flowers more numerous, in racemes near the ends of evident peduncles.
16 Calyx strongly pouched at the base, the pedicel appearing ventral ..... *Vicia villosa*
16 Calyx slightly, if at all, pouched at the base, the pedicel basal or nearly so ..... *Vicia benghalensis*
14 Axis of leaf without a tendril or seta.
17 Flowers solitary or in umbels.
18 Stipules expanded, not gland-like ..... *Lotus corniculatus*
18 Stipules reduced to dot-like glands which are often dark or reddish ..... *Lotus wrangelianus*
17 Flowers in racemes.
19 Tree; flowers white ..... *Robinia*
19 Herbaceous annual; flowers bluish ..... *Astragalus*

Astragalus tener A.Gray var. **ferrisiae** Liston – FERRIS' MILK-VETCH. A rare annual that is locally common along the grassy margins of several alkaline pools and drainages in the northwest quarter of Cell 3, Tract AB (*Oswald 6005, 6113, 6114*), the only known location on the refuge. CNPS Inventory List 1B. Spring.

Lotus corniculatus L. – BIRD'S-FOOT-TREFOIL. According to Anderson's list, this plant was sparse in a wet area near the entrance in 1937. It is now a common, widespread, and locally abundant perennial forb in marshy and vernally wet places (*Wilbur* in 1961). Native to Eurasia. Spring into summer; some plants blooming again in early fall.

Lotus wrangelianus Fisch. & C.A.Mey. – WRANGEL LOTUS. Locally common in upland grassy fields (*Oswald 5318*, TG; *Oswald 6045*, T5[1]). Spring. [*L. subpinnatus* Lag., misapplied]

Lupinus microcarpus Sims var. ***microcarpus*** – PINK-FLOWERED LUPINE. Uncommon annual lupine forming colonies in wet clay soils in grassy fields (Silveira, TAB; Oswald, TG). Spring. [*L. subvexus* C.P.Sm.; *L. ruber* A.Heller]

Lupinus polycarpus Greene – SMALL-FLOWERED LUPINE. Locally common annual lupine in wet clay soils of grassy places (*Anderson 78*, sparse in N half of refuge; *Hanson* in 1950; *Oswald & Silveira 6026*, NW corner of TAB[3]). Spring. [*L. micranthus* Guss. misapplied. This lupine is included in *L. bicolor* Lindl. in *The Jepson Manual*, but it appears to be clearly distinct in our range.]

Medicago polymorpha L. – COMMON BUR-CLOVER. Common weedy annual forb along roads, on dikes, and in grassy fields (*Marshall* in 1954; *Oswald 6116*, TAB[3]). Some plants have essentially smooth fruits, a variant that is usually not taxonomically recognized (*Marshall* in 1954). Bur-clover is apparently much more common now than in 1937; Anderson (collection #11) lists it as sparse along the east boundary in Section 35. Spring. [*M. polymorpha* var. *brevispina* (Benth.) Heyn; *M. hispida* Gaertn., including var. *confinis* (W.D.J.Koch) Burnat]

Melilotus alba (L.) Medik. – WHITE SWEET-CLOVER. Eurasian native that is found along the edge of marshes, creeks, and roads (Oswald, Wetlands Hiking Trail). Summer.

Melilotus indica (L.) All. – INDIAN SWEET-CLOVER. Common and widespread annual forb along levee roads and ditches and in grassy fields (*Anderson 12*, gravel pit; *Marshall* in 1954; *Oswald 6043*, T5[1]). Spring.

Robinia pseudoacacia L. – BLACK LOCUST. Several small trees have volunteered along the creek at the headquarters complex. Native to the eastern US. Spring.

Trifolium albopurpureum Torr. & A.Gray var. ***albopurpureum*** – INDIAN CLOVER. Reported as common over most of the refuge in 1938 (*Anderson 104*). It was not found during the 1993–94 survey. Spring.

Trifolium bifidum A.Gray var. ***decipiens*** Greene – DECEPTIVE NOTCH-LEAVED CLOVER. Locally common annual in grassy upland and on the banks of seasonally flooded marshes (*Oswald 5320 & 5338*, TG; probably the clover (*#100*) referred to *T. gracilentum* by Anderson in 1938). Spring.

Trifolium ciliolatum Benth. – FOOTHILL CLOVER. Reported as common over most of the refuge in 1938 (*Anderson 105*). It was not found during the 1993–94 survey. Spring. [*T. ciliatum* Nutt.]

Trifolium depauperatum Desv. var. ***amplectens*** (Torr. & A.Gray) McDermott – INVOLUCRATE COWBAG CLOVER. Locally common annual in grassy fields (*Anderson 101*, common over most of the refuge in 1938; *Oswald 5319*, TG). Spring. [*T. amplectens* Torr. & A. Gray]

Trifolium fucatum Lindl. – SOUR CLOVER. Apparently common over most of the refuge in 1938 (*Anderson 102*). Today it is an uncommon annual in adobe soil of grassy fields (*Oswald 6040*, NE corner of P7; *Oswald 6101*, NW corner of P7A[4]). Spring.

Trifolium hirtum All. – ROSE CLOVER. Widespread naturalized annual in northern California but apparently uncommon at the refuge (Oswald, edge of the Visitor's Parking Lot). Native to Eurasia. Spring.

Trifolium microcephalum Pursh – SMALL-HEADED CLOVER. Inconspicuous annual known only from moist soil along a vernally flooded swale on the northwest side of Cell 3, Tract AB (*Oswald 6115*). Spring.

Trifolium variegatum Nutt. – WHITE-TIPPED CLOVER. An abundant annual reported to grow over most of the refuge in 1938 (*Anderson 98*). Today it is only occasionally found on the margins of vernal pools and other vernally wet depressions (Oswald, NE corner T1[6]). Spring.

Vicia benghalensis L. – RED-FLOWERED VETCH. Uncommon annual forb along roads and in weedy fields (*Oswald 5350*, NE corner of T41). Native to Europe. Spring.

Vicia sativa L. ssp. *sativa* – GARDEN VETCH. Herbaceous annual growing in weeds along Norman Rd. (*Oswald 6095*). Native to Europe. Spring.

Vicia villosa ssp. *varia* (Host) Corb. – WINTER VETCH. Occasional to locally abundant annual forb in weedy fields and along roads and ditches (*Oswald 5349*, NE corner T41). Native to Europe. Spring. [*V. villosa* var. *glabrescens* W.D.J.Koch; *V. dasycarpa* Ten.]

FRANKENIACEAE – FRANKENIA FAMILY

Frankenia salina (Molina) I.M.Johnst. – ALKALI SEA-HEATH. Ubiquitous herbaceous perennial in alkaline soils of upland fields, seasonally flooded marshes, and borders of vernal pools (*Anderson 56*, on all alkali spots and barren areas; *Hanson 42-50*, without a location; *Marshall* in 1954, without a location; *Oswald 5406*, TAB[3]). Late spring and summer. [*F. grandifolia* Cham. & Schltdl., including var. *campestris* A.Gray]

GENTIANACEAE – GENTIAN FAMILY

Centaurium muehlenbergii (Griseb.) W.Wight ex Piper – JUNE CENTAURY. Attractive, locally abundant, and widespread annual in drying, grassy fields, along the edge of roads, and on the borders of marshes (*Wilbur* in 1961; *Oswald 5361*, SW corner T2[11]). Late spring and early summer. [*C. floribundum* (Benth.) B.L.Rob.]

GERANIACEAE – GERANIUM FAMILY

1 Leaves palmately veined or divided; stamens all bearing anthers ..... *Geranium*
1 Leaves pinnately veined or divided; stamens having outer filaments without anthers.
  2 Leaves simple, shallowly to deeply lobed.
    3 Sepals lacking fine glandular pubescence between the lines of stiff hairs and with a prominent reddish-pointed tip; concavities at top of fruit subtended by 2 folds..... *Erodium botrys*
    3 Sepals with fine glandular pubescence between the lines of hairs and with a short green tip; concavities at top of fruit subtended by a single fold..... *Erodium brachycarpum*
  2 Leaves pinnately compound.
    4 Leaves pinnately lobed or divided into sharp-pointed divisions; tips of sepals with bristles..... *Erodium cicutarium*
    4 Leaves oval, toothed but not lobed or divided; tips of sepals lacking bristles ..... *Erodium moschatum*

Erodium botrys (Cav.) Bertol. – LONG-BEAKED FILAREE. Annual forb on levees, along roads and in parking lots, and in grassy fields (*Anderson 85*, over entire area; *Hanson* in 1950, without a location; *Oswald 5992*, parking lot in the NE corner of T41). Native to southern Europe. Spring.

Erodium brachycarpum (Godr.) Thellung – SHORT-FRUITED FILAREE. Annual forb on levees and in grassy fields (*Marshall* in 1954, without a location; *Oswald 5984*, T18). Native to southern Europe. Spring.

Erodium cicutarium (L.) L'Hér. – RED-STEMMED FILAREE. Common annual on roadsides, dikes, and hiking trails, and grassy fields (*Anderson 69 & 86*, over most of the area; *Oswald 5960*, Wetlands Hiking Trail in T11[1]). Native to Eurasia. Late winter to spring.

Erodium moschatum (L.) L'Hér. – WHITE-STEMMED FILAREE. Annual in weeds on levee roads and edges of parking areas (*Oswald 5965*, Parking Area D at NE corner P7). Native to Europe. Early spring.

Geranium dissectum L. – CUT-LEAVED GERANIUM. Common and widespread weedy annual in vernally wet, marshy places (*Oswald 6098*, woodlot in NE corner of T31). Native to Europe. Spring.

HYDROPHYLLACEAE – WATER-LEAF FAMILY

Phacelia ciliata Benth. – GREAT VALLEY PHACELIA. Annual forb represented by a single collection in the SNWR herbarium (*Hanson* in 1952, without a location). It was also reported as a few scattered plants on the refuge in 1938 (*Anderson 97*). Spring.

JUGLANDACEAE – WALNUT FAMILY

Juglans californica S.Watson var. **hindsii** Jeps. – NORTHERN CALIFORNIA WALNUT. Small trees, many of nut-bearing age, are scattered along Hunters Creek in the south edge of the refuge. This tree is included in List 1B of the CNPS Inventory, based on endangered native stands in Contra Costa, Napa, and Sacramento counties. It is widely planted along streets and highways in the North Valley and is used as a rootstock for English walnuts. It is now widely naturalized along creeks and rivers. [*J. hindsii* (Jeps.) Jeps. ex R.E.Sm.]

LAMIACEAE – MINT FAMILY
[*Labiatae*]

1 Corolla regular or nearly so, the lobes nearly equal.
  2 Fertile stamens 2; flowers white..... *Lycopus*
  2 Fertile stamens 4; flowers usually lavender to purplish..... *Mentha*
1 Corolla strongly 2-lipped.
  3 Calyx with 10 more or less spiny, hooked teeth at the tip ..... *Marrubium*
  3 Calyx teeth not hooked at tip.
    4 Upper lip of corolla concave.
      5 Calyx teeth spine-tipped; summer-flowering perennial ..... *Stachys*
      5 Calyx teeth lacking spines; spring-flowering annual ..... *Lamium*
    4 Upper lip of corolla plane ..... *Pogogyne*

Lamium amplexicaule L. – GIRAFFEHEAD. Weedy annual along roads and in other disturbed places (*Oswald 5997*, NE side of P10[2]). Native to Eurasia. Early spring.

Lycopus americanus Muhl. ex W.P.C.Bart. – AMERICAN BUGLEWEED. Common herbaceous perennial along the edge of marshes and in other wet places (*Anderson* 9, W boundary drain); Hanson in 1951, without a location; *Marshall* in 1954, bank of Logan Creek; *Oswald 5638*, S edge of TAB[3]). Summer into fall.

Marrubium vulgare L. – WHITE HOREHOUND. Reported as only a few isolated plants on the refuge in

1937 (*Anderson 71*, Gravel Pit & drain along W boundary). It is now a common and widespread weedy perennial along roads, dikes, trails, and in other disturbed places (*Oswald 6112*, TAB[3]). Native to Europe. Spring.

Mentha arvensis L. – AMERICAN WILD MINT. Sparse herbaceous perennial reported from the Gravel Pit in 1937 (*Anderson 55*). It was not relocated during the 1993–94 survey. Late spring and summer.

Pogogyne zizyphoroides Benth. – SACRAMENTO POGOGYNE. Apparently rare on the refuge in 1937 (*Anderson 58*, near ditch W of headquarters). It is now a common and widespread annual forb on the margins of vernal pools and in other vernally wet, grassy places (*Oswald 5297*, NE corner T1[6]). Spring.

Stachys stricta Greene – SONOMA HEDGE-NETTLE. Uncommon herbaceous perennial in wet soil along streams and other wet places (*Wilbur & O'Neill* in 1961, edge of rice checks; *Oswald 5806*, edge of Hunters Creek). This plant has a strong, unpleasant odor. Late spring into summer. [*Stachys ajugoides* Benth. var. *stricta* (Greene) Jeps.]

LENTIBULARIACEAE – BLADDERWORT FAMILY

Utricularia gibba L. – HUMPED BLADDERWORT. Represented by a collection in the SNWR herbarium (*Marshall* in 1954). The plant was submersed in 1 ft of water in a rice check. Indicated as probably alien in California in The Jepson Manual. Fall.

LIMNANTHACEAE – MEADOWFOAM FAMILY

Limnanthes douglasii R.Br. ssp. ***rosea*** (Hartw. ex Benth.) C.T.Mason – ROSY MEADOWFOAM. In 1938, rosy meadowfoam grew in small patches along the north and east boundaries of the refuge (*Anderson 80*). Today this herbaceous annual is known only from the margin of a small "hog wallow" in adobe soil in the southwest corner of Cell 3, Tract AB, where it is locally abundant (*Oswald 6048*). The veins in the petals seem to lack the reddish pigment seen in this subspecies on the east side of the valley, but the linear leaflets and prominently ridged nutlets correspond to the ssp. *rosea* rather than the ssp. *nivea* of the Inner North Coast Ranges to the west. Early spring.

LYTHRACEAE – LOOSESTRIFE FAMILY

1 Flower tube more or less cylindrical.
  2 Plants perennial, usually well over 4 dm tall; petals over 4 mm long ..... *Lythrum californicum*
  2 Plants annual or rarely short-lived perennial, usually less than 4 dm tall; petals less than 4 mm long.
    3 Flower-tube very slender in fruit, the ribs strongly scabrous ..... *Lythrum tribracteatum*
    3 Flower-tube stout in fruit, the ribs smooth ..... *Lythrum hyssopifolium*
1 Flower tube short, bell-shaped to globular.
  4 Leaves narrow at the base, not clasping the stem; flowers mostly 1 in each axil (at SNWR?) ..... *Rotala ramosior* (L.) Koehne
  4 Leaves broad at the base, clasping the stem.
    5 Inflorescences 3 to 5-flowered, usually with peduncles, the peduncle to 9 mm long; petals deep rose-purple, sometimes with a deeper purple spot at the base, 2 mm long and about as wide; anthers deep yellow; capsule equaling or exceeding the calyx-lobes ..... *Ammannia coccinea*
    5 Inflorescences 1 to 3(5)-flowered, sessile; petals pale lavender, sometimes with a deep rose basal spot or midvein, ca. 2.5 mm long and 3 mm wide; anthers pale yellow to yellow; capsule usually enclosed by or equaling the calyx lobes ..... *Ammannia robusta*

Ammannia coccinea Rottb. – VALLEY REDSTEM. Common annual in shallow water and later on the drying margins of ponds (*Hanson 5-51*, in a rice field; *Oswald 5565*, T15). Late spring and summer. [*A. auriculata* Willd., misapplied]

Ammannia robusta Heer & Regel – GREAT REDSTEM. Locally abundant annual in shallow water and on the drying beds of marshes (*Oswald 5776*, SE ¼ T2[8]). Summer.

Lythrum californicum Torr. & A.Gray – CALIFORNIA LOOSESTRIFE. Rare or overlooked perennial along ditches, often growing among tules (*Oswald 5890*, T44). Summer and fall.

Lythrum hyssopifolium L. – HYSSOP LOOSESTRIFE. Common and widespread annual or biennial in drying marshes and on the borders and beds of seasonally flooded fields (*Hills* in 1982; *Oswald 5414*, NW corner TAB[3]). Native to Europe. Spring & summer. [Includes *L. adsurgens* Greene, the perennial form of the species.]

Lythrum tribracteatum Salzm. ex Spreng. – SLENDER-FRUITED LOOSESTRIFE. Common and widespread annual forb on the drying margins of vernal pools and seasonally flooded marshes (*Oswald & Silveira 5403*, TC[2]). Native to southern Europe. Spring & summer.

MALVACEAE – MALLOW FAMILY

1 Style branches terminating in head-like or truncate stigmas.
  2 Involucel absent below the calyx; plants up to 1 m or more tall; petals yellow or orange; carpels 2–9 seeded ..... *Abutilon*
  2 Involucel of 1–several small bracts present below the calyx; low spreading plants; petals yellowish; carpels with a single seed ..... *Malvella*
1 Style branches threadlike, longitudinally stigmatic on the inner side.
  3 Involucels with 3 small bracts; flowers mostly in axils of regular stem leaves and much shorter than the leaves.
    4 Small bracts at base of flower lance-ovate to oblong ..... *Malva nicaeensis*
    4 Small bracts at base of flower linear.
      5 Petals twice the length of the calyx (at SNWR?) ..... *Malva neglecta* Wallr.
      5 Petals scarcely longer than the calyx ..... *Malva parviflora*
  3 Involucels with 1 small bract or none; flowers in racemes or spikes ..... *Sidalcea*

Abutilon theophrasti Medik. – VELVETLEAF. This common weed of surrounding agricultural areas is known at the refuge only from a single waif growing at the vehicle-fueling station at the headquarters complex (*Oswald & Silveira 5800*). Native to southern Asia. Late summer.

Malva nicaeensis All. – BULL MALLOW. Common annual to biennial weed along levees and roads (*Marshall* in 1956, without a location; *Oswald 5354*, SE corner Pool 10[2]). Native to Eurasia. Spring.

Malva parviflora L. – LITTLE MALLOW. Common and locally abundant weedy annual on and along dike roads (Oswald, SE corner T1[5]). Native to Eurasia. Spring.

Malvella leprosa (Ortega) Krapov. – ALKALI-MALLOW. Common and widespread perennial along roads, on alkaline flats, and in grassy fields (*Anderson 54*, on all alkali spots and barren areas; *Hills* in 1982, without a location; *Oswald & Ahart 5424*, along Nor-

man Rd.). Late spring & summer. [*Sida hederacea* (Douglas) Torr. & A.Gray]

Sidalcea diploscypha (Torr. & A.Gray) A.Gray – FRINGED CHECKER-MALLOW. Uncommon annual in grassy fields (*Hanson* in 1950, without a location; *Marshall* in 1955, without a location; *Wilbur* in 1961, without a location; Oswald & Silveira, P7A[4] in 1993). Spring.

MARTYNIACEAE – UNICORN-PLANT FAMILY

Proboscidea louisianica (Mill.) Tell. ssp. *louisianica* – COMMON UNICORN-PLANT. Represented by a single collection in the SNWR herbarium (*Marshall* in 1954). The plant was growing in a rice check. Summer. [*Martinia proboscidea* Gloxin]

MOLLUGINACEAE – CARPETWEED FAMILY

1 Plant pubescent with branched hairs ..... *Glinus*
1 Plant glabrous ..... *Mollugo*

Glinus lotoides L. – GLINUS. Occasional European annual along the road at the viewing platform (*Oswald 5453*, southeast corner of P1A[3]), probably introduced in the stream gravel hauled into the area. Native to Europe. Spring.

Mollugo verticillata L. – INDIAN-CHICKWEED. Uncommon matted annual in roadside gravel (*Oswald 5502*, parking area at the viewing platform at the SE corner of the Tour Route). Native to tropical America. Late spring and summer.

MORACEAE – MULBERRY FAMILY

1 Fruit an akene with a fleshy calyx, forming a succulent berry-like multiple fruit ..... *Morus*
1 Akenes within a fleshy receptacle that matures into a bag-like fruit (fig) ..... *Ficus*

Ficus carica L. – FIG. A number of small trees grow along impoundments and creeks (*Oswald 6161*, Logan Creek just upstream from the NE corner of the Tour Route). Native to the Mediterranean area. Plants vegetative.

Morus alba L. – WHITE MULBERRY. A single tree noted at the rookery in the northeast corner of Tract 37 (Oswald in 1993). Vegetative in September.

MYRTACEAE – MYRTLE FAMILY

Eucalyptus camaldulensis Dehnh. – RIVER RED GUM. Tall tree planted at the Headquarters complex (*Oswald 5961*) and at several other places on the refuge (NE corner T41). Occasional seedlings volunteer. Native to Australia. Winter and early spring.

OLEACEAE – OLIVE FAMILY

1 Leaves pinnately compound; fruit a samara ..... *Fraxinus*
1 Leaves simple; fruit a drupe ..... *Olea*

Fraxinus latifolia Benth. – OREGON ASH. Occasional small tree at scattered locations along Logan Creek (*Oswald 5363*, NE corner T2[11]; Oswald, near the viewing platform). Spring.

Olea europaea L. – OLIVE. A few scattered volunteers have been seen on the refuge (Oswald, NE corner of T31; Oswald, N edge P5). A small grove has also been planted at the headquarters complex. Native to western Asia.

ONAGRACEAE – EVENING-PRIMROSE FAMILY

1 Petals 5, yellow; plants aquatic with floating leaves or becoming terrestrial at dry-down ..... *Ludwigia*
1 Petals 4, pinkish to white; plants in dry to wet places but not aquatic.
  2 Seeds lacking a terminal tuft of hairs (sect. *Boisduvalia*).
    3 Seeds in 2 rows in each cavity of ovary (section with a razor blade to see).
      4 Capsule more or less cylindrical, lacking thick vascular ribs along the lines of dehiscence ..... *Epilobium pygmaeum*
      4 Capsule conspicuously 4-sided with thick vascular ribs along the lines of dehiscence on the corners ..... *Epilobium cleistogamum*
    3 Seeds in a single row in each cavity of ovary (at SNWR?) ..... *Epilobium densiflorum* (Lindl.) P.Hoch & Raven
  2 Seeds with a terminal tuft of hairs (sect. *Epilobium*).
    5 Plants annual; stems with exfoliating epidermis; plants of places that become dry in summer ..... *Epilobium brachycarpum*
    5 Plants perennial; epidermis not exfoliating from the stems; plants of wet places ..... *Epilobium ciliatum*

Epilobium brachycarpum C.Presl – TALL ANNUAL WILLOWHERB. Locally abundant annual in dry soil along roads and levees (*Oswald 5888*, Pole Line Rd. along E side of T16[2]). Late summer and fall. [*E. paniculatum* Nutt. ex Torr. & A.Gray, including vars. *laevicaule* (Rydb.) Munz & *tracyi* (Rydb.) Munz]

Epilobium ciliatum Raf. ssp. ***ciliatum*** – FRINGED WILLOWHERB. Occasional herbaceous perennial along streams and marshes (*Wilbur* in 1961, without a location; *Oswald 5639*, S edge of TAB[3]; Oswald, NE corner of T2[11]). The plants on the refuge are the grayish, densely pubescent variant of the subspecies. Late spring and summer. [*E. adenocaulon* Hausskn., including vars. *holosericeum* (Trel.) Munz, *occidentale* Trel., & *parishii* (Trel.) Munz]

Epilobium cleistogamum (Curran) P.Hoch & Raven – CLEISTOGAMOUS SPIKE-PRIMROSE. Represented by a collection in the SNWR herbarium (*Marshall* in 1954, without a location). Summer. [*Boisduvalia cleistogama* Curran]

Epilobium pygmaeum (Speg.) P.Hoch & Raven – SMOOTH SPIKE-PRIMROSE. Widespread and locally abundant annual on the drying beds of vernal pools and seasonally flooded marshes (*Oswald 5359*, NE corner T1[6]). Spring. [*Boisduvalia glabella* (Nutt.) Walp., including var. *campestris* (Jeps.) Jeps.]

Ludwigia peploides (Humb., Bonpl. & Kunth) Raven – FLOATING PRIMROSE-WILLOW. Common emergent perennial with floating leaves, forming dense colonies in marshes, creeks, and ditches. It often becomes stranded on mud if the water level drops, where it continues to grow and flower (*Anderson 57*, in drains, ditches, and canals; *Oswald 5633*, SW corner of T5[3]). Late spring into fall. [*Jussiaea californica* Jeps.; *J. repens* L. var. *peploides* (Humb., Bonpl., & Kunth) Griseb.]

OXALIDACEAE – WOOD-SORREL FAMILY

Oxalis corniculata L. – CREEPING WOOD-SORREL. Common weed in the lawn at the Headquarters Building

(Oswald in 1994). Probably native to the Old World. Spring into fall.

PLANTAGINACEAE – PLANTAIN FAMILY

1 Leaves sharply and deeply toothed except in depauperate individuals; spikes nodding in bud ..... *Plantago coronopus*
1 Leaves entire or minutely toothed; spikes erect in bud.
2 Leaves narrow, linear to almost threadlike; spring annuals.
3 Sepals glabrous; stamens 2 ..... *Plantago elongata*
3 Sepals long hairy; stamens 4 ..... *Plantago erecta*
2 Leaves broader; weedy perennial ..... *Plantago lanceolata*

Plantago coronopus L. – CUT-LEAVED PLANTAIN. Common and widespread annual forb on dike roads, in moist clay soils in grassy fields, near vernal pools, and on alkali scalds (*Oswald 5309*, P1[1]). Native to Europe. Spring.

Plantago elongata Pursh – ELONGATE PLANTAIN. Locally abundant on the drying beds of shallow vernal pools and in other vernally wet places (*Oswald 5310*, P1[1]). Spring. [*P. bigelovii* A.Gray, including ssp. *californica* (Greene) Bassett]

Plantago erecta E.Morris – ERECT PLANTAIN. Uncommon annual forming localized colonies in grassy fields (*Oswald 5989*, SW corner of TAB[3]). Early spring. [*P. hookeriana* Fisch. & C.A.Mey. var. *californica* (Greene) Poe]

Plantago lanceolata L. – ENGLISH PLANTAIN. Occasional perennial weed of levees and roadsides (*Oswald & Ahart 5426*, edge of Norman Rd.). Native to Europe. Spring & summer.

POLEMONIACEAE – PHLOX FAMILY

1 Flowers bicolored, the lobes pink or white, the throat and tube yellow; leaves opposite, palmately cleft ..... *Linanthus*
1 Flowers white; leaves mostly alternate, pinnately dissected ..... *Navarretia*

Linanthus bicolor (Nutt.) Greene – BICOLORED LINANTHUS. Small but attractive annual in adobe soil of grassy fields, often forming large populations (*Oswald 5988*, SW corner of TAB[3]; Oswald, grassy flat on W side of P10[2]). Spring.

Navarretia leucocephala Benth. ssp. ***leucocephala*** – WHITE-FLOWERED NAVARRETIA. Common and locally abundant along the edge of vernal pools, in seasonally flooded marshes at dry-down, and in vernally wet, grassy fields (*Anderson 110*, abundant over most of the refuge in 1938; *Oswald 5343*, NW corner T31). Spring.

POLYGONACEAE – BUCKWHEAT FAMILY

1 Calyx 5-parted (occasionally 6-parted), the segments similar.
2 Flowers in axillary fascicles
3 Plants prostrate to ascending, growing in disturbed places; perianth about 2.5 mm long, exserted from the stipule ..... *Polygonum arenastrum*
3 Plants erect, growing in marshy places; perianth about 2 mm long, more or less enclosed in the stipule ..... *Polygonum prolificum*
2 Flowers in terminal dense to open spike-like racemes or panicles.
4 Racemes 1–2, terminal on the branches; stamens or styles exserted ..... *Polygonum amphibium*
4 Racemes several to numerous, terminal and axillary; stamens and styles included in the perianth or exserted.
5 Stipules entire or torn, not fringed with cilia or bristles; outer perianth member with the midvein divided at tip into 2 short recurved veins ..... *Polygonum lapathifolium*
5 Sheathing stipules fringed with bristly cilia; outer perianth membrane not as above.
6 Calyx dotted with glands; spikes slender, arching
7 Glandular dots abundant throughout the perianth
8 Calyx white; akenes shining ..... *Polygonum punctatum*
8 Calyx greenish or with rose tips; akenes dull ..... *Polygonum hydropiper*
7 Glandular dots only on the inner perianth members ..... *Polygonum hydropiperoides*
6 Calyx not glandular-dotted.
9 Bracts of the inflorescence crowded, overlapping, the pedicels not exserted from them; racemes dense, erect; leaves sometimes with a prominent purple spot near the middle; plants in damp, disturbed soil ..... *Polygonum persicaria*
9 Bracts of inflorescence barely if at all overlapping, the pedicels exserted from them; racemes slender, loose, erect to arching; plants rooted in or near water ..... *Polygonum hydropiperoides*
1 Calyx of 6 sepals, the 3 outer herbaceous, the 3 inner larger, forming valves over the nutlets
10 Edges of valves entire ..... *Rumex crispus*
10 Edges of valves toothed ..... *Rumex dentatus*

Polygonum amphibium L. var. ***emersum*** Michx. – WATER SMARTWEED. Uncommon perennial forming colonies along the dry margins of seasonal marshes (Oswald, south leg of the Tour Route in P1A[3]). The identification is tentative since all plants have been vegetative to date (in both 1993 and 1994). [*P. coccineum* Muhl.]

Polygonum arenastrum Boreau – COMMON KNOTWEED. Common annual weed in dry soil of roads and paths, where it tends to have a prostrate growth form (*Anderson 35*, uncommon along drains and roads in 1937; *Marshall* in 1954, without a location; *Oswald 5946*, NW corner of T5[2]). Native to Europe. The closely related *P. aviculare* L., to which some of our plants have routinely been referred, is apparently not documented in California (*The Jepson Manual*, page 888). Spring and summer.

Polygonum hydropiper L. – WATER-PEPPER. Uncommon annual in shallow water and on wet mud along ditches (*Oswald 5935*, Wetlands Hiking Trail on W side T11[1]). Native to Europe. Late summer into fall.

Polygonum hydropiperoides Michx. – SWAMP SMARTWEED. Common emergent perennial in quiet water of sloughs and ponds, often forming extensive colonies (*Oswald 5569*, Logan Creek along the E side of P10[2]). Summer into fall.

Polygonum lapathifolium L. – WILLOW-WEED. Locally abundant annual in moist soil along marshes, creeks, and ditches (*Anderson 46*, common in wet places; *Hanson* in 1951, without a location; *Oswald 5464*, NE corner of T25). Late spring into fall. [Includes var. *salicifolium* Sibth.]

Polygonum persicaria L. – LADY'S-THUMB. Annual weed along the edge of marshes (*Hanson 6-51*, without a location; Oswald, Wetlands Hiking Trail). Native to Europe. Late spring into fall.

Polygonum prolificum (Small) B.L.Rob. – PROLIFIC KNOTWEED. Erect, much-branched knotweed in alkaline soil of marshy fields and ponds that dry during the summer (*Oswald 5946*, NW corner of T5[2]). Native to eastern North America. Summer into fall.

Polygonum punctatum Elliott – DOTTED SMARTWEED. Annual or sometimes perennial plant forming localized colonies in shallow water or in wet mud along marshes and streams (*Oswald 5779*, edge of Logan Creek at the NE corner of the Tour Route; *Oswald 5807*, edge of Hunters Creek in T44). Summer into fall.

Rumex crispus L. – CURLY DOCK. Abundant and widespread herbaceous perennial in marshy and grassy fields (*Marshall* in 1954, without a location; *Oswald 6212*, NW corner of TAB[3]). According to Anderson's list, this plant was already common along all of the drains, ditches, canals, lakes, and wet areas in 1937. Native to Eurasia. Spring.

Rumex dentatus L. – TOOTHED DOCK. Common and widespread annual forb on the edges of vernal pools, seasonally flooded marshes, and in other wet, marshy places (*Oswald 5303.1*, NE corner T1[6]). Native to Eurasia. Spring. [*R. dentatus* ssp. *klotzschianus* (Meisn.) Rech.f.]

PORTULACACEAE – PURSLANE FAMILY

1 Calyx fused with the lower part of the ovary, its lobes coming off the summit of the capsule ..... *Portulaca*
1 Calyx and ovary free.
  2 Flowers red, conspicuous ..... *Calandrinia*
  2 Flowers white, the petals small and inconspicuous ..... *Montia*

Calandrinia ciliata (Ruiz & Pav.) DC. – REDMAIDS. Represented by a collection in the SNWR herbarium (*Hanson* in 1950, without a specific location cited) but not relocated during this study. Although native to California, the plant tends to be weedy. Spring.

Montia fontana L. ssp. ***amporitana*** Sennen – WATER MONTIA. Locally abundant annual in vernally wet soil of uplands and depressions in grasslands (*Oswald 5969*, NW portion of TG). Early spring.

Portulaca oleracea L. – COMMON PURSLANE. Occasional to locally common weed in disturbed places (*Wilbur* in 1962, N of headquarters; Oswald, edge of Visitor's Parking at the headquarters complex; Oswald, parking area at viewing platform at SE corner of Tour Route). Native to Europe. Summer.

RANUNCULACEAE – BUTTERCUP FAMILY

1 Flowers several on a leafy stem, with large purple petals and sepals; fruit a capsule ..... *Delphinium*
1 Flowers single at the end of a leafless scape or nearly sessile, with inconspicuous white petals; fruit consisting of many akenes on an elongated receptacle.
  2 Flowers scapose ..... *Myosurus minimus*
  2 Flowers sessile or nearly so ..... *Myosurus sessilis*

Delphinium variegatum Torr. & A.Gray ssp. ***variegatum*** – ROYAL LARKSPUR. Represented by a collection from along Hwy. 99 near the entrance to the refuge (*Kridler* in 1956) but not relocated during this study. Spring.

Myosurus minimus L. – TINY MOUSETAIL. Inconspicuous and easily overlooked annual on the drying margins of vernal pools and in other vernally wet drainages and depressions (*Oswald 5335*, TG). Occasional plants have very short scapes and would key to the ssp. *apus* (Greene) G.R.Campb., a plant in List 3 of the CNPS Inventory. However, these plants always seem to grow in marginal habitats and are probably best interpreted as depauperate forms of the typical long-scaped plant. Early spring. [Includes var. *filiformis* Greene & ssp. *major* (Greene) G.R.Campb.]

Myosurus sessilis S.Watson – SESSILE MOUSETAIL. Uncommon but locally abundant annual on drying silty mud of shallow, seasonally flooded marshes and muddy-bottomed vernal pools (*Oswald 5340*, T28[2]). Spring. [*M. minimus* L. var. *sessiliflorus* (Huth) G.R.Campb.]

ROSACEAE – ROSE FAMILY

1 Leaves simple ..... *Pyracantha*
1 Leaves pinnately compound.
  2 Leaflets green below; fruit a hip ..... *Rosa*
  2 Leaflets whitish tomentose below; fruit a blackberry ..... *Rubus*

Pyracantha koidzumii (Hayata) Rehder – PYRACANTHA. Known from a single shrub growing along the levee on the south side of Pool 2 (*Silveira* in 1995). The seeds of pyracantha, a standard horticultural shrub, are dispersed by a number of fruit-eating birds, and it is not uncommon to find waifs in suitable habitat in Northern California. Native to Formosa. Spring.

Rosa multiflora Thurb. ex Murr. – RAMBLER ROSE. Introduced in many of the wildlife areas in the North Valley where it persists and sometimes volunteers. It is locally abundant in the woodlot in the northeast corner of Tract 31 (*Oswald 6097*), forming patches of impenetrable brambles and sometimes climbing into trees. Native to Japan. Spring.

Rubus discolor Weihe & Nees – HIMALAYAN BLACKBERRY. Weedy perennial forming patches of impenetrable brambles along ditches and creeks and in other low places (Oswald, west boundary of refuge along the Wetlands Hiking Trail; Oswald, along Hunters Creek). Native to Eurasia. Spring flowering, the fruits ripening during the summer. [*R. procerus* Mueller]

RUBIACEAE – MADDER FAMILY

1 Leaves 5–8 in a whorl; fruit roundish, the carpels not curved outward on the inner face ..... *Galium parisiense*
1 Leaves 4–5 in a whorl; fruit much longer than broad, the carpels curved outward on the inner face ..... *Galium murale*

Galium parisiense L. – WALL BEDSTRAW. Locally abundant annual weed in roadside gravel along Norman Rd. (*Oswald & Ahart 5417*). Native of the Mediterranean area. Spring.

Galium murale (L.) All. – TINY BEDSTRAW. Inconspicuous but locally common annual weed in roadside gravel along Norman Rd. (*Oswald & Ahart 5418*). Native to Europe. Spring.

SALICACEAE – WILLOW FAMILY

1 Buds with numerous bud scales, scales of catkins cut into narrow lobes; stamens 6–60 ..... *Populus*
1 Buds with a single bud scale; scales of catkins entire; stamens 1–10.
  2 Leaf blades entire or nearly so.
    3 Leaves glabrous beneath.
      4 Tree; leaves narrowly lanceolate, gray-green above and below; catkin scales yellow; stamens 3–9; catkins appearing with or after the leaves ..... *Salix gooddingii*
      4 Shrub or small tree; leaves dark green above, paler below; catkin scales black; stamens 2; catkins appearing before the leaves (at SNWR?) ..... *Salix lasiolepis* Benth.
    3 Leaves definitely pubescent beneath.
      5 Leaves linear to lance-linear, 0.3–0.6 cm wide, tapering at both ends, grayish-green on both surfaces; catkin scales yellow; catkins appearing with or after the leaves, the scales yellow ..... *Salix exigua*
      5 Leaves lanceolate to oblanceolate or obovate, mostly more than 1 cm wide; catkins appearing before the leaves, the scales black (at SNWR?) ..... *Salix lasiolepis* Benth.
  2 Leaf blades distinctly toothed.
    6 Leaves permanently pubescent beneath ..... *Salix exigua*

6 Leaves glabrous although sometimes lighter colored below.
7 Capsule with soft shaggy to silky hairs ..... *Salix gooddingii*
7 Capsule glabrous ..... *Salix laevigata*

Populus fremontii S.Watson – FREMONT'S COTTONWOOD. A common tree on the refuge, although not as abundant as the black willow. Scattered trees grow along Logan Creek and other waterways, and it is common in the woodlot in Tract 31 and at the rookery in Tract 37. Early spring.

Salix exigua Nutt. – NARROW-LEAVED WILLOW. Common small tree tending to form small thickets along creeks and in marshy places. It is easily recognized by its grayish leaves. Spring. [*S. exigua* var. *stenophylla* (Rydb.) C.K.Schneid.; *S. hindsiana* Benth., including vars. *leucodendroides* (Rowlee) C.R.Ball & *parishiana* (Rowlee) C.R.Ball]

Salix gooddingii C.R.Ball – GOODDING'S BLACK WILLOW. This is the most common tree on the refuge, growing along Logan Creek and other waterways. It is also common in the woodlot in Tract 31 and at the rookery in Tract 37. Spring. [*S. nigra* Marsh. var. *vallicola* Dudley; *S. gooddingii* var. *variabilis* Ball]

Salix laevigata Bebb – RED WILLOW. Occasional tree along streams, marshes, and in woodlots (Oswald, TC[1]; Oswald, Logan Creek along P6[2]; Oswald, N edge of P1B; Oswald, rookery in the NE corner of T37). Early spring. [Includes var. *araquipa* (Jeps.) C.R.Ball]

SCROPHULARIACEAE – FIGWORT FAMILY

1 Fertile stamens 5; corolla nearly regular ..... *Verbascum*
1 Fertile stamens 4 or 2; corolla more or less 2-lipped.
2 Stigmas distinct, flattened or plate-like.
3 Corolla white, not distinctly 2-lipped; plants aquatic or becoming terrestrial at drydown ..... *Bacopa*
3 Corolla yellow, nearly 2-lipped; plants terrestrial ..... *Mimulus*
2 Stigmas united, head-like or dot-like.
4 Corolla spurred or sac-like on lower side of base.
5 Corolla merely sac-like or swollen at base; plants erect ..... *Antirrhinum*
5 Corolla with a narrow spur; plants with prostrate to ascending branches ..... *Kickxia*
4 Corolla not spurred or sac-like at base.
6 Corolla elongated, the upper lip narrowly arched, forming a beak-like extension that encloses the anthers; stamens 4.
7 Upper corolla lip forming a beak, open at front; stigma expanded, capitate or lobed.
8 Stamens each with 2 anther sacs; corolla throat not indented.
9 Bracts green throughout; corolla white, turning pinkish with age ..... *Castilleja rubicundula*
9 Bracts tipped with white, yellow, rose, or purple.
10 Corolla whitish, the spike narrow ..... *Castilleja attenuata*
10 Corolla crimson or purple, the spike broad ..... *Castilleja exserta*
8 Stamens each with a single anther sac; corolla throat abruptly indented, forming a fold ..... *Triphysaria*
7 Upper corolla lip forming a galea (hood), closed at front with the opening directed downward; stigma unexpanded ..... *Cordylanthus*
6 Corolla nearly plane, the upper lip flattened, not forming a beak; stamens 2.
11 Main stem with lateral racemes below the tip ..... *Veronica anagallis-aquatica*
11 Main stem ending in a single raceme-like inflorescence ..... *Veronica peregrina*

Antirrhinum sp. – SNAPDRAGON. An unidentified snapdragon with purplish-red flowers was collected in low, alkaline ground between the railroad and Hwy. 99W at the site of Norman (*Oswald & Ahart 5427*). Late spring.

Bacopa rotundifolia (Michx.) F.Wettst. – ROUND-LEAVED WATER-HYSSOP. Locally common floating annual of marshy pools or becoming stranded on mud (*Hanson* in 1951, without a location; *Oswald 5460*, W side of Pole Rd. at the N end of T15; *Oswald 5500*, S edge of T14[3]). Native to the central United States. Spring. [*B. nobsiana* Mason]

Castilleja attenuata (Gray) T.I.Chuang & Heckard – VALLEY-TASSELS. Common annual forb in grassy fields (*Anderson 103*, a few around headquarters and along W boundary line in 1938; *Oswald 6002*, TAB[3]). Spring. [*Orthocarpus attenuatus* A.Gray]

Castilleja exserta (A.Heller) T.I.Chuang & Heckard ssp. ***exserta*** – PURPLE OWL-CLOVER. A few plants were reported west of the power line near headquarters in 1938 (*Anderson 99*). No plants were found during the 1993–94 survey. Spring.

Castilleja rubicundula (Jeps.) T.I.Chuang & Heckard ssp. ***rubicundula*** – CREAMSACS. Formerly very common on the refuge in early spring (*Anderson 72* on 28 Feb. 1938), this attractive annual is now apparently completely extirpated. [*Orthocarpus lithospermoides* Benth. var. *bicolor* (A.Heller) Jeps.]

Cordylanthus palmatus (Ferris) J.F.Macbr. – PALMATE BIRD'S-BEAK. Three transplant populations of this rare birds'-beak from a large natural population on the Delevan Refuge have been successfully established at the Sacramento Refuge in Cell 3 of Tract AB, Cell 2 of Tract C, and Cell 3 of Tract 8. CNPS Inventory List 1B. Late spring and summer.

Kickxia elatine (L.) Dumort. – SHARP-LEAVED FLUELLIN. Common along roads and in other disturbed places (*Wilbur* in 1961, road edges; *Oswald 5503*, parking area at viewing platform at SE corner of Tour Route). Native to Europe. Late spring and summer.

Mimulus guttatus Fisch. ex DC. – SEEP MONKEY-FLOWER. Common and widespread in moist soil along vernal pools and drainages and on the edges of seasonally flooded marshes (*Anderson 83*, near Farmer Waite Lake, now approximated by P1A[3]; *Oswald 5990*, W side of T24[4]). This is a highly variable species in which many taxa have been named. The plants on the refuge are relatively small-flowered annuals. Spring.

Triphysaria eriantha (Benth.) T.I.Chuang & Heckard var. ***eriantha*** – JOHNNYTUCK. Common annual forb in grassy places (*Hanson* in 1952, without a location; *Oswald 5968*, TG). Spring. [*Orthocarpus bidwelliae* A. Gray; *O. erianthus* Benth. var. *erianthus*]

Verbascum blattaria L. – MOTH MULLEIN. Herbaceous biennial that is common along the edge of the Visitor's Parking area at Refuge Headquarters (*Oswald 6157*). Anderson (collection *21*) lists this plant as rare along east boundary south of Norman Rd. in 1937. Native to Eurasia. Spring and summer.

Veronica anagallis-aquatica L. – BLUE WATER SPEEDWELL. Locally abundant herbaceous perennial in ditches, along the edge of seasonally-flooded fields, and in marshy places (*Oswald 5305*, T2[3]; Oswald, ditch along W boundary bordering the Wetlands Hiking Trail; Oswald, edge of Logan Creek). Native to Europe. Spring.

Veronica peregrina L. ssp. ***xalapensis*** (Humb., Bonpl., & Kunth) Pennell – PURSLANE SPEEDWELL. Common and widespread annual forb forming dense populations on the floor of drying vernal pools, along the edge of seasonally flooded marshes, and in other marshy places (*Oswald 5342*, T28[2]; *Oswald 6089*, N edge T16[1]). Spring.

SOLANACEAE – NIGHTSHADE FAMILY

1 Corolla rotate, its tube short.
  2 Calyx becoming large and papery and enclosing the fruit.
    3 Corolla 10–20 mm wide; fruiting calyx lobes acuminate ..... *Physalis acutifolia*
    3 Corolla 3–8 mm wide; fruiting calyx lobes acute ..... *Physalis angulata*
  2 Calyx herbaceous, not enclosing the fruit.
    4 Herbage densely scaly-stellate; flowers violet or blue ..... *Solanum elaeagnifolium*
    4 Herbage glabrous; flowers white ..... *Solanum americanum*
1 Corolla tubular, yellow ..... *Nicotiana*

Nicotiana glauca Graham – TREE TOBACCO. Erect shrub or small tree represented by a collection in the SNWR herbarium from along Hunter's Creek (*O'Neill* in 1961). This plant was not relocated during this study. Native to South America. Late summer.

Physalis acutifolia (Miers) Sandwith – SHARP-LEAVED GROUND-CHERRY. Known only from a single waif in the parking lot at the Checking Station south of Norman Rd. (*Oswald 5811*). It is most easily separated from the next species by its larger flowers (10–20 mm wide). Late summer. [*P. wrightii* A.Gray]

Physalis lanceifolia Nees – LANCE-LEAVED GROUND-CHERRY. Occasional weedy annual in localized populations on the dry bed of vernally wet pools and in disturbed places (*Wilbur* in 1961, in rice checks; *Oswald 5690*, NW corner of T11[5]). The flowers are relatively small (3–8 mm wide). Native to South America. Summer. [*P. angulata* L. var. *lanceifolia* (Nees) Waterf.]

Solanum americanum Mill. – AMERICAN BLACK NIGHTSHADE. Occasional annual to subshrub along the edge of marshes (Oswald, Wetlands Hiking Trail in T11[1]). Spring and summer. [*S. nodiflorum* Jacq.]

Solanum elaeagnifolium Cav. – WHITE HORSE-NETTLE. Uncommon weedy perennial forming localized populations on levee roads (*Wilbur* in 1961, without a specific location; *Oswald 6411*, S side of P11[3]). Native of central U.S. and northern Mexico. Summer.

TAMARICACEAE – TAMARISK FAMILY

1 Flowers 4-merous ..... *Tamarix parviflora*
1 Flowers 5-merous ..... *Tamarix ramosissima*

Tamarix parviflora DC. – SMALL-FLOWERED TAMARISK. Weedy shrub planted at several locations on the refuge (*O'Neill* in 1961, T40; *Oswald 5358*, NE side T31). Native to southeastern Europe. Early spring.

Tamarix ramosissima Ledeb. – SALT-CEDAR. An attractive shrub planted at the headquarters complex (*Oswald 6210*). It blooms later in the spring than *T. parviflora*, and the flowers are a deeper red color. Native to eastern Asia. Late spring.

URTICACEAE – NETTLE FAMILY

Urtica dioica L. ssp. ***holosericea*** (Nutt.) Thorne – STINGING NETTLE. Occasional perennial forming colonies along creeks (Oswald, Logan Creek bordering TH and P1B; Oswald, Hunters Creek in T44). Late spring and summer.

VERBENACEAE – VERVAIN FAMILY

1 Stems erect, clumped, often over 1 m tall; calyx 5-toothed; flowers in terminal spikes; nutlets 4 ..... *Verbena*
1 Stems prostrate, creeping, forming a matted groundcover; calyx 2-toothed; flowers in short, usually axillary spikes or heads; nutlets 2.
  2 Leaves including petioles 3–5 cm long; peduncles 2–7.5 cm long ..... *Phyla nodiflora* var. *nodiflora*
  2 Leaves including petioles 1–1.5 cm long; peduncles 1.5–3 cm long ..... *Phyla nodiflora* var. *rosea*

Phyla nodiflora (L.) Greene var. ***nodiflora*** – CREEPING LIPPIA. Locally abundant creeping perennial on the floor of the woodlot in the northeast corner of Tract 31 (*Oswald 6410*). Late spring and summer. [*Lippia nodiflora* (L.) Michx. var. *reptans* (Humb., Bonpl., & Kunth) Kuntze]

Phyla nodiflora (L.) Greene var. ***rosea*** (D.Don) Munz – ROSY LIPPIA. Naturalized South American perennial forming mats in lawns, along roads, and on banks of ponds (*Oswald 5571*, S edge of P10[2]). Late spring and summer. [*Lippia nodiflora* (L.) Michx. var. *rosea* (D.Don) Munz]

Verbena litoralis Humb., Bonpl., & Kunth – SHORE VERVAIN. Scattered to common tall, clumped, herbaceous perennial along creeks and ditches (*Oswald 5636*, SW corner of T5[3]; Oswald, Logan Creek; Oswald, Hunters Creek). Native to Central and South America. Late spring & summer. [*V. brasiliensis* Vell.]

VITACEAE – GRAPE FAMILY

Vitis californica Benth. – CALIFORNIA GRAPE. Uncommon woody vine climbing on trees along Logan Creek, bordering the east leg of the Tour Route. Late spring.

ZYGOPHYLLACEAE – CALTROP FAMILY

Tribulus terrestris L. – PUNCTURE-VINE. Occasional annual weed in roadside gravel and other disturbed places (*O'Neill* in 1961, S levee of P5; *Oswald & Ahart 5423*, along Norman Rd.). Late spring & summer.

MONOCOT FLOWERING PLANTS

KEY TO FAMILIES

1 Foliage of the palm type ..... *Arecaceae*
1 Foliage not of the palm type.
  2 Duckweeds, usually floating on water or stranded on mud; plants small, 10 mm or less, not differentiated into stem and leaves, with 1 or a few simple roots ..... *Lemnaceae*
  2 Plants larger, with stems, leaves, and usually well-developed roots.
    3 Perianth wanting or reduced, its parts often bristles or scales, not petal-like in color or texture.
      4 Flowers in the axils of chaffy or husk-like scales, these in spikes, spikelets or heads.
        5 Leaf-sheaths split lengthwise on the side opposite the blade; leaves usually two-ranked; stems mostly hollow and cylindrical; filaments attached near the middle of anthers ..... *Poaceae*
        5 Leaf-sheaths continuous around the stem; leaves mostly 3-ranked; stems often triangular and pithy; filaments attached to bottom of anthers ..... *Cyperaceae*
      4 Flowers not concealed in the axils of chaffy or husk-like scales.
        6 Plants terrestrial or if aquatic, leaves and flowers well above the water.

7 Inflorescence a dense elongate spike, the male flowers in upper and female flowers in lower part of spike; cattails to 2 m tall ..... *Typhaceae*
7 Inflorescence of heads, racemes, or open clusters; each flower with both stamens and pistil ..... *Juncaceae*
6 Plants aquatic, floating or below the surface, the flowers sometimes barely above the surface.
8 Flowers in spikes ..... *Potamogetonaceae*
8 Flowers axillary ..... *Zannichelliaceae*
3 Perianth well-developed, petal-like in color and texture.
9 Carpels more or less free, 1-chambered, maturing into a bunch or whorl of akenes; plants aquatic or on drying mud ..... *Alismataceae*
9 Carpels united into a 3-chambered ovary maturing into a capsule or berry .... *Liliaceae*

ALISMATACEAE – WATER-PLANTAIN FAMILY

1 Akenes arranged in a ring on the receptacle; leaves never hastate at the base.
2 Petals toothed or incised; akenes conspicuously horned, the head star-like ..... *Damasonium californicum*
2 Petals essentially entire; akenes rounded, the ring of fruits smooth ..... *Alisma*
1 Akenes densely packed over the surface of the receptacle, not forming a ring.
3 Leaves never hastate (arrow-like); fruiting heads bur-like ..... *Echinodorus*
3 Some or all of the leaves hastate.
4 Lowest node of inflorescence with only 2 flowers, these with both stamens and pistils; pedicels becoming reflexed in fruit; plants annual, lacking stolons and tubers ..... *Sagittaria montevidensis*
4 Lowest node of inflorescence with 3 flowers, these with pistils only; pedicels ascending in fruit; plants perennial from stolons and tubers.
5 Basal leaf lobes about twice as long as the terminal lobe ..... *Sagittaria longiloba*
5 Basal leaf lobes about equal to or shorter than the terminal lobe (at SNWR?) ..... *Sagittaria latifolia* Willd.

Alisma plantago-aquatica L. – WATER-PLANTAIN. Emersed plant of ditches and marshy places represented by a collection in the SNWR herbarium (*Marshall* in 1954, without a specific location) but not relocated during this study. Summer. [Includes var. *americanum* Schult. & Schult.f.; *A. triviale* Pursh]

Damasonium californicum Torr. ex Benth. – FRINGED WATER-PLANTAIN. Found in a few low spots in 1938 (*Anderson 96*) but not relocated during the 1993–94 survey. Spring. [*Machaerocarpus californicus* (Torr. ex Benth.) Small]

Echinodorus berteroi (Spreng.) Fassett – UPRIGHT BURHEAD. Widespread and often locally abundant annual in shallow water of marshes or stranded on mud at dry-down (*Anderson 14*, uncommon in Grimes Lake (now approximated by P2); *Marshall* in 1954, display pool; *Oswald 5456*, NE corner of P6[1]). Spring and summer. [*E. rostratus* (Nutt.) Engelm., *E. cordifolius* (L.) Griseb., misapplied]

Sagittaria longiloba Engelm. – LONG-LOBED ARROWHEAD. Locally common perennial in ponds, especially dry ponds that are flooded in late summer (*Oswald 6465*, N side of T16[1]; Oswald, ponds along the Wetlands Hiking Trail). Late summer and fall. [*S. greggii* J.G.Sm.]

Sagittaria montevidensis Cham. & Schltdl. ssp. ***calycina*** (Engelm.) C.Bogin – HOODED ARROWHEAD. Common and locally abundant annual in shallow water of marshes or becoming stranded on mud at dry-down (*Hanson* in 1951, without a location; *Oswald 5458*, west side of Pole Line Rd. at the north end of T15; *Oswald 6466*, north side of T16[1]). Late spring and summer. [*S. calycina* Engelm.]

ARECACEAE – PALM FAMILY
[*Palmae*]

1 Leaves palmate ..... *Washingtonia*
1 Leaves pinnate ..... *Phoenix*

Phoenix canariensis Chabaud – CANARY ISLAND DATE PALM. Occasional volunteer along streams (Oswald, NE end T2[11]). Several trees are also planted at Refuge Headquarters.

Washingtonia filifera (L.Linden) H.A.Wendl. – CALIFORNIA FAN PALM. Several seedlings were noted on the bank of the creek bordering the north side of T11[1]. This native of the Sonoran Desert is commonly planted in the North Valley.

CYPERACEAE – SEDGE FAMILY

1 Flowers all unisexual; akenes surrounded by a sac-like perigynium ..... *Carex*
1 Flowers with both stamens and pistil or some with stamens only; akenes naked.
2 Scales of spikelet 2-ranked.
3 Spikelets disarticulating above the basal pair of scales; scales persistent ..... *Cyperus strigosus*
3 Spikelets persistent on the spike; scales deciduous.
4 Axis of spikelet winged with a pair of inner transparent appendages at each node; plant annual ..... *Cyperus erythrorhizos*
4 Axis of spikelet not winged.
5 Perennial with short rhizomes ..... *Cyperus eragrostis*
5 Annual with fibrous roots ..... *Cyperus difformis*
2 Scales of spikelet overlapping spirally.
6 Involucral leaves present; style-base deciduous, tubercle none.
7 Involucral leaf solitary, often appearing as a continuation of the stem.
8 Spikelets 1–12 in a capitate cluster; stems triangular, usually less than 1 m tall ..... *Scirpus mucronatus*
8 Spikelets numerous in umbels; stem stout and cylindrical, usually more than 1 m tall, sometimes to 4 m tall ..... *Scirpus acutus*
7 Involucral leaves 2–5, usually exceeding the inflorescence.
9 Inflorescence loosely umbellate; akene 3-faced; style 3-branched; bristles nearly as long as the akene.
10 Leaves 8–16 mm wide ..... *Scirpus fluviatilis*
10 Leaves usually less than 5 mm wide ..... *Scirpus tuberosus*
9 Inflorescence head-like with 1 to several elongated rays; akene lens-shaped; style usually 2-branched; bristles 1/2 as long as the akene ..... *Scirpus maritimus*
6 Involucral leaves none; style-base persistent as a tubercle.
11 Akenes lenticular (flattened); style 2-branched (sometimes 3-branched in *Eleocharis obtusa*).
12 Annual with fibrous roots; stems slender, 10–50 cm tall ..... *Eleocharis obtusa*
12 Perennial with rhizomes; stems stout, 50–100 cm tall .. *Eleocharis macrostachya*
11 Akenes plump or triangular; style 3-branched; stems threadlike, 2–6(10) cm tall; akenes 0.9–1.3 mm long (including the tubercle) ..... *E. parvula*

Carex praegracilis W.Boott – CLUSTERED FIELD SEDGE. Rhizomatous sedge forming a localized colony between the east leg of the Tour Route and Logan Creek bordering Cell 3 of Pool 1A (Oswald). Spring.

Cyperus difformis L. – SMALL-FLOWERED UMBRELLA-SEDGE. Locally common along the margins of marshy pools (*Anderson* 2, uncommon in wet areas; Hanson in 1951; *Wilbur & O'Neill* in 1961, edge of rice check; *Oswald 5567*, edge of T15 on the west side of the Pole Line Rd.; Oswald, Wetlands Hiking Trail). Native to the Old World. Summer.

Cyperus eragrostis Lam. – TALL CYPERUS. Common herbaceous perennial in marshy places and in vernally wet depressions (*Hanson* in 1949 & *Hanson* in 1951, both without locations; *Oswald 5459*, N end of T15 along the Pole Line Rd.; Oswald, Wetlands Hiking Trail in T11[2]). Spring and summer.

Cyperus erythrorhizos Muhl. – RED-ROOTED CYPERUS. Occasional annual in wet ground along the edge of flooded marshes (*Hanson 4-51*, without a location; *Marshall* in 1954, without a location; *Oswald 5891*, E side of P12[2]; Oswald, Wetlands Hiking Trail). Summer and fall.

Cyperus strigosus L. – STRAW-COLORED CYPERUS. Locally common perennial along the edge of marshes

(*Oswald 5941*, near the beginning of the Tour Route in T11[4]). Summer and fall.

Eleocharis macrostachya Britton – PALE SPIKE-RUSH. Common and widespread perennial rush forming extensive colonies in marshes, marshy fields, and shallow ponds (*Anderson 64*, without a specific location; *Hanson 18-51*, without a location; *Oswald 5347*, T38[2]). Spring and summer. [*E. palustris* (L.) Roem. & Schult., in part]

Eleocharis obtusa (Willd.)Schult. var. ***engelmannii*** (Steud.) Gilly – ENGELMANN'S SPIKE-RUSH. Occasional annual spike-rush forming localized populations on drying mud along the margin of seasonal marshes (*Oswald 5450*, Wetlands Hiking Trail in T11[1]). Spring.

Eleocharis parvula (Roem. & Schult.) Link ex Bluff & Fingerh. – LITTLE-HEADED SPIKE-RUSH. Delicate diminutive perennial forming extensive colonies in shallow water and later on dry mud of alkaline pools (*Oswald 5333*, TG). Spring. CNPS Inventory List 4. [Includes the var. *coloradoensis* (Britton) Beetle]

Scirpus acutus Muhl. ex Bigelow var. ***occidentalis*** (S.Watson) Beetle – HARD-STEMMED TULE. Ubiquitous tall perennial sedge forming extensive colonies in marshes (*Anderson 62*, common in wet places but without a specific location; *Hanson* in 1951, without a location). Spring.

Scirpus fluviatilis (Torr.) A.Gray – RIVER BULRUSH. Uncommon perennial forming colonies on the edge of marshes (*Hanson 12-51, Hanson 15-51,* and *Marshall* in 1954, all without locations; *Oswald 5355*, E side P10). It is usually growing with *S. tuberosus*. Spring.

Scirpus maritimus L. – SALTMARSH BULRUSH. Occasional perennial forming colonies on the edge of permanent ponds and seasonally flooded marshes (*Hanson* in 1951, without a location; *Oswald 5339*, E side of T21[4]). It sometimes forms mixed colonies with *S. tuberosus*. Spring and summer. [*S. paludosus* A.Nels.; *S. maritimus* var. *paludosus* (A.Nels.) Kükenth.; *S. robustus* Pursh, misapplied]

Scirpus mucronatus L. – ROUGH-SEEDED BULRUSH. Weedy perennial of rice fields and other wet places represented by two old collections in the SNWR herbarium (*Marshall* in 1951 & *Wilbur* in 1962, both without specific locations). Native to Eurasia. Summer.

Scirpus tuberosus Desf. – TUBEROUS BULRUSH. Common and widespread perennial sedge forming small to large colonies along the margins of most of the impoundments on the refuge (*Hanson* in 1951, without a location; *Oswald 5303*, T4[3]). Native to Europe. Spring. [*S. maritimus* L. var. *tuberosus* (Desf.) Roem. & Schult.]

HYDROCHARITACEAE – WATERWEED FAMILY
[Includes *Najadaceae* of most western floras]

1 Leaf sheaths typically with ear-like appendages (at SNWR?) ..... *Najas graminea* Delile
1 Leaf sheaths truncate or rounded, without ear-like appendages ..... *Najas guadalupensis*

Najas guadalupensis (Spreng.) Magnus – COMMON WATER-NYMPH. Sometimes locally abundant submersed aquatic in shallow water of ponds (*Marshall* in 1954, without a specific location; *Oswald 6464*, S side of T11[1] beside Wetlands Hiking Trail). Summer into fall.

JUNCACEAE – RUSH FAMILY

1 Inflorescence seemingly lateral, the lowest bract cylindrical and exactly like a continuation of the stem.
2 Anthers shorter than to equal to length of filament; plants densely tufted .. *Juncus effusus*
2 Anthers much longer than filaments; plants forming spreading colonies from creeping rootstocks ..... *Juncus balticus*
1 Inflorescence seemingly terminal, the lowest bract not like a continuation of the stem.
3 Flowers inserted singly on the inflorescence ..... *Juncus bufonius* var. *bufonius*
3 Flowers borne in small head-like clusters on the branches of the inflorescence ..... *Juncus bufonius* var. *congestus*

Juncus balticus Willd. – BALTIC RUSH. Rhizomatous perennial forming extensive colonies in fields and along roads and creeks (*Oswald 6104*, SW corner of T39; Oswald, along Hunters Creek; Oswald, S edge of T12[1]). Spring.

Juncus bufonius L. var. ***bufonius*** - COMMON TOAD RUSH. Locally common in vernally wet fields and along the edge of marshes (*Oswald 5566*, T15). Spring.

Juncus bufonius var. ***congestus*** Wahlenb. – CONGESTED TOAD RUSH. Locally abundant annual collected in a summer-dry marsh (*Oswald 5346*, T38[2]) and probably more widespread. Spring. [*J. bufonius* var. *congdonii* (S.Watson) J.T.Howell]

Juncus effusus L. var. ***pacificus*** Fernald & Wiegand – PACIFIC RUSH. Densely tufted perennial known only from a single colony growing in a weedy field bordering a tule marsh near the south end of Cell 2 of Tract C (*Oswald 5948*). Summer.

LEMNACEAE – DUCKWEED FAMILY

1 Frond with 2–several rootlets ..... *Spirodela*
1 Frond with 1 rootlet.
2 Frond 1-nerved ..... *Lemna minuta*
2 Frond 3–5-nerved.
3 Fronds with prominent nodal and apical papules ..... *Lemna aequinoctialis*
3 Fronds with a row of several papules along midline, the nodal and apical not distinctly prominent, or papules obscure or lacking.
4 Fronds often orbicular, swollen on under side with enlarged air spaces, the upper surface often yellowish-green mottled with reddish pigment ..... *Lemna gibba*
4 Fronds flattened on under side, the upper surface often shiny green.
5 Fronds often with a row of papules along midline, the under side often suffused with reddish pigment ..... *Lemna turionifera*
5 Fronds smooth or with an obscure row of papules on upper surface, not developing reddish pigment below ..... *Lemna minor*

Lemna aequinoctialis Welw. – SUMMER DUCKWEED. Found on one occasion in a ditch at the southeast corner of Cell 5 of Tract 1 (*Oswald 5958*) where it formed a dense colony. This duckweed can be identified by the prominent nodal and apical papules, which are visible in the field with the aid of a 10X lens. Collected in late October, the plants vegetative. [*L. perpusilla* Torr., misapplied]

Lemna gibba L. – INFLATED DUCKWEED. Uncommon but often locally abundant when found floating on the surface of ponds (*Oswald 5308*, P1[1]). The fronds are dull green and frequently streaked with red. The lower surface is usually noticeably inflated. Most months (plants vegetative).

Lemna minor L. – COMMON DUCKWEED. Locally common in shallow water among tules, especially in the fall of the year (Oswald, near the beginning of the Tour Route, T11[4]). This species is very similar to *L. turionifera* and, in the absence of anthocyanin pigment and turions, the two species probably cannot be reliably separated. All plants vegetative.

Lemna minuta Humb., Bonpl. & Kunth – LEAST DUCKWEED. Locally abundant on the margins of flooded ponds and in ditches (*Oswald 5953*, SW corner TD[5]; Oswald, between Norman Rd. and T23). All collections vegetative. [*L. minima* Humb. ex Phil.; *L. minuscula* Herter].

Lemna turionifera Landolt – TURION DUCKWEED. Occasional but usually abundant when found in quiet water of ditches and along the edge of marshes (*Oswald 5570*, S edge of P10[2]; Oswald, between Norman Rd. and T23). It is most reliably separated from *L. minor* by the development of reddish anthocyanin pigments on the lower surface. The plants also form starch-filled overwintering bodies (turions) during late fall and winter. All collections vegetative.

Spirodela polyrhiza (L.) Schleid. – COMMON DUCKMEAT. Apparently uncommon, at least during this survey in 1993-94. A few plants were found mixed in with a dense population of *Lemna minuta* on the edge of a recently flooded field (*Oswald 5952*, SW corner TD[5]). Plants vegetative.

LILIACEAE – LILY FAMILY

1 Flowers in scape-like umbel.
  2 Perianth segments separate or nearly so.
    3 Plants with a strong onion-like odor and taste ..... *Allium*
    3 Plants without an onion-like odor and taste ..... *Muilla*
  2 Perianth segments united into a definite basal tube; plants without an onion-like odor and taste.
    4 Anthers 6 ..... *Triteleia*
    4 Anthers 3 ..... *Brodiaea*
1 Flowers not in scape-like umbel.
  5 Green "foliage" consisting of needle-like branchlets borne in the axils of scale-like leaves; plant from rhizome with fleshy tubers ..... *Asparagus*
  5 Foliage consisting of true leaves; plant from a bulb or corm.
    6 Flowers white; styles 3, distinct to the base ..... *Zigadenus*
    6 Flowers yellow; style 1, more or less lobed at the summit ..... *Calochortus*

Allium amplectens Torr. – CLASPING ONION. Uncommon herbaceous perennial occurring in localized populations in adobe soil of grassy fields (*Anderson 91*, uncommon in 1938; *Oswald 6046*, SW corner of TAB[3]; *Oswald 6099*, NW corner of P7A[4]; Silveira, N edge T18). Spring.

Asparagus officinalis L. – GARDEN ASPARAGUS. A single waif noted along the Wetlands Hiking Trail west of the Headquarters Building (T13[2]). Vegetative.

Brodiaea coronaria (Salisb.) Engl. var. ***coronaria*** – HARVEST BRODIAEA. Perennial from a fleshy bulb, typically growing in adobe clay soils. At the refuge, it is known only from scattered colonies in upland grassland in the northwest corner of Tract G (*Oswald 5322*). Spring.

Calochortus luteus Douglas ex Lindl. – YELLOW MARIPOSA-LILY. Scattered perennial from a deep-seated bulb in grassy upland fields (*Anderson 108*, sparse E of Logan Creek and a few other spots in 1938; Oswald in 1993, TG). Spring.

Muilla maritima (Torr.) S.Watson – MUILLA. Bulbous perennial in adobe soil of grassy fields, often growing with *Zigadenus fremontii* (*Oswald 6039*, TG; *Oswald 6047*, SW corner of TAB[3]; Oswald in 1994, W side of P7A[4]). Spring.

Triteleia laxa Benth. – ITHURIEL'S-SPEAR. Perennial from a deep-seated bulb reported as abundant and found almost everywhere on the refuge in 1938 (*Anderson 94*). Today it is known only from a localized population in adobe soil of a grassy flat in northwest corner of Cell 4, Pool 7A (*Oswald 6100*). Spring. [*Brodiaea laxa* (Benth.) S.Watson]

Zigadenus fremontii (Torr.) Torr. ex S.Watson – FREMONT'S DEATH-CAMAS. Apparently common in 1938 over most of the refuge where the soil was not too wet (*Anderson 87*). Today only scattered colonies grow in adobe clay of low spots in grassy fields and on the borders of marshy places (*Marshall* in 1954, entrance at RR; *Oswald 5967*, TG; Oswald, SW corner of TAB[3]). Early spring. [Includes vars. *inezianus* Jeps., *minor* (Hook. & Arn.) Jeps., & *salsus* Jeps.]

POACEAE – GRASS FAMILY
[*Gramineae*]

1 Spikelets with the glumes persistent, the spikelet axis jointed above them, 1 to many-flowered; upper lemmas frequently empty; spikelet axis often prolonged beyond the upper lemma.
  2 Spikelets sessile or nearly so.
    3 Spikes usually more than one; spikelets on one side of the axis, forming 1-sided spikes (Tribe *Chlorideae*).
      4 Panicle of slender spikes arranged racemosely on an elongate axis.
        5 Lemmas awned; spikelets 7–12 mm long ..... *Leptochloa fascicularis*
        5 Lemmas awnless; spikelets 5–7 mm long ..... *Leptochloa uninervia*
      4 Panicle of slender spikes in an umbel-like arrangement ..... *Cynodon*
    3 Spike terminal, single; spikelets alternating on opposite sides of the axis (Tribe *Hordeae*).
      6 Spikelets solitary at each node of the spike axis.
        7 Spikelets 1-flowered, sunken in hollows in the spike axis.
          8 First glume absent; spike straight ..... *Hainardia*
          8 First glume present; spike curved ..... *Parapholis*
        7 Spikelets 2 to several-flowered, not sunken into the spike axis.
          9 Spikelets placed edgewise to the spike axis ..... *Lolium*
          9 Spikelets placed flatwise to the spike axis ..... *Elytrigia*
      6 Spikelets 2–3 at each node.
        10 Spikelets 3 at each node of the spike axis, the lateral pair pedicelled, usually reduced to awns.
          11 Plants perennial ..... *Hordeum jubatum*
          11 Plants annual.
            12 Glumes of central spikelet and the inner ones of the lateral spikelets with ciliate margins.
              13 Anthers of central and lateral florets about equal in length ..... *Hordeum murinum* ssp. *leporinum*
              13 Anthers of lateral florets more than 2 times longer than anthers of central floret ..... *Hordeum murinum* ssp. *glaucum*
            12 Glumes not ciliate.
              14 Spike ovate to ovate-oblong, usually less than 5 cm long; awns and glumes strongly spreading at maturity ..... *Hordeum marinum*
              14 Spike linear-oblong, usually over 5 cm long; awns and glumes not spreading at maturity ..... *Hordeum depressum*
        10 Spikelets 2 at each node, all alike (at SNWR?) ..... *Taeniatherum caput-medusae* (L.) Nevski
2 Spikelets usually upon distinct pedicels, borne in an open or spike-like raceme or panicle.
  15 Spikelets 1-flowered.
    16 Spikelets with 2 sterile or male lemmas below the fertile lemma; palea 1-nerved (Tribe *Phalarideae*).
      17 Spikelets in groups of 7, 1 fertile surrounded by 6 sterile, the group falling entire ..... *Phalaris paradoxa*
      17 Spikelets all alike, not falling entire in groups.
        18 Plants perennial ..... *Phalaris aquatica*
        18 Plants annual.
          19 Glumes broadly winged; panicle ovate to short-oblong ..... *Phalaris minor*
          19 Glumes wingless; panicles linear or oblong ..... *Phalaris lemmonii*

16 Spikelets without sterile lemmas below the fertile lemma; palea 2-nerved (Tribe *Agrostideae*).
20 Glumes usually longer than the lemma; panicle diffuse, exserted from the sheath ..... *Agrostis*
20 Panicle short, compact, usually partly enclosed in the sheath.
21 Sheath margins hairy ..... *Crypsis vaginiflora*
21 Sheath margins glabrous ..... *Crypsis schoenoides*
15 Spikelets 2 to many-flowered.
22 Lemma usually shorter than the empty glumes; the awn dorsal and usually bent (Tribe *Aveneae*).
23 Spikelets nodding; glumes 2–3.5 cm long.
24 Teeth of lemmas awned or bristly; pedicels capillary ..... *Avena barbata*
24 Teeth of lemmas acute, not bristly; pedicels stoutish ..... *Avena fatua*
23 Spikelets not nodding; glumes less than 1 cm long.
25 Axis of spikelet prolonged behind the upper floret; lemmas squared and irregularly toothed at the summit ..... *Deschampsia*
25 Axis of spikelet not prolonged; lemmas tapering into 2 slender teeth (at SNWR?) ..... *Aira caryophyllea* L.
22 Lemma usually longer than the empty glumes; the awn terminal and straight or none (Tribe *Festuceae*)
26 Lemmas divided at the top into 5–11 teeth or awns.
27 Lemmas with 7–11 very short teeth ..... *Tuctoria*
27 Lemmas with 5 rather long, pointed teeth or awns ..... *Orcuttia*
26 Lemmas awnless or 1 to 3-awned.
28 Plants stout reeds to several meters high.
29 Leaves crowded at the base of the stems ..... *Cortaderia*
29 Leaves distributed along the stems ..... *Arundo*
28 Plants usually less than 1 meter high, not reed-like.
30 Sexes separate; perennials in moist to wet places ..... *Distichlis*
30 Sexes not separate.
31 Lemmas fan-shaped; glumes absent; inflorescence dense and cylindric (at SNWR?) ..... COLUSA GRASS, CNPS LIST 1B, *Neostapfia colusana* (Davy) Davy
31 Lemmas not fan-shaped; glumes present; inflorescence not cylindric.
32 Lemmas as broad as long; florets closely overlapping, resembling a snake rattle ..... *Briza*
32 Lemmas longer than broad; florets not resembling a snake rattle.
33 Nerves of lemma parallel, not converging at lemma tip ..... *Puccinellia*
33 Nerves of lemma converging toward the summit.
34 Lemmas awned or awn-tipped from a minutely cleft apex.
35 Spikelets strongly flattened; lemmas compressed-keeled and with terminal teeth nor more than 0.5 mm long (at SNWR) ..... *Bromus carinatus* Hook. & Arn. var. *carinatus*
35 Spikelets cylindrical or only slightly flattened, the lemmas not compressed-keeled and with terminal teeth mostly 0.6–5 mm long.
36 Lemmas broad, rounded apically, the teeth mostly less than 1 mm long; first glume 3–5 nerved ..... *Bromus hordeaceus*
36 Lemmas narrow, elongate, tapering at the tip, the teeth 2–5 mm long; 1st glume 1-nerved.
37 Panicle erect, contracted, purplish; awns 1–2 cm long.
38 Stem pubescent below the dense panicle ..... *Bromus madritensis* ssp. *rubens*
38 Stem glabrous below the slightly open panicle ..... *Bromus madritensis* ssp. *madritensis*
37 Panicle open, with spreading or drooping branches ..... *Bromus diandrus*
34 Lemmas awnless or awned from the tip.
39 Spikelets awned.
40 Plants annual, less than 5 dm tall.
41 Lemmas not ciliate.
42 Lower glume more than half as long as the second (at SNWR?) ..... *Vulpia bromoides* (L.) S.F.Gray
42 Lower glume less than half as long as the second ..... *Vulpia myuros* var. *myuros*
41 Lemmas conspicuously long-ciliate at the apex ..... *Vulpia myuros* var. *hirsuta*
40 Plants perennial, usually over 8 dm tall ..... *Festuca*
39 Spikelets awnless ..... *Poa*
1 Spikelets falling from the pedicels entire, jointed below the glumes, naked or enclosed in bristles or bur-like involucels, 1-flowered or, if 2-flowered, the lower flower male; no lemmas empty; spikelet axis not extending beyond the upper lemma.
43 Spikelets strongly flattened laterally; glumes reduced or wanting (Tribe *Oryzeae*).
44 Perennial with slender elongate rhizomes; glumes absent ..... *Leersia*
44 Cultivated annual without rhizomes; glumes small but present ..... *Oryza*
43 Spikelets mostly not strongly flattened; glumes, or at least 1, usually developed.
45 Lemma and palea leathery or papery, very different in color and appearance from the glumes (Tribe *Paniceae*).
46 Spikelets subtended by bristles.
47 Cespitose perennial from short, stout rhizomes ..... *Setaria parviflora*
47 Annual without rhizomes ..... *Setaria pumila*
46 Spikelets not subtended by bristles.
48 Glumes awned or abruptly pointed; apex of palea not enclosed by lemma.
49 Sterile and fertile lemmas long-awned or awn-tipped; primary branches of inflorescence 3–7 cm long; leaves never purple-banded *Echinochloa crus-galli*
49 Sterile and fertile lemmas scarcely pointed; primary branches of inflorescence 1–3 cm long; leaves sometimes purple-banded ..... *Echinochloa colona*
48 Glumes awnless; apex of palea usually enclosed by the lemma.
50 Inflorescence of 1-sided, spike-like racemes.
51 Racemes slender ..... *Digitaria*
51 Racemes stout.
52 Racemes a pair at the summit of the stem ..... *Paspalum distichum*
52 Racemes several to many, forming a panicle ..... *Paspalum dilatatum*
50 Inflorescence diffuse, not of 1-sided, spike-like racemes ..... *Panicum*
45 Lemma and palea thin, transparent, much more delicate in texture than the glumes.
53 Spikelets in pairs (Tribe *Andropogoneae*) ..... *Sorghum*
53 Spikelets not in pairs (Tribe *Agrostideae*).
54 Glumes long-awned.
55 Lemma awnless; glumes lobed, the lobes longer than 0.6 mm and ciliate-fringed ..... *Polypogon maritimus*
55 Lemma awned; glume lobes either absent or less than 0.6 mm long and not ciliate-fringed ..... *Polypogon monspeliensis*
54 Glumes awnless.
56 Mature panicle well-exserted ..... *Alopecurus*
56 Mature panicle usually at least partially enclosed in the enlarged leaf sheaths.
57 Sheath margins hairy ..... *Crypsis vaginiflora*
57 Sheath margins glabrous ..... *Crypsis schoenoides*

Agrostis avenacea J.G.Gmel. – PACIFIC BENT. Common and widespread weedy grass along the edge of marshes and in vernally wet, grassy fields (*Marshall* in 1954, without a location; *Oswald 5360*, SW side T2[11]). Late spring.

Alopecurus saccatus Vasey – PACIFIC MEADOW-FOXTAIL. Common annual in vernal pools (*Oswald 5326*, TG). Spring.

Arundo donax L. – GIANT-REED. Tall, tufted, bamboo-like perennial along streams, ditches, and marshy fields (*Oswald 5956*, Wetlands Hiking Trail). Native to Europe. Fall.

Avena barbata Brot. – BARBED OAT. Common and widespread annual along roads and in grassy fields. Native to southern Europe. Spring.

Avena fatua L. – WILD OAT. Annual grass along roads and in grassy fields (*Anderson 30*, common along large drains and on high ground; *Hanson* in 1950, without a location; *Marshall* in 1954, without a location). It is less common than the previous oat, from which it can be separated by the larger spikelets borne on thicker pedicels. The lemmas are pointed but lack the paired bristles found in *A. barbata*. Native to Europe. Spring.

Briza minor L. – LESSER QUAKING-GRASS. Uncommon or perhaps only inconspicuous annual in grassy fields (*Oswald 5348*, NE corner T41). Native to southern and western Europe. Spring.

Bromus diandrus Roth – RIPGUT BROME. Coarse annual grass along roads, on dikes, in weedy fields, and in other disturbed places (*Hanson* in 1950, without a location; *Marshall* in 1954, without a location). Native to Europe. Spring. [*Bromus rigidus* Roth]

Bromus hordeaceus L. – SOFT CHESS. Common and widespread grass in upland fields and along roads and ditches (*Anderson 34*, on rice checks throughout the refuge; *Hanson* in 1950, without a location; *Oswald 6044*, T5[1]). Native to Eurasia. Spring. [*B. mollis* L., *B. racemosus* L., & *B. scoparius* L., misapplied]

Bromus madritensis L. ssp. *rubens* (L.) Husn. – RED BROME. Common annual forming localized patches in grassy fields and on the margins of vernal pools (*Anderson 19*, Logan Creek "NE of hog ranch buildings;" *Marshall* in 1954, Pole Line Rd. between headquarters and Norman Rd.; *Oswald 5300*, NE corner T1[6]). Native to Europe. Spring. [*B. rubens* L.]

Cortaderia selloana (Schult.) Asch. & Graebn. – URUGUAYAN PAMPASGRASS. Tall tufted perennial planted near the woodlot in Tract 31. A single clump, which would appear to be of natural origin, is located in T4[1]. Native to eastern South America. Fall.

Crypsis schoenoides (L.) Lam. – SWAMP PRICKLEGRASS or SWAMP-TIMOTHY. Common and locally abundant European grass on the dry beds of marshes (*Oswald 5409*, TAB[3]) and in roadside gravel. Late spring and summer. [*Heleochloa schoenoides* (L.) Host]

Crypsis vaginiflora (Forssk.) Opiz – AFRICAN PRICKLEGRASS. The first North American collection of this Eurasian annual was made by Burtt-Davy at Norman in 1898. In 1937, Anderson lists it as being sparse in the southeast corner of section 25 (*Anderson 28*). Today it is a widespread and locally abundant weed on the dry beds of seasonally flooded marshes and in summer-dry ponds. Two forms occur on the refuge, sometimes growing side by side. One is very compact, forming small, round, brittle tufts less than 1 dm in diameter (*Oswald 5497*, NE¼ T18); the other has elongated internodes and forms loose spreading plants 2–3 dm in diameter. John R. Reeder of the University of Arizona has kindly examined a specimen of the latter type (*Oswald 5634*, SW corner of T5[3]) and reports that it is within the range of variation for *C. vaginiflora*. Late spring and summer. [*C. aculeata* (L.) Aiton, misapplied; *C. niliaca* Fig.]

Cynodon dactylon (L.) Pers. – BERMUDA-GRASS. Reported as uncommon near headquarters and in section 15 in 1937 (*Anderson 45*). Today it is a common perennial forming dense matted colonies in dry marshes and along creeks, ditches, and roads (*Oswald & Ahart 5419*, edge of Norman Rd.; Oswald, P1A[3]). Native to Africa. Late spring and summer.

Deschampsia danthonioides (Trin.) Munro ex Benth. – ANNUAL HAIRGRASS. Widespread and locally abundant annual on the margins and drying beds of shallow vernal pools and drainages (*Marshall* in 1954, without a location). Spring.

Digitaria sanguinalis (L.) Scop. – HAIRY CRABGRASS. Weed in roadside gravel, lawns, and other disturbed places, relatively uncommon at the refuge (*O'Neill* in 1961, without a location; *Oswald & Ahart 5420*, along Norman Rd; Oswald, Visitor's Parking Lot at the headquarters complex). Late spring into fall.

Distichlis spicata (L.) Greene – SALTGRASS. Widespread and locally abundant perennial in low, grassy fields and along marshes, especially in more alkaline places (*Anderson 15*, over most of the refuge; *Hanson* in 1951, without a location; *Oswald & Ahart 5425*, ditch along Norman Rd.). Spring. [Includes vars. *divaricata* Beetle, *nana* Beetle, *stolonifera* Beetle & *stricta* (Torr.) Beetle]

Echinochloa colona (L.) Link – JUNGLE-RICE. Reported as an uncommon grass in wet areas in 1937 (*Anderson 70*). It was not relocated during the 1993–94 survey. Native to Eurasia. Summer and fall.

Echinochloa crus-galli (L.) P.Beauv. – WATERGRASS or MILLET. Common along the edge of marshes and in flooded fields, where it is managed for waterfowl (*Anderson 42*, common along all wet places; *Hanson* in 1951, without a location; *Oswald 5637*, NW corner of P1[1]). Native to Eurasia and Africa. Summer.

Elytrigia pontica (Podp.) Holub ssp. *pontica* – TALL WHEATGRASS. Common tall bunchgrass along roads and in grassy fields (*Oswald 5696*, along Norman Rd.). It has been seeded in several of the upland tracts in the south part of the refuge. Native to Eurasia. Summer. [*Agropyron elongatum* (Host) P.Beauv., in part]

Festuca arundinacea Schreb. – TALL FESCUE. Occasional tufted perennial along ditches and creeks (Oswald, Wetlands Hiking Trail in T11[3]; Oswald, along Logan Creek bordering P1A[3]). Native to Europe. Spring.

Hainardia cylindrica (Willd.) Greuter – BARBGRASS. Uncommon but locally abundant European annual in grassy fields (*Oswald 5411*, N edge of TAB[3]; *Oswald & Ahart 5415*, NE corner of TG). It is superficially similar to sicklegrass (*Parapholis incurva*), from which it differs in having a straight rather than curved inflorescence and spikelets with single rather than paired glumes. It is not recorded from the northern Sacramento Valley in *The Jepson Manual*. [*Monerma cylindrica* (Willd.) Coss. & Durand]

Hordeum depressum (Scribn. & J.G.Sm.) Rydb. – DWARF BARLEY. Common and widespread annual in vernally wet, alkaline soils, often on the borders of vernal pools (*Hanson* in 1950, without a location; *Oswald 5299*, NE corner T1[6]). Spring.

Hordeum jubatum L. – FOXTAIL BARLEY. Widespread and attractive grass in roadside ditches, on the edge of marshes, and along shallow drainages in grassy upland fields (*Anderson 13*, W of headquarters area; *Hanson* in 1950, without a location; *Marshall* in 1954, without a location; *Oswald 5317*, T17). Spring, sometimes heading out again in the fall.

Hordeum marinum Huds. ssp. *gussoneanum* (Parl.) Thell. – MEDITERRANEAN BARLEY. Common annual along roads, along dry edges of vernal pools, in fields, and in waste places (*Anderson 37*, found on a few of the rice checks in 1937; *Oswald 5301*, NE corner T1[6]). Native to Europe. Spring. [*H. hystrix* Roth; *H. geniculatum* All.]

Hordeum murinum L. ssp. *glaucum* (Steud.) Tzvelev – GLAUCOUS BARLEY. Uncommon annual represented by a collection in the SNWR herbarium, without a specific location (*Marshall* in 1954, det. H.L. Mason). Spring. [*H. glaucum* Steud.; *H. stebbinsii* Covas]

Hordeum murinum L. ssp. *leporinum* (Link) Arcang. – HARE BARLEY. Coarse annual on levees, along roads, and in other weedy places (*Oswald 5966*, Parking Area D in NE corner P7). Native to Europe. Spring. [*H. leporinum* Link]

Leersia oryzoides (L.) Sw. – RICE CUTGRASS. Common in wet soil or shallow water on the margins of marshes and streams, usually forming spreading colonies (*Marshall* in 1954, without a location; *Oswald 5935*, W edge of T11[3]). Summer.

Leptochloa fascicularis (Lam.) A.Gray – BEARDED SPRANGLETOP. Common annual on the dry beds of marshes (*Hanson 17-51*, without a location; *Oswald 5499*, NE corner of T18). Late spring and summer. [*Diplachne fascicularis* (Lam.) P.Beauv.]

Leptochloa uninervia (C.Presl) Hitchc. & Chase – MEXICAN SPRANGLETOP. Common grass in drying marshes (*Oswald 5407*, TAB[3]). Although listed as an annual, at least some of the plants on the refuge have a distinctly perennial aspect. Late spring. [*Diplachne uninervia* (C.Presl) Parodi]

Lolium multiflorum Lam. – ANNUAL RYEGRASS. Common and widespread annual grass along roads, in both marshy and upland fields, and in waste places (*Marshall*, without any data). Native to Europe. Spring.

Orcuttia pilosa Hoover – HAIRY ORCUTTGRASS. Rediscovered at the refuge by Joseph Silveira in 1993, this rare annual grows on the dry beds of vernal pools in populations varying from less than 50 plants to more than a thousand individuals (*Silveira & Oswald in 1993*, P1[1]; *Silveira & Oswald in 1993*, TC[2]; *Oswald 5403*, TAB[3]; *Silveira & Oswald in 1993*, TAB[3]; *Silveira & Oswald in 1993*, T18). Anderson collected an Orcuttgrass, which he identified as *O. californica*, on the damp bed of Farmer Waite Lake (now approximated by Cell 3 of Pool 1A) in 1937. Since *O. pilosa* was not separated from *O. californica* until 1941, *O. californica* would have been the logical choice available to him in Jepson's *Manual of the Flowering Plants of California* (1925). Since *O. californica* as now defined is restricted to southern California, Anderson's grass can reliably be referred to *O. pilosa*. CNPS Inventory List 1B. Late spring.

Oryza sativa L. – CULTIVATED RICE. At one time grown on the refuge and represented by an old collection in the SNWR herbarium (*Hanson* in 1951). Summer.

Panicum capillare L. – WITCHGRASS. Annual grass found in the parking area at the viewing platform at the south-east corner of the Tour Route (*Oswald 5693*). Summer.

Parapholis incurva (L.) C.E.Hubb. – SICKLEGRASS. Locally abundant European annual on the edges of drying alkaline pools and in vernally wet grassy fields (*Oswald 5313*, P1[1]). It is superficially similar to *Hainardia cylindrica*, from which it differs in having a curved inflorescence and spikelets with paired glumes. It is recorded only from salt marshes along the coast in *The Jepson Manual*, page 1278. Spring. [*Pholiurus incurvus* (L.) Schinz & Thell.]

Paspalum dilatatum Poir. – DALLISGRASS. Common perennial along marshes and in other wet places (*Anderson 22*, in drains, canals, ditches, and streams; Oswald, Wetlands Hiking Trail). Native to South America. Spring & summer.

Paspalum distichum L. – KNOTGRASS. Common and locally abundant perennial in shallow water or later on the dry margins of marshes (Oswald, P1A[3]). Late spring and summer.

Phalaris aquatica L. – HARDING-GRASS or PERLA-GRASS. Tufted perennial scattered along roads and sometimes planted in fields (Oswald, NE side of T31). Native to Mediterranean Europe. Spring. [*P. stenoptera* Hack.; *P. tuberosa* L. var. *stenoptera* (Hack.) Hitchc.]

Phalaris lemmonii Vasey – LEMMON'S CANARY-GRASS. Uncommon annual in shallow vernal pools in upland grassy fields (*Oswald 5332*, TG). Spring.

Phalaris minor Retz. – LESSER CANARY-GRASS. Occasional weedy annual along canals, creeks, and levees (*Oswald 6159*, NW corner T16[1]). Native to the Mediterranean area. Spring.

Phalaris paradoxa L. –MEDITERRANEAN CANARY-GRASS. Occasional weedy annual in grassy fields and along roads (*Marshall* in 1954, without a location; *Oswald 5352*, NE corner T41). Native to Mediterranean Europe. Spring.

Poa annua L. – ANNUAL BLUEGRASS. Locally common annual on levee roads and in parking lots, lawns, and other disturbed places (*Oswald 5963*, levee road on N side P7). The plants are often grazed by waterfowl. Native to Europe. Spring.

Polypogon maritimus Willd. – MEDITERRANEAN BEARDGRASS. Locally common annual in drying marshes and vernal pools (*Hills* in 1982, without a location; *Oswald 5345*, T38[2]). Native to Mediterranean Europe and Africa. Spring.

Polypogon monspeliensis (L.) Desf. – ANNUAL BEARDGRASS. Locally abundant annual along the edges of vernal pools, in vernally wet drainages, and in ditches (*Anderson 18*, not common along Logan Creek and drains; *Hanson* in 1950, without a location). Native to southern and western Europe. Spring.

Puccinellia simplex Scribn. – LESSER ALKALI-GRASS. Locally abundant annual on the margins of drying alkaline pools and scalds (*Oswald 5328*, TG). Spring.

Setaria parviflora (Poir.) Kerguélen – PERENNIAL BRISTLEGRASS. Uncommon tufted perennial in roadside ditches along Norman Rd. (*Oswald & Ahart 5416*). Late Spring. [*S. geniculata* (Lam.) P.Beauv., misapplied; *S. gracilis* Kunth]

Setaria pumila (Poir.) Roem. & Schult. – YELLOW BRISTLEGRASS. Annual grass represented by a collection

in the SNWR herbarium (*O'Neill* in 1961, Norman Rd. along West Canal seeps). Summer. [*S. glauca* (L.) P. Beauv.; *S. lutescens* (Weigel) F.T.Hubb.; *Chaetochloa lutescens* (Weigel) Stuntz]

Sorghum halepense (L.) Pers. – JOHNSONGRASS. Common perennial from stout rhizomes in moist to dry places along roads and creeks. Native to the Mediterranean. Late spring and summer.

Tuctoria greenei (Vasey) Reeder – GREENE'S TUCTORIA. A rare annual grass discovered by Joseph Silveira in 1994 (*Silveira s.n.*). About 55 plants were found on the dry bed of a vernal pool in Cell 1 of Pool 1. The related *Orcuttia pilosa* grows in the same pool. CNPS Inventory List 1B. Late spring. [*Orcuttia greenei* Vasey]

Vulpia myuros (L.) C.C.Gmel. var. *hirsuta* Hack. – FOXTAIL FESCUE. Common and locally abundant spring annual in fields, margins of vernal pools, and other grassy places (*Oswald 6004*, TAB[3]). Native to Europe. Spring. [*Festuca megalura* Hack.]

Vulpia myuros (L.) C.C.Gmel. var. *myuros* – RATTAIL FESCUE. Common and locally abundant spring annual in fields, margins of vernal pools, and other grassy places (*Marshall* in 1954, without a location; *Oswald 5302*, NE corner T1[6]). Native to Europe. Spring. [*Festuca myuros* L.]

POTAMOGETONACEAE – PONDWEED FAMILY

1 Leaves all submerged and similar.
  2 Leaves broad, finely serrate, the margins strongly undulate ..... *Potamogeton crispus*
  2 Leaves linear, the margins not serrate nor undulate.
    3 Stipules fused with base of leaf to form a sheath, the leaf blades thus not attached directly at the nodes ..... *Potamogeton pectinatus*
    3 Stipules free from the leaves or nearly so ..... *Potamogeton foliosus*
1 Leaves of 2 kinds, floating (broad and leathery) and submerged (narrow or, if broad, thin) ..... *Potamogeton nodosus*

Potamogeton crispus L. – CRISPATE-LEAVED PONDWEED. Submersed in flowing water of streams and drainages (*Oswald 6412*, SW corner of the Tour Route). Native to Eurasia. Summer.

Potamogeton foliosus Raf. var. ***foliosus*** – LEAFY PONDWEED. Submersed perennial in marshes (*Anon.* in 1950; Oswald, T15). Summer.

Potamogeton pectinatus L. – SAGO PONDWEED. Locally abundant submersed perennial in quiet water of deeper ponds and in flowing water of ditches (*Anderson 47*, in Gravel Pit Lake; *Hanson 9-51*, without a location; *Oswald 5367*, gravel pit in TC[1]; *Oswald 5493*, ditch near the SW corner of the Tour Route. In the latter plants, the sheath extends past the blade 4–7 mm, forming a hyaline ligule). Spring & summer.

Potamogeton nodosus Poir. – LONG-LEAVED PONDWEED. Represented by an old collection in the SNWR herbarium (*Hanson 9-51*, without a location), the plants growing in both running and still water 4–5 ft deep. It is also reported from the canal along Hwy. 99 in 1937 (*Anderson 63*). Summer. [*P. americanus* Cham. & Schltdl.]

TYPHACEAE – CATTAIL FAMILY

1 Usually no interval between staminate and pistillate spikes; pistillate spike becoming dark brown ..... *T. latifolia*
1 Staminate and pistillate spikes usually separated.
  2 Base of leaf-blade gland-dotted on side facing stem; pistillate spike yellowish to cinnamon-brown ..... *T. domingensis*
  2 Base of leaf-blade not gland-dotted; pistillate spike dark brown ..... *T. angustifolia*

Typha angustifolia L. – NARROW-LEAVED CATTAIL. Relatively uncommon cattail, forming colonies in marshes (Oswald, S edge of P1A[3]). Late spring.

Typha domingensis Pers. – SOUTHERN CATTAIL. This is the more common of the narrow-leaved cattails in marshy places on the refuge (e.g., between the visitor's parking area and the headquarters complex). Late spring.

Typha latifolia L. – BROADLEAF CATTAIL. Widespread perennial forming large colonies in marshes, sloughs, and ditches. Late spring.

ZANNICHELLIACEAE – HORNED-PONDWEED FAMILY

Zannichellia palustris L. – HORNED-PONDWEED. Locally abundant submersed perennial in ditches and marshes (*Marshall* in 1955, without a location; *Oswald 5469*, west boundary of the refuge near the headquarters complex; *Oswald 5574*, T30). Spring and summer.

APPENDIX I. Plants growing on the Sacramento National Wildlife Refuge that are listed in the CNPS *Inventory of Rare and Endangered Vascular Plants of California* (Skinner & Pavlik, 1994).

Astragalus tener var. ferrisiae, List 1B.
Atriplex cordulata, List 1B
Atriplex depressa, List 1B.
Atriplex joaquiniana, List 1B.
Atriplex persistens, List 1B.
Chamaesyce hooveri, List 1B, PT
Cordylanthus palmatus, List 1B, CE, FE (transplant populations).
Eleocharis parvula, List 4.
Juglans californica var. hindsii, List 1B (our plants naturalized).
Lepidium latipes var. *heckardii*, List 1B.
Myosurus minimus ssp. *apus*, List 3 (identification uncertain; see discussion under *M. minimus*).
Orcuttia pilosa, List 1B, CE, PE.
Tuctoria greenei, List 1B, CR, PE.

CNPS LISTS

1B	Rare, threatened, or endangered in California and elsewhere.
3	Plants about which we need more information—a review list.
4	Plants of limited distribution—a watch list.

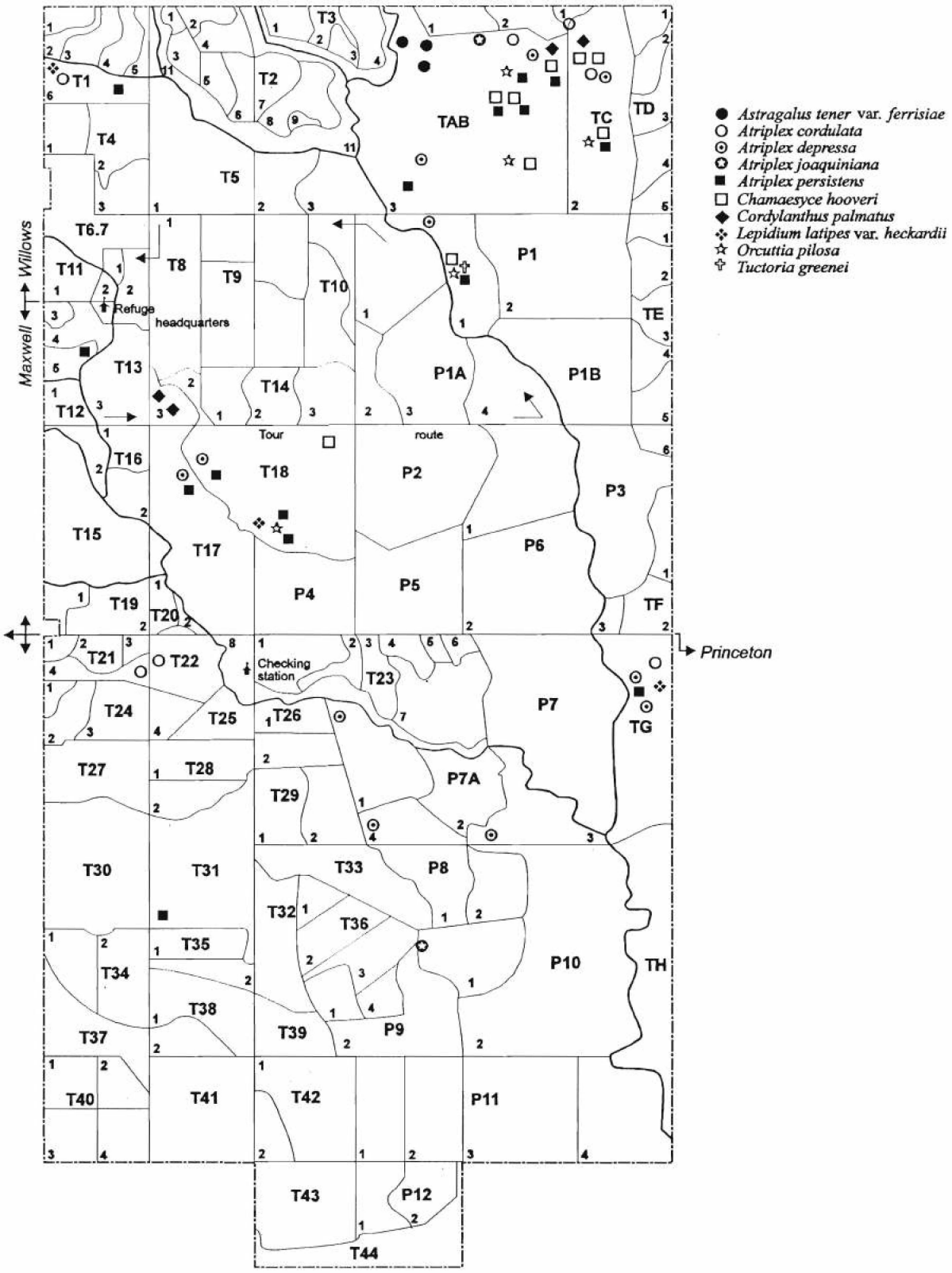
STATE LISTS

CE	State listed, endangered.
CR	State-listed, rare.

FEDERAL LISTS

FE	Federally listed, endangered.
PE	Federally-proposed, endangered.
PT	Federally-proposed, threatened.

APPENDIX II. Plot map showing the distribution of some of the rare plants on the Sacramento National Wildlife Refuge.



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