JORDAN RIVER WETLAND WILDLIFE EVALUATION

DIVISION OF WILDLIFE RESOURCES
UTAH STATE DEPARTMENT OF NATURAL RESOURCES

JORDAN RIVER WETLANDS WILDLIFE EVALUATION

Jordan River Wetland Advanced Identification Study

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Department of Natural Resources

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INTRODUCTION

The tremendous importance and special values of wetlands as wildlife habitat are well documented and universally acknowledged (Adamus 1983, Sather and Smith 1984, Weller 1981). In addition, the special role of palustrine scrub-shrub (SS) and wooded (FO) wetlands as critical wildlife habitat in Utah and throughout the intermountain and southwest regions is also recognized (Brinson et al. 1981, Johnson et al. 1985, Johnson et al. 1978). Much research has already been devoted to identifying and understanding the specific relationships between wildlife and these wetland and riparian habitats.

Riverine and palustrine wetlands, such as those along the Jordan River, provide food and cover, nesting, rearing, resting and stopover sites, protection from human disturbance (of particular significance in urban environments), and migration corridors for a diversity of wildlife. Invertebrates, fish, amphibians, reptiles, birds, and mammals all use wetland habitats.

The influence of water and the unique vegetative composition and structure of wetland and riparian habitats support a significantly high productivity and diversity of animal species. Wetland and riparian habitats in Utah, particularly at lower elevations, provide plant species and vegetative structure, density and diversity generally lacking in the drier and open surrounding areas. An associated diversity and disproportionately high number of wildlife species typically exhibit an affinity for and dependency on these habitats. In addition, wetland habitat functions vary seasonally, and wildlife populations within wetland and riparian habitats are distinctly different from season to season (Brinson et al. 1981).

The assessment of the values of habitat functions of wetlands, particularly associated wetlands in a riverine system, is complex. Many temporal, environmental, ecological, and species-specific variables influence the relative habitat values of wetlands. Sather and Smith (1984) identify structure and species diversity of the vegetation, surrounding land uses, spatial patterns within and between wetlands, vertical and horizontal zonation, size, water chemistry, food chain support, wildlife species composition, and daily and seasonal dynamics as some of the variables.

The Jordan River wetlands include a variety of wetland classes. The diversity in wetland plant species and in vegetation structure, density, and interspersion (Halpin 1987) provides habitats that can independently and collectively support a diversity of wildlife. The various wetland classes represent a diversity of habitats that each may support different wildlife species. The habitat diversity itself is a required quality for still other wildlife. The close proximity and interspersion of the various wetland classes supports wildlife dependent on different wetland habitats for different needs and activities (ie. feeding, resting, breeding, rearing young). Compounding all these variables, temporal variations in wetland habitat values also exist as habitat characteristics and species compositions, needs, and uses change seasonally.

Avian and other wildlife occurrence in wetlands along the Jordan River was surveyed during the summer of 1986 to assist in evaluating the existing and potential habitat values of particular wetlands and of the whole river system in general. Survey techniques employed were rudimentary in that the broad complex of variables influencing wildlife use of wetlands was not entirely addressed. Furthermore, the survey period was restricted and did not account for seasonal, long-term, or river system dynamics.

A thorough evaluation of site-specific wetland habitat values would require a long-term, intensive field effort. However, it is already known that wetland and riparian habitats are extremely important to wildlife. Many detailed studies have already established this basic principle. The intent of the surveys was to examine the pertinence of this principle locally by obtaining summer indices of the degrees and types of uses by wildlife of the wetland habitats along the Jordan River.

Survey effort focused primarily on birds because of the number of avian species dependent on wetland and riparian habitats and because of the relative visibility of birds. However, wetland habitats are also important for other kinds of wildlife, and these should be considered as well. Avian species' occurrence, activities, and relative distributions among available wetland habitats were observed. This information is summarized and presented here for review as part of the Jordan River Wetland Advanced Identification Study (WAIDS) sponsored by the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and Salt Lake City and County Health Department.

OBJECTIVES

1. Birds and other wildlife in wetlands along the Jordan River were surveyed to:

   a. determine species occurrence and use of wetland habitats along the river during the summer season, 1986;

   b. examine associations between avian species and wetland habitats;

   c. obtain indices to help evaluate the current and potential local significance of Jordan River wetlands to wildlife populations.

METHODS

AVIAN SURVEYS

Summer field surveys of avian occurrence and use of wetland habitats within the Jordan River corridor between the Jordan Narrows and 2100 South were conducted June 2 - September 8, 1986. Most survey effort was concentrated in June, 1986.

Birds that were seen and heard as 1 to 2 observers walked through wetlands within the river corridor parallel to the river were identified by species and were counted. Their activities and the habitats they occurred in were also recorded (Figure 1). Wetland habitats were categorized by system and class (Table 1).

Surveys were conducted during daylight hours at various times of day. Nocturnal species were not surveyed. Individual surveys represent observations made from one side of the river (east or west) during a unidirectional walk parallel to the river through a single basin (Appendix 1).

Surveys were conducted in upper and lower sections of the river, but not all basins were sampled. All wetland classes and habitats that occur along the Jordan River were represented in surveyed basins. Analyses of species occurrence by wetland habitats and by surveyed basins are summarized. Federal, state, and blue list data pertinent to the status of species that may use Jordan River wetlands is also presented. References to general species occurrence within Utah are cited from Behle et al. (1985).

MAMMAL OBSERVATIONS

Mammals, tracks and other sign observed incidentally during avian survey periods were recorded by species and the basin and wetland class they occurred in (Figure 2). In addition, information about potentially-occurring species is provided from Smith and Greenwood (1984, Appendix 2).

REPTILES AND AMPHIBIANS

Information about potentially-occurring reptiles and amphibians is provided from Smith and Greenwood (1984, Appendix 2).

Table 1. Riverine and palustrine wetland classification (Cowardin et al. 1979).

SYSTEM:	Riverine	Wetlands and deepwater habitats contained within a channel. A channel is an open conduit either naturally or artificially created which periodically or continuously contains moving waters, or which forms a connecting link between two bodies of standing water.
	Palustrine	All nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens. Also, all wetlands lacking such vegetation but with area less than 8 ha, active wave-formed or bedrock shoreline features lacking, water depth in deepest part of basin less than 2 m at low water, and salinity due to ocean-derived salts less than 0.5%.
CLASS:		
	Unconsolidated Shore (US)	Wetlands having unconsolidated substrates with $< 75\%$ areal cover of stones, boulders or bedrock; $< 30\%$ areal cover of vegetation other than pioneering plants; and any of the following water regimes: irregularly exposed regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded.
	Aquatic Bed (AB)	Wetlands and deep water habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Water regimes include subtidal, irregularly exposed, regularly flooded, permanently flooded, intermittently exposed, semipermanently flooded, and seasonally flooded.
	Emergent (EM)	Wetlands characterized by erect, rooted herbaceous hydrophytes that are present for most of the growing season in most years. Usually dominated by perenial plants. All water regimes are included except subtidal and irregularly exposed.
	Scrub-Shrub (SS)	Wetlands dominated by woody vegetation less than 6 m tall. Species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. All water regimes except subtidal are included.
	Forested (FO)	Wetlands characterized by woody vegetation that is 6 m tall or taller. All water regimes are included except subtidal.

FIELD TALLY SHEET - DIVISION OF WILDLIFE RESOURCES

JORDAN RIVER WETLANDS AVIAN SURVEY

OBSERVERS' NAMES _____

_____

BASIN NUMBER [ ]

WIND DIR. AND SPEED _____ TEMP. _____ CLOUD COVER _____

DATE _____ STARTING TIME _____ ENDING TIME _____

ENTRY NUMBER	SPECIES	NUMBER OF INDIVIDUALS	WETLAND AND VEGETATION TYPE	ACTIVITY	REMARKS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

WETLAND AND VEGETATION TYPE SYSTEMS: P-palustrine, R-riverine.
CLASSES: EM-emergent, SS-scrub-shrub, FO-foreated, AB-aquatic bed, US-unconsolidated shore, UB-unconsolidated bottom, SB-streambed, Other[1](U).
If field observations of vegetation type differ from topo map, record what you see and indicate the discrepancy in the Remarks column.

ACTIVITY Feeding, Singing, Resting/Perched, Nesting[2], Flying[3], Flushed (by observer prior to identification of activity), Other[1].

Figure 1. Data form for avian surveys.

WILDLIFE OBSERVATIONS

OBSERVERS _____

Jordan River Wetlands

BASIN NUMBER [ ]

DATE _____

Wildlife observations including mammals, reptiles, amphibians, bird nests, other signs (tracks, droppings, bird pellets, etc.) and additional notes. Record entry letter on map form to indicate location of observation.

ENTRY LETTER	WETLAND AND VEGETATION TYPE	DESCRIPTION

Figure 2. Data form for observations of mammals and other incidental wildlife sitings.

RESULTS AND DISCUSSION

AVIAN SURVEYS

Thirty-five avian surveys were made in 11 basins between June 2 and September 8, 1986. Twenty-five of the surveys were conducted in June, seven in July, one in August, and two in September (Table 2).

Observations of birds and wetland habitat uses were made in Basins 1-5, 7, 9, 10, 12, 13 and 19. Seventy-six avian species were seen in and over the river (SB), along its shores and on sandbars (US,UB), and in aquatic bed (AB), emergent (EM), scrub-shrub (SS), and forested (FO) wetlands along the Jordan River (Table 3). Bird activities within these wetlands included feeding, resting, preening, calling, singing, courting, nesting, and flying.

A total of 3,455 bird observations were made, including individuals that occurred in groups and flocks. Most (45%) observations were of birds flying along the river and feeding and resting in the river channel. Visibility of birds in flight and on the open water is greater than of birds in vegetated wetlands and of birds engaged in most other activities. Numbers of birds flying along the river, however, did indicate that the river functions as a travel corridor for many species.

Evaluation of the relative importance of particular wetland habitats and sites to birds and other wildlife is complex (Adamus 1983a). Habitat values are species and community specific. Some vegetative life forms, for example, may offer adequate cover for some species but not for others. Also, the variety of wildlife species that occur in wetlands along the Jordan River exhibit a range of feeding strategies. These include use of and dependency on all wetland classes and many different kinds of plants and food chains. Furthermore, habitat values vary seasonally and with a diversity of uses among different species and even within individual species. During the summer surveys, birds occurred in all available wetland classes along the Jordan River displaying a diversity of activities and habitat uses.

Relative availability of wetland classes and habitat characteristics varied among sampled basins (Figure 3), complicating an assessment of the values of particular wetland habitats. With inconsistent visibility among wetland classes and bird activities and with variable availability of wetland habitats among basins, distribution of total bird numbers and activities among wetland classes indicate only general patterns of habitat use.

Almost half the birds seen (45%) were over or in channels of the river. Another significant portion of the sightings (23%) were of birds in wetlands with woody vegetation (SS, SS/AB, SS/EM, SS/FO, FO, FO/SS). While palustrine emergent wetlands represent the largest proportion (77%) of wetland area along the Jordan River, only 12% of the total sightings were of birds in emergent wetlands (EM, EM/AB, EM/SS). Three percent (3%) of the birds observed occurred in aquatic beds (AB, AB/EM, AB/SS).

Table 2. Avian surveys in Jordan River wetlands during summer, 1986.

Survey	Basin	Date of Survey	Number of Bird Sightings	Number of Bird Species
1	1	June 4	99	25
2		June 24	188	21
3		June 26	201	25
4		June 30	51	15
5		July 25	144	20
6		Aug 6	63	15
7		Sept 8	51	9
			N = 797	49 Total Species
8	2	June 30	36	14
9		July 25	17	4
			N = 53	17 Total Species
10	3	June 6	294	33
11		June 24	151	21
12		June 25	87	8
13		June 26	57	14
14		July 10	296	27
15		July 16	44	13
16		July 24	32	9
17		Sept 8	232	26
			N = 1,193	59 Total Species
18	4	June 6	162	24
19		June 6	153	25
20		July 10	38	6
			N = 353	37 Total Species
21	5	June 3	6	5
			N = 6	5 Total Species
22	7	June 3	12	3
			N = 12	3 Total Species
23	9	June 2	30	10
24		June 2	42	7
25		June 3	134	23
26		June 19	170	2
27		June 19	142	16
28		June 20	56	7
			N = 574	39 Total Species
29	10	June 25	140	18
			N = 140	18 Total Species

Table 2. Avian surveys in Jordan River wetlands during summer, 1986 (continued).

Survey	Basin	Date of Survey	Number of Bird Sightings	Number of Bird Species
30	12	June 2	7	6
31		June 20	57	7
			N = 64	13 Total Species
32	13	June 19	117	16
			N = 117	16 Total Species
33	19	June 4	20	6
34		June 11	43	14
35		July 25	83	19
			N = 146	29 Total Species

TOTAL BIRD SIGHTINGS N = 3,455

Table 3. Bird species observed in Jordan River wetlands, June 2 - September 10, 1986.

Western grebe (Aechmophorus occidentalis)
White pelican (Pelecanus erythrorhynchos)
Double-crested cormorant (Phalacrocorax auritus)
Great blue heron (Ardea herodias)
Snowy egret (Egretta thula)
Green-backed heron (Butorides striatus)
Black-crowned night heron (Nycticorax nycticorax)
White-faced ibis (Plegadis chihi)
Canada goose (Branta canadensis)
Mallard (Anas platyrhynchos)
Gadwall (Anas strepera)
Blue-winged teal (Anas discors)
Cinnamon teal (Anas cyanoptera)
Redhead (Aythya americana)
Common merganser (Mergus merganser)
Turkey vulture (Cathartes aura)
Sharp-shinned hawk (Accipiter striatus)
Red-tailed hawk (Buteo jamaicensis)
Osprey (Pandion haliaetus)
American kestrel (Falco sparverius)
Ring-necked pheasant (Phasianus colchicus)
Virginia rail (Rallus limicola)
Sora (Porzana carolina)
American coot (Fulicia americana)
Killdeer (Charadrius vociferus)
Common snipe (Gallinago gallinago)
Spotted sandpiper (Actitis macularia)
Willet (Catoptrophorus semipalmatus)
Solitary sandpiper (Tringa solitaria)
Greater yellowlegs (Tringa melanoleuca)
Lesser yellowlegs (Tringa flavipes)
Long-billed dowitcher (Limnodromus scolopaceus)
Sandpiper, unidentified (Calidris sp.)
American avocet (Recurvirostra americana)
Black-necked stilt (Himantopus mexicanus)
Wilson's phalarope (Phalaropus tricolor)
California gull (Larus californicus)
Franklin's gull (Larus pipixcan)
Forster's tern (Sterna forsteri)
Caspian tern (Sterna caspia)
Rock dove (Columba livia)
Mourning dove (Zenaida macroura)
Black-chinned hummingbird (Archilochus alexandri)
Belted kingfisher (Ceryle alcyon)
Northern flicker (Colaptes auratus)

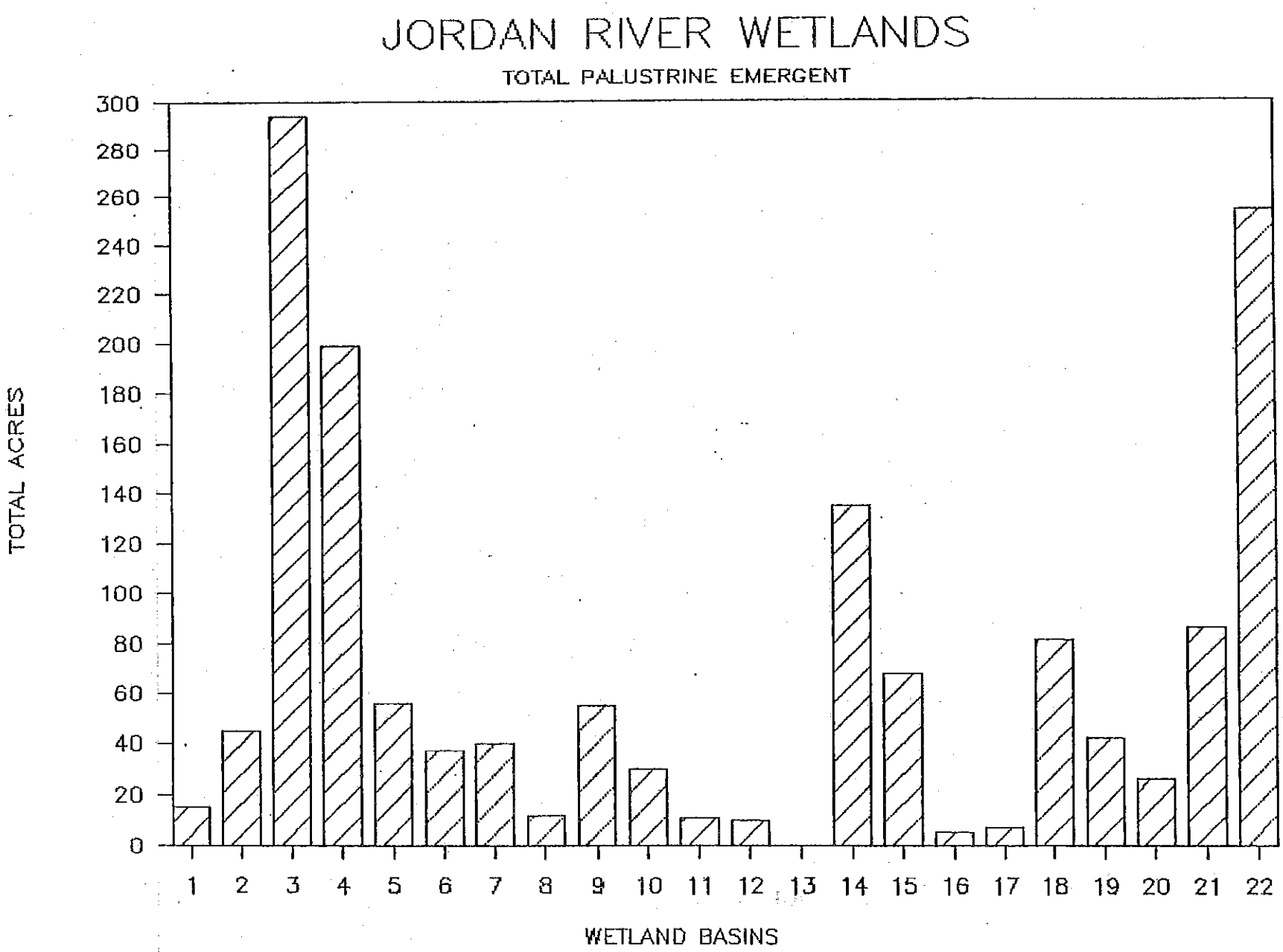
Table 3. Continued.

Eastern kingbird (Tyrannus tyrannus)
Western kingbird (Tyrannus verticalis)
Flycatcher, unidentified (Empidonax sp.)
Tree swallow (Tachycineta bicolor)
Bank swallow (Riparia riparia)
Rough-winged swallow (Stelgidopteryx serripennis)
Barn swallow (Hirundo rustica)
Cliff swallow (Hirundo pyrrhonota)
Black-billed magpie (Pica pica)
Black-capped chickadee (Parus atricapillus)
Marsh wren (Cistothorus palustris)
American robin (Turdus migratorius)
European starling (Sturnus vulgaris)
Yellow warbler (Dendroica petechia)
Yellow-rumped warbler (Dendroica coronata)
Common yellowthroat (Geothlypis trichas)
Yellow-breasted chat (Icteria virens)
Black-headed grosbeak (Pheucticus melanocephalus)
Lazuli bunting (Passerina amoena)
Savannah sparrow (Passerculus sandwichensis)
Vesper sparrow (Pooecetes gramineus)
Song sparrow (Melospiza melodia)
Western meadowlark (Sturnella neglecta)
Red-winged blackbird (Agelaius phoeniceus)
Yellow-headed blackbird (Xanthocephalus xanthocephalus)
Brewer's blackbird (Euphagus cyanocephalus)
Brown-headed cowbird (Molothrus ater)
Northern oriole (Icterus galbula)
House finch (Carpodacus mexicanus)
American goldfinch (Carduelis tristis)
House sparrow (Passer domesticus)

Additional winter species observed in wetlands during Jordan River Christmas Bird Count (CBC), January 1, 1987.

Bald eagle (Haliaeetus leucocephalus)
Winter wren (Troglodytes troglodytes)
Loggerhead shrike (Lanius ludovicianus)
American tree sparrow (Spizella arborea)
White-crowned sparrow (Zonotrichia leucophrys)
Harris' sparrow (Zonotrichia querula)
Dark-eyed junco (Junco hyemalis)

FIGURE 3. DISTRIBUTION OF PREDOMINANT WETLANDS



Species Occurrence

HERONS AND EGRETS

Four species of herons and egrets were observed in wetlands along the Jordan River. These birds are waders and consume primarily fish, amphibians and invertebrates. All 4 species were frequently observed feeding in aquatic beds (AB) near edges with emergent and scrub-shrub vegetation (Figure 4). The great blue heron, the largest and tallest of these birds, was also seen wading within the main river channel (SB), in oxbows, and near sandbars and along shallower shorelines (US). Snowy egrets also foraged in shallower portions of the main river channel and oxbow meanders. The green-backed heron, a rare summer resident in Utah, occurred regularly in a particular aquatic bed (AB) with dense emergent (EM) and willow (SS) growth at its edges (Basin 3). Although predominantly active in the evening, black-crowned night herons were the most frequently observed of the heron species. Several nest sites were found along the river. Most nests were in clumps of Russian olives (Elaeagnus angustifolia) or other shrub and tree growth. The flimsy stick nests of this species were constructed 5 - 25' high in the shrubs and trees and still appeared active in early June. The black-crowned night heron is commonly a colonial nester, and often 2 to 4 nests occurred in a single small clump of trees.

WHITE-FACED IBIS

The largest number of any species observed along the Jordan River was white-faced ibises (N=533). Most frequently, flocks of ibises were observed in flight traveling along the river corridor. Ibises fed in pastures and irrigated fields within the river floodplain, in emergent wetlands, and in shallow portions of the river channel (Figure 4).

WATERFOWL

Cinnamon teal were the most frequently observed ducks (N=198). They fed and rested in aquatic beds (AB), backwater meanders and oxbows, the main river channel, and emergent (EM) wetlands. Mallards, gadwalls, blue-winged teal, redheads, and common mergansers were also seen in the river and in associated wetlands (Figure 5). Most of these species were frequently observed in backwater meanders, oxbows, aquatic beds or resting along sandbars and in shallow portions of the river channel. The mergansers were seen in the river and resting at its edge (US). Many observations of ducks were of flying birds traveling over the river corridor.

Canada geese were observed feeding in emergent wetlands (EM) and in flight over the river. Smith and Greenwood (1984) provide further evaluation of waterfowl use of wetlands along some sections of the Jordan River (Appendix 3).

FIGURE 4. General wetland habitat use patterns along the Jordan River by herons, egrets, and white-faced ibises. Summer, 1986. (Adapted from Weller 1981).

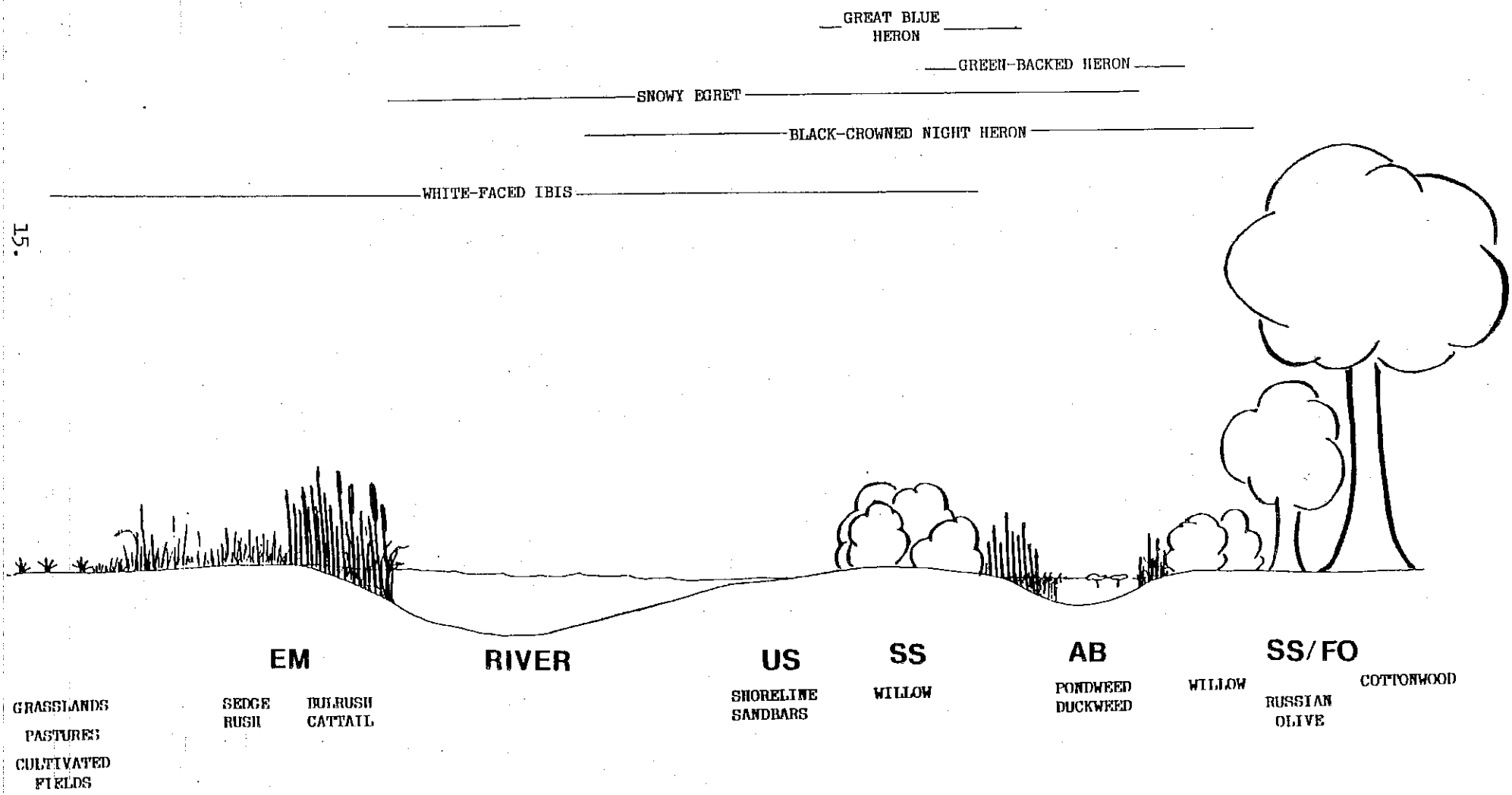
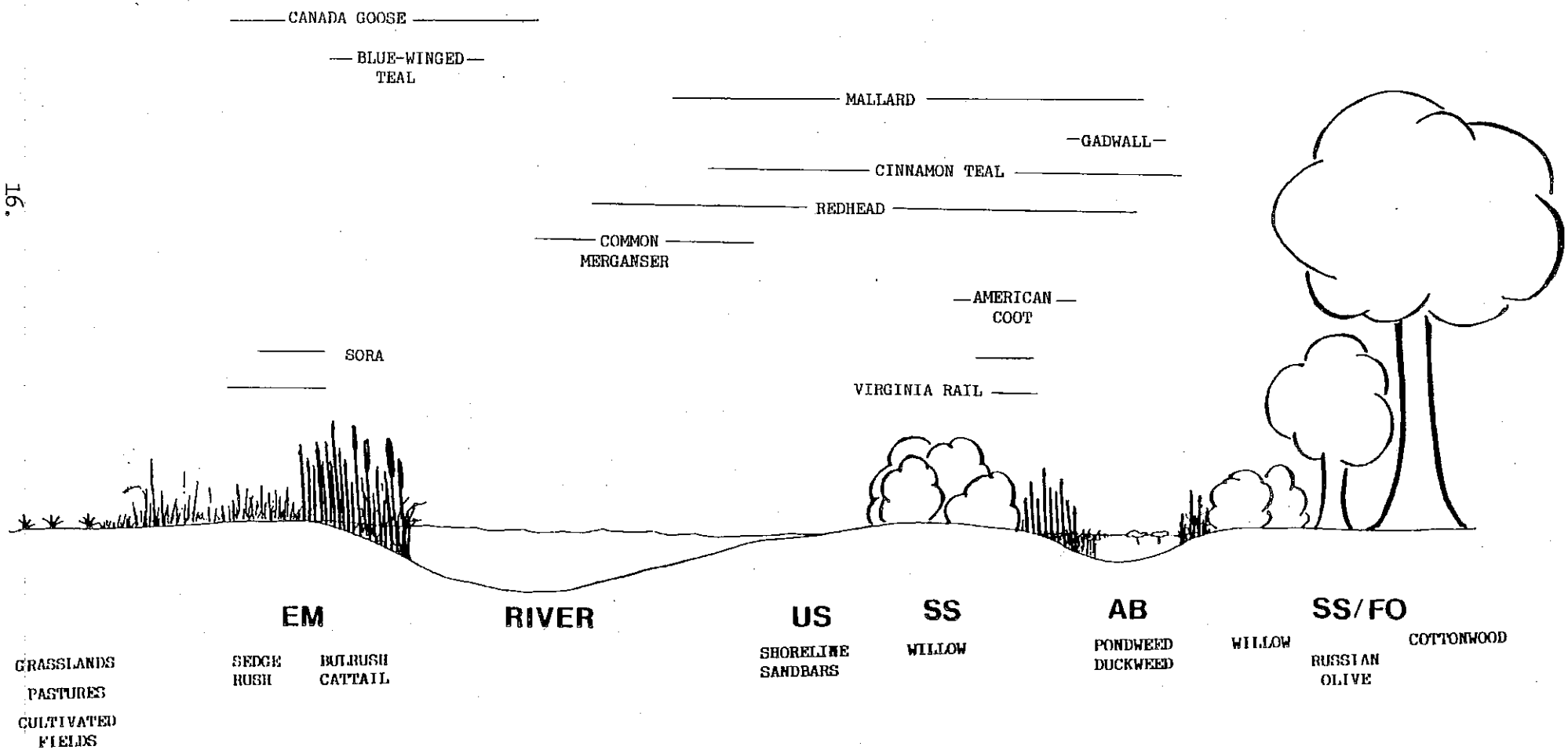


FIGURE 5. General wetland habitat use patterns along the Jordan River by waterfowl, coots, and rails. Summer, 1986. (Adapted from Weller 1981).



RAPTORS

During the summer months, 5 diurnal species of raptors were observed within the Jordan River corridor. The American kestrel was the most frequently counted hawk (N=16). Kestrels were observed perched or flying and hovering in emergent (EM), scrub-shrub (SS), and forested (FO) wetlands and in adjacent pastures and fields. Red-tailed hawks were seen soaring over the river. An osprey and a turkey vulture were each observed in flight traveling along the river corridor. A sharp-shinned hawk was observed chasing black-necked stilts from a river sandbar and then resting in adjacent willows (SS).

Pellets and droppings of an unidentified owl species were found along a fence line in an emergent (EM) wetland in Basin 4.

RAILS, COOTS, AND RING-NECKED PHEASANTS

Virginia rails and soras were heard and seen in emergent (EM) wetlands often associated with aquatic beds (AB) and willow thickets (SS). Observations of American coots were limited to only 2 birds which were seen resting in an emergent wetland with some scrub-shrub (EM/SS) vegetation (Figure 5).

Ring-necked pheasants were also heard and seen in emergent (EM) or scrub-shrub (SS) wetlands and in adjacent grassy areas (Figure 7). Smith and Greenwood (1984) provide further discussion of ring-necked pheasant occurrence along the Jordan River.

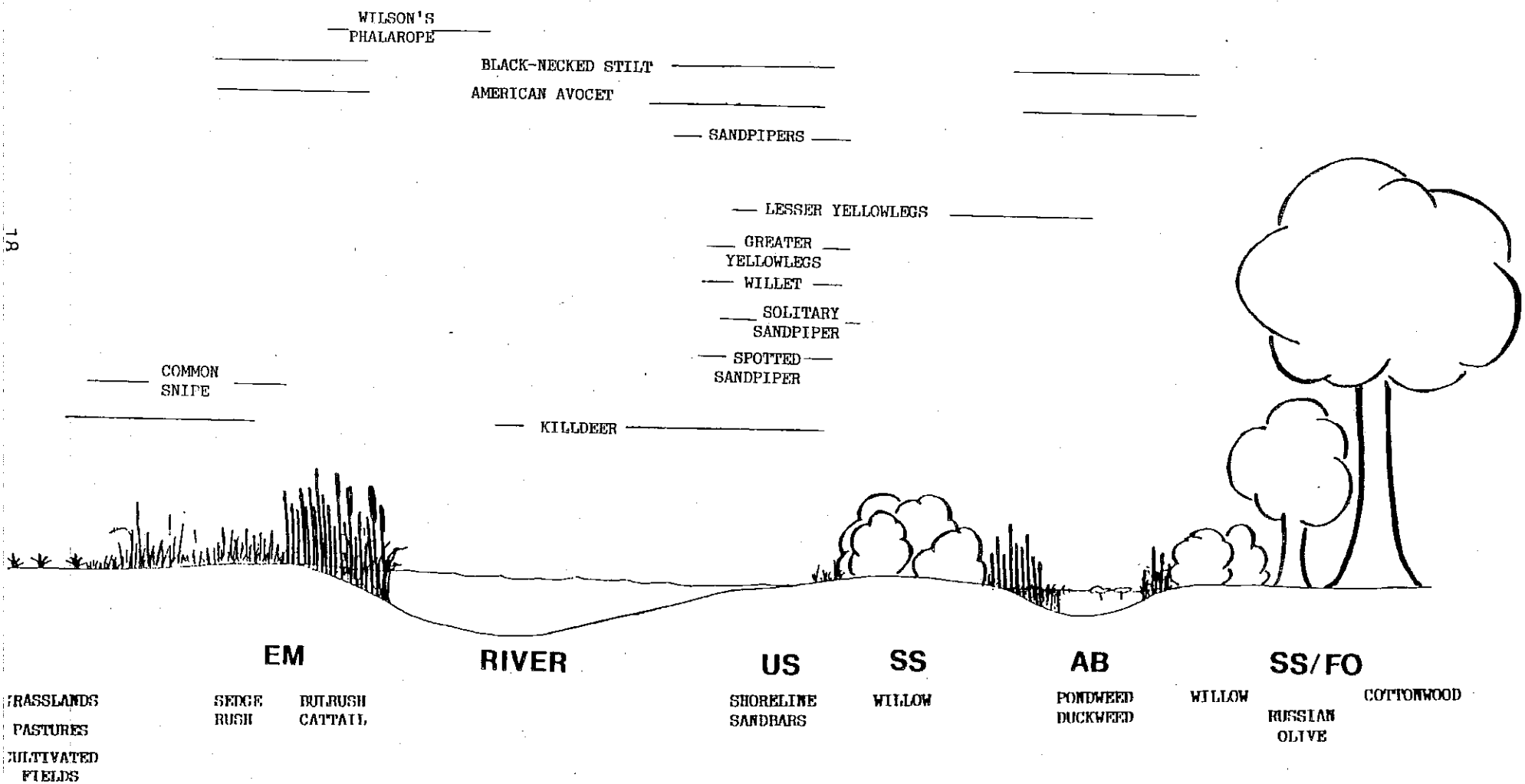
SHOREBIRDS

The food source of most species within this group is predominantly aquatic and wetland invertebrates, including adult and larval insects and small crustaceans that they find on the surface of water, in the water column, in substrates below the water surface and in other muddy, sandy or gravelly soils associated with water and wetlands. Some of these birds are waders, and some feed along the edges of water and wet sites.

Killdeer, which behaviorally are very vociferous and conspicuous, were the most frequently encountered shorebird. This species was commonly observed on sandbars and along muddy and sandy shores (SB, US) of the river. Killdeer also occurred in relatively open, gravelly or short grass areas adjacent to the river. The species is a ground nester and probably nested in some of these sites.

Common snipe were frequently flushed from emergent (EM) wetlands. Spotted sandpipers were most often seen foraging along the river's edge on muddy and sandy shorelines and on sandbars (US, UB, SB). Three observations of solitary sandpipers, an uncommon transient in Utah, were made of individuals feeding along the edge of the river on muddy and sandy shorelines (US, US/SS).

FIGURE 6. General wetland habitat use patterns along the Jordan River by shorebirds.. Summer, 1986. (Adapted from Weller 1981).



Both greater and lesser yellowlegs occurred along the river. These birds occur in Utah as transients during spring and fall migration periods. Most observations of both species were of birds foraging along sandbars, shorelines, and shallow river edges (US, SB).

Long-billed dowitchers, western sandpipers, and least sandpipers are all common transients as they migrate through Utah stopping to feed and replenish their energy reserves for migration to and from northern breeding grounds and southern wintering sites. Surveys were initiated after the spring migration period of these species. During August, however, when some age classes of these birds are passing back through Utah, two flocks of unidentified sandpipers (N=75) were observed feeding on sandbars within the river channel, and another small flock of sandpipers (N=15) was noted flying low above the water surface of the river (Basin 3). The occurrence of these birds is related to the availability of invertebrate food items, and it is probable that greater use of wetlands (US, UB, SB) of the Jordan River is made by these migrants than indicated by these limited observations.

American avocets and black-necked stilts are long-legged shorebirds, and both species are common summer residents throughout northern Utah. Most of these birds also occurred along sand and mudbars, shorelines, and shallow river edges (US, UB, SB) where they were observed feeding. Black-necked stilts were also seen feeding in areas of emergent vegetation (EM) and in shallow aquatic beds (AB).

Wilson's phalaropes were seen feeding in emergent (EM) wetlands and flying over the river.

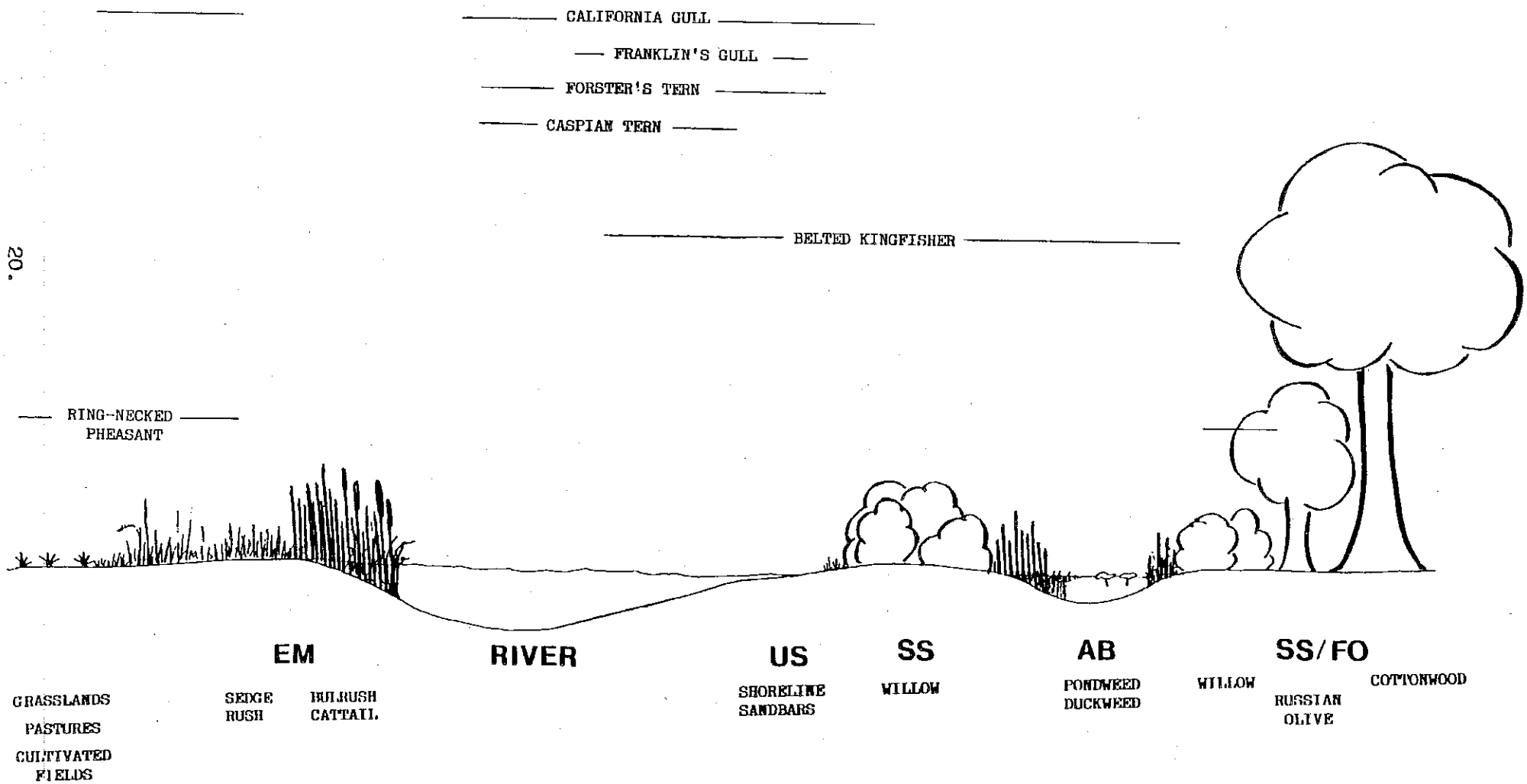
TERNS AND GULLS

Most observations of terns and gulls were of birds using the river corridor as a flyway (Figure 7). Terns and gulls were also observed resting along sandbars, muddy and sandy shorelines, and in shallow water of the river channel (US, UB, SB). A concentration of Forster's terns, whose diet consists largely of small fish and aquatic insects and other invertebrates, was seen in early summer feeding from the river in Basin 2. Caspian terns, Franklin's gulls, and California gulls were other species observed using wetlands along the river.

DOVES

Mourning doves occurred commonly within wetlands and adjacent habitats. This species used available perches in wetlands and was observed resting in emergent (EM) and scrub-shrub (SS, SS/FO) wetlands.

FIGURE 7. General wetland habitat use patterns along the Jordan River by gulls, terns, kingfishers, and pheasants. Summer, 1986. (Adapted from Weller 1981).



BELTED KINGFISHER

The belted kingfisher is a fish-eating bird that commonly nests in excavated burrows in soil banks along rivers. This species was seen flying low over the river in Basin 1 and perched near aquatic beds (AB/EM, AB/SS) in Basin 3 (Figure 7).

FLYCATCHERS

Eastern kingbirds, an uncommon summer resident in northern Utah, were most often observed flycatching from perches in shrubs and trees in scrub-shrub (SS, SS/EM) wetlands (Basin 1). The western kingbird, a common summer resident in Utah, occurred most frequently in scrub-shrub (SS/EM, SS/FO, FO) wetlands and adjacent grassy habitats. Unidentified empidonax flycatchers (N=3) were seen foraging in scrub-shrub (SS, EM/SS) wetlands as well (Figure 8).

SWALLOWS

Swallows fed and nested along the river and in associated wetlands. These birds consume flying insects such as midges and mosquitos which they catch while flying. Large numbers of barn swallows, bank swallows, tree swallows, rough-winged swallows and cliff swallows were frequently observed feeding directly over the river and occasionally over emergent (EM) and scrub-shrub (SS) wetlands. Bank swallows nested in soil banks along the river and adjacent to wetlands, and barn swallows nested under bridges over the river.

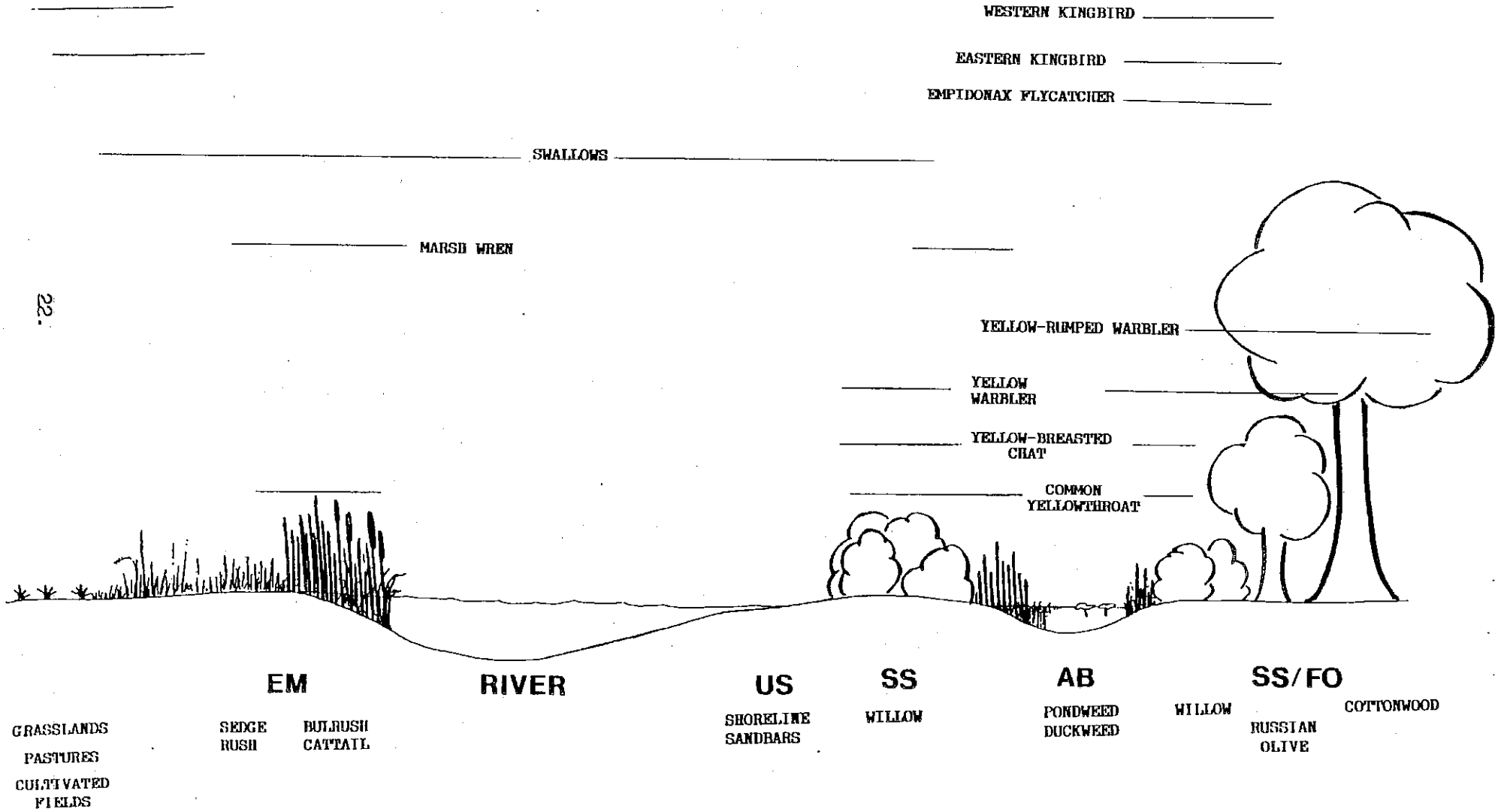
WRENS

Marsh wrens, a wetland species that frequently nests in bulrush and cattail stands, were observed and heard in emergent (EM) wetlands (Figure 8). This species also occurred in dense willow stands (SS/EM) along the river during the winter (CBC, Jan. 1987). A winter wren, a rare winter visitant in Utah, was also seen in a mixed emergent/scrub-shrub (EM/SS) wetland during winter (CBC, Jan. 1987).

WARBLERS

Yellow warblers, common yellowthroats, and yellow-breasted chats were heard singing and observed feeding in emergent and scrub-shrub (EM, EM/SS, SS) wetlands (Figure 8). All three of these warbler species are summer residents in Utah that typically occur in riparian habitats, primarily in willow thickets along streams and rivers. The common yellowthroat also frequently uses emergent (EM) wetlands with bulrush and cattail vegetation.

FIGURE 8. General wetland habitat use patterns along the Jordan River by swallows, wrens, flycatchers, and warblers. Summer, 1986. (Adapted from Weller 1981).



Along the Jordan River, singing and feeding yellow-breasted chats were observed in dense willow thickets (Basin 1). The chat is a species of questionable status and, therefore, of special concern. Indications of declining chat populations regionally are thought to be associated with the widespread degradation and loss of riparian habitat.

In September, a group of yellow-rumped warblers was seen foraging in a Russian olive grove along the river (Basin 3). These birds were probably fall migrants.

BLACKBIRDS, MEADOWLARKS, AND ORIOLES

Yellow-headed blackbirds and red-winged blackbirds were commonly observed in wetlands along the Jordan River. Both species typically nest in bulrush, cattail, and other emergent wetland vegetation. Along the Jordan River, both were most frequently observed nesting, singing, feeding , and resting in emergent and scrub-shrub (willow) wetlands (EM, EM/SS, SS).

Western meadowlarks were seen in wetlands (EM, EM/SS, SS) and adjacent grassy habitats. Brewer's blackbirds were also observed in emergent (EM) and scrub-shrub (SS) wetlands and adjacent fields and pastures. Brown-headed cowbirds often perched in shrubs and trees in scrub-shrub (EM/SS, SS) wetlands.

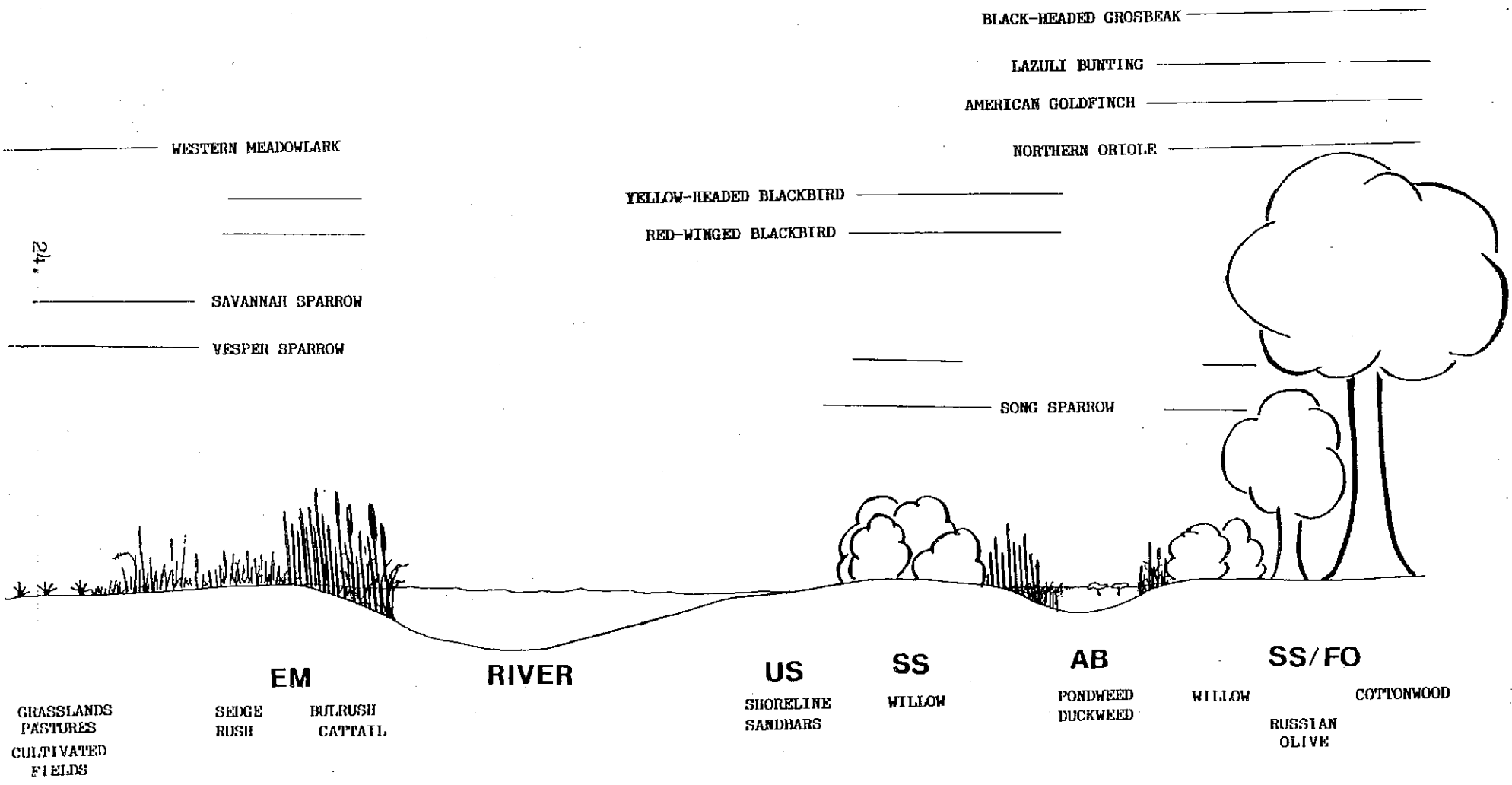
Northern orioles, which typically inhabit trees and wooded areas along streams and in other habitats, occurred in scrub-shrub and forested wetlands (EM/SS, SS, SS/FO). Orioles were observed feeding, resting, singing and nesting along the river (Figure 9).

GROSBEAKS, FINCHES, AND SPARROWS

The occurrence of the birds in this group was most closely related with wetlands that provided low, dense vegetation or a woody canopy (EM/SS, SS, SS/FO). Black-headed grosbeaks, lazuli buntings, house finches, and American goldfinches were observed feeding, resting, and singing in scrub-shrub and forested (SS, SS/FO) wetlands and in adjacent habitats with trees.

Savannah, vesper, and song sparrows occurred in emergent and scrub-shrub (EM, EM/SS, SS) wetlands. The observed activities of these species included feeding, resting, and singing. Harris' sparrows, rare but regular winter visitants, tree sparrows, common winter residents, white-crowned sparrows, and dark-eyed juncos were additional species noted in wetlands during the winter (CBC, Jan. 1987).

FIGURE 9. General wetland habitat use patterns along the Jordan River by blackbirds, finches, and sparrows. Summer, 1986. (Adapted from Weller 1981).



Species of Special Concern

FEDERAL ENDANGERED AND THREATENED SPECIES

Bald Eagle - The bald eagle occurs primarily as a winter visitant in Utah. No bald eagles were observed along the river during the summer, but large numbers of this endangered species do feed and roost in the wetland habitats of the Jordan River throughout the winter season. Fish, rabbits and carrion are among the most important food items of wintering bald eagles in this region. When the availability of jackrabbits as a prey item diminishes during cyclic population lows of this species, fish and other wetland food sources become increasingly significant in supporting large concentrations of bald eagles in Salt Lake County.

In addition, cottonwoods and other trees, most available in riparian wetlands (SS/FO, FO), provide essential roosting habitat for bald eagles in Utah's valleys. Bald eagles feed and roost along the Jordan River, with particularly large concentrations of eagles roosting along lower sections of the river.

Peregrine falcon - No sightings of peregrine falcons in Jordan River wetlands were made during the summer survey period. The species is a rare permanent resident of Utah occurring as a breeder (Falco peregrinus anatum) and as a migrant (Falco peregrinus tundrius). Peregrine falcons do currently breed in the vicinity of the Jordan River, including nest sites along the south shore of the Great Salt Lake and in downtown Salt Lake City. Analyses of the prey remains of these local birds indicate the use of shorebirds, waterfowl and other wetland prey species.

The wetlands of the Jordan River provide potential feeding habitat for resident and transient peregrine falcons. They also play an essential systematic role in influencing the ecology of wetland habitats downstream and along the south shore of the Great Salt Lake where the use of wetlands by this endangered species is frequent.

CANDIDATE SPECIES

White-faced ibis - The Great Basin population of the white-faced ibis is a Utah candidate species (category 2 = probably enough data exists to support listing) for federal listing (U.S. Fish and Wildlife Service 1986).

NATIVE UTAH SPECIES OF SPECIAL CONCERN

In addition to endangered and threatened status, Utah's state list of native species of special concern (Division of Wildlife Resources 1986), defines the following classifications:

Sensitive - any species that, although still occurs in numbers adequate for survival, has been greatly depleted or occurs in limited areas and/or numbers due to a restricted or specialized habitat. A management program, including protection or habitat manipulation, is needed.

Status Questioned - Insufficient data available on which to base a reliable assessment as to status.

The wildlife listed are species that are found in the state as residents or species that use areas of the state as a necessary part of their annual life cycle even though they may migrate to or from the state at certain times of the year. The purpose of the state listing is to call attention to the status of these species and encourage special consideration in planning and management activities.

Sensitive birds included on Utah's 1986 list that were observed during the summer surveys of Jordan River wetlands include:

Double-crested cormorant	Osprey
Caspian tern	White-faced ibis

Species of Questionable Status that occurred in wetland habitats along the Jordan River include:

Great blue heron	Black-crowned night heron
Western grebe	Yellow-breasted chat

BLUE LIST

Initiated in 1971 (Arbib 1971), the blue list has become an "early warning list" of declining, threatened, or vulnerable avian species in North American. The birds named to this list have recently given or are currently giving indications of non-cyclical population declines or range contractions, either locally or widespread and, therefore, warrant special attention.

The blue list for 1986 (Tate 1986) identified birds for which there are currently indications of uncertain or unstable status throughout or somewhere in their ranges. Blue-listed species that were observed along the Jordan River* or that very likely use wetlands of the Jordan include:

*Western grebe
Canvasback
*Sharp-shinned hawk
Northern harrier
Short-earred owl
Common nighthawk
*Loggerhead shrike
*Willow flycatcher
*Yellow warbler

Other blue-listed species occur in Utah, some of which also depend on or benefit from wetland and riparian habitat. Other birds listed that occur in Utah include:

Least bittern
American bittern
Cooper's hawk
Swainson's hawk
Ferruginous hawk
Snowy plover
Long-billed curlew
Black tern
Yellow-billed cuckoo
Common barn owl
Burrowing owl
Hairy woodpecker
Purple martin
Bewick's wren
Grasshopper sparrow

Additional birds cited as species of local concern (Tate 1986) that may use wetlands of the Jordan or whose local habitats may be influenced by the functions of Jordan River wetlands include:

*White pelican
*Double-crested cormorant
*Great blue heron
*Black-crowned night heron
*Turkey vulture
*Osprey
*Cliff swallow

WETLAND- AND RIPARIAN-OBLIGATE SPECIES

Most of the summer birds using the Jordan River wetland habitats are wetland- or riparian-obligate species. These birds depend exclusively on these habitats throughout or during some phase of their life cycle. As the total amount and quality of wetland habitat diminishes, existing and potential wetlands become more important in the support of wetland-dependent wildlife.

Jordan River Basins

BASIN 1

Seven surveys were conducted in Basin 1. Seven hundred ninety seven (797) observations of birds were made, the largest proportion of these (40%) representing a diversity of species flying along the river and swallows feeding over the water. White-faced ibises, California gulls, Forster's terns, Caspian terns, and waterfowl were observed in flight in Basin 1. Four sightings of soaring red-tailed hawks were also made.

Thirty seven percent of the observations were of birds in scrub-shrub (SS, SS/EM) wetlands. The scrub-shrub wetlands in Basin 1 are predominantly stands of willows associated with aquatic beds (AB), unconsolidated bottoms (UB), and emergent (EM) wetlands. A few cottonwood trees also occur in Basin 1. The variety of passerine species in this basin, both during the breeding period of early summer and later in August and September when migration begins, was probably associated with the vegetative structural diversity and density available in Basin 1. Eastern kingbirds, western kingbirds, empidonax flycatchers, yellow-breasted chats, yellow warblers, black-headed grosbeaks, lazuli buntings, American goldfinches, song sparrows, and northern orioles frequented the willows and cottonwoods. Yellow-headed and red-winged blackbirds were common in mixed emergent and scrub-shrub wetlands of Basin 1 also.

Great blue herons, snowy egrets, and black-crowned night herons occurred in Basin 1. Mallards and cinnamon teal commonly rested and fed in oxbows and braided meanders of the river in the upper portion of the basin. Virginia rails were found in mixed aquatic bed, emergent, and scrub-shrub wetlands.

BASIN 2

The river corridor is narrow in Basin 2, and wetlands are generally restricted areas supporting emergent and scrub-shrub vegetation. Two surveys included this basin. The occurrence of a feeding flock of white-faced ibises in an emergent wetland is most noteworthy.

BASIN 3

Basin 3 provides some of the most extensive wetland habitat along the river. Emergent vegetation predominates, but clumps and small groves of Russian olives also provide shrub and tree cover. Aquatic beds, oxbow meanders, sandbars, and shorelines support habitat diversity in this basin.

Observations included 1193 bird sightings in 8 surveys. Nearly half of the observations were of birds flying along the river or of birds feeding and resting in the river channel, on sandbars, and along shorelines (SB, US). The river channel is wide along a portion of Basin 3. Sandy bars and

shorelines and shallow water in this area hosted a diversity of feeding and resting birds, including herons, egrets, ibises, cinnamon teal, California gulls, Franklin's gulls, Forster's terns, American avocets, black-necked stilts, killdeer, lesser yellowlegs, spotted and solitary sandpipers, Wilson's phalaropes, and unidentified small sandpipers (probably western or least sandpipers).

Recorded in flight over the river were double-crested cormorants, great blue herons, snowy egrets, black-crowned night herons, white-faced ibises, mallards, cinnamon teal, California gulls, Forster's terns, Caspian terns, osprey, red-tailed hawks, killdeer, Wilson's phalaropes, spotted sandpipers, mourning doves, northern flickers, swallows, and blackbirds. A colony of bank swallows nested in cavities excavated in a high dirt bank abutting the river corridor on the west side of the river.

Herons and egrets, including the green-backed heron, ducks, lesser yellowlegs, and belted kingfishers fed in aquatic beds (AB). A variety of bird species were found in emergent (EM) wetlands. Emergent vegetation in this basin included large areas of sedges (Carex sp.) and rushes (Juncus sp.) and smaller areas of cattails (Typha sp.) and bulrushes (Scirpus sp.). Killdeer, common snipe, Virginia rails, common yellowthroats, savannah and song sparrows, and red-winged blackbirds were species frequently encountered in emergent vegetation.

American kestrels, a sharp-shinned hawk, mourning doves, black-billed magpies, American robins, western kingbirds, western meadowlarks, northern orioles, brown-headed cowbirds, Brewer's blackbirds, and European starlings were additional species occurring in Basin 3 in wetlands associated with scrub-shrub (SS) vegetation.

Russian olive groves are present in Basin 3, providing some of the only contiguous tree growth along the Jordan River. The presence of black-crowned night heron nests during the early summer and of a group of foraging yellow-rumped warblers during September in these trees provided examples of the importance of woody and structural habitat characteristics of riparian wetlands to nesting and migrating birds.

bASIN 4

Most of the 353 birds sightings made in 3 surveys of Basin 4 were of birds in flight over the river or on the water within the river channel. The birds observed in flight included a diversity of species. Herons, egrets, ibises, ducks, gulls and terns, shorebirds, and swallows were the most common birds feeding and resting in the water of the main channel and oxbows, on sandbars, and along shorelines (SB, US). Several black-crowned night heron nests were found in a small clump of Russian olives growing at the edge of an oxbow on the east side of the river.

Most of Basin 4 wetlands support emergent vegetation. A large (grazed) emergent wetland occurs on the east side of the river where sedges and rushes are prevalent. Patches of hardstem bulrush and cattails occur along the river's edge. Canada geese were observed feeding in emergent wetlands of Basin 4, and common snipe were flushed from them also. Emergent vegetation

associated with aquatic bed (AB) or scrub-shrub (SS) vegetation hosted other species as well, including cinnamon teal, redheads, soras, common yellowthroats, and red-winged blackbirds.

BASINS 5 AND 7

Few observations were made in Basins 5 and 7. Species seen in emergent wetlands of Basin 5 included red-tailed hawk, red-winged blackbird, western meadowlark, and savannah sparrow. Killdeer were observed along the river's shoreline (US). In Basin 7, snowy egrets, cinnamon teal, and red-winged blackbirds were seen in aquatic beds (AB).

BASIN 9

Six surveys were conducted in Basin 9 in which 574 bird sightings were made. A rich variety of species was seen in flight over this section of the river, including two large flocks of white-faced ibises. A diversity of birds were observed in aquatic bed (AB) and emergent (EM) wetlands in the Basin including snowy egrets, black-crowned night herons, redheads, cinnamon teal, blue-winged teal, soras, American coots, ring-necked pheasants, mourning doves, killdeer, sandpiper, common snipe, American avocets, black-necked stilts, Wilson's phalaropes, common yellowthroats, yellow-headed blackbirds, red-winged blackbirds, savannah sparrows, and song sparrows.

White-faced ibises and California gulls were observed feeding in an irrigated field adjacent to emergent wetlands.

BASIN 10

One hundred forty (140) birds were seen during 1 survey in Basin 10. On the west side of the Jordan River across from Basin 9, Basin 10 provides predominately emergent wetland habitat. A similar diversity of species occurred in this Basin as in Basin 9.

BASIN 12 AND 13

In 3 surveys of these 2 basins, 181 birds were counted. Black-crowned night herons, Forster's terns, California gulls, and barn and bank swallows were recorded in flight over the river. Both swallow species were observed feeding over the water and wetlands. Barn swallows nested under the bridge.

A western grebe was seen feeding in the river. Ring-necked pheasants, mourning doves, American robins, red-winged blackbirds, and western meadowlarks occurred in emergent (EM) and scrub-shrub (SS) wetlands. Killdeer were observed along the river's shore in these basins.

BASIN 19

This Basin supports a diversity of wetland vegetation and habitats. In the 3 surveys conducted in Basin 19, a variety of birds were seen, including passerines in emergent and scrub-shrub wetlands (SS/EM, SS). Ring-necked pheasants, mourning doves, barn and rough-winged swallows, American robins, western kingbirds, black-billed magpies, black-chinned hummingbirds, northern orioles, red-winged blackbirds, black-headed grosbeaks, and savannah and song sparrows were the most common species observed.

Mallards frequented the aquatic beds (AB). According to a local resident, a tall dead tree standing in a recently flooded area provided a popular perch for cormorants, herons, and egrets (pers. comm.). During the survey periods, double-crested cormorants, great blue herons, snowy egrets, and white-faced ibises were seen flying over the river in this Basin.

MAMMAL OBSERVATIONS

Mammals and mammalian sign seen in wetlands along the Jordan River included wetland-dependent species (muskrat, beaver), predators (red fox, long-tailed weasel), mule deer, and smaller mammals (vole and rabbit species). These data are based on incidental observations and provide only limited indications of the use of wetland habitat by mammals. Greenwood and Smith (1984) compiled a list of expected mammals along the Jordan River based on species' habitat requirements and distributions (Appendix 2).

Table 4. Mammals and mammaliam sign* observed incidently in wetlands along the Jordan River. Summer, 1986.

Basin	Species		Wetland[1] Class	Date Observed
1	Muskrat	Ondatra zibethica	SS/EM/AB	Jun 4
	Raccoon	Procyon lotor		
	Mule deer	Odocoileus hemionus		
	Mule deer (2)	Odocoileus hemionus	SS/EM	Aug 6
	Red fox*	Vulpes vulpes	EM/SS	Aug 6
	Unidentified rodent*		EM/SS	Aug 6
	Mule deer*	Odocoileus hemionus	SS/EM	Sep 8
	Beaver*	Castor canadensis	SB	Jan 1, 1987
3	Muskrat	Ondatra zibethica	AB	Jun 6
	Vole	Microtus sp.	SS	Jun 6
	Rock squirrel	Citellus variegatus	Other	Jun 6
	Muskrat	Ondatra zibethica	EM	Jun 6
	Vole	Microtus sp.	SS	Jun 24
	Muskrat	Ondatra zibethica	EM	Jun 26
	Muskrat	Ondatra zibethica	irrig. ditch	Jul 16
4	Unidentified rabbit*	Leporidae		Jun 6
	Muskrat*	Ondatra zibethica	EM	Jun 6
	Muskrat	Ondatra zibethica	canal	Jun 6
9	Muskrat	Ondatra zibethica	AB	Jun 3
	Red fox*	Vulpes vulpes	EM	
	Raccoon*	Procyon lotor	EM	
	Red fox (1 young)	Vulpes vulpes	EM	Jun 17
10	Long-tailed weasel	Mustela frenata	EM	Jun 25

[1]Cowardin et al. 1979.

REPTILES AND AMPHIBIANS

Incidental observations of reptiles and amphibians in wetlands along the Jordan River included unidentified species of garter snakes, toads, and frogs. Wetland habitat is critical for many species of reptiles and amphibians. In fact, locally some species' numbers and distributions have diminished because of degradation and loss of wetlands. Jordan River wetlands probably currently and potentially could support healthy populations of some species in this group of wildlife. More definitive information is needed pertaining to reptiles and amphibians and their specific management needs. Greenwood and Smith (1984) also provided a list of expected reptiles and amphibians along the Jordan River (Appendix 2).

CONCLUSIONS

The observations of birds and their uses of wetland habitats along the Jordan River during the summer does confirm the principle that the habitat functions of these local wetlands are indeed important in supporting wildlife populations. Qualitative analyses of the summer avian data at least indicates that the Jordan River wetlands provide feeding, breeding, rearing, and resting habitat for a diversity of species. Most of these species are wetland-obligate, and some are endangered or sensitive species.

The diversity of species is supported by the close association of diverse wetland habitat types. Patterns of habitat use by general species groups indicate the value of the variety of available wetland classes along the Jordan River.

General association between species groups and wetland habitats during the summer season:

Unconsolidated shorelines and bottoms and Aquatic beds (including oxbow meanders) - herons, egrets, waterfowl, breeding and migrating shorebirds

Emergent wetlands - ibises, waterfowl, rails, passerines

Scrub-shrub and Forested wetlands - Arboreal nesting birds, raptors, breeding and migrating passerines

The proximity of the diversity itself is a habitat attribute that supports species needing different wetlands for various activities. Black-crowned night herons, for example, nested in trees (FO) along the river but fed in aquatic bed (AB) and emergent (EM) wetlands. Furthermore, the systemic properties of the whole river ecosystem supports some species. The use of the river and its contiguous wetlands as a flyway by birds is indicative of the values of these properties.

The specific geographic location of the Jordan River wetlands warrants special consideration too. Some long-distance migrants have evolved physiological and energetic strategies that render them dependent on the availability of wetland and riparian habitats in specific areas along their flyways. Some of the shorebird and passerine species observed in Jordan River wetlands are examples of migrant species dependent on specific wetland feeding and stopover sites. Furthermore, the river system and its wetlands provide the habitat link between Utah Lake and the Great Salt Lake and, as suggested by summer observations, is valuable as a travel corridor for migrating birds and wildlife moving between the two lakes.

In addition, the ecological role the Jordan River wetlands play in the generally arid and open intermountain region should be considered. Regionally, the wetlands associated with the Jordan River represent part of a naturally limited and very unique habitat resource, particularly critical to migrating and resident wetland-dependent species. These relative habitat values increase even more as other wetlands are lost naturally (as with the recent rise of the Great Salt Lake and subsequent salt-water inundation of wetlands around the lake) or fragmented and degraded with expanding demands for space, water, and other resources that influence the integrity and sustenance of wetland ecosystems.

Assessment of relative habitat functions and values of particular wetlands and basins is difficult. Adamus (1983a) discusses this issue and attributes much of the complexity to wildlife species diversity (Appendix 4). Wetland habitat values are often species or community specific and are contingent on many variables. The summer data indicated that a variety of species with different needs are supported by the Jordan River wetland habitats.

For the purpose of the WAIDS evaluation, "effectiveness ratings" for habitat functions were assigned to wetlands by basins (Appendix 5). The ratings are qualitative and based on summer observations of wildlife (bird) occurrence and general wetland class and vegetative characteristics. "Probable" ratings were also assigned to basins for which no wildlife observations were made. These are based on wetland habitat use patterns determined from the summer wildlife observations and on available wetland classes and vegetative characteristics.

Relative indices such as wetland vegetation structure and diversity and wetland size are valid considerations as well. They are included in the effectiveness ratings. However, these indices are simplistic and do not account for all habitat functions. Specific issues like the existing and potential use of the Jordan River wetlands by endangered, sensitive, declining, migratory or endemic species also influence the value of habitat functions. The Jordan River wetlands do provide habitat for a number of wildlife species needing special attention.

Evaluating habitat functions and basing management decisions on relative values of individual wetlands and basins also overlooks the collective functions of these wetlands as part of the whole Jordan River system. Site-specific habitat values are limited. As the varied activities of the rich diversity of bird species observed just during the summer indicates, the association between individual wetland sites along the entire river length is itself a very important functional value. Further fragmentation will exclude species dependent on this association and will diminish wetland habitat values.

Supporting hydrological and ecological processes and the role of river dynamics in wetland habitat creation and sustenance also require consideration in assessing wetland values (Appendix 6). The functional habitat values of all the wetlands along the Jordan River are related. Activities affecting any individual wetland site could also affect values of other wetlands, indirectly as well as directly. For example, activities that destroy or degrade wetlands often represent financial investments that stimulate (publicly-financed) programs that protect the investments. Flood control efforts such as

channelization and dredging aimed at protecting housing, utilities and other facilities near the river interfere with the natural river dynamics that sustain wetlands. The Jordan River wetlands and floodplain should be considered integral parts of the river itself. If the loss or degradation of individual wetlands is permitted (justified by relatively low site-specific habitat or other functional values in comparison to other wetlands along the river), the habitat quality of other wetlands could also be compromised.

The surrounding urbanization should also influence values assigned to the habitat functions of the wetlands. Some specific habitat values become critical as the extent and rate of industrial, commercial, and residential development expands locally. Habitat functions of the Jordan River wetlands can be maintained in this urban environment though. Indeed, if the wetlands and their supporting processes are protected, they could play a beneficial role in integrative urban management efforts.

Finally, assessment of habitat and other wetland functions should include consideration of potential as well as existing values. Land and water uses and other activites have influenced the river and its wetlands in many ways. Not all these effects are irreversible and evaluation of wetland functions should not be limited to current conditions. In fact, as wetland and riparian habitats are degraded or lost on a large scale, it is becoming increasingly important to consider restoration and enhancement strategies.

RECOMMENDATIONS

Habitat functional values of Jordan River wetlands are significant and include the collective functions of individual wetlands within the whole river system. These existing values should be maintained, and management stategies should encompass the broad watershed and dynamic river processes that sustain the wetlands and their habitat qualities. In sites where wetland vegetation and habitat values have been degraded, restoration and enhancement opportunities exist and should be pursued with revegetation efforts, grazing management, and preservation of water fluctuations and physical diversity. The role of the long-term dynamics of the river in influencing wetland vegetation and habitat values needs recognition. Consideration and inclusion of these river-system properties and processes are recommended in efforts to protect and maximize wetland values along the Jordan River.

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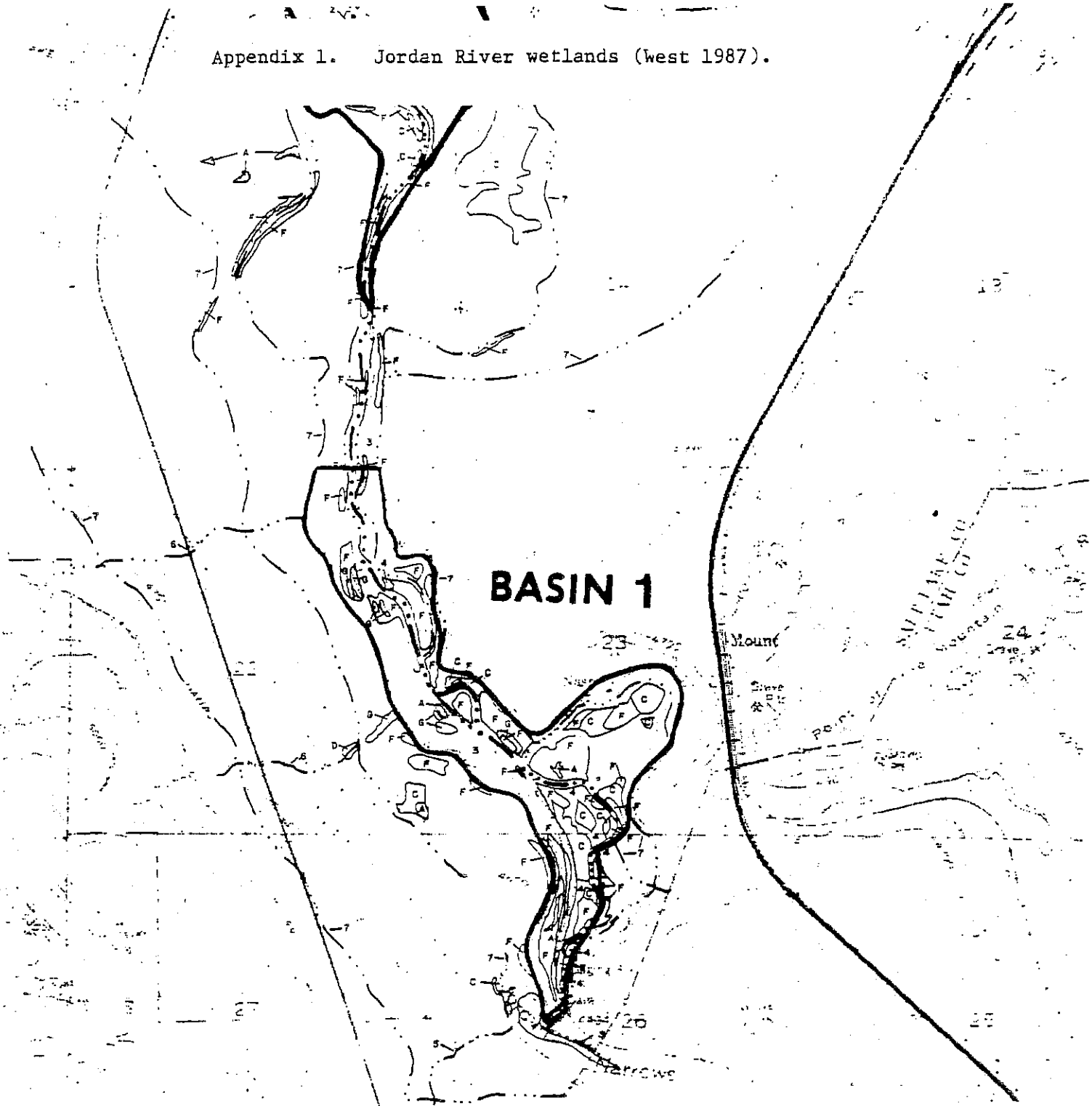
APPENDIX

Appendix 1. Jordan River wetlands (West 1987).



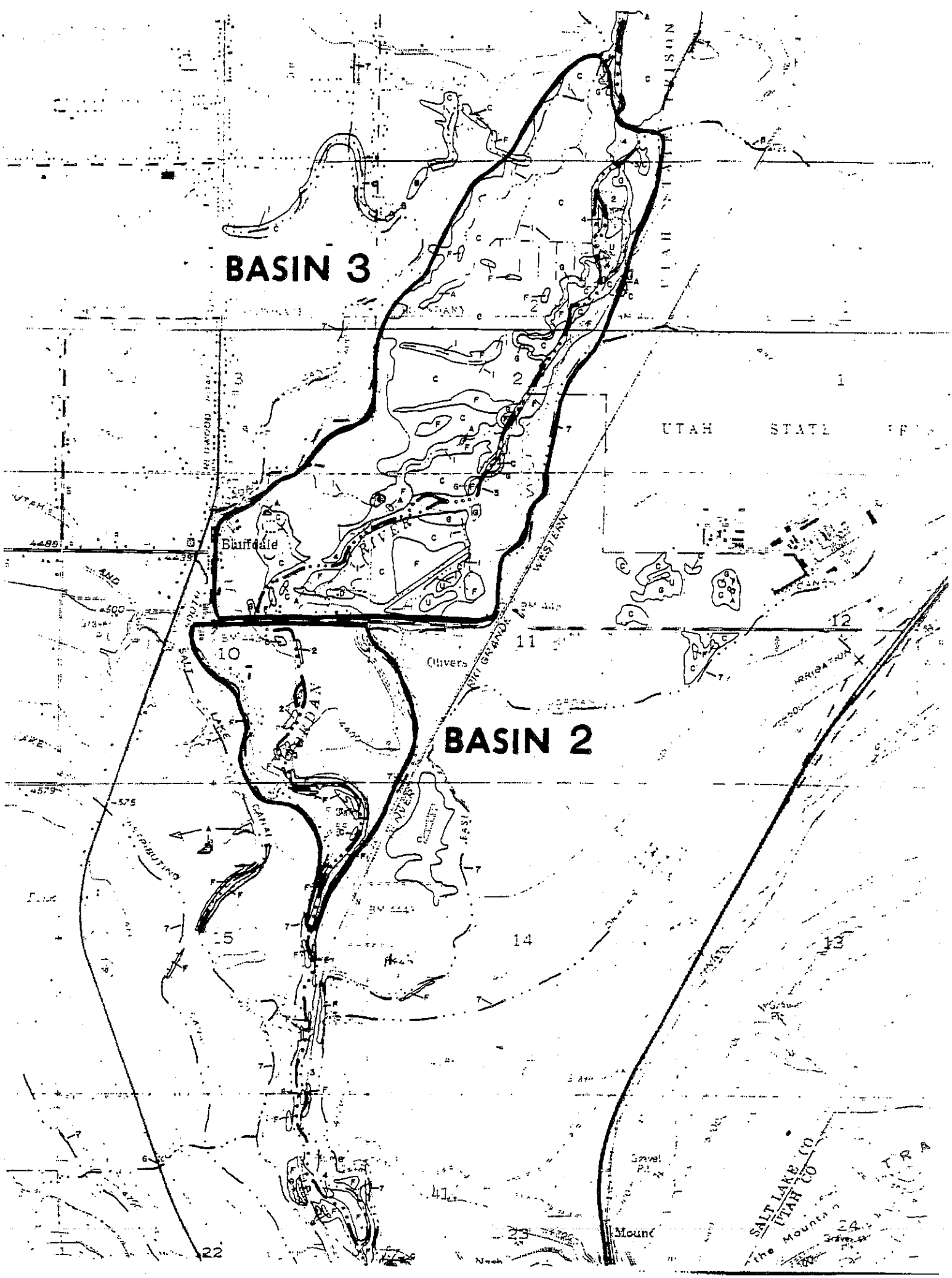
Basins and wetlands of the Jordan River, Narrows to 2100 South.

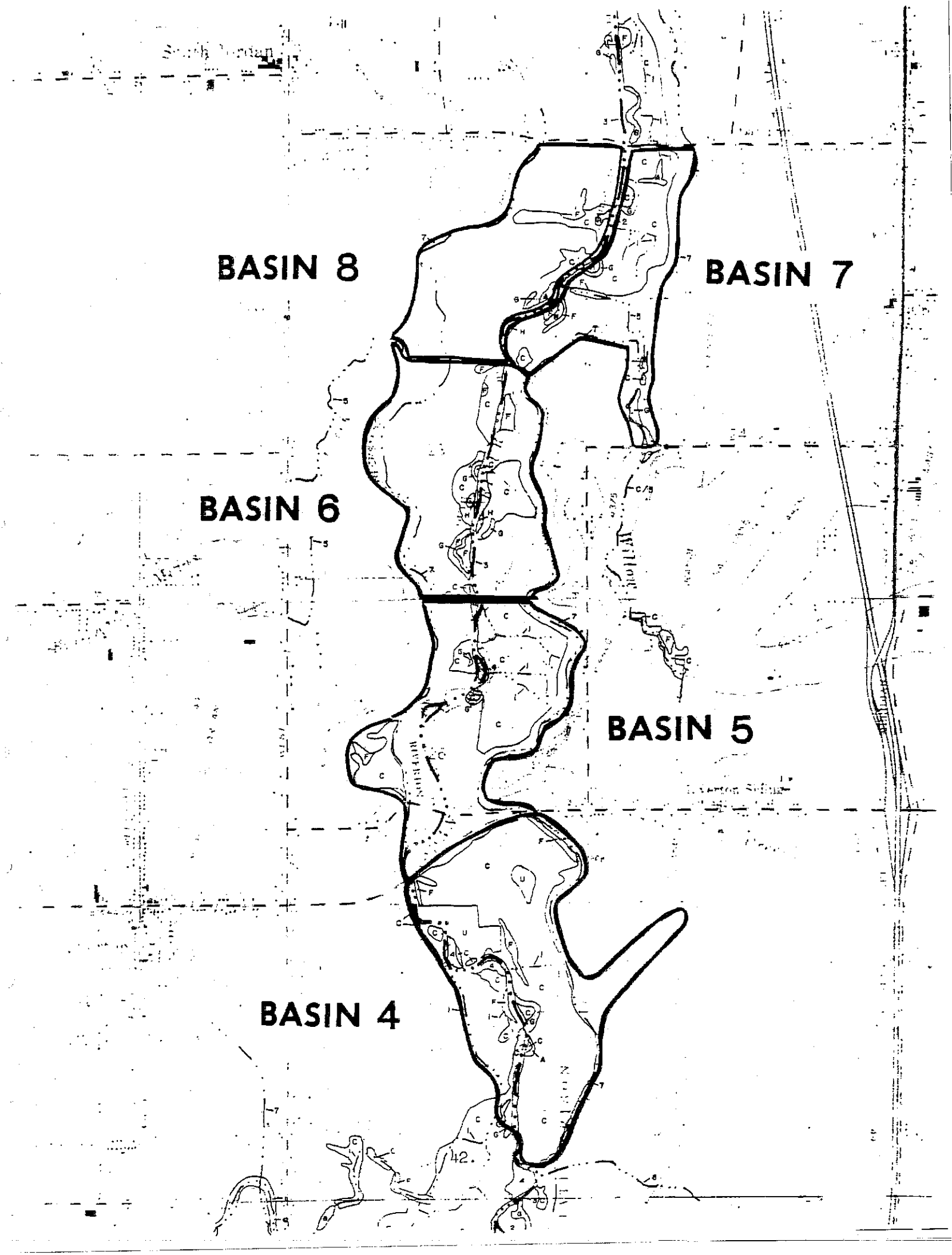
Wetland Systems and Classes (Cowardin et al. 1979)

Map Legend

Riverine (R)		Palustrine (P)	
1	R2ABF	A	Aquatic Bed (AB)
2	R2EMC	B	PABF
3	R2UBH	C	Emergent (EM)
4	R2USD	D	Forested (FO)
5	R4SBC	E	PRB
6	R4SBJ	F	Scrub-Shrub (SS)
7	R4SBKx	G	Unconsolidated Bottom (UB)
		H	Unconsolidated Shore (US)
		U	Upland

West, P. 1987. WAIDS wetland mapping. Summary report of Jordan River wetland mapping.


BASIN 3
BASIN 2
Bluffdale
Olivers
UTAH STATE
SALT LAKE CO.
UTAH CO.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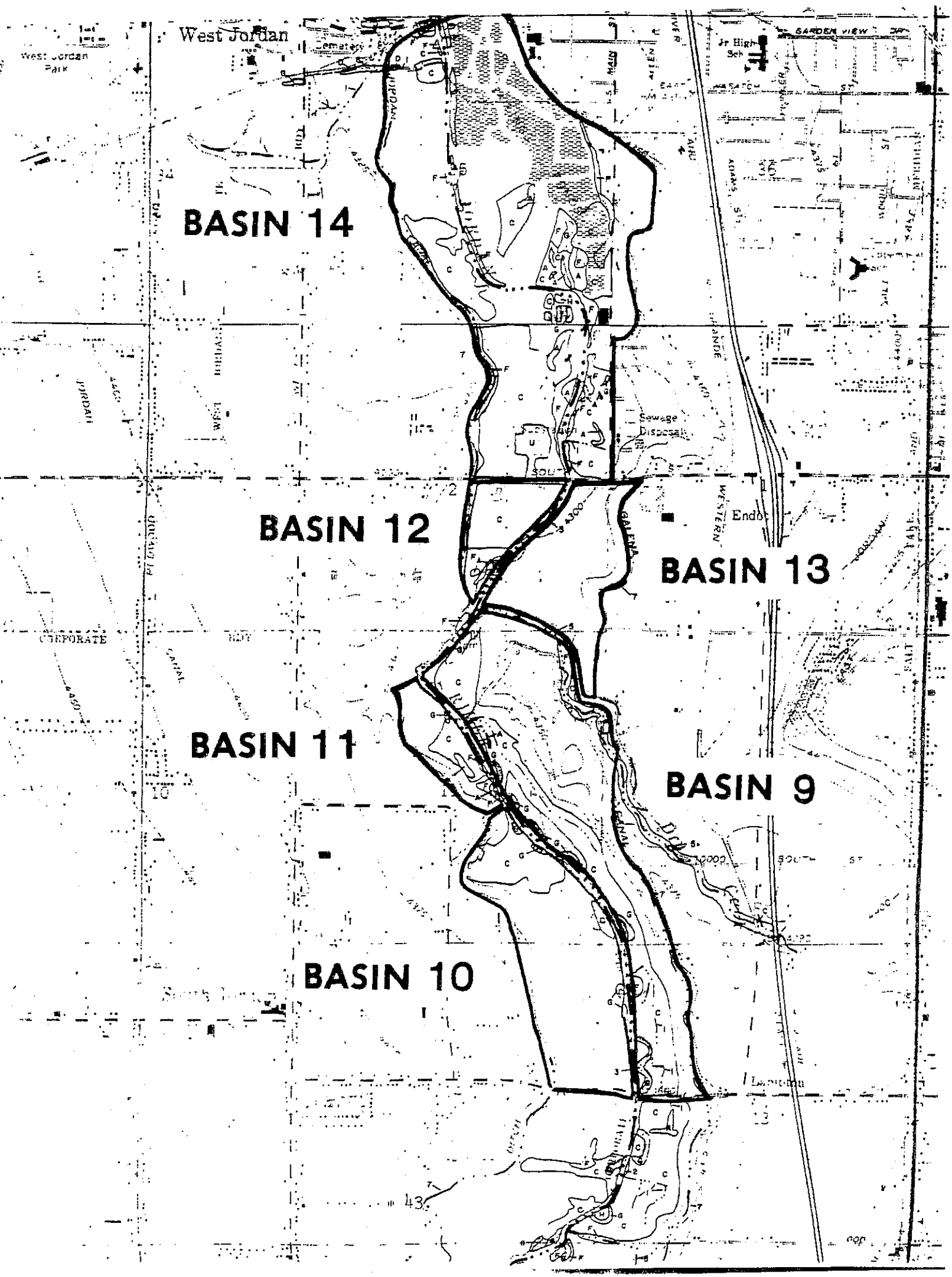
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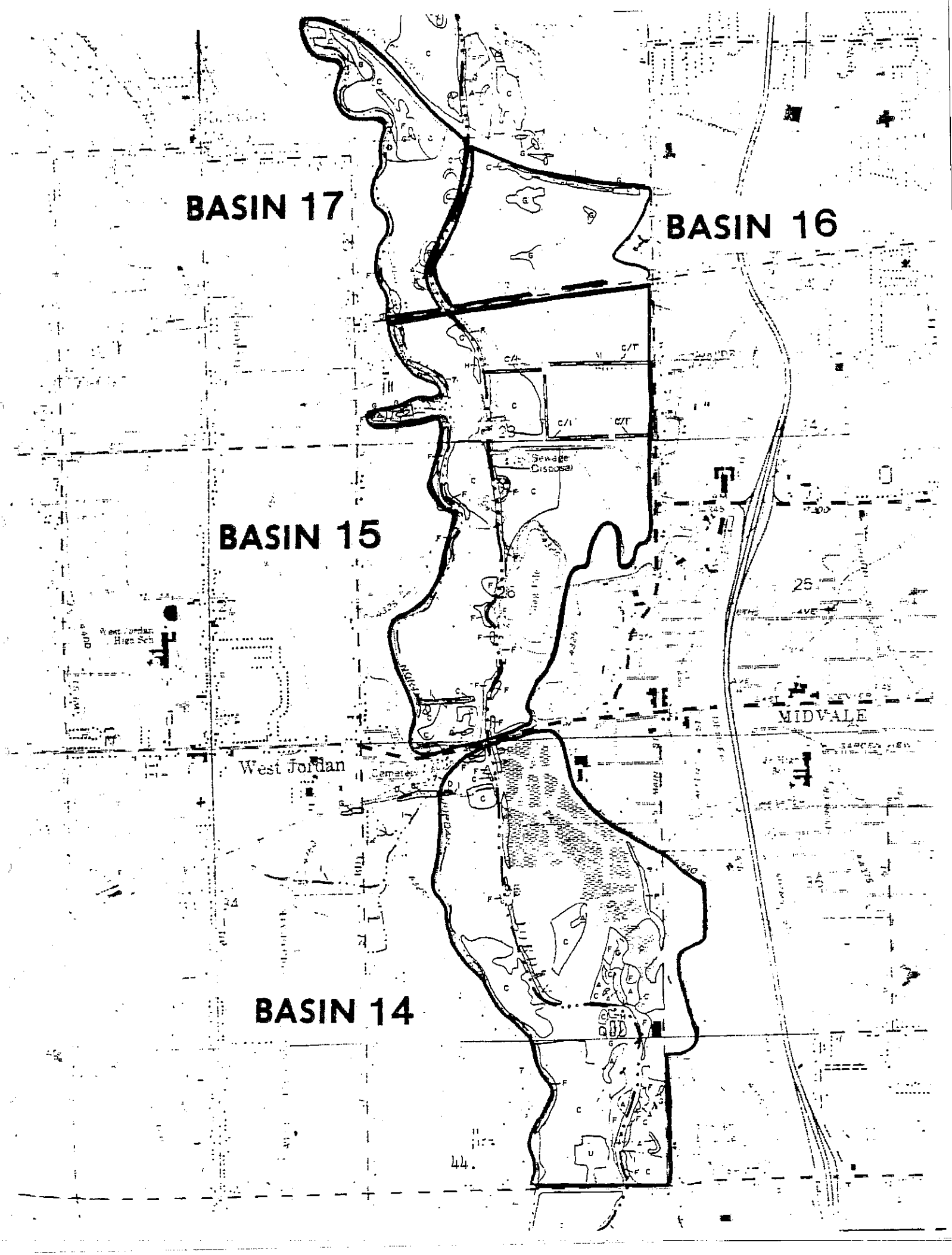
BASIN 10
Sewage Disposal
Endot
CORPORATE
43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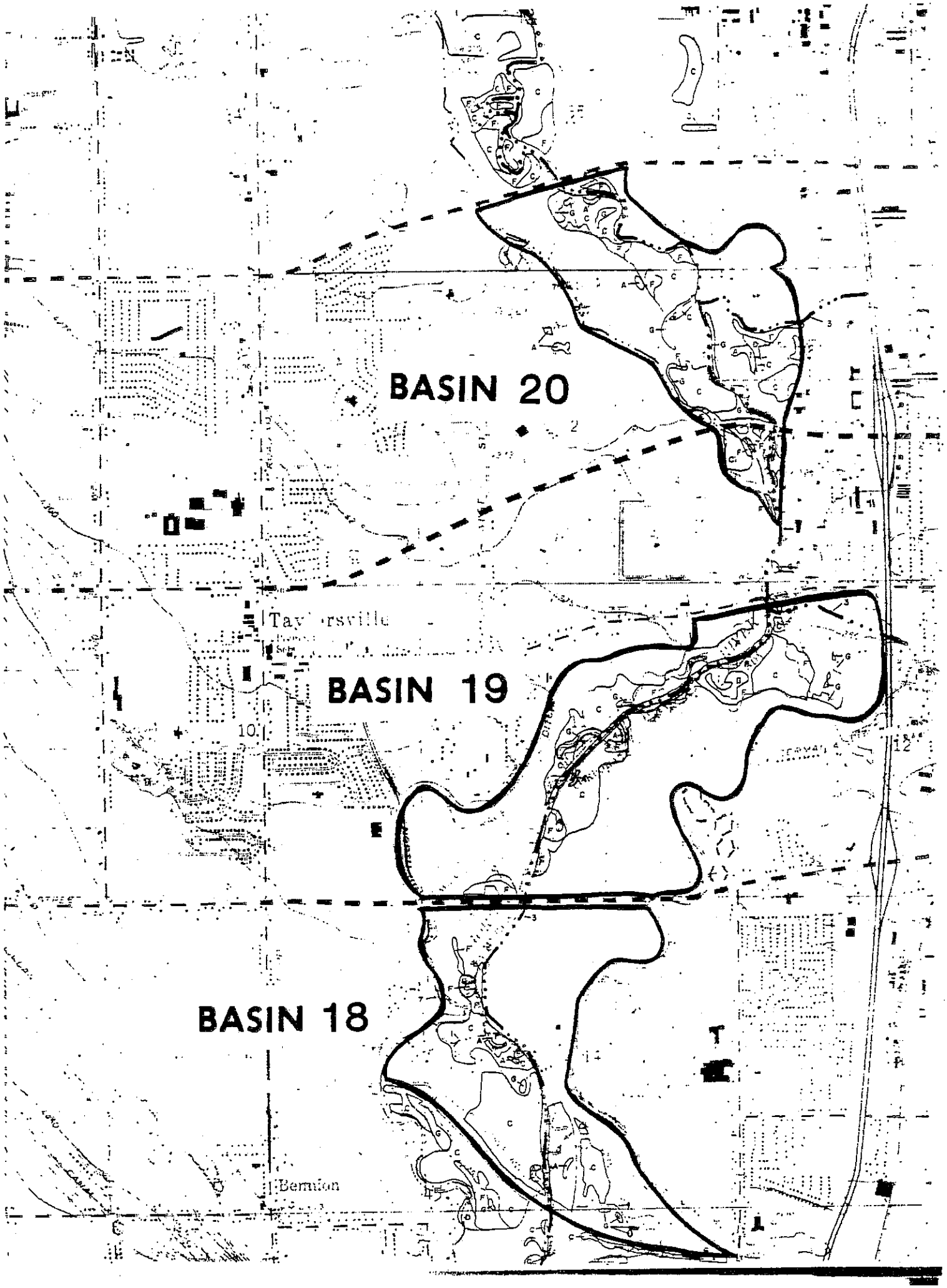
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BASIN 19
BASIN 18
Taylorsville
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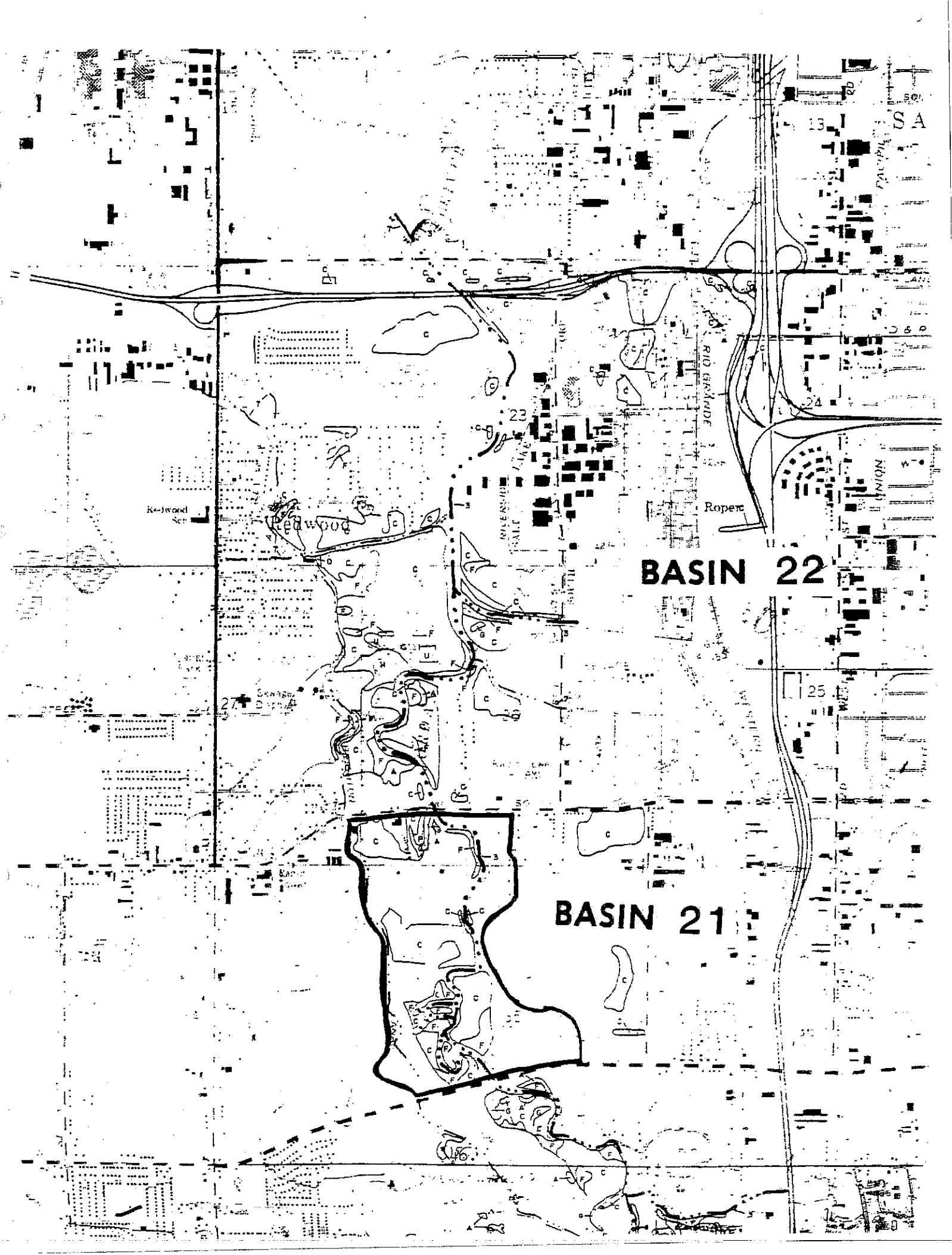
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BASIN 21
Redwood
Ropere
RIO GRANDE
23
24
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27

Appendix 2.

From: Smith, R. B. and C. L. Greenwood. 1984. Jordan River terrestrial wildlife inventory proposed Lampton Reservoir area. Bonneville Unit, Central Utah Project.

List of Wildlife Species Observed or Potentially Occurring in the Jordan River Study Area

Following is a list of vertebrate wildlife species that occur or are believed to occur in the study area. Species that we observed or could find a record of occurrence for are denoted with an asterisk (*). The following code letters are used to describe the status for each species. Status was based on general observations and knowledge, but was rather speculative in many cases.

C Common - These species are widespread and abundant.
U Uncommon - These species are widespread, but not abundant.
R Rare - These species are seldom identified during any one year.
O Occasional - These species are periodically identified during a long term period (10-50 years).
A Accidental - Distribution for these species does not normally include this area. Sightings are as far between as 50 to 100 years.
E Endangered - These species are endangered with extinction or extirpation.
L Limited - These species are common but restricted to a particular area or habitat type in Utah.
P Protected - These species are protected by state or federal laws in Utah.
N Nonprotected - These species are not protected by any laws in Utah.
G Game or furbearer species.

Species	Status
AMPHIBIANS	
Family Ambystomidae	
Tiger salamander - *Ambystoma tigrinum*	C-P
Family Pelobatidae	
Great Basin spadefoot toad - *Scaphiopus intermontanus*	C-P
Family Bufonidae	
Woodhouse's toad - *Bufo woodhousei*	C-P
Western toad - *Bufo boreas*	C-P

Species	Status
Family Ranidae	
Bullfrog - Rana catesbeiana	L-P
Leopard frog - Rana pipiens	C-P
Family Hylidae	
Boreal chorus frog - Pseudacris triseriata	C-P
REPTILES	
Family Iguanidae	
Great Basin fence lizard - Sceloporus occidentalis	C-P
*Northern sagebrush lizard - Sceloporus graciosus	C-P
Side-blotched lizard - Uta stansburiana	C-P
Family Scincidae	
Great Basin skink - Eumeces skiltonianus	L-P
Family Boidae	
Utah rubber boa - Charina bottae	C-P
Family Colubridae	
*Wandering garter snake - Thamnophis elegans	C-P
Valley garter snake - Thamnophis sirtalis	U-P
Regal ring-necked snake - Diadophis punctatus	U-P
*Western yellow-bellied racer - Coluber constrictor	C-P
Western smooth green snake - Opheodrys vernalis	U-P
*Gopher snake - Pituophis melanoleucus	C-P
Western milk snake - Lampropeltis triangulum	U-P
Western long-nosed snake - Rhinocheilus lecontei	C-P
Family Viperidae	
Great Basin rattlesnake - Crotalus viridis	C-P
MAMMALS	
Order Insectivora	
Family Soricidae	
Merriam shrew - Sorex merriami	U-N
Vagrant shrew - Sorex vagrans	C-N
Dusky shrew - Sorex obscurus	C-N
Northern water shrew - Sorex palustris	
Family Vespertilionidae	
*Silver-haired bat - Lasionycteris noctivagans	
*Hoary bat - Lasiurus cinereus	
*Spotted bat - Euderma maculata	
Pallid bat - Antrozous pallidus	
*Small-footed bat - Myotis leibii	C-N
*Little brown bat - Myotis lucifugus	C-N

Species	Status
MAMMALS (Cont'd.)	
*Long-eared bat - Myotis evotis	C-N
Western pipistrelle bat - Pipistrellus hesperus	C-N
*Big brown bat - Eptesicus fuscus	C-N
*Long-legged myotis - Myotis volans	
Family Molossidae	
*Mexican freetail bat - Tadarida brasiliensis	
Family Leporidae	
*Black-tailed jackrabbit - Lepus californicus	C-N
*Desert cottontail - Sylvilagus auduboni	C-P-G
Family Sciuridae	
Townsend ground squirrel - Citellus townsendi	L-N
*Rock squirrel - Citellus variegatus	C-N
Least chipmunk - Eutamias minimus	C-N
Family Geomyidae	
*Valley pocket gopher - Thomomys bottae	C-N
Family Heteromyidae	
Great Basin pocket mouse - Perognathus parvus	C-N
Ord kangaroo rat - Dipodomys ordi	C-N
Great Basin kangaroo rat - Dipodomys microps	C-N
Dark kangaroo mouse - Microdipodops megacephalus	U-N
Family Castoridae	
*Beaver - Castor canadensis	C-P-G
Family Cricetidae	
Western harvest mouse - Reithrodontomys megalotis	C-N
Deer mouse - Peromyscus maniculatus	C-N
Brush mouse - Peromyscus boylei	C-N
Northern grasshopper mouse - Onychomys leucogaster	U-N
*Muskrat - Ondatra zibethica	C-N
*Meadow vole - Microtus pennsylvanicus	C-N
Mountain vole - Microtus montanus	C-N
Longtail vole - Microtus longicaudus	C-N
Sagebrush vole - Microtus curtatus	C-N
Family Muridae	
Black rat - Rattus rattus	C-N
Norway rat - Rattus norvegicus	C-N
House mouse - Mus musculus	C-N

Species	Status
MAMMALS (Cont'd.)	
Family Zapodidae	
W. jumping mouse - *Zapus princeps*	C-N
Family Erethizontidae	
Porcupine - *Erethizon dorsatum*	C-N
Family Canidae	
Coyote - *Canis latrans*	C-N
*Red fox - *Vulpes fulva*	L-N
Family Procyonidae	
*Raccoon - *Procyon lotor*	C-N
Family Mustelidae	
Long-tailed weasel - *Mustela frenata*	C-P-G
Mink - *Mustela vison*	L-P-G
Badger - *Taxidea taxus*	C-P-G
*Striped skunk - *Mephitis mephitis*	C-P-G
Spotted skunk - *Spilogale putorius*	C-P-G
Family Felidae	
Bobcat - *Lynx rufus*	C-P-G
Family Cervidae	
*Mule deer - *Odocoileus hemionus*	C-P-G
BIRDS	
Order Popicipediformes	
Family Podicipedidae	
*Eared grebe - *Podiceps nigricollis*	C-P
*Western grebe - *Aechnophorus occidentalis*	C-P
*Pied-billed grebe - *Podilymbus podiceps*	C-P
Order Pelecaniformes	
Family Pelcanidae	
White pelican - *Pelecanus erythrorhynchos*	C-P
Family Phalacrocoracidae	
*Double-crested cormorant - *Phalacrocorax auritus*	U-P
Order Ciconiiformes	
Family Ardeidae	
*Great blue heron - *Ardea herodias*	C-P
Cattle egret - *Bubulcus ibis*	O-P
*Snowy egret - *Egretta thula*	C-P
*Black-crowned night heron - *Nycticorax nycticorax*	C-P

Species	Status
BIRDS (Cont'd.)	
Family Threskiornithidae	
*White-faced ibis - Plegadis chihi	C-P
Order Anseriforms	
Family Anatidae	
Whistling swan - Olor columbianus	C-P-G
*Canada goose - Branta canadensis	C-P-G
White-fronted goose - Anser albifrons	O-P-G
Snow goose - Chen caerulescens	C-P-G
*Mallard - Anas platyrhynchos	C-P-G
*Gadwall - Anas strepera	C-P-G
*Pintail - Anas acuta	C-P-G
*Green-winged teal - Anas crecca	C-P-G
*Blue-winged teal - Anas discors	U-P-G
*Cinnamon teal - Anas cyanoptera	C-P-G
*American widgeon - Anas americana	C-P-G
*Northern shoveler - Anas clypeata	C-P-G
*Redhead - Aythya americana	C-P-G
*Ring-necked duck - Aythya collaris	U-P-G
Canvasback - Aythya valisineria	C-P-G
*Lesser scaup - Aythya affinis	C-P-G
Common goldeneye - Bucephala clangula	C-P-G
Bufflehead - Bucephala albeola	C-P-G
*Ruddy duck - Oxyura jamaicensis	C-P-G
*Common merganser - Mergus merganser	C-P-G
*Red-breasted merganser - Mergus serrator	C-P-G
Order Falconiformes	
Family Cathartidae	
*Turkey vulture - Cathartes aura	C-P
Family Accipitridae	
*Sharp-shinned hawk - Accipiter striatus	C-P
Cooper's hawk - Accipites cooperii	C-P
*Red-tailed hawk - Buteo jamaicensis	C-P
Swainson's hawk - Buteo swainsoni	C-P
*Rough-legged hawk - Buteo lagopus	C-P
Ferruginous hawk - Buteo regalis	C-P
*Golden eagle - Aquila chrysaetos	C-P
Bald eagle - Haliaeetus leucocephalus	E-P
*Marsh hawk - Circus cyaneus	C-P
Family Pandionidae	
Osprey - Pandion haliaetus	U-P

Species	Status
BIRDS (Cont'd.)	
Family Falconidae	
*Prairie falcon - Falco mexicanus	C-P
Peregrine falcon - Falco peregrinus	E-P
*Merlin - Falco columbarius	U-P
*American kestrel - Falco sparverius	C-P
Order Galliformes	
Family Phasianidae	
*California quail - Lophortyx californicus	C-P-G
*Ring-necked pheasant - Phasianus colchicus	C-P-G
Order Gruiformes	
Family Gruidae	
Sandill crane - Grus canadensis	L-P
Family Rallidae	
*Virginia rail - Rallus limicola	C-P
*Sora rail - Porzana carolina	C-P
*American coot - Fulica americana	C-P
Purple gallinule - Prophyrula martinica	A-P
Order Charadriiformes	
Family Charadriidae	
*Killdeer - Charadrius vociferus	C-P
Black-bellied plover - Pluvialis squatarola	C-P
Family Scolopacidae	
*Common snipe - Capella gallinago	C-P-G
Long-billed curlew - Numenius americanus	C-P
Willet - Catoptrophorus semipalmatus	U-P
*Spotted sandpiper - Actitis macularia	C-P
Marbled godwit - Limosa fedoa	C-P
Solitary sandpiper - Tringa solitaria	U-P
Greater yellowlegs - Tringa Melanoleuca	C-P
Lesser yellowlegs - Tringa flavipes	C-P
Semipalmated sandpiper - Calidris pusilla	R-P
Western sandpiper - Calidris mauri	C-P
Long-billed dowitcher - Limnodromus scolopaceus	C-P
Family Recurvirostridae	
*American avocet - Recurvirostra americana	C-P
*Black-necked stilt - Himantopus mexicanus	C-P
Family Phalaropodidae	
*Wilson's phalarope - Steganopus tricolor	C-P

Species	Status
BIRDS (Cont'd.)	
Family Laridae	
*California gull - Larus californicus	C-P
Ring-billed gull - Larus delarwarensis	C-P
Franklin's gull - Larus pipixcan	C-P
Bonaparte's gull - Larus philidelphia	U-P
*Forster's tern - Sterna forsteri	C-P
Caspian tern - Sterna caspia	U-P
Black tern - Chilidonias niger	C-P
Order Columbiformes	
Family Columbidae	
*Rock dove - Columba livia	C-P
*Mourning dove - Zenaida macroura	C-P
Order Cuculiformes	
Family Cucuidae	
Yellow-billed cuckoo - Coccyzus americanus	U-P
Black-billed cuckoo - Coccyzus erythropthalmus	A-P
Order Strigiformes	
Family Tytonidae	
*Barn owl - Tyto alba	L-P
Family Strigidae	
Screech owl - Otus asio	C-P
*Great-horned owl - Bubo virginianus	C-P
Pygmy owl - Glaucidium gnoma	U-P
Burrowing owl - Athene cunicularia	L-P
Long eared owl - Asio otus	C-P
Short-eared owl - Asio flammeus	C-P
Saw-whet owl - Aegolius acadicus	C-P
Order Caprimulgiformes	
Family Caprimulgidae	
Poor-will - Phalaenoptilus nuttallii	C-P
*Common nighthawk - Chordeiles minor	C-P
Order Apodiformes	
Family Apodidae	
White-throated swift - Aeronautes saxatalis	C-P
Family Trochilidae	
Black-chinned hummingbird - Archilochus alexandri	C-P
*Broad-tailed hummingbird - Selasphorus platycercus	C-P

Species	Status
BIRDS (Cont'd.)	
Order Coraciiformes	
Family Alcedinidae	
*Belted kingfisher - Megaceryle alcyon	U-P
Order Piciformes	
Family Picidae	
*Common flicker - Colaptes auratus	C-P
Lewis' woodpecker - Melanerpes lewis	U-P
Yellow-bellied sapsucker - Sphyrapicus varius	C-P
Hairy woodpecker - Picoides villosus	C-P
*Downy woodpecker - Picoides pubescens	C-P
Order Passeriformes	
Family Alaudidae	
*Horned lark - Eremophila alpestris	C-P
Family Hirundinidae	
*Violet-green swallow - Tachycineta thalassina	C-P
*Tree swallow - Iridoprocne bicolor	C-P
*Bank swallow - Riparia riparia	C-P
*Rough-winged swallow - Stelgidopteryx ruficollis	C-P
*Barn swallow - Hirundo rustica	C-P
*Cliff swallow - Petrochelidon pyrrhonota	C-P
Family Corvidae	
Scrub jay - Aphelocoma coerulescens	C-P
*Black-billed magpie - Pica pica	C-P
*Common raven - Corvus corax	C-P
Common crow - Corvus brachyrhynchos	U-P
Family Tyrannidae	
*Eastern kingbird - Tyrannus tyrannus	C-P
*Western kingbird - Tyrannus verticalis	C-P
Eastern phoebe - Sayornis phoebe	R-P
Say's phoebe - Sayornis saya	C-P
Willow flycatcher - Empidonax traillii	C-P
Gray flycatcher - Empidonax wrightii	C-P
Western flycatcher - Empidonax difficilis	C-P
Western wood pewee - Contopus sordidulus	C-P
Family Paridae	
*Black-capped chickadee - Parus atricapillus	C-P
Bushtit - Psaltriparus minimus	C-P
Family Sittidae	
White-breasted nuthatch - Sitta carolinensis	C-P

Species	Status
BIRDS (Cont'd.)	
Family Certhiidae	
Brown creeper - *Certhia familiaris*	C-P
Family Cinclidae	
Dipper - *Cinclus mexicanus*	C-P
Family Troglodytidae	
House wren - *Troglodytes aedon*	C-P
Bewick's wren - *Thryomanes bewickii*	C-P
*Long-billed marsh wren - *Cistohorus palustris*	C-P
Family Mimidae	
Mockingbird - *Mimus polyglottos*	U-P
Gray catbird - *Dumetella carolinensis*	U-P
Sage thrasher - *Oreoscoptes montanus*	C-P
Family Turdidae	
*American robin - *Turdus migratorius*	C-P
Hermit thrush - *Catharus guttatus*	C-P
Veery - *Catharus fuscescens*	U-P
Western bluebird - *Sialia mexicana*	U-P
*Mountain bluebird - *Sialia currucoides*	C-P
Family Motacillidae	
Water pipet - *Anthus spinoletta*	C-P
Family Bombycillidae	
Bohemian waxwing - *Bombycilla garrulus*	C-P
Cedar waxwing - *Bombycilla cedrorum*	U-P
Family Laniidae	
*Northern shrike - *Lanius excubitor*	U-P
*Loggerhead shrike - *Lanius ludovicianus*	C-P
Family Sturnidae	
*Starling - *Sturnus vulgaris*	C-P
Family Vireonidae	
Solitary vireo - *Vireo solitarius*	U-P
Red-eyed vireo - *Vireo olivaceus*	A-P
Warbling vireo - *Vireo gilvus*	C-P

Species	Status

BIRDS (Cont'd.)

Family Parulidae

Orange-crowned warbler - Vermivora celata	C-P
*Yellow warbler - Dendroica petechia	C-P
Black-throated blue warbler - Dendroica caerulescens	A-P
*Yellow-rumped warbler - Dendroica coronata	C-P
Black-throated gray warbler - Dendroica nigrescens	C-P
*Common yellowthroat - Geothlypis trichas	C-P
*Yellow-breasted chat - Icteria virens	C-P
Wilson's warbler - Wilsonia pusilla	C-P
American redstart - Setophaga ruticilla	U-P

Family Ploceidae

*House sparrow - Passer domesticus	C-P

Family Icteridae

Bobolink - Dolichonyx oryzivorus	L-P
*Western meadowlark - Sturnella neglecta	C-P
*Yellow-headed blackbird - Xanthocephalus xanthocephalus	C-P
*Red-winged blackbird - Agelaius phoeniceus	C-P
*Northern oriole - Icterus galbula	C-P
*Brewer's blackbird - Euphagus cyanocephalus	C-P
*Brown-headed cowbird - Molothrus ater	C-P

Family Thraupidae

Western tanager - Piranga ludoviciana	C-P

Family Fringillidae

Black-headed grosbeak - Pheucticus melanocephalus	C-P
Blue grosbeak - Guiraca caerulea	C-P
*Lazuli bunting - Passerina amoena	C-P
Lapland longspur - Calcarius lapponicus	U-P
Lark bunting - Calamospiza melanocorys	U-P
Fox sparrow - Passerella iliaca	U-P
*Song sparrow - Melospiza melodia	C-P
Lincoln sparrow - Melospiza lincolnii	C-P
*White-crowned sparrow - Zonotrichia leucophrys	C-P
White-throated sparrow - Zonotrichia albicollis	R-P
*Dark-eyed junco - Junco hyemalis	C-P
*Gray-headed junco - Junco caniceps	C-P
*Savannah sparrow - Passercules sandwichensis	C-P
Grasshopper sparrow - Ammodramus savannarum	O-P
Tree sparrow - Spizella arborea	U-P
Chipping sparrow - Spizella passerina	C-P
Brewer's sparrow - Spizella breweri	C-P
*Vesper sparrow - Pooecetes gramineus	C-P
*Lark sparrow - Chondestes grammacus	C-P
Black-throated sparrow - Amphispiza bilineata	C-P
Green-tailed towhee - Pipilo chlorurus	C-P
Rufous-sided towhee - Pipilo erythrophthalmus	C-P
Evening grosbeak - Hesperiphona vespertina	C-P
Cassin's finch - Carpodacus cassinii	C-P
*House finch - Carpodacus mexicanus	C-P
Black rosy finch - Leucosticte atrata	U-P
Common redpoll - Carduelis flammea	U-P
*American goldfinch - Carduelis tristis	C-P
Lesser goldfinch - Carduelis psaltria	U-P

Appendix 3.

From: Smith, R. B. and C. L. Greenwood. 1984. Jordan River terrestrial wildlife inventory. Proposed Lampton Reservoir area. Bonneville Unit, Central Utah Project.

Table 7. Waterfowl species and numbers observed during monthly surveys on the Jordan River study area, Salt Lake County, Utah, Nov. 1982 - Aug. 1983.

Species	Number observed										% of total
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
American widgeon	0	0	10	1	0	0	0	0	0	0	1
Blue-winged teal	0	0	0	0	0	0	8	9	0	0	1
Cinnamon teal	0	0	10	7	26	82	78	64	102	64	23
Common merganser	1	0	8	0	3	0	0	0	0	2	1
Gadwall	0	0	0	0	2	22	3	1	0	9	2
Green-winged teal	0	4	6	38	105	268	0	1	0	13	24
Lesser scaup	0	0	0	0	0	0	0	1	0	0	tr[a]
Mallard	16	22	159	61	83	50	32	48	65	81	33
Northern shoveler	0	2	46	9	8	2	0	1	2	20	5
Pintail	0	2	15	4	9	7	0	24	11	4	4
Redhead	0	0	0	0	2	10	0	9	5	4	2
Ruddy duck	0	0	0	0	0	0	0	0	7	5	1
Red-breasted merganser	0	0	0	0	0	4	0	0	0	0	tr
Canada goose	0	4	26	11	0	0	0	0	0	11	2
Unidentified	0	0	0	0	0	4	8	3	9	2	1
Total	17	34	280	131	238	449	129	161	201	215	100

[a]Trace = < 1%

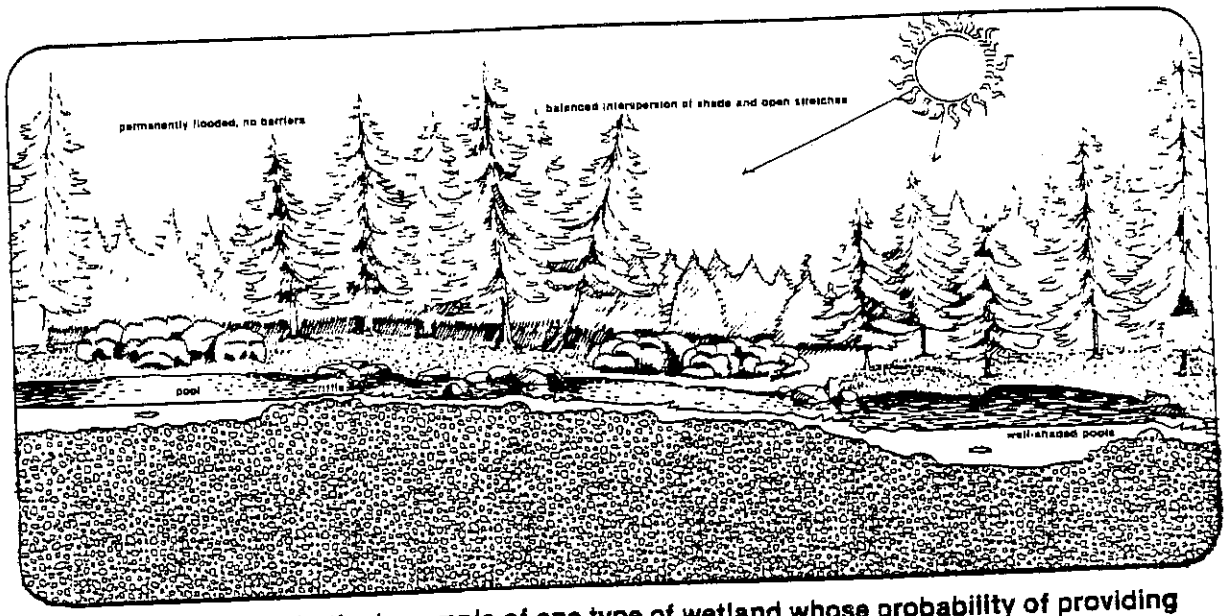

Figure 9. Hypothetical example of one type of wetland whose probability of providing good fishery habitat (for most coldwater riverine species) might be high

Such wetlands are described more precisely in Vol. II, p. 73-76.

spersion of open water and vegetation, or of various vegetation and sediment types, is not conclusively known for any fishery species. Fishes highly dependent on aquatic vegetation for cover are indicated in Tables 7 and 8, Volume II.

2.8 Habitat for Wildlife

2.8.1 DEFINITIONS

Habitat, as used in this manual, pertains to those features which affect the food and cover needs of wildlife in the place where they reside.

Wildlife includes birds, mammals, reptiles, and amphibians. Because the list of all such vertebrates using wetlands would be exhaustive, this manual focuses on those which are most strongly dependent on wetlands, and for which available information is adequate to distinguish levels of use among various wetland types. Because most such species are birds, the analysis presented in this manual focuses on birds, including harvested waterfowl and other harvested and nongame species which require wetlands (Table 9, Vol. II). Only species which are regular inhabitants of the United States, and are not necessarily threatened or endangered, are included, on the assumption that most users already have available to them information on habitat needs of these rarer species. The focus on birds should in no sense imply that other wetlands wildlife, particularly furbearers (principally muskrat, nutria, beaver, mink, otter, and raccoon), some other mammals (e.g., water shrew, swamp rabbit, many seals, manatees), most amphibians (e.g., frogs, salamanders), some reptiles (e.g., bog turtle, sea turtles, alligator), as well as some insects (e.g., bog elfin butterfly, mayflies) are any less important or dependent on wetlands.

It is difficult to judge what constitutes an "obligatory" or dependent relationship between a species and its habitat. For this manual, wetland-dependent species are defined as being only those which normally use wetlands almost exclusively for food and cover throughout most of their U.S. range, and which spend most of their lifetime within wetlands. This excludes the scores of animals which require wetlands just as a source of drinking water, as winter cover (e.g., northern deer and pheasants), as a haven and dispersal center within urban areas (e.g., oppossum), or for other purposes. In reality, the needs of such species are often just as critical.

The degree of dependence on wetlands in general, as well as wetlands of a specific type, often varies greatly for any given species depending on the abundance and distribution of wetlands and suitable alternative habitats within a region. For example, riparian wetlands in the arid Southwest may support many species which in other parts of their range are much less likely to inhabit wetlands.

2.8.2 INTERACTIONS WITH OTHER WETLAND FUNCTIONS

Direct Economic Significance: Birding, hunting, and other wildlife-oriented recreational activities are important to many local and a few regional economies. The dollar value of the nationwide harvest of wetland-dependent wildlife is given species-specifically by Chabreck (1979a). Depredations by wetland-associated wildlife may also result in locally significant crop losses, while wildlife collisions with vehicles may be costly to individuals. Damming activities by beaver may damage roads and kill valuable timber or crops, and muskrats may undermine causeway stability with their burrowing.

Ground Water Recharge and Discharge; Flood Storage: Although this interaction is usually negligible, beaver dams may have some temporary local influence.

Shoreline Anchoring; Sediment Trapping: Waterfowl and aquatic furbearers occasionally and temporarily devastate local aquatic vegetation, thus potentially aggravating erosion and sedimentation. On the other hand, beaver dams may expedite sediment trapping.

Nutrient Retention and Removal; Food Chain Support: Colonial water birds and concentrations of feeding gulls and waterfowl may occasionally play a key role in dispersing or concentrating nutrients within a watershed, at least during certain seasons (Burton et al. 1979). Waterfowl such as geese which extract root as well as above-ground portions of aquatic plants may be critical for cycling appreciable amounts of nutrients (up to 58 percent of plant biomass) which otherwise would remain permanently buried and unavailable to fishery food chains (Smith and Odum 1981).

Habitat for Fisheries: Channels opened in wetland vegetation by muskrats may allow access of fishes to new feeding areas, as well as enhance interspersion important to waterfowl. Alligator "holes" may hold water during dry periods, serving as refuge for other wildlife and fish. Beaver impoundments may have temporary, localized, adverse or positive effects on stream fisheries. Areas which are ideal habitat for most wildlife species are not necessarily good habitat for most fisheries.

Active Recreation: Wildlife observation is often a focus of recreational boaters, particularly canoeists. However, presence of some wildlife (e.g., alligators) may deter some recreational uses.

2.8.3 VALIDITY

A large and important segment of the North American fauna depends on wetlands for habitat. Few of the species described in this manual can adjust to using terrestrial environments if their native wetland disappears. However, some (e.g., waterfowl) appear to be "adapted" to the naturally dynamic character of wetlands and may travel great distances in search of replacement wetlands. Their success in doing so depends on the biological carrying capacity and distribution of other wetlands in the region. There are no known cases where diminuation of wetland habitat resulted in a population shift to remaining wetland habitat without adverse impact on the total population (Clark and Clark 1979).

Although the wetland-upland edge is often among the most diverse and productive environments for wildlife (Brinson et al. 1981), species richness and wildlife population densities in wetlands are sometimes lower than those of adjacent uplands. When viewed from a geographically broader perspective, however, wetlands contribute to the presence of many species which otherwise would be lacking from the regional fauna. For example, monotypic moss wetlands (bogs) and tidal emergent wetlands (salt marshes) typically have an impoverished breeding bird fauna, but many of the species which do occur (e.g., palm warbler and seaside sparrow, respectively) are highly specialized and unlikely to breed in other wetland or terrestrial environments. Of course, in a few very wet regions, terrestrial environments may actually be scarce, and if equally threatened by development, may be more deserving of attention if regional diversity is to be maintained.

2.8.4 FUNCTIONAL THRESHOLDS AND QUANTIFICATION

Relatively little literature suggests generally applicable, quantitative criteria for what constitutes a "significant" level of wildlife or wildlife habitat abundance or diversity, especially in terms of wetlands. This will, of course, vary according to the species, region, and perceptions of the public. The following criteria have been suggested by scientists of the International Union for the Conservation of Nature (IUCN) (Szijj 1972) as defining wetlands of international significance for birds:

- --Regularly supports 1 percent (being at least 100 individuals) of the flyway or biogeographical population of one species of waterfowl;
- --Regularly supports either 10,000 ducks, geese, and swans, or 10,000 coots, or 20,000 waders;
- --Supports an appreciable number of endangered species of plant or animal;
- --Is of special value for maintaining genetic and ecological diversity because of the quality and peculiarities of its flora and fauna; and
- --Plays a major role in its region as the habitat of plants and of aquatic and other animals of scientific or economic importance.

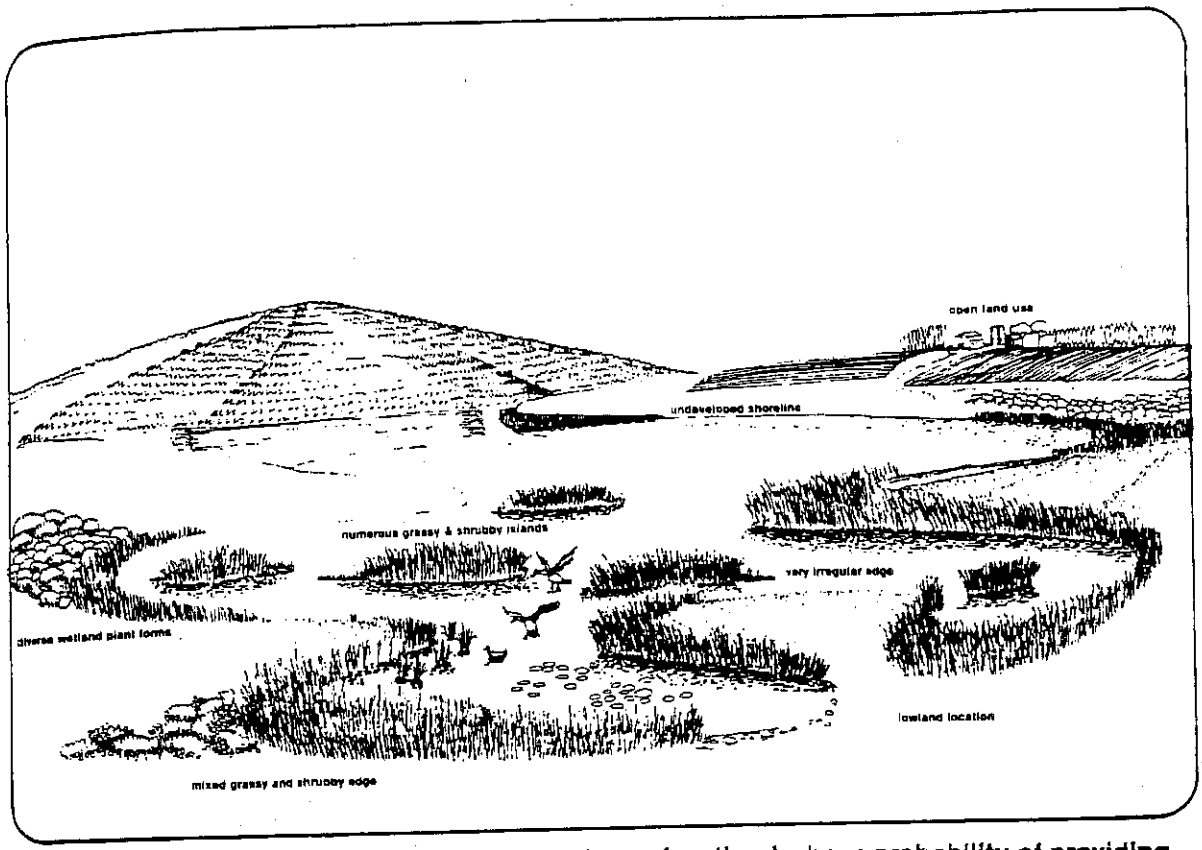

Figure 10. Hypothetical example of one type of wetland whose probability of providing good wildlife habitat (for most nesting dabbling ducks) might be high

Such wetlands are described more precisely in Vol. II, p. 80-81.

advance or be reversed much more rapidly than on uplands, it is crucial that a variety of wetland types be present simultaneously throughout a region. This is particularly true in regions subject to frequent drought (mostly those where evaporation exceeds precipitation, as shown in Vol.II,p.35) or catastrophic flooding (e.g., hurricane-prone regions). Prairie-nesting waterfowl in particular seem to require a wide variety of closely associated wetland basins within their home range (Flake 1979). However, species with smaller home ranges (e.g., swamp sparrow) in regions with less environmental variability might benefit more from a large supply of a single appropriate wetland type.

Diversity within a single basin is also usually beneficial. When many wetland types are present in relatively equal proportions distributed evenly throughout a basin (high interspersion), the "edge effect" is maximized. Studies of waterfowl have indicated that breeding populations are more highly correlated with total length of wetland shoreline in a region than total acreage of wetlands (Weller 1979). Upland bird communities are also typically more diverse and productive along wetland edges (Brinson et al. 1981). Furbearers create channel networks in wetlands and use them as travel routes. These channels may also help delineate territories of yellow-headed blackbirds and teal (Weller 1979), thus enhancing total diversity.

There probably are limits to the degree to which "edge" is beneficial. At some point, especially for animals with larger territories, habitat might become too fragmented. This threshold is presently unknown for most species (Kroodsma 1979), but preliminary data from nonwetland habitats, possible applicable to forested wetlands, suggests that diversity decreases rapidly once the stand becomes smaller than about 30 acres (Thomas et al. 1979). The exact threshold may vary not only by species, but also by season and by the "hardness" of the edge. For example, edges between open water and blocks of tall vegetation are probably of greater ecological consequence than "soft" edges at the transition between scrub-shrub and forested wetlands (Winchester and Harris 1979).

Criteria have also been developed for specific purposes, in limited areas, and for particular species groups. For example, the state of Maine uses a percentage criterion to prioritize eider duck nesting areas for acquisition, and the U.S. Fish and Wildlife Service has used a series of criteria to prioritize Pacific Coast waterfowl wintering areas. The Vermont Department of Water Resources (E. Swanson, pers. comm) has suggested, on a preliminary basis, that basins with 5 or more breeding pairs of any duck species, or more than 50 waterfowl-days of use during migration, may be significant in that state.

2.8.5 PROCESSES

Major factors affecting this function are the following:

--Availability of cover and freedom from disturbance

--Availability of food

--Availability of specialized habitat needs

The availability of cover, food, and specialized habitat needs is related to a fourth factor: interspersion. All of these are necessary at every season and life stage.

Availability of Cover: "Cover" consists of areas used by wildlife for protection from predators and the elements. In wetlands, cover may be provided by large rocks, wetland vegetation, bathymetric relief, debris from upland sources, undercut banks, or the water itself.

One cannot justifiably report that a particular wetland has "good cover" unless the species for which it is good are specified. For example, a 10-cm-high growth of emergent sedge provides poor cover for geese but excellent cover for diminutive sora rails. Species-specific preferences are also reflected in the need for cover. Seaside sparrows normally remain well concealed in coastal salt marshes, while wintering harlequin ducks in the Northeast prefer the marine waters off exposed peninsulas even during the fiercest of storms. The needs of a particular species for cover may also vary seasonally. Muskrats in northern areas often prefer shallow wetlands in summer, but move to basins with freeze-proof depths in winter (Errington 1963).

The availability of cover is perhaps most influenced by a wetland's hydroperiod. Nesting waterfowl may leave wetlands when flooding submerges emergent vegetation, but flooding may also make available new areas around the basin periphery which formerly were dry uplands. Temporary drawdown or drought usually encourages lush growth of wetland plants ultimately beneficial as cover, but may also allow formerly isolated islands valuable to nesting waterbirds to become temporarily accessible to predators. Severe prairie droughts are believed to follow 20-30-year cycles (Weller 1979), while rainfall patterns on the Florida Gulf Coast apparently have had a 7-year periodicity (Livingston and Loucks 1979).

Availability of Food: Wetlands wildlife represent the full range of feeding strategies. Some are opportunists, others are specialists; some are herbivores, others are carnivores, insectivores, or omnivores; some are aerial feeders, others feed from the ground, water column, or sediment. Thus, as with cover, it is not possible to state that a particular wetland class or subclass is generally "best" as a food source for obligate wetlands wildlife. It is quite apparent, however, that regardless of which system they are in, rooted vascular aquatic bed wetlands are highly important to harvested waterfowl, and in many regions waterfowl contribute the greatest to species richness of the wetland wildlife fauna. Shorebirds (sandpipers and plovers) also comprise a large proportion of both the quantity and diversity of wetland-dependent wildlife, at least during migration, but they generally avoid aquatic beds in favor of invertebrate-rich unconsolidated (mud and sand flat) wetlands. Among animal food sources, crayfish appear to be important to a wide range of wildlife species (Weller 1979).

Food habits of wetland wildlife vary both seasonally and regionally, often depending on what is available. Ice, flooding, and natural characteristics of the food source (e.g., seasonal maturation and morphology if plant, seasonal spawning movements if fish) partly govern its availability. To some extent, wildlife can shift among food sources within the same trophic level, but the limits of adaptability (i.e., the magnitude, duration, and frequency of the shift) of most species are unknown. For example, prothonotary warblers might be able to shift from consuming midges to consuming craneflies, but they are unlikely to shift on a year-round basis from being an insectivore to being a herbivore. Muskrats are known to be capable of shifting to upland food sources, at least for short periods, and brant shifted to sea lettuce (Ulva) during the 1930s when eelgrass underwent a temporary decline. Although such flexibility may prevent species extinction, some loss to the population often results.

Availability of Specialized Habitat Needs: Other wildlife habitat needs which are less directly related to food and cover may be termed "specialized habitat needs." For example, bald eagles typically require very tall snags adjacent to open water for use as perches. Cliff swallows need exposed shorelines or puddles as a source of mud for their nests. Such requirements are usually quite inflexible.

* Diversity and Interspersion: Perhaps the most critical factor controlling wetland wildlife, both individually and for the entire community, is the diversity of wetlands on a regional basis. Because in most wetlands succession can naturally

Appendix 5. Jordan River basin effectiveness ratings.

Basin Effectiveness: Wildlife Habitat

Effectiveness ratings High, Moderate, Low are to indicate wetland habitat values within basins. Note that cumulative habitat values of the Jordan River wetland ecosystem and the role of individual wetlands and basins as part of the system are not addressed with these ratings. Basin boundaries do not necessarily represent ecological boundaries, and the relationships between individual wetlands and basins as integral parts of the riverine system should not be overlooked. Use of wetland habitats along the Jordan River by many species of fish and wildlife is dependent on the systemic properties of the wetlands as is the sustenance of the wetlands themselves. Probable ratings are assigned to basins for which little or no data was obtained during summer avian surveys based on vegetation characteristics.

Basin	No. of Surveys	Total Bird Observations	No. Species Observed	Effectiveness	Comments
1	7	797	49	High	Use by diversity species. Vegetation and struct. diversity. Shrubs (willows) and trees (elms and cottonwoods) present. Backwater meanders.
2	2 MORE DATA NEEDED*	53	17	Prob. Low*	Steep banks, wetlands confined, but woody vegeta- prob. important to passerines. Terns and swallows feed from/over channel W.f. ibis feeding.
3	8	1193	59	High	Ground water disch and oxbows support veg. and habitat diversity. Sandbars and shallow shorelines import. Aq. beds and trees also present. Largest total species diversity observed.
4	3	353	37	High	Contiguous wtlds in both B. 3, 4. Enhancement possib Dredging and grazing has degraded quality of both 3, 4.

Basin	No. of Surveys	Total Bird Observations	No. Species Observed	Effectiveness	Comments
5	1	6	5	Prob. Mod.*	Provide diversity incl. sizeable EM
6	*NO DATA, MORE NEEDED			Prob. Mod.*	oxbows, US, SS.
7	1	12	3	Prob. Mod.*	Potential diversi Channelization & dredge spoils.
8	*NO DATA, MORE NEEDED				
9	6	574	39	High	Diversity of wildl observed.
10	*MORE DATA NEEDED			Prob. Mod.	Channeliz. and
11	1	140	18	to High*	spoil piles have
	*MORE DATA NEEDED			(both part of) Basin 9 complex)	degraded. Habitat values can be improved.
12	2	64	13	Prob. Mod.*	
13	1	117	16	Prob. Mod.*	
	*MORE DATA NEEDED FOR EACH				
14	*MORE DATA NEEDED			Prob. High*	Supports contiguou wetlands: EM and some diversity: AB, US, SS, oxbows and willows.
15	*MORE DATA NEEDED			Prob. High	SS growth potentially import to breeding and migrating passerin populations.
16-18	*MORE DATA NEEDED			Prob. High	Oxbows, understor, canopy (SS, trees) to support diversi Some improvements could be made.
19	3	146	29	High	Veg. & wildl. hab diversity includin structural variety import. to wildl. diversity. Regen. of willows and cottonwoods. Oxbows, AB, US, EM SS, trees present.

Basin	No. of Surveys	Effectiveness	Comments
20-22	*DATA NEEDED	Prob. High*	Wetland class and veg. structural diversity existing including SS and FO. Important to breeding and migrating passerines, herons...

Discussion of Jordan River wetland habitat functions and supporting processes. From: Halpin, M. A. 1987. Jordan River wetland vegetation evaluation. WAILDS Report. pp. 26-28.

Wetland Habitat Values

The importance and tremendous value of wetland and riparian communities as wildlife habitat are well documented and universally recognized. The Jordan River wetlands provide valuable food, cover, nesting, rearing, resting and stopover sites, protection from disturbance (of particular value in its urban surroundings), and a travel corridor for migrating birds and for wildlife moving between the Great Salt Lake and Utah Lake. Furthermore, because the abundance and distribution of wetlands is regionally limited, the habitat values of the wetlands that do exist here are very significant. In this arid environment, the Jordan River wetlands are particularly important for "wetland-obligatory" species depending almost exclusively on wetland habitats for food and cover throughout their range and life cycle.

In addition, the riparian habitat qualities of the Jordan River wetlands warrant special consideration. Within the river's corridor, vegetative characteristics are uniquely influenced by the moisture conditions associated with the river system. Riparian habitats in Utah, particularly at lower elevations, support plant species and vegetative structure, density and diversity generally lacking in the drier and open surrounding areas. An associated diversity and disproportionately high number of wildlife species typically exhibit an affinity for and dependency on riparian habitats in this area. The natural riparian habitat attributes of the Jordan River wetlands, compounded with the limited availability and quality of habitat in the surrounding urban environment, magnify the general value of the wetlands as habitat for wildlife.

Relative habitat values of specific wetland sites within the river system are difficult to assess. Adamus (1983a) presented a good discussion of this issue. Habitat values may be species specific. Some of the shorter sedges in emergent wetlands along the river provide excellent cover for smaller species such as common snipe, for example, but may be inadequate for Canada geese. The variety of wildlife species that occur in wetlands along the Jordan River also exhibit a range of feeding strategies. These include use of and dependency on all wetland classes and many of the different kinds of plants and food chains supported by the plants. Furthermore, habitat values vary seasonally and with a diversity of uses among different species and even within individual species. All existing wetlands along the Jordan River provide valuable habitat for many uses by whole communities of wildlife throughout the year.

Some vegetation and site characteristics provide indices of specific habitat values. Adamus (1983a) summarized the importance of wetland diversity, both on a regional basis and within individual basins. Regionally, wetland diversity is critical for species that require a variety of closely-associated wetlands (breeding herons and waterfowl, for example) and during periods of rapid successional reversals or advances. Floods and droughts may drive these. In this context, the Jordan River wetlands, as a segment of the overall wetland complex of northern Utah, are extremely important in providing wetland habitat during periods of high water and loss of the Great Salt Lake wetlands to inundation.

Vegetative and wetland class diversity within a Basin provide one measure of value to wildlife on the premise that species richness is enhanced with habitat diversity and interspersion. Transect data indicated plant diversity within all palustrine wetland classes. Vegetative density, interspersion, and structural diversity along the Jordan River is characteristic of aquatic beds, oxbows, flood meanders, shallow banks and sites exposed to periodic river overflow, and the very few Basins where limited clumps of taller woody vegetation occur. These sites are currently the most valuable in terms of habitat diversity. Vegetative structural diversity and associated habitat quality could be enhanced along the entire river with greater mixed-aged growth of cottonwoods and other trees.

Size of wetlands provides another general index to relative habitat value. Largest and most extensive wetlands are primarily dominated by emergent vegetation. Large emergent wetlands occur in Basins 3 - 7, 9 - 11, 14, 15, and 18 - 22.

Of the wetland plant genera identified along transects, algae, Lemna, Potamogeton, Scirpus, Carex, Distichlis, and Juncus all have species that provide valuable foods for many herbivorous and omnivorous wildlife species. Seeds, rootstocks, tubers and other parts of these plants are consumed.

Potamogeton is one of the largest and most significant groups of seed-bearing aquatics. In Utah, sago pondweed (Potamogeton pectinatus) is one species of particular importance to waterfowl and other wildlife. Lemna is another aquatic food plant commonly used by ducks and other waterbirds. Some algaes are eaten by ducks and marshbirds, but probably of greater food value is the food chain role algae plays in providing macroinvertebrates for consumption by fish and wildlife species.

Bulrush species (Scirpus sp.) provide one of the most important and commonly-used foods of wetland wildlife. The seeds and rootstocks are eaten by a variety of birds and muskrats. In addition, Scirpus and Typha (cattails) provide valuable cover for resting and nesting wildlife.

Carex, Distichlis, Eleocharis, Equisetum, and Juncus, which are predominant and common plant genera in emergent wetlands along the Jordan River, are valuable food plants as well. In most species of these genera, the seeds and rootstocks are consumed by waterfowl, rails, snipe, dowitchers and other wetland species. Distichlis, with its creeping rootstock and low, dense vegetative growth is often used for nesting cover by waterfowl such as cinnamon teal and northern shovelers.

Willows and cottonwoods provide vegetative foods and food chain support. These shrubs and trees also create the valuable structural dimension of habitat in the Jordan River wetlands, providing essential cover for arboreal species.

Land Uses Influencing Wetland Vegetation

Grazing practices, water flow manipulation and diversion, and channelization most conspiculously influence vegetation and habitat values in existing wetlands along the Jordan River. The degree of grazing by cattle and horses in some wetlands (basins 3, 4, 7, 15, 18, and 19) has diminished wetland vegetation density and regeneration. In these areas, grazing activity has contributed to the degradation of soil and moisture conditions necessary for the regeneration and survival of wetland plants. Soil compaction, reduced emergent density, and bank sloughing, due to the presence of livestock, has occurred in some sites. The influence grazing has on the establishment of tree growth and an overstory within the river corridor is also of concern.

Water flow manipulation and channelization also affect wetland vegetation along the Jordan River. By interfering with water flow dynamics, these activities disrupt processes that influence physical aspects, which in turn, affect plant species (Bayha and Schmidt 1983). Periodic overflow of the channel is a critical process in the establishment and survival of some wetland species. Riparian wetland vegetation is adapted to water fluctuations and dependent on the dynamics of the river ecosystem.

Bayha and Schmidt (1983) summarized the interactions between flood magnitude, frequency, duration, and seasonal timing and the physical aspects of the riparian wetland environment. The action of moving water plays an essential role in scouring and producing areas of bare, moist, mineral soils important for seed germination of some wetland species. Furthermore, high volume and flow velocity are responsible for overbank sediment and nutrient deposition and for lateral migration of the river.

The river and morphological changes resulting from high flows increase diversity of flow conditions, bed material distribution, and bed forms following subsidence. The riparian wetland system responds by establishing successional stages of vegetative growth. Willow is one of the first species to establish itself on new sand and gravel bars. Along the Jordan River, examples of this effective process occur in Basins 1, 2, 14, 15, 18, and 19 and in other sites exposed to periodic inundation. Recent dredging activities and efforts to stabilize banks with concrete debris and other artificial materials has destroyed and prohibited the natural reestablishment of willows and other vegetation along banks of the Jordan River in some sites (Basins 3, 7 - 13, 20 - 22).

Reduced seasonal fluctuation in river flow could diminish the long-term role of the Jordan River in recharging ground water. Decreased and stabilized water flow may also cause the river to act as a drain on subsurface water, reducing soil moisture available to wetland vegetation (Bayha and Schmidt 1983).

Degradation of vegetative occurrence and diversity is already evident in some sites and may expand with continued efforts to stabilize the river channel and the temporally- and spatially-dynamic processes that drive the entire system. The general lack of mixed-aged tree growth within the riparian corridor, for example, could in part be associated with moisture limitations during critical spring periods of germination.