of the floodplain that may have historically contained willow flycatcher breeding habitat but that has already been factored into the total estimate.

4) Hoover Dam was completed in 1935, three years before the aerial photos were taken. Initially, Hoover may have provided more willow flycatcher habitat due to cessation of natural flood events over those three years. Sandbars, where willows germinated historically, were often lost to the next flood event, especially if that flood event occurred the subsequent year (USBR, unpub. data). Riparian vegetation also became established, admittedly in small amounts by 1938, within the narrow canyons where historically little or no riparian vegetation existed due to the frequent scouring flood events (Webb, 1996).

Table 4. 1996-98 occupied southwestern willow flycatcher breeding habitat by river reach.

River Reach	Occupied Habitat
Grand Canyon to Davis Dam*	1,146
Mohave Valley	2,487
Mohave Canyon	66
Chemehuevis Valley**	838
Great Valley	126
Yuma Valley***	1,373
Limitrophe	9
Totals	6,045

*Grand Canyon to Davis Dam total includes Lower Virgin River sites, Lower Grand Canyon sites
**Chemehuevis Valley total includes Lower Bill Williams River sites
***Yuma Valley total includes Canebrake Canyon

It is difficult to come up with an actual acre number for the range limits around the 1938 total acreage figure. At best guess, the liberal interpretation of the 1938 photos may have overestimated the actual potential habitat by as much as 15 percent. The increase in habitat due to Hoover Dam was marginal. In 1930, Reclamation flew a portion of the Great Valley. When comparing these photos to the 1938 photos of the same area, there was an increase of approximately 2,000 acres in 1938 (5%). Interpretive error could be as much a factor in this difference as an actual increase in habitat. Other factors, such as the wet cycle the Colorado River appeared to be in during the early 1900's, also must be factored in. The best estimate for the range of potential historical southwestern willow flycatcher breeding habitat along the Lower Colorado River is 50,000 to 100,000 acres. This estimate takes into account both errors in interpretation of the 1938 photographs and stochastic factors such as the highly dynamic flow regimes found historically along the Lower Colorado River.

CURRENT OCCUPIED AND POTENTIAL HABITAT

Until recently, the southwestern willow flycatcher was considered extirpated from the Lower Colorado River (Hunter et al., 1987; Rosenberg et al., 1991). In 1995, however, biologists at Havasu National Wildlife Refuge, near Needles, California, observed two fledgling willow flycatchers which prompted Reclamation to initiate comprehensive surveys in the spring of 1996 (Spencer et al., 1996, Christy Smith, per. comm.). Since 1996, nesting willow flycatchers have been observed from the Grand Canyon to the Limitrophe, south of Yuma (McKernan, 1997; McKernan and Braden, 1998;

McKernan, per comm.). During the 1998 breeding season, approximately 61 pair of southwestern willow flycatchers were observed between Mesquite, Nevada on the Virgin River just above Lake Mead, to Gadsden, Arizona, south of Yuma. At least seven other individuals were observed throughout the breeding season, although breeding could not be confirmed for these individuals. Approximately 50 nests were discovered during the 1998 surveys (McKernan and Braden, per. comm.).

Table 5. 1994 acreage, by vegetation communities, along the Lower Colorado River from Davis Dam to Mexico.

COMMUNITY TYPE	MOHAVE	TOPOCK GORGE	HAVASU	PARKER	PALO VERDE	CIBOLA	IMPERIAL	LAGUNA	YUMA	LIMITROPHE	TOTAL
SC I	278	0	0	0	0	0	0	0	12	0	290
SC II	6	0	2	2	0	0	47	5	9	16	87
SC III	67	13	0	0	27	23	67	15	40	15	267
SC IV	73,874	105	82	1,864	1,632	4,394	4,081	1,625	1,129	1,644	24,092
SC V	3,023	87	71	2,722	868	2,210	957	1,195	300	1,663	13,096
SC VI	1,429	16	85	1,598	1,111	322	517	552	239	1,142	7,011
CW I	0	0	32	0	2	0	0	0	0	34	68
CW II	26	0	0	26	0	90	6	3	0	0	151
CW III	644	0	335	8	3	64	278	38	318	145	1,833
CW IV	110	7	0	184	8	47	84	61	258	169	928
CW V	62	0	0	16	0	0	24	6	6	38	152
CW VI	13	0	0	2	33	0	2	28	27	161	266
HM III	41	0	0	0	0	0	0	0	0	0	41
HM IV	125	0	0	7	0	0	11	3	3	0	149
HM V	0	0	0	16	85	32	60	0	0	0	193
HM VI	6	0	0	0	0	0	18	0	0	0	24
SM I	3	0	0	0	0	0	0	0	0	0	3
SM II	14	0	0	0	0	0	0	1	0	0	15
SM III	500	0	0	0	1	0	0	0	7	0	508
SM IV	2,100	129	326	2,227	1,372	878	905	556	264	14	8,771
SM V	1,204	26	138	799	645	428	182	160	53	44	3,679
SM VI	300	0	31	376	589	65	9	195	0	0	1,565
SH III	4	0	0	0	10	0	53	0	0	0	67
SH IV	116	0	91	37	54	449	288	77	3	0	1,115
SH V	0	0	15	19	0	708	260	25	0	0	1,027
SH VI	0	0	3	0	0	128	0	0	0	0	131
AW VI	657	0	126	2,377	383	133	44	587	324	566	5,197
ATX VI	24	0	50	342	37	62	5	40	110	44	714
MA 1	1,450	420	474	69	8	380	823	524	55	13	4,216
MA 2	275	6	12	0	8	0	220	0	12	0	533
MA 3	164	30	59	321	19	71	922	249	76	2	1,913
MA 4	215	652	9	300	98	195	936	91	27	0	2,523
MA 5	84	95	16	13	5	26	65	9	1	0	314
MA 6	1	0	7	79	0	2	351	5	118	29	592
MA 7	420	8	7	69	22	30	74	31	126	144	931
CRV	0	106	223	0	0	0	151	113	153	3	749
TOTAL	20,747	1,699	2,195	13,474	7,022	10,738	11,440	6,196	3,821	5,887	83,218

[1] Community type codes: CW=Cottonwood-Willow, SC=Salt cedar, SH= Saltcedar-Honey mesquite, SM=Saltcedar-Screwbean mesquite, HM=Honey mesquite, AW=Arrowweed, ATX=Atriplex, MA=Marsh, CR=Creosote

Southwestern willow flycatchers utilize saltcedar, primarily, for nesting substrate along the Lower Colorado River. Often, there is also a small overstory component of larger Gooddings willows. Occasionally, flycatchers are found within more historically typical breeding habitat but few stands of this type survive. Although the data are inconclusive, the two most important factors for flycatchers appear to be stand structure (density) and presence of water. However, stands that apparently have the necessary components to be utilized as breeding habitat by willow flycatchers are not always being used (McKernan and Braden, 1998). Some debate has been ongoing on whether saltcedar-dominated stands act as sink habitats, furthering the decline of the species (Pulliam, 1988). Nest productivity studies along the Lower Colorado River do not support this hypothesis (McKernan and Braden, 1998). Further studies are ongoing to try to answer these questions.

Occupied habitat has been defined as "a contiguous area with consistent physical and biotic characteristics where territorial males or pairs of flycatchers have been documented during previous breeding seasons (generally after June 15 and before July 30...) at least once in the last few years, assuming the habitat had not been degraded or otherwise altered in the interim. If a portion of contiguous habitat is or was used, the entire contiguous area is

considered occupied" (Cordery, per. comm.). Analysis of aerial photographs around survey sites, which met this definition in 1996-98, estimates approximately 4,093 acres of occupied habitat along the Lower Colorado River from Pierce Ferry, Arizona to the SIB, not including an additional 806 acres along the Lower Bill Williams River, an additional 966 acres along the Lower Virgin River, and an additional 180 acres in the Lower Grand Canyon. Occupied habitat along the Lower Colorado, including these other areas of concern, totals over 6,045 acres (Table 4).

Suitable but unoccupied habitat is harder to define. If we assume that stand structure, stand density, and presence of water are the most important factors, we can estimate potentially suitable nesting habitat by analyzing vegetation type maps. The Bureau of Reclamation has periodically compiled vegetation type maps of the Lower Colorado River since 1976 (Anderson and Ohmart, 1976; Anderson and Ohmart, 1984; Younker and Anderson, 1986; Salas et al., 1996). The system currently used to classify vegetation along the Lower Colorado River is based on plant community and structure (Anderson and Ohmart, 1984). Appendix B lists the habitat and structure types used in this system. Southwestern willow flycatchers seem to prefer stands with a component of dense vegetation between 8 and 25 feet in height (USFWS, 1997; Sogge et al., 1997). In the Anderson and Ohmart vegetation classification system, cottonwood-willow I, II, III, IV, V; marsh types 2, 3, 4 (depending on surrounding vegetation); and saltcedar III would fit this criterion (Anderson and Ohmart, 1984). Some stands classified as saltcedar IV would also fit this criterion.

1. Limitrophe
2. Below Colorado Gila Confluence
3. Imperial to Laguna Dam
4. Imperial NWR
5. Gilmore's Camp
6. Cibola NWR
7. PVIID lands
8. CRIT
9. Bill Williams River NWR
10. Planet Ranch
11. Havasu NWR

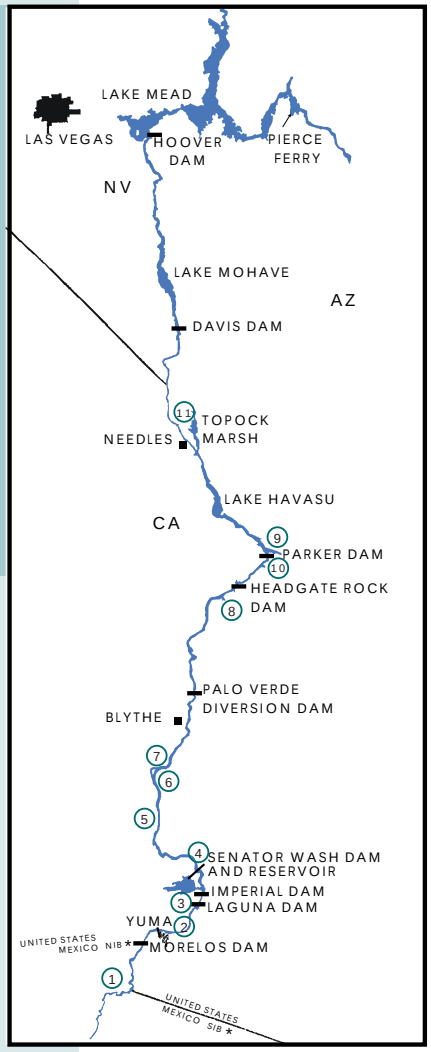

Figure 18. Map of potential restoration sites along the Lower Colorado River.

The most recently completed vegetation type maps were compiled from 1994 aerial photography. These maps cover the approximately 80 percent of the Colorado River floodplain between Davis Dam and the SIB. Some areas on the outer edges of the floodplain, farthest from the Colorado River itself, were not flown and, consequently, not mapped. A summary of vegetation type classes, by river reach, is shown in Table 5. Reclamation is currently revising the vegetation type maps using 1997 aerial photography. The revised maps will include the Grand Canyon from Separation Canyon down to Lake Mead, the Virgin River from the Virgin River Gorge to Lake Mead, and the shorelines of Lakes Mead and Mohave. Updated acreage numbers should be available in the spring of 1999.

Table 6. Occupied habitat and potentially suitable but unoccupied habitat by vegetation community type per river reach, 1998.

Community Type	Mohave Valley	Chemehuevis Valley	Great Valley	Canebrake Canyon	Yuma	Limitrophe	Total
CW I		32					36
CW II	26		116	9		34	151
CWIII	644	335	75	316	318		1,833
CW IV	117		239	145	258	145	928
CW V	62		16	30	6	169	152
SC III				20		38	31
SC IV	5,321	11	292	3,275	438	11	9,567
MA 2	275			115	12	230	402
MA 3				230			230
MA 4	815		125	936	27		1,930
TOTAL	7,260	378	863	5,076	1,059	627	15,290

Using the 1994 vegetation type maps, field reconnaissance was undertaken to analyze potential stands for habitat suitability. Young cottonwood-willow stands (types III, IV, and V) all require water to become established and to survive. Consequently, it can be assumed that these stands are potential willow flycatcher breeding sites. Cottonwood-willow types I and II stands could be remnants from the pre-dam period and must be analyzed for potential at this time. Saltcedar III stands have the stand structure needed to support breeding flycatchers but these stands must also be analyzed for proximity to water. Saltcedar IV stands need to be analyzed for stand density and proximity to water to be included as suitable breeding sites.

Analysis of the 1994 vegetation type maps indicate approximately 11,197 acres of potentially suitable but unoccupied habitat along the Lower Colorado River (Table 6). The majority of both occupied and potentially suitable but unoccupied habitat occurs within the Mohave Valley, near Topock Marsh, and in Canebrake Canyon, now usually referred to as the Imperial Division. Both areas are mainly under federal ownership. The potential habitat outside of these two areas usually occurs on national wildlife refuges. Very little occupied or potentially suitable but currently unoccupied habitat is privately owned along the Lower Colorado River.