Appendix I1
Natural Communities, Special-status Terrestrial Species, and Wetlands and Other Waters Supporting Appendix

Table I1-1. Impacts on the Tidal Perennial Aquatic Natural Community by Alternative

Alternative	Permanent Impacts (acres)	Long-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total Impacts (acres Affected)
1	36.76	1.88	13.94	52.58
2b	34.11	1.43	13.69	49.23
3	33.44	1.88	DWR's Preferred Alternative.43	40.75
4b	30.79	1.43	DWR's Preferred Alternative.19	37.41
DWR's Preferred Alternative	DWR's Preferred Alternative.86	1.16	4.10	11.12

Table I1-2. Impacts on the Tidal Freshwater Emergent Wetland Natural Community by Alternative

Alternative	Permanent Impacts (acres)	Long-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total Impacts (acres)
1, 2b	0.23	0.00	0.82	1.05
3, 4b	0.21	0.00	0.37	0.58
DWR's Preferred Alternative	0.18	0.00	0.39	0.57

Table I1-3. Impacts on the Valley/Foothill Riparian Natural Community by Alternative

Alternative	Permanent Impacts (acres)	Long-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total Impacts (acres)
1	49.41	3.30	17.34	70.05
2b	47.36	2.04	17.23	66.63
3	14.23	2.81	9.57	26.61
4b	12.17	1.55	9.46	23.18
DWR's Preferred Alternative	15.42	4.56	9.80	29.78

Table I1-4. Impacts on the Nontidal Perennial Aquatic Natural Community by Alternative

Alternative	Permanent Impacts (acres)	Long-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total Impacts (acres)
1	0.21	0.34	0.44	0.99
2b	0.21	0.11	0.44	0.76
3	0.21	0.33	0.29	0.83
4b	0.21	0.10	0.29	0.60
DWR's Preferred Alternative	0.52	0.87	0.32	1.71

Table I1-DWR's Preferred Alternative. Impacts on Nontidal Freshwater Perennial Emergent Wetland by Alternative

Alternative	Permanent Impacts (acres)	Long-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total Impacts (acres)
1	3.69	0.98	3.84	8.51
2b	3.47	0.91	3.70	8.08
3, DWR's Preferred Alternative	0.30	0.07	0.45	0.82
4b	0.08	0.00	0.31	0.39

Table I1-6. Impacts on Nontidal Brackish Emergent Wetland by Alternative

Alternative	Permanent Impacts (acres)	Log-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total Impacts (acres)
All	0	0	0	0

Table I1-7. Impacts on Alkaline Seasonal Wetland Complex by Alternative

Alternative	Permanent Impacts (acres)	Long-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total Impacts (acres)
1, 2b, 3, 4b	1.86	0.00	2.50	4.36
DWR's Preferred Alternative	0.22	0.00	0.54	0.76

Table I1-8. Impacts on the Vernal Pool Complex by Alternative

Alternative	Permanent Impacts (acres)	Long-Term Temporary Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1, 3	9.02	0.00	10.15	19.17
2b, 4b	8.95	0.00	9.89	18.84
DWR's Preferred Alternative	11.91	11.62	2.55	26.08

Table I1-9. Impacts on Dwarf Downingia by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat (acres) in Project Footprint	Occurrences in Study Area	Occurrences Affected
1, 3, DWR's Preferred Alternative	12,302	0.32	6	0
2b, 4b	12,302	0.00	6	0

Table I1-10. Impacts on Spiny-Sepaled Button-Celery by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat (acres) in Project Footprint	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	565	17.87	1	0
DWR's Preferred Alternative	565	0.37	1	0

Table I1-11. Impacts on Legenere by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat (acres) in Project Footprint	Occurrences in Study Area	Occurrences Affected
1, 3, DWR's Preferred Alternative	11,987	0.32	DWR's Preferred Alternative	0
2b, 4b	11,987	0.00	DWR's Preferred Alternative	0

Table I1-12. Impacts on Hogwallow Starfish and Delta Woolly Marbles by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat (acres) in Project Footprint	Occurrences in Study Area	Occurrences Affected
1, 3	1,253	19.2	ca. 3	0
2b, 4b	1,253	18.8	ca. 3	0
DWR's Preferred Alternative	1,253	26.1	ca. 3	0

Table I1-13. Impacts on Alkali Milk Vetch by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	10,782	46.40	14	0
DWR's Preferred Alternative	10,782	21.58	14	0

Table I1-14. Impacts on Brittlescale by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	4,976	16.79	4	0
DWR's Preferred Alternative	4,976	0.13	4	0

Table I1-15. Impacts on Recurved Larkspur by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	836	25.22	4	1
DWR's Preferred Alternative	836	0.13	4	0

Table I1-16. Impacts on San Joaquin Spearscale by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b	27,430	120.77	11	2
3, 4b	27,430	122.11	11	2
DWR's Preferred Alternative	27,430	96.73	11	0

Table I1-17. Impacts on Long-Styled Sand-Spurry by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	2,846	16.38	6	3
DWR's Preferred Alternative	2,846	0.13	6	1

Table I1-18. Impacts on California Alkali Grass by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	596	DWR's Preferred Alternative.82	2	0
DWR's Preferred Alternative	596	0.19	2	0

Table I1-19. Impacts on Crownscale by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	468	4.4	DWR's Preferred Alternative	1
DWR's Preferred Alternative	468	0.8	DWR's Preferred Alternative	0

Table I1-20. Impacts on Ferris' Goldfields by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	468	4.4	4	0
DWR's Preferred Alternative	468	0.8	4	0

Table I1-21. Impacts on Little Mousetail by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	468	4.4	1	0
DWR's Preferred Alternative	468	0.8	1	0

Table I1-22. Impacts on Jepson's Coyote-Thistle by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	9,065	0.54	2	0
DWR's Preferred Alternative	9,065	0.19	2	0

Table I1-23. Impacts on Diamond-Petaled California Poppy by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	2,523	17.38	1	0
DWR's Preferred Alternative	2,523	35.31	1	0

Table I1-24. Impacts on Heckard's Peppergrass by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3	12,831	20.74	DWR's Preferred Alternative	0
4b	12,831	20.73	DWR's Preferred Alternative	0
DWR's Preferred Alternative	12,831	2.73	DWR's Preferred Alternative	0

Table I1-25. Impacts on Shining Navarretia by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	7,896	17.38	0	0
DWR's Preferred Alternative	7,896	62.41	0	0

Table I1-26. Impacts on Saline Clover by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Affected Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 3	14,790	22.29	7	0
2b, 4b	14,790	21.96	7	0
DWR's Preferred Alternative	14,790	26.84	7	0

Table I1-27. Impacts on Caper-Fruited Tropidocarpum by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	3,158	17.38	6	0
DWR's Preferred Alternative	3,158	62.41	6	0

Table I1-28. Impacts on Small-Flowered Morning-Glory by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	7,896	17.4	0	0
DWR's Preferred Alternative	7,896	62.4	0	0

Table I1-29. Impacts on Stinkbells by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	7,896	17.4	1	0
DWR's Preferred Alternative	7,896	62.4	1	0

1 **Table I1-30. Impacts on Cotula Navarretia by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b, 3, 4b	7,896	17.4	3	0
DWR's Preferred Alternative	7,896	62.4	3	0

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3 **Table I1-31. Impacts on Bolander's Water-Hemlock by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b	548	0.16	DWR's Preferred Alternative	0
3, 4b	548	0.13	DWR's Preferred Alternative	0
DWR's Preferred Alternative	548	0.08	DWR's Preferred Alternative	0

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5 **Table I1-32. Impacts on Bristly Sedge by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1	1,345	3.05	18	2
2b	1,345	1.85	18	1
3, DWR's Preferred Alternative	1,345	2.67	18	2
4b	1,345	1.48	18	1

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7 **Table I1-33. Impacts on Delta Mudwort by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1	2,238	7.34	58	0
2b	2,238	6.79	58	0
3	2,238	4.03	58	0
4b	2,238	3.48	58	0
DWR's Preferred Alternative	2,238	1.51	58	0

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Table I1-34. Impacts on Delta Tule Pea by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1	DWR’s Preferred Alternative,300	39.29	62	4
2b	DWR’s Preferred Alternative,300	36.51	62	4
3	DWR’s Preferred Alternative,300	8.17	62	1
4b	DWR’s Preferred Alternative,300	DWR’s Preferred Alternative.38	62	1
DWR’s Preferred Alternative	DWR’s Preferred Alternative,300	8.72	62	1

Table I1-35. Impacts on Marsh Skullcap by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b	795	0.35	DWR’s Preferred Alternative	0
3, 4b	795	0.18	DWR’s Preferred Alternative	0
DWR’s Preferred Alternative	795	0.14	DWR’s Preferred Alternative	0

Table I1-36. Impacts on Mason’s Lilaeopsis by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1	2,231	7.34	158	1
2b	2,231	6.79	158	1
3	2,231	4.03	158	0
4b	2,231	3.48	158	0
DWR’s Preferred Alternative	2,231	1.51	158	0

1 **Table I1-37. Impacts on Sanford's Arrowhead by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b	1,915	0.89	23	0
3, 4b, DWR's Preferred Alternative	1,915	0.33	23	0

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3 **Table I1-38. Impacts on Side-Flowering Skullcap by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b	1,111	0.35	13	1
3, 4b	1,111	0.18	13	0
DWR's Preferred Alternative	1,111	0.14	13	0

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5 **Table I1-39. Impacts on Suisun Marsh Aster by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1	DWR's Preferred Alternative,520	34.31	125	12
2b	DWR's Preferred Alternative,520	32.07	125	12
3	DWR's Preferred Alternative,520	DWR's Preferred Alternative.13	125	1
4b	DWR's Preferred Alternative,520	2.89	125	1
DWR's Preferred Alternative	DWR's Preferred Alternative,520	4.83	125	1

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7 **Table I1-40. Impacts on Woolly Rose-Mallow by Alternative**

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1, 2b	700	0.05	119	0
3, 4b	700	0.08	119	0
DWR's Preferred Alternative	700	0.06	119	0

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Table I1-41. Impacts on Watershield by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1	8,153	7.47	2	1
2b	8,153	7.24	2	1
3	8,153	3.35	2	0
4b	8,153	3.11	2	0
DWR's Preferred Alternative	8,153	3.07	2	0

Table I1-42. Impacts on Modeled Habitat for Eel-Grass Pondweed by Alternative

Alternative	Modeled Habitat in Study Area (acres)	Modeled Habitat in Project Footprint (acres)	Occurrences in Study Area	Occurrences Affected
1	15,081	9.50	1	0
2b	15,081	8.84	1	0
3	15,081	1.65	1	0
4b	15,081	0.99	1	0
DWR's Preferred Alternative	15,081	2.55	1	0

Table I1-43. Impacts on Modeled Habitat for Vernal Pool Aquatic Invertebrates by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Indirect Impacts (acres)	Total (acres)
1, 2b, 3, 4b	2.86	3.67	45.33	51.86
DWR's Preferred Alternative	0.42	0.76	19.61	20.79

Table I1-44. Impacts on Modeled Habitat within Critical Habitat for Vernal Pool Fairy Shrimp by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1, 2b, 3, 4b	1.60	0.84	2.44
DWR's Preferred Alternative	0.00	0.23	0.23

Table I1-45. Impacts on Modeled Habitat for Conservancy Fairy Shrimp by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
All Alternatives	0	0	0

Table I1-46. Impacts on Modeled Habitat for Vernal Pool Terrestrial Invertebrates by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1, 3	9.02	10.15	19.17
2b, 4b	8.95	9.89	18.84
DWR's Preferred Alternative	23.53	2.55	26.08

Table I1-47. Impacts on Habitat for Sacramento and Antioch Dunes Anthicid Beetles by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
All Alternatives	0	0	0

Table I1-48. Impacts on Modeled Habitat for Valley Elderberry Longhorn Beetle by Alternative

Alternative	Permanent Riparian Impacts (acres)	Temporary Riparian Impacts (acres)	Total (acres)
1	52.72	17.34	70.06
2b	49.40	17.23	66.63
3	17.04	9.57	26.61
4b	13.73	9.46	23.19
DWR's Preferred Alternative	19.98	9.80	29.78

Table I1-49. Impacts on Modeled Habitat for Delta Green Ground Beetle by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
All Alternatives	0	0	0

Table I1-50. Impacts on Modeled Habitat for Curved-Foot Hygrotus Diving Beetle by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1, 2b, 4b	61.51	19.35	80.86
3	62.02	19.35	81.37
DWR's Preferred Alternative	4.10	3.27	7.37

Table I1-51. Impacts on Modeled Habitat for Crotch and Western Bumble Bees by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	366.03	100.67	466.70
2b	355.46	99.65	455.11
3	132.94	65.74	198.68
4b	122.37	64.72	187.09
DWR's Preferred Alternative	95.11	45.69	140.80

Table I1-52. Impacts on Modeled Habitat for California Tiger Salamander by Alternative

Alternative	Permanent Impacts—Aquatic (acres)	Permanent Impacts—Upland (acres)	Temporary Impacts—Aquatic (acres)	Temporary Impacts—Upland (acres)	Total (acres)
1, 2b, 3, 4b	0.00	94.38	0.00	20.89	115.27
DWR's Preferred Alternative	0.20	59.61	0.00	19.07	78.88

Table I1-53. Impacts on Modeled Habitat for Western Spadefoot Toad by Alternative

Alternative	Permanent Impacts—Aquatic (acres)	Permanent Impacts—Upland (acres)	Temporary Impacts—Aquatic (acres)	Temporary Impacts—Upland (acres)	Total (acres)
1	0.00	38.32	0.00	3.40	41.72
2b	0.00	35.33	0.00	3.64	38.97
3	0.00	37.83	0.00	3.41	41.24
4b	0.00	34.85	0.00	3.66	38.51
DWR's Preferred Alternative	0.20	32.92	0.00	4.17	37.29

Table I1-54. Impacts on Modeled Habitat for California Red-Legged Frog by Alternative

Alternative	Permanent Impacts—Aquatic (acres)	Permanent Impacts—Upland (acres)	Temporary Impacts—Aquatic (acres)	Temporary Impacts—Upland (acres)	Total (acres)
1, 2b, 3, 4b	0.47	DWR's Preferred Alternative.97	1.17	6.47	14.08
DWR's Preferred Alternative	0.21	7.00	0.12	2.71	10.04

Table I1-55. Impacts on Modeled Habitat within Critical Habitat for California Red-Legged Frog by Alternative

Alternative	Permanent Impacts—Aquatic (acres)	Permanent Impacts—Upland (acres)	Temporary Impacts—Aquatic (acres)	Temporary Impacts—Upland (acres)	Total (acres)
1, 2b, 3, 4b	0.00	0.00	0.00	0.00	0.00
DWR's Preferred Alternative	0.01	1.65	0.01	1.15	2.82

Table I1-56. Impacts on Modeled Habitat for Western Pond Turtle by Alternative

Alternative	Permanent Impacts—Aquatic (acres)	Permanent Impacts—Upland (acres)	Temporary Impacts—Aquatic (acres)	Temporary Impacts—Upland (acres)	Total (acres)
1	89.38	374.11	35.75	112.26	611.50
2b	82.08	349.00	35.29	112.02	578.39
3	79.23	130.66	20.61	68.96	299.46
4b	70.94	105.92	20.15	68.72	265.73
DWR's Preferred Alternative	35.04	112.64	16.37	48.30	212.35

Table I1-57. Impacts on Modeled Habitat for Coast Horned Lizard by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	234.07	48.31	282.38
2b	231.84	47.55	279.39
3	29.92	13.89	43.81
4b	27.69	13.14	40.83
DWR's Preferred Alternative	19.81	20.10	39.91

Table I1-58. Impacts on Modeled Habitat for California Legless Lizard by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1, 2b	230.44	43.27	273.71
3, 4b	26.30	8.74	35.04
DWR's Preferred Alternative	16.18	14.95	31.13

Table I1-59. Impacts on Modeled Habitat for California Glossy Snake by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1, 2b, 3, 4b	0.00	0.00	0.00
DWR's Preferred Alternative	0.01	0.07	0.08

Table I1-60. Impacts on Modeled Habitat for San Joaquin Coachwhip by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1, 2b, 3, 4b	85.62	15.14	100.76
DWR's Preferred Alternative	50.15	21.36	71.51

Table I1-61. Impacts on Modeled Habitat for Giant Garter Snake by Alternative

Alternative	Permanent Impacts—Aquatic (acres)	Permanent Impacts—Upland (acres)	Temporary Impacts—Aquatic (acres)	Temporary Impacts—Upland (acres)	Total (acres)
1	26.37	305.91	16.51	95.51	444.30
2b	23.70	289.99	16.20	95.20	425.09
3	17.39	80.23	13.86	53.78	165.26
4b	14.94	64.31	13.55	53.46	146.26
DWR's Preferred Alternative	10.27	67.16	12.00	33.77	123.20

Table I1-62. Impacts on Modeled Migratory Habitat for Western Yellow-Billed Cuckoo by Alternative

Alternative	Permanent Impacts—Aquatic (acres)	Permanent Impacts—Upland (acres)	Temporary Impacts—Aquatic (acres)	Temporary Impacts—Upland (acres)	Total (acres)
1	26.37	305.91	16.51	95.51	444.30
2b	23.70	289.99	16.20	95.20	425.09
3	17.39	80.23	13.86	53.78	165.26
4b	14.94	64.31	13.55	53.46	146.26
DWR's Preferred Alternative	10.27	67.16	12.00	33.77	123.20

Table I1-63. Impacts on Modeled Habitat for California Black Rail by Alternative

Alternative	Permanent Impacts—Delta (acres)	Permanent Impacts—Mid-Channel Island Primary (acres)	Permanent Impacts—Mid-Channel Island Secondary (acres)	Temporary Impacts—Delta (acres)	Temporary Impacts—Mid-Channel Island Primary (acres)	Temporary Impacts—Mid-Channel Island Secondary (acres)	Total (acres)
1	6.95	0.00	0.00	DWR's Preferred Alternative. 33	0.47	0.00	12.75
2b	DWR's Preferred Alternativ e.54	0.00	0.00	4.42	0.47	0.00	10.43
3	12.00	0.00	0.00	3.29	0.22	0.00	15.51
4b	10.59	0.00	0.00	2.38	0.22	0.00	13.19
DWR's Preferred Alternative	12.48	0.00	0.00	3.18	0.27	0.00	15.93

Table I1-64. Impacts on Modeled Habitat for Greater Sandhill Crane by Alternative

Alternative	Permanent Impacts—Permanent Roost (acres)	Permanent Impacts—Temporary Roost (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Permanent Roost (acres)	Temporary Impacts—Temporary Roost (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	0.00	313.05	1,072.66	0.00	29.55	165.48	1,580.74
2b	0.00	238.42	861.38	0.00	29.61	162.50	1,291.91
3	0.00	3.05	1,083.24	1.46	4.97	96.74	1,189.46
4b	0.00	3.05	794.38	1.46	4.97	94.33	898.19
DWR's Preferred Alternative	0.00	3.79	1,349.18	1.46	4.40	77.76	1,436.59

Table I1-65. Impacts on Modeled Habitat for Lesser Sandhill Crane by Alternative

Alternative	Permanent Impacts—Permanent Roost (acres)	Permanent Impacts—Temporary Roost (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Permanent Roost (acres)	Temporary Impacts—Temporary Roost (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	0.00	313.05	1,478.89	0.00	29.55	171.62	1,993.11
2b	0.00	238.42	1,266.47	0.00	29.61	167.87	1,702.37
3	0.00	3.05	1,531.73	1.46	4.97	107.74	1,648.95
4b	0.00	3.05	1,212.28	1.46	4.97	104.70	1,326.46

Alternative	Permanent Impacts—Permanent Roost (acres)	Permanent Impacts—Temporary Roost (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Permanent Roost (acres)	Temporary Impacts—Temporary Roost (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
DWR's Preferred Alternative	0.00	3.79	1,359.77	1.46	4.40	83.34	1,452.76

Table I1-66. Impacts on Modeled Foraging Habitat for California Least Tern by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	17.23	13.57	30.80
2b	14.13	13.32	27.45
3	13.69	DWR's Preferred Alternative.06	18.75
4b	10.59	4.82	15.41
DWR's Preferred Alternative	6.75	3.97	10.72

Table I1-67. Impacts on Modeled Rookery Habitat for Double-Crested Cormorant, Great Blue Heron, and Great Egret by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	18.37	11.07	29.44
2b	15.05	10.95	26.00
3	16.66	8.48	25.14
4b	13.34	8.37	21.71
DWR's Preferred Alternative	19.62	8.69	28.31

Table I1-68. Impacts on Modeled Rookery Habitat for Snowy Egret and Black-Crowned Night Heron by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	23.27	15.72	38.99
2b	19.66	15.46	35.12
3	17.24	9.29	26.53
4b	13.63	9.04	22.67
DWR's Preferred Alternative	20.17	9.53	29.70

Table I1-69. Impacts on Modeled Habitat for Osprey by Alternative

Alternative	Permanent Impacts—Nesting (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Nesting (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	15.74	22.40	9.12	14.03	61.29
2b	12.81	19.07	9.01	13.79	54.68
3	15.84	14.23	7.67	DWR's Preferred Alternative.37	43.11
4b	12.90	10.90	7.56	DWR's Preferred Alternative.13	36.49
DWR's Preferred Alternative	17.93	8.15	7.77	4.31	38.16

Table I1-70. Impacts on Modeled Nesting and Foraging Habitat for White-Tailed Kite by Alternative

Alternative	Permanent Impacts—Nesting (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Nesting (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	15.74	2,443.68	9.12	258.19	2,726.73
2b	12.81	2,170.57	9.01	256.14	2,448.53
3	15.84	2,396.46	7.67	205.15	2,625.12
4b	12.90	2,088.42	7.56	203.75	2,312.63
DWR's Preferred Alternative	17.93	1,564.32	7.77	111.19	1,701.21

Table I1-71. Impacts on Modeled Nesting Habitat for Cooper's Hawk by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	18.37	11.06	29.43
2b	15.05	10.95	26.00
3	16.66	8.47	25.13
4b	13.34	8.36	21.70
DWR's Preferred Alternative	19.62	8.69	28.31

Table I1-72. Impacts on Modeled Foraging Habitat for Golden Eagle, Ferruginous Hawk, and Other Wintering Raptors by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	2,252.94	257.83	2,510.77
2b	2,041.63	254.85	2,296.48
3	2,080.36	214.23	2,294.59
4b	1,804.11	211.81	2,015.92
DWR's Preferred Alternative	1,391.31	115.36	1,506.67

Table I1-73. Impacts on Modeled Nesting and Foraging Habitat for Northern Harrier and Short-Eared Owl by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	1,955.82	194.38	2,150.20
2b	1,750.00	192.18	1,942.18
3	1,986.03	183.47	2,169.DWR's Preferred Alternative0
4b	1,715.28	181.84	1,897.12
DWR's Preferred Alternative	1,330.35	87.09	1,417.44

Table I1-74. Impacts on Modeled Habitat for California Horned Lark and Grasshopper Sparrow by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	2,252.94	257.83	2,510.77
2b	2,041.63	254.85	2,296.48
3	2,080.36	214.23	2,294.59
4b	1,804.11	211.81	2,015.92
DWR's Preferred Alternative	1,391.31	115.36	1,506.67

Table I1-75. Impacts on Modeled Nesting and Foraging Habitat for Swainson's Hawk by Alternative

Alternative	Permanent Impacts—Nesting (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Nesting (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	15.74	2,697.47	9.12	303.27	3,025.60
2b	12.81	2,413.02	9.01	300.30	2,735.14
3	15.84	2,487.87	7.67	225.03	2,736.41
4b	12.90	2,168.39	7.56	222.72	2,411.57

Alternative	Permanent Impacts—Nesting (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Nesting (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
DWR's Preferred Alternative	17.71	1,653.59	7.77	141.40	1,820.47

Table I1-76. Impacts on Modeled Habitat for Burrowing Owl by Alternative

Alternative	Permanent Impacts—High Value (acres)	Permanent Impacts—Low Value (acres)	Temporary Impacts—High Value (acres)	Temporary Impacts—Low Value (acres)	Total (acres)
1	968.72	2,080.10	186.72	208.57	3,444.11
2b	873.64	1,867.94	186.40	206.23	3,134.21
3	754.74	1,991.63	146.86	142.39	3,035.62
4b	660.03	1,740.74	147.10	140.16	2,688.03
DWR's Preferred Alternative	522.00	1,273.65	61.45	116.66	1,973.76

Table I1-77. Impacts on Modeled Nesting and Foraging Habitat for Least Bittern by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	4.90	4.66	9.56
2b	4.61	4.52	9.13
3	0.58	0.82	1.40
4b	0.29	0.68	0.97
DWR's Preferred Alternative	0.55	0.84	1.39

Table I1-78. Impacts on Modeled Nesting and Foraging Habitat for Loggerhead Shrike by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	2,293.57	269.73	2,563.30
2b	2,080.98	266.76	2,347.74
3	2,085.28	220.00	2,305.28
4b	1,807.75	217.60	2,025.35
DWR's Preferred Alternative	1,399.19	121.39	1,520.58

Table I1-79. Impacts on Modeled Nesting and Foraging Habitat for Modesto Song Sparrow by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	57.62	22.00	79.62
2b	54.01	21.75	75.76
3	17.62	10.39	28.01
4b	14.01	10.14	24.15
DWR's Preferred Alternative	20.54	10.63	31.17

Table I1-80. Impacts on Modeled Nesting and Foraging Habitat for Yellow-Breasted Chat by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	51.14	16.68	67.82
2b	48.18	16.58	64.76
3	12.03	8.83	20.86
4b	9.07	8.73	17.80
DWR's Preferred Alternative	13.43	8.96	22.39

Table I1-81. Impacts on Modeled Nesting and Foraging Habitat for Yellow-Headed Blackbird by Alternative

Alternative	Permanent Impacts—Nesting (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Nesting (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	4.90	2,252.94	4.66	257.83	2,520.33
2b	4.61	2,041.63	4.52	254.85	2,305.61
3	0.58	2,082.32	0.82	216.60	2,300.32
4b	0.29	1,806.08	0.68	214.18	2,021.23
DWR's Preferred Alternative	0.55	1,393.28	0.84	117.61	1,512.28

Table I1-82. Impacts on Modeled Nesting and Foraging Habitat for Yellow Warbler by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	47.43	12.84	60.27
2b	44.81	12.67	57.48
3	9.60	6.75	16.35
4b	6.98	6.59	13.57
DWR's Preferred Alternative	10.12	6.76	16.88

Table I1-83. Impacts on Modeled Recolonization Habitat for Least Bell's Vireo by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	47.43	12.84	60.27
2b	44.81	12.67	57.48
3	9.60	6.75	16.35
4b	6.98	6.59	13.57
DWR's Preferred Alternative	10.12	6.76	16.88

Table I1-84. Impacts on Modeled Habitat for Suisun Song Sparrow and Saltmarsh Common Yellowthroat by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
All Alternatives	0	0	0

Table I1-85. Impacts on Modeled Habitat for Tricolored Blackbird by Alternative

Alternative	Permanent Impacts—Previously Occupied Colony (acres)	Permanent Impacts—Potential Nesting (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Previously Occupied Colony (acres)	Temporary Impacts—Potential Nesting (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	0.00	7.62	2,504.43	0.00	6.59	317.12	2,835.76
2b	0.00	7.30	2,270.66	0.00	6.45	314.48	2,598.89
3	0.00	1.05	2,281.35	0.00	1.62	260.26	2,544.28
4b	0.00	0.72	1,982.48	0.00	1.48	258.18	2,242.86
DWR's Preferred Alternative	0.00	1.89	1,538.14	0.00	1.76	152.96	1,694.75

Table I1-86. Structures Evaluated for Bat Habitat in the Project Footprint [a]

Alternative	Permanent Impacts—Previously Occupied Colony (acres)	Permanent Impacts—Potential Nesting (acres)	Permanent Impacts—Foraging (acres)	Temporary Impacts—Previously Occupied Colony (acres)	Temporary Impacts—Potential Nesting (acres)	Temporary Impacts—Foraging (acres)	Total (acres)
1	0.00	7.62	2,504.43	0.00	6.59	317.12	2,835.76
2b	0.00	7.30	2,270.66	0.00	6.45	314.48	2,598.89
3	0.00	1.05	2,281.35	0.00	1.62	260.26	2,544.28
4b	0.00	0.72	1,982.48	0.00	1.48	258.18	2,242.86
DWR’s Preferred Alternative	0.00	1.89	1,538.14	0.00	1.76	152.96	1,694.75

I- = Interstate; SR = State Route

[a] Evaluation conducted by DWR staff in 2009 (California Department of Water Resources 2011).

Table I1-87. Impacts on Modeled Bat Habitat by Alternative

Alternative	Permanent Impacts (foraging) (acres)	Temporary Impacts (foraging) (acres)	Permanent Impacts (structure roosting) (acres)	Temporary Impacts (structure roosting) (acres)	Permanent Impacts (tree roosting) (acres)	Temporary Impacts (tree roosting) (acres)	Total (acres)
1	3,234.24	443.97	DWR’s Preferred Alternative.72	4.70	144.72	21.55	3,854.90
2b	2,823.21	439.54	DWR’s Preferred Alternative.52	4.21	59.74	21.02	3,353.24
3	2,966.81	351.56	7.93	4.90	109.03	16.84	3,457.07
4b	2,519.69	347.80	7.74	4.40	24.05	16.30	2,919.98
DWR’s Preferred Alternative	2,023.17	240.09	10.43	6.88	232.02	24.57	2,537.16

Table I1-88. Impacts on San Joaquin Kit Fox Habitat by Alternative

Alternative	Permanent Impacts High Quality (acres)	Permanent Impacts Moderate Quality (acres)	Permanent Impacts Low Quality (acres)	Temporary Impacts High Quality (acres)	Temporary Impacts Moderate Quality (acres)	Temporary Impacts Low Quality (acres)	Total (acres)
1, 2b, 3, 4b	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DWR's Preferred Alternative	0.01	0.00	38.28	0.05	0.02	16.94	55.30

Table I1-89. Impacts on Modeled Habitat for American Badger by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	161.48	44.57	206.05
2b	153.19	44.26	197.45
3	102.45	30.11	132.56
4b	94.16	29.80	123.96
DWR's Preferred Alternative	66.63	33.10	99.73

Table I1-90. Impacts on Modeled Habitat for San Joaquin Pocket Mouse by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
1	161.48	44.57	206.05
2b	153.19	44.26	197.45
3	102.45	30.11	132.56
4b	94.16	29.80	123.96
DWR's Preferred Alternative	66.63	33.10	99.73

Table I1-91. Impacts on Modeled Habitat for Salt Marsh Harvest Mouse by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
All alternatives	0	0	0

Table I1-92. Impacts on Modeled Habitat for Riparian Brush Rabbit by Alternative

Alternative	Permanent Impacts (acres)	Temporary Impacts (acres)	Total (acres)
All alternatives	0	0	0

Table I1-93. Estimated Fill of Aquatic Resources Associated with the Construction of Project Facilities (permanent and temporary)

	Alt.1	Alt.2b	Alt.3	Alt.4b	DWR's Preferred Alternative
Wetlands	–	–	–	–	–
Alkaline Wetland[1]	DWR's Preferred Alternative.90	DWR's Preferred Alternative.90	DWR's Preferred Alternative.90	DWR's Preferred Alternative.90	0.98
Seasonal Wetland	59.12	59.11	30.54	30.53	5.01
Vernal pool	0.00	0.00	0.00	0.00	0.20
Forested Wetland	3.72	3.47	3.25	2.99	3.25
Scrub Shrub Wetland	4.21	4.18	1.27	1.24	2.26
Freshwater Emergent Wetland	9.56	9.13	1.40	0.97	1.39
Wetlands Subtotal	82.51	81.79	42.36	41.63	13.09
Non-Wetland Waters	–	–	–	–	–
Agricultural Ditch	82.99	79.25	78.71	73.97	36.31
Conveyance Channel	22.00	22.00	22.00	22.00	0.40
Tidal Channel	30.45	27.10	18.40	15.06	10.72
Natural Channel	0.58	0.58	0.58	0.58	0.24
Depression	0.77	0.54	0.60	0.37	1.48
Non-Wetland Waters Subtotal	136.79	129.47	120.29	111.98	49.15
Total	219.30	211.26	162.65	153.61	62.24

Table I1-94. Summary of Temporary Disturbance in Natural Communities under Alternatives with the Most Potential Impacts (Alternative 2a) and the Fewest Potential Impacts (Alternative 2b) from Invasive Plant Species

Natural Community	Alternative 2a Long-Term Temporary and Temporary Impacts (acres)	Alternative 2b Long-Term Temporary and Temporary Impacts (acres)
Agricultural	1,204.49	898.84
Alkali Seasonal Wetland Complex	2.50	2.5
Grassland	93.75	86.40
Nontidal Brackish Emergent Wetland	0.00	0.00
Nontidal Freshwater Perennial Emergent Wetland	4.82	4.60
Nontidal Perennial Aquatic	0.99	0.56

[1] The alkaline wetland acreage includes alkaline wetlands that fall within vernal pool complexes. As explained in Section 13.1.2.1, *Vernal Pool Complex*, the southwestern portion of the delineation study area near Clifton Court Forebay consists of a mosaic of vernal pools, alkaline seasonal wetlands, and grasslands that fall within vernal pool complexes mapped by Witham et al. (2014); therefore, some of these wetlands fall under the vernal pool complex natural community.

Natural Community	Alternative 2a Long-Term Temporary and Temporary Impacts (acres)	Alternative 2b Long-Term Temporary and Temporary Impacts (acres)
Other Seasonal Wetlands	18.15	18.14
Tidal Brackish Emergent Wetland	0.00	0.00
Tidal Freshwater Emergent Wetland	0.82	0.82
Tidal Perennial Aquatic	19.50	15.12
Valley/Foothill Riparian	22.05	19.27
Vernal Pool Complex	10.15	9.89
Total	1,377	1,056

Table I1-95. Summary of Terrestrial Wildlife Species Occurring in Study Area with Potential Movement/Connectivity Impacts

Wildlife Crossing Guild	Species Occurring in Study Area with Potential Movement/Connectivity Impacts
Low-mobility small fauna	Mammals: San Joaquin pocket mouse Reptiles and Amphibians: California tiger salamander, *western spadefoot toad*, California red-legged frog, *coast horned lizard, Northern California legless lizard, California glossy snake*, *San Joaquin coachwhip* Invertebrates: Valley elderberry longhorn beetle.
Semi-Aquatic Obligate	Mammals: River otter, mink, beaver Reptiles and Amphibians: Giant garter snake, *western pond turtle*
Moderate-mobility small fauna	Mammals: *American badger*, squirrels, raccoon, weasels
Adaptive high-mobility fauna	Mammals: Bobcat, coyote
High-openness, high-mobility carnivores	Mammals: Mountain lion
Adaptive ungulates	Mammals: Mule deer
Very high openness fauna	Mammals: San Joaquin kit fox
Aerial fauna	Mammals (bats): *pallid bat*, *Townsend's big-eared bat*, big brown bat, silver-haired bat, *western red bat*, hoary bat, California myotis, little brown bat, western small footed myotis, Yuma myotis, western pipistrelle, *western mastiff bat*, Mexican free-tailed bat Birds: California black rail, Swainson's hawk, tricolored blackbird, golden eagle, ferruginous hawk, *Northern harrier, short-eared owl, Modesto song sparrow,* osprey, white-tailed kite, Cooper's hawk, cormorants, herons, egrets, *burrowing owl, yellow-headed blackbird, grasshopper sparrow, yellow-breasted chat, loggerhead shrike, least bittern*

Table I1-96. Summary Table of Conservation Plans that Overlap with the Project Study Area

Conservation Plan	Plan Status	Plan Area (acres)	Boundary Overlap with Study Area (acres)	Proportion of Conservation Plans that Overlap Study Area
East Contra Costa County HCP/NCCP	Approved in 2007	174,018	63,002	36%
San Joaquin County MSHCP and Open Space Plan	Approved in 2001	912,386	318,898	35%
South Sacramento HCP	Approved in 2019	317,655	43,958	14%
East Alameda County Conservation Strategy	Approved in 2011	271,486	6,470	2%

Sources: Cal-Atlas Geospatial Clearinghouse; TRA Environmental Services 2011; County of Sacramento et al. 2000, 2018; East Alameda County Conservation Strategy Steering Committee 2010; East Contra Costa Habitat Conservation Plan Association 2006.

HCP = habitat conservation plan; NCCP = natural communities conservation plan; MSHCP = multi-species habitat conservation plan.

Table I1-97. Impacts from Construction of Water Conveyance Facilities under the Alternatives Relative to Total Area of Overlapping Conservation Plans

Alternative	Permanent Surface Impacts (acres)	Proportion of Surface Impacts Relative to Plan Area (% of plan area)
Plan: South Sacramento HCP Plan Area: 317,655 acres		
1	455.20	0.1%
2b	194.20	0.1%
3	484.66	0.2%
4b	194.20	0.1%
DWR's Preferred Alternative	542.41	0.2%
Plan: San Joaquin County MSHCP Plan Area: 912,386 acres		
1	822.08	0.1%
2b	751.63	0.1%
3	291.59	<0.1%
4b	251.11	<0.1%
DWR's Preferred Alternative	425.98	<0.1%
Plan: East Contra Costa County HCP/NCCP Plan Area: 174,018 acres		
1, 2b, 4b	1,363.73	0.8%
3	1,394.81	0.8%
DWR's Preferred Alternative	0.16	<0.01%
Plan: East Alameda County Conservation Strategy Plan Area: 271,486 acres		
1, 2b, 3, 4b	1.21	<0.1%

Alternative	Permanent Surface Impacts (acres)	Proportion of Surface Impacts Relative to Plan Area (% of plan area)
DWR's Preferred Alternative	328.75	0.1%

HCP = habitat conservation plan; NCCP = natural communities conservation plan; MSHCP = multi-species habitat conservation plan.

Table I1-98. Cumulative Impacts on Terrestrial Biological Resources from Plans, Policies, and Programs

Alternative	Permanent Surface Impacts (acres)	Proportion of Surface Impacts Relative to Plan Area (% of plan area)
Plan: South Sacramento HCP Plan Area: 317,655 acres		
1	455.20	0.1%
2b	194.20	0.1%
3	484.66	0.2%
4b	194.20	0.1%
DWR's Preferred Alternative	542.41	0.2%
Plan: San Joaquin County MSHCP Plan Area: 912,386 acres		
1	822.08	0.1%
2b	751.63	0.1%
3	291.59	<0.1%
4b	251.11	<0.1%
DWR's Preferred Alternative	425.98	<0.1%
Plan: East Contra Costa County HCP/NCCP Plan Area: 174,018 acres		
1, 2b, 4b	1,363.73	0.8%
3	1,394.81	0.8%
DWR's Preferred Alternative	0.16	<0.01%
Plan: East Alameda County Conservation Strategy Plan Area: 271,486 acres		
1, 2b, 3, 4b	1.21	<0.1%
DWR's Preferred Alternative	328.75	0.1%

Caltrans = California Department of Transportation; cfs = cubic feet per second; CVP = Centra Valley Project; BiOp = Biological Opinion; CDFW = California Department of Fish and Wildlife; DWR = California Department of Water Resources; EBMUD = East Bay Municipal Utility District; EIR = Environmental Impact Report; EIS = Environmental Impact Statement; EPA = U.S. Environmental Protection Agency; I = Interstate; NMFS = National Marine Fisheries Service; Reclamation = Bureau of Reclamation; SR = State Route; SWP = State Water Project; USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service.

Appendix I2

Special-Status Species with Potential to Occur in the Study Area

> The information in this Appendix is presented as provided by the California Department of Water Resources (the applicant) in the Delta Conveyance Project Draft Environmental Impact Report (Draft EIR) Appendix 13A, *Special-Status Species with Potential to Occur in the Study Area,* and therefore is presented from the California Environmental Quality Act perspective. However, the U.S. Army Corps of Engineers relied on this information when preparing its Draft Environmental Impact Statement. All chapter references in this appendix are to those in the Draft EIR. Please refer to the Draft EIR for any information cross referenced.

Special-status plant and wildlife species considered for inclusion in the analysis in Chapter 13, *Terrestrial Biological Resources*, are presented in this appendix. Table 13A-1, *Special-Status Plant Species Considered for Analysis [in the Study Area]*, presents detailed information on the special-status plant species known or with potential to occur in study area and includes their common and scientific names, listing status (federal, state, and California Native Plant Society [CNPS]), notes on the species habitat, distribution in California, flowering period, potential for occurrence in the study area, and whether they are analyzed in the chapter. Table 13A-2 *Special-Status Wildlife Species Considered for Analysis [in the Study Area]*, provides information on the special-status wildlife species that were identified for consideration in Chapter 13, including common and scientific names, listing status (federal, state, global rank, and/or state rank), notes on the species life history, habitat, distribution in California, potential for occurrence in the study area, and whether they are analyzed in the chapter. The species listed in these table were generated from queries of the California Natural Diversity Database (CNDDB), CNPS, and the U.S. Fish and Wildlife Service (USFWS) database based on the limits of the study area, and by taking into consideration the ranges of special-status species that have a potential to occur in the study area despite not having occurrences in the study area. Due to the length and complexity of this information, and in an effort to maintain the readability of Chapter 13, this information is presented in an appendix.

Table 13A-1. Special-Status Plant Species Considered for Analysis [in the Study Area]

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Large-flowered fiddleneck *Amsinckia grandiflora*	E/E/1B.1	Cismontane woodland, valley and foothill grassland slopes; 902–1,804 feet. Historically known from Mount Diablo foothills in Contra Costa, Alameda, and San Joaquin Counties; currently known from three natural occurrences.	Species not known to occur in study area; study area below 900 feet elevation.	No
Slender silver moss *Anomobryum julaceum*	–/–/2B.2	On damp rock and soil on outcrops, usually on roadcuts in broadleafed upland forest, lower montane coniferous forest, North Coast coniferous forest; 328–3,281 feet. Scattered occurrences in California from Humboldt and Shasta Counties south to Los Angeles County; Oregon and elsewhere.	Species not known to occur in study area; no potential habitat present.	No
Mt. Diablo manzanita *Arctostaphylos auriculata*	–/–/1B.3	Chaparral and oak woodland in canyons and on slopes on sandstone; 443–2,132 feet. Endemic to Contra Costa County especially Mt Diablo area, San Francisco Bay Area.	Species not known to occur in study area; no potential habitat in study area.	No
Contra Costa manzanita *Arctostaphylos manzanita* subsp. *laevigata*	–/–/1B.2	Rocky sites in chaparral; 1,640–3,609 feet. Eastern San Francisco Bay region, Mount Diablo, southern Inner North Coast Range, Vaca Mountains in Contra Costa County.	Species not known to occur in study area; no potential habitat present.	No
Ferris's milk vetch *Astragalus tener* var. *ferrisiae*	–/–/1B.1	Seasonally wet areas in meadows and seeps, subalkaline flats in valley and foothill grassland; 6–246 feet. Historical range included the Central Valley from Butte to Alameda County but currently only occurs in Butte, Glenn, Colusa, and Yolo Counties.	One extant occurrence in study area (Yolo County); not known to occur in areas that would be affected.	No
Alkali milk-vetch *Astragalus tener* var. *tener*	–/–/1B.2	Playas, on adobe clay in valley and foothill grassland, vernal pools on alkaline soils; 3–197 feet. Southern Sacramento Valley, northern San Joaquin Valley, east San Francisco Bay Area.	Occurrences reported in or abutting study area.	Yes
Heartscale *Atriplex cordulata* var. *cordulata*	–/–/1B.2	Saline or alkaline soils in chenopod scrub, meadows and seeps, sandy areas in valley and foothill grassland; below 1,837 feet. Western Central Valley and valleys of adjacent foothills.	One occurrence in study area at Jepson Prairie, outside area that would be affected.	No
Crownscale *Atriplex coronata* var. *coronata*	–/–/4.2	Alkaline clay soils in chenopod scrub, playas, valley and foothill grasslands; 1–516 feet. Southern Sacramento Valley, eastern San Joaquin Valley, eastern San Francisco Bay Area, Inner South Coast Ranges.	Occurrences reported in study area.	Yes
Brittlescale *Atriplex depressa*	–/–/1B.2	Alkaline clay soils in chenopod scrub, playas, valley and foothill grasslands; 3–1,049 feet. Western and eastern Central Valley and adjacent foothills on west side of Central Valley.	Occurrences reported in or abutting study area.	Yes

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
San Joaquin spearscale *Atriplex joaquiniana*	–/–/1B.2	Alkaline soils in chenopod scrub, meadows and seeps, playas, valley and foothill grassland; 3–2,739 feet. Western edge of the Central Valley from Glenn to Tulare Counties.	Occurrences reported in or abutting study area.	Yes
Lesser saltscale *Atriplex minuscula*	–/–/1B.1	Sandy alkaline soils in chenopod scrub, playas, valley and foothill grassland; 49–656 feet. Sacramento Valley and San Joaquin Valley: Merced County to Kern County, disjunct to Alameda and Butte Counties.	Species not known to occur in study area, study area not within species' range.	No
Vernal pool smallscale *Atriplex persistens*	–/–/1B.2	Dry beds of vernal pools on alkaline soils; 33–377 feet. Central Valley from Glenn to Tulare County.	Species not known occur in study area; occurrences at Jepson Prairie are outside of study area.	No
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	–/–/1B.2	Sometimes on serpentine soils in chaparral, cismontane woodland, valley and foothill grassland; 295–5,102 feet. Scattered occurrences in the Coast Ranges and Sierra Nevada foothills.	Species not known to occur in study area; no potential habitat in study area.	No
Big tarplant *Blepharizonia plumosa*	–/–/1B.1	Valley and foothill grassland; 98–1,657 feet. San Francisco Bay Area, with occurrences in Alameda, Contra Costa, San Joaquin*, Stanislaus, and Solano Counties.	Species occurrences in study area are extirpated.	No
Watershield *Brasenia schreberi*	–/–/2B.3	Freshwater marshes; 98–7,218 feet. Scattered occurrences in northern and central California; widespread across US.	Occurrences reported in and abutting study area.	Yes
Mt. Diablo fairy-lantern *Calochortus pulchellus*	–/–/1B.2	Cismontane woodland; chaparral, riparian woodland, valley and foothill grassland; 98–2,756 feet. Alameda, Contra Costa, and Solano Counties.	Species not known to occur in study area; no potential habitat in study area.	No
Bristly sedge *Carex comosa*	–/–/2B.1	Coastal prairie, marshes and swamps at lake margins, valley and foothill grassland; below 2,050 feet. Scattered occurrences throughout California; Oregon, Washington, and elsewhere.	Occurrences reported in study area.	Yes
Tiburon paintbrush *Castilleja affinis* subsp. *neglecta*	E/T/1B.2	Serpentine grasslands; 197–1,312 feet. San Francisco Bay Area: Marin, Napa, and Santa Clara Counties.	Species not known to occur in study area; no potential habitat in study area.	No
Lemmon's jewel-flower *Caulanthus lemmonii*	–/–/1B.2	Dry, exposed slopes in grasslands and pinyon-juniper woodland; 262– 4,003 feet. Southeast San Francisco Bay Area, south through the South Coast Ranges and adjacent San Joaquin Valley to Ventura County.	Species not known to occur in study area; no potential habitat in study area.	No
Congdon's tarplant *Centromadia parryi* subsp. *congdonii*	–/–/1B.2	Alkaline soils in annual grassland, on lower slopes, flats, and swales, sometimes on saline soils; below 754 feet. East San Francisco Bay Area, Salinas Valley, Los Osos Valley.	Study area outside of species' range; one occurrence in study area with questionable identification.	No

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Pappose tarplant *Centromadia parryi* subsp. *parryi*	–/–/1B.2	Coastal prairie, meadows and seeps, coastal salt marshes and swamps, alkaline soils in vernally mesic valley and foothill grassland; 6–1,378 feet. North and Central Coast Ranges, the southern Sacramento Valley; occurrences in Butte, Colusa, Glenn, Lake, Napa, San Mateo, and Solano Counties.	Study area outside of species' range; one occurrence in study area with questionable identification.	No
Parry's rough tarplant *Centromadia parryi* subsp. *rudis*	–/–/4.2	Grassland habitats, often on clay or alkaline soils; 0–300 feet. Inner North Coast Ranges, Sacramento Valley, northern San Joaquin Valley.	Five occurrences present in Yolo County part of study area outside of area that would be affected.	No
Hispid bird's-beak *Chloropyron molle* subsp. *hispidum*	–/–/1B.1	Meadow and seeps, valley and foothill grassland, playas, on alkaline soils; 3–508 feet. Central Valley in Alameda, Fresno, Kern, Merced, Placer, and Solano Counties.	Species not known to occur in study area.	No
Soft bird's-beak *Chloropyron molle* subsp. *molle*	E/R/1B.2	Tidal salt marsh; below 10 feet. San Francisco Bay region: Suisun Marsh, Contra Costa, Marin*, Napa, Solano, Sacramento*, and Sonoma* Counties.	Only known occurrence in study area is extirpated.	No
Palmate-bracted bird's-beak *Chloropyron palmatum*	E/E/1B.1	Alkaline sites in grassland and chenopod scrub; 16–508 feet. Livermore Valley and scattered locations in the Central Valley from Colusa County to Fresno County.	Only known occurrence in study area is extirpated.	No
Bolander's water-hemlock *Cicuta maculata* var. *bolanderi*	–/–/2.1	Marshes and swamps, coastal, fresh or brackish water; 0–656 feet. Contra Costa, Los Angeles*, Marin, Sacramento, Santa Barbara*, San Luis Obispo*, Solano Counties; also, Arizona, New Mexico, and Washington.	Occurrences reported in and abutting study area.	Yes
Slough thistle *Cirsium crassicaule*	–/–/1B.1	Chenopod scrub, riparian scrub, sloughs in swamps and marshes; 10–328 feet. San Joaquin Valley: San Joaquin, Kings and Kern Counties.	Two occurrences reported in study area, one extirpated. Occurrence outside of area that would be affected.	No
Suisun thistle *Cirsium hydrophilum* var. *hydrophilum*	E/–/1B.1	Salt marshes and swamps; below 3 feet. Suisun Marsh, Solano County.	Species not known to occur in study area. Study area outside of known range.	No
Small-flowered morning-glory *Convolvulus simulans*	–/–/4.2	Grassland, coastal sage scrub, chaparral, on clay soils, occasionally on serpentine, 100–2,870 feet. Southern Sierra Nevada foothills, San Joaquin Valley, San Francisco Bay Area, South Coast Ranges, coastal Southern California.	Species not known to occur in study area; potential habitat present in study area.	Yes
Hoover's cryptantha *Cryptantha hooveri*	–/–/1A	Inland dunes and coarse, sandy soil in valley and foothill grassland; 29–492 feet. Northern and central San Joaquin Valley: Contra Costa*, Kern, Madera*, and Stanislaus* Counties.	Only known occurrence in study area historic, last seen in Antioch in 1908 and possibly extirpated due to development. No potential habitat in study area.	No

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Peruvian dodder *Cuscuta obtusiflora* var. *glandulosa*	–/–/2B.2	Freshwater marshes and swamps; 49–919 feet. Not seen since 1948; occurrences in Butte, Los Angeles, Merced, Sacramento(?), San Bernardino*, and Sonoma Counties; Baja California and elsewhere.	Species not known to occur in study area.	No
Hospital Canyon larkspur *Delphinium californicum* subsp. *interius*	–/–/1B.2	Openings in chaparral, mesic cismontane woodland, on moist slopes and ravines; 754–3,592 feet. Inner South Coast Ranges, eastern San Francisco Bay: Alameda, Contra Costa, Merced, San Benito, Santa Clara, San Joaquin, San Luis Obispo, and Stanislaus Counties.	Species not known to occur in study area; no potential habitat in study area.	No
Recurved larkspur *Delphinium recurvatum*	–/–/1B.2	Alkaline soils in valley and foothill grassland, saltbush scrub, cismontane woodland; 10–2,460 feet. Central Valley from Colusa* to Kern Counties.	Occurrences reported in study area.	Yes
Western leatherwood *Dirca occidentalis*	–/–/1B.2	Moist areas in broadleaved upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, North Coast coniferous forest, riparian forest, riparian woodland; 82–1,296 feet. San Francisco Bay region, Alameda, Contra Costa, Marin, Santa Clara, San Mateo, and Sonoma Counties.	Species not known to occur in study area; no potential habitat in study area.	No
Dwarf downingia *Downingia pusilla*	–/–/2B.2	Wet areas in valley and foothill grassland, vernal pools; 3–1,460 feet. Inner North Coast Ranges, southern Sacramento Valley, northern and central San Joaquin Valley.	Occurrences reported in or abutting study area.	Yes
Streamside daisy *Erigeron biolettii*	–/–/3	Moist, rocky areas in broadleaved upland forest, cismontane woodland, North Coast coniferous forest, and ledges along rivers; 98–3,609 feet. North Coast, from Humboldt County to Marin County.	Species not known to occur in study area; no potential habitat in study area.	No
Tiburon buckwheat *Eriogonum luteolum* var. *caninum*	–/–/1B.2	On sandy to gravelly serpentinite soils in chaparral, coastal prairie, oak woodland, valley and foothill grassland; below 2,296 feet. Central Inner North Coast Range, northern Central coast, and northern San Francisco Bay Area: Alameda, Contra Costa, Marin, and Sonoma(?*) Counties.	Species not known to occur in study area; no potential habitat in study area.	No
Antioch Dunes buckwheat *Eriogonum nudum* var. *psychicola*	–/–/1B.1	Inland dunes; below 66 feet. Known from a single occurrence in the Antioch Dunes, Contra Costa County.	Species occurs in study area outside of area that would be affected (Antioch).	No
Mt. Diablo buckwheat *Eriogonum truncatum*	–/–/1B.1	Coarse, sandy soils in chaparral, coastal scrub, valley and foothill grassland; 10–1,148 feet. Historically known from Alameda, Contra Costa, and Solano Counties; recently rediscovered on Mt. Diablo.	Species not known to occur in study area; no potential habitat in study area.	No

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Jepson's button-celery *Eryngium jepsonii*	–/–/1B.2	Grasslands, on vernally moist clay soils, below 1,640 ft; Southern Interior North Coast Ranges, deltaic Great Valley, San Francisco Bay Area	Two occurrences in study area are outside of areas that would be affected. Potential habitat in areas that would be affected.	Yes
Spiny-sepaled button-celery *Eryngium spinosepalum*	–/–/1B.2	Vernal pools, swales, roadside ditches, at 50–4,165 feet; Western San Joaquin Valley, southern Sierra Nevada Foothills	Species occurs in study area.	Yes
Delta button-celery *Eryngium racemosum*	–/E/1B.1	Riparian scrub in seasonally inundated depressions on clay soils; 10–98 feet. San Joaquin River delta, floodplains, and adjacent Sierra Nevada Foothills: Calaveras, Contra Costa, Merced, San Joaquin*, and Stanislaus Counties.	Only occurrences in study area are extirpated, in areas that would not be affected.	No
Contra Costa wallflower *Erysimum capitatum* var. *angustatum*	E/E/1B.1	Inland dunes; 10–66 feet. Known only from the Antioch Dunes in Contra Costa County.	Species occurs in study area outside of area that would be affected (Antioch).	No
Diamond-petaled California poppy *Eschscholzia rhombipetala*	–/–/1B.1	On alkaline clay soils in grassland, chenopod scrub, where grass cover is sparse enough to allow growth of low annuals; below 3,199 feet. Interior foothills of South Coast Ranges from Alameda County to Stanislaus Counties, Carrizo Plain in San Luis Obispo County.	Species occurs in study area.	Yes
Stinkbells *Fritillaria agrestis*	–/–/4.2	Chaparral, cismontane woodland, pinyon-juniper woodland, valley and foothill grassland, on clay or serpentinite substrate; 33–5,102 feet. Alameda, Contra Costa, Fresno, Kern, Mendocino, Monterey, Merced, Monterey, Mariposa, Placer, Sacramento, Santa Barbara, San Benito, San Luis Obispo, San Mateo, Stanislaus, and Tuolumne Counties.	Occurrence reported in study area outside of area that would be affected (Oakley).	Yes
Fragrant fritillary *Fritillaria liliacea*	–/–/1B.2	Adobe soils of interior foothills, coastal prairie, coastal scrub, valley and foothill grassland, often on serpentinite; 10–1,345 feet. Coast Ranges from Marin County to San Benito County.	Occurrences reported in study area outside of area that would be affected (Jepson Prairie).	No
Adobe-lily *Fritillaria pluriflora*	–/–/1B.2	Chaparral, cismontane woodland, valley and foothill grassland, often on adobe soils; 197–2,313 feet. Northern Sierra Nevada foothills, Inner North Coast Ranges, edges of Sacramento Valley.	Species not known to occur in study area; study area outside of species' known range.	No
Boggs Lake hedge-hyssop *Gratiola heterosepala*	–/E/1B.2	Clay soils in areas of shallow water, lake margins of swamps and marshes, vernal pool margins; 33–7,792 feet. Inner North Coast Ranges, Central Sierra Nevada foothills, Sacramento Valley and Modoc Plateau in Fresno, Lake, Lassen, Madera, Merced, Modoc, Placer, Sacramento, Shasta, Siskiyou, San Joaquin, Solano, and Tehama Counties; and Oregon.	A single occurrence reported in study area (Jepson Prairie). Would only be potentially affected by tidal restoration.	Yes

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Diablo helianthella *Helianthella castanea*	–/–/1B.2	At chaparral/oak woodland ecotone, often in partial shade, on rocky soils, also coastal scrub, riparian woodland, broadleafed upland forest, valley and foothill grassland; 197–4,265 feet. San Francisco Bay Area: Alameda, Contra Costa, Marin*, San Francisco*, and San Mateo Counties; also reported from San Diego County.	Species not known to occur in study area; no potential habitat in study area.	No
Hogwallow starfish *Hesperevax caulescens*	–/–/4.2	Vernal pools, clay flats, in grasslands; 0–985 feet. Broadly ranging in California, primarily in Great Valley and adjacent foothills, also in South Coast Ranges, Peninsular Ranges.	Species occurs in study area.	Yes
Brewer's western flax *Hesperolinon breweri*	–/–/1B.2	Chaparral, cismontane woodland, valley and foothill grassland usually on soils derived from serpentinite; 98–2,953 feet. Southern North Inner Coast Ranges, northeast San Francisco Bay region, especially Mt. Diablo: Contra Costa, Napa, and Solano Counties.	Species not known to occur in study area; no potential habitat in study area.	No
Woolly rose-mallow *Hibiscus lasiocarpos* var. *occidentalis*	–/–/1B.2	Freshwater marshes and swamps; below 394 feet. Scattered locations in the Central Valley, including the Delta, from Butte County to San Joaquin County.	Occurrences reported in and abutting study area.	Yes
Santa Cruz tarplant *Holocarpha macradenia*	T/E/1B.1	Coastal terrace grasslands, coastal scrub, often on light sandy to sandy clay soils; 33–722 feet. Coastal slope of the Santa Cruz Mountains, Monterey and Santa Cruz Counties.	Species not known to occur in study area; study area outside of species' range.	No
Central Coast iris *Iris longipetala*	–/–/4.2	North and Central Coast, outer North Mesic areas in coastal prairie, lower montane coniferous forest, meadows; 0–2,000 feet. Coast Ranges, San Francisco Bay Area.	Occurrences adjacent to but not in study area; no potential habitat in study area.	No
Carquinez goldenbush *Isocoma arguta*	–/–/1B.1	Annual grassland on alkaline soils and flats; 3–66 feet. Deltaic Sacramento Valley, Suisun Slough, Contra Costa and Solano Counties.	Two occurrences in study area but outside of areas that would be affected.	Yes
Contra Costa goldfields *Lasthenia conjugens*	E/–/1B.1	Wet areas in cismontane woodland, valley and foothill grassland, vernal pools, alkaline playas or saline vernal pools and swales; below 1,542 feet. Scattered occurrences in Coast Range valleys and southwest edge of Sacramento Valley: Alameda, Contra Costa, Mendocino*, Monterey, Marin, Napa, Santa Barbara*, Santa Clara*, Solano and Sonoma Counties.	Species reported in study area outside of area that would be affected (Antioch).	No
Ferris' goldfields *Lasthenia ferrisiae*	–/–/4.2	Alkaline vernal pools, wet saline flats; 0–2,300 feet. San Joaquin Valley and valleys of adjacent foothills.	Occurrences reported in study area.	Yes
Delta tule pea *Lathyrus jepsonii* subsp. *jepsonii*	–/–/1B.2	Coastal and estuarine marshes (freshwater and brackish); below 13 feet. San Francisco Bay region, also part of Central Valley in Alameda, Contra Costa, Napa, Santa Clara*, San Joaquin, Solano, and Sonoma Counties.	Occurrences reported in or abutting study area.	Yes

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Legenere *Legenere limosa*	–/–/1B.1	Vernal pools; 3–2,887 feet. Primarily in the lower Sacramento Valley, also from North Coast Ranges, northern San Joaquin Valley, and the Santa Cruz mountains.	Occurrences reported in or abutting study area.	Yes
Heckard's pepper-grass *Lepidium latipes* var. *heckardii*	–/–/1B.2	On margins of alkali scalds in annual grassland; 6–656 feet. Southern Sacramento Valley in Glenn, Merced, Sacramento, Solano, and Yolo Counties.	Occurrences reported in study area.	Yes
Woolly-headed lessingia *Lessingia hololeuca*	–/–/3	Clay or serpentinite soils of broadleafed upland forest, coastal scrub, lower montane coniferous forest, valley and foothill grassland; 49–1,001 feet. Southern North Coast Ranges; southern Sacramento Valley; northern San Francisco Bay region; and Alameda, Monterey, Marin, Napa, Santa Clara, San Mateo, Solano, Sonoma, and Yolo Counties.	Species not known to occur in study area, no potential habitat in study area.	No
Mason's lilaeopsis *Lilaeopsis masonii*	–/R/1B.1	Freshwater or brackish marsh, riparian scrub, in tidal zone; below 33 feet. Southern Sacramento Valley, Sacramento-San Joaquin River Delta, northeast San Francisco Bay Area in Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, Solano, and Yolo Counties.	Occurrences reported in or abutting study area.	Yes
Delta mudwort *Limosella subulata*	–/–/2B.1	Muddy or sandy intertidal flats and marshes, streambanks in riparian scrub; generally, at sea level (i.e., below 10 feet). Deltaic Central Valley: Contra Costa, Sacramento, San Joaquin, and Solano Counties; Oregon.	Occurrences reported in or abutting study area.	Yes
Showy madia *Madia radiata*	–/–/1B.1	Oak woodland, valley and foothill grassland, slopes; 82–3,986 feet. Scattered populations in the interior foothills of the South Coast Ranges: Contra Costa*, Fresno, Kings*, Kern, Monterey*, Santa Barbara*, San Benito, Santa Clara, San Joaquin*, San Luis Obispo, and Stanislaus Counties.	Historic occurrences in study area (Antioch), outside of area that would be affected.	No
Hall's bush-mallow *Malacothamnus hallii*	–/–/1B.2	Chaparral and coastal scrub; 22–2,493 feet. Alameda, Contra Costa, Mendocino, Merced, Santa Clara, San Mateo, and Stanislaus Counties.	Species not known to occur in study area; no potential habitat in study area.	No
Little mousetail *Myosurus minimus* subsp. *apus*	–/–/3.1	Valley and foothill grassland, alkaline vernal pools; 66–2,100 feet. Central Valley and South Coast from Butte County south to San Diego County; Baja California, Oregon.	One occurrence reported in study area, which may be a misidentification.	Yes
Cotula navarretia *Navarretia cotulifolia*	–/–/4.2	Grassland, oak woodland, openings in chaparral, on adobe clay soils; 0–1,640 feet. Inner North Coast Ranges, western Sacramento Valley, San Francisco Bay Area, Inner South Coast Ranges.	Occurrences in study area.	Yes

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Baker's navarretia *Navarretia leucocephala* subsp. *bakeri*	–/–/1B.1	Vernal pools and swales in woodland, lower montane coniferous forest, mesic meadows, and grassland; 16–5,709 feet. Inner North Coast Range, western Sacramento Valley: Colusa, Glenn, Lake, Mendocino, Marin, Napa, Solano, Sonoma, Tehama, and Yolo Counties.	Occurrences in study area are outside of areas that would be affected (Jepson Prairie, Tule-Glide Ranch).	No
Shining navarretia *Navarretia nigelliformis* subsp. *radians*	–/–/1B.2	Mesic areas with heavy clay soils, in swales and clay flats; in oak woodland, grassland; 249–3,281 feet. Interior foothills of South Coast Ranges from Merced County to San Luis Obispo County.	Species occurs adjacent to study area and potential habitat present in study area.	Yes
Colusa grass *Neostapfia colusana*	T/E/1B.1	Adobe soils of large vernal pools; 16–656 feet. Central Valley with scattered occurrences from Colusa to Merced Counties.	One occurrence in study area (Jepson Prairie). Would only be potentially affected by tidal restoration.	Yes
Antioch Dunes evening-primrose *Oenothera deltoides* subsp. *howellii*	E/E/1B.1	Inland dunes; below 98 feet. Northeast San Francisco Bay region, known from three native occurrences; Contra Costa and Sacramento Counties.	Occurrences in study area are outside of areas that would be affected (Antioch).	No
Gairdner's yampah *Perideridia gairdneri* subsp. *gairdneri*	–/–/4.2	Coastal prairie, grasslands, and grassy openings in coniferous forest; 0–1,150 feet. Widely scattered localities, primarily in coastal California and the North Coast Ranges.	Species not known to occur in study area; study area outside of the species' range.	No
Bearded popcorn-flower *Plagiobothrys hystriculus*	–/–/1B.1	Mesic grassland, vernal pools; below 899 feet. Montezuma Hills in Napa, Solano, and Yolo Counties.	Occurrences in study area are outside of areas that would be affected (Jepson Prairie).	No
Eel-grass pondweed *Potamogeton zosteriformis*	–/–/2B.2	Assorted freshwater marshes, ponds, lakes and streambanks; below 6,102 feet. Scattered locations in northern California: Contra Costa, Lake, Lassen, Modoc, and Shasta Counties; Oregon, Utah, Washington, and elsewhere.	A single occurrence is known from study area.	Yes
Delta woolly marbles *Psilocarphus brevissimus* var. *multiflorus*	–/–/4.2	Vernal pools and swales; 30–1,640 feet. Widely scattered occurrences in the Sacramento Valley, northern San Joaquin Valley, and San Francisco Bay Area.	Species present in study area outside of areas that would be affected, but potential habitat in project footprint.	Yes
California alkali grass *Puccinellia simplex*	–/–/1B.2	Seasonally wet alkaline wetlands, sinks, flats, vernal pools, and lake margins, below 3,000 feet; Scattered locations in the San Francisco Bay Area, Great Valley, Tehachapi Mountains, western Mojave Desert	Two occurrences in study area; potential habitat present in study area.	Yes
Sanford's arrowhead *Sagittaria sanfordii*	–/–/1B.2	Freshwater marshes, sloughs, canals, and other slow-moving shallow water habitats; below 2,132 feet. Scattered locations in Central Valley and Coast Ranges.	Occurrences reported in and abutting study area.	Yes

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Marsh skullcap *Scutellaria galericulata*	–/–/2B.2	Marshes, mesic meadows, seeps, lower montane coniferous forest; below 6,890 feet. Northern High Sierra Nevada, Modoc Plateau in El Dorado, Lassen, Modoc, Nevada, Placer, Plumas, Shasta, and Siskiyou Counties. Also known from the Delta in San Joaquin County, Oregon, and elsewhere.	Occurrences reported in study area.	Yes
Side-flowering skullcap *Scutellaria lateriflora*	–/–/2B.2	Mesic meadows, marshes and swamps; below 1,640 feet. Known in California from occurrences in northern San Joaquin Valley in Sacramento and San Joaquin Counties and east of the Sierra Nevada in Inyo County, New Mexico, Oregon, and elsewhere.	Occurrences reported in study area.	Yes
Chaparral ragwort *Senecio aphanactis*	–/–/2B.2	Oak woodland, coastal scrub, chaparral, open sandy or rocky areas, on alkaline soils; 49–2,625 feet. Scattered locations in central western and southwestern California, from Alameda County to San Diego County.	Occurrences adjacent to but not in study area; no potential habitat in study area.	No
Keck's checkerbloom *Sidalcea keckii*	E/–/1B.1	Serpentine clay soils in cismontane woodland, valley and foothill grassland; 394 feet–1,394 feet. Known historically from only three occurrences in Fresno, Merced, and Tulare Counties; similar plants from Inner North Coast Ranges in Colusa, Napa, Solano, and Yolo Counties treated as this species until further studies completed.	Species not known to occur in study area; no potential habitat in study area.	No
Long-styled sand-spurrey *Spergularia macrotheca* var. *longistyla*	–/–/1B.2	Alkaline grassland, meadows, marshes, mud flats, hot springs, below 200 m; Interior North Coast Ranges, Great Valley	Six occurrences and potential habitat in study area.	Yes
Suisun Marsh aster *Symphyotrichum lentum*	–/–/1B.2	Brackish and freshwater marshes and swamps; below 10 feet. Sacramento–San Joaquin Delta, Suisun Marsh, Suisun Bay: Contra Costa, Napa, Sacramento, San Joaquin, and Solano Counties.	Occurrences reported in or abutting study area.	Yes
Wright's trichocoronis *Trichocoronis wrightii* var. *wrightii*	–/–/2B.1	On alkaline soils in floodplains, meadows and seeps, marshes and swamps, riparian forest, vernal pools; 16–1,427 feet. Scattered locations in the Central Valley and Southern Coast; Texas.	Only occurrence in study area is presumed extirpated.	No
Showy rancheria clover *Trifolium amoenum*	E/–/1B.1	Low elevation grasslands, including swales and disturbed areas, sometimes on serpentinite soils; 16–1,361 feet. Coast Range foothills in the San Francisco Bay region, currently known from only two recent occurrences in Marin County.	Species not known to occur in study area; study area outside of species range.	No
Saline clover *Trifolium hydrophilum*	–/–/1B.2	Salt marsh, mesic alkaline areas in valley and foothill grasslands, vernal pools, marshes and swamps; below 984 feet. Sacramento Valley, central western California.	Occurrences reported in study area.	Yes

Table 13A-1. Continued

Common and Scientific Names	Legal Status [a] Federal/State/CRPR	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Caper-fruited tropidocarpum *Tropidocarpum capparideum*	–/–/1B.1	Grasslands on alkaline hills; below 1,493 feet. Historically known from the northwest San Joaquin Valley and adjacent Coast Range foothills; currently known from Fresno, Monterey, and San Luis Obispo Counties.	Extant occurrence adjacent to study area, and potential habitat present in study area.	Yes
Solano grass *Tuctoria mucronata*	E/E/1B.1	Vernal pools, mesic grassland; 16–33 feet. Southwestern Sacramento Valley in Solano and Yolo Counties.	One occurrence in study area (Jepson Prairie). Would only be potentially affected by tidal restoration.	Yes
Oval-leaved viburnum *Viburnum ellipticum*	–/–/2B.3	Chaparral, cismontane woodland, and lower montane coniferous forest; 705–4,593 feet. Northwest California, San Francisco Bay Area, northern and central Sierra Nevada foothills.	Species not known to occur in study area.	No

Habitat and Distribution in California
? = population status within that County uncertain.
* = known populations believed extirpated from that County.
[a] Status explanations:
Federal
E = listed as endangered under the federal Endangered Species Act.
T = listed as threatened under the federal Endangered Species Act.
– = no listing.
State
E = listed as endangered under the California Endangered Species Act.
T = listed as threatened under the California Endangered Species Act.
R = listed as rare under the California Native Plant Protection Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
– = no listing.
California Rare Plant Rank[1]
1A = presumed extinct.
1B = rare, threatened, or endangered in California and elsewhere.
2B = rare, threatened, or endangered in California only.
3 = plants about which more information is needed to determine their status.
4 = plants of limited distribution.
.1 = seriously endangered in California.
.2 = fairly endangered in California.
.3 = not very endangered in California.

[1] In March 2010, CDFW changed the name of "CNPS List" or "CNPS Ranks" to "California Rare Plant Rank" (or CRPR). This was done to reduce confusion over the fact that CNPS and CDFW jointly manage the Rare Plant Status Review groups (300+ botanical experts from government, academia, non-governmental organizations, and the private sector) and that the rank assignments are the product of a collaborative effort and not solely a CNPS assignment.

Table 13A-2. Special-Status Wildlife Species Considered for Analysis [in the Study Area]

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Invertebrates					
Conservancy fairy shrimp *Branchinecta conservatio*	E/–	G1 S2	Found in large turbid playa pools. Occurs from Butte and Tehama Counties to Ventura County.	Known to occur in the study area.	Yes
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–	G3 S3	Vernal pools, swales, and other ephemeral wetlands. Occurs in the Central Valley from Shasta to Tulare and Kings Counties, in the central and southern Coast Ranges from Napa County to Los Angeles County, and inland in western Riverside County.	Known to occur in the study area.	Yes
Midvalley fairy shrimp *Branchinecta mesovallensis*	–/–	G2 S2S3	Vernal pools, swales, and other ephemeral wetlands. Occurs in the Sacramento Valley from Glenn County to Santa Clara County, San Joaquin Valley, and the Sierra foothills from Yuba County to Kern County.	Known to occur in the study area.	Yes
California linderiella *Linderiella occidentalis*	–/–	G2G3 S2S3	Vernal pools, swales, and other ephemeral wetlands. Range is limited to the Central Valley and Coast Ranges.	Known to occur in the study area.	Yes
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–	G4 S3S4	Occupies a variety of vernal pool habitats in the Central Valley and San Francisco Bay Area. Species has a patchy distribution across the Central Valley from Shasta County southward to northwestern Tulare County.	Known to occur at several locations in the study area.	Yes
Hairy water flea *Dumontia oregonensis*	–/–	G1G3 S1	Described in 2003 from a specimen taken from a vernal pool in southern Oregon. Documented in California in Sacramento and Solano Counties.	Known to occur in a vernal pool less than 1 mile outside the study area; could occur in vernal pools throughout the study area.	Yes
Antioch Dunes anthicid beetle *Anthicus antiochensis*	–/–	G1 S1	Loose sand on sand bars and sand dunes. Detected at Antioch Dines in Contra Costa County as well as several sites along the Sacramento River in Glenn, Tehama, Shasta, and Solano Counties.	Could occur in dune or sandbar habitat in the study area.	Yes
Sacramento anthicid beetle *Anthicus sacramento*	–/–	G1 S1	Interior sand dunes and sand bars, as well as in dredge spoil heaps. Found on Sacramento and lower San Joaquin Rivers from Shasta to San Joaquin Counties. Found at one site on the Feather River in Sutter County.	Could occur in sandy riparian habitat in the study area.	Yes
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–	G3T2 S2	Elderberry shrubs, typically in riparian habitats. Central Valley, including the study area, below approximately 500 feet elevation.	Known to occur in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a]		Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
	Federal/State	Other			
Delta green ground beetle *Elaphrus viridis*	T/–	G1S1	Typically occurs in the grassland-vernal pool complex. Species has only been detected in the greater Jepson Prairie area in Solano County. Typically occurs in the grassland-vernal pool complex.	Jepson Prairie is within the western portion of the study area, where the species is known to occur.	Yes
Ricksecker's water scavenger beetle *Hydrochara rickseckeri*	–/–	G2? S2?	Detected in Lake, Marin, Placer, Sacramento, San Joaquin, San Mateo, Solano, and Sonoma Counties. Typically known from a variety of aquatic habitats including vernal pools.	Potential to occur in the study area.	Yes
Curved-foot hygrotus diving beetle *Hygrotus curvipes*	–/–	G1 S1	Known to occur in Alameda and Contra Costa Counties. Small seasonal pools, associated with alkaline plant communities.	Potential to occur in the south western part of the study area, in Contra Costa County.	Yes
Molestan blister beetle *Lytta molesta*	–/–	G2 S2	Has been collected on *Lupinus, Trifolium,* and *Eriodium.* Often associated with grasslands and dried vernal pools. Occurs in the Central Valley of California.	Known to occur in the study area.	Yes
Blennosperma vernal pool andrenid bee *Andrena blennospermatis*	–/–	G2 S2	Detected in the Inner North Coast Ranges and Tehama, Solano, San Joaquin, Sacramento, El Dorado, and Placer Counties. Occurs in uplands around vernal pools.	Could occur in vernal pool grasslands in the study area.	Yes
Crotch bumble bee *Bombus crotchii*	–/CE	G3G4 S1S2	Occurs throughout the Pacific Coast, Western Desert, and adjacent foothills throughout most of the state's southwestern region. Inhabits grasslands and shrublands.	Historic records in the study area.	Yes
Western bumble bee *Bombus occidentalis*	–/CE	G2G3 S1	Known range extends throughout California. Habitat varies widely and includes open grassy areas, urban parks and gardens, chaparral and scrub lands, and mountain meadows.	Historic records in the study area.	Yes
Lange's metalmark butterfly *Apodemia mormo langei*	E/–	G5T1 S1	Endemic to the Antioch Dunes. Host plant is nude buckwheat. Distribution limited to Antioch Dunes in Contra Costa County.	Known to occur at Antioch Dunes in the study area but not addressed due to no potential for effects from construction and operations.	No
Longhorn fairy shrimp *Branchinecta longiantenna*	E/–	G1 S1S2	Typically found in sandstone outcrop pools in the region but also occurs in alkali sink pools on the Carrizo Plain. Known to occur in Alameda, Contra Costa, Merced, and San Luis Obispo Counties.	Not known to occur in the study area and the study area lacks sandstone outcrop pools	No

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
San Bruno elfin butterfly *Callophrys mossii bayensis*	E/–	G4T1 S1	Species is found in the fog-belt of steep north-facing slopes in the coastal mountains and is associated with its larval food plant, stonecrop (*Sedum spathulifolium*). All known locations are restricted to San Mateo County.	Study area is outside the known range of this species.	No
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	–/–	G5T2 SH	Required fine to medium sand on terraced floodplains or low sandy water edge flats. Sandy floodplain habitat in the Sacramento Valley. Historic records for Sutter, Colusa, and Yolo Counties. Presumed extinct.	Not expected to occur in the study area because the species is believed to be extinct.	No
San Joaquin dune beetle *Coelus gracilis*	–/–	G1 S1	Species is a flightless beetle that burrows in sand dunes. Occurred historically from Kings County north to Antioch Dunes; presumed extirpated from Antioch Dunes.	Unlikely to occur in the study area because species is believed to be extirpated from the Antioch Dunes.	No
Antioch efferian robberfly *Efferia antiochi*	–/–	G1G2 S1S2	No specific habitat information is available; robberfly larvae usually develop in the ground or in rotting wood, where they prey on other insect larvae. Known to occur in the Antioch Dunes, near Danville in Contra Costa County, and in Fresno County.	Known to occur at Antioch Dunes in the study area but not addressed due to no potential for effects from construction and operations	No
Redheaded sphecid wasp *Eucerceris ruficeps*	–/–	G1G3 S1S2	Occur in hard-packed sand. Known from Interior dunes in Western Central Valley from Contra Costa County to Fresno County.	Known to occur at Antioch Dunes, which would not see effects from project operations and maintenance.	No
Middlekauff's shieldback katydid *Idiostatus middlekauffi*	–/–	G1G2 S1	Interior dunes. Known only from Antioch Dunes.	Known to occur at Antioch Dunes, which would not see effects from project operations and maintenance.	No
Hurd's metapogon robberfly *Metapogon hurdi*	–/–	G1G2 S1S2	Sand dunes. Antioch Dunes and near Fresno, historically.	Known to occur at Antioch Dunes, which would not see effects from project operations and maintenance.	No
Antioch multilid wasp *Myrmosula pacifica*	–/–	GH SH	Possibly extinct. Known historically from Antioch Dunes, near the City of Davis, and Inyo County. CNDDB reports Inyo and Antioch site extant.	Known to occur at Antioch Dunes, which would not see effects from project operations and maintenance.	No
Antioch andrenid bee *Perdita scitula antiochensis*	–/–	G1T1 S1	Ground nesting bee that has been collected from Eriogonum, California matchweed (*Gutierrezia californica*), telegraphweed (*Heterotheca grandiflora*), and Valley lessingia (*Lessingia gladulifera*). Currently known only from Antioch Dunes. Formerly occurred in Oakley.	Known to occur at Antioch Dunes, which would not see effects from project operations and maintenance.	No

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Antioch sphecid wasp *Philanthus nasalis*	–/–	G1 S1	Sand dunes and inland marine sand hills. Extirpated from Antioch Dunes, extant in sand hills in Santa Cruz County.	Extirpated from Antioch Dunes, which would not see effects from project operations and maintenance.	No
Antioch Dunes halictid bee *Sphecodogastra antiochensis*	–/–	G1 S1	Nests in stabilized sand dunes, host plant is Antioch Dines evening primrose (*Oenothera deltoids howellii)* and Contra Costa wildflower (*Erysimum capitatum angustatum*). Species is restricted to the Antioch Dunes.	Known to occur at Antioch Dunes, which would not see effects from project operations and maintenance.	No
Amphibians					
California tiger salamander *Ambystoma californiense*	T/T	G2G3 S2S3	In winter, breeds in vernal pools and seasonal wetlands with a minimum 10-week inundation period. In summer, aestivates in grassland habitat, primarily in small mammal burrows. Occurs from Yolo County to Kern County in the Central Valley, up to 2,000 feet elevation in the Sierra Nevada foothills, and from Sonoma County to Santa Barbara County on the coast.	Known to occur in the study area.	Yes
Western spadefoot *Spea hammondii*	–/SSC	G3 S3	In winter, breeds in vernal pools and seasonal wetlands with a minimum 3-week inundation period. In summer, aestivates in grassland habitat, in soil crevices, and rodent burrows. Species is found throughout the Central Valley and coastal lowlands from Shasta County in Northern California to Baja California in Mexico, at elevations ranging from sea level to 4,500 feet.	No records in the study area, but the study area does contain suitable habitat and is in the range of the species.	Yes
California red-legged frog *Rana draytonii*	T/SSC	G2G3 S2S3	Foothill ponds and streams with none to dense shrubby or emergent riparian vegetation, minimum 11–20 weeks of water for larval development, and upland refugia for aestivation. Occurs in the San Francisco Bay Area and Coast Ranges, in addition to the Transverse and Peninsular ranges. Very few populations are now known from Ventura, Los Angeles, and Riverside Counties.	Known to occur in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Foothill yellow-legged frog *Rana boylii*	–/E, SSC	G3 S3	In most of Northern California west of Cascade crest and along western flank of Sierra south to Kern County. Isolated population in San Joaquin County. Absent from Monterey County and San Gabriel Mountains. Ranges up to approximately 6,000 feet. Inhabits moderate to high gradient streams in woodland, forest, mixed chaparral, and wet meadow habitats with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby.	No records in the study area and no suitable habitat.	No
Reptiles					
Western pond turtle *Emys marmorata*	–/SSC	G3G4 S3	Forages in ponds, marshes, slow-moving streams, sloughs, and irrigation/drainage ditches; nests in nearby uplands with low, sparse vegetation. Species is found from the Pacific Coast inland to the Sierra Nevada foothills to elevations as high as 6,700 ft above sea level.	Known to occur in the study area.	Yes
Coast horned lizard *Phrynosoma blainvilli*	–/SSC	G3G4 S3S4	Variety of open habitats, including chaparral, oak savanna, and grassland; found primarily in areas with sandy, friable soils, scattered shrubs, and abundant ant colonies. Species is found from Shasta County in the north to Baja California in the south and along the California coast inland to the Sierra Nevada and west of the Mojave Desert.	No known occurrence in the study area but the study area is within the species range and there is suitable habitat.	Yes
Northern California legless lizard *Anniella pulchra*	–/SSC	G3 S3	Occurs from Contra Costa County south to Baja California, at elevations from sea level to 5,900 feet. Found in habitats with loose soil for burrowing or thick duff or leaf litter; often forages in leaf litter at plant bases; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas.	Known to occur in the study area.	Yes
California glossy snake *Arizona elegans occidentalis*	–/SSC	G5T2 S2	Occurs from Contra Costa County south to San Quintin, Baja California, including the central San Joaquin Valley and along the base of the Southern Coastal Range, at elevations ranging from sea level to 5,900 feet. Found in grasslands, coastal sage scrub, and chaparral in areas where soil is loose.	Known to occur in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
San Joaquin coachwhip *Masticophis flagellum ruddocki*	–/SSC	G5T2T3 S2?	Occurs from Arbuckle in the Sacramento Valley southward to the grapevine in the San Joaquin Valley and westward into the inner Coast Ranges. An isolated population occurs at Sutter Buttes. Known elevation range from approximately 66 to 2,952 feet. Occurs in open, dry, vegetative associations with little or no tree cover (e.g., valley grassland and saltbush scrub associations); often occurs in association with mammal burrows.	No occurrences in the study area but is within the species range and suitable habitat exists.	Yes
Giant garter snake *Thamnophis gigas*	T/T	G2 S2	Forages in slow-moving streams, sloughs, ponds, marshes, inundated floodplains, rice fields, and irrigation/drainage ditches; also requires upland refugia not subject to flooding during the snake's inactive season. Range extends from near Chico in Butte County, south to the Mendota Wildlife Area in Fresno County.	Known to occur in the study area.	Yes
Alameda whipsnake *Masticophis lateralis euryxanthus*	T/T	G4T2 S2	Range restricted to Alameda and Contra Costa Counties; fragmented into five disjunct populations throughout its range. Absent from Central Valley floor. Inhabits valleys, foothills, and low mountains associated with northern coastal scrub or chaparral habitat; requires rock outcrops for cover and foraging.	The study area is outside the known range of the species.	No
Birds					
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	T, BCC/E (nesting)	G5T2T3 S1	Nests in valley, foothill, and desert riparian forest with densely foliaged deciduous trees and shrubs, especially willows; other associated vegetation includes cottonwood trees, blackberry, nettle, and wild grape. Potential habitat also occurs in valley marshland with willow riparian corridors, such as that found in the Llano Seco area of Butte County. Patch size has been found to be the most important habitat variable to predict presence of western yellow-billed cuckoos on the Sacramento River (Girvetz and Greco 2009:24; Halterman 1991:3–4). Large patch sizes (minimum 50 acres to 100 acres, with a minimum width of 328.1 feet) are typically required for cuckoo occupancy (Laymon 1998; Riparian Habitat Joint Venture 2004:57). Historically common throughout the Central Valley, the	There are two historic sightings and two recent sightings of yellow-billed cuckoo in the vicinity of the study area, but they are presumed to be migrating birds. There are no known breeding pairs in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
			recent known breeding populations of breeding western yellow-billed cuckoo in California include the Colorado River system in Southern California, the South Fork Kern River east of Bakersfield, and several disjunct locations in isolated sites along the Sacramento River in Northern California north of the study area, including Sutter Basin and Butte County.		
California black rail *Laterallus jamaicensis coturniculus*	BCC/T, FP	G3G4T1 S1	Nests and forages in saline, freshwater, or brackish emergent marshes with gently grading slopes and upland refugia with vegetative cover beyond the high-water line. The species persists in remaining tidal marshes in the San Francisco Bay estuary, Tomales Bay, Bolinas Lagoon, the Delta, Morro Bay, the Salton Sea, and the lower Colorado River. The species has also been found more recently at several inland freshwater sites in the Sierra Nevada foothills in Butte, Yuba, Nevada Counties, and most recently in Placer County. In the Sacramento–San Joaquin Delta, the species occurs in patches of emergent wetland found along the perimeter of sloughs and on in-Channel Islands of larger watercourses.	Known to occur in the study area.	Yes
Greater sandhill crane *Antigone canadensis tabida*	–/T, FP (nesting, wintering)	G5T4 S2	In the Delta, the greater sandhill crane forages primarily in croplands with waste grain, such as corn, alfalfa fields and pastures, and in rice where available. Roosting habitat consists of wetlands or flooded croplands and in the delta cranes are traditional to their roost sites (in that they return to the same sites year after year). The winter range includes the Central Valley and Delta, Carrizo Plain, Southern California south of the Salton Sea, and Colorado River. The breeding range of the Central Valley Population of greater sandhill crane extends into northeastern California, outside of the study area.	Known to occur in the study area during winter.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Lesser sandhill crane *Antigone canadensis*	–/SSC (wintering)	G5T4 S3S4	In the Delta, the lesser sandhill crane forages primarily in croplands with waste grain, such as corn, alfalfa and pastures, and in rice, where available. Roosting habitat consists of wetlands or flooded croplands and in the Delta cranes are traditional to their roost sites (in that they return to the same sites year after year). The subspecies does not breed in California but is a winter resident in Sacramento–San Joaquin Delta. Lesser sandhill cranes also winter regularly in Sacramento Valley, San Joaquin River NWR, Tulare Basin, and in smaller numbers in Southern California south of the Salton Sea.	Known to occur in the study area during winter.	Yes
California least tern *Sternula antillarum browni*	E/E, FP	G4T2T3 Q S2	California least terns nest in loose colonies on barren or sparsely vegetated sandy or gravelly substrates above the high tide line along the coastline and in lagoons and bays of the California coast. Foraging typically occurs in shallow estuaries or lagoons or in the shallow tidal zone of the open ocean and bays. Nests along the Pacific Coast from Baja California up to San Francisco. The San Francisco Bay Estuary through to the Delta is considered to be at the northern limit of the species range where some small colonies occur.	Known to occur in the western portion of study area at the Pittsburgh Power Plant and east of the study area in the Sacramento Wastewater Treatment Plant Bufferlands.	Yes
Double-crested cormorant *Phalacrocorax auritus*	–/WL (nesting colony)	G5 S4	Breeds colonially in trees, human-made features such as transmission line towers, and on rock ledges. Forages in open water. Breeding range spans the study area, the coast and offshore islands, Clear Lake, the Salton Sea, the Colorado River, and portions of northeastern California; winter range expands to include the Central Valley and additional portions of Southern California.	Rookeries known to occur in the study area. Known to occur throughout the study area.	Yes
Least bittern *Ixobrychus exilis*	BCC/SSC (nesting)	G4G5 S2	Nests and forages in freshwater and brackish marshes with tall emergent vegetation. Current breeding range is scattered in patches of the Sacramento and San Joaquin valleys, Clear Lake, marshes around several large lakes in eastern California, and portions of Southern California, where they also winter.	Uncommon breeder in the study area but have been recorded at Stone Lakes National Wildlife Refuge, Cosumnes River Preserve, Sherman Island, Holland Tract and Shin Kee Tract.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Great blue heron *Ardea herodias*	–/– (nesting colony)	G5 S4	Nests colonially in tall trees that often include nesting with other species. Forages in freshwater and saline marshes, shallow open water, and occasionally cropland or low, open upland habitats, such as pastures. Year-round range spans most of California except the eastern portion of the state and the highest elevations; winter range expands to include eastern California.	Rookeries known to occur in the study area. May nest and forage throughout the study area.	Yes
Great egret *Ardea alba*	–/– (nesting colony)	G5 S4	Typically nests in rookeries that often include nesting with other species. Forages in freshwater and saline marshes, shallow open water, and occasionally cropland or low, open upland habitats, such as pastures. Year-round range spans the Central Valley, central coast, and portions of Southern California. Winter range expands to include the remainder of the coast.	Rookeries known to occur in the study area. May nest and forage throughout the study area.	Yes
Snowy egret *Egretta thula*	–/– (nesting colony)	G5 S4	Nests colonially in dense marshes and low trees; forages in freshwater and saline marshes, shallow open water, and occasionally irrigated cropland or wet upland habitats. Year-round range spans the Central Valley, Delta, entire coast, central Coast Ranges, and southeastern California; winter range expands to include northeastern California.	Rookeries known to occur in the study area. May nest and forage throughout the study area.	Yes
Black-crowned night-heron *Nycticorax nycticorax*	–/– (nesting colony)	G5 S4	Nests colonially in dense marshes, groves of low trees, and dense shrubs; forages in freshwater and saline marshes and in shallow open water at the edge of marsh vegetation. Year-round range includes much of lowland California.	Rookeries known to occur in the study area. May nest and forage throughout the study area.	Yes
Osprey *Pandion haliaetus*	–/WL (nesting)	G5 S4	Forages exclusively in fish-bearing waters; nests in nearby trees or tall, constructed platforms. Breeding range includes Cascade Range to Lake Tahoe and south to Marin County. Winter range also includes the central coast and additional portions of Southern California. Year-round range includes the northern and western portions of the Central Valley.	Known to occur in the study area, but few nests have been documented and therefore assumed to be a rare nesting species in the Delta.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
White-tailed kite *Elanus leucurus*	–/FP (nesting)	G5 S3S4	Forages in low-elevation, open grasslands, savannah-like habitats, agricultural areas, wetlands, and oak woodlands. Nests in nearby uplands in valley/foothill riparian or other trees associated with compatible foraging habitat. Year-round range spans the Central Valley, Coast Ranges and coast, Sierra Nevada foothills, and Colorado River.	Known to occur in the study area.	Yes
Golden eagle *Aquila chrysaetos*	BCC/ FP, WL (nesting, wintering)	G5 S3	Forages in a variety of open habitats, including grassland, pasture, and cropland; Nests primarily on cliffs, rock outcrops, and in large trees. Winter range spans most of California; breeding range excludes the Central Valley floor.	Low potential for pairs to nest in the vicinity of the project footprint due to lack of suitable habitat; nonbreeding individuals may forage throughout the area's uplands and in the scrub and grasslands of the southern portion near Clifton Court Forebay and around the Bethany Reservoir.	Yes
Northern harrier *Circus cyaneus*	–/SSC (nesting)	G5 S3	Nests on the ground among herbaceous vegetation, such as grasses or cattails; forages in grasslands, agricultural fields, and marshes. Year-round resident of California. Breeding range encompasses Northern California, the Central Valley, the central coast, and portions of Southern Californian desert.	Known to occur in the study area.	Yes
Cooper's hawk *Accipiter cooperii*	–/WL (nesting)	G5 S4	Nests and forages primarily in riparian woodlands and other wooded habitats. Year-round range spans most of the wooded portions of California.	Known to occur in the study area.	Yes
Swainson's hawk *Buteo swainsoni*	BCC/T (nesting)	G5 S3	Nests in isolated trees, open woodlands, and woodland margins; forages in grasslands and agricultural fields. Breeding range spans the Central Valley, northeastern California, and a few additional scattered sites; most of the population migrates south of California in fall/winter to Mexico and South America, although a small number winters in the Delta.	Known to occur in the study area.	Yes
Ferruginous hawk *Buteo regalis*	BCC/WL (wintering)	G4 S3S4	Forages most commonly in grasslands, shrublands, and agricultural fields. Winter range includes Modoc Plateau, Central Valley, Coast Ranges, and southwestern California. Does not breed in California.	No potential for nesting individuals in the study area because outside of breeding range; individuals may forage in winter throughout the uplands of the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Burrowing owl *Athene cunicularia*	BCC/SSC (burrowing sites and some wintering sites)	G4 S3	Nests and forages in grasslands, agricultural fields, and low scrub habitats, especially where California ground squirrel burrows are present; occasionally inhabits artificial structures and small patches of disturbed habitat. Year-round range includes the Central Valley and Delta and portions of the central coast, eastern California, and Southern California.	Known to occur in the study area.	Yes
Short-eared owl *Asio flammeus*	–/SSC (nesting)	G5 S3	Nests on the ground in short vegetation. Forages in wetland natural communities, grasslands, and grassland-like cultivated lands such as pastures and alfalfa fields. Breeding range is patchily distributed throughout the state, including portions of the Sacramento and San Joaquin valleys, northeastern California, and a few scattered coastal sites.	Uncommon breeder in the study area, but small numbers have been documented episodically at the Cosumnes River Preserve and in Byron in Contra Costa County.	Yes
Loggerhead shrike *Lanius ludovicianus*	BCC/SSC (nesting)	G4 S4	Nests in isolated shrubs and trees and woodland/scrub edges of open habitats; forages in grasslands, agricultural fields, and low scrub habitats. Occurs year-round throughout California, except for the northwest, heavily forested higher mountains, and higher areas of deserts. Breeding range spans much of lowland California, and winter range includes most lowland areas south of Glenn County.	Known to occur in the study area.	Yes
Least Bell's vireo *Vireo bellii pusillus*	E/E (nesting)	G5T2 S2	Nests and roosts in low riparian thickets of willows and shrubs, usually near water but sometimes along dry, intermittent streams; other associated vegetation includes cottonwood trees, blackberry, mulefat, and mesquite (in desert). Formerly a common and widespread summer resident throughout Sacramento and San Joaquin valleys and in the coastal valleys and foothills from Santa Clara County south, but its numbers have drastically declined, and the species has been extirpated from much of its California range.	There was a sighting in April 2010 of two singing males in the Yolo Bypass Wildlife Area, and a second sighting of a least Bell's vireo in the spring of 2011. Singing males were also detected at Bradford Island in 2018 and 2019 (eBird 2021). Although there is no evidence of nesting success, these observations suggest the species may have the potential to re-establish within the study area.	Yes
California horned lark *Eremophila alpestris actia*	–/WL	G5T4Q S4	Nests and forages in open habitats with sparse vegetation, including grasslands and fallow agricultural fields. Year-round range of the California horned lark encompasses California's central and southern coast and the San Joaquin Valley.	Known to occur in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Bank swallow *Riparia*	–/T (nesting)	G5 S2	Nests in vertical banks or bluffs, typically adjacent to water, devoid of vegetation, and with friable, eroding soils; forages in a wide variety of habitats. Breeds in much of lowland and riparian California, with 75 percent nesting colonies along the Sacramento and Feather Rivers and their tributaries. Additional breeding locations are scattered throughout the northern and central portions of the state; migrates south of California in fall/winter.	Low probability of nesting in the study area because suitable bank conditions are rare; however, one nesting colony has been documented in the Delta in Brannan Island State Recreation Area.	Yes
Grasshopper sparrow *Ammodramus savannarum*	–/SSC (nesting)	G5 S3	Nests and forages in dense grasslands; favors a mix of native grasses, forbs, and scattered shrubs. Breeding range in California is fragmented throughout the state west of the Cascade-Sierra Nevada Crest. In the Central Valley, loss of native and nonnative grassland through agriculture and urbanization have further fragmented grasshopper sparrow's patchy breeding distribution. In California, grasshopper sparrows occur primarily in summer from March to September. Some may winter in California, mostly on the southern coast.	Known to occur in the study area.	Yes
Song sparrow ("Modesto" population) *Melospiza melodia*	–/SSC	G5 S3?	Nests and forages primarily in emergent marsh, riparian scrub, and early successional riparian forest habitats, and infrequently in mature riparian forest and sparsely vegetated ditches and levees. Year-round range includes the Delta east of Suisun Marsh, the Sacramento Valley, and the northern San Joaquin Valley.	Known to occur in the study area.	Yes
Suisun song sparrow *Melospiza melodia maxillaris*	BCC/SSC	G5T3 S3	Nests and forages in brackish water marshes dominated by cattails, tules, and pickleweed. Year-round range is confined to tidal salt and brackish marshes of the Suisun Bay area from the Carquinez Strait east to Antioch at the confluence of the San Joaquin and Sacramento Rivers. Current distribution of the species in this area is defined by the extent of remaining tidal marsh habitats in the Suisun Bay.	Known to occur on Sherman Island at the eastern limit of the subspecies range.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Yellow-breasted chat *Icteria virens*	–/SSC (nesting)	G5 S3	Nests and forages in riparian thickets of willow and other brushy tangles near water and thick understory in riparian woodland. Breeding range includes the northern Sacramento Valley, Cascade Range, Sierra Nevada foothills, northwestern California, most of the Coast Ranges, the Colorado River, and other scattered sites. Breeding range is thought to be approximately 35% of its historical range, with breeding yellow-breasted chats now rare or absent in much of the Central Valley.	Known to occur in the study area.	Yes
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	–/SSC (nesting)	G5 S3	Nests in freshwater emergent wetlands with dense vegetation and deep water, often along borders of lakes or ponds. Breeds east of the Cascade Range and Sierra Nevada, the Central Valley, portions of the Coast ranges, and in Southern California in the Imperial and Colorado River valleys. Migrates south to winter; some winter in the southern Central Valley and in Imperial Valley.	Known to occur in the study area.	Yes
Tricolored blackbird *Agelaius tricolor*	BCC/T, SSC (nesting colony)	G2G3 S1S2	Nests colonially in large, dense stands of freshwater marsh, riparian scrub, and other shrubs and herbs; forages in grasslands and agricultural fields. Year-round resident throughout the Central Valley and the central and southern coasts, with additional scattered locations throughout California. Breeding occurs in the foothills of the Sierra Nevada south to Kern County, the coastal slopes from Sonoma County to the Mexican border, and sporadically in the Modoc Plateau. Uncommon breeder in the Delta.	Known to occur in the study area.	Yes
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	BCC/SSC	G5T3 S3	Occurs in primarily brackish marsh with dense and continuous wetland or riparian vegetation down to the water surface; however, to a lesser degree, also uses woody swamp/riparian and freshwater marsh. Often found in rush, tall grass, and willow-dominated communities. Endemic to the greater San Francisco Bay Area.	Known to occur on Sherman Island at the eastern limit of the subspecies range.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Yellow warbler *Setophaga petechia*	BCC/SSC (nesting)	G5 S3S4	Nests and forages in early successional riparian habitats. Range includes coastal and Northern California and the Sierra Nevada below approximately 7,000 feet; mostly extirpated from the southern Sacramento and San Joaquin valleys. However, nesting territories have been recorded in the San Joaquin Wildlife Refuge.	Known to occur in the study area, likely as a migrant.	Yes
Western snowy plover *Charadrius alexandrinus nivosus*	T, BCC/SSC (nesting)	G3T3 S2S3	Nests and forages on sandy and gravelly beaches along the coast and the shores of inland alkali lakes. Breeds in coastal California and near alkali lakes in eastern California and remnant alkali playas in the southern San Joaquin Valley.	Not expected to occur in the study area.	No
Merlin *Falco columbarius*	–/WL (wintering)	G5 S3S4	Forages in a wide variety of habitats, but in the Central Valley is most common around agricultural fields and grasslands. Winter range encompasses most of California except the highest elevations; does not breed in California.	May forage in winter throughout the study area.	Yes
Prairie falcon *Falco mexicanus*	BCC/WL (nesting)	G5 S4	Nests on bluffs and cliffs. Forages most commonly in grasslands and low shrublands; also forages in agricultural fields. Year-round range includes eastern California, the Coast Ranges, and much of Southern California; winter range expands to include the Delta, Central Valley, and coastal California.	Low potential for nesting pairs to occur in the study area due to lack of suitable habitat.	No
American peregrine falcon *Falco peregrinus anatum*	BCC/FP (nesting)	G4T4 S3S4	Nests on cliffs or on buildings in urban areas. Forages in a wide variety of habitats but is most common near water where shorebirds and waterfowl are abundant. Year-round range includes the Sierra Nevada, Cascade Range, northeastern California, Coast Ranges, and coast; winter range expands to include the Central Valley and the Delta and additional portions of eastern and Southern California.	Not expected to nest in the study area because outside of the published breeding range.	No

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Purple martin *Progne subis*	–/SSC (nesting)	G5 S3	Nests in tree cavities, bridges, utility poles, lava tubes, and buildings; forages in foothill and low montane oak and riparian woodlands, and less frequently in coniferous forests and open or developed habitats. Breeding range includes the Sierra Nevada, Cascade Range, portions of the Coast Ranges and coast, and parts of Southern California; extirpated from the Delta, and nesting in the Central Valley has been reduced to transportation structures in and around the city of Sacramento.	Not expected to nest in the study area.	No
California Ridgway's rail *Rallus obsoletus*	E/E, FP	G5T1 S1	Nests and forages in dense cordgrass and cattail marshes with vegetated refugia during the highest tides. Year-round near coastal range, surrounds San Francisco and San Pablo bays, and documented at several locations in Suisun Bay.	Range does not include the study area.	No
Mammals					
Pallid Bat *Antrozous pallidus*	–/SSC	H G5 S3	Deserts, grasslands, shrublands, woodlands, and forests; most common in open, dry habitats; typically roosts in rock crevices, also in tree hollows, bridges, and buildings, in colonies ranging from 1 to more than 200 individuals. Occurs throughout California except for the high Sierra Nevada from Shasta to Kern Counties to northern Mendocino County.	Potentially occurs in the study area.	Yes
Townsend's big-eared bat *Corynorhinus townsendii*	–/SSC	H G3G4 S2	This species requires caves, mines, tunnels, buildings, or other human-made structures for roosting, and may use separate sites for night, day, hibernation, or maternity roosts. Typically roosts in colonies of fewer than 100 individuals. Forages in all habitats except alpine and subalpine, although most commonly in mesic forests and woodlands. Year-round range spans most of California, except the highest elevations of the Sierra Nevada south of Lake Tahoe.	Potentially occurs in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Big brown bat *Eptesicus fuscus*	–/–	L	Common throughout California, absent only from the highest alpine meadows and talus slopes. Roosts opportunistically in buildings, bridges, palm thatch, snags, tree hollows, and in rock crevices. Forages over wide range of habitats including open habitat among scattered trees, over water, and above residential areas.	Known to occur in the study area.	Yes
Silver-haired bat *Lasionycteris noctivagans*	–/–	M G5 S3S4	Distribution includes coastal and montane forests from the Oregon border south along the coast to San Francisco Bay and along the Sierra Nevada and Great Basin region to Inyo County. Typically roosts in tree cavities, crevices and under loose bark. May also use leaf litter, buildings, mines and caves. Breeds in coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley foothill and montane riparian habitats; may occur in any habitat during migration. Breeding range does not include the Delta. There are only a few scattered breeding locations known in the San Francisco Bay Area, Central Valley, or central coast.	Potentially occurs in the study area.	Yes
Western red bat *Lasiurus blossevillii*	–/SSC	H G5 S3	Mature riparian broadleaf forest in the Central Valley is primary summer breeding habitat for the species in California (females and pups). Riverside orchards may also be used as maternity roosts. Roosts alone or in small family groups in tree foliage, occasionally shrubs; prefers habitat edges and mosaics with trees that are protected from above and open below with open areas for foraging, including grasslands, shrublands, and open woodlands. Unsubstantiated records of hibernation in leaf litter during the winter. Occurs from Shasta County to the Mexico border, west of the Sierra Nevada/Cascade crest and deserts.	Known to occur in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Hoary bat *Lasiurus cinereus*	–/–	M G5 S4	This species is the most widespread North American bat and may be found nearly everywhere in California from sea level to 13,200 feet, although its distribution is patchy in southeastern deserts. Populations in the Central Valley are most likely non-reproductive or migratory. Typically roosts alone in a variety of broadleaf tree species such as cottonwood and sycamore; also found roosting in conifers. Breeding habitat includes all woodlands and forests with medium to large-size trees and dense foliage. May be found in a range of vegetation and roost substrates during migration.	Known to occur in the study area.	Yes
California myotis *Myotis californicus*	–/–	L	Commonly found throughout California below 6,000 feet in elevation. Roosts singly or in small groups in crevices and cavities in trees and rocks; occasionally roosts in human structures. Maternity colonies of up to 52 individuals have been documented in large snags and under tree bark. Forages over a variety of habitats, including arid habitats, open lands, forest canopies, forest margins, and water.	Potentially occurs in the study area.	Yes
Little brown bat *Myotis lucifigus*	–/– (San Bernardino Mountains population)	M G3 S2S3	Occurs in California from the Oregon border south along the coast to San Francisco Bay and along the Sierra Nevada/Cascades and Great Basin from the Oregon border to Kern County. An isolated population occurs in the San Bernardino Mountains. Roosts opportunistically in a variety of structures from trees to buildings. Forages in a range of habitats, but typically over water. Likely fall latitudinal or elevational migrant to colder areas with caves of suitable temperature regime for hibernation.	Potentially occurs in the study area.	Yes
Western small-footed myotis *Myotis ciliolabrum*	–/–	M G5 S3	Occurs in coastal California from Contra Costa County south to the Mexico border, the west and east side of the Sierra Nevada, and in Great Basin and desert habitats from Modoc to Kern and San Bernardino Counties. Particularly associated with coniferous forests and rocky xeric habitats. Typically roosts in rock crevices in mines, caves and occasionally in buildings, bridges and other human structures. Forages over a variety of habitats.	Potentially occurs in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
Yuma myotis *Myoits yumanensis*	–/–	LM G5 S4	Common and widespread throughout California from sea level to 11,000 feet excluding the Mojave and Colorado Desert regions. Strongly associated with water sources. Roosts in a variety of structures including bridges, buildings, caves, mines, trees and rock crevices. Has been known to roost in cliff swallow nests. Typically forages low over water.	Potentially occurs in the study area.	Yes
Western pipistrelle *Pipistrellus hesperus*	–/–	L	Occurs in the Central Valley, foothills, and Coast Ranges from Tehama County to Mexico, and in the deserts from Alpine County to Mexico. Scattered populations exist in eastern Modoc County, and Siskiyou, Lassen, and Trinity Counties. Found in arid habitats throughout California and in lower elevation montane forests with significant rocky areas. Typically roosts in or under rocks, in crevices in cliffs, rocky slopes, or scattered boulders. Unsubstantiated records of roosting in burrows.	Potentially occurs in the study area.	Yes
Western mastiff bat *Eumops perotis californicus*	–/SSC	H G4T4 S3S4	Typically roosts in crevices in cliffs and rocky outcrops, in colonies of fewer than 100 individuals. May also roost in bridges, caves and buildings that allow sufficient height and clearance for dropping into flight. There is at least one record of this species roosting in an untrimmed palm tree. Forages in a variety of grassland, shrub, and wooded habitats, including riparian and urban areas, although most commonly in open, arid lands. Uncommon resident in southeastern San Joaquin Valley and the Coastal Ranges specifically residing between Monterey County to Southern California and from the California coast east to the Colorado Desert.	Potentially occurs in the study area.	Yes
Mexican free-tailed bat *Tadarida brasiliensis*	–/–	L	Common throughout California, although uncommon in high Sierra Nevada and the north coastal region. Prefers open habitats such as woodlands, shrublands, and grasslands. Widely distributed throughout California during the breeding season. Roosts in large colonies in bridges and buildings in the Central Valley; breeding colonies may be concentrated in relatively few sites. Also roosts in caves, rock crevices, mines and tunnels. Forages over a range of habitats.	Known to occur in the study area.	Yes

Table 13A-2. Continued

Common and Scientific Names	Status [a] Federal/State	Status [a] Other	Habitat and Distribution in California	Potential for Occurrence in the Study Area	Analyzed in EIR
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	G4T S2	Grasslands and oak savannas with friable soils; home range sizes of 600–1,300 acres. Year-round range is fragmented throughout the San Joaquin Valley.	Outside of current range defined by USFWS.	No
American badger *Taxidea taxus*	–/SSC	G5 S3	Uncommon solitary species that is widely distributed throughout the state except in the northern North Coast area from below sea level to over 12,000 ft. Prefers drier open shrub, forest, and herbaceous habitats with friable soils. Home range typically varies in size between 5 and 1,800 acres but can become much larger during breeding season as males locate receptive females. Natal dens are constructed in dry, sandy soil with sparse overstory.	Historic records in the study area.	Yes
San Joaquin pocket mouse *Perognathus inornatus*	–/–	G2G3 S2S3	Occurs between 1,100 and 2,000 ft elevation, spanning through the San Joaquin Valley, Delta, Sacramento Valley through Colusa County, and portions of the southern Coast Ranges. Habitat includes shrubby ridge tops and hillsides in dry, open grasslands or scrub areas with friable soils.	Known to occur in the study area.	Yes
Salt marsh harvest mouse *Reithrodontomys raviventris*	E/E, FP	G1G2 S1S2	Occurs primarily in tidal brackish emergent wetlands dominated by pickleweed and at higher elevation refugia. Year-round range includes the marshes surrounding Suisun, San Pablo, and San Francisco bays, with the Collinsville-Antioch area forming the eastern limit of the range.	Known to occur in the study area.	Yes
Riparian brush rabbit *Sylvilagus bachmani riparius*	E/E	G5T1 S1	Extirpated from most of its historic range and now restricted to Caswell Memorial State Park on the Stanislaus River, at the confluence with the San Joaquin River, and an adjacent portion of an overflow channel and Paradise Cut, Tom Paine Slough, and channels of the San Joaquin River. Prefers dense thickets of brush associated with riparian habitats.	Known to occur in the study area.	Yes
Riparian woodrat *Neotoma fuscipes riparia*	E/SSC	G5 T1Q S1	Riparian forest, particularly dense willow thickets with an oak overstory. Extirpated from most of historic range and now restricted to Caswell Memorial State Park on the Stanislaus River, at the confluence with the San Joaquin River, and an historic occurrence from 1970s near Vernalis.	Outside of the current defined range for the species.	No

Table 13A-2. Continued

[a] Status

Federal Listing Categories:

E = Listed as endangered under the federal Endangered Species Act (ESA).
T = Listed as threatened under the ESA.
PT = Proposed for listing as threatened under the ESA.
BCC = U.S. Fish and Wildlife Service bird of conservation concern.
C = Candidate for listing under the ESA.
– = No status.

State Listing Categories:

E = Listed as endangered under the California Endangered Species Act (CESA).
T = Listed as threatened under CESA.
C = Candidate for protection under CESA.
FP = Fully protected under the California Fish and Game Code.
SSC = California species of special concern.
WL = California Department of Fish and Wildlife watch list.
CFGC = Rookeries protected under the California Fish and Game Code.
– = No status.

Other:

Western Bat Working Group (http://www.wbwg.org/spp_matrix.html)

H = High priority: Species is imperiled or at high risk of imperilment.
M = Moderate priority: This designation indicates a level of concern that should warrant closer evaluation, more research, and conservation actions of both the species and possible threats. A lack of meaningful information is a major obstacle in adequately assessing these species' status and should be considered a threat.
L = Low priority: While there may be localized concerns, the overall status of the species is believed to be secure.

NatureServe Conservation Status (shown only for species without legal status)

GH = Possibly Extinct (species)—Missing; known from only historical occurrences but still some hope of rediscovery.
G1 = Critically Imperiled—At very high risk of extinction because of extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2 = Imperiled—At high risk of extinction because of very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3 = Vulnerable—At moderate risk of extinction because of a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4 = Apparently Secure—Uncommon but not rare; some cause for long-term concern because of declines or other factors.
G5 = Secure—Common; widespread and abundant.
G#G# = Range Rank—A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community.
G#? = Question mark indicated uncertainty as to status of a species.
SH = Possibly Extirpated (Historical)—Species or community occurred historically in the state, and there is some possibility that it may be rediscovered.
S1 = Critically Imperiled—Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.
S2 = Imperiled—Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.
S3 = Vulnerable—Vulnerable in the state because of a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

Table 13A-2. Continued

S4 = Apparently Secure—Uncommon but not rare; some cause for long-term concern because of declines or other factors.

S#S# = Range Rank—A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty in the status of a species or community.

S#? = Question mark indicates uncertainty as to status of a species.

T = Infraspecific Taxon (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank State Rank, lower numbers equate to higher vulnerability.

Q = Q following the T-rank denotes the taxon's information taxonomic status.

Appendix I3
Species Accounts—Part 1

The information in this Appendix is presented as provided by the California Department of Water Resources (the applicant) in the Delta Conveyance Project Draft Environmental Impact Report (Draft EIR) Appendix 13B, *Species Accounts* and, therefore, is presented from the California Environmental Quality Act perspective. However, the U.S. Army Corps of Engineers relied on this information when preparing its Draft Environmental Impact Statement. All chapter references in this appendix are to those in the Draft EIR. Please refer to the Draft EIR for any information cross referenced.

13B.0 Introduction

This appendix includes species accounts for special-status terrestrial species that have the potential to occur in the study area (Table 13B-1), as analyzed in Chapter 13, *Terrestrial Biological Resources*. Due to the length and complexity of this information, and in an effort to maintain the readability of Chapter 13, this information is presented in an appendix.

Table 13B-1. Organization of Appendix 13B, Special-Status Species Accounts

Section Number	Common Name	Scientific Name
13B.1	Alkali milk-vetch	*Astragalus tener* var. *tener*
13B.2	Brittlescale	*Atriplex depressa*
13B.3	Watershield	*Brasenia schreberi*
13B.4	Bristly sedge	*Carex comosa*
13B.5	Soft bird's-beak	*Chloropyron molle* ssp. *molle*
13B.6	Bolander's water-hemlock	*Cicuta maculata* var. *bolanderi*
13B.7	Recurved larkspur	*Delphinium recurvatum*
13B.8	Dwarf downingia	*Downingia pusilla*
13B.9	Jepson's coyote-thistle	*Eryngium jepsonii*
13B.10	Delta button-celery	*Eryngium racemosum*
13B.11	Spiny-sepaled button-celery	*Eryngium spinosepalum*
13B.12	Diamond-petaled California poppy	*Eschscholzia rhombipetala*
13B.13	San Joaquin spearscale	*Extriplex joaquinana*
13B.14	Woolly rose-mallow	*Hibiscus lasiocarpos* var. *occidentalis*
13B.15	Delta tule pea	*Lathyrus jepsonii* var. *jepsonii*
13B.16	Legenere	*Legenere limosa*
13B.17	Heckard's peppergrass	*Lepidium latipes* var. *heckardii*
13B.18	Mason's lilaeopsis	*Lilaeopsis masonii*
13B.19	Delta mudwort	*Limosella australis*
13B.20	Shining navarretia	*Navarretia nigelliformis* subsp. *radians*
13B.21	Eel-grass pondweed	*Potamogeton zosteriformis*
13B.22	California alkali grass	*Puccinellia simplex*

Section Number	Common Name	Scientific Name
13B.23	Sanford's arrowhead	*Sagittaria sanfordii*
13B.24	Marsh skullcap	*Scutellaria galericulata*
13B.25	Side-flowering skullcap	*Scutellaria lateriflora*
13B.26	Long-styled sand-spurrey	*Spergularia macrotheca* var. *longistyla*
13B.27	Suisun Marsh aster	*Symphyotrichum lentum*
13B.28	Saline clover	*Trifolium hydrophilum*
13B.29	Caper-fruited tropidocarpum	*Tropidocarpum capparideum*
13B.30	California Rare Plant Rank 3 and 4 Species	
13B.30.1	Crownscale	*Atriplex coronata* var. *coronata*
13B.30.2	Small-flowered morning-glory	*Convolvulus simulans*
13B.30.3	Stinkbells	*Fritillaria agrestis*
13B.30.4	Hogwallow starfish	*Hesperevax caulescens*
13B.30.5	Ferris' goldfields	*Lasthenia ferrisiae*
13B.30.6	Little mousetail	*Myosurus minimus* subsp. *apus*
13B.30.7	Cotula navarretia	*Navarretia cotulifolia*
13B.30.8	Delta woolly marbles	*Psilocarphus brevissimus* var. *multiflorus*
13B.31	Conservancy fairy shrimp	*Branchinecta conservatio*
13B.32	Vernal pool fairy shrimp	*Branchinecta lynchi*
13B.33	Midvalley fairy shrimp	*Branchinecta mesovallensis*
13B.34	California linderiella	*Linderiella occidentalis*
13B.35	Vernal pool tadpole shrimp	*Lepidurus packardi*
13B.36	Hairy water flea	*Dumontia oregonensis*
13B.37	Antioch Dunes anthicid beetle	*Anthicus antiochensis*
13B.38	Sacramento anthicid beetle	*Anthicus sacramento*
13B.39	Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*
13B.40	Delta green ground beetle	*Elaphrus viridis*
13B.41	Ricksecker's water scavenger beetle	*Hydrochara rickseckeri*
13B.42	Curved-foot hygrotus diving beetle	*Hygrotus curvipes*
13B.43	Molestan blister beetle	*Lytta molesta*
13B.44	Blennosperma vernal pool andrenid bee	*Andrena blennospermatis*
13B.45	Crotch bumble bee	*Bombus crotchii*
13B.46	Western bumble bee	*Bombus occidentalis*
13B.47	California tiger salamander	*Ambystoma californiense*
13B.48	Western spadefoot	*Spea hammondii*
13B.49	California red-legged frog	*Rana draytonii*
13B.50	Western pond turtle	*Emys marmorata*
13B.51	Coast horned lizard	*Phrynosoma blainvillii*
13B.52	California legless lizard	*Anniella pulchra*
13B.53	California glossy snake	*Arizona elegans occidentalis*
13B.54	San Joaquin coachwhip	*Masticophis flagellum ruddocki*
13B.55	Giant garter snake	*Thamnophis gigas*
13B.56	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*

Section Number	Common Name	Scientific Name
13B.57	California black rail	*Laterallus jamaicensis coturniculus*
13B.58	Greater sandhill crane	*Antigone canadensis tabida*
13B.59	Lesser sandhill crane	*Antigone canadensis canadensis*
13B.60	California least tern	*Sterna antillarum browni*
13B.61	Double-crested cormorant	*Phalacrocorax auritus*
13B.62	Least bittern	*Ixobrychus exilis*
13B.63	Great blue heron	*Ardea herodias*
13B.64	Great egret	*Ardea alba*
13B.65	Snowy egret	*Egretta thula*
13B.66	Black-crowned night heron	*Nycticorax nycticorax*
13B.67	Osprey	*Pandion haliaetus*
13B.68	White-tailed kite	*Elanus leucurus*
13B.69	Golden eagle	*Aquila chrysaetos*
13B.70	Northern harrier	*Circus hudsonius*
13B.71	Cooper's hawk	*Accipiter cooperii*
13B.72	Swainson's hawk	*Buteo swainsoni*
13B.73	Ferruginous hawk	*Buteo regalis*
13B.74	Burrowing owl	*Athene cunicularia*
13B.75	Short-eared owl	*Asio flammeus*
13B.76	Loggerhead shrike	*Lanius ludovicianus*
13B.77	Least Bell's vireo	*Vireo bellii pusillus*
13B.78	California horned lark	*Eremophila alpestris actia*
13B.79	Bank swallow	*Riparia riparia*
13B.80	Grasshopper sparrow	*Ammodramus savannarum*
13B.81	Modesto song sparrow	*Melospiza melodia*
13B.82	Suisun song sparrow	*Melospiza melodia maxillaris*
13B.83	Yellow-breasted chat	*Icteria virens*
13B.84	Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
13B.85	Tricolored blackbird	*Agelaius tricolor*
13B.86	Saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*
13B.87	Yellow warbler	*Setophaga petechia*
13B.88	Pallid bat	*Antrozous pallidus*
13B.89	Townsend's big-eared bat	*Corynorhinus townsendii*
13B.90	Big brown bat	*Eptesicus fuscus*
13B.91	Silver-haired bat	*Lasionycteris noctivagans*
13B.92	Western red bat	*Lasiurus blossevillii*
13B.93	Hoary bat	*Lasiurus cinereus*
13B.94	California myotis	*Myotis californicus*
13B.95	Little brown myotis	*Myotis lucifugus*
13B.96	Western small-footed myotis	*Myotis ciliolabrum*
13B.97	Yuma myotis	*Myotis yumanensis*
13B.98	Western pipistrelle	*Pipistrellus hesperus*

Section Number	Common Name	Scientific Name
13B.99	Western mastiff bat	*Eumops perotis californicus*
13B.100	Mexican free-tailed bat	*Tadarida brasiliensis*
13B.101	San Joaquin kit fox	*Vulpes macrotis mutica*
13B.102	American badger	*Taxidea taxus*
13B.103	San Joaquin pocket mouse	*Perognathus inornatus*
13B.104	Salt marsh harvest mouse	*Reithrodontomys raviventris*
13B.105	Riparian brush rabbit	*Sylvilagus bachmani riparius*

13B.0.1 Species Account Organization

13B.0.1.1 Legal Status

State, federal, and other sources were reviewed to determine legal status designations for wildlife and plant species found in the study area. For wildlife and plants, listing status under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA) was determined. For wildlife, the California Department of Fish and Wildlife (CDFW) the *Special Animals List* was consulted to determine other federal and state designations such as fully protected species (all taxa), CDFW Species of Special Concern, CDFW Watch List Species, and U.S. Fish and Wildlife Service (USFWS) Bird of Conservation Concern (California Department of Fish and Wildlife 2020a). For wildlife species that are not state or federally listed, not species of special concern according to CDFW, and not fully protected animals (includes birds, reptiles, amphibians, fish and mammals), the NatureServe ranking for the species from the Special Animals List was reported (California Department of Fish and Wildlife 2020a). The NatureServe element ranking includes a global rank (G-rank) and state rank (S-rank), which describe the species status over its entire global distribution and its status in the state (California Department of Fish and Wildlife 2020a). The NatureServe ranking codes, rank status, and a description of these are presented below in Table 13B-2. The Western Bat Working Group (WBWG) website (Western Bat Working Group 1998) was also consulted to determine the status of a given bat species throughout its western North American range. For plants, the California Rare Plant Rank and NatureServe Ranking (also known as Heritage Ranking for plants) for each species were obtained from the current *Special Vascular Plants, Bryophytes, and Lichens List* (California Department of Fish and Wildlife 2020b). The designation of critical habitat was determined for each wildlife or plant species as well as status of recovery plans using the U.S. Fish and Wildlife Service databases.

Table 13B-2. NatureServe Codes Used in the Species Accounts

NatureServe Rank Code (G-global, S-state)	NatureServe Rank Status	Description
G1	Critically Imperiled	At very high risk of extinction due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
G2	Imperiled	At high risk of extinction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors

NatureServe Rank Code (G-global, S-state)	NatureServe Rank Status	Description
G3	Vulnerable	At moderate risk of extinction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors
G4	Apparently Secure	At fairly low risk of extinction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors
G5	Secure	At very low risk of extinction due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.
S1	Critically Imperiled	At very high risk of extirpation in the state due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors
S2	Imperiled	At high risk of extirpation in the state due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
S3	Vulnerable	At moderate risk of extirpation in the state due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors
S4	Apparently Secure	At a fairly low risk of extirpation in the state due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
S5	Secure	At very low or no risk of extirpation in the state due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

Notes:

- By expressing the ranks as a range of values: e.g., S2S3 indicates the rank is somewhere between S2 and S3.
- By adding a "?" to the rank: e.g., S2?; this represents more certainty than S2S3, but less certainty than S2.
- Taxa which are subspecies receive a taxon rank (T-rank) in addition to the G-rank. Whereas the G-rank reflects the condition of the entire species, the T-rank reflects the global status of just the subspecies. For example, the Point Reyes mountain beaver, Aplodontia rufa ssp. phaea, is ranked G5T2. The G-rank refers to the whole species, i.e., Aplodontia rufa; the Trank refers only to the global condition of ssp. Phaea.
- Q = Questionable taxonomy that may reduce conservation priority — Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. The "Q" modifier is only used at the global level, not at the state level.

13B.0.1.2 Range and Distribution within the Study Area

The overall range and status for the species is described, as well as its distribution and status in the study area. This information reflects the body of available literature through December 2020. California Natural Diversity Database (CNDDB) occurrence data (California Department of Fish and Wildlife 2020c), eBird (eBird 2021), and Delta Habitat Conservation and Conveyance Program (DHCCP) occurrence data (California Department of Water Resources 2011), which contains some bird occurrence data that had been submitted to CDFW but has yet made it into the CNDDB, were used to establish the number of occurrences in the study area. Additional specific sources for occurrence information in the study area were used for the following species.

- For the tricolored blackbird, data from the *Tricolored Blackbird Portal* (Meese pers. comm. 2020) for additional colonies.
- For the greater and lesser sandhill crane, traditional sandhill crane roost sites and the general distribution of wintering sandhill cranes have been documented within the study area (Ivey et al. 2016:60) and were used to determine the range and distribution of both subspecies.
- For least bittern, the species range (Sterling 2008:136) only overlaps with the northern portion of the study area, however because there have been multiple occurrences recorded outside of the current range (eBird 2021), and because least bittern is a secretive species and not easily detected, the published range may be underestimated; therefore, the least bittern distribution was assumed to extend throughout the entire study area.

13B.0.1.3 Habitat Requirements

This section summarizes the habitat types that each species is associated with throughout its range and within the study area. This includes associated vegetation types for many of the species and home range and territory size, where applicable.

13B.0.1.4 Seasonal Patterns

This section varies depending on species but, in general, it provides a description of daily or seasonal patterns or reproduction timing and behavior. Blooming periods are also included for plants.

13B.0.1.5 Species Habitat Suitability Methods

Species habitat suitability models for plant and wildlife species are developed primarily using landcover data from geographic information systems (GIS) data sources. Habitat suitability for each species is determined based on whether or not a landcover type is could potentially be occupied based on the species' habitat requirements, and the species known range within the study area as described in the species account. The models are not developed based on species occurrence data, which is incomplete for most species in the study area. Instead, species occurrence data are used to bolster the validity of the habitat models and, if necessary, revise the vegetation input data.

By its nature, this type of model tends to overestimate suitable habitat by being as inclusive as possible in the absence of site-specific data on vegetation structure, species composition, hydrology, occurrence of or proximity to other habitat elements, and other variables that would provide more certainty with respect to habitat quality and the potential for occurrence.

However, it is possible to underestimate as well as overestimate the extent of suitable habitat. For example, areas of suitable habitat for a species may not be identified if they are smaller than the minimum mapping unit size for a specific landcover layer. This may be important for species that can use small, isolated habitat features, such as individual trees or small groups of trees. Still, the more likely scenario is that an overestimate occurs as small acreages of unsuitable habitat are absorbed into larger suitable habitat polygons. It is also important to note that while the models portray a reasonable distribution of habitat suitability for each species, areas that are not identified as habitat do not indicate with certainty that a species would not occur, but rather that there is a much lower probability of species occurrence compared with areas identified as suitable habitat.

Where applicable, habitat suitability is also identified according to the specific life stages of the species, such as breeding, foraging, or dispersal habitat, and in some cases according to minimum habitat area requirements using home range or territory size data. Where appropriate, habitat suitability is also defined qualitatively (e.g., high, medium, and low value) based on broad suitability categories (e.g., grassland, pasture, other cultivated land) or through a general examination of species associations within vegetation types. When habitat suitability categories are used, a description of the rationale and assumptions for those categories are included in the species account model description. Finally, other input variables are used to address specific conditions that are not accounted for in the landcover databases but that can be generated through GIS analysis. These include soils and elevation data, buffers, connectivity between habitat types, and specific land use types such as levee slopes.

For each model, the GIS datasets are identified and each general landcover type, which includes natural communities, developed, or agricultural, and specific subtypes aggregated under these landcovers, which includes vegetation communities, DWR mapped aquatic resources, crop types, and other land uses, are identified within each life requisite habitat type association (e.g., foraging, nesting, aquatic). The assumptions used in the formulation of the model are described, as well as the potential for the model to over- or under-estimate the extent of habitat in the study area. The landcovers and subtypes, where applicable, may be presented in a paragraph form or for species with multiple associations will be listed as follows:

- Landcover type (e.g., Valley/foothill riparian, Agricultural)
    - Subtype (e.g., Scrub shrub wetland, Miscellaneous grain and hay)

13B.0.2 References Cited

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13B.1 Alkali Milk-Vetch (*Astragalus tener* var. *tener*)

13B.1.1 Legal Status

Alkali milk-vetch is not listed under either the ESA or CESA. Its NatureServe Ranking in the California Natural Diversity Database (CNDDB) is G2T1/S1, which means that globally (G) the species is imperiled and at a high risk for extinction, that globally the variety (T) is highly imperiled and at high risk for extinction, and that within the state (S) the variety is highly imperiled and at high risk for extinction as a result of restricted range, very few populations and steep decline (California Department of Fish and Wildlife 2020a:iii, 19).

The California Rare Plant Rank of 1B.2 for alkali milk-vetch indicates that it is rare, threatened, or endangered in California and elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv,19; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380(California Department of Fish and Wildlife 2020a:i).

13B.1.2 Range and Distribution within the Study Area

Alkali milk-vetch is endemic to California. The current range of alkali milk-vetch comprises the Southern Sacramento Valley, northern San Joaquin Valley, east San Francisco Bay Area, and Interior South Coast Ranges, extending from Napa, Solano, and Yolo Counties in the north, to Merced County in the south, to Alameda County in the west (Wojciechowski and Spellenberg 2012). A total of 66 occurrences are known (California Department of Fish and Wildlife 2020b; Consortium of California Herbaria 2020); 18 of the known extant occurrences are in the Solano-Colusa Vernal Pool Region of Solano County, and two are in the vicinity of Clifton Court Forebay (California Department of Fish and Wildlife 2020b). One other collection in the Consortium of California Herbaria (2020) at the Hay Road Landfill has not yet been added to the CNDDB and represents an additional extant occurrence in the study area

Historically, alkali milk-vetch was widely distributed around the San Francisco Bay region and in the Sacramento and northern San Joaquin Valleys as far south as Monterey and San Benito Counties (Barneby 1964:1047). Currently, 28 of the 66 known occurrences are considered to be extirpated or possibly extirpated, and another 13 occurrences have not been observed in the past 20 years (California Department of Fish and Wildlife 2020b).

In the study area there are 18 extant occurrences, mostly in the Jepson Prairie, Tule Glide Ranch, and Clifton Court Forebay areas. Small groups of up to 20 plants were found on suitable habitat on the Tule Ranch (Witham 2003:8). Alkali milk-vetch has been observed 0.25 mile south of Saxon Station on the western edge of the Yolo Bypass on the Yolo Bypass Wildlife Area. To the west, it was observed growing in clay soils west of Bunker Station. In the Jepson Prairie Preserve, multiple occurrences are recorded in vernally wet grassland. On the southwest edge of the study area, it has been observed in alkaline grassland vegetation south of Discovery Bay and west of Clifton Court Forebay (California Department of Water Resources 2011:4-2; California Department of Fish and Wildlife 2020b).

13B.1.3 Habitat Requirements

Little is known about the ecology of alkali milk-vetch. In the Central Valley, it grows in mesic areas with alkaline soils, including the margins of vernal pools, the adjacent grasslands, and tributary swales (California Department of Fish and Wildlife 2020b). At the Tule Ranch site in the Yolo Bypass, alkali milk-vetch is found in vernally mesic grasslands dominated by annual ryegrass and associated with alkaline vernal pools (Witham 2003:8).

In Yolo County, alkali milk-vetch has been recorded at Yolo County Grasslands Park, Tule Ranch in the Yolo Bypass, Regional Park, the City of Woodland Preserve, and the property to the east of Regional Park (California Department of Fish and Wildlife 2020b). A survey conducted in 2009 found approximately 1,500 alkali milk-vetch plants at the City of Woodland Regional Park, making this population one of the largest in Yolo County (Dean 2009:8). Within the Regional Park, plants were typically located in shallow claypan vernal pools growing with goldfield species (*Lasthenia*), mousetail species (*Myosurus*), vernal pool allocarya (*Plagiobothrys*), and sometimes with San Joaquin spearscale (*Extriplex joaquiniana*).

13B.1.4 Seasonal Patterns

Alkali milk-vetch is an annual herb that blooms from March to June. There are few data documenting the population trends of alkali milk-vetch. Because most of the recent observations of individuals have been at sites where it was previously considered extirpated, it appears that those individuals have established from long-lived seed banks. A large 5-year survey of California's vernal pool vegetation found that alkali milk-vetch was the most variable rare taxon in terms of occurrence and only appeared once during the study at a very low cover value (i.e., 1%) (Buck 2004:13; Barbour et al. 2007:62).

13B.1.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.1.5.1 GIS Model Data Sources

The alkali milk-vetch model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal pool Complex (Witham et al 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.1.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species would be expected to occur. The extent of modeled habitat in the study area is depicted in Figure 13B.1-1.

13B.1.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.1.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the geographic information system (GIS) model data sources:

- Vernal pool complex
  - Vernal pool complex—Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Vernal pool complex—Mediterranean California naturalized annual and perennial grassland
  - Vernal pool complex—California annual herb/grass
  - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Vernal pool complex—*Allenrolfea occidentalis*
  - Vernal pool complex—*Distichlis spicata*
  - Vernal pool complex—*Frankenia salina*
  - Vernal pool complex—*Suaeda moquinii*
  - Vernal pool Complex—vernal pool
  - Vernal pool Complex—alkaline wetland
  - Vernal pool complex—southwestern North American salt basin and high marsh
  - Vernal pool
- Alkali seasonal wetland
  - *Allenrolfea occidentalis*
  - *Bassia (hyssopifolia, scoparia)*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Suaeda moquinii*
  - Southwestern North American salt basin and high marsh
  - Western North American disturbed alkaline marsh and meadow
  - Barren
  - Alkaline wetland

- Nontidal brackish emergent wetland
  - *Distichlis spicata*
  - Southwestern North American salt basin and high marsh
- Grassland
  - California annual herb/grass group

Soil types associated with alkali milk-vetch were determined by overlaying the occurrence locations from the CNDDB onto the Soil Survey Geographic Database (SSURGO) (Soil Survey Staff, Natural Resources Conservation Service 2020). Soils mapped at occurrence locations are strongly alkaline. Of the occurrences present in the Tule-Glide Ranch, Jepson Prairie, and Clifton Court Forebay areas, 91% percent of the occurrences of alkali milk-vetch are found on the following soil series, which were used to further refine the habitat model:

- Solano
- Pescadero
- San Ysidro
- Capay
- Marcuse

13B.1.6 References Cited

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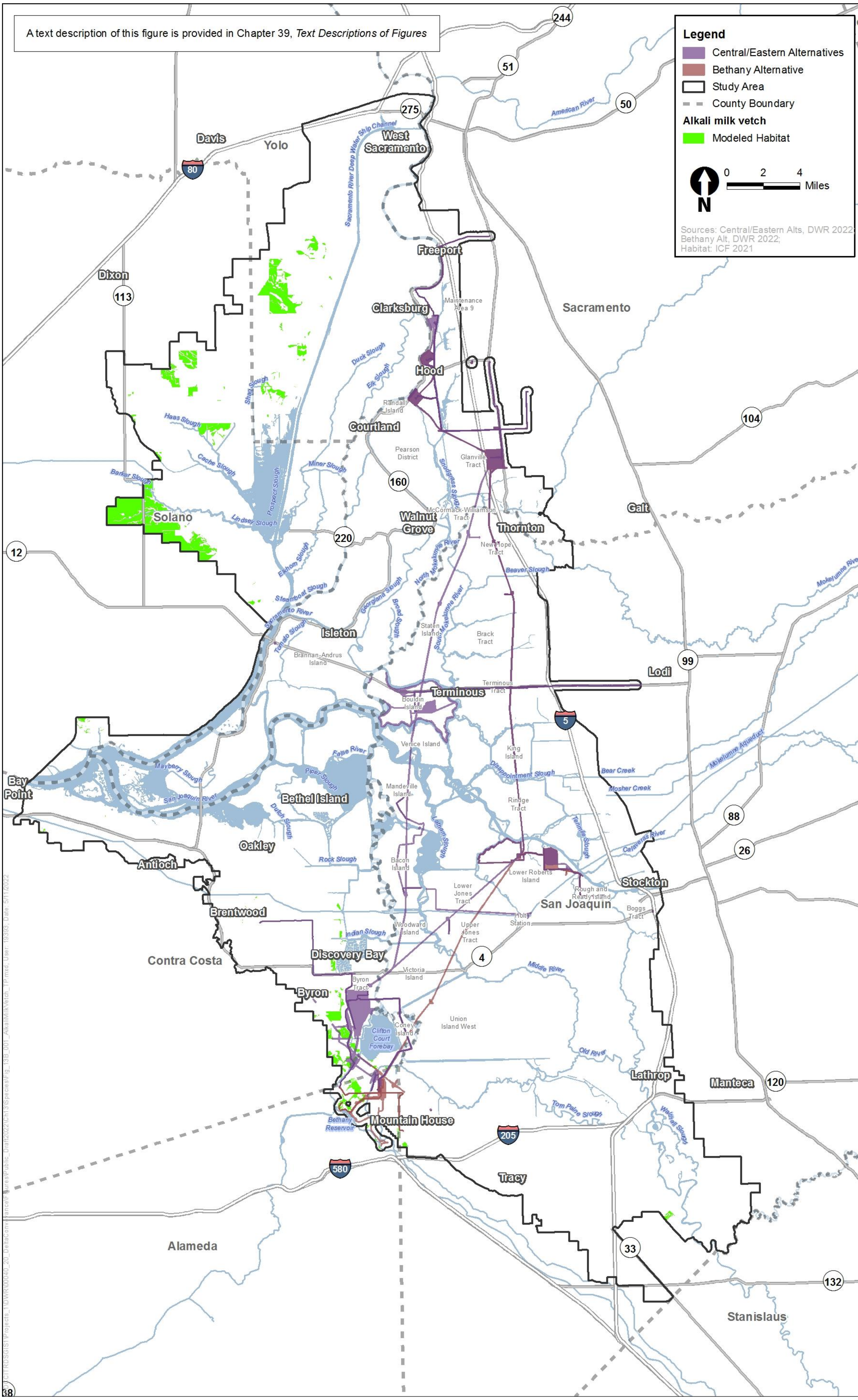

Figure 13B.1-1. Akali Milk-Vetch Modeled Habitat in the Study Area

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13B.2 Brittlescale (*Atriplex depressa*)

13B.2.1 Legal Status

Brittlescale is not listed under either the ESA or CESA. This species' NatureServe Ranking in the California Natural Diversity Database (CNDDB) is G2/S2, which means that globally (G) and within the state (S) brittlescale is considered imperiled (California Department of Fish and Wildlife 2020a:iii,20). This status is assigned when a species has very restricted range, very few populations (often 20 or fewer), steep population declines, or other factors that make it very vulnerable to extirpation.

The California Rare Plant Rank of 1B.2 for brittlescale indicates that it is rare, threatened, or endangered in California or elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv,20; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.2.2 Range and Distribution within the Study Area

Brittlescale is endemic to California. Its range extends from Glenn and Colusa Counties in the north, to Merced County in the south. Yolo, Solano, Contra Costa, and Alameda Counties are within its range (California Department of Fish and Wildlife 2020b; California Native Plant Society 2020). The CNDDB reports 60 occurrences for this species, one of which is considered to be extirpated (California Department of Fish and Wildlife 2020b). One additional occurrence was found during surveys near Clifton Court Forebay in 2011 (California Department of Water Resources 2011:6-2), and another collection was made in Colusa County in 2011 (Consortium of California Herbaria 2020), for a range-wide total of 61 extant occurrences.

There are four occurrences of brittlescale, all presumed extant, in the study area (California Department of Water Resources 2011:4-2; California Department of Fish and Wildlife 2020b). Within the study area, brittlescale has been reported in two localities in Solano County: one at Olcott Lake on Jepson Prairie, and a second location in Jepson Prairie southwest of Olcott Lake (California Department of Fish and Wildlife 2020b). Brittlescale is also found in numerous occurrences adjacent to the study area in and along drainages and alkaline seeps in Solano County and eastern Contra Costa County (California Department of Fish and Wildlife 2020b).

Brittlescale was found at 14 locations near Clifton Court Forebay during 2011 surveys (California Department of Water Resources 2011:4-2). One location was near Byron Hot Springs (existing CNDDB occurrence 2), and the other 13 locations were southwest of Clifton Court Forebay. The plants in locations southwest of Clifton Court Forebay represent a new occurrence not yet recorded in the CNDDB. Brittlescale plants were found in scalds in grazed alkali seasonal wetlands. Each location contained from 15 to over 1,000 individuals. No brittlescale was found in the conveyance planning area during surveys conducted in 2009 and 2010 (California Department of Water Resources 2011:S-2).

13B.2.3 Habitat Requirements

Brittlescale is found in meadows, seeps, and vernal pools, with alkaline clay soils (California Native Plant Society 2020). Species associated with brittlescale include common spikeweed (*Centromadia pungens*), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia salina*), low barley (*Hordeum depressum*), Mediterranean barley (*Hordeum marinum* subsp. *gussoneanum*), western niterwort (*Nitrophila occidentalis*), Parish's pickleweed (*Arthrocnemum subterminale*), bush seepweed (*Suaeda nigra*), heartscale (*Atriplex cordulata* var. *cordulata*), and San Joaquin spearscale (*Extriplex joaquinana*) (California Department of Fish and Wildlife 2020b; California Native Plant Society 2020). The reported CNDDB occurrences in Solano and east Contra Costa counties are in proximity to hydrologic features such as swales and playa pools. Brittlescale is found at elevations of 3 to 1,050 feet (California Native Plant Society 2020).

13B.2.4 Seasonal Patterns

Brittlescale is a small annual herb that blooms from June to October (Zacharias 2012; California Native Plant Society 2020).

13B.2.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.2.5.1 GIS Model Data Sources

The brittlescale model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.2.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented to occur. The extent of modeled habitat in the study area is depicted in Figure 13B.2-1.

13B.2.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.2.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Alkaline seasonal wetland
  - Southwestern North American salt basin and high marsh
  - *Allenrolfea occidentalis*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Suaeda moquinii*
  - Western North American disturbed alkaline marsh and meadow
  - Barren
  - Alkaline wetland
- Vernal pool complex
  - Vernal pool complex—*Allenrolfea occidentalis*
  - Vernal pool complex—*Distichlis spicata*
  - Vernal pool complex—*Frankenia salina*
  - Vernal pool complex—*Suaeda moquinii*
  - Vernal pool complex—Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Vernal pool complex—alkaline wetland
  - Vernal pool complex—vernal pool
  - Vernal pool complex—Mediterranean California naturalized annual and perennial grassland
  - Vernal pool

Soil types associated with brittlescale were determined by overlaying the occurrence locations from the CNDDB onto SSURGO (Soil Survey Staff, Natural Resources Conservation Service 2020). Soils mapped at occurrence locations are strongly alkaline. Most of the occurrences in or adjacent to the study area are located on soils of the Pescadero or Solano series, and a few are located on soils of the Antioch-San Ysidro complex. Therefore, modeled habitat was limited to the following soil series in the statutory Delta:

- Solano
- Pescadero
- Antioch-San Ysidro

13B.2.6 References Cited

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Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. Web Soil Survey. Available online at https://websoilsurvey.nrcs.usda.gov/. Accessed: March 2020 through February 17, 2020.

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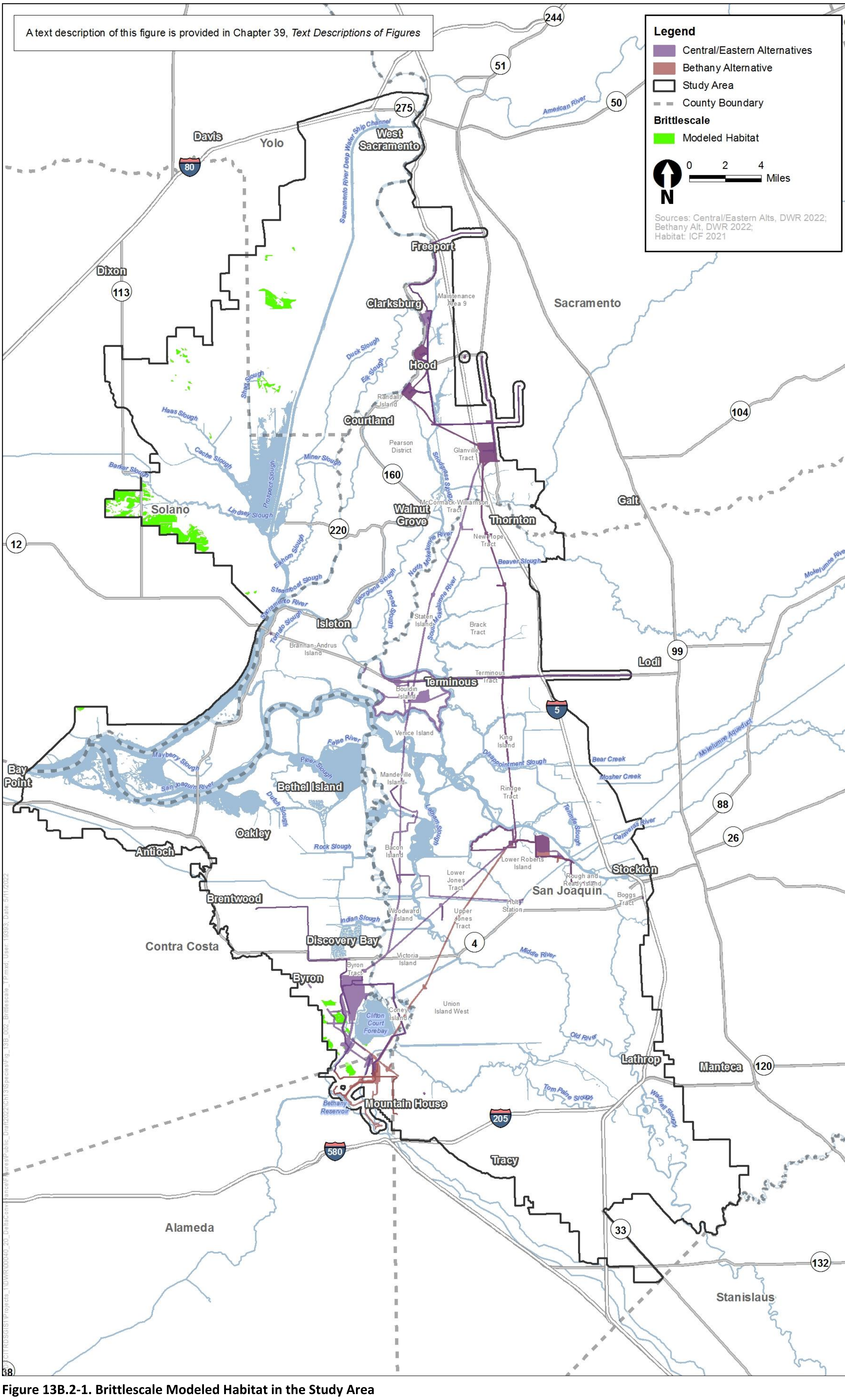

Figure 13B.2-1. Brittlescale Modeled Habitat in the Study Area

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13B.3 Watershield (*Brasenia schreberi*)

13B.3.1 Legal Status

Watershield is not listed under either ESA or CESA. This species' NatureServe Ranking in the CNDDB is G5/S3, which means that globally (G) watershield is considered common and secure, but within the state (S) watershield is considered vulnerable (California Department of Fish and Wildlife 2020a:iii, 24). This status is because it has a restricted range in California with relatively few populations.

The California Rare Plant Rank of 2B.3 for watershield indicates that it is rare, threatened, or endangered in California but more common elsewhere. Its state threat level (.3) indicates that it is not very threatened in California (California Department of Fish and Wildlife 2020a:iv, 24; California Native Plant Society 2020). Plants with a rank of 2B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.3.2 Range and Distribution within the Study Area

The current range of watershield in California includes the Klamath Ranges, North Coast Ranges, High Cascades Range, High Sierra Nevada, Modoc Plateau (except the Warner Mountains), and Sacramento Valley (Rosatti 2012). The CNDDB reports 43 occurrences for this species, one of which is considered to be extirpated, and two of which are potentially extirpated (California Department of Fish and Wildlife 2020b). A total 22 of these 43 occurrences have not been observed in the last 20 years.

There are two occurrences of watershield in the study area (California Department of Fish and Wildlife 2020b). One occurrence, in the slough at the center of Bouldin Island, was last observed in 1893 and is believed to be extirpated (California Department of Fish and Wildlife 2020b). The second occurrence, at Stone Lakes, was last observed in 1976 (California Department of Fish and Wildlife 2020b).

13B.3.3 Habitat Requirements

Watershield typically grows in freshwater marshes and swamps, including both natural and artificial water bodies (California Department of Fish and Wildlife 2020b; California Native Plant Society 2020). It can be the dominant species, covering much of the water surface where it grows, and associated species include smartweed (*Polygonum* spp.), pondweed (*Potamogeton* spp.), tules (*Schoenoplectus* spp.), spikerush (*Eleocharis* sp.), and rushes (*Juncus* sp.) (California Department of Fish and Wildlife 2020b). Watershield is found at elevations below 7,150 feet (2,180 meters) (California Department of Fish and Wildlife 2020b).

13B.3.4 Seasonal Patterns

Watershield blooms from April to October (Rosatti 2012).

13B.3.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.3.5.1 GIS Model Data Sources

The watershield model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2017 Land Use Data (Land IQ 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.3.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.3-1.

13B.3.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.3.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Nontidal perennial aquatic habitat
    - Naturalized temperate Pacific freshwater vegetation
    - Temperate freshwater floating mat
    - Temperate Pacific freshwater aquatic bed
    - *Eichhornia crassipes*
    - *Ludwigia (hexapetala, peploides)*
    - *Azolla (filiculoides, microphylla)*
    - *Lemna (minor)* and relatives
    - Water
    - Depression

13B.3.6 References Cited

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California Department of Fish and Wildlife. 2020b. *Brasenia schreberi* element occurrence query. California Natural Diversity Database. RareFind 5, April 3, 2020 Version.

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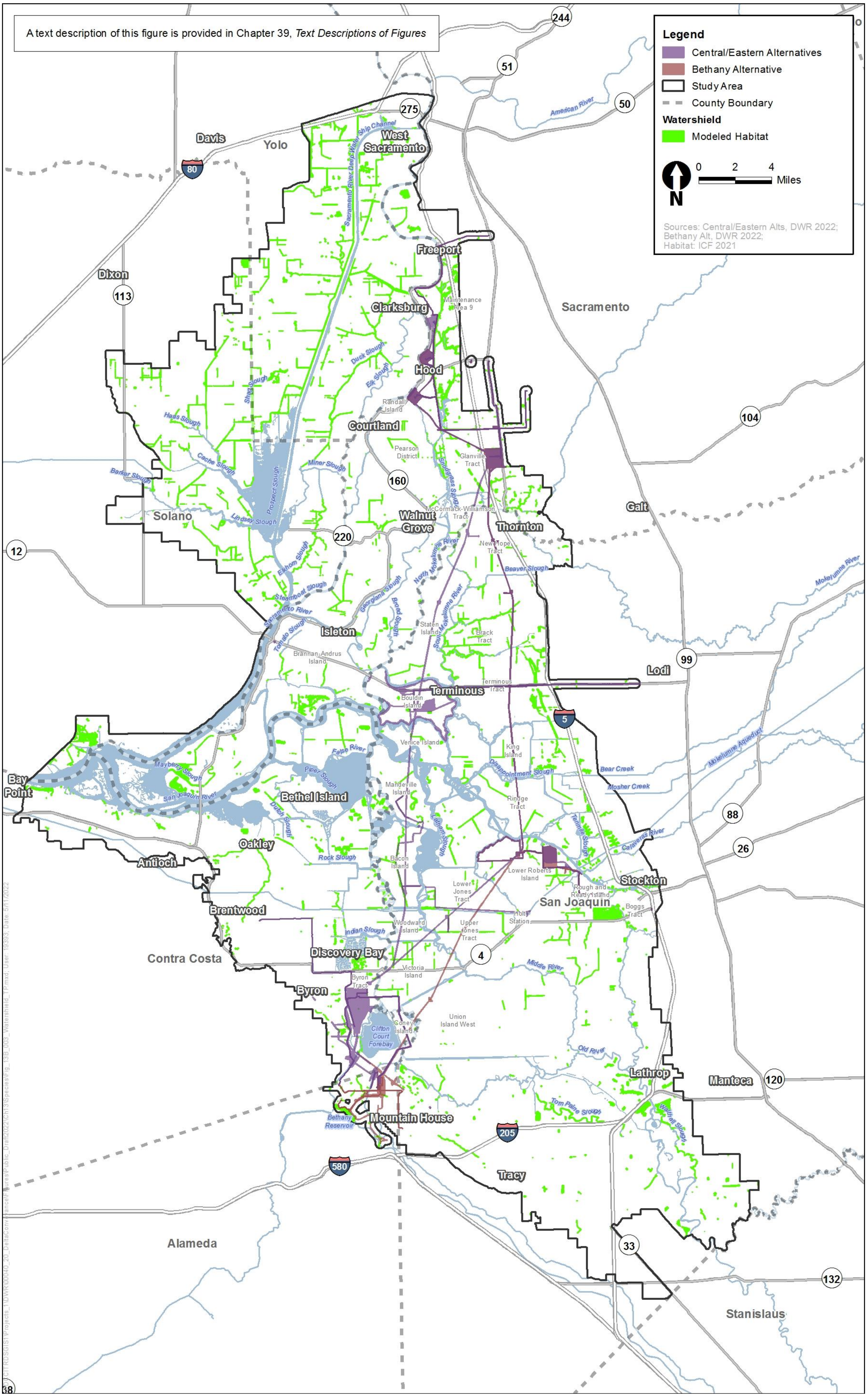

1
2 **Figure 13B.3-1. Watershield Modeled Habitat in the Study Area**

13B.4 Bristly Sedge (*Carex comosa*)

13B.4.1 Legal Status

Bristly sedge is not listed under either ESA or CESA. This species' NatureServe Ranking in the California Natural Diversity Database (CNDDB) is G5/S2, which means that globally (G) bristly sedge is considered common and secure, but within the state (S) bristly sedge is considered to be imperiled (California Department of Fish and Wildlife 2020a:iii, 29). This status is because it has relatively few, small populations in California.

The California Rare Plant Rank of 2B.1 for bristly sedge indicates that it is rare, threatened, or endangered in California but more common elsewhere. Its state threat level (.1) indicates that it is seriously threatened in California (California Department of Fish and Wildlife 2020a:iv, 29; California Native Plant Society 2020). Plants with a rank of 2B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.4.2 Range and Distribution within the Study Area

The current range of bristly sedge in California includes the Klamath Ranges, High Cascades Range, Modoc Plateau (except the Warner Mountains), interior North Coast Ranges, northern Central Coast, San Francisco Bay Area, San Bernardino Mountains, and Sacramento Valley (Zika et al. 2015). The CNDDB reports 29 occurrences for this species, four of which are possibly extirpated (California Department of Fish and Wildlife 2020b). Seven other occurrences have not been observed in the last 20 years.

There are 18 occurrences of bristly sedge in the study area (California Department of Fish and Wildlife 2020b). DWR botanists discovered most of these occurrences in 2009 along or near Snodgrass Slough and Stones Lakes (California Department of Water Resources 2011:S-2;2-8). One occurrence in the western Delta is recorded on the Webb Tract, and another occurrence, last observed in 1928 and possibly extirpated, is recorded from the south Delta near Holt (California Department of Fish and Wildlife 2020b).

13B.4.3 Habitat Requirements

Bristly sedge typically grows on the margins of freshwater marshes and riparian habitats (California Native Plant Society 2020). It can be found in clumps along the water's edge, on partially submerged log, or growing among tules (*Schoenoplectus acutus*) or cattails (*Typha* spp.) (California Department of Fish and Wildlife 2020b). Bristly sedge is found at elevations from –16 feet to 3,313 feet, although the occurrences in the Delta are all between 0 and 10 feet (California Department of Fish and Wildlife 2020b).

13B.4.4 Seasonal Patterns

Bristly sedge is a perennial species that grows in loose clusters. It sets fruit from July to September (Zika et al. 2012).

13B.4.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.4.5.1 GIS Model Data Sources

The bristly sedge model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.4.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.4-1.

13B.4.5.2.1 Geographic Limits

The model is geographically constrained to parts of the study area where occurrences of bristly sedge are found, which consists of the Sacramento River and Mokelumne River systems upstream of and including Webb Tract, in Sacramento, San Joaquin, and Contra Costa Counties.

13B.4.5.2.2 Additional Model Parameters

In the study area, bristly sedge grows at the interface between riparian and wetland habitats. Therefore, bristly sedge habitat was modeled at locations where valley/foothill riparian habitat types intersect with vegetation type occurring in the tidal aquatic perennial, nontidal aquatic perennial, and nontidal freshwater perennial natural communities. The modeled habitat was defined as the area extending 20 feet into the valley/foothill riparian natural community habitat types and 10 feet into the specified tidal aquatic perennial, nontidal aquatic perennial, and nontidal freshwater perennial emergent wetland natural communities.

Modeled habitat includes the following types from the GIS model data sources:

- Valley/foothill riparian
  - Forested wetland
  - Vancouverian riparian deciduous forest
  - *Populus fremontii*
  - *Quercus lobata*
  - *Rubus armeniacus*
  - *Salix exigua*
  - *Salix gooddingii*

- *Salix lasiolepis*
- Scrub shrub wetland

- Tidal perennial aquatic
  - *Azolla (filiculoides, microphylla)*
  - *Eichhornia crassipes*
  - *Lemna (minor)* and relatives
  - *Ludwigia (hexapetala, peploides)*
  - Natural channel
  - Naturalized temperate Pacific freshwater vegetation
  - Temperate Pacific freshwater aquatic bed
  - Tidal channel
  - Water
- Tidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
  - *Schoenoplectus (acutus, californicus)*
- Nontidal freshwater perennial emergent wetland
  - *Schoenoplectus (acutus, californicus)*

13B.4.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Vascular Plants, Bryophytes, and Lichens List*. California Natural Diversity Database. January. Sacramento, CA.

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California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

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California Department of Water Resources. 2011. *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*. December. Sacramento, CA.

Zika, P. F., A. L. Hipp, and J. Mastrogiuseppe. 2015. *Carex comosa*. In Jepson Flora Project (eds.) Jepson eFlora, Revision 3. Available: https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=17339. Accessed: April 29, 2020.

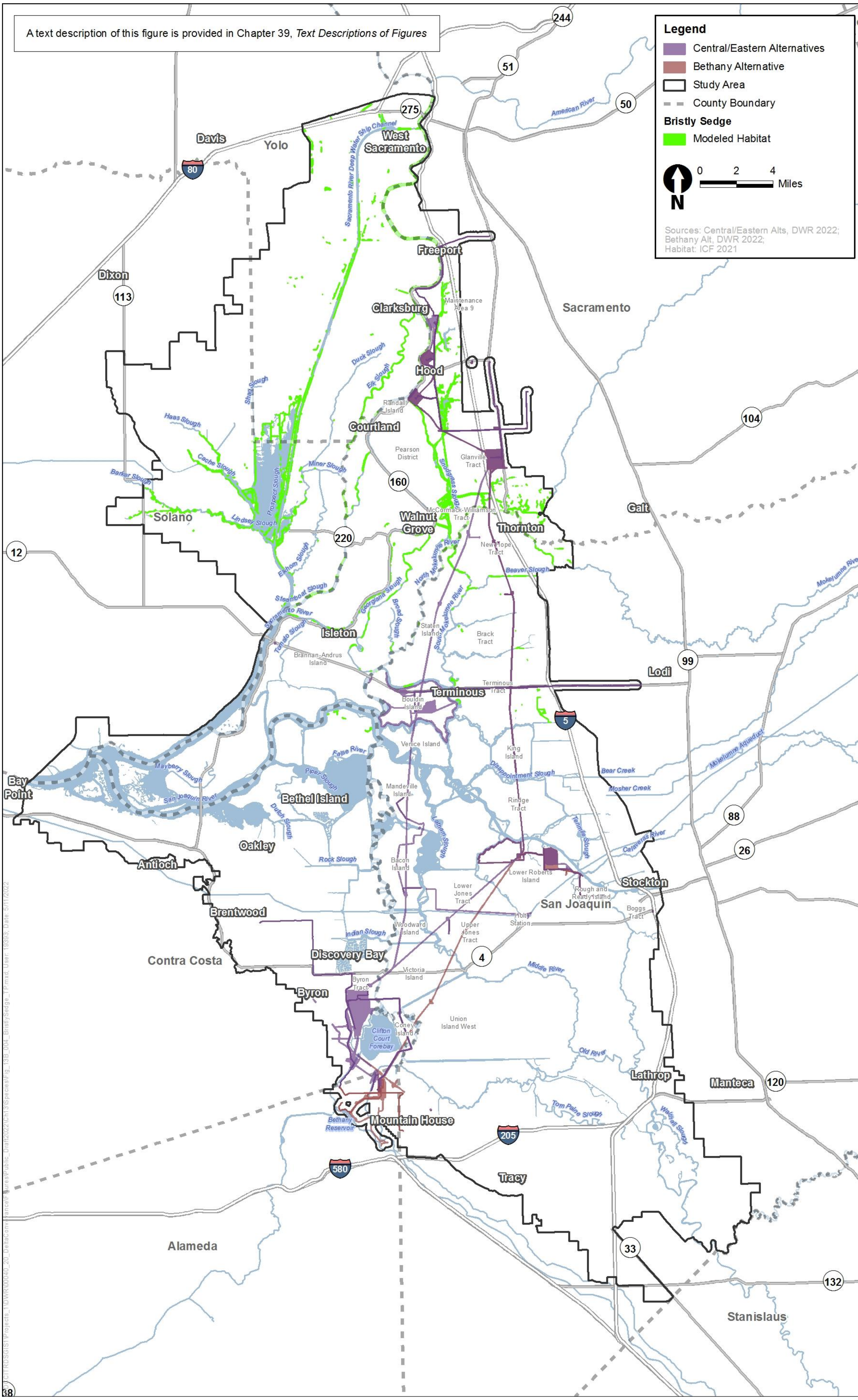

Figure 13B.4-1. Bristly Sedge Modeled Habitat in the Study Area

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13B.5 Soft Bird's-Beak (*Chloropyron molle* ssp. *molle*)

13B.5.1 Legal Status

Soft bird's-beak is listed as endangered under the ESA (November 1997; 62 FR 61916) and listed as rare under the California Native Plant Protection Act (July 1979). Its NatureServe Ranking in the CNDDB is G2T1/S1, which means that globally (G) this species is imperiled and the subspecies is critically imperiled and is at high risk for extinction as a result of restricted range, very few populations and steep decline the(the G rank refers to the global range of the species, while the T rank refers to the subspecies) (California Department of Fish and Wildlife 2020a:iii, 35). The S1 rank indicates that soft birds'-beak is critically imperiled within the state.

The California Rare Plant Rank of 1B.2 for soft bird's-beak indicates that the species is rare, threatened, or endangered in California and elsewhere, and its state threat level (.2) indicates that the species is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv, 35; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

USFWS designated critical habitat for soft bird's-beak in the four areas that contain the largest and most intact populations and habitat (72 FR 18528, April 12, 2007). No critical habitat is located within the statutory Delta.

In the most recent 5-year review, USFWS recommended the continuation of endangered status for soft bird's-beak (U.S. Fish and Wildlife Service 2009).

13B.5.2 Range and Distribution within the Study Area

Soft bird's-beak is endemic to salt and brackish marshes from San Pablo Bay to Suisun Bay and is known from 27 occurrences, 19 of which are presumed extant (California Department of Fish and Wildlife 2020b). Historically, the range of soft bird's-beak extended from tidal marshes of Napa and Solano Counties in the north, Contra Costa County in the south, Sonoma and Marin Counties in the west, and Sacramento County in the east. It is now believed to be extirpated from Marin, Sacramento and Sonoma Counties but remains extant in Napa, Solano, and Contra Costa Counties (California Department of Fish and Wildlife 2020b). The largest extant occurrences are on CDFW reserves and wildlife areas, a California Department of Parks and Recreation park, a county park, and a property held for conservation purposes by a land trust.

Only one occurrence is known in the study area, at the south end of Sherman Island near the Antioch Bridge (California Department of Fish and Wildlife 2020b; U.S. Fish and Wildlife Service 2009:3-5). This occurrence has not been observed since 1972 and may be extirpated (California Department of Fish and Wildlife 2020b).

13B.5.3 Habitat Requirements

Soft bird's-beak grows at the upper margin of tidal brackish high marshes in the San Francisco Estuary, often near the upper marsh–upland boundary (Grewell 2005:24). Where the topography is relatively uniform, soft bird's-beak is distributed in bands at the upper margin of the brackish high marsh. In Suisun Marsh these bands are not correlated with elevation, but with soil pore water salinity during the dry season, which is determined by distance to channel and varies from season to season depending on freshwater flows from creeks draining into the marsh (Culberson 2001:81). Where the topography is more complex, such as areas with ridges or mounds and on levee banks, soft bird's-beak can be found in a variety of patch shapes (Grewell 2005). Plant distribution is influenced by a number of factors, including the existence of a persistent seed bank, the dispersal and germination dynamics of its floating seed, the extent of bare soil where seedlings can establish, the presence of appropriate host species, and the absence of dense populations of large, perennial, nonnative plant species (Grewell et al. 2003; Grewell 2005; Grewell et al. 2007:139–140). The presence of a natural tidal inundation pattern is important and the more muted the tidal influence is, such as in tidal creeks with salt water exclusion gates or marshes with extensive levee systems, the less suitable the habitat is for soft bird's-beak (Grewell et al. 2003; Grewell 2005; Grewell et al. 2007:139–140). A number of hypotheses have been suggested to explain the effects of the muted tidal influence, including increased rates of seed predation and herbivory by native insects, high densities of inappropriate host species such as nonnative annual plants, and invasion and displacement by large nonnative plant species such as perennial pepperweed (*Lepidium latifolium*) (Grewell 2005).

Frequent plant associates include pickleweed (*Salicornia pacifica*), saltgrass (*Distichlis spicata*), salt marsh dodder (*Cuscuta salina*), and spearscale (*Atriplex prostrata*) (Baye et al.:11-17, 2000; Grewell 2005; Grewell et al. 2007:139–140).

13B.5.4 Seasonal Patterns

Soft bird's-beak is an annual herb that blooms from July to November (California Native Plant Society 2020; Wetherwax and Tank 2012: 966).

13B.5.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.5.5.1 GIS Model Data Sources

The soft bird's-beak model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).

13B.5.5.2 Habitat Model Description

The habitat modeled for the species is based on the natural communities and vegetation types within which the species is known to occur. Within the project area, modeled habitat for soft bird's-beak consists of tidal brackish emergent wetland, including the vegetation types listed in the list below. The extent of modeled habitat in the study area is depicted in Figure 13B.4-1.

13B.5.5.2.1 Geographic Limits

Soft bird's-beak is endemic to salt and brackish marshes from San Pablo Bay to Suisun Bay.

13B.5.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Tidal Brackish Emergent Wetland
    - Southwestern North American salt basin and high marsh
    - Frankenia salina Alliance
    - Temperate Pacific tidal salt and brackish meadow
    - Atriplex prostrata - Cotula coronopifolia
    - Distichlis spicata
    - Sarcocornia pacifica (Salicornia depressa).

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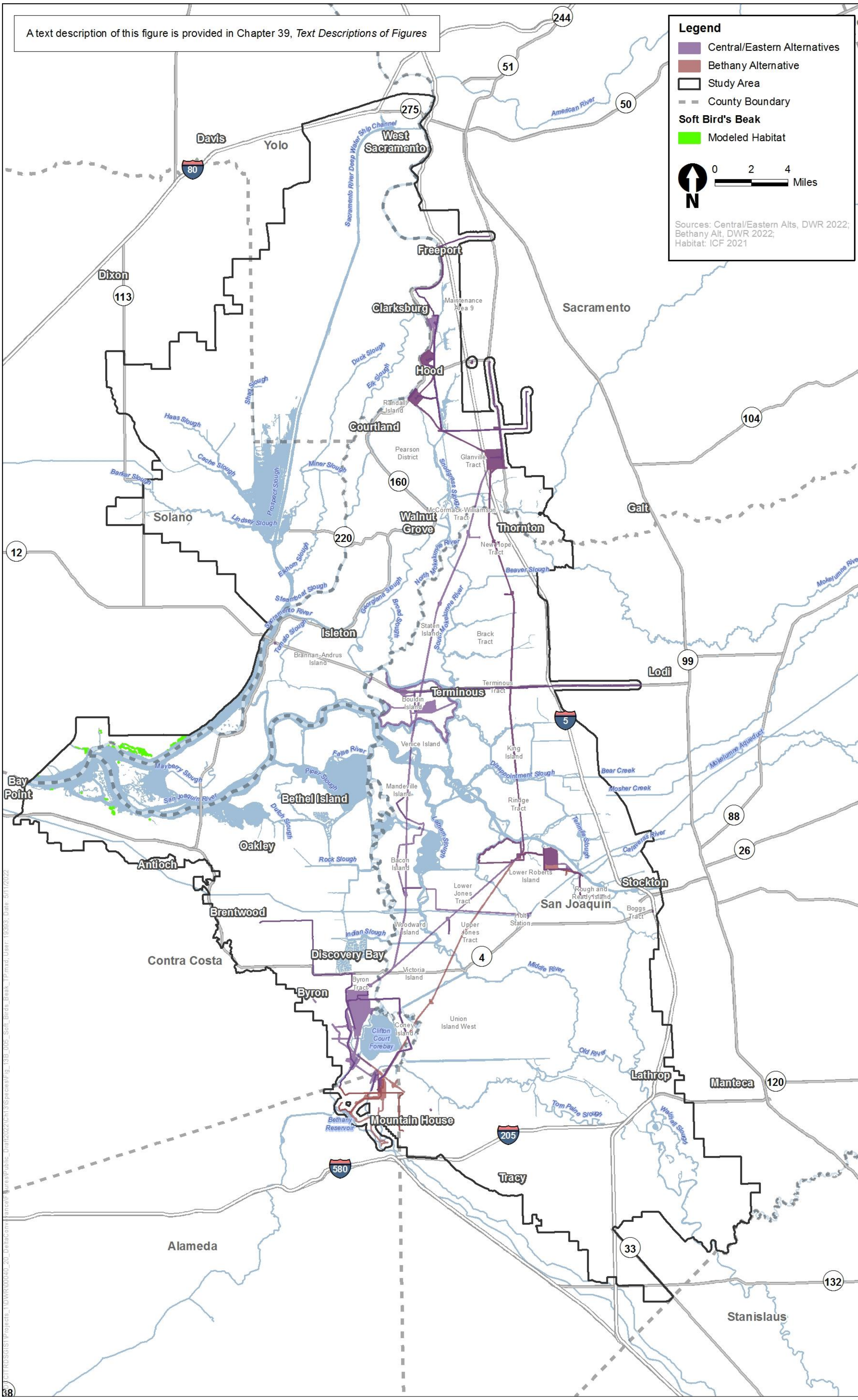

Figure 13B.5-1. Soft Birds Beak Modeled Habitat in the Study Area

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13B.6 Bolander's Water-Hemlock (*Cicuta maculata* var. *bolanderi*)

13B.6.1 Legal Status

Bolander's water-hemlock (*Cicuta maculata* var. *bolanderi*) is not listed under either the ESA or CESA. This species' NatureServe Ranking in the CNDDB is G5T4T5/S2?, which means that globally (G) the species is considered common and secure, but the variety (T) is secure to apparently secure, with some cause for long-term concern due to declines or other factors (California Department of Fish and Wildlife 2020a:iii, 37). Within the state (S), Bolander's water-hemlock is ranked as imperiled, with the "?" indicating some uncertainty about the ranking (California Department of Fish and Wildlife 2020a:iii). This status is due to its restricted range in California with relatively few populations.

The California Rare Plant Rank of 2B.1 for Bolander's water-hemlock indicates that it is rare, threatened, or endangered in California but more common elsewhere (California Department of Fish and Wildlife 2020a:iv, 39; California Native Plant Society 2020). Its state threat level (.1) indicates that it is seriously threatened in California (California Department of Fish and Wildlife 2020a:iv). Plants with a rank of 2B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.6.2 Range and Distribution within the Study Area

The current range of Bolander's water-hemlock in California includes the southern Sacramento Valley, the Central Coast and the South Coast (Constance and Wetherwax 2012). The CNDDB reports 17 occurrences for Bolander's water-hemlock, all of which are presumed to be extant (California Department of Fish and Wildlife 2020b). Eleven occurrences have not been observed in the last 20 years.

There are five occurrences of Bolander's water-hemlock in the study area: near Collinsville, on Brown's Island, at Big Break, along Calhoun Cut, and at Delta Meadows Park (California Department of Fish and Wildlife 2020b). All five occurrences are presumed to be extant, although none of them have been revisited within the last 20 years.

13B.6.3 Habitat Requirements

Habitat requirements for Bolander's water-hemlock have not been well-documented in California, although it has mostly been recorded growing in coastal freshwater or brackish marsh. Associated species include tules (*Schoenoplectus* spp.), cattails (*Typha* spp.), rushes (*Juncus* spp.), sedges (*Carex* spp.), and saltgrass (*Distichlis spicata*) (California Department of Fish and Wildlife 2020b). Based on these associates, Bolander's water-hemlock grows within the tidal zone above the area of active tidal erosion. Bolander's water-hemlock is found from sea level to 65 feet elevation (California Department of Fish and Wildlife 2020b).

13B.6.4 Seasonal Patterns

Bolander's water-hemlock is a perennial herb that blooms from July to September (Constance and Wetherwax 2012).

13B.6.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.6.5.1 GIS Model Data Sources

The Bolander's water-hemlock model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.6.5.2 Habitat Model Description

The habitat model for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.6-1.

13B.6.5.2.1 Geographic Limits

Bolander's water-hemlock grows within the upper tidal zone at the interface between tidal waters and terrestrial vegetation. Within the project area, Bolander's water-hemlock habitat types were geographically bounded by the area extending 10 feet landward from the boundary of the tidal perennial aquatic land cover type. This area is expected to encompass the upper tidal zone that experiences daily tidal inundation.

13B.6.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Tidal brackish emergent wetland
  - Arid West freshwater emergent marsh
  - *Schoenoplectus (acutus, californicus)*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Naturalized warm-temperate riparian and wetland
  - *Phragmites australis—Arundo donax*
  - *Southwestern North American salt basin and high marsh*
  - *Frankenia salina*

    - Temperate Pacific tidal salt and brackish meadow
    - *Atriplex prostrata—Cotula coronopifolia*
    - *Distichlis spicata*
    - *Sarcocornia pacifica (Salicornia depressa)*
    - *Bolboschoenus maritimus*
- Tidal freshwater emergent wetland
    - Arid West freshwater emergent marsh
    - Californian warm temperate marsh/seep
    - *Juncus arcticus* (var. *balticus*, *mexicanus*)
    - Naturalized warm-temperate riparian and wetland
    - *Phragmites australis—Arundo donax*
    - *Schoenoplectus (acutus, californicus)*
    - *Typha (angustifolia, domingensis, latifolia)*
    - Freshwater emergent wetland

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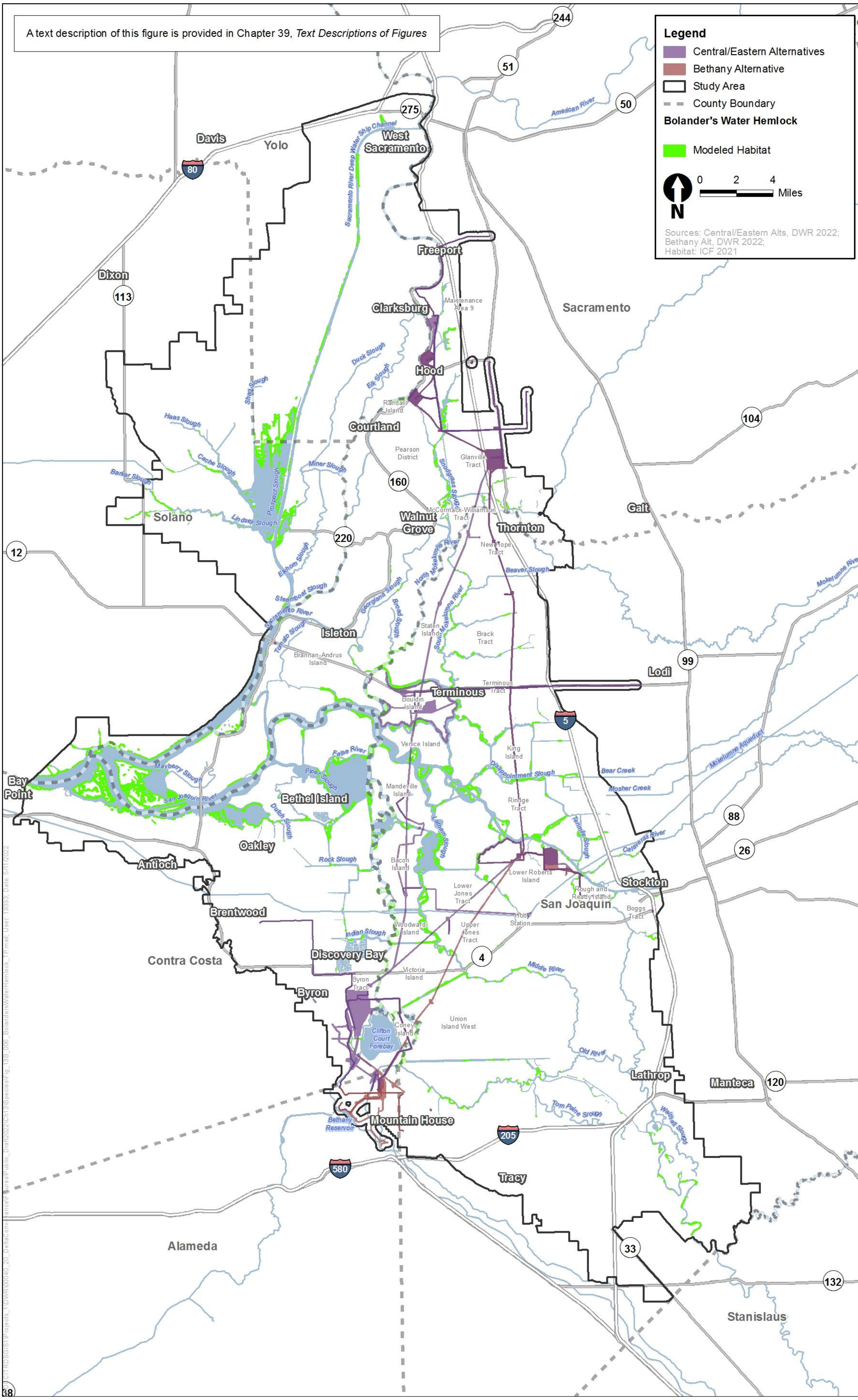

Figure 13B.6-1. Bolanders Water Hemlock Modeled Habitat in the Study Area

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13B.7 Recurved Larkspur (*Delphinium recurvatum*)

13B.7.1 Legal Status

Recurved larkspur (*Delphinium recurvatum*) is not listed under either the federal ESA or CESA. This species' NatureServe Ranking in the CNDDB is G2/S2, which means that globally (G) and within the state (S) recurved larkspur is considered to be imperiled (California Department of Fish and Wildlife 2020a:iii, 45). This status is due to its restricted range in California with relatively few populations.

The California Rare Plant Rank of 1B.2 for recurved larkspur indicates that it is rare, threatened, or endangered in California but more common elsewhere (California Department of Fish and Wildlife 2020a:iv, 45; California Native Plant Society 2020). Its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.7.2 Range and Distribution within the Study Area

Recurved larkspur is endemic to California. It is distributed primarily throughout the western and southern San Joaquin Valley from Contra Costa County to Kern County, with additional occurrences in the interior South Coast Ranges, Carrizo Plain, and western Mojave Desert (Antelope Valley) (Koontz and Warnock 2012; California Department of Fish and Wildlife 2020b. It also occurred historically in the Sacramento Valley (Koontz and Warnock 2012). The CNDDB reports 120 occurrences for this species, of which 14 are considered to be extirpated, 1 is potentially extirpated (California Department of Fish and Wildlife 2020b), and 77 have not been observed in the last 20 years.

There are four occurrences of recurved larkspur in the study all located in the area west and southwest of Clifton Court Forebay (California Department of Fish and Wildlife 2020b). All four occurrences are presumed extant; one were observed in 2010, but other three have not been revisited for over 20 years.

13B.7.3 Habitat Requirements

Recurved larkspur is associated with alkaline habitats, primarily with alkaline grasslands, allscale (*Atriplex polycarpa*) scrub, and spinescale (*Atriplex spinescens*) scrub, although it sometimes occurs in iodine bush (*Allenrolfea occidentalis*) scrub and mesquite (*Prosopis glandulosus*) thickets (Koontz and Warnock 2012; California Department of Fish and Wildlife 2020b). It generally occurs on loam soils (sandy loam, loam, and clay loam) that are moderately to strongly alkaline and well-drained to moderately well-drained. Most of the populations range in elevation from 3 meters (10 feet) on the valley floor up to 365 meters (1,200 feet) in the adjacent foothills. A few populations in the Antelope Valley, Carrizo Plain, and interior South Coast Ranges are found at elevations between 1,400 feet and 2,250 feet (California Department of Fish and Wildlife 2020b). Species commonly associated with recurved larkspur include annual grasses (*Bromus* spp., *Festuca* spp., *Hordeum* spp.), alkali sacaton (*Sporobolus airoides*), common spikeweed (*Centromadia pungens*), bush seepweed (*Suaeda nigra*), and alkali heath (*Frankenia salina*) (California Department of Fish and Wildlife 2020b).

13B.7.4 Seasonal Patterns

Recurved larkspur is a perennial herb that blooms between March and June (Koontz and Warnock 2012).

13B.7.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.7.5.1 GIS Model Data Sources

The recurved larkspur model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.7.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.7-1.

13B.7.5.2.1 Geographic Limits

Based on the CNDDB occurrence records for recurved larkspur, only four occurrences are reported north of the Sacramento River. Two of these occurrences are extirpated, and two are historic records. Also, the species identity of these occurrences is possibly incorrect. All other occurrences are located south of the Sacramento River; more specifically, south of Highway 4 in Contra Costa and Alameda County. Although potentially suitable habitat is present in the statutory Delta in Solano and Yolo Counties, no occurrences are known from that area (California Department of Fish and Wildlife 2020b). Therefore, the model is restricted to portions of the study area south of Highway 4 in Contra Costa and Alameda County.

13B.7.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Vernal pool complex
    - Vernal pool complex—Californian mixed annual/perennial freshwater vernal pool/swale bottomland
    - Vernal pool complex—vernal pool

  - Vernal pool complex—alkaline wetland
  - Vernal pool complex—*Allenrolfea occidentalis*
  - Vernal pool complex—California annual herb/grass
  - Vernal pool complex—*Distichlis spicata*
  - Vernal pool complex—*Frankenia salina*
  - Vernal pool complex—*Suaeda moquinii*
  - Vernal pool complex—Mediterranean California naturalized annual and perennial grassland
  - Vernal pool complex—Western North American disturbed alkaline marsh and meadow
- Alkaline seasonal wetland
  - *Allenrolfea occidentalis*
  - *Distichlis spicata*
  - *Frankenia salina*
  - Southwestern North American salt basin and high marsh
  - Western North American disturbed alkaline marsh and meadow
  - Alkaline wetland
  - Barren
- Grassland
  - California annual herb/grass

Soil types associated with recurved larkspur were determined by overlaying the occurrence locations from the CNDDB onto the SSURGO (Soil Survey Staff, Natural Resources Conservation Service 2020). All occurrences of recurved larkspur in the study area are on Solano series soils. Therefore, the habitat model was limited to the following soil series:

- Solano

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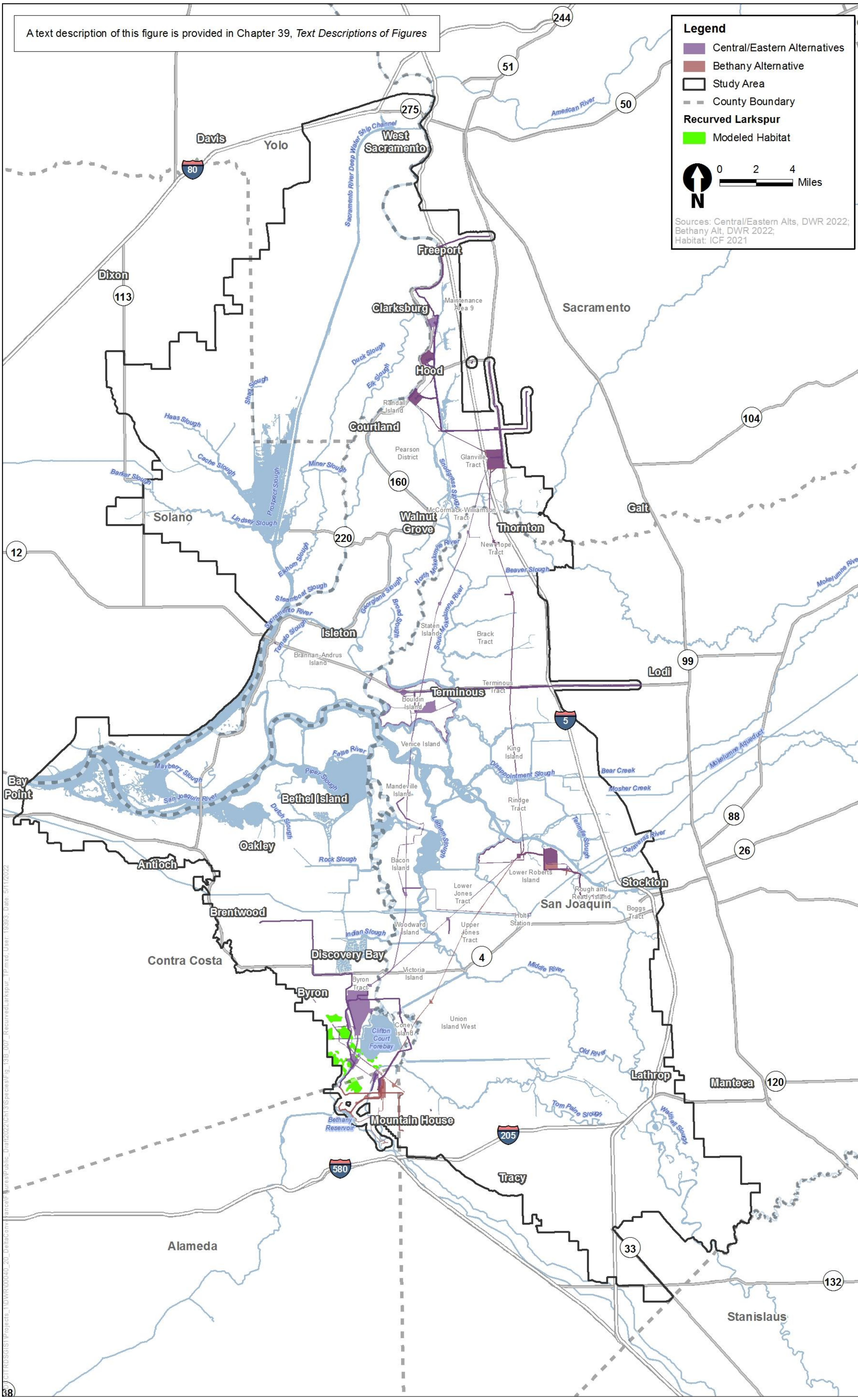

Figure 13B.7-1. Recurved Larkspur Modeled Habitat in the Study Area

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13B.8 Dwarf Downingia (*Downingia pusilla*)

13B.8.1 Legal Status

Dwarf downingia (*Downingia pusilla*) is not listed under either the federal ESA or CESA. Its NatureServe Ranking in the CNDDB is GU/S2, which means that globally (G) the species status is unknown, and within the state (S) this species is imperiled and is at high risk for extinction as a result of restricted range, very few populations, and steep decline (California Department of Fish and Wildlife 2020a:iii, 47).

The California Rare Plant Rank of 2B.2 for dwarf downingia indicates that it is rare, threatened, or endangered in California but more common elsewhere (California Department of Fish and Wildlife 2020a:iv, 45; California Native Plant Society 2020). Its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv, 45). Plants with a rank of 2B are considered to meet the definitions of rare, threatened or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.8.2 Range and Distribution within the Study Area

In California, dwarf downingia is known from 132 occurrences, of which 124 are presumed extant, in a range that extends from southern Tehama County to Fresno County and from Sonoma County to Placer County; it is also found in Chile (California Department of Fish and Wildlife 2020b; Schultheis 2012). It occurs on alluvial terraces and floodplains in the Sacramento Valley (California Department of Fish and Wildlife 2020b). It has been reported from the northeastern part of the San Joaquin Valley, although not near the study area, and it is also found on valley floors and margins in Sonoma and Napa Counties (California Department of Fish and Wildlife 2020b).

Dwarf downingia occurs in six occurrences in two areas of the study area. Five occurrences have been reported from vernal pools, vernal swales, alkaline seasonal wetlands, tire ruts, and hydrologically altered sloughs. It is relatively common in the greater Jepson Prairie area, including existing conservation lands in the Jepson Prairie Preserve (managed by Solano Land Trust) and Calhoun Cut Ecological Reserve (managed by California Department of Fish and Wildlife) (Witham 2006:15; California Department of Fish and Wildlife 2020b). During the 2009 and 2010 field surveys for BDCP, dwarf downingia was observed in vernal pools on the North Stone Lakes Unit of the Stone Lakes National Wildlife Refuge (California Department of Water Resources 2011:2-9, 4-2), which is CNDDB Element Occurrence 56. No additional observations of dwarf downingia were made during the 2011 surveys (California Department of Water Resources 2011:6-2).

13B.8.3 Habitat Requirements

Throughout its distribution, dwarf downingia occurs in vernal pools, vernal swales, pools in seasonal streambeds, vernal marshes, tire ruts, hydrologically altered sloughs, and irrigation ponds (California Department of Fish and Wildlife 2020b). At some occurrences, it is found with indicators of long-duration inundation, such as pale spikerush (*Eleocharis macrostachya*) (Barbour et al. 2007:25). In the Jepson Prairie area, it is found in alkaline/saline vernal pools (Barbour et al. 2007:66). In the Stone Lakes area, it is associated with vernal pools that form in the former headwaters of natural drainages propagating upslope from the Sacramento–San Joaquin River Delta. When present in a vernal pool, its population persistence has been found to be relatively constant when compared to other rare vernal pool species (Buck 2004:13,28; Barbour et al. 2007:62).

13B.8.4 Seasonal Patterns

Dwarf downingia is an annual herb that blooms between March and May (Schultheis 2012).

13B.8.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.8.5.1 GIS Model Data Sources

The dwarf downingia model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.8.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.8-1.

13B.8.5.2.1 Geographic Limits

The dwarf downingia habitat model is constrained to exclude vernal pool habitat in Alameda and Contra Costa Counties. No records of dwarf downingia have been reported for the western San Joaquin Valley (California Department of Fish and Wildlife 2020b). An additional constraints layer was added to the model to remove modeled habitat near Collinsville, on Sherman Island, and Rough and Ready Island, where seasonal wetland habitat was classified as vernal pools for it to be incorporated into the vernal pool invertebrate models. However, the habitat is not suitable habitat for dwarf downingia.

13B.8.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Vernal pool complex

- Vernal pool complex-Californian mixed annual/perennial freshwater vernal pool/swale bottomland
- Vernal pool complex-Mediterranean California naturalized annual and perennial grassland
- Vernal pool complex-California annual herb/grass
- Californian mixed annual/perennial freshwater vernal pool/swale bottomland
- Vernal Pool

13B.8.6 References Cited

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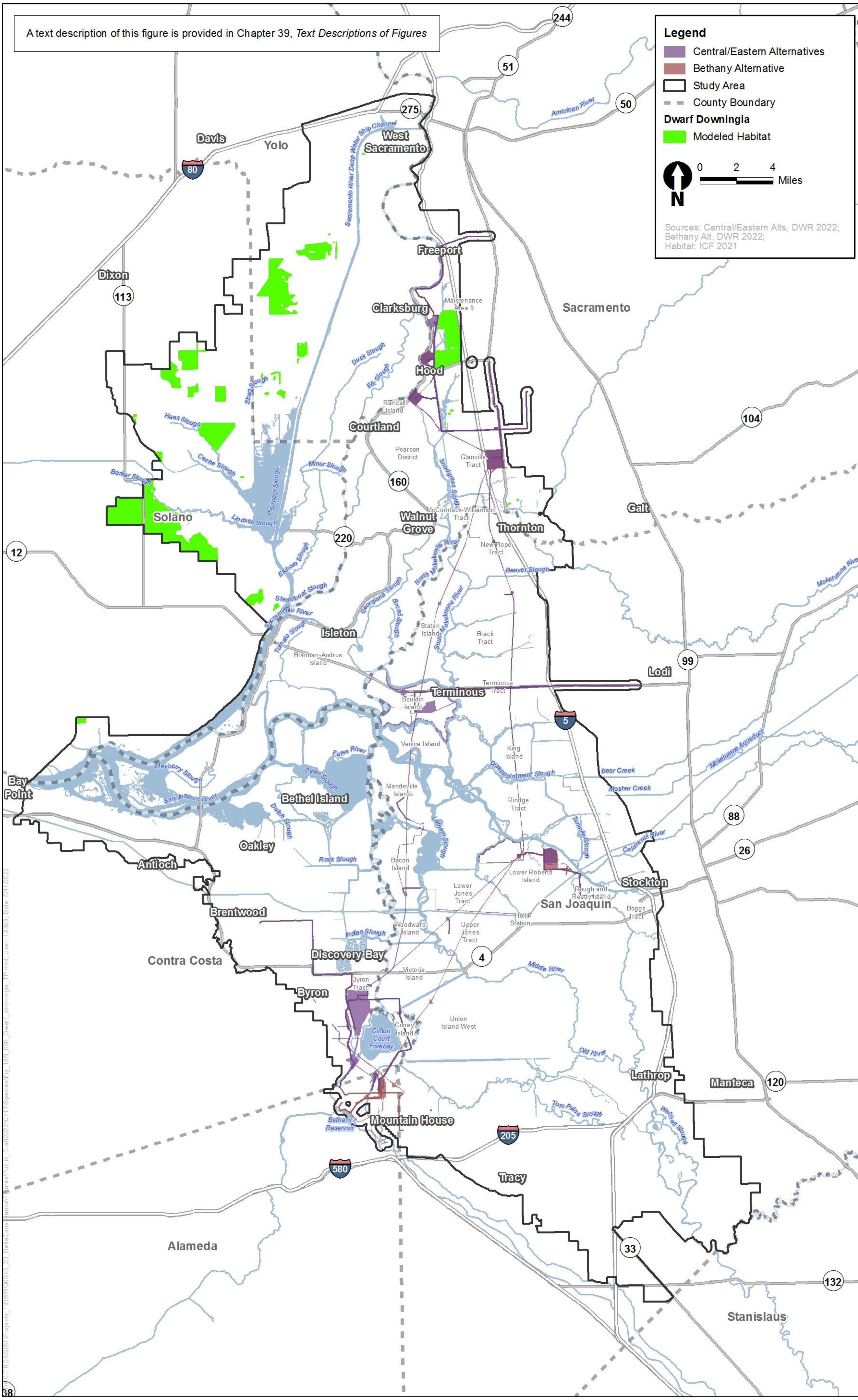


Figure 13B.8-1. Dwarf Downingia Modeled Habitat in the Study Area

13B.9 Jepson's Coyote-Thistle (*Eryngium jepsonii*)

13B.9.1 Legal Status

Jepson's coyote-thistle (*Eryngium jepsonii*) is not listed under either the federal ESA or CESA. This species' NatureServe Ranking in the CNDDB is G2/S2, which means that globally (G) and within the state (S) Jepson's coyote-thistle is considered to be imperiled (California Department of Fish and Wildlife 2020a:iii,60). This status is due to its relatively few, small populations in California.

The California Rare Plant Rank of 1B.2 for Jepson's coyote-thistle indicates that it is rare, threatened, or endangered in California and elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildllife 2020a:IV,60; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.9.2 Range and Distribution within the Study Area

The current range of Jepson's coyote-thistle in California includes the southern interior North Coast Ranges, San Francisco Bay Area, and lower Sacramento Valley (Preston et al. 2012). The CNDDB reports 19 occurrences for this species, all of which are presumed extant (California Department of Fish and Wildlife 2020b). Six occurrences have not been observed in the last 20 years.

There are two occurrences of Jepson's coyote-thistle in the study area (California Department of Fish and Wildlife 2020b). Both occurrences are at the Tule Glide Ranch in Yolo County.

13B.9.3 Habitat Requirements

Jepson's coyote-thistle grows in grasslands on clay soils (California Native Plant Society 2020; Preston et al. 2012). At the Tule Glide Ranch, it grows in the upland portions of the vernal pool complex that occurs there, with Italian ryegrass (*Festuca perenne*), Mediterranean barley (*Hordeum marinum*), hayfield tarweed (*Hemizonia congesta*), tomcat clover (*Trifolium willdenovii*), thimble clover (*Trifolium microdon*), chick lupine (*Lupinus microcarpus*), Chilean trefoil (*Acmispon wrangelianus*), hogwallow starfish (*Hesperevax caulescens*), and Keck's mallow (*Sidalcea keckii*). Jepson's coyote-thistle is found at elevations below 1,640 feet (Preston et al. 2012), although the occurrences at Tule Glide Ranch are at about 15 feet (California Department of Fish and Wildlife 2020b).

13B.9.4 Seasonal Patterns

Jepson's coyote-thistle is a perennial herb that blooms between April and August (Preston et al. 2012). After setting seed in late summer, the plants remain dormant until the winter rainfall season.

13B.9.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.9.5.1 GIS Model Data Sources

The Jepson's coyote-thistle model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.9.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.9-1.

13B.9.5.2.1 Geographic Limits

The vegetation units included in the model occur throughout the statutory Delta.

13B.9.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Vernal pool complex
    - Vernal pool complex-Californian mixed annual/perennial freshwater vernal pool/swale bottomland
    - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
    - Vernal pool complex-Mediterranean California naturalized annual and perennial grassland
    - Vernal pool complex-California annual herb/grass
- Grassland
    - Mediterranean California naturalized annual and perennial grassland
    - California annual herb/grass

Soil types associated with Jepson's coyote-thistle were determined by overlaying the occurrence locations from the CNDDB onto the SSURGO (Soil Survey Staff 2020). Soils mapped at occurrence locations are clays. The following soil series in the statutory Delta show occurrences of Jepson's coyote-thistle and are used to refine the habitat model:

- Clear Lake
- Capay

13B.9.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Vascular Plants, Bryophytes, and Lichens List*. California Natural Diversity Database (CNDDB). Quarterly publication. January. Sacramento, CA.

California Department of Fish and Wildlife. 2020b. *Eryngium jepsonii* element occurrence query. California Natural Diversity Database, RareFind 5, May 31, 2020 version. California Department of Fish and Wildlife.

California Department of Water Resources. 2020. Aquatic Resources Delineation Data (update). Received October 22, 2020.

California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

California Department of Water Resources and GEI Consultants Inc. 2020. *Aquatic Resources Delineation Report—Delta Conveyance Project*. March 31, 2020 (updated June 23, 2020).

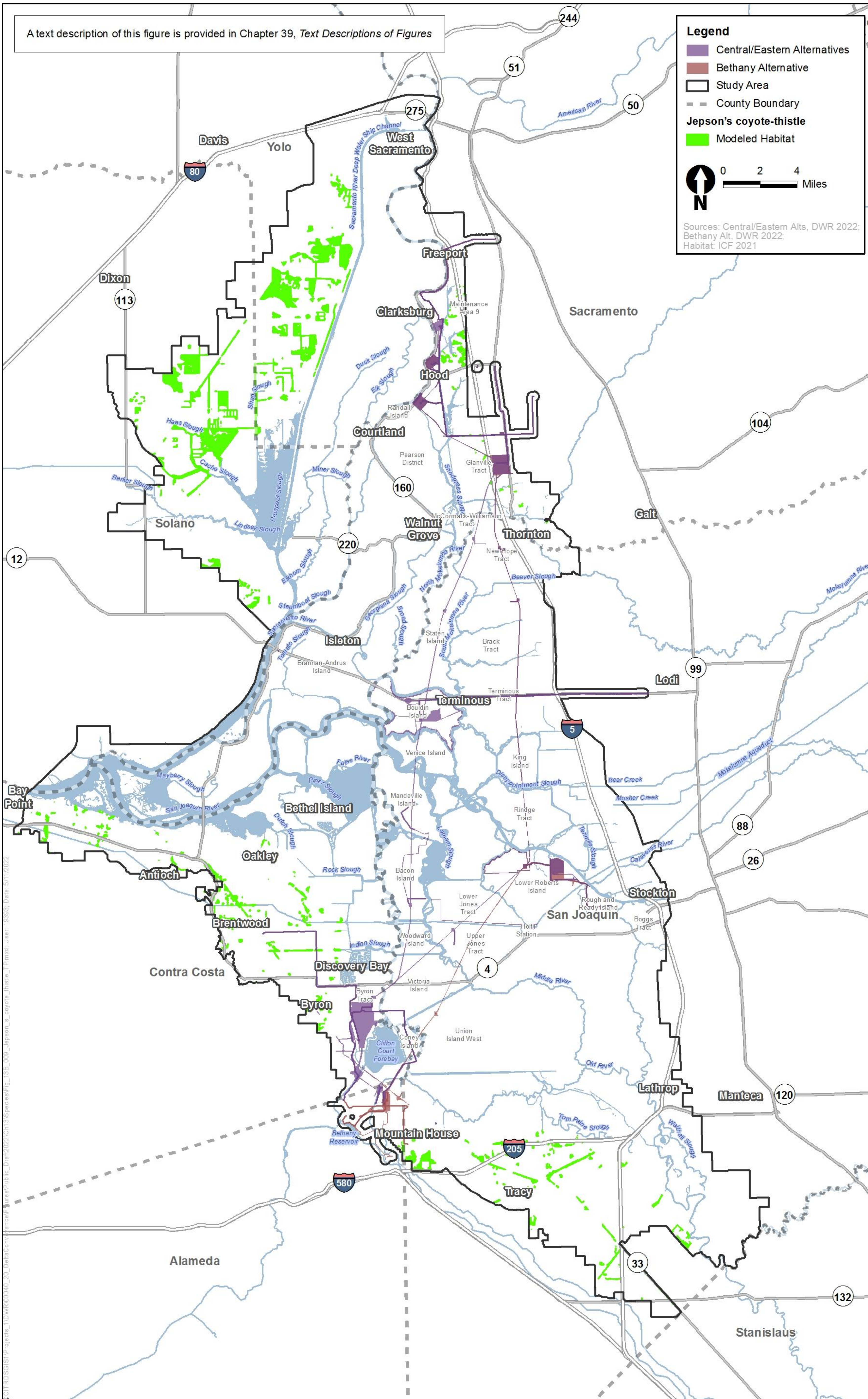
California Native Plant Society. 2020. *Eryngium jepsonii* species query. *Inventory of Rare and Endangered Plants of California* (online edition, v8-03 0.39). California Native Plant Society. Sacramento, CA. Available: http://www.rareplants.cnps.org/detail/1132.html . Accessed: June 4, 2020.

Chico State Research Foundation, Geographical Information Center. 2019. Delta Vegetation and Land Use Update – 2016 [ds2855]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip . Accessed: March 6, 2020.

Preston, R. E., M. S. Park, and L. Constance. 2012. *Eryngium jepsonii*. In Jepson Flora Project (eds.), Jepson eFlora. Available: https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=78144 . Accessed: June 4, 2020.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. Web Soil Survey. Available: https://websoilsurvey.nrcs.usda.gov/.

Witham, C. W., R. F. Holland, and J. Vollmar. 2014. *Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012* [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip. Accessed: April 29, 2020.



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2 **Figure 13B.9-1. Eryngium Jepsonii Modeled Habitat in the Study Area**

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13B.10 Delta Button-Celery (*Eryngium racemosum*)

13B.10.1 Legal Status

Delta button-celery is not listed under the ESA but is state-listed as endangered. This species' NatureServe Ranking in the CNDDB is G1/S1, which means that globally (G) and within the state (S) delta button-celery is considered to be critically imperiled (California Department of Fish and Wildlife 2020a:III, 60). This status is because it has relatively few, small populations in California and because the habitat has been hydrologically altered and is subject to invasion by non-native species.

The California Rare Plant Rank of 1B.1 for delta button-celery indicates that it is rare, threatened, or endangered in California and elsewhere, and its state threat level (.1) indicates that it is seriously threatened in California (California Department of Fish and Wildlife 2020a:iv, 60; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.10.2 Range and Distribution within the Study Area

The current range of Delta button-celery in California is the northern San Joaquin Valley (Preston et al. 2012). The CNDDB reports 26 occurrences for this species, 6 of which are possibly extirpated (California Department of Fish and Wildlife 2020b), and 11 occurrences have not been observed in the last 30 years.

Two occurrences are reported from the study area: one near Lathrop and one near Discovery Bay, both of which are possibly extirpated (California Department of Fish and Wildlife 2020b).

13B.10.3 Habitat Requirements

Delta button-celery grows in seasonally flooded depressions within the floodplains of the San Joaquin River, generally on clay soils (Preston et al. 2012). Because this habitat is periodically inundated by floodwater, the associated plants are disturbance-tolerant wetland species, including native herbaceous hydrophytes as well as invasive non-native species. Because historic flows of the San Joaquin River have been altered by upstream dams and water diversions and by construction of flood-control levees, the extent of suitable habitat appears to have been greatly diminished.

13B.10.4 Seasonal Patterns

Delta button-celery is an herbaceous perennial that blooms between June and August (Preston et al. 2012). After setting seed in late summer, the plants remain dormant until the depressions are inundated by rain or flood waters.

13B.10.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.10.5.1 GIS Model Data Sources

The Delta button-celery model uses the following dataset:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

13B.10.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented to occur. The extent of modeled habitat in the study area is depicted in Figure 13B.10-1.

13B.10.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.10.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Valley-Foothill Riparian
  - Naturalized Warm Temperate Riparian and Wetland
  - *Cynodon dactylon*
  - *Lepidium latifolium*
  - Polygonum lapathifolium-Xanthium strumarium
  - Southwestern North American riparian evergreen and deciduous woodland
  - *Acer negundo*
  - *Quercus lobata*
  - *Juglans hindsii* and Hybrids
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Salix gooddingii*
  - *Salix laevigata*
  - Southwestern North American Riparian Wash/Scrub
  - *Baccharis pilularis*
  - *Cephalanthus occidentalis*
  - *Rosa californica*
  - *Rubus armeniacus*
  - *Salix exigua*
  - *Salix lasiolepis*

- *Salix lucida*
- *Sambucus nigra*
- *Vitis californica*

To further refine the limits of the habitat model, vegetation polygons were added to the model only where occurring on soil types associated with Delta button-celery. Soil types associated with Delta button-celery throughout its range were determined by overlaying the CNDDB occurrences onto the Soil Survey Geographic Database (SSURGO) (Soil Survey Staff, Natural Resources Conservation Service 2020). Soils mapped at occurrence locations are associated with floodplains. Only two of these soil series are found in the study area:

- Grangerville
- Columbia.

13B.10.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Vascular Plants, Bryophytes, and Lichens List*. California Natural Diversity Database (CNDDB). Quarterly publication. January. Sacramento, CA.

California Department of Fish and Wildlife. 2020b. *Eryngium racemosum* element occurrence query. California Natural Diversity Database, RareFind 5, January 31, 2021 version. California Department of Fish and Wildlife.

California Native Plant Society. 2020. *Eryngium racemosum* species query. *Inventory of Rare and Endangered Plants of California* (online edition, v8-3 0.39). California Native Plant Society. Sacramento, CA. Available: http://www.rareplants.cnps.org/detail/787.html . Accessed: February 12, 2021.

Chico State Research Foundation, Geographical Information Center. 2019. Delta Vegetation and Land Use Update – 2016 [ds2855]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip . Accessed: March 6, 2020.

Preston, R. E., M. S. Park, and L. Constance. 2012. *Eryngium racemosum.* In Jepson Flora Project (eds.), *Jepson eFlora*. Available: https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=25097 . Accessed: February 12, 2021.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. Web Soil Survey. Available: https://websoilsurvey.nrcs.usda.gov/.

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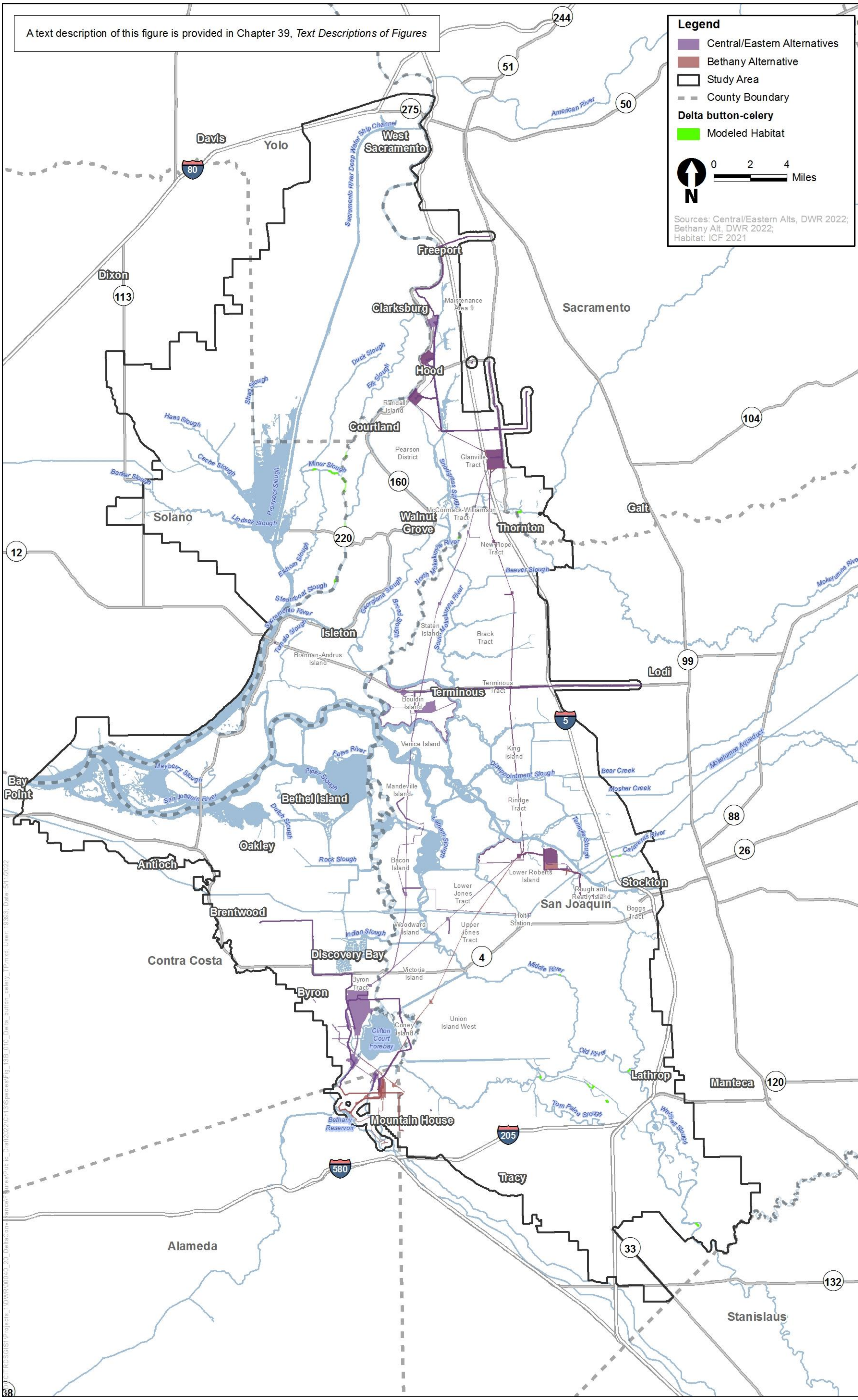

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Figure 13B.10-1. Delta Button Celery Modeled Habitat in the Study Area

13B.11 Spiny-Sepaled Button-Celery (*Eryngium spinosepalum*)

13B.11.1 Legal Status

Spiny-sepaled button-celery is not listed under either ESA or CESA. This species' NatureServe Ranking in the CNDDB is G2/S2, which means that globally (G) and within the state (S) spiny-sepaled button-celery is considered to be imperiled (California Department of Fish and Wildlife 2020a:III,60). This status is because it has relatively few, small populations in California.

The California Rare Plant Rank of 1B.2 for spiny-sepaled button-celery indicates that it is rare, threatened, or endangered in California and elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv,60; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.11.2 Range and Distribution within the Study Area

The current range of spiny-sepaled button-celery in California runs along the eastern and western edges of the San Joaquin Valley (Preston et al 2012). The CNDDB reports 108 occurrences of this species, four of which are extirpated or possibly extirpated (California Department of Fish and Wildlife 2020b). A total of 36 occurrences have not been observed in the last 20 years.

There is one occurrence of spiny-sepaled button-celery in the study area, located near the Byron Airport (California Department of Fish and Wildlife 2020b). This occurrence is at the periphery of the range and is the furthest north occurrence.

13B.11.3 Habitat Requirements

Spiny-sepaled button-celery grows in vernal pools and swales, along ephemeral and seasonal stream channels, and roadside ditches, sometimes growing in adjacent grasslands (California Native Plant Society 2020; Preston et al. 2012). In the study area, it grows in vernal pool complex habitat.

13B.11.4 Seasonal Patterns

Spiny-sepaled button-celery is a perennial herb that blooms between April and July (Preston et al. 2012). After setting seed in late summer, the plants remain dormant until fall rains inundate the vernal pool habitat.

13B.11.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.11.5.1 GIS Model Data Sources

The spiny-sepaled button-celery model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.11.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.11-1.

13B.11.5.2.1 Geographic Limits

Within the statutory Delta, spiny-sepaled button-celery is restricted to Contra Costa County. Spiny-sepaled button-celery ranges along the west side of the San Joaquin Valley as far north as Contra Costa County, but it does not occur north of the Sacramento/San Joaquin Rivers.

13B.11.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Vernal pool complex
    - Vernal pool complex—Californian mixed annual/perennial freshwater vernal pool/swale bottomland
    - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
    - Vernal pool complex—Mediterranean California naturalized annual and perennial grassland
    - Vernal pool complex—California annual herb/grass
    - Vernal pool complex—*Frankenia salina*
    - Vernal pool complex—*Allenrolfea occidentalis*
    - Vernal pool complex—*Distichlis spicata*
    - Vernal pool complex—*Suaeda moquinii*
    - Vernal pool complex—Western North American disturbed alkaline marsh and meadow
    - Vernal pool complex—vernal pool
    - Vernal pool complex—alkaline wetland
    - Vernal pool

- Alkaline seasonal wetland complex
  - Alkaline wetland
  - *Allenrolfea occidentalis*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Suaeda moquinii*

Soil types associated with spiny-sepaled button-celery occurrences were determined by overlaying the occurrence locations from the CNDDB onto SSURGO (Soil Survey Staff, Natural Resources Conservation Service 2020). The occurrences in the study area is located on soils of the Solano series. Therefore, modeled habitat was limited to the following soil series:

- Solano loam

13B.11.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Vascular Plants, Bryophytes, and Lichens List.* Natural Diversity Database. January. Sacramento, CA. Available:

California Department of Fish and Wildlife. 2020b. *Eryngium spinosepalum* element occurrence query. California Natural Diversity Database. RareFind 5, June 4, 2020 Version.

California Department of Water Resources. 2020. Aquatic Resources Delineation Data (update). Received October 22, 2020.

California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

California Department of Water Resources and GEI Consultants Inc. 2020. *Aquatic Resources Delineation Report—Delta Conveyance Project*. March 31, 2020 (updated June 23, 2020).

California Native Plant Society. 2020. *Eryngium spinosepalum* species query. *Inventory of Rare and Endangered Plants of California* (online edition, v8-3 0.39). California Native Plant Society. Sacramento, CA. Available: https://rareplants.cnps.org/Plants/Details/788 . Accessed: June 4, 2020.

Chico State Research Foundation, Geographical Information Center. 2019. Delta Vegetation and Land Use Update – 2016 [ds2855]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip . Accessed: March 6, 2020.

Preston, R. E., M. S. Park, and L. Constance. 2012. *Eryngium spinosepalum.* In Jepson Flora Project (eds.), *Jepson eFlora*. Available: https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=78144 . Accessed: June 4, 2020.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. Web Soil Survey. Available: https://websoilsurvey.nrcs.usda.gov/. Accessed: March 2020 through February 17, 2020.

Witham, C. W., R. F. Holland, and J. Vollmar. 2014. *Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012* [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip. Accessed: April 29, 2020.

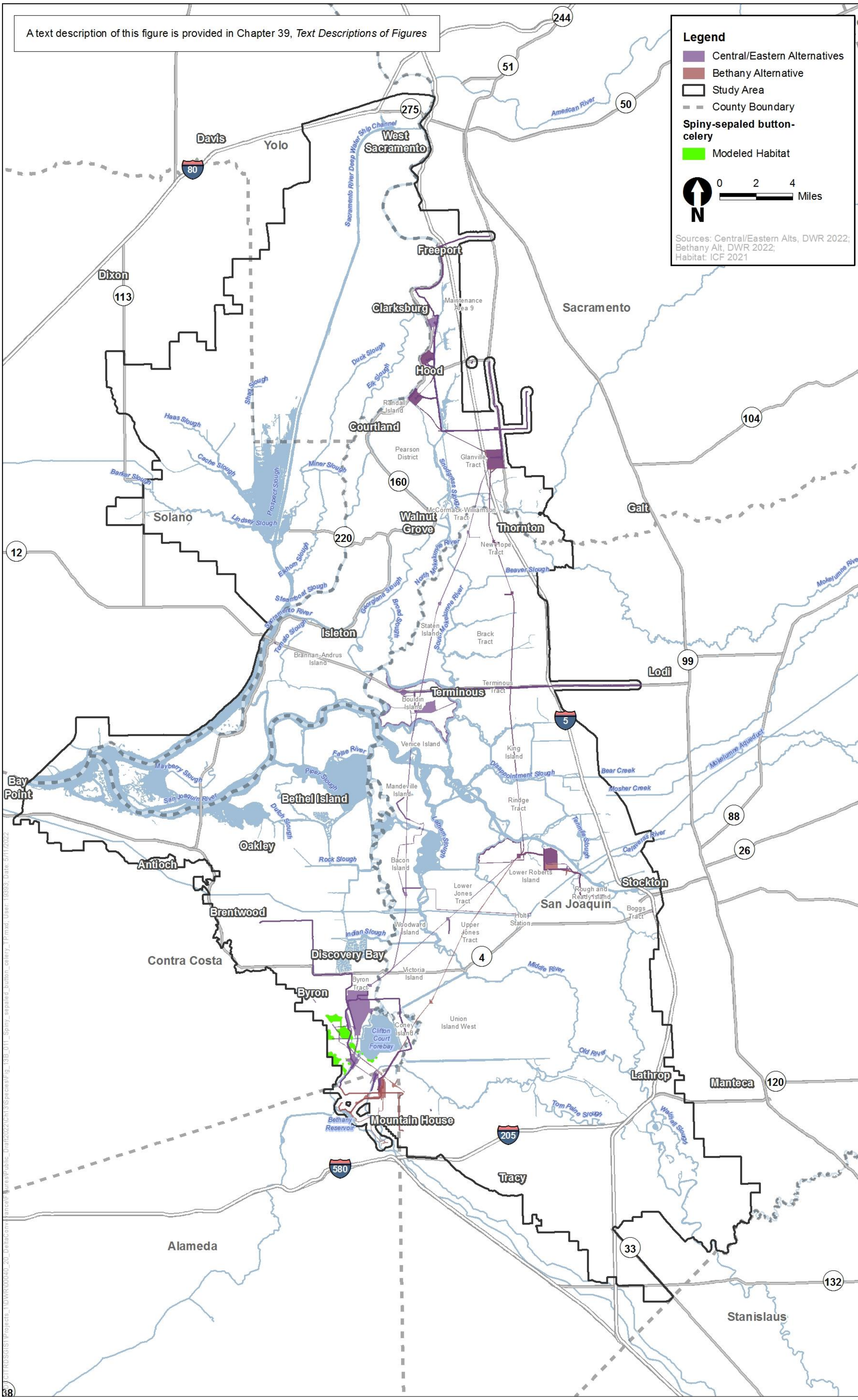

Figure 13B.11-1. Spiny Sepaled Button Celery Modeled Habitat in the Study Area

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13B.12 Diamond-Petaled California Poppy (*Eschscholzia rhombipetala*)

13B.12.1 Legal Status

Diamond-petaled California poppy is not listed under either ESA or CESA. This species' NatureServe Ranking in the California Natural Diversity Database (CNDDB) is G1/S1, which means that globally (G) and within the state (S) the species is considered critically imperiled (California Department of Fish and Wildlife 2020a:iii, 63). This status is a result of its extreme rarity (12 occurrences) and small population sizes that make it very vulnerable to extirpation.

The California Rare Plant Rank of 1B.1 for diamond-petaled California poppy indicates that it is rare, threatened, or endangered in California or elsewhere, and its state threat level (.1) indicates that it is severely threatened in California (California Department of Fish and Wildlife 2020:iv, 20; California Native Plant Society 2021). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.12.2 Range and Distribution within the Study Area

Diamond-petaled California poppy is endemic to California. Populations occur in the inner foothills of the Diablo Range from Contra Costa County to Stanislaus County; in the La Panza Range, Temblor Range, and Carrizo Plain of San Luis Obispo County; and, at a reported occurrence in the interior North Coast Ranges in Glenn County (California Department of Fish and Wildlife 2021). The CNDDB reports 12 occurrences for this species, two of which are considered to be extirpated (California Department of Fish and Wildlife 2021).

There are three occurrences of diamond-petaled California poppy in the study area (California Department of Fish and Wildlife 2021). One occurrence, at Antioch Dunes, and a second occurrence, at Byron Hot Springs, are possibly extirpated. An occurrence at Bethany Reservoir State Recreation Area is extant (California Department of Fish and Wildlife 2021).

13B.12.3 Habitat Requirements

Diamond-petaled California poppy is found in grasslands, generally on clay soils (California Department of Fish and Wildlife 2021). Species associated with diamond-petaled California poppy include native and non-native grasses, fiddleneck (*Amsinckia* spp.), filaree (*Erodium* spp.), Douglas' silverpuffs (*Microseris douglasii*), dobie pod (*Tropidocarpum gracile*), round-leaf filaree (*California macrophylla*), caulanthus (*Caulanthus* spp.), scorpionweed (*Phacelia* spp.), lotus (*Acmispon* spp.), popcornflower (*Plagiobothrys* spp.), and other native and nonnative forbs.

13B.12.4 Seasonal Patterns

Diamond-petaled California poppy is a small annual herb that blooms in March and April (Hannan and Clark 2012; California Native Plant Society 2021).

13B.12.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.12.5.1 GIS Model Data Sources

The diamond-petaled California poppy model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018).

13B.12.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species would be expected to occur. The extent of modeled habitat in the study area is depicted in Figure 13B.12-1.

13B.12.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.12.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Mediterranean California naturalized annual and perennial grassland
- California annual herb/grass group

Soil types associated with diamond-petaled California poppy were determined by overlaying the occurrence locations from the CNDDB onto SSURGO (Soil Survey Staff, Natural Resources Conservation Service 2020). Soils mapped at occurrence locations generally are clay. The following soil series in the statutory Delta show occurrences of diamond-petaled California poppy:

- Rincon
- Linne

13B.12.6 References Cited

California Department of Fish and Wildlife. 2020. *Special Vascular Plants, Bryophytes, and Lichens List.* Natural Diversity Database. January. Sacramento, CA.

California Department of Fish and Wildlife. 2021. *Eschscholzia rhombipetala* element occurrence query. *California Natural Diversity Database.* RareFind 5, January 1, 2021 Version.

California Native Plant Society. 2021. *Eschscholzia rhombipetala* species query*. Inventory of Rare and Endangered Plants of California* (online edition, version 8-3 0.39). Sacramento, CA. Available: http://www.rareplants.cnps.org/detail/806.html . Accessed: January 11, 2020.

Chico State Research Foundation, Geographical Information Center. 2019. Delta Vegetation and Land Use Update – 2016 [ds2855]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip . Accessed: March 6, 2020.

Hannan, G. L., and C. Clark 2012. *Eschscholzia rhombipetala*. In *Jepson Flora Project* (eds.) Jepson eFlora, https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=25218 . Accessed: January 13, 2021.

ICF. 2017. Land Cover Mapping for the East Bay RCIS.

ICF. 2018. Land Cover Mapping for the Sand Hill Wind Project.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. Web Soil Survey. Available: https://websoilsurvey.nrcs.usda.gov/. Accessed: March 2020 through February 17, 2021.

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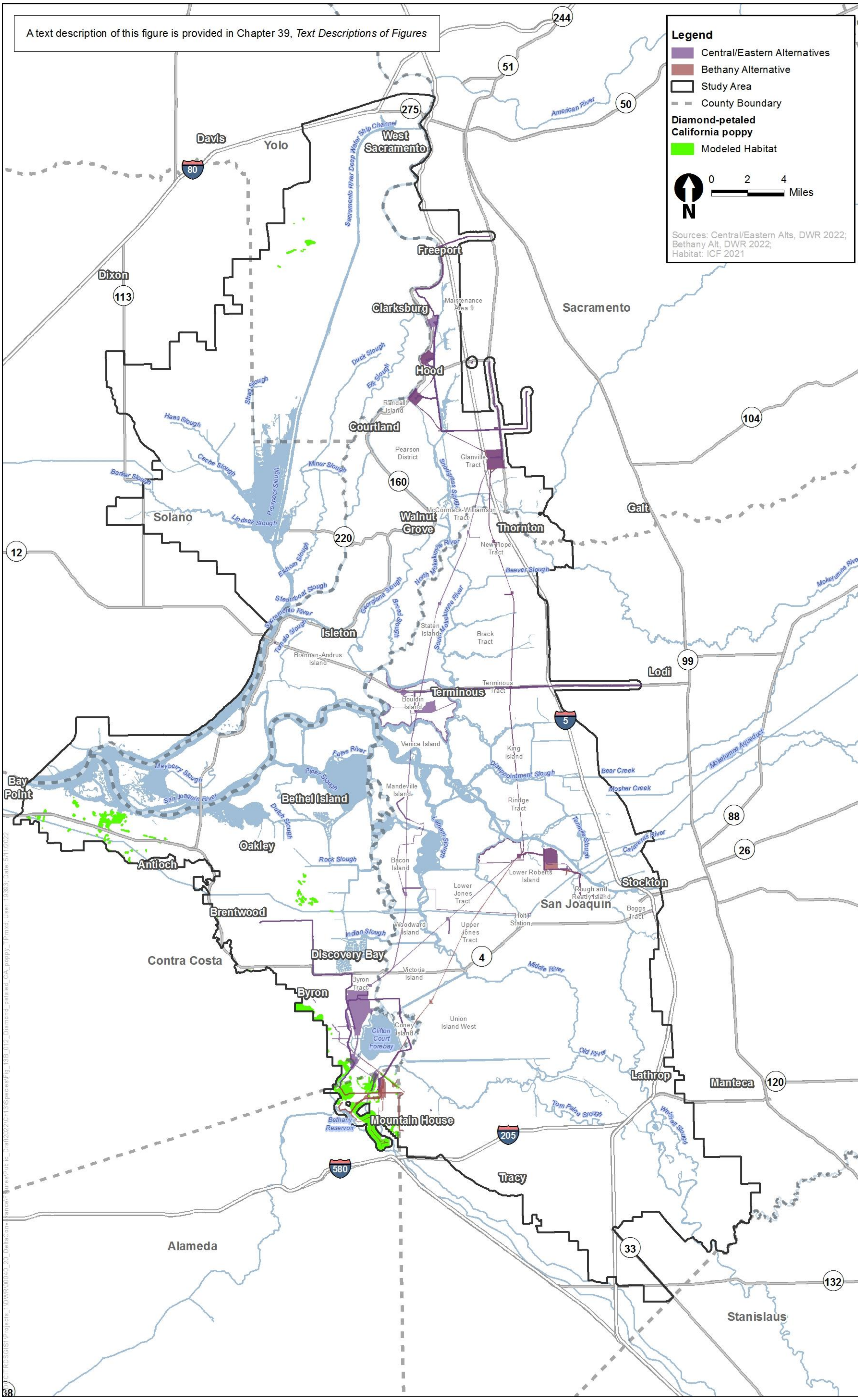

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2 **Figure 13B.12-1. Diamond-Petaled California Poppy Modeled Habitat in the Study Area**

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13B.13 San Joaquin Spearscale (*Extriplex joaquinana*)

13B.13.1 Legal Status

San Joaquin spearscale is not listed under either ESA or CESA. The species' NatureServe Ranking in the CNDDB is G2/S2, which means that globally (G) and within the state (S) the species is imperiled (California Department of Fish and Wildlife 2020a:iii, 64).

The California Rare Plant Rank of 1B.2 indicates that San Joaquin spearscale is rare, threatened, or endangered in California and elsewhere, with a threat level (.2) of moderately threatened in California (California Department of Fish and Wildlife 2020a:iv, 64; California Native Plant Society 2020). Plants with rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.13.2 Range and Distribution within the Study Area

Endemic to California, the range of San Joaquin spearscale includes Glenn, Colusa and Yolo Counties to the north; Contra Costa, Santa Clara, San Benito, Napa, Solano, and Alameda Counties to the west; and Sacramento, Fresno, Merced, and San Joaquin Counties to the south (California Department of Fish and Wildlife 2020b). There are 127 occurrences, 114 of them extant (California Department of Fish and Wildlife 2020b).

In the study area, San Joaquin spearscale is known from nine extant occurrences and two extirpated occurrences, generally in the lower Sacramento Valley and in eastern Contra Costa County (California Department of Fish and Wildlife 2020b). It has been observed at the Tule Glide Ranch Preserve and Main Prairie in Yolo County and near Discovery Bay, Byron, and west of Clifton Court Forebay, in Contra Costa County (California Department of Fish and Wildlife 2020b).

13B.13.3 Habitat Requirements

San Joaquin spearscale occurs in alkali grassland and meadows, and other seasonal wetlands with alkaline soils (California Department of Fish and Wildlife 2020b). In the Central Valley of California, it appears to be restricted to alkaline soils along the rims of former basins. It is also found in alkaline and saline soils near creeks and seeps along the eastern flank of the inner North Coast Ranges (Zacharias 2012; California Department of Fish and Wildlife 2020b). Similar soils occur in the alluvial fans of Brushy, Kellogg, and Marsh Creeks along the northeastern edge of the San Joaquin Valley. San Joaquin spearscale is generally found associated with other salt- or alkali-tolerant species, including saltgrass (*Distichlis spicata*), alkali heath (*Frankenia salina*), bush seepweed (*Suaeda nigra*), alkali weed (*Cressa truxillensis*), common spikeweed (*Centromadia pungens*), low barley (*Hordeum depressum*), and iodine bush (*Allenrolfea occidentalis*) (California Department of Fish and Wildlife 2020b). In many instances the species occurs with or is found near other populations of special-status plants in the study area, such as brittlescale (*Atriplex depressa*) (California Department of Fish and Wildlife 2020b).

13B.13.4 Seasonal Patterns

San Joaquin spearscale is an herbaceous annual that blooms between April and October (Zacharias 2012).

13B.13.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.13.5.1 GIS Model Data Sources

The San Joaquin spearscale model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.13.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented to occur. The extent of modeled habitat in the study area is depicted in Figure 13B.13-1.

13B.13.5.2.1 Geographic Limits

The habitat model encompasses the entire study area.

13B.13.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Alkali seasonal wetland complex
  - *Frankenia salina*
  - *Allenrolfea occidentalis*
  - *Distichlis spicata*
  - Alkaline wetland
- Vernal pool complex
  - Vernal pool complex—Californian mixed annual/perennial freshwater vernal pool/swale bottomland

    - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
    - Vernal pool complex—*Allenrolfea occidentalis*
    - Vernal pool complex—*Distichlis spicata*
    - Vernal pool complex—*Frankenia salina*
    - Vernal pool complex—*Suaeda moquinii*
    - Vernal pool complex—Western North American disturbed alkaline marsh and meadow
    - Vernal pool complex—alkaline wetland
    - Vernal pool complex—Mediterranean California naturalized annual and perennial grassland
    - Vernal pool complex—California annual herb/grass
    - Vernal pool
- Grassland
    - Mediterranean California naturalized annual and perennial grassland
    - California annual herb/grass group

Soil types associated with San Joaquin spearscale were determined by overlaying the occurrence locations from the CNDDB onto SSURGO (Soil Survey Staff, Natural Resources Conservation Service 2020). Soils mapped at occurrence locations are either clay or clay loam and generally alkaline. The following soil series present in the statutory Delta show occurrences of San Joaquin spearscale:

- Altamont
- Brentwood
- Capay
- Clear Lake
- Conejo
- Cropley
- Diablo
- Egbert
- Kimball
- Linne
- Marcuse
- Omni
- Pescadero
- Positas
- Reyes
- Rincon
- San Ysidro

- Solano
- Sycamore
- Willows

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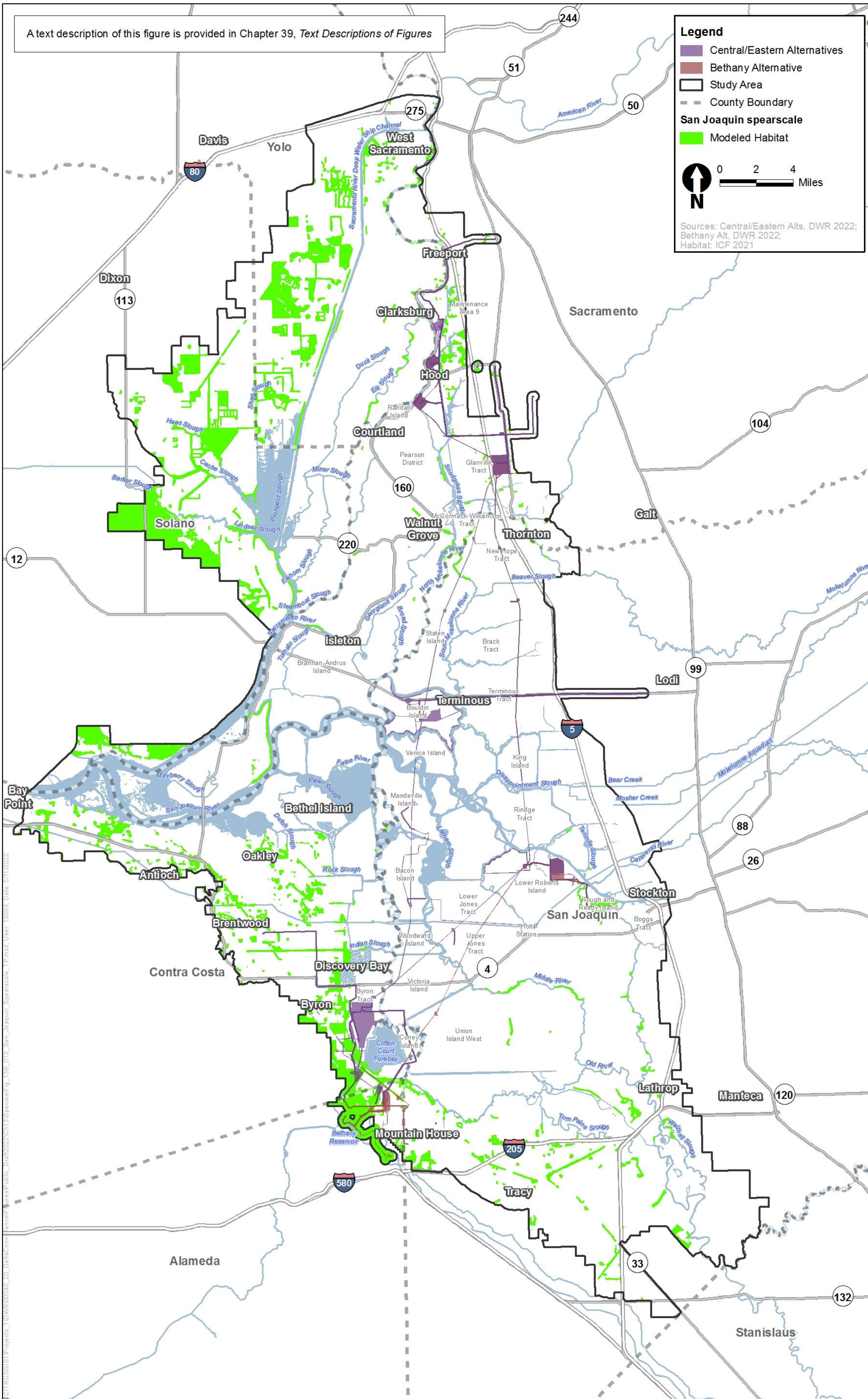

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2 **Figure 13B.13-1. San Joaquin Spearscale Modeled Habitat in the Study Area**

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13B.14 Woolly Rose-Mallow (*Hibiscus lasiocarpos* var. *occidentalis*)

13B.14.1 Legal Status

Woolly rose-mallow is not listed under either the federal ESA or CESA. This species' NatureServe Ranking in the CNDDB is G5T3/S3, which means that globally (G) and within the state the variety (T) is considered vulnerable (California Department of Fish and Wildlife 2020a:iii,72). This status is because it has a restricted range in California.

The California Rare Plant Rank of 1B.2 for wooly rose-mallow indicates that it is rare, threatened, or endangered in California, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv, 72; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.14.2 Range and Distribution within the Study Area

The current range of woolly rose-mallow in California includes the Sacramento Valley and the Delta (Hill 2012). The CNDDB reports 173 occurrences for woolly rose-mallow, all but one of which are presumed to be extant (California Department of Fish and Wildlife 2020b). A total of 73 occurrences have not been observed in the last 20 years.

There are 120 occurrences of woolly rose-mallow in the study area, located throughout much of the study area's tidal area. All but one of the occurrences are presumed to be extant.

13B.14.3 Habitat Requirements

Habitat for woolly rose-mallow consists of freshwater emergent wetlands, including both tidal and nontidal wetlands. It also occurs in the tidal zone of riparian scrub and on riprap. Associated species include tules (*Schoenoplectus* spp.), cattails (*Typha* spp.), other wetland species, and willows (*Salix* spp.) and other riparian shrubs (California Department of Fish and Wildlife 2020b). Woolly rose-mallow is found from sea level to 510 feet elevation (California Department of Fish and Wildlife 2020b).

13B.14.4 Seasonal Patterns

Woolly rose-mallow is a perennial herb that blooms between July and November (Hill 2012).

13B.14.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.14.5.1 GIS Model Data Sources

The woolly rose-mallow model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.14.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.14-1.

13B.14.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.14.5.2.2 Additional Model Parameters

Woolly rose-mallow primarily grows within the upper tidal zone, at the interface between tidal waters and terrestrial vegetation. Within the study area, woolly rose-mallow habitat was geographically bounded by the area extending 10 feet on both sides of the landward boundary of all vegetation types in the tidal perennial aquatic natural community. This area is expected to encompass the upper tidal zone that experiences daily tidal inundation. Additional habitat for woolly rose-mallow is present along the margins of nontidal perennial wetlands. Within the study area additional primary woolly rose-mallow habitat was geographically bounded by the area extending 10 feet on both sides of the boundary of all vegetation types in the nontidal perennial aquatic natural community.

Modeled habitat includes the following types from the GIS model data sources.

- Tidal perennial aquatic
  - *Azolla (filiculoides, microphylla)*
  - *Eichhornia crassipes*
  - *Lemna (minor)* and relatives
  - *Ludwigia (hexapetala, peploides)*
  - Naturalized temperate Pacific freshwater vegetation
  - Temperate freshwater floating mat
  - Temperate Pacific tidal salt and brackish meadow
  - Water
  - Natural channel
  - Tidal channel
- Nontidal perennial aquatic
  - *Azolla (filiculoides, microphylla)*
  - *Eichhornia crassipes*

- *Lemna (minor)* and relatives
- *Ludwigia (hexapetala, peploides)*
- Naturalized temperate Pacific freshwater vegetation
- Temperate freshwater floating mat
- Temperate Pacific freshwater aquatic bed
- Water
- Conveyance channel
- Natural channel

13B.14.6 References Cited

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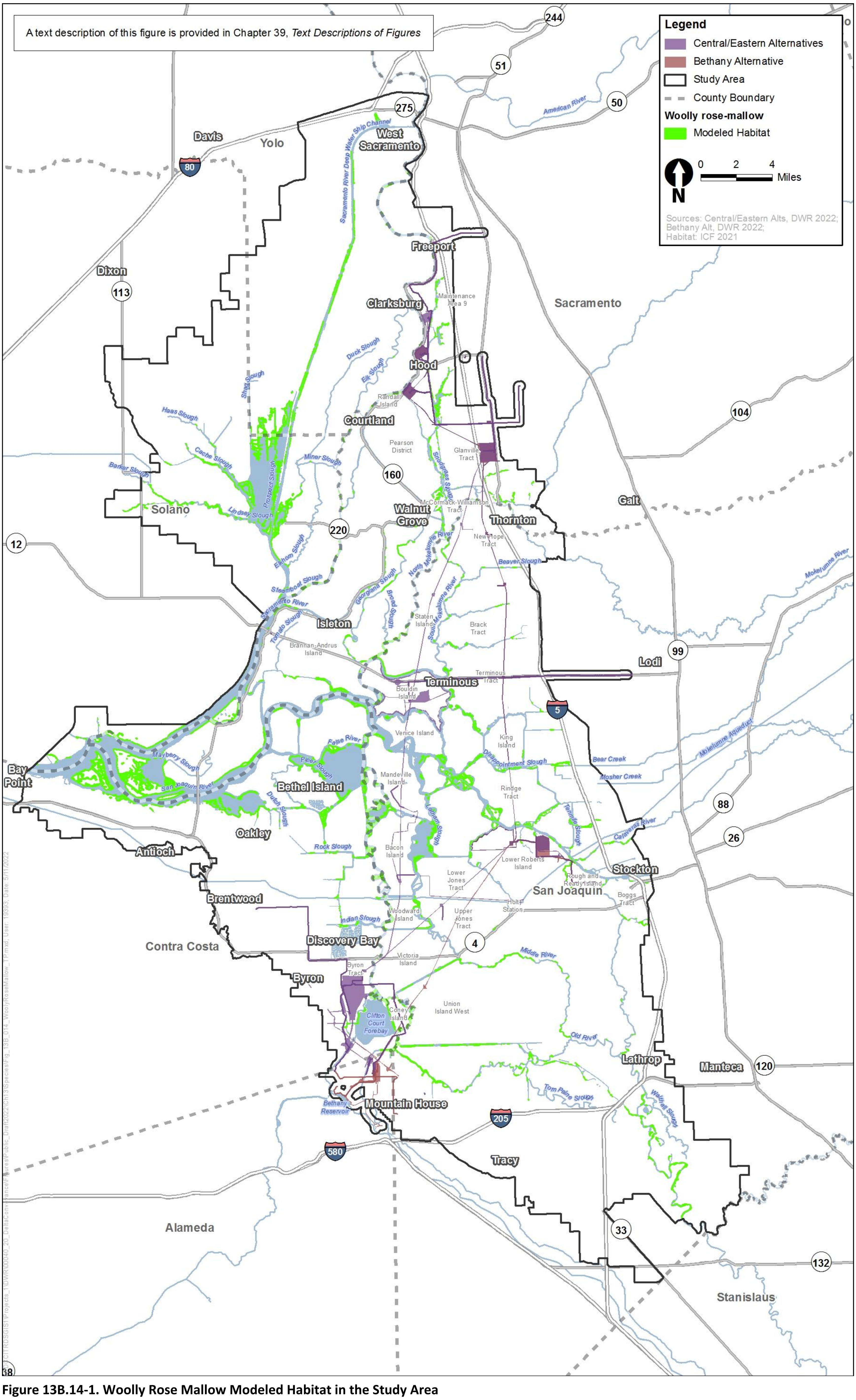

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2 **Figure 13B.14-1. Woolly Rose Mallow Modeled Habitat in the Study Area**

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13B.15 Delta Tule Pea (*Lathyrus jepsonii* var. *jepsonii*)

13B.15.1 Legal Status

Delta tule pea is not listed under either ESA or CESA. The species' NatureServe Ranking in the CNDDB is G5T2/S2, which means that the species has a global (G) population that is secure, but the status of this particular variety (T2) indicates that it is imperiled because of very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation (California Department of Fish and Wildlife 2020a:iii,72). The state rank (S2) indicates that it is considered imperiled (California Department of Fish and Wildlife 2020a:iii).

The California Rare Plant Rank of 1B.2 for Delta tule pea indicates that it is rare, threatened, or endangered in California and elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Native Plant Society 2020; California Department of Fish and Wildlife 2020a:iv, 72). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered, as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.15.2 Range and Distribution within the Study Area

Delta tule pea is endemic to the Delta, ranging from Sacramento and Solano Counties in the north, Napa and Sonoma Counties in the west, and Contra Costa and San Joaquin Counties in the south (Steele and Isely 2012). Delta tule pea has 133 occurrences, two of which are listed as possibly extirpated (California Department of Fish and Wildlife 2020b). The species occurs throughout the statutory Delta and along the Napa River around Dutchman Slough (California Department of Fish and Wildlife 2020b).

In the study area, there are 62 occurrences of Delta tule pea, one of which is possibly extirpated (California Department of Fish and Wildlife 2020b); it grows at and immediately above the tidal zone in marshes and along rivers and streams. Delta tule pea is found throughout all the major tidal slough channels in Suisun Marsh and has been observed near Hass Slough, Snodgrass Slough, Lost Slough, on Ryer Island, Staten Island, Andrus Island, Bouldin Island, Rough and Ready Island, Browns Island, Winter Island, on the banks of the Middle River by the Upper and Lower Jones Tracts, and near Collinsville and Pittsburgh, and other locations throughout the Delta (California Department of Fish and Wildlife 2020b). Delta tule pea also occurs within the tidal zone along Calhoun Cut and Barker Slough in the Cache Slough area (Witham and Kareofelas 1994:15).

A total of 26 Delta tule pea stands were located during Delta Habitat Conservation and Conveyance Program 2009 surveys (California Department of Water Resources 2011:2-9). The stand locations ranged from Elk Slough near Courtland to Middle River near Victoria Island. The number of individuals recorded at each stand ranged from 1 to 50 plants, although the habit of this perennial vine (i.e., climbing through and over other plants) sometimes made it difficult to count. One individual Delta tule pea plant was found in tidal marsh on the southwest portion of Webb Tract during the 2010 surveys, and four stands of Delta tule pea were found during the 2011 surveys (California Department of Water Resources 2011:4-2, 6-2). These stands were found on in-channel islands and riprapped levees on the South Mokelumne River north of Bouldin Island, Old River near Fay Island, and the San Joaquin River near Prisoner's Point on Mandeville Island. Each stand contained between one and five individual plants.

13B.15.3 Habitat Requirements

Delta tule pea occurs along tidal streams and on the borders of fresh and brackish marshes from 0 to 13 feet in elevation (Grewell et al. 2007:140; California Native Plant Society 2020). It has been observed to co-occur with or near other special status plant species, such as soft bird's-beak (*Chloropyron molle* ssp. *molle*), Mason's lilaeopsis (*Lilaeopsis masonii*), Suisun Marsh aster (*Symphyotrichum lentum*), and delta mudwort (*Limosella australis*) (Witham and Kareofelas 1994:15; California Department of Fish and Wildlife 2020b).

Delta tule pea was found in riparian forest, riparian scrub, tidal marsh, and exposed mudbanks on in-channel islands during 2009 surveys (California Department of Water Resources 2011:2-9). In 2009, Delta tule pea was commonly found growing with bulrush (*Schoenoplectus* spp.) and other associates, including arroyo willow (*Salix lasiolepis*), common reed (*Phragmites australis*), American dogwood (*Cornus sericea*), hedge false bindweed (*Calystegia sepium*), marsh pennywort (*Hydrocotyle* spp.), Himalayan blackberry (*Rubus armeniacus*), California rose (*Rosa californica*), California grape (*Vitis californica*), narrow-leaved willow (*Salix exigua*), and narrow-leaved cattail (*Typha angustifolia*). Associated species recorded during 2010 surveys included cattail species (*Typha* spp.), seep monkeyflower (*Mimulus guttatus*), bog rush (*Juncus effusus*), dallis grass (*Paspalum dilatatum*), Santa Barbara sedge (*Carex barbarae*), and hedge false bindweed (California Department of Water Resources 2011:4-2).

13B.15.4 Seasonal Patterns

Delta tule pea is a perennial herb that blooms between May and September (Steele and Isely 2012). Population trends of Delta tule pea have not been documented. According to the California Native Plant Society (2020), most known occurrences are small.

13B.15.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.15.5.1 GIS Model Data Sources

The Delta tule pea model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.15.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.15-1.

13B.15.5.2.1 Geographic Limits

The model encompasses the entire study area. Delta tule pea grows within the upper tidal zone, at the interface between tidal waters and terrestrial vegetation, typically climbing up and into the adjacent vegetation. Within the study area, the Delta tule pea model consists of tule (*Schoenoplectus*) and cattail (*Typha*) dominated tidal wetlands and other nontidal vegetation types listed below, geographically bounded by the area extending 30 feet landward from the boundary of the tidal brackish emergent wetland and tidal freshwater perennial aquatic natural community vegetation types. Where tidal brackish emergent wetland and tidal freshwater perennial aquatic natural communities are absent, additional modeled habitat consists of the nontidal vegetation types geographically bounded by the area extending 30 feet landward from the boundary of the tidal channel vegetation type. This area is expected to encompass the channel banks at and above the upper tidal zone that experiences daily tidal inundation.

13B.15.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Tidal perennial aquatic
    - Tidal channel
- Tidal brackish emergent wetland
    - *Schoenoplectus* (*acutus, californicus*)
    - *Typha* (*angustifolia, domingensis, latifolia*)
- Tidal freshwater emergent wetland
    - *Schoenoplectus* (*acutus, californicus*)
    - *Typha* (*angustifolia, domingensis, latifolia*)
    - Naturalized warm-temperate riparian and wetland
    - *Lepidium latifolium*
    - *Phragmites australis—Arundo donax*
    - Freshwater emergent wetland
    - *Cynodon dactylon*
- Valley/foothill riparian
    - *Acer negundo*
    - *Alnus rhombifolia*
    - *Baccharis pilularis*
    - *Cephalanthus occidentalis*
    - *Cornus sericea*
    - *Eucalyptus spp.—Ailanthus altissima, Robinia pseudoacacia*
    - *Fraxinus latifolia*
    - *Juglans hindsii* and hybrids

  - *Lepidium latifolium*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Robinia pseudoacacia*
  - *Rosa californica*
  - *Rubus armeniacus*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*
  - *Salix lasiolepis*
  - *Salix lucida*
  - *Sambucus nigra*
  - *Vitis californica*
  - Forested wetland
  - Introduced North American Mediterranean woodland and forest
  - Naturalized warm-temperate riparian and wetland
  - Southwestern North American riparian evergreen and deciduous woodland
  - Southwestern North American introduced riparian scrub
  - Southwestern North American riparian/wash scrub
  - Scrub shrub wetland
  - Vancouverian riparian deciduous forest
- Grassland
  - Mediterranean California naturalized annual and perennial grassland
  - *Conium maculatum-Foeniculum vulgare*
  - *Cynodon dactylon*
  - *Centaurea (solstitialis, melitensis)*
- Developed
  - Semi-agricultural/right-of-way
- Agriculture
  - Upland herbaceous

13B.15.6 References Cited

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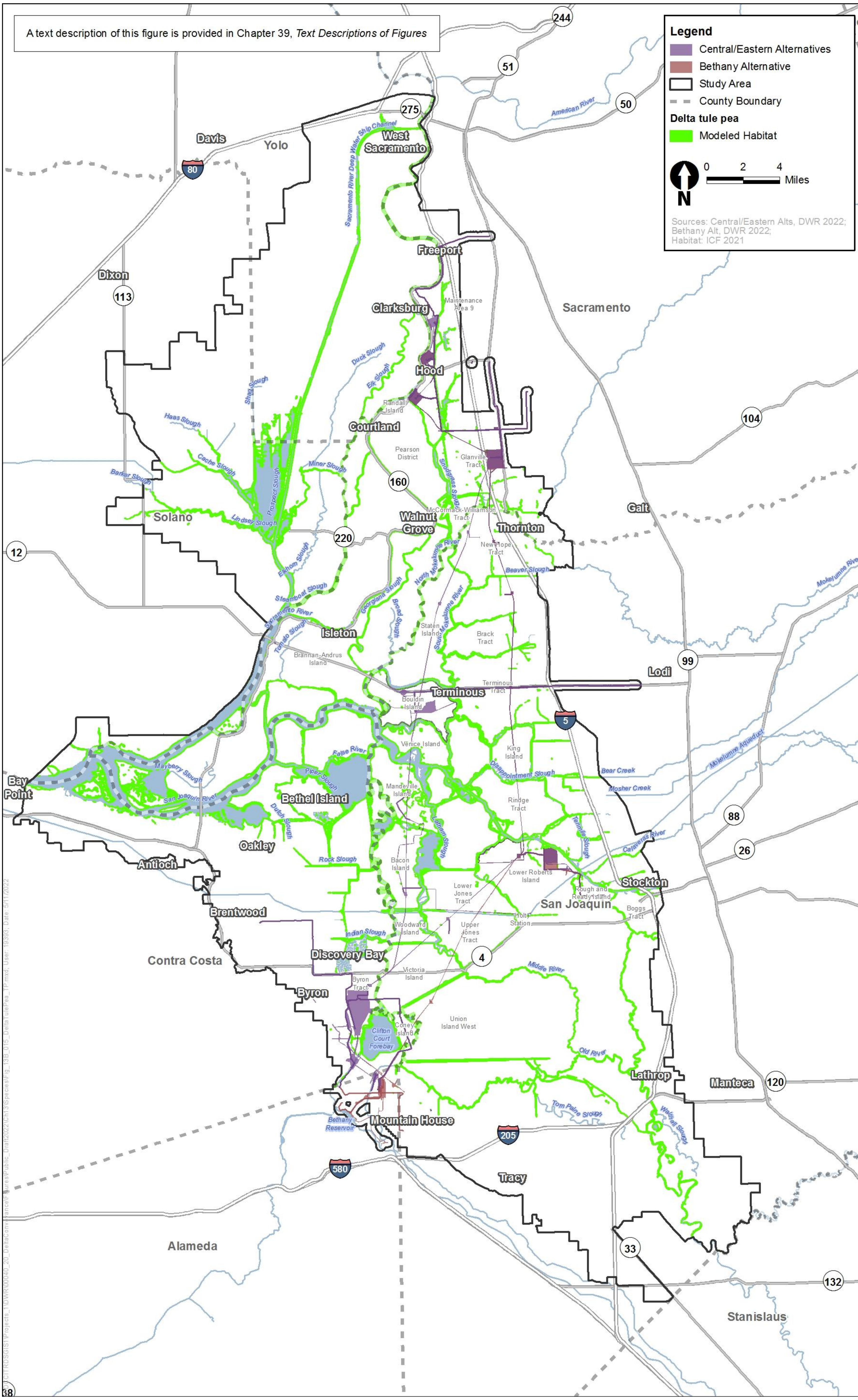

Figure 13B.15-1. Delta Tule Pea Modeled Habitat in the Study Area

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13B.16 Legenere (*Legenere limosa*)

13B.16.1 Legal Status

Legenere is not listed under either the federal ESA or CESA. Its NatureServe Ranking in the CNDDB is G2/S2, which means that globally (G) and within the state (S) it is considered imperiled or at high risk of extinction due to its very restricted range, very few populations (often 20 or fewer), steep population declines, or other factors making it vulnerable to extirpation (California Department of Fish and Wildlife 2020a:iii, 79).

The California Rare Plant Rank of 1B.1 for legenere indicates that it is rare, threatened, or endangered in California and elsewhere, and it is seriously endangered in California, with a threat level (.1) of seriously threatened in California (California Native Plant Society 2020; California Department of Fish and Wildlife 2020a:iv,79). Plants with a rank of 1B may meet the definitions of rare, threatened or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.16.2 Range and Distribution within the Study Area

Legenere's range extends from southwestern Shasta County to southern Santa Clara County (Morin 2012). It is found on bottomlands and alluvial terraces in the Sacramento Valley with its distribution at the south end of the Sacramento Valley bifurcated by the Sacramento–San Joaquin River Delta (California Department of Fish and Wildlife 2020b). It occurs in the extreme northeastern part of the San Joaquin Valley and is also found on valley floors and margins in both the northern end of the South Coast Range in San Mateo, Alameda, and Santa Clara Counties and the southern end of the North Coast Range in Sonoma and Napa Counties (California Department of Fish and Wildlife 2020b). The CNDDB records 74 extant occurrences (83 total occurrences, 8 of which are extirpated and 1 of which is possibly extirpated) (California Department of Fish and Wildlife 2020b).

Legenere has been reported in the study area from four occurrences in vernal pools, vernal swales, and alkaline flats in vernal pool grasslands in the greater Jepson Prairie area (Witham 2006:16; Barbour et al. 2007:25; California Department of Fish and Wildlife 2020b). Surveys in 2009 documented a fifth occurrence in the study area, consisting of two stands of legenere growing in a roadside ditch in a vernal pool grassland on lands managed by the Stone Lakes National Wildlife Refuge (California Department of Water Resources 2011:2-10). These stands ranged in size from 20 to 50 individuals. Associated species included small stipitate popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), white water-buttercup (*Ranunculus aquatilis*), rayless goldfields (*Lasthenia glaberrima*), and bractless hedge-hyssop (*Gratiola ebracteata*). The nonnative competitor waxy mannagrass (*Glyceria declinata*), which also was found in the areas where legenere was documented, is considered a potential threat to the population. Additionally, the area where legenere was found is disked annually to provide a firebreak between the roadway and grassland.

Eighteen stands of legenere were found during the follow-up 2010 surveys at Stone Lakes National Wildlife Refuge (California Department of Water Resources 2011:4-2). Numbers of individuals ranged from 1 to more than 1,000 per stand. All stands were found in grassland or grassland with disturbed vernal pools on grazed lands. The dramatic increase in the abundance of legenere plants documented in 2010 was attributed to the significant increase in rainfall during winter 2009/2010.

Legenere was found with water-starwort (*Callitriche* spp.), small stipitate popcornflower, rayless goldfields, curly dock (*Rumex crispus*), vernal buttercup (*Ranunculus bonariensis*), pale spikerush (*Eleocharis macrostachya*), Pacific foxtail (*Alopecurus saccatus*), and turkey tangle frogfruit (*Phyla nodiflora*).

No occurrences of legenere were documented during the 2011 surveys (California Department of Water Resources 2011:6-2).

Recorded occurrences in western Sacramento and San Joaquin Counties are immediately east of the eastern boundary of the study area.

13B.16.3 Habitat Requirements

Throughout its distribution, legenere occurs in vernal pools, vernal swales, pools in seasonal streambeds, vernal marshes, and stock ponds (California Department of Fish and Wildlife 2020b). Occurrence records often state that it is found with long inundation indicator species, such as pale spikerush (*Eleocharis macrostachya*) and smooth goldfields (*Lasthenia glaberrima*) (Witham 2006:16; Barbour et al. 2007:25; California Department of Fish and Wildlife 2020b). However, throughout its range, it can occur in pools of various sizes and depths (Barbour et al. 2007:6,25).

13B.16.4 Seasonal Patterns

Legenere is a semiaquatic annual herb that blooms between May and June (Morin 2012). In a large multiple-year vernal pool study, the occurrence of vegetative plants in particular vernal pools was found to fluctuate in response to environmental factors with the species disappearing and reappearing in some years (Buck 2004:28; Barbour et al. 2007:62). Legenere species may respond positively to dry season soil disturbances, as one occurrence in Sacramento County was reported to support up to 1,000 to 10,000 plants in 1991 despite having been "…disked annually for firebreak," but no plants were observed during a 2007 survey (California Department of Fish and Wildlife 2020b).

13B.16.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.16.5.1 GIS Model Data Sources

The legenere model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.16.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented. The extent of modeled habitat in the study area is depicted in Figure 13B.16-1.

13B.16.5.2.1 Geographic Limits

The habitat model for legenere encompasses the entire study area, except for Alameda and Contra Costa Counties. No legenere occurrences are known from the study area in these counties.

13B.16.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Vernal pool complex
- Vernal pool complex-Californian mixed annual/perennial freshwater vernal pool/swale bottomland
- Californian mixed annual/perennial freshwater vernal pool/swale bottomland
- Vernal pool complex-vernal pool
- Vernal pool

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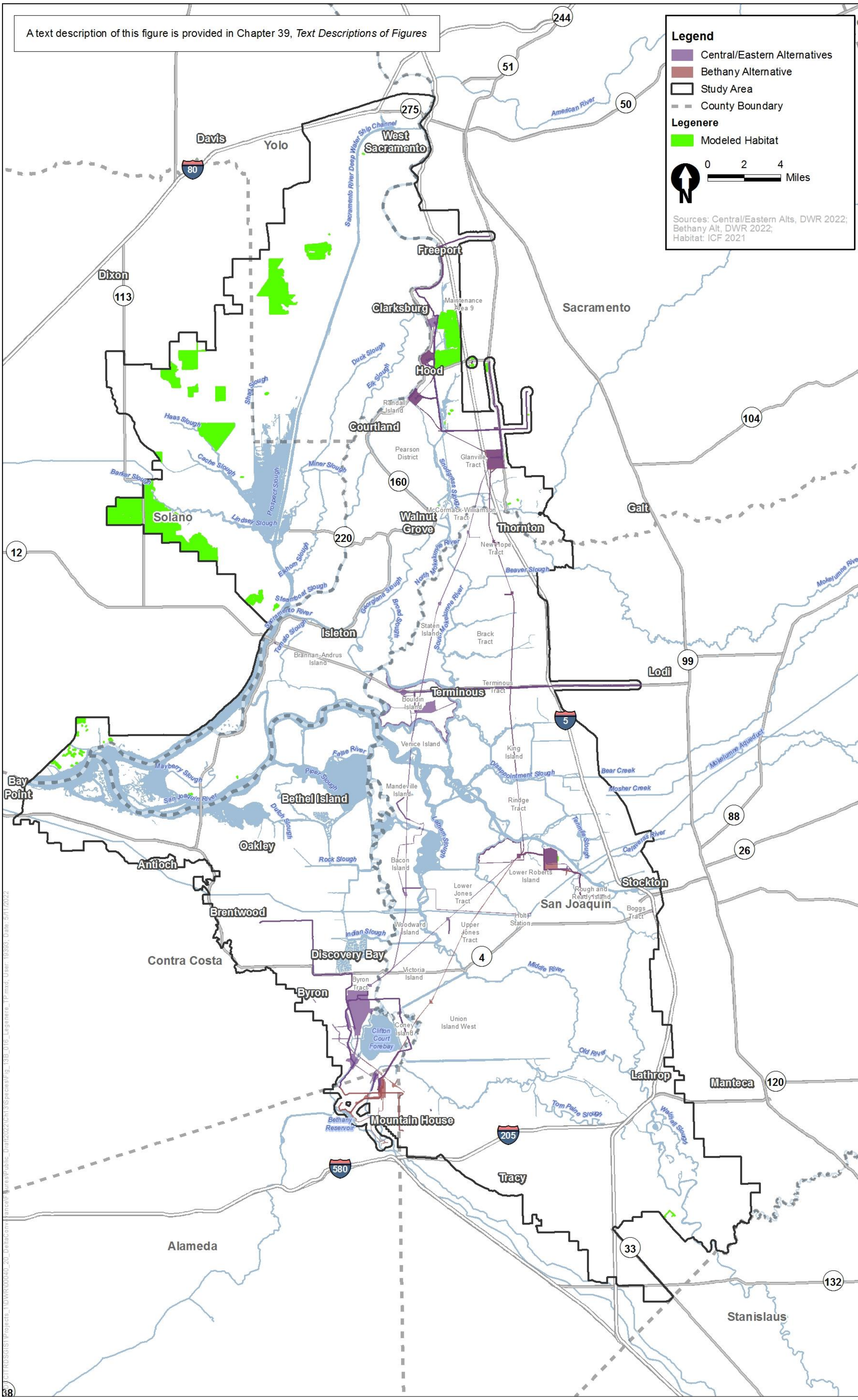

1
2 **Figure 13B.16-1. Legenere Modeled Habitat in the Study Area**

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13B.17 Heckard's Pepper Grass (*Lepidium latipes* var. *heckardii*)

13B.17.1 Legal Status

Heckard's peppergrass (*Lepidium latipes* var. *heckardii*) is not listed under either the federal ESA or CESA. Its NatureServe Ranking in the CNDDB is G4T1/S1, which means that globally (G) the species as a whole is apparently secure across its overall distribution, but this variety (T1) is critically imperiled because of extreme rarity due to very restricted range, very few populations (often five or fewer populations), very steep population declines, or other factors making it very vulnerable to extirpation (California Department of Fish and Wildlife 2020a:iii, 80). The state rank (S1) indicates that it is considered critically imperiled in California (California Department of Fish and Wildlife 2020a:iii).

The California Rare Plant Rank of 1B.2 for Heckard's peppergrass indicates that it is rare, threatened, or endangered in California and elsewhere, and it is considered to be moderately threatened in California (California Native Plant Society 2020; California Department of Fish and Wildlife 2020a:iv,80). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

Heckard's peppergrass was originally described by Rollins (1993a:47) and included in Rollins' treatment of the Brassicaceae in the first edition of The Jepson Manual (Rollins 1993b:429). The treatment of the Brassicaceae in The Jepson Manual second edition did not list Heckard's peppergrass as a separate variety, noting that the two varieties are sometimes found growing together (Al-Shehbaz 2012). However, California Native Plant Society (2020) and the CNDDB (California Department of Fish and Wildlife 2020a, 2020b) continue to recognize Heckard's peppergrass as a distinct variety.

13B.17.2 Range and Distribution within the Study Area

Heckard's peppergrass is endemic to California and is known from 14 occurrences (California Department of Fish and Wildlife 2020b). The reported range of Heckard's peppergrass extends from Glenn and Colusa Counties to Solano and Sacramento Counties, with a single occurrence in Merced County (California Department of Fish and Wildlife 2020b). Its distribution includes the alkaline soil areas to the southeast and south of the City of Woodland and at the CDFW Tule Ranch unit of the CDFW Yolo Bypass Wildlife Area (Tule Ranch) in Yolo County (Dean 2009:8; Witham 2003:8; California Department of Fish and Wildlife 2020b). Populations of Heckard's peppergrass at the Tule Ranch site are sparse but dispersed throughout the site (Witham 2003:9).

Five occurrences of Heckard's peppergrass have been observed in the study area. Two occurrences are present west of the Yolo Bypass in Yolo County in the area of the Tule Ranch (Witham 2003:13; California Department of Fish and Wildlife 2020b).

In Solano County, Heckard's peppergrass has been reported from and along Haas Slough, but that occurrence was last observed by Jepson in 1891 (California Department of Fish and Wildlife 2020b).

Aerial imagery indicates that the Haas Slough occurrence is likely to have been extirpated by the spread of intensive agriculture along both sides of the slough.

One occurrence of Heckard's peppergrass (EO12) was recorded in the study area during 2009 surveys on lands managed by Stone Lakes National Wildlife Refuge (California Department of Water Resources 2011:2-10). This population contained 150 individuals and was located on a slope alongside a linear depression within a grazed grassland. Associated species included Pacific foxtail (*Alopecurus saccatus*) and small stipitate popcornflower (*Plagiobothrys stipitatus* var. *micranthus*).

A second occurrence of Heckard's peppergrass (EO 15), consisting of three stands, were found at the Stone Lakes National Wildlife Refuge during 2010 surveys (California Department of Water Resources 2011:4-2). The stands ranged from 75 to 500 individuals. Heckard's peppergrass was found growing with common mouse-ear chickweed (*Cerastium fontanum*), small stipitate popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), Great Valley gumplant (*Grindelia camporum*), spikeweed (*Centromadia* sp.), dwarf peppergrass (*Lepidium latipes* var. *latipes*), annual bluegrass (*Poa annua*), tiny mousetail (*Myosurus minimus*), redstem filaree (*Erodium cicutarium*), curly dock (*Rumex crispus*), pineapple weed (*Matricaria discoidea*), pale spikerush (*Eleocharis macrostachya*), and ryegrass (*Festuca perenne*).

Heckard's peppergrass was not found during 2011 surveys (California Department of Water Resources 2011:6-2).

13B.17.3 Habitat Requirements

Populations near the city of Woodland occur on alkaline flats and mesic alkaline grasslands that were once contoured rice fields on Pescadero silty clay, saline-alkaline, and Capay clay soils (Soil Survey Staff 2020). On the Tule Ranch site in the Yolo Bypass and on the East Wilcox and Gridley Ranches in Solano County, it occurs in grazed grassland in vernal pool complex areas with slightly alkaline soils (Witham 2003:9, 2006:16; California Department of Fish and Wildlife 2020b). Occurrence records and survey reports suggest that Heckard's peppergrass is closely associated with Sacramento Valley populations of alkali milk-vetch (*Astragalus tener* var. *tener*), another rare species (Dean 2009:8; California Department of Fish and Wildlife 2020b).

13B.17.4 Seasonal Patterns

Heckard's peppergrass is an annual herb that blooms between March and May (Al-Shehbaz 2012).

13B.17.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.17.5.1 GIS Model Data Sources

The Heckard's peppergrass model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants, Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.17.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented. The extent of modeled habitat in the study area is depicted in Figure 13B.17-1.

13B.17.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.17.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Vernal pool complex
  - Vernal pool complex—Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Vernal pool complex—Mediterranean California naturalized annual and perennial grassland
  - Vernal pool complex—California annual herb/grass
  - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Vernal pool complex—alkaline wetland
  - Vernal pool complex—*Allenrolfea occidentalis*
  - Vernal pool complex—*Distichlis spicata*
  - Vernal pool complex—*Frankenia salina*
  - Vernal pool complex—*Suaeda moquinii*
  - Vernal pool complex-vernal pool
- Alkaline seasonal wetland
  - Alkaline wetland

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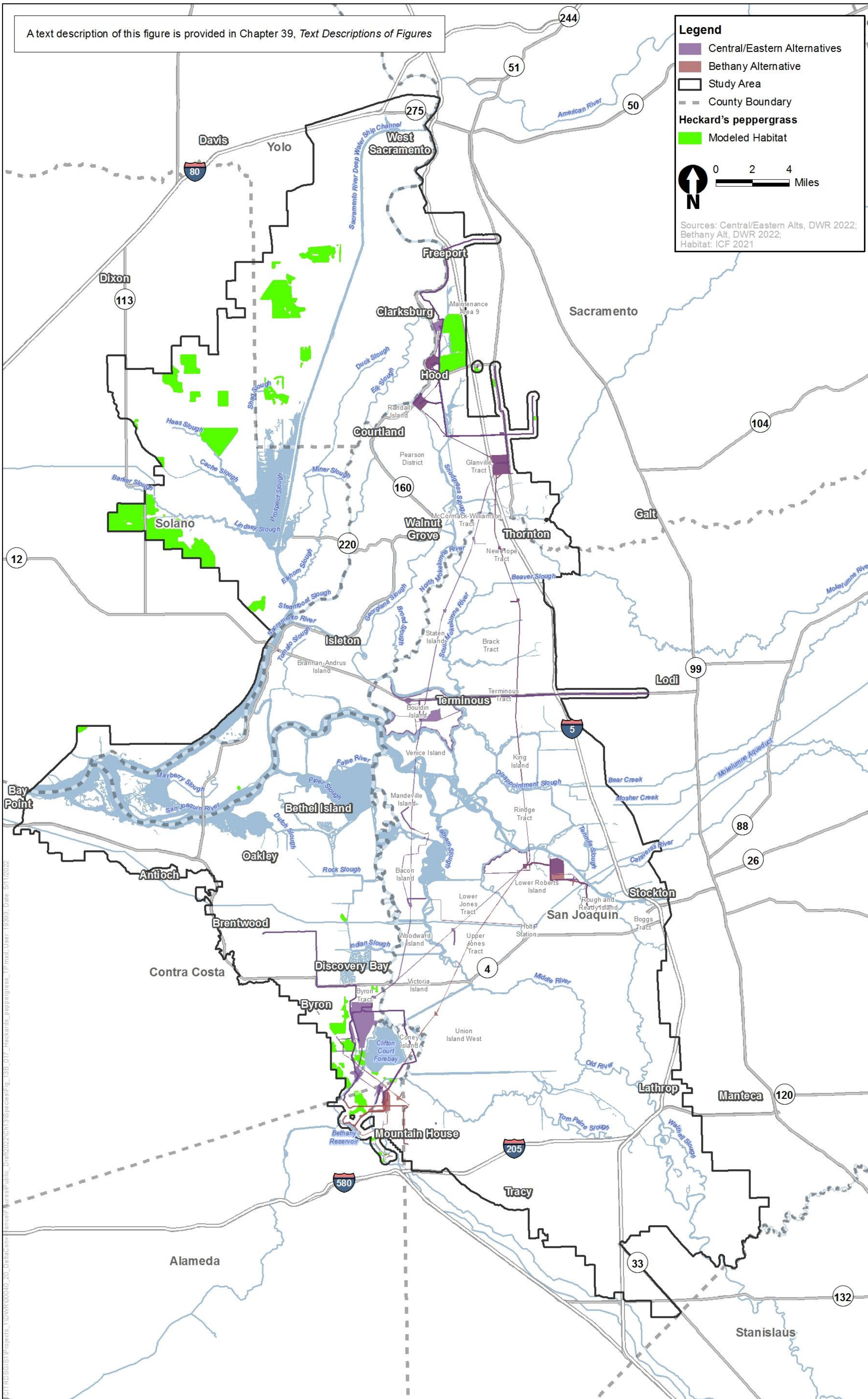

1
2 **Figure 13B.17-1. Heckard's Pepper Grass Modeled Habitat in the Study Area**

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13B.18 Mason's Lilaeopsis (*Lilaeopsis masonii*)

13B.18.1 Legal Status

Mason's lilaeopsis is state-listed as rare under the California Native Plant Protection Act (November 1979). It is not listed under the federal ESA or CESA. Its NatureServe Ranking in the CNDDB is G2/S2, which means that globally (G) and within the state (S), the species is considered imperiled (California Department of Fish and Wildlife 2020a:iii, 82).

The California Rare Plant Rank of 1B.1 for Mason's lilaeopsis indicates that it is rare, threatened, or endangered in California and elsewhere, and it is seriously endangered in California (California Native Plant Society 2020; California Department of Fish and Wildlife 2020a:iv,82). Plants with a rank of 1B may meet the definitions of rare, threatened, and endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:iii).

A taxonomic review concluded that Mason's lilaeopsis is genetically indistinguishable from the more common and widespread *Lilaeopsis occidentalis* and that the morphological differences observed between the coastal and inland forms are due to environmental plasticity (Fiedler et al. 2011:142). The report recommends not recognizing *L. masonii* as a separate species and recommends removing it from the State's list of rare plants. However, the paper acknowledges that *L. masonii* has been useful as an umbrella species for conservation planning efforts.

13B.18.2 Range and Distribution within the Study Area

Mason's lilaeopsis is endemic to California and is known from 198 occurrences, all but one of which are presumed extant (California Department of Water Resources 2011; California Department of Fish and Wildlife 2020b). The range of Mason's lilaeopsis extends from Napa and Solano Counties in the north, to Contra Costa and Alameda Counties in the south, to Marin County in the west, and to Sacramento and San Joaquin Counties in the east (California Department of Fish and Wildlife 2020b).

Mason's lilaeopsis is found throughout the Delta along rivers and sloughs; the majority of known occurrences (158) are within the study area (California Department of Water Resources 2011; California Department of Fish and Wildlife 2020b). Most occurrences are from the central and west Delta. In the south Delta, occurrences are predominately along Old River and Middle River. In the north Delta, it occurs in the Cache Slough complex and near Delta Meadows.

Over 300 stands of Mason's lilaeopsis were found during 2009 surveys (California Department of Water Resources 2011), including sites north of Prospect and Liberty Islands, an almost 12-mile-long stand of plants along the banks of the Deep Water Ship Channel, and scattered locations along the Yolo Bypass toe drain. Nineteen stands of Mason's lilaeopsis were found during 2010 surveys (California Department of Water Resources 2011). Mason's lilaeopsis was found in tidal freshwater emergent wetlands on the waterways between Webb Tract and Woodward Island, the south shore of Bacon Island, and the southeast corner of Fabian Tract on Old River. Twenty-six additional stands of Mason's lilaeopsis were found during 2011 surveys on in-channel islands, levees, and old wooden pilings along the South Mokelumne River north of Bouldin Island, San Joaquin River near Prisoner's

Point on Mandeville Island, and Old River near Fay Island (California Department of Water Resources 2011).

13B.18.3 Habitat Requirements

Mason's lilaeopsis is found in relatively unvegetated areas in brackish or freshwater habitats that are inundated by waves or tides such as estuarine wetlands and immediately below the banks of tidal sloughs, rivers, and creeks (Golden and Fiedler 1991:5; Fiedler and Zebell 1993:6; California Department of Fish and Wildlife 2020b; California Native Plant Society 2020). It is a colonizing species that establishes on newly deposited or exposed sediments (California Native Plant Society 2020). Some reports suggest that Mason's lilaeopsis is not substrate-specific, because it is found in organic mucks, silty clays, and even pure sand throughout its range (Golden and Fiedler 1991:5). Other reports find that it prefers low tidal flats on clay or silty soils (Witham and Kareofelas 1994). It is occasionally found distributed in soil pockets along riprap-lined levees (Golden and Fiedler 1991:5) and along the edges of tule marshes (Witham and Kareofelas 1994:16;). It has been found in areas with high soil salinity, but those sites might not be optimal habitat (Fiedler and Zebell 1993:33). Within the Delta, Mason's lilaeopsis is not found upstream from where tides affect water levels (Suisun Ecological Workgroup 1997:11).

Plant species commonly associated with Mason's lilaeopsis in the Delta include California bulrush (*Schoenoplectus californicus*), whorled marsh pennywort (*Hydrocotyle verticillata*), and low bulrush (*Isolepis cernua*) (Golden and Fiedler 1991:6–7). In the sloughs west of Liberty Island at the south end of the Sacramento River Deep Water Ship Channel, Mason's lilaeopsis grows in a narrow band between the mudflats and mesic terrestrial vegetation. In Suisun Marsh and other places, Mason's lilaeopsis is predominantly associated with California tule, low bulrush, and three-ribbed arrowgrass (*Triglochin striata*) (Suisun Ecological Workgroup 1997:11; California Department of Fish and Wildlife 2020b). During the Delta Habitat Conservation and Conveyance Program 2009 to 2011 surveys, some of the species associated with Mason's lilaeopsis included hardstem bulrush (*Schoenoplectus acutus*), water iris (*Iris pseudacorus*), marshpepper (*Persicaria hydropiper*), giant reed (*Arundo donax*), whorled marsh pennywort, nutsedge (*Cyperus* sp.), iris-leaved rush (*Juncus xiphioides*), common buttonbush (*Cephalanthus occidentalis*), red willow (*Salix laevigata*), smooth beggartick (*Bidens laevis*), alkali weed (*Cressa truxillensis*), water pygmyweed (*Crassula aquatica*), Himalayan blackberry (*Rubus armeniacus*), common reed (*Phragmites australis*), sneezeweed (*Helenium puberulum*), Pacific aster (*Symphyotrichum chilense*), Santa Barbara sedge (*Carex barbarae*), common rush (*Juncus effusus*), seep monkeyflower (*Mimulus guttatus*), dallis grass (*Paspalum dilatatum*), and hedge false bindweed (*Calystegia sepium*) (California Department of Water Resources 2011:2-10, 4-3, 6-3).

13B.18.4 Seasonal Patterns

Mason's lilaeopsis is a semi-aquatic perennial herb that blooms between April and November (Constance and Wetherwax 2012).

13B.18.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.18.5.1 GIS Model Data Sources

The Mason's lilaeopsis model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.18.5.2 Habitat Model Description

Mason's lilaeopsis grows within the upper tidal zone, at the interface between tidal waters and terrestrial vegetation. It grows in barren soil microsites within many different vegetation alliances but also grows in unvegetated areas, such as on the riprap of levees and areas with waterside development. Therefore, the habitat model for Mason's lilaeopsis is based primarily on the tidal perennial habitat land cover type, which includes the tidal channel habitat type of both the Delta Vegetation and Land Use Update and the DWR 2020 Aquatic Resources Delineation (Figure 13B-17). Within the project area, Mason's lilaeopsis habitat was geographically defined as the area extending 10 feet landward from the boundary of the tidal channel land cover type. This area is expected to encompass the upper tidal zone that experiences daily tidal inundation and deposition of waterborne sediments. It encompasses many different vegetation types, but it also includes developed areas and levees where riprap has been placed. The extent of modeled habitat in the study area is depicted in Figure 13B.18-1.

13B.18.5.2.1 Geographic Limits

Mason's lilaeopsis is distributed throughout the tidally influenced portions of the study area.

13B.18.5.2.2 Additional Model Parameters

A constraint layer was created in the geographic information system (GIS) to remove modeled habitat areas that were deemed unsuitable, including the interior of Clifton Court Forebay and, after inspection of aerial site photography, other areas such as boat docks and port facilities.

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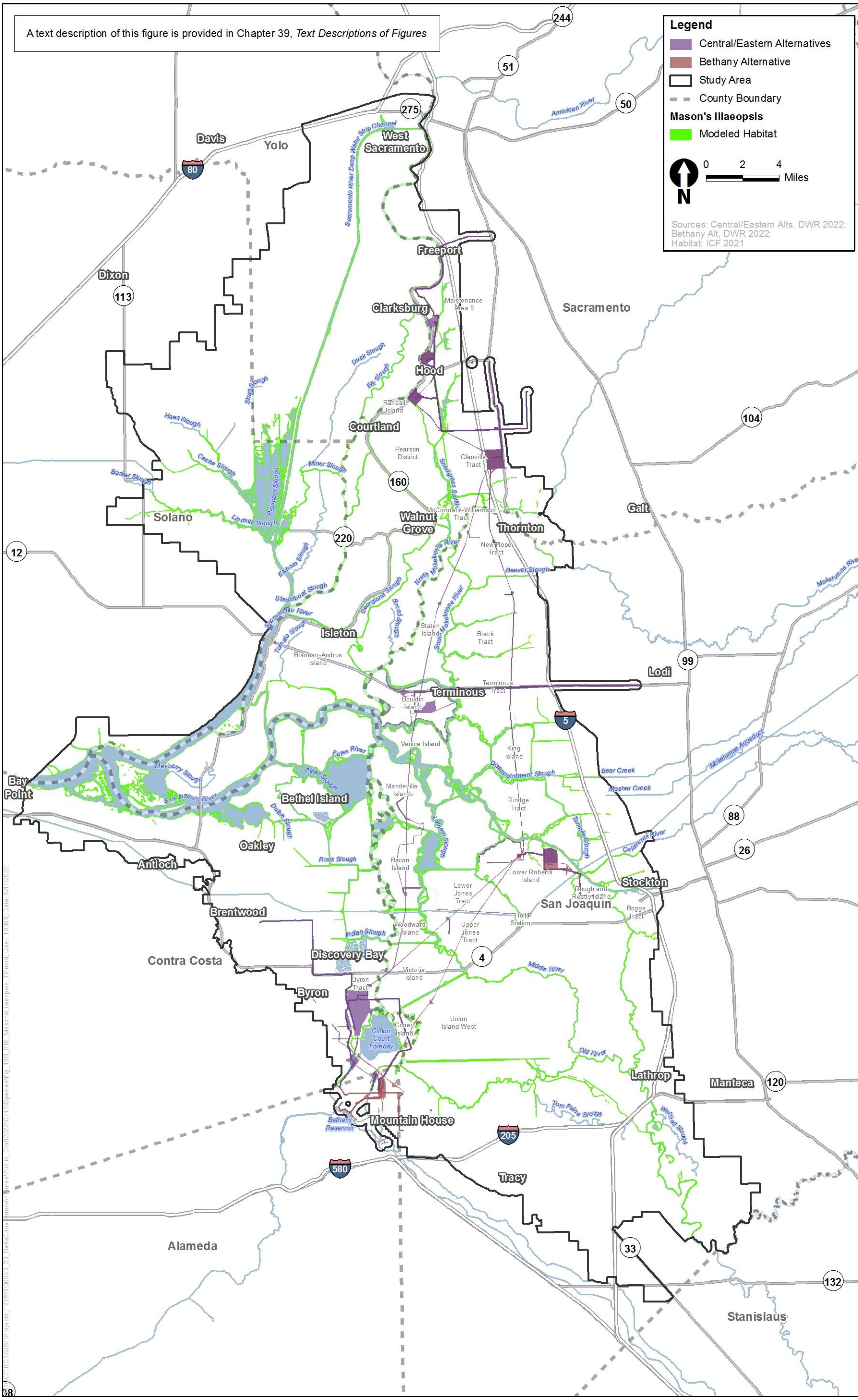

Figure 13B.18-1. Mason's Lilaeopsis Modeled Habitat in the Study Area

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13B.19 Delta Mudwort (*Limosella australis*)

13B.19.1 Legal Status

Delta mudwort is not listed under either the federal ESA or CESA. Its NatureServe Ranking in the CNDDB is G4G5/S2, which means that globally (G) the species as a whole is secure to apparently secure across its overall distribution, but some factors of concern, such as narrow habitat or continuing threats, do exist (California Department of Fish and Wildlife 2020a:iii,83). The state rank (S) indicates that it is considered imperiled, meaning at high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it vulnerable to extirpation (California Department of Fish and Wildlife 2020a:iii).

The California Rare Plant Rank of 2B.1 for Delta mudwort indicates that it is rare, threatened, or endangered in California, but more common elsewhere, with a threat level (.1) of seriously threatened in California (California Native Plant Society 2020:iv,83; California Department of Fish and Wildlife 2020a). Plants with a rank of 2B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.19.2 Range and Distribution within the Study Area

In California, Delta mudwort is found primarily in the Sacramento–San Joaquin River Delta (Delta) region (Wetherwax 2012). In the Delta, it extends from Solano County in the north, San Joaquin County in the south, Contra Costa County in the west, and Sacramento County in the east. Outside of California, it can be found in British Columbia, on the east coast of North America, and in Europe (Wetherwax 2012). On the east coast of the United States, it is threatened by habitat destruction (California Native Plant Society 2020).

In the study area, Delta mudwort occurs in the tidal zones of marshes, rivers, and creeks, predominantly in the central area of the statutory Delta. Of the 59 reported occurrences of Delta mudwort in California, 58 are located in the study area, and all are presumed extant (California Department of Fish and Wildlife 2020b). It has been observed in the tidal zone along Calhoun Cut and Barker Slough (Witham and Kareofelas 1994:17), in the Miner Slough Wildlife Area, along Montezuma Slough, near Three Mile Slough, at Brown's Island, near Collinsville, and at other locations throughout the Delta (California Department of Fish and Wildlife 2020b).

Thirty-four stands of Delta mudwort were recorded during 2009 surveys conducted as part of the Delta Habitat Conservation and Conveyance Program (California Department of Water Resources 2011:2-10). Delta mudwort was found growing on exposed mudflats and mudbanks in tidal marshes in the central Delta from Walnut Grove to Clifton Court Forebay (California Department of Water Resources 2011:2-10). An additional four stands of Delta mudwort were recorded during 2011 surveys, mainly on in-channel islands as well as riprapped levees on the South Mokelumne River north of Bouldin Island and the San Joaquin River near Prisoners Point on Mandeville Island (California Department of Water Resources 2011:6-2).

13B.19.3 Habitat Requirements

Delta mudwort grows on intertidal flats and muddy banks of watercourses in estuarine areas, surrounded by brackish or freshwater marsh and riparian scrub vegetation. It is found in brackish and freshwater tidal marsh and riparian scrub plant communities along with Mason's lilaeopsis (*Lilaeopsis masonii*) immediately below the tidal elevation where Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*) and Suisun Marsh aster (*Symphyotrichum lentum*) are commonly found (Witham and Kareofelas 1994:16).

In addition to Mason's lilaeopsis, Delta mudwort was often found intermixed with associates, such as whorled marsh pennywort (*Hydrocotyle verticillata*), water pygmyweed (*Crassula aquatica*), and low bulrush (*Isolepis cernua*) during the 2009 surveys (California Department of Water Resources 2011:2-10). Other less common associates included Delta tule pea, common reed (*Phragmites australis*), needle spikerush (*Eleocharis acicularis*), smartweeds (*Persicaria* spp.), cattail species (*Typha* spp.), American dogwood (*Cornus sericea*), Himalayan blackberry (*Rubus armeniacus*), and nutsedge (*Cyperus* spp.).

Delta mudwort appears to be sensitive to salinity concentrations near or greater than 7 parts per thousand (ppt), with substantially reduced growth (Fiedler and Zebell 1993:35; Zebell and Fiedler 1996:37–38).

13B.19.4 Seasonal Patterns

Delta mudwort is a perennial herb that blooms from April to August (Wetherwax 2012; California Native Plant Society 2020).

13B.19.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.19.5.1 GIS Model Data Sources

The Delta mudwort model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.19.5.2 Habitat Model Description

Delta mudwort grows within the upper tidal zone at the interface between tidal waters and terrestrial vegetation. It grows in barren soil microsites within many different vegetation alliances but also grows in unvegetated areas, such as on the riprap of levees and areas with waterside development. Therefore, the habitat model for Delta mudwort is based primarily on the tidal perennial habitat land cover type, which includes the tidal channel habitat type of both the Delta

Vegetation and Land Use Update and the DWR 2020 Aquatic Resources Delineation. The extent of modeled habitat in the study area is depicted in Figure 13B.19-1.

13B.19.5.2.1 Geographic Limits

Within the project area, Delta mudwort habitat was geographically defined as the area extending 5 feet on both sides of the boundary of the tidal perennial aquatic land cover type. This area is expected to encompass the upper tidal zone that experiences daily tidal inundation and deposition of waterborne sediments. It encompasses many different vegetation types, but it also includes developed areas and levees where riprap has been placed.

13B.19.5.2.2 Additional Model Parameters

A constraints layer was created in the geographic information system (GIS) to remove modeled habitat areas that were deemed unsuitable, including the interior of Clifton Court Forebay and, after inspection of aerial site photography, other areas such as boat docks and port facilities.

13B.19.6 References Cited

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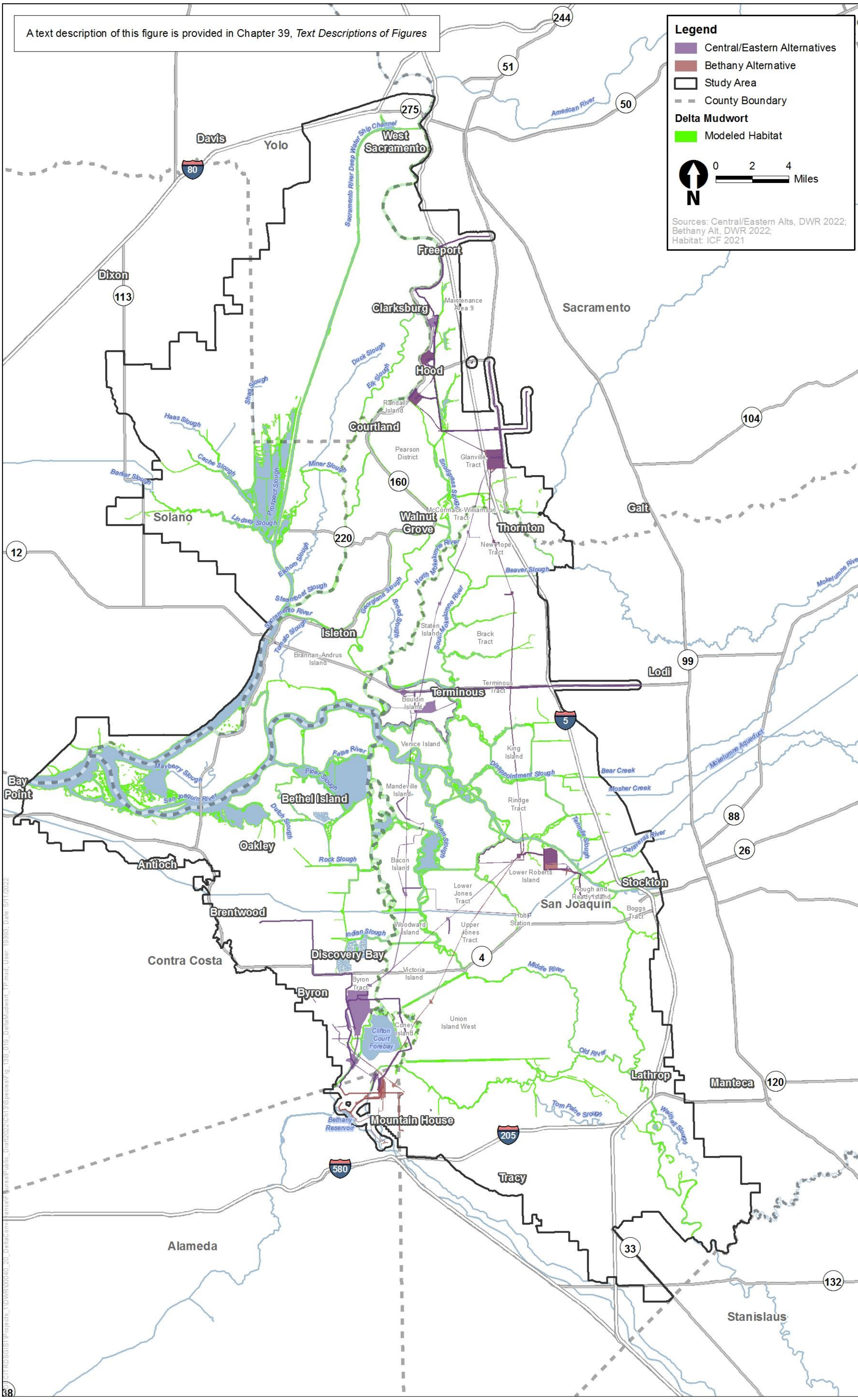

Figure 13B.19-1. Delta Mudwort Modeled Habitat in the Study Area

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13B.20 Shining Navarretia (*Navarretia nigelliformis* subsp. *radians*)

13B.20.1 Legal Status

Shining navarretia is not listed under either the federal ESA or CESA. This species' Heritage Element Ranking in the CNDDB is G4T2/S2, which means that globally (G) and within the state (S) the species is considered secure, but the subspecies (T) is considered imperiled (California Department of Fish and Wildlife 2020:iii, 108). This status is a result of its restricted range and relatively few (102) small occurrences that puts it at high risk of extirpation.

The California Rare Plant Rank of 1B.2 for shining navarretia indicates that it is rare, threatened, or endangered in California or elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020:iv, 106; California Native Plant Society 2021). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020:i).

13B.20.2 Range and Distribution within the Study Area

Shining navarretia is endemic to California. The primary range for the subspecies is the South Coast Ranges from San Luis Obispo County to San Benito County; additional occurrences are scattered along the margins of the northern San Joaquin Valley and along the western margin of the Sacramento Valley in Glenn County (California Department of Fish and Wildlife 2021). The CNDDB reports 102 occurrences for this subspecies, two of which are considered possibly extirpated (California Department of Fish and Wildlife 2021).

There are no occurrences of shining navarretia reported from the study area, although five occurrences are within a few miles of the western edge of the study area, including an occurrence within a mile of Bethany Reservoir (California Department of Fish and Wildlife 2021).

13B.20.3 Habitat Requirements

Shining navarretia is found in grasslands and open, grassy areas in oak woodland and chaparral, generally on clay soils (California Department of Fish and Wildlife 2021). Species associated with shining navarretia are native and non-native grasses and forbs, including species associated with clay or clay loam soils, such as other navarretias (*Navarretia* spp.), silverpuffs (*Microseris* spp.), blow-wives (*Achyrachaena mollis*), tarweeds (*Deinandra* spp.), popcornflowers (*Plagiobothrys* spp.), peppergrasses (Lepidium spp.), and blue dicks (*Dipterostemon capitatus*).

13B.20.4 Seasonal Patterns

Shining navarretia is a small annual herb that blooms from May through July (Johnson 2013; California Native Plant Society 2021).

13B.20.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.20.5.1 GIS Model Data Sources

The shining navarretia model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sand Hill Repowering Land Cover Dataset (ICF 2018)

13B.20.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species would be expected to occur. The extent of modeled habitat in the study area is depicted in Figure 13B.20-1.

13B.20.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.20.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

- Mediterranean California naturalized annual and perennial grassland.
- California annual herb/grass

Soil types associated with shining navarretia were determined by overlaying the occurrence locations from the CNDDB onto the SSURGO soil map (Soil Survey Staff 2020). Soils mapped at occurrence locations generally are clay or clay loams. Modeled habitat was limited to the following soil series in the statutory Delta where the species has been documented:

- Capay
- Diablo
- Rincon
- Linne
- Altamont

13B.20.6 References Cited

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Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. Web Soil Survey. Available: https://websoilsurvey.nrcs.usda.gov/. Accessed: March 2020 through February 17, 2020.

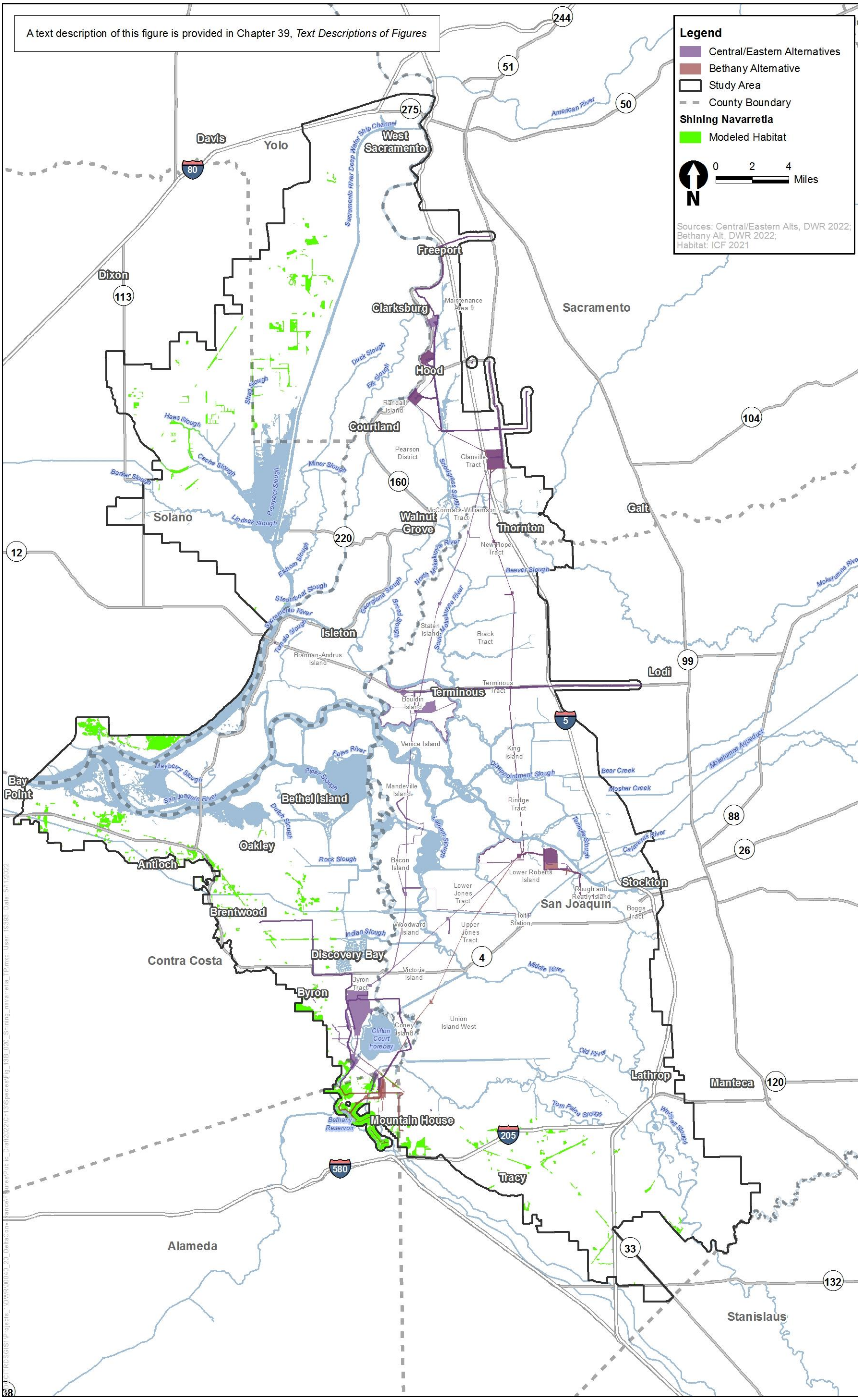

Figure 13B.20-1. Shining Navarretia Modeled Habitat in the Study Area

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13B.21 Eel-Grass Pondweed (*Potamogeton zosteriformis*)

13B.21.1 Legal Status

Eel-grass pondweed is not listed under either the federal ESA or CESA. This species' NatureServe Ranking in the CNDDB is G5/S3, which means that globally (G) eel-grass pondweed is considered common and secure, but within the state (S) eel-grass is considered vulnerable (California Department of Fish and Wildlife 2020a:iii, 108). This status is because it has a restricted range in California with relatively few populations.

The California Rare Plant Rank of 2B.2 for eel-grass pondweed indicates that it is rare, threatened, or endangered in California but more common elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv, 108; California Native Plant Society 2020). Plants with a rank of 2B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.21.2 Range and Distribution within the Study Area

Eel-grass pondweed has been recorded at a few widespread locations in California, mostly on the Modoc Plateau, but also at Clear Lake, in the Sacramento-San Joaquin Delta, in eastern Merced County, and in Mono County (Consortium of California Herbaria 2020; California Department of Fish and Wildlife 2020b). The CNDDB reports 20 occurrences for this species, all of which are presumed extant (California Department of Fish and Wildlife 2020b). Thirteen occurrences have not been observed in the last 20 years. Outside of California, the species ranges north into British Columbia and to eastern North America (Hellquist et al. 2012).

One occurrence of eel-grass pondweed is documented in the study area (California Department of Fish and Wildlife 2020b). The occurrence, which is based on a 1949 collection from Webb Island (California Department of Fish and Wildlife 2020b), has not been relocated since then.

13B.21.3 Habitat Requirements

Eel-grass pondweed grows in ponds, lakes, and streams, including reservoirs and ditches (Hellquist et al. 2012; California Department of Fish and Wildlife 2020b). Very little specific information about the species' habitat in California is available.

13B.21.4 Seasonal Patterns

Eel-grass pondweed is an aquatic herbaceous annual that blooms between June and July (Hellquist et al. 2012).

13B.21.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.21.5.1 GIS Model Data Sources

The eel-grass pondweed model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.21.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented. The extent of modeled habitat in the study area is depicted in Figure 13B.21-1.

13B.21.5.2.1 Geographic Limits

The eel-grass pondweed model encompasses the entire study area.

13B.21.5.2.2 Additional Model Parameters

The selected vegetation types were limited to nontidal natural communities. Nontidal areas are defined geographically as those areas on the landward side of the GIS levee map data. Modeled habitat includes the following types from the GIS model data sources.

- Nontidal freshwater perennial emergent wetland
  - Arid West freshwater emergent marsh
  - *Schoenoplectus (acutus, californicus)*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Freshwater emergent wetland
- Nontidal perennial aquatic
  - Naturalized temperate Pacific freshwater vegetation
  - *Eichhornia crassipes*
  - *Ludwigia (hexapetala, peploides)*
  - Temperate freshwater floating mat
  - *Azolla (filiculoides, microphylla)*
  - *Lemna (minor) and Relatives*
  - Temperate Pacific freshwater aquatic bed

- Water
- Depression
- Natural channel

13B.21.6 References Cited

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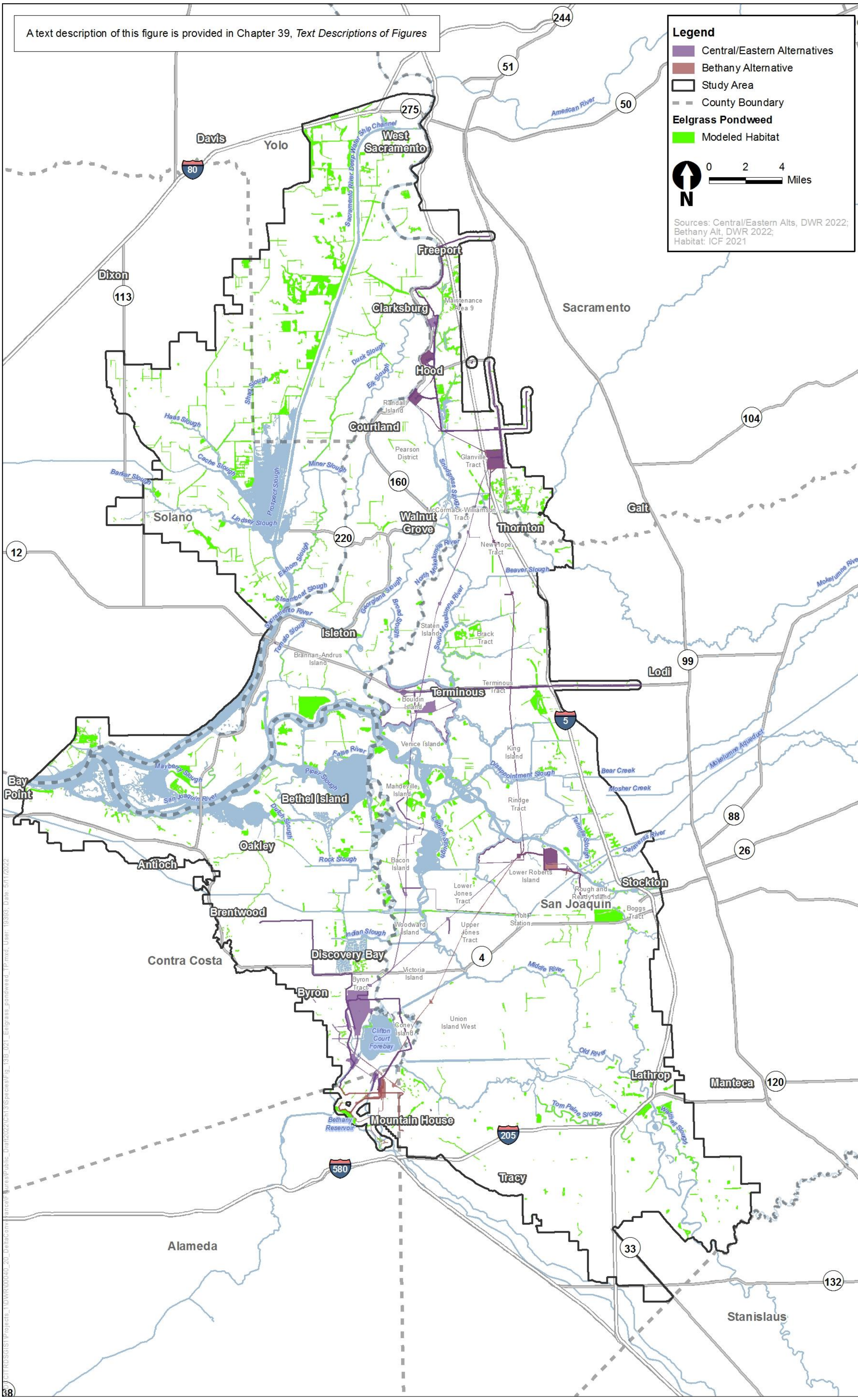

Figure 13B.21-1. Eel-Grass Pondweed Modeled Habitat in the Study Area

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13B.22 California Alkali Grass (*Puccinellia simplex*)

13B.22.1 Legal Status

California alkali grass is not listed under either the federal ESA or CESA. This species' NatureServe Ranking in the CNDDB is G3/S2, which means that globally (G) California alkali grass is considered vulnerable, and within the state (S) it is considered imperiled (California Department of Fish and Wildlife 2020a:iii,110). This status is due to its restricted range in California with relatively few populations.

The California Rare Plant Rank of 1B.2 for California alkali grass indicates that it is rare, threatened, or endangered in California and elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv,110; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.22.2 Range and Distribution within the Study Area

California alkali grass has been recorded at scattered locations in or adjacent to the Great Valley and in the western Mojave Desert (Davis 2012; California Department of Fish and Wildlife 2020b). The CNDDB reports 80 occurrences for this species, 65 of which are presumed extant (California Department of Fish and Wildlife 2020b). Only 22 occurrences have been observed in the last 20 years. Outside of California, the species ranges north into Oregon and east to Utah (Davis 2012).

Two occurrences of California alkali grass are documented in the study area (California Department of Fish and Wildlife 2020b), both of which are located southwest of Clifton Court Forebay. One of the occurrences was last observed in 1986 and the other in 2006, but both are presumed to be extant.

13B.22.3 Habitat Requirements

California alkali grass grows in seasonal or intermittent wetlands in soils with high salt concentrations, including seeps, vernal pools, and ponds and barren areas within saltbush scrub and alkaline meadow (California Department of Fish and Wildlife 2020b). Assciated species include saltbush (*Atriplex* spp.), saltscale (*Atriplex* spp.), bush seepweed (*Suaeda nigra*), alkali heath (*Frankenia salina*), saltgrass (*Distichlis spicata*), common spikeweed (*Centromadia pungens*), sand spurrey (*Spergularia* spp.), alkali peppergrass (*Lepidium dictyotum*), and low barley (*Hordeum depressum*).

13B.22.4 Seasonal Patterns

California alkali grass is an annual grass that blooms between March and May (Davis 2012).

13B.22.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.22.5.1 GIS Model Data Sources

The California alkali grass model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.22.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.22-1.

13B.22.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.22.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Vernal pool complex
  - Vernal pool complex-*Allenrolfea occidentalis*
  - Vernal pool complex-*Distichlis spicata*
  - Vernal pool complex-*Frankenia salina*
  - Vernal pool complex-*Suaeda moquinii*
  - Vernal pool complex-Western North American disturbed alkaline marsh and meadow
  - Vernal pool complex-alkaline wetland
- Alkaline wetland complex
  - Alkaline wetland
  - Southwestern North American salt basin and high marsh
  - Western North American disturbed alkaline marsh and meadow
  - *Allenrolfea occidentalis*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Suaeda moquinii*

- ○ Barren

Soil types associated with California alkali grass were determined by overlaying the occurrence locations from the CNDDB onto the SSURGO (Soil Survey Staff 2020). Soils mapped at occurrence locations are strongly alkaline. Modeled habitat was limited to the following soil series in the statutory Delta where the species has been documented:

- Pescadero
- Solano

13B.22.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Vascular Plants, Bryophytes, and Lichens List.* California Natural Diversity Database (CNDDB). Quarterly publication. January. Sacramento, CA.

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Davis, J. I. 2012. *Puccinellia simplex*. In Jepson Flora Project (eds.), *Jepson eFlora*. Available: https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=40339 . Accessed: June 10, 2020.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. 2020. Web Soil Survey. Available: https://websoilsurvey.nrcs.usda.gov/. Accessed: March 2020 through February 17, 2020.

Witham, C. W., R. F. Holland, and J. Vollmar. 2014. *Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012* [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip . Accessed: April 29, 2020.

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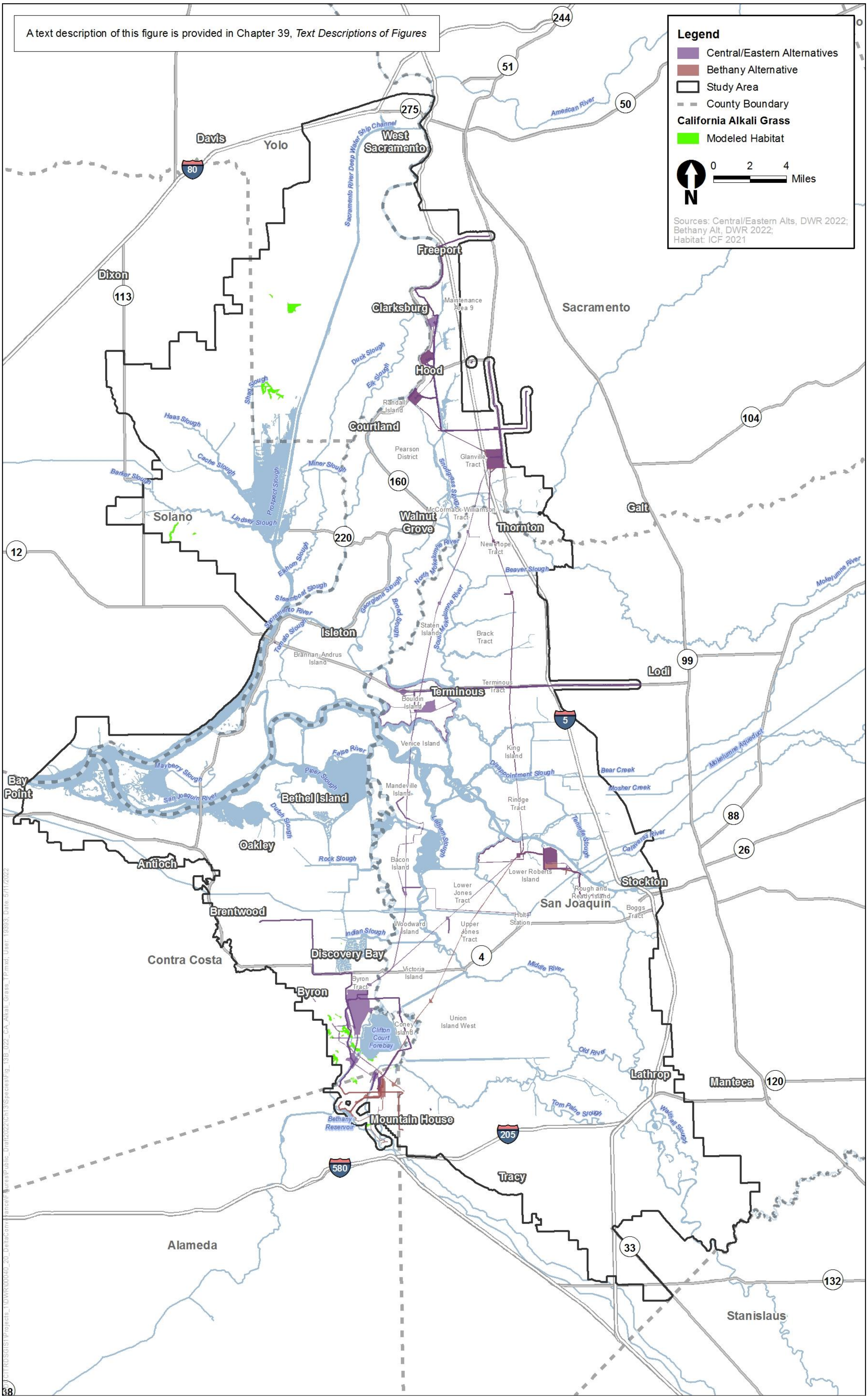

1
2 **Figure 13B.22-1. California Alkali Grass Modeled Habitat in the Study Area**

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13B.23 Sanford's Arrowhead (*Sagittaria sanfordii*)

13B.23.1 Legal Status

Sanford's arrowheadis not listed under either the federal ESA or CESA. This species' NatureServe Ranking in the CNDDB is G3/S3, which means that globally (G) and within the state (S) Sanford's arrowhead is considered vulnerable (California Department of Fish and Wildlife 2020a:iii,113). This status is due to its restricted range in California with relatively few populations.

The California Rare Plant Rank of 1B.2 for Sanford's arrowead indicates that it is rare, threatened, or endangered in California and elsewhere. Its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv,113; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.23.2 Range and Distribution within the Study Area

Sanford's arrowhead has a broad range in California but occurs in scattered locations throughout that range. It is found in the northern North Coast, Klamath Ranges, Cascade Range foothills, Great Valley, and northern South Coast (Turner et al. 2012; California Department of Fish and Wildlife 2020b). The CNDDB reports 126 occurrences for this species, 117 of which are presumed extant (California Department of Fish and Wildlife 2020b). Most of the occurrences (78) were reported in the last 20 years.

There are 23 occurrences of Sanford's arrowhead documented in the study area, many of which were located during surveys of the Delta in 2011 (California Department of Water Resources 2011:6-3; California Department of Fish and Wildlife 2020b). One of the occurrences is possibly extirpated.

13B.23.3 Habitat Requirements

Sanford's arrowhead grows in freshwater ponds, marshes, and ditches, including tidal mudflats and riprap, and at the margins of riparian scrub and forest (Turner et al. 2012; California Department of Fish and Wildlife 2020b). Associated species include cattails (*Typha* spp.), tules (*Scirpus* spp.), yellow water weed (*Ludwigia* spp.), knotweed (*Persicaria* spp.), and other native and nonnative emergent and floating wetland species (California Department of Fish and Wildlife 2020b).

13B.23.4 Seasonal Patterns

Sanford's arrowhead is an annual herb that is an emergent aquatic species, blooming between May and October (Turner et al. 2012).

13B.23.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.23.5.1 GIS Model Data Sources

The Sanford's arrowhead model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.23.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented. The extent of modeled habitat in the study area is depicted in Figure 13B.23-1.

13B.23.5.2.1 Geographic Limits

Within the study area, modeled habitat was geographically constrained to the Sacramento and Mokelumne River systems upstream from Rio Vista. Sanford's arrowhead has not been documented downstream from Rio Vista or in the San Joaquin River system.

13B.23.5.2.2 Additional Model Parameters

Sanford's arrowhead occurs along the shallow margins of stream channels, often with riparian vegetation on the adjacent bank. To model Sanford's arrowhead habitat where the natural community is valley/foothill riparian, a 30-foot-wide buffer was extended from the waterside edge of the selected riparian vegetation types into the adjacent tidal perennial aquatic, tidal freshwater emergent wetland, nontidal aquatic, and nontidal freshwater perennial emergent wetland vegetation types specified below.

Modeled habitat includes the following types from the GIS model data sources:

- Valley/foothill riparian
  - *Cephalanthus occidentalis*
  - *Fraxinus latifolia*
  - *Juglans hindsii and hybrids*
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Quercus lobata*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix lasiolepis*
  - Introduced North American Mediterranean woodland and forest
  - Southwestern North American riparian evergreen and deciduous woodland

   - Forested wetland
   - Scrub shrub wetland
- Tidal freshwater emergent wetland
   - *Schoenoplectus (acutus, californicus)*
   - *Typha (angustifolia, domingensis, latifolia)*
   - Arid West freshwater emergent marsh
   - Freshwater emergent wetland
- Tidal perennial aquatic
   - *Ludwigia (hexapetala, peploides)*
   - Naturalized temperate Pacific freshwater vegetation
   - Tidal channel
   - Water
- Nontidal freshwater perennial emergent wetland
   - Arid west freshwater emergent marsh
   - Freshwater emergent wetland
   - Naturalized warm-temperate riparian and wetland
   - *Schoenoplectus (acutus, californicus)*
   - *Typha (angustifolia, domingensis, latifolia)*
- Nontidal perennial aquatic
   - *Ludwigia (hexapetala, peploides)*
   - Naturalized temperate Pacific freshwater vegetation
   - Temperate Pacific freshwater aquatic bed
   - Natural channel
   - Water

13B.23.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Vascular Plants, Bryophytes, and Lichens List.* California Natural Diversity Database (CNDDB). Quarterly publication. January. Sacramento, CA.

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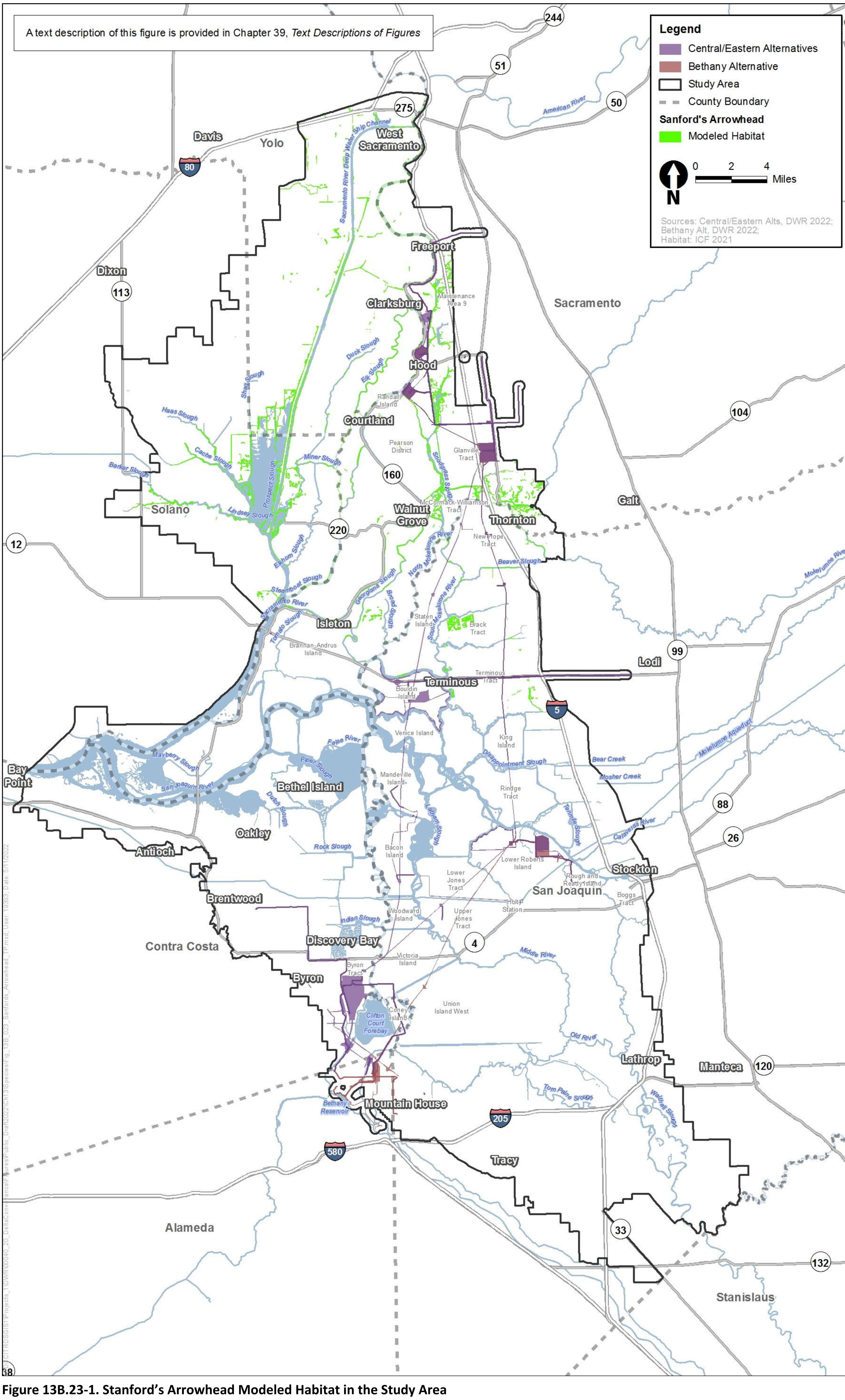

Figure 13B.23-1. Stanford's Arrowhead Modeled Habitat in the Study Area

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13B.24 Marsh Skullcap (*Scutellaria galericulata*)

13B.24.1 Legal Status

Marsh skullcap (*Scutellaria galericulata*) is not listed under either the federal ESA or CESA. This species' NatureServe Ranking in the CNDDB is G5/S3, which means that globally (G) the species is secure but considered vulnerable within the state (S) (California Department of Fish and Wildlife 2020a:iii, 115). This status is due to its restricted range in California with relatively few populations.

The California Rare Plant Rank of 2B.2 for marsh skullcap indicates that it is rare, threatened, or endangered in California but more common elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iii, 115; California Native Plant Society 2020). Plants with a rank of 2B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.24.2 Range and Distribution within the Study Area

Marsh skullcap has a narrow range in California, occurring at scattered locations in the Modoc Plateau and the high Sierra Nevada (Olmstead 2012), but with disjunct occurrences in the Sacramento-San Joaquin Delta (California Department of Fish and Wildlife 2020b). The CNDDB reports 39 occurrences for this species, all of which are presumed extant (California Department of Fish and Wildlife 2020b). Most of the occurrences (27) were observed in the last 20 years.

There are five occurrences of marsh skullcap documented in the study area (California Department of Fish and Wildlife 2020b). All of the occurrences are presumed to be extant.

13B.24.3 Habitat Requirements

In the study area, marsh skullcap grows in freshwater tidal wetlands, sometimes growing on the tops of semisubmerged logs (California Department of Fish and Wildlife 2020b). Associated species include tules (*Scirpus* spp.), soft rush (*Juncus effusus*), and other native and nonnative emergent and floating wetland species, often where the wetlands are associated with riparian shrubs and trees (California Department of Fish and Wildlife 2020b).

13B.24.4 Seasonal Patterns

Marsh skullcap is a perennial herb that blooms between June and September (Olmstead 2012).

13B.24.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.24.5.1 GIS Model Data Sources

The marsh skullcap model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.24.5.2 Habitat Model Description

The habitat modeled for the species includes the tidally influenced natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.24-1.

13B.24.5.2.1 Geographic Limits

The model encompasses the entire study area. Where marsh skullcap grows in the valley/foothill riparian natural community, marsh skullcap habitat types were geographically bounded by the area extending 10 feet landward and 10 feet waterward from the boundary with the tidal perennial aquatic natural community type.

13B.24.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Valley foothill riparian
  - *Acer negundo*
  - *Alnus rhombifolia*
  - *Cephalanthus occidentalis*
  - *Cornus sericea*
  - *Fraxinus latifolia*
  - *Juglans hindsii* and Hybrids
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Quercus wislizeni*
  - *Rosa californica*
  - *Salix exigua*
  - *Salix laevigata*
  - *Salix lasiolepis*
  - *Salix lucida*
  - Forested wetland

    - Scrub shrub wetland
    - Southwestern North American riparian evergreen and deciduous woodland
    - Southwestern North American riparian/wash scrub
    - Vancouverian riparian deciduous forest
- Tidal freshwater emergent wetland
    - Arid west freshwater emergent marsh
    - *Schoenoplectus (acutus, californicus)*
    - *Typha (angustifolia, domingensis, latifolia)*
    - Freshwater emergent wetland

13B.24.6 References Cited

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Olmstead, R. G. 2012. *Scutellaria galericulata*. In Jepson Flora Project (eds.), *Jepson eFlora*. Available: https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=43891 . Accessed: June 12, 2020.

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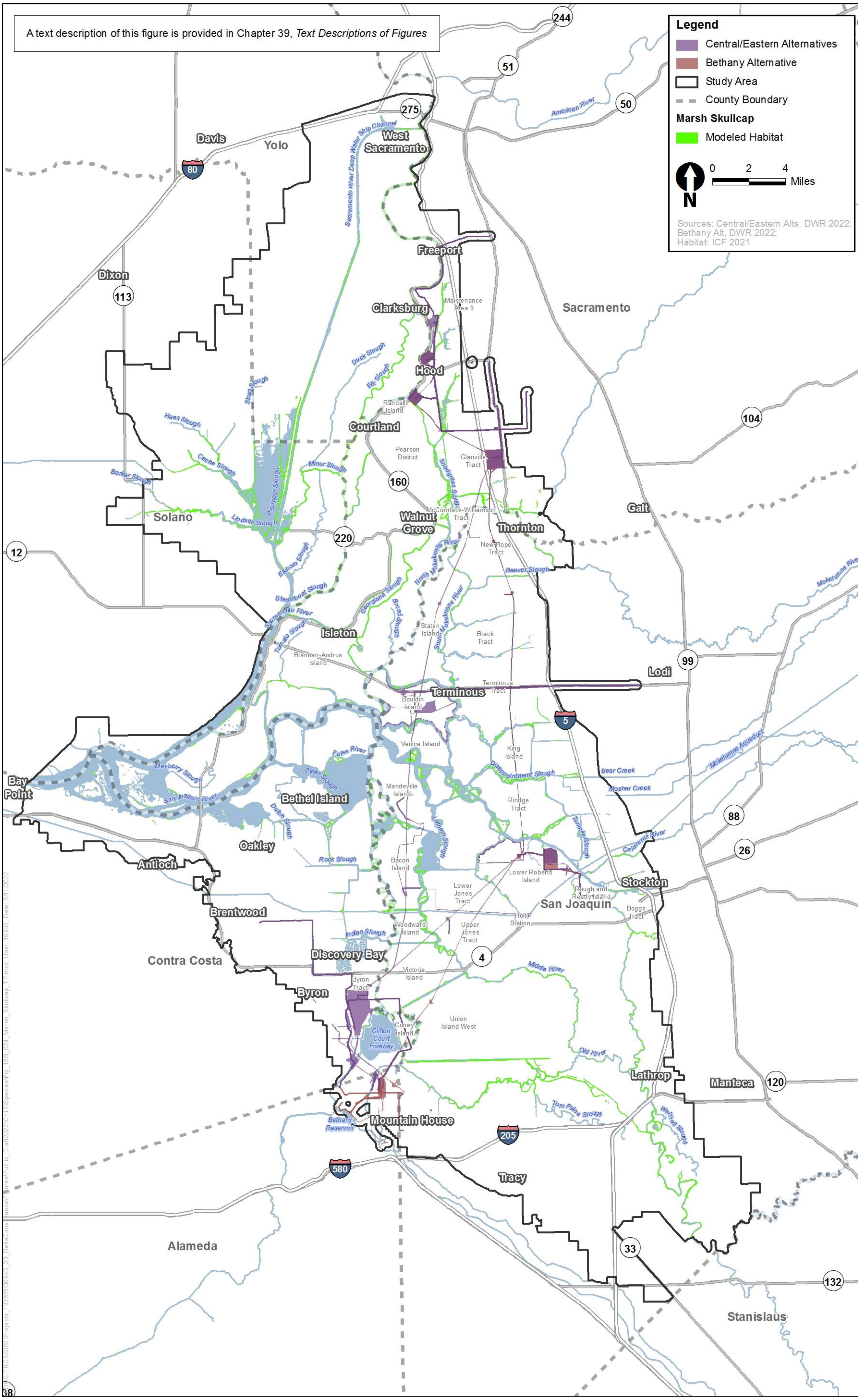

Figure 13B.24-1. Marsh Skullcap Modeled Habitat in the Study Area

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13B.25 Side-Flowering Skullcap (*Scutellaria lateriflora*)

13B.25.1 Legal Status

Side-flowering skullcap (*Scutellaria lateriflora*) is not listed under either the federal ESA or CESA. Its NatureServe Ranking in the CNDDB is G5/S2, which means that globally (G) the species population is secure or ineradicable because it is common outside of California, but within the state (S) the species is considered imperiled (California Department of Fish and Wildlife 2020a:iii, 115).

The California Rare Plant Rank of 2B.2 for side-flowering skullcap indicates that it is rare, threatened, or endangered in California but more common elsewhere, and its state threat level (.2) indicates that it is moderately endangered in California (California Department of Fish and Wildlife 2020a:iii, 115; California Native Plant Society 2020). Plants with a rank of 2B may meet the definitions of rare, threatened and endangered as defined in CEQA Section 15380(California Department of Fish and Wildlife 2020a:i).

13B.25.2 Range and Distribution within the Study Area

Side-flowering skullcap is a widespread but scattered species of swamps, marshes, and bogs in the central and eastern United States, but in California it is limited to a small area of the statutory Delta (Olmstead 2012). There are 13 extant occurrences reported in the CNDDB, the majority within 3 miles of Walnut Grove in southeast Sacramento County (California Department of Fish and Wildlife 2020b). Prior to 2009, side-flowering skullcap was known from only two occurrences. It was collected from Bouldin Island in 1892 but that occurrence has not been relocated since, and it was discovered in 1993 in the vicinity of Delta Meadows State Park (California Department of Fish and Wildlife 2020b). Surveys in 2009 identified it in Sycamore Slough and found additional occurrences in the Delta Meadows State Park area (California Department of Water Resources 2011:2-11). It has also been recorded as a waif from a crop field on an herb farm in Gilroy in Santa Clara County (Consortium of California Herbaria 2020; Hrusa et al. 2002:86), but this record is not treated as an occurrence in the CNDDB.

As noted above, side-flowering skullcap is known to occur in the study area only within the statutory Delta. During botanical surveys within the study area conducted in 2009, it was found at the Delta Meadows State Park and at additional locations in and along the channels of Snodgrass Slough, Lost Slough, and the Mokelumne River (California Department of Water Resources 2011:2-11). No additional occurrences of this species were discovered during 2009 surveys conducted along channels in the north, west, south, and central Delta, and none were found during the 2010 and 2011 surveys. The exact location of the Bouldin Island occurrence is unknown. Numbers of plants observed at the other 12 occurrences are low, ranging from 1 to 68, and 8 occurrences have 10 or fewer plants (California Department of Fish and Wildlife 2020b). Population conditions have been rated as fair to good, although population trends are unknown for all occurrences (California Department of Fish and Wildlife 2020b). Of the 13 occurrences, 2 are in existing conservation lands in the vicinity of Delta Meadows State Park in the greater Cosumnes-Mokelumne River area.

13B.25.3 Habitat Requirements

Side-flowering skullcap occurs in wet meadows, seeps, marshes and swamps (California Department of Fish and Wildlife 2020b; California Native Plant Society 2020). In the study area it occurs in freshwater tidal areas along channels and sloughs, almost always growing on partially submerged logs, degraded pilings, or woody debris along tidal channels (California Department of Fish and Wildlife 2020b). These conditions ensure that the plant is well watered but not growing in anaerobic soils. Typical associated species include common nightshade (*Solanum americanum*), bugleweed (*Lycopus americanus*), soft rush (*Juncus effusus*), spike bentgrass (*Agrostis exarata*), white alder (*Alnus rhombifolia*), purpletop vervain (*Verbena bonariensis*), willowherb (*Epilobium* spp.), and buttonwillow (*Cephalanthus occidentalis*) (California Department of Fish and Wildlife 2020b).

In the Delta Meadows State Park area side-flowering skullcap co-occurs with the rare marsh skullcap (*Scutellaria galericulata*), often on the same stumps.

13B.25.4 Seasonal Patterns

Side-flowering skullcap is a perennial herb that blooms between May and July (Olmstead 2012).

13B.25.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.25.5.1 GIS Model Data Sources

The side-flowering skullcap model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.25.5.2 Habitat Model Description

The habitat types modeled for the species includes the natural community and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.25-1.

13B.25.5.2.1 Geographic Limits

The model encompasses the entire study area. Side-flowering skullcap grows within the upper tidal zone, at the interface between tidal waters and terrestrial vegetation. Where side-flowering skullcap grows in the valley/foothill riparian natural community, side-flowering skullcap habitat types were geographically bounded by the area extending 10 feet landward and 10 feet waterward from the boundary with the tidal perennial aquatic natural community type.

13B.25.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Tidal freshwater emergent wetland
  - Arid West freshwater emergent marsh
  - *Schoenoplectus (acutus, californicus*)
  - *Typha (angustifolia, domingensis, latifolia)*
  - Freshwater emergent wetland
- Valley/foothill riparian
  - *Acer negundo*
  - *Alnus rhombifolia*
  - *Cephalanthus occidentalis*
  - *Cornus sericea*
  - *Fraxinus latifolia*
  - *Juglans hindsii and hybrids*
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Quercus wislizeni*
  - *Rosa californica*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*
  - *Salix lucida*
  - *Salix lasiolepis*
  - Forested wetland
  - Scrub shrub wetland
  - Southwestern North American riparian evergreen and deciduous woodland
  - Southwestern North American riparian/wash scrub
  - Vancouverian riparian deciduous forest

13B.25.6 References Cited

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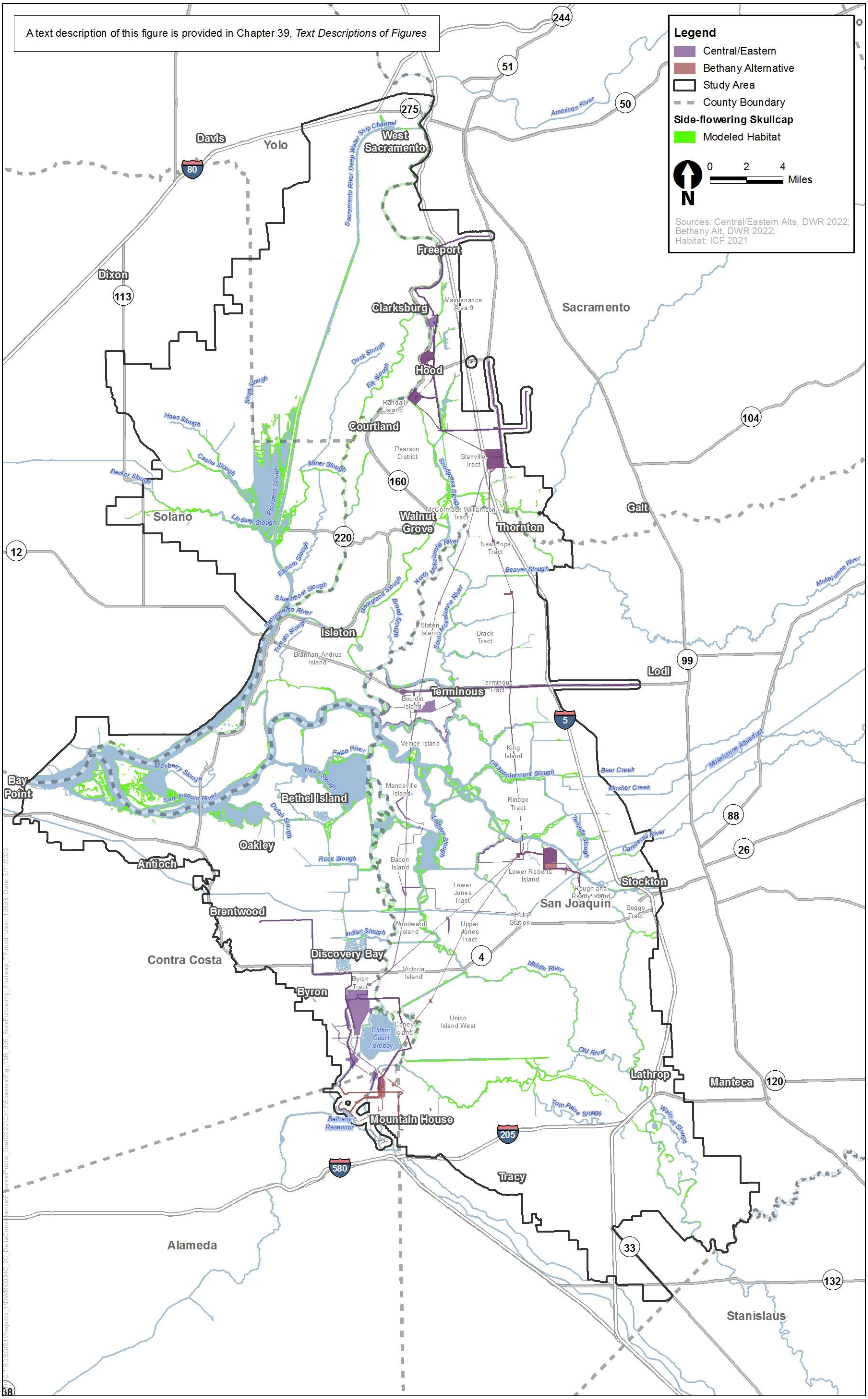

1
2 **Figure 13B.25-1. Side-Flowering Skullcap Modeled Habitat in the Study Area**

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13B.26 Long-Styled Sand-Spurrey (*Spergularia macrotheca* var. *longistyla*)

13B.26.1 Legal Status

Long-styled sand-spurrey is not listed under the federal ESA or CESA. This species' NatureServe Ranking in the California Natural Diversity Database is G5T2/S2, which means that globally the species is considered secure, but both globally and within the state of California the subspecies is considered imperiled (California Department of Fish and Wildlife 2020a:iii, 119).

Long-styled sand-spurrey has a California Rare Plant Rank of 1B.2, which indicates that it is rare or endangered in California and elsewhere, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2020a:iv, 119; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of Rare or Endangered under CEQA Guidelines Section 15125 (c) and/or Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.26.2 Range and Distribution within the Study Area

Long-styled sand-spurrey is endemic to California, and its known range includes the San Francisco Bay Area, Inner Northern Coast Ranges, and the Central Valley, including Alameda, Contra Costa, Napa, and Solano counties (Hartman and Rabeler 2012; California Department of Fish and Wildlife 2020b). There are 22 reported occurrences of long-styled sand-spurrey recorded in the CNDDB (California Department of Fish and Wildlife 2020b). There are also unconfirmed occurrence records from Mendocino and Fresno Counties (Calflora 2020). Little is known about the status of most of these occurrences, though all but one are presumed extant (California Department of Fish and Wildlife 2020b).

Six of the 22 reported occurrences of long-styled sand-spurrey are at least partially within the study area to the west and south of Clifton Court Forebay. All of these occurrences are presumed extant, but only two occurrences have been surveyed recently. These two occurrences (CNDDB 21 and 22) are southwest of Clifton Court Forebay on lands owned by the State of California and managed by DWR. Both of these occurrences were surveyed in 2017 and had populations ranging from 1,000 to 10,000 individuals (California Department of Fish and Wildlife 2020b).

13B.26.3 Habitat Requirements

Long-styled sand-spurrey occurs at elevations less than 837 feet above mean sea level (California Native Plant Society 2020). It grows in alkaline soils within meadows and seeps, marshes and swamps, vernal pool complexes, and grasslands (California Native Plant Society 2020; California Department of Fish and Wildlife 2020b). Occurrences within the study area appear to have an affinity for disturbed soils (California Department of Fish and Wildlife 2020b).

13B.26.4 Seasonal Patterns

Long-styled sand-spurrey is an annual herb that blooms from February to May (Hartman and Rabeler 2012).

13B.26.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.26.5.1 GIS Model Data Sources

The long-styled sand-spurrey model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Vernal Pool Data (Witham et al. 2014)
- East Bay RCIS Land Cover Dataset (ICF 2017)
- Sand Hill Repowering Land Cover Dataset (ICF 2018)

13B.26.5.2 Habitat Model Description

The habitat types modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.26-1.

13B.26.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.26.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Vernal pool complex
    - Vernal pool complex—Californian mixed annual/perennial freshwater vernal pool/swale bottomland
    - Vernal pool complex—*Allenrolfea occidentalis*
    - Vernal pool complex—*Distichlis spicata*
    - Vernal pool complex—*Frankenia salina*
    - Vernal pool complex—*Suaeda moquinii*
    - Vernal pools
    - Vernal pool complex—alkaline wetland

- Alkaline seasonal wetland complex
  - *Allenrolfea occidentalis*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Suaeda moquinii*
  - Alkaline Wetland

Soil types associated with long-styled sand-spurrey were determined by overlaying the occurrence locations from the CNDDB onto the Soil Survey Geographic Database (SSURGO) (Soil Survey Staff, Natural Resources Conservation Service 2020). Soils mapped at occurrence locations are strongly alkaline. Modeled habitat was limited to the following soil series in the statutory Delta where long-styled sand-spurrey has been documented:

- Solano
- Pescadero

13B.26.6 References Cited

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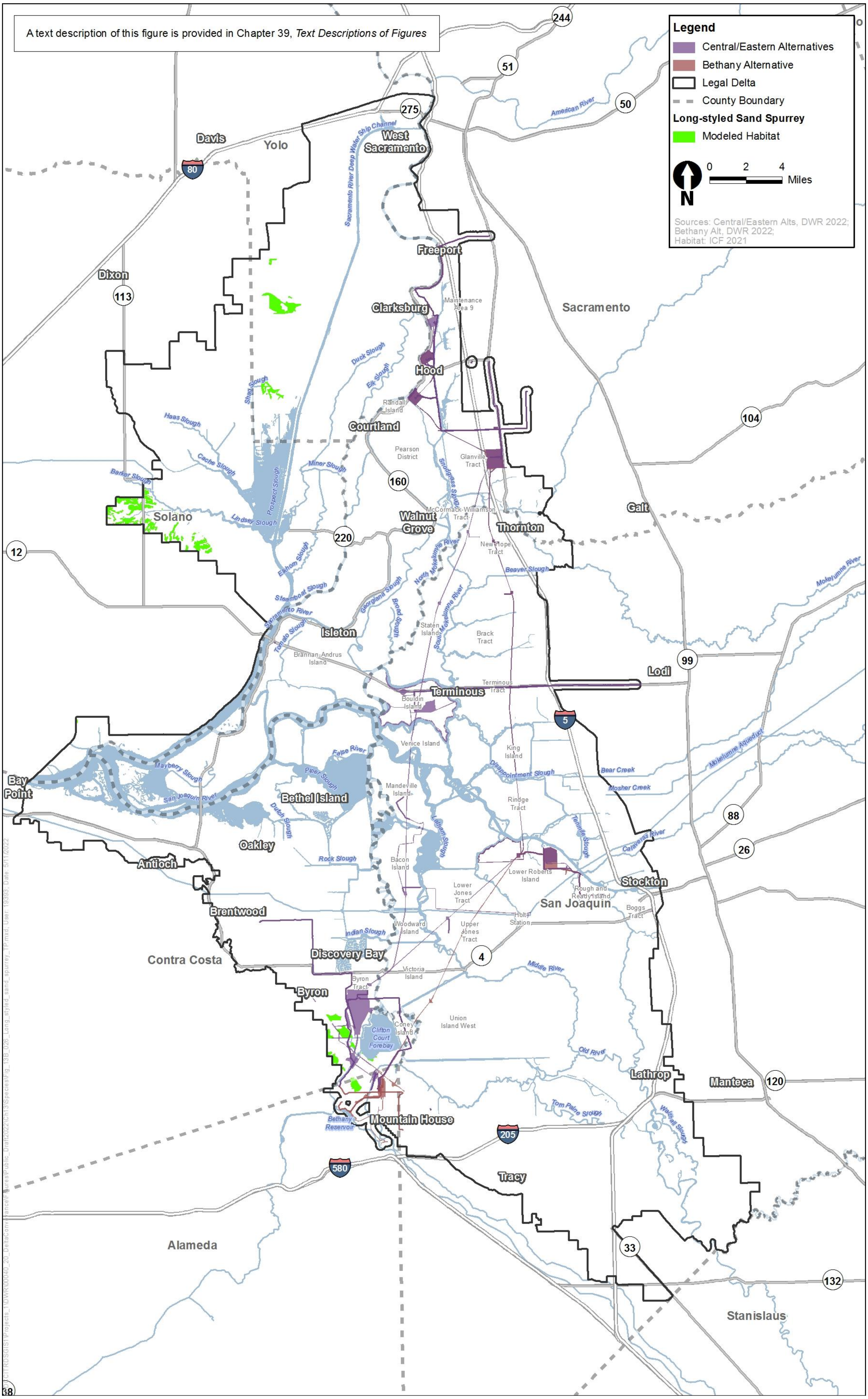

Figure 13B.26-1. Long-Styled Sand Spurrey Modeled Habitat in the Study Area

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13B.27 Suisun Marsh Aster (*Symphyotrichum lentum*)

13B.27.1 Legal Status

Suisun Marsh aster is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G2/S2, which means that within its global range (G) and within the state range (S) the species is considered imperiled (California Department of Fish and Wildlife 2020a:iii, 122).

Suisun Marsh aster has a California Rare Plant Rank of 1B.2, which indicates that it is rare, threatened, or endangered in California and elsewhere, and its state threat level (.2) indicates that it is fairly threatened in California (California Native Plant Society 2020; California Department of Fish and Wildlife 2020a:iv, 122). Plants with a rank of 1B may meet the definitions of rare or endangered under CEQA Guidelines Section 15125(c) and/or Section 15380 (California Department of Fish and Wildlife 2020a).

13B.27.2 Range and Distribution within the Study Area

The range of Suisun Marsh aster extends from Napa and Solano Counties in the north to San Joaquin County in the south, Contra Costa County in the west, and Sacramento County in the east (Allen 2012; California Department of Fish and Wildlife 2020b). It is endemic to Suisun Marsh and the Delta and is known from 175 occurrences, all presumed extant, the majority of which are within the study area (California Department of Fish and Wildlife 2020b).

Of the 175 reported occurrences of Suisun Marsh aster, 124 are located at least partially within the study area throughout the west and central Delta, with scattered occurrences in the north Delta (California Department of Fish and Wildlife 2020b). All of these occurrences are presumed extant, and many were surveyed by DWR during Delta Habitat Conservation and Conveyance surveys in 2009 (California Department of Water Resources 2011).

13B.27.3 Habitat Requirements

Suisun Marsh aster grows along tidal sloughs and streams on the upper margins of brackish and freshwater marshes, sometimes in relatively shaded areas either along north-facing banks or under overhanging trees (California Department of Fish and Wildlife 2020b; Witham and Kareofelas 1994:14). It often occurs with common reed (*Phragmites australis*), cattails (*Typha* spp.), bulrushes (*Schoenoplectus* spp.), nutsedge (*Cyperus* sp.), purpletop vervain (*Verbena bonariensis*), dallisgrass (*Paspalum dilatatum*), willows (*Salix* spp.), poison hemlock (*Conium maculatum*), giant reed (*Arundo donax*), white alder (*Alnus rhombifolia*), mugwort (*Artemisia douglasiana*), iris-leaved rush (*Juncus xiphioides*), rough bugleweed (*Lycopus asper*), smooth beggartick (*Bidens laevis*), and blackberry (*Rubus* spp.) (Witham and Kareofelas 1994:14; California Department of Water Resources 2011:2–11, 6–4). It has been observed in proximity to other rare plant species, including Mason's lilaeopsis (*Lilaeopsis masonii*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), Delta mudwort (*Limosella australis*), soft bird's-beak (*Chloropyron molle* subsp. *molle*), and woolly rose-mallow (*Hibiscus lasiocarpus*) (California Native Plant Society 2020; California Department of Fish and Wildlife 2020b; California Department of Water Resources 2011:2–11, 6–4; Witham and Kareofelas 1994:14).

13B.27.4 Seasonal Patterns

Suisun Marsh aster is a perennial, rhizomatous herb (Allen 2012). It blooms from May through November, depending on environmental conditions (California Native Plant Society 2020).

13B.27.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.27.5.1 GIS Model Data Sources

The Suisun Marsh aster model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.27.5.2 Habitat Model Description

The habitat types modeled for the species includes the natural communities and vegetation types within which the species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.27-1.

13B.27.5.2.1 Geographic Limits

The model encompasses the entire study area. Suisun Marsh Aster grows within the upper tidal zone, at the interface between tidal waters and terrestrial vegetation. Within the project area, the Suisun Marsh Aster model consists of tule- (*Schoenoplectus acutus*) and cattail-dominated tidal wetlands and other tidally influenced vegetation types, listed below, that extend 30 feet landward from the boundary of the tidal brackish emergent wetland and tidal freshwater perennial aquatic natural community vegetation types. Where tidal brackish emergent wetland and tidal freshwater perennial aquatic natural communities are absent, additional modeled habitat consists of the nontidal vegetation types geographically bounded by the area extending 30 feet landward from the boundary of the tidal channel vegetation type. This area is expected to encompass the channel banks at and above the upper tidal zone that experience daily tidal inundation.

13B.27.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Tidal perennial aquatic
  - Tidal channel
- Tidal brackish emergent wetlands
  - *Phragmites australis—Arundo donax*
  - *Schoenoplectus* (*acutus, californicus*)

    - *Typha* (*angustifolia, domingensis, latifolia*)
- Tidal freshwater perennial emergent wetlands
    - *Cynodon dactylon*
    - *Lepidium latifolium*
    - *Phragmites australis—Arundo donax*
    - *Schoenoplectus* (*acutus, californicus*)
    - Arid west freshwater emergent marsh
    - Freshwater emergent wetland
    - Naturalized warm-temperate riparian and wetland
- Grassland
    - *Centaurea* (*solstitialis, melitensis*)
    - *Conium maculatum—Foeniculum vulgare*
    - *Cynodon dactylon*
    - Mediterranean California naturalized annual and perennial grassland
- Developed
    - Semi-agricultural/right-of-way
- Agriculture
    - Upland herbaceous
- Valley foothill riparian
    - *Acer negundo*
    - *Alnus rhombifolia*
    - *Baccharis pilularis*
    - *Cephalanthus occidentalis*
    - *Cornus sericea*
    - *Eucalyptus* spp.—*Ailanthus altissima—Robinia pseudoacacia*
    - *Fraxinus latifolia*
    - *Juglans hindsii* and hybrids
    - *Lepidium latifolia*
    - *Platanus racemosa*
    - *Populus fremontii*
    - *Rosa californica*
    - *Quercus agrifolia*
    - *Quercus lobata*

- *Quercus wislizeni*
- *Robinia pseudoacacia*
- *Rubus armeniacus*
- *Salix exigua*
- *Salix gooddingii*
- *Salix laevigata*
- *Salix lasiolepis*
- *Salix lucida*
- *Sambucus nigra*
- *Vitis californica*
- Introduced North American Mediterranean woodland and forest
- Naturalized warm-temperate riparian and wetland
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian evergreen and deciduous woodland
- Southwestern North American riparian/wash scrub
- Scrub shrub wetland
- Vancouverian riparian deciduous forest

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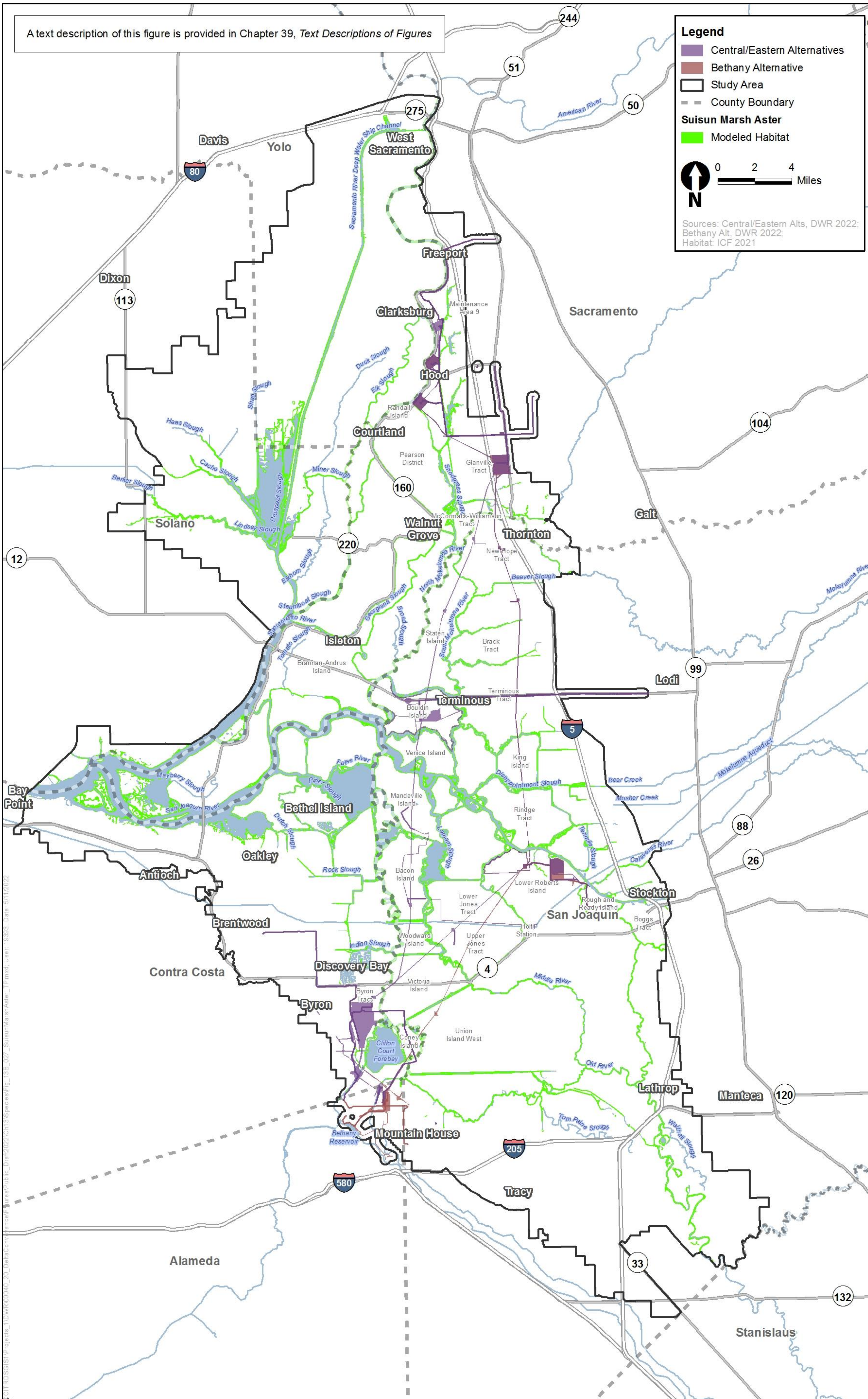

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2 **Figure 13B.27-1. Suisun Marsh Ashter Modeled Habitat in the Study Area**

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13B.28 Saline Clover (Trifolium hydrophilum)

13B.28.1 Legal Status

Saline clover is not listed under the ESA or CESA. Its NatureServe Ranking in the California Natural Diversity Database (CNDDB) is G2/S2, which means that it is considered imperiled both globally and within the state of California (California Department of Fish and Wildlife 2020a:iii, 125).

Saline clover has a California Rare Plant Rank of 1B.2, which indicates that it is rare or endangered in California and elsewhere, and its state threat level (.2) indicates that it is fairly threatened in California (California Department of Fish and Wildlife 2020a:iv, 125; California Native Plant Society 2020). Plants with a rank of 1B may meet the definitions of rare or endangered under CEQA Guidelines Section 15125 (c) and/or Section 15380 (California Department of Fish and Wildlife 2020a:i).

13B.28.2 Range and Distribution within the Study Area

Saline clover is endemic to California, and its current known range includes the Delta, the southern Sacramento Valley, the northwestern San Joaquin Valley, the San Francisco Bay Area, the Inner North Coast Ranges, and the Central Coast, including Alameda, Contra Costa, Lake, Monterey, Napa, Sacramento, San Benito, Santa Clara, Santa Cruz, San Joaquin, San Luis Obispo, San Mateo, Solano, and Yolo Counties (Vincent and Isely 2012; California Department of Fish and Wildlife 2020b). There are 56 reported occurrences of saline clover recorded in the CNDDB (California Department of Fish and Wildlife 2020b). Little is known about the status of most of these occurrences, though all but 10 are presumed extant. Seven reported occurrences of saline clover are considered extirpated and three are reported as possibly extirpated (California Department of Fish and Wildlife 2020b).

Seven of the 56 reported occurrences of saline clover are located at least partially within the study area. Most of these occurrences are located in the north Delta, including the Yolo Bypass Wildlife Area and North Stone Lake. One historical occurrence is located in the vicinity of Stockton. All occurrences of saline clover within the study area are presumed extant, but three of these represent historical collections that have not been confirmed by recent field work. The occurrences at North Stone Lake represent the largest known populations within the study area, ranging in size from approximately 30 plants to 26,000 plants (California Department of Fish and Wildlife 2020b).

13B.28.3 Habitat Requirements

Saline clover occurs at elevations less than 984 feet above mean sea level (California Native Plant Society 2020). It grows in marshes and swamps, vernal pools, and mesic alkaline soils within grasslands (California Native Plant Society 2020; California Department of Fish and Wildlife 2020b). Known occurrences within the study area all occur within vernal pool complexes and seasonally wet grasslands (California Department of Fish and Wildlife 2020b).

13B.28.4 Seasonal Patterns

Saline clover is an annual herb that blooms from April through June, depending on environmental conditions (Vincent and Isely 2012; California Native Plant Society 2020).

13B.28.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.28.5.1 GIS Model Data Sources

The saline clover model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.28.5.2 Habitat Model Description

The habitat types modeled for the species include the natural communities and vegetation types within which this species could occur. The extent of modeled habitat in the study area is depicted in Figure 13B.28-1.

13B.28.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.28.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Vernal pool complex
  - Vernal pool complex-Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Vernal pool complex-Mediterranean California naturalized annual and perennial grassland
  - Vernal pool complex-California annual herb/grass group
  - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Vernal pool
- Alkali seasonal wetland complex
  - Vernal pool complex—*Allenrolfea occidentalis*
  - Vernal pool complex—*Distichlis spicata*
  - Vernal pool complex—*Frankenia salina*

- Vernal pool complex—*Suaeda moquinii*
- Vernal pool complex—Western North American disturbed alkaline marsh and meadow
- Alkaline wetland

- Tidal brackish emergent wetland
  - Southwestern North American salt basin and high marsh group

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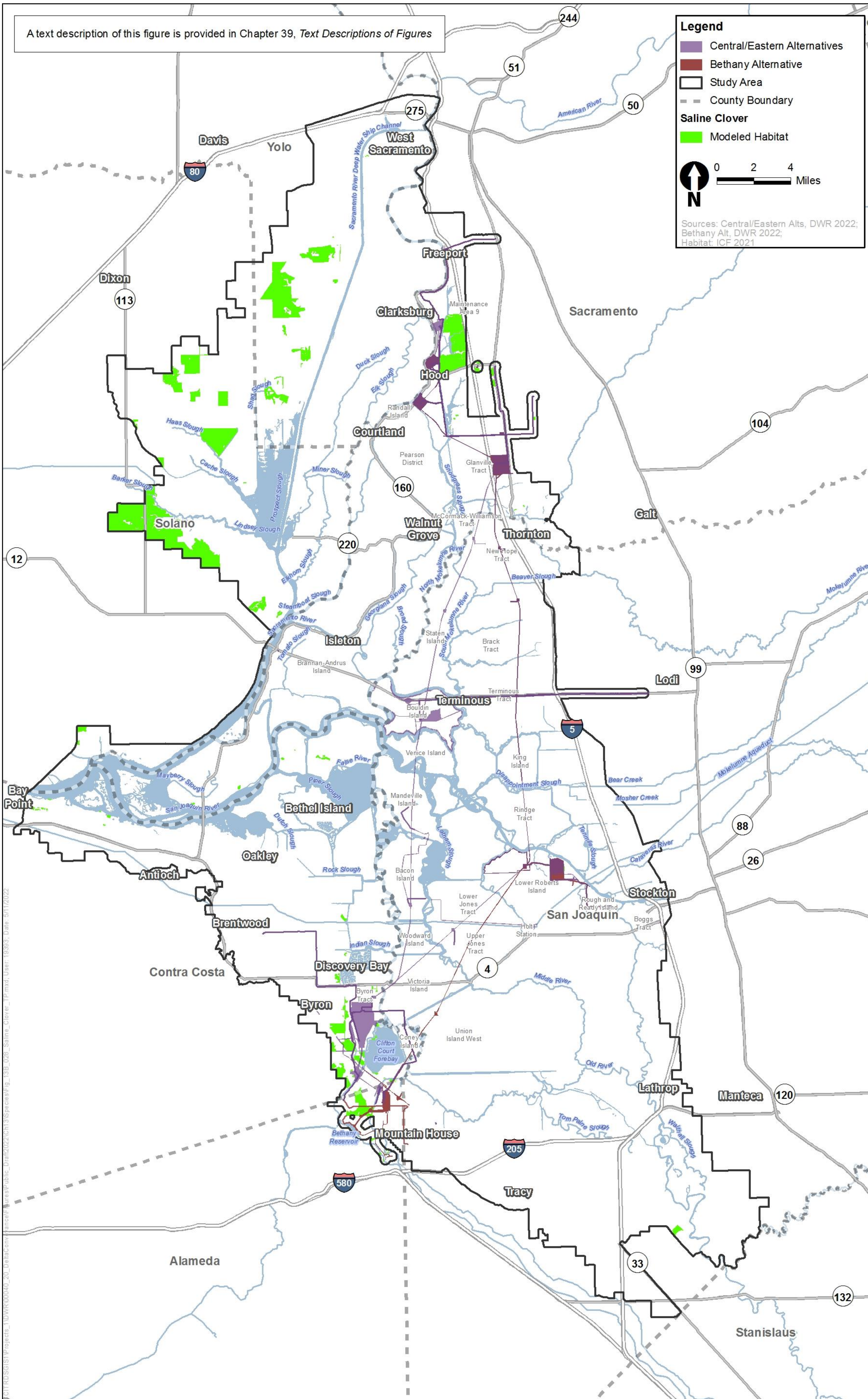

Figure 13B.28-1. Saline Clover Modeled Habitat in the Study Area

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13B.29 Caper-Fruited Tropidocarpum (*Tropidocarpum capparideum*)

13B.29.1 Legal Status

Caper-fruited tropidocarpum is not listed under either the ESA or CESA. This species' NatureServe Ranking in the CNDDB is G1/S1, which means that globally (G) and within the state (S) the species is considered critically imperiled (California Department of Fish and Wildlife 2020a:iii, 146). This status is a result of its extreme rarity (18 occurrences) and small population sizes that make it very vulnerable to extirpation.

The California Rare Plant Rank of 1B.1 for caper-fruited tropidocarpum indicates that it is rare, threatened, or endangered in California or elsewhere, and its state threat level (.1) indicates that it is severely threatened in California (California Department of Fish and Wildlife 2020:iv, 144; California Native Plant Society 2021). Plants with a rank of 1B may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 (California Department of Fish and Wildlife 2020:i).

13B.29.2 Range and Distribution within the Study Area

Caper-fruited tropidocarpum is endemic to California. Although known originally from the Diablo Range foothills from Contra Costa County to San Joaquin County, additional occurrences have been reported from the outer South Coast Ranges in Monterey and San Luis Obispo Counties (California Department of Fish and Wildlife 2021). The CNDDB reports 18 occurrences for this species, six of which are considered to be extirpated or possibly extirpated (California Department of Fish and Wildlife 2021).

There are six reported occurrences of caper-fruited tropidocarpum in the study area, four of which are extirpated or possibly extirpated, and two of which have not been relocated within the last 60 years (California Department of Fish and Wildlife 2021). A recently located occurrence near Bethany Reservoir State Recreation Area is extant (California Department of Fish and Wildlife 2021).

13B.29.3 Habitat Requirements

Caper-fruited tropidocarpum is found in grasslands, generally on clay soils (California Department of Fish and Wildlife 2021). Species associated with caper-fruited tropidocarpum are native and nonnative grasses and forbs, including fiddlenecks (*Amsinckia* spp.), filaree (*Erodium* spp.), silverpuffs (*Microseris* spp.), and blue dicks (*Dipterostemon capitatus*).

13B.29.4 Seasonal Patterns

Caper-fruited tropidocarpum is a small annual herb that blooms in March and April (Al-Shehbaz 2012; California Native Plant Society 2021).

13B.29.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.29.5.1 GIS Model Data Sources

The caper-fruited tropidocarpum model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)

13B.29.5.2 Habitat Model Description

The habitat modeled for the species includes the natural communities and vegetation types within which the species has been documented. The extent of modeled habitat in the study area is depicted in Figure 13B.29-1.

13B.29.5.2.1 Geographic Limits

The model encompasses the entire study area.

13B.29.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

- Mediterranean California naturalized annual and perennial grassland
- California annual herb/grass

Soil types associated with caper-fruited tropidocarpum were determined by overlaying the occurrence locations from the CNDDB onto the SSURGO database (Soil Survey Staff, Natural Resources Conservation Service 2020). Soils mapped at occurrence locations generally are clay or clay loams. The following soil series in the statutory Delta show occurrences of caper-fruited tropidocarpum and are used to focus the habitat model.

- Calla
- Carbona
- Rincon
- Linne
- Altamont

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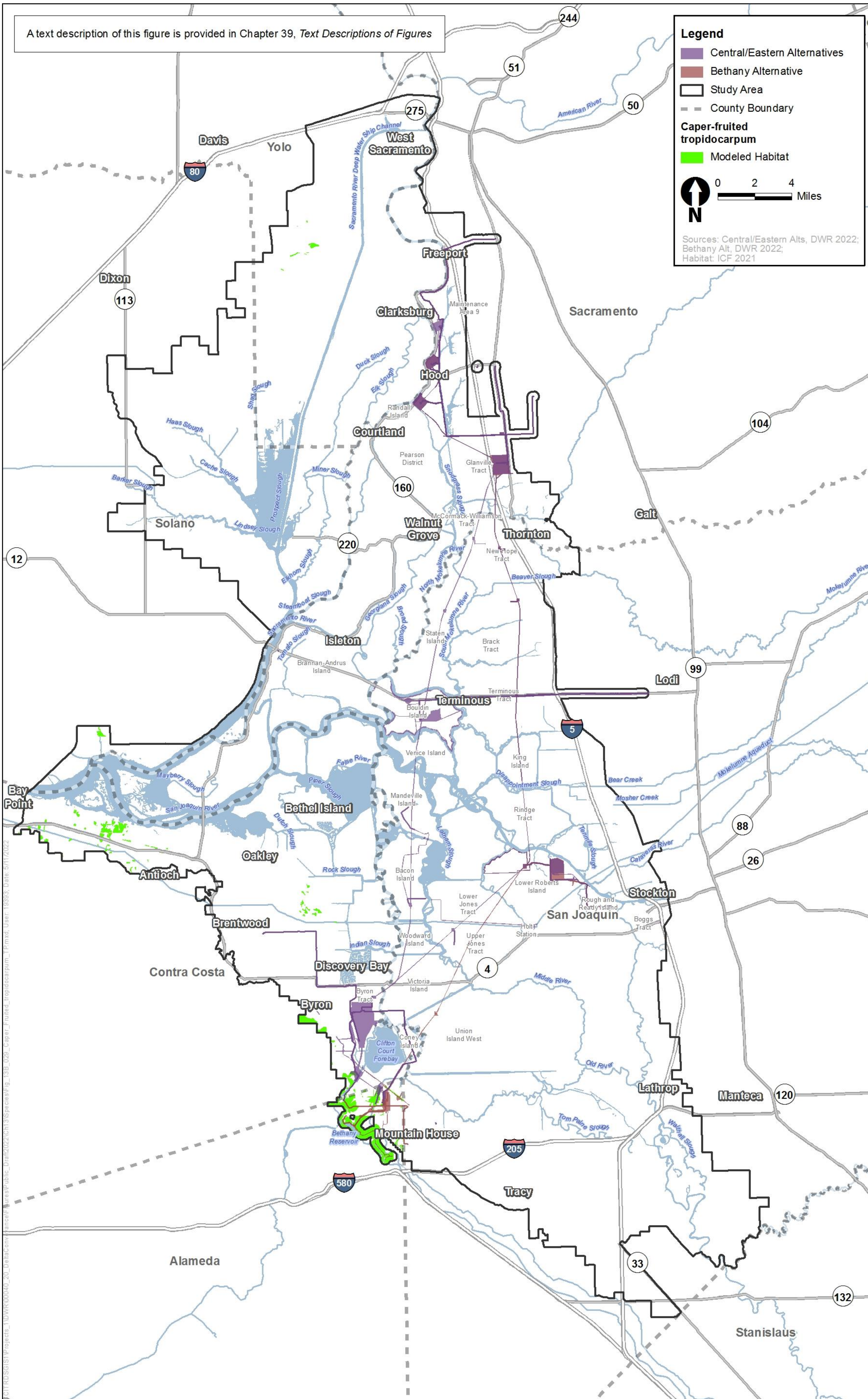

Figure 13B.29-1. Caper-Fruited Tropidocarpum Modeled Habitat in the Study Area

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13B.30 California Rare Plant Rank 3 and 4 Species

Section 15380 of the CEQA Guidelines applies to any species that meet the criteria for endangered, rare, or threatened, and California Rare Plant Rank (CRPR) rank 4 taxa may meet this definition under certain circumstances. Populations at the periphery of a species' range, populations in areas where the species is unusually uncommon or is in decline, and populations on unusual substrates or associated with a habitat that is declining in California are examples of circumstances where impacts on a CRPR 4 ranked species may be considered significant (California Native Plant Society 2020). In this section, CRPR 3 and 4 species from Appendix 13A, *Special-Status Species with Potential to Occur in the Study Area*, with potential to be affected by the proposed project, are evaluated to determine whether impacts on these species would be significant.

Specific models depicting the extent of potential habitat for CRPR 3 and 4 plants were not developed because specific information like that available for CRPR 1 and 2 plants is not available in the California Natural Diversity Database (CNDDB). Instead, models developed for habitats or for CRPR 1 and 2 species with similar habitat requirements were used to evaluate the potential for impacts on CRPR 3 and 4 plants.

13B.30.1 Crownscale (*Atriplex coronata* var. *coronata*)

13B.30.1.1 Legal Status

Crownscale is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G4T3/S3, which means that globally (G) the species is apparently secure and at a fairly low risk of extinction, that the variety (T) is vulnerable and at moderate risk for extinction, and that within the state (S) the variety is vulnerable and at moderate risk for extinction (California Department of Fish and Wildlife 2021:iii, 23).

The CRPR of 4.2 for crownscale indicates that it is a plant of limited distribution, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2021:viii, 23; California Native Plant Society 2020). Plants with a rank of 4 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.1.2 Range and Distribution within the Study Area

Crownscale is endemic to California, distributed from the southern Sacramento Valley to the western San Joaquin Valley and interior valleys of the Inner South Coast Ranges (Zacharias 2013). Calflora (2021) reports 237 records for crownscale in California. There are 48 records of crownscale in the seven Delta counties, and there are at least 5 records of crownscale in the study area near Byron and Discovery Bay.

13B.30.1.3 Habitat Requirements

Crownscale grows in habitats with alkaline soils, including alkaline grassland, alkaline meadow, and alkaline scrub, generally in open level areas on valley floors below 655 feet elevation (Zacharias 2013). It occurs in swales, on vernal pool margins, and in the adjacent upland habitat. Associated species include iodine bush (*Allenrolfea occidentalis*), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia salina*), alkali weed (*Cressa truxillensis*), bush seepweed (*Suaeda nigra*), and other alkali-tolerant species. It is also frequently associated with other annual *Atriplex* species. In the study area, alkaline seasonal wetlands are habitat for crownscale.

13B.30.1.4 Seasonal Pattern

Crownscale is an annual species that blooms between March and October.

13B.30.1.5 Species Habitat Suitability Model

A specific model for crownscale was not created to estimate potential impacts. Instead, potential project impacts to crownscale were based on the habitat mapping for alkaline seasonal wetland complex.

13B.30.2 Small-Flowered Morning-Glory (*Convolvulus simulans*)

13B.30.2.1 Legal Status

Small-flowered morning-glory is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G4/S4, which means that globally (G) the species is apparently secure and at a fairly low risk of extinction and that within the state (S) the variety is apparently secure and at a fairly low risk of extinction (California Department of Fish and Wildlife 2021:iii, 49).

The CRPR of 4.2 for small-flowered morning-glory indicates that it is a plant of limited distribution, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2021:iv, 49; California Native Plant Society 2020). Plants with a rank of 4 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.2.2 Range and Distribution within the Study Area

Small-flowered morning-glory is distributed widely in the southern and western part of California, including the southern Sierra Nevada Foothills, San Francisco Bay Area, San Joaquin Valley and adjacent southern Interior Coast Ranges, southern Outer South Coast Ranges, Western Transverse Ranges, South Coast, Channel Islands, and Peninsular Ranges (Preston 2012). It also ranges into Baja California. Calflora (2021) reports 477 records for small-flowered morning-glory in California. There are 15 records of small-flowered morning-glory in the seven Delta counties. However, there are no records of the species within the study area.

13B.30.2.3 Habitat Requirements

Small-flowered morning-glory grows in grasslands and grassy openings in chaparral and coastal scrub, typically on clay soils, and sometimes in association with serpentine seeps (Preston 2012). Although the species sometimes occurs in serpentine soils, this habitat is not present in the study area. Species associated with small-flowered morning-glory are nonnative annual grasses and other species typically found in grasslands, such as lupines (*Lupinus* spp.), fiddlenecks (*Amsinckia* spp.), phacelias (*Phacelia* spp.), popcorn flowers (*Plagiobothrys* spp.), and filarees (*Erodium* spp.). It has been found at elevations between 100 and 2,870 feet. In the study area, grasslands with clay soils are potential habitat for this species.

13B.30.2.4 Seasonal Patterns

Small-flowered morning-glory is an annual species that blooms between April and June.

13B.30.2.5 Species Habitat Suitability Model

A specific model for small-flowered morning-glory was not created to estimate potential project impacts. Instead, impacts to small-flowered morning-glory were based on the model for shining navarretia, which has similar habitat requirements.

13B.30.3 Stinkbells (*Fritillaria agrestis*)

13B.30.3.1 Legal Status

Stinkbells is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G3/S3, which means that globally (G) and within the state (S) the species is vulnerable with a moderate risk of extinction (California Department of Fish and Wildlife 2021:iii, 80).

The CRPR of 4.2 for stinkbells indicates that it is a plant of limited distribution, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2021:iv,49; California Native Plant Society 2020). Plants with a rank of 4 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.3.2 Range and Distribution within the Study Area

Stinkbells is endemic to California, where it occurs in the outer North Coast Ranges, the Sierra Nevada Foothills, the Central Valley, and central western California (McNeal and Ness 2012). Calflora (2021) reports 303 records for stinkbells in California, and there are 77 records of the species within the seven Delta counties. Most of the records in Alameda and Contra Costa Counties from the Diablan foothills west of the study area. Within the study area, there is one record of the species from near Byron.

13B.30.3.3 Habitat Requirements

The species grows in grasslands, foothill woodlands, and open grassy areas in chaparral, between 30 and 5,100 feet elevation (McNeal and Ness 2012). Species associated with stinkbells are nonnative annual grasses and other species typically found in grasslands, such as sanicles (*Sanicula* spp.), blue dicks (*Dipterostemon capitatus*), Johnny-jump-up (*Viola pedunculata*), cut-leaved geranium (*Geranium dissectum*), common vetch (*Vicia sativa*), and filarees (*Erodium* spp.).

13B.30.3.4 Seasonal Patterns

Stinkbells is an herbaceous perennial that blooms from March to June.

13B.30.3.5 Species Habitat Suitability Model

A specific model for stinkbells was not created to estimate potential project impacts. Instead, impacts on stinkbells are based on the model for shining navarretia, which has similar habitat requirements.

13B.30.4 Hogwallow Starfish (*Hesperevax caulescens*)

13B.30.4.1 Legal Status

Hogwallow starfish is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G3/S3, which means that globally (G) and within the state (S) the species is vulnerable with a moderate risk of extinction (California Department of Fish and Wildlife 2021:iii, 80).

The CRPR of 4.2 for hogwallow starfish indicates that it is a plant of limited distribution, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2021:iv, 49; California Native Plant Society 2020). Plants with a rank of 4 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.4.2 Range and Distribution within the Study Area

Hogwallow starfish is endemic to California, where it occurs in the Interior North Coast Ranges, Cascade Range Foothills, Sierra Nevada Foothills, Great Valley, and Outer South Coast Ranges (Morefield 2012a). Calflora (2021) reports 175 records for hogwallow starfish in California, and there are 65 records of the species in the seven Delta counties. In the study area, the only records for the species are in Solano and Yolo Counties.

13B.30.4.3 Habitat Requirements

Hogwallow starfish grows in clay soils of vernal pools and flats and on slopes, sometimes on serpentine soil (Morefield 2012a). It occurs at elevations below 1,660 feet. Species associated with hogwallow starfish include silverpuff species (*Microseris* spp.), popcornflowers (*Plagiobothrys* spp.), Q-tips (*Micropus californicus*), peppergrass species (*Lepidium nitidum*, *L. latipes*), clovers (*Trifolium* spp.), and blow-wives (*Achyrachaena mollis*).

13B.30.4.4 Seasonal Patterns

Hogwallow starfish is an annual species that blooms from March to June.

13B.30.4.5 Species Habitat Suitability Model

A specific model for hogwallow starfish was not created to estimate potential project impacts. Instead, potential impacts on hogwallow starfish were based on habitat mapping for vernal pool complex.

13B.30.5 Ferris' Goldfields (*Lasthenia ferrisiae*)

13B.30.5.1 Legal Status

Ferris' goldfields is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G3/S3, which means that globally (G) and within the state (S) the species is vulnerable with a moderate risk of extinction (California Department of Fish and Wildlife 2021:iii, 96).

The CRPR of 4.2 for Ferris' goldfields indicates that it is a plant of limited distribution, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of

Fish and Wildlife 2021:iv, 96; California Native Plant Society 2020). Plants with a rank of 4 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.5.2 Range and Distribution within the Study Area

Ferris' goldfields is endemic to California, where it is distributed along the western half of the San Joaquin Valley, ranging north to the southern Sacramento Valley (Chan and Ornduff 2012). Calflora (2021) reports 129 records for Ferris' goldfields in California, and there are 36 records of the species in the seven Delta counties. In the study area, there are records from Clifton Court Forebay, Byron, and Discovery Bay.

13B.30.5.3 Habitat Requirements

Ferris' goldfields grows in alkaline vernal pools and flats associated with iodine bush (*Allenrolfea occidentalis*) and saltgrass (*Distichlis spicata*) below 2,300 feet elevation (Chan and Ornduff 2012).

13B.30.5.4 Seasonal Patterns

13B.30.5.5 Ferris' goldfields is an annual species that blooms from February to May. Species Habitat Suitability Model

A specific model for Ferris' goldfields was not created to evaluate potential impacts. Instead, potential project impacts on Ferris' goldfields were based on the habitat mapping for alkaline seasonal wetland complex.

13B.30.6 Little Mousetail (*Myosurus minimus* subsp. *apus*)

13B.30.6.1 Legal Status

Little mousetail is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G5T2Q/S2, which means that globally (G) the species is secure, but that the subspecies is vulnerable and at high risk of extinction, and within the state (S) the subspecies is vulnerable and at high risk of extinction (California Department of Fish and Wildlife 2021:iii, 96). However, the "Q" modifier indicates that there is taxonomic uncertainty about the subspecies.

The CRPR of 3.1 for little mousetail indicates that more information is needed about the taxonomy to assign it to another list or to drop it from the CRPR listing, and its state threat level (.1) indicates that it is seriously threatened in California (California Department of Fish and Wildlife 2021:iv, 96; California Native Plant Society 2020). Plants with a rank of 3 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.6.2 Range and Distribution Within The Study Area

Little mousetail is mostly known from coastal Southern California, although there are scattered records for it from across the state. Calflora (2021) reports 127 records for little mousetail in California, and there are 20 records of the species in the seven Delta counties. In the study area, there are records from Clifton Court Forebay and Byron. The taxonomic status of little mousetail has been questioned, and it may a hybrid rather than a subspecies (Whittemore 1997:135-136).

13B.30.6.3 Habitat Requirements

In the study area, little mousetail occurs in grasslands and vernal pools with alkaline soils (Calflora 2021).

13B.30.6.4 Seasonal Patterns

Little mousetail is an annual that blooms from March to June.

13B.30.6.5 Species Habitat Suitability Model

A specific model for little mousetail was not created to evaluate potential impacts. Instead, potential project impacts on little mousetail were based on the habitat mapping for alkaline seasonal wetland complex.

13B.30.7 Cotula Navarretia (*Navarretia cotulifolia*)

13B.30.7.1 Legal Status

Cotula navarretia is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G4/S4, which means that globally (G) and within the state (S) the species is apparently secure and at a fairly low risk of extinction (California Department of Fish and Wildlife 2021:iii, 49).

The CRPR of 4.2 for Cotula navarretia indicates that it is a plant of limited distribution, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2021:iv, 49; California Native Plant Society 2020). Plants with a rank of 4 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.7.2 Range and Distribution within the Study Area

Cotula navarretia is endemic to California, where it is distributed in the Interior North Coast Ranges, Sacramento Valley, San Francisco Bay Area, and Interior South Coast Ranges (Johnson 2013). Calflora (2021) reports 124 records for cotula navarretia in California, and there are 57 records of the species in the seven Delta counties. In the study area, there 3 records from the study area near Byron Hot Springs and along Bruns Road (Calflora 2021).

13B.30.7.3 Habitat Requirements

Cotula navarretia grows in chaparral, woodlands, and grasslands, on heavy clay soils (Johnson 2013).

13B.30.7.4 Seasonal Patterns

Cotula navarretia is an annual species that blooms in May and June.

13B.30.7.5 Species Habitat Suitability Model

A specific model for cotula navarretia was not created to evaluate potential impacts. Instead, impacts to cotula navarretia are based on the model for shining navarretia, which has similar habitat requirements.

13B.30.8 Delta Woolly Marbles (*Psilocarphus brevissimus* var. *multiflorus*)

Delta woolly marbles is not listed under either the ESA or CESA. Its NatureServe Ranking in the CNDDB is G4T3/S3, which means that globally (G) the species is apparently secure and at a fairly low risk of extinction, that the variety (T) is vulnerable and at moderate risk for extinction, and that within the state (S) the variety is vulnerable and at moderate risk for extinction (California Department of Fish and Wildlife 2021:iii, 136).

The CRPR of 4.2 for Delta woolly marbles indicates that it is a plant of limited distribution, and its state threat level (.2) indicates that it is moderately threatened in California (California Department of Fish and Wildlife 2021:viii, 136; California Native Plant Society 2020). Plants with a rank of 4 may meet the definitions of rare, threatened, or endangered as defined in CEQA Section 15380 under some conditions (California Native Plant Society 2020).

13B.30.8.1 Range and Distribution within the Study Area

Delta woolly marbles is known from widely scattered occurrences in the Sacramento Valley, northern San Joaquin Valley, and San Francisco Bay Area (Morefield 2012b). Calflora (2021) reports 36 records for Delta woolly marbles in California, with 22 records of the species in the seven Delta counties. There are 3 records in the study area, all in the Jepson Prairie area (Calflora 2021).

13B.30.8.2 Habitat Requirements

Delta woolly marbles is associated with vernal pools (Morefield 2012b).

13B.30.8.3 Seasonal Patterns

Delta woolly marbles is an annual species that bloom in May and June.

13B.30.8.4 Species Habitat Suitability Model

A specific model for Delta woolly marbles was not created to estimate potential project impacts. Instead, impacts on Delta woolly marbles are based on habitat mapping for vernal pool complex.

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13B.31 Conservancy Fairy Shrimp (*Branchinecta conservatio*)

13B.31.1 Legal Status

Conservancy fairy shrimp is listed as endangered under the ESA. Critical habitat was designated for the species in 2006 (71 FR 7118–7316).

13B.31.2 Range and Distribution within the Study Area

Conservancy fairy shrimp is endemic to California, and its known range is limited to the Central Valley, with the exception of one population in Ventura County (U.S. Fish and Wildlife Service 2012:2). The U.S. Fish and Wildlife Service acknowledges 10 populations of Conservancy fairy shrimp, which includes the Yolo Bypass Wildlife Area in Yolo County and Jepson Prairie in Solano County (U.S. Fish and Wildlife Service 2012:3).

Within the study area, the range of the species is limited to areas of suitable habitat in Solano and Yolo Counties, which is based on the populations acknowledged by USFWS in the study area (U.S. Fish and Wildlife Service 2012:3), current CNDDB records (California Department of Fish and Wildlife 2020), and based on past survey results for other areas of vernal pool habitat in the study area, which include DWR surveys at Stone Lakes National Wildlife Refuge and the area around Clifton Court Forebay (California Department of Water Resources 2011:2-16–2-20).

Five occurrences of Conservancy fairy shrimp are within the study area, four in Solano County in the Jepson Prairie area (3) and in an area just west of the Montezuma Hills (1), and one in Yolo County in the Yolo Bypass Wildlife Area (California Department of Fish and Wildlife 2020).

13B.31.3 Habitat Requirements

Conservancy fairy shrimp are found in vernal pools that are typically large, turbid playa pools that may be inundated well into the summer (U.S. Fish and Wildlife Service 2012:2). Conservancy fairy shrimp require an average of 49 days to reach maturity and are known to survive in temperatures ranging from 41°F to 75°F (Eriksen and Belk 1999:88-89).

13B.31.4 Seasonal Patterns

Conservancy fairy shrimp hatch from cysts that remain in the soil until the first winter rains and complete their lifecycle by early summer when warm water temperatures and drying conditions render the habitat unsuitable. Cysts are shed by mated females and remain in the soil until the following winter (Eriksen and Belk 1999:88).

13B.31.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.31.5.1 GIS Model Data Sources

The Conservancy fairy shrimp model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.31.5.2 Habitat Model Description

The Conservancy fairy shrimp model is limited to vernal pools. The extent of modeled habitat in the study area is depicted in Figure 13B.31-1.

13B.31.5.2.1 Geographic Limits

The model is limited to Solano and Yolo counties where there are known populations (U.S. Fish and Wildlife Service 2012:3; California Department of Fish and Wildlife 2020).

13B.31.5.2.2 Additional Model Parameters

Modeled habitat is limited to vernal pool complex (all types).

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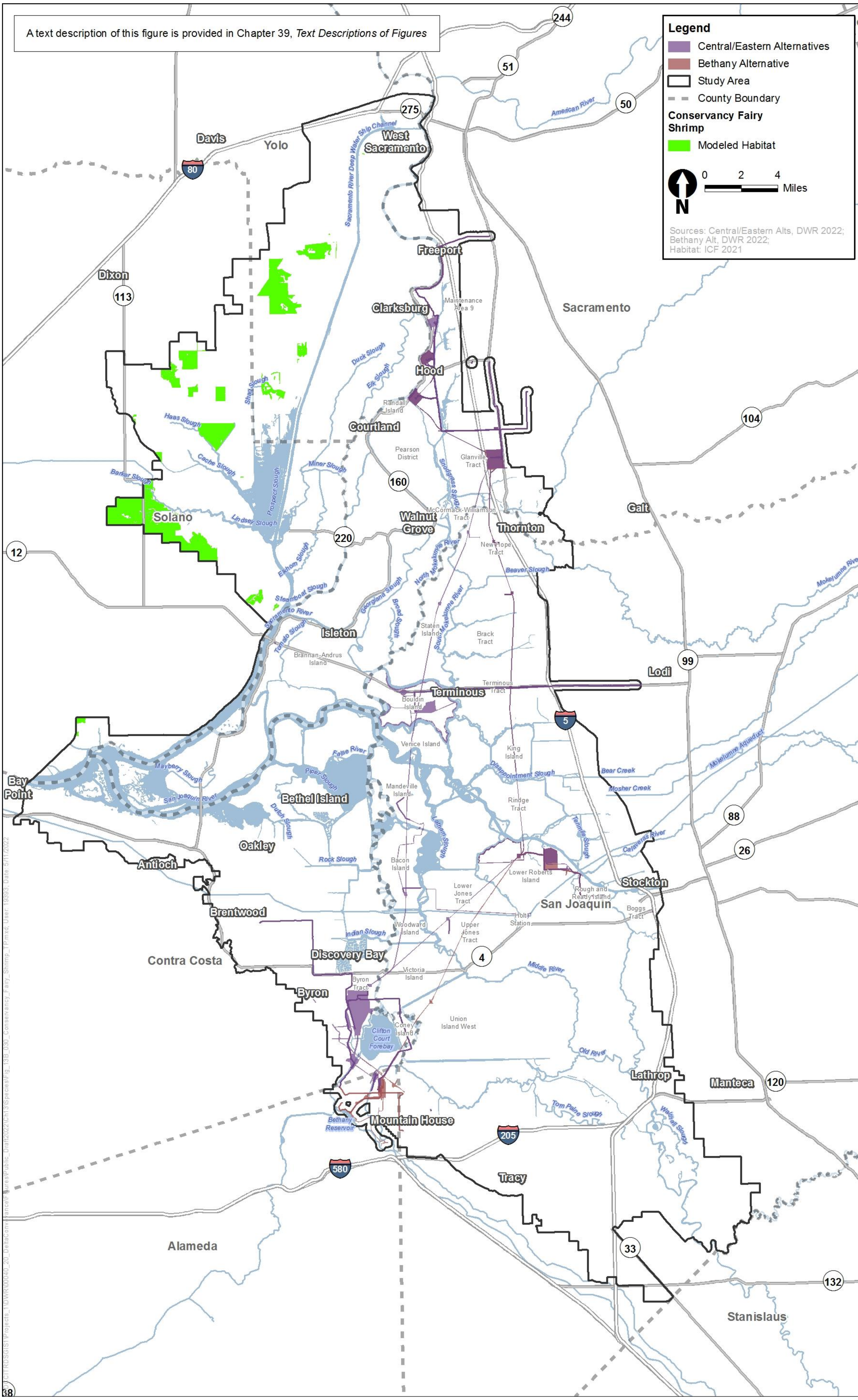

Figure 13B.31-1. Conservancy Fairy Shrimp Modeled Habitat in the Study Area

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13B.32 Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

13B.32.1 Legal Status

Vernal pool fairy shrimp is listed as threatened under the federal ESA throughout its range (59 FR 48136). Critical habitat for vernal pool fairy shrimp was designated in 2006 (U.S. Fish and Wildlife Service 2020).

13B.32.2 Range and Distribution within the Study Area

There is little information about the historical range of vernal pool fairy shrimp. The species is currently known to occur in a wide range of vernal pool habitats in the central western, southwestern, and Central Valley areas of California, and in two vernal pool habitats in the Agate Desert area of Jackson County, Oregon (U.S. Fish and Wildlife Service 2005:II-191–II-192). It has the largest geographical range of listed fairy shrimp in California, but is seldom abundant (U.S. Fish and Wildlife Service 2005:II-194). The species is currently found at locations across the Central Valley from Shasta County to Tulare and Kings Counties, in the central and southern Coast Ranges from Napa County to Los Angeles County, and inland in western Riverside County, California (U.S. Fish and Wildlife Service 2005:II-194–II-195; California Department of Fish and Wildlife 2020).

Within the study area, vernal pool fairy shrimp has the potential to occur throughout but is generally limited to known areas of suitable habitat in and around Stone Lakes in Sacramento County, within the Yolo Bypass, within Solano County, and in eastern Contra Costa County near Clifton Court Forebay.

There are 19 CNDDB records for vernal pool fairy shrimp in the study area, which occur in the Stone Lakes National Wildlife Refuge (1), in the Yolo Bypass (8), in Jepson Prairie in Solano County (2), in southern Solano County near Montezuma Hills (1), in Antioch (1), and in the area of Clifton Court Forebay (6) (California Department of Fish and Wildlife 2020).

13B.32.3 Habitat Requirements

Vernal pool fairy shrimp is entirely dependent on the aquatic environment provided by the temporary waters of natural vernal pool and playa pool ecosystems as well as the artificial environments of ditches and tire ruts (59 FR 48136; U.S. Fish and Wildlife Service 2007:24, 26). The temporary waters fill directly from precipitation as well as from surface runoff and perched groundwater from their watersheds (U.S. Fish and Wildlife Service 2007:30). The watershed extent that is necessary for maintaining the hydrological functions of the temporary waters depends on a number of complex factors including soil properties, the existence of a perched aquifer overlying an impermeable soil layer, slope, effects of vegetation on evapotranspiration rates, compaction of surface soils by grazing animals, and other factors (U.S. Fish and Wildlife Service 2007:30).

The temporary waters that are habitat for the vernal pool fairy shrimp are extremely variable and range from clear sandstone pools to turbid, alkaline vernal pools (U.S. Fish and Wildlife Service 2005:II-196). Vernal pool fairy shrimp have also been found in degraded vernal pool habitats and artificially created seasonal pools (Helm 1998:132). Vernal pool fairy shrimp commonly co-occur with other fairy shrimp and vernal pool tadpole shrimp (*Lepidurus packardi*) (U.S. Fish and Wildlife Service 2005:II-197).

In a study using large plastic pools to simulate natural vernal pools, Helm found that vernal pool fairy shrimp can reproduce as early as 18 days following hatching, with the average being 40 days (Helm 1998:133). Site-specific conditions, primarily water temperature, have been shown to affect time to reach reproductive maturity (Helm 1998:132).

13B.32.4 Seasonal Patterns

Vernal pool fairy shrimp are adapted to the environmental conditions of their ephemeral habitats. One adaptation is the ability of vernal pool fairy shrimp cysts to remain dormant in the soil when their vernal pool habitats are dry. The cysts survive the hot, dry summers and cold, wet winters that follow until vernal pools and swales fill with rainwater and conditions are right for hatching. When the pools refill in the same or subsequent seasons, some, but not all, of the cysts may hatch. The cyst bank in the soil may comprise cysts from several years of breeding (U.S. Fish and Wildlife Service 2005:II-195; 59 FR 48136). Beyond inundation of the habitat, the specific cues for hatching are unknown, although temperature and electrical conductivity (solute concentration) are believed to play a large role (Helm 1998:132).

13B.32.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.32.5.1 GIS Model Data Sources

The vernal pool fairy shrimp model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.32.5.2 Habitat Model Description

The vernal pool fairy shrimp habitat model includes vernal pools, alkaline seasonal wetlands, and some seasonal wetlands. Vernal pool complexes in the western part of the study area often occur in a mosaic with alkaline seasonal wetlands; many of the species that occur in the vernal pool complex also occur in the alkaline seasonal wetland complex within this mosaic of natural communities. The modeled habitat relies on both aquatic resource delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the Great Valley Vernal Pool Data, the Sand Hill Wind Repowering SEIR Land Cover Dataset, the East Bay RCIS 2017 Land Cover Dataset, the Delta Vegetation and Land Use Update, and the Great Valley Ecoregion 2018 Vegetation dataset. The extent of modeled habitat in the study area is depicted in Figure 13B.32-1.

13B.32.5.2.1 Geographic Limits

The entire study area.

13B.32.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the DWR 2020 Aquatic Resources Delineation (Witham et al. 2014; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
    - Alkaline wetland
    - Vernal Pool

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Alkaline seasonal wetland complex
    - Alkaline wetland
- Other seasonal wetlands
    - Seasonal wetlands

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the Delta Vegetation and Land Use Update (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019):

- Vernal pool complex
    - All types

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Alkaline seasonal wetland complex
    - All types

Outside the delineation study area, density class information from the Great Valley Vernal Pool Data (Witham at al. 2014) was used to report an estimated wetted acre. This includes the following cover classes: <2%, 2%–5%, 5%–10%, >10%, and 100% for individual pools. In the statutory Delta, the cover classes reported only go as high as 5%–10%.

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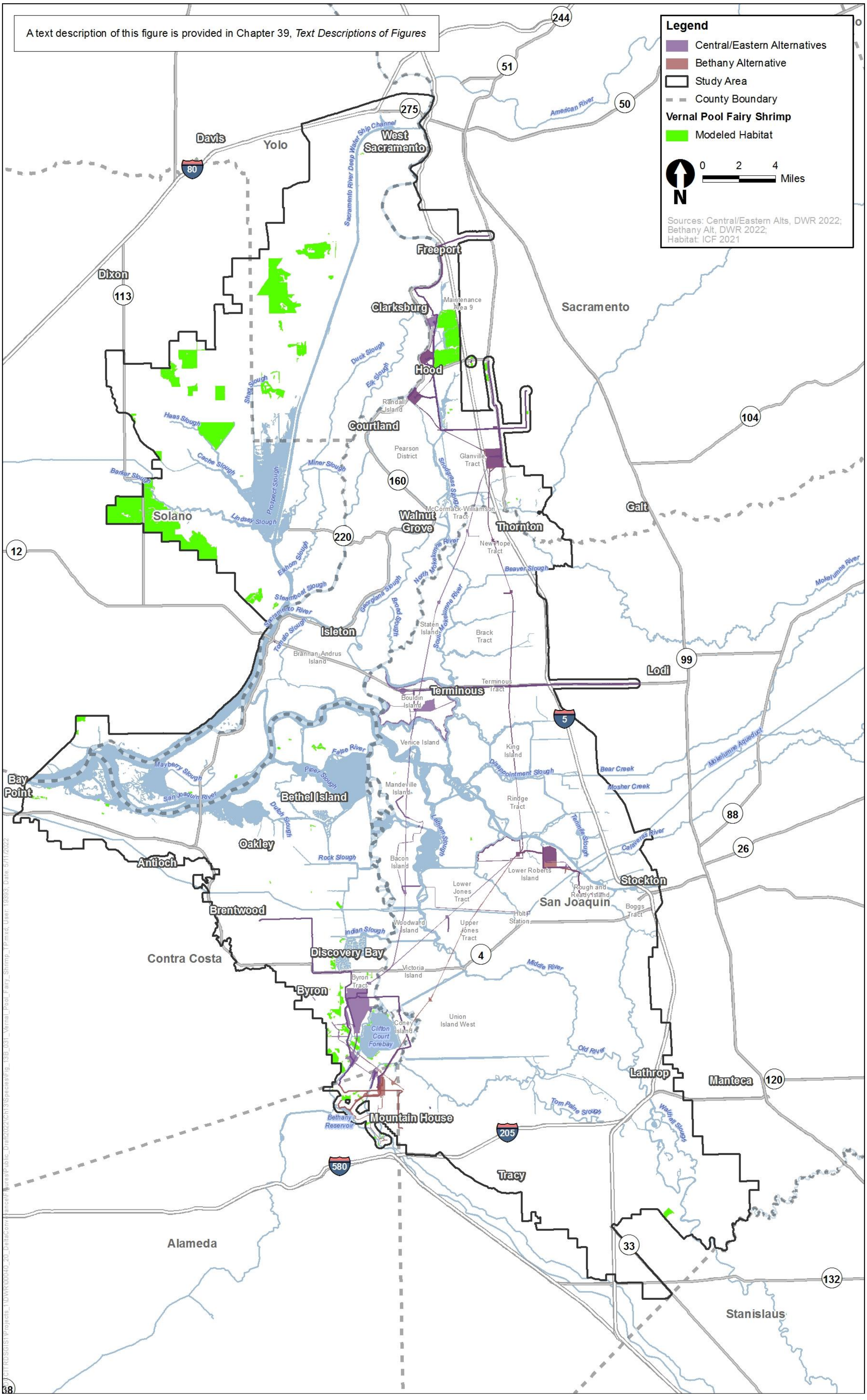

Figure 13B.32-1. Vernal Pool Fairy Shrimp Modeled Habitat in the Study Area

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13B.33 Midvalley Fairy Shrimp (*Branchinecta mesovallensis*)

13B.33.1 Legal Status

Midvalley fairy shrimp has a NatureServe ranking of G2/S2S3 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:11).

13B.33.2 Range and Distribution within the Study Area

Midvalley fairy shrimp is endemic to California, and its known range is limited to the Central Valley (U.S. Fish and Wildlife Service 2005:II-211).

Within the study area, midvalley fairy shrimp has the potential to occur throughout but is generally limited to known areas of suitable habitat in and around Stone Lakes in Sacramento County, within the Yolo Bypass, within Solano County, and in eastern Contra Costa County near Clifton Court Forebay.

There are seven occurrences of midvalley fairy shrimp in the study area, which are located in the Yolo Bypass (3), in Jepson Prairie in Solano County (1), and in the vicinity of Clifton Court Forebay (3) (California Department of Fish and Wildlife 2020b).

13B.33.3 Habitat Requirements

Midvalley fairy shrimp are found in vernal pools; primarily small, short-lived pools and grass-bottomed swales that have an average ponding depth of 10 centimeters (Helm 1998:137). This species is unusually tolerant of warm water temperatures and has been observed in pools as warm as 89°F (Helm 1998:131).

13B.33.4 Seasonal Patterns

Like other fairy shrimp, midvalley fairy shrimp hatch from cysts that remain in the soil until winter rains inundate vernal pool habitat; however, compared to other fairy shrimp, they mature comparatively quickly, in as little as 8 days (U.S. Fish and Wildlife Service 2005:II-211).

13B.33.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.33.5.1 GIS Model Data Sources

The midvalley fairy shrimp model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.33.5.2 Habitat Model Description

The midvalley fairy shrimp habitat model includes vernal pools, alkaline seasonal wetlands, and some seasonal wetlands. Vernal pool complexes in the western part of the study area often occur in a mosaic with alkaline seasonal wetlands; many of the species that occur in the vernal pool complex also occur in the alkaline seasonal wetland complex within this mosaic of natural communities. The modeled habitat relies on both aquatic resource delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the Great Valley Vernal Pool Data, the Sand Hill Wind Repowering SEIR Land Cover Dataset, the East Bay RCIS 2017 Land Cover Dataset, the Delta Vegetation and Land Use Update, and the Great Valley Ecoregion 2018 Vegetation dataset. The extent of modeled habitat in the study area is depicted in Figure 13B.33-1.

13B.33.5.2.1 Geographic Limits

The entire study area.

13B.33.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the DWR 2020 Aquatic Resources Delineation (Witham et al. 2014; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
  - Alkaline wetland
  - Vernal pool

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Alkaline seasonal wetland complex
  - Alkaline wetland
- Other seasonal wetlands
  - Seasonal wetlands

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the Delta Vegetation and Land Use Update (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019):

- Vernal pool complex
    - All types

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Alkaline seasonal wetland complex
    - All types

Outside the delineation study area, density class information from the Great Valley Vernal Pool Data (Witham at al. 2014) was used to report an estimated wetted acre. This includes the following cover classes: <2%, 2%–5%, 5%–10%, >10%, and 100% for individual pools. In the statutory Delta, the cover classes reported only go as high as 5%–10%.

13B.33.6 References Cited

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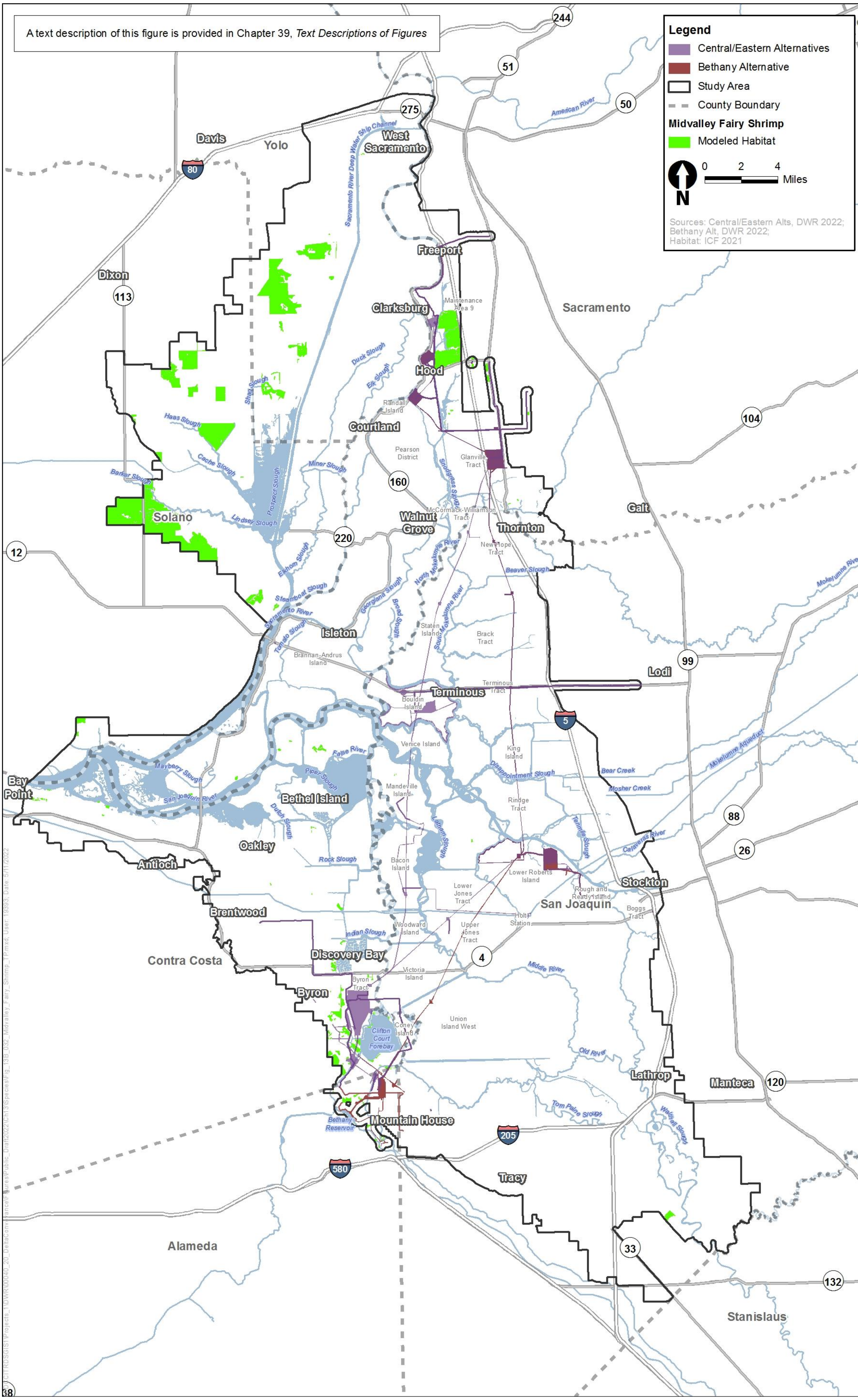

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2 **Figure 13B.33-1. Midvalley Fairy Shrimp Modeled Habitat in the Study Area**

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13B.34 California Linderiella (*Linderiella occidentalis*)

13B.34.1 Legal Status

California linderiella has a NatureServe ranking of G2G3/S2S3 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:11).

13B.34.2 Range and Distribution within the Study Area

California linderiella is endemic to California; Its known range is limited to the Central Valley and Coast Ranges (U.S. Fish and Wildlife Service 2005:II-216).

Within the study area, California linderiella has the potential to occur throughout but is generally limited to known areas of suitable habitat in and around Stone Lakes in Sacramento County, within the Yolo Bypass, within Solano County, and in eastern Contra Costa County near Clifton Court Forebay.

There are 16 CNDDB occurrences in the study area, which include the area near Clifton Court Forebay (1), on Holland Tract (1), in Antioch (1), in the Yolo Bypass (9), and in the Stone Lakes area (4) (California Department of Fish and Wildlife 2020b).

13B.34.3 Habitat Requirements

California linderiella occurs in vernal pools that vary widely in size and turbidity. They are also highly tolerant of high-water temperatures and have been found in pools ranging from 41°F to 85°F. This species frequently co-occurs with vernal pool fairy shrimp, and is usually numerically dominant (U.S. Fish and Wildlife Service 2005:II-218).

13B.34.4 Seasonal Patterns

California linderiella is the longest lived fairy shrimp species in the Central Valley, having been observed to live up to 168 days. The species requires a minimum of 31 days to reach maturity (U.S. Fish and Wildlife Service 2005:II-218).

13B.34.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.34.5.1 GIS Model Data Sources

The California linderiella model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.34.5.2 Habitat Model Description

The California linderiella habitat model includes vernal pools, alkaline seasonal wetlands, and some seasonal wetlands. Vernal pool complexes in the western part of the study area often occur in a mosaic with alkaline seasonal wetlands; many of the species that occur in the vernal pool complex also occur in the alkaline seasonal wetland complex within this mosaic of natural communities. The modeled habitat relies on both aquatic resource delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the Great Valley Vernal Pool Data, the Sand Hill Wind Repowering SEIR Land Cover Dataset, the East Bay RCIS 2017 Land Cover Dataset, the Delta Vegetation and Land Use Update, and the Great Valley Ecoregion 2018 Vegetation datasets. The extent of modeled habitat in the study area is depicted in Figure 13B.34-1.

13B.34.5.2.1 Geographic Limits

The entire study area.

13B.34.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the DWR 2020 Aquatic Resources Delineation (Witham et al. 2014; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
  - Alkaline wetland
  - Vernal pool

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Alkaline seasonal wetland complex
  - Alkaline wetland
- Other seasonal wetlands
  - Seasonal wetlands

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the Delta Vegetation and Land Use Update (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019):

- Vernal pool complex
  - All types

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Alkaline seasonal wetland complex
  - All types

Outside the delineation study area, density class information from the Great Valley Vernal Pool Data (Witham at al. 2014) was used to report an estimated wetted acre. This includes the following cover classes: <2%, 2%–5%, 5%–10%, >10%, and 100% for individual pools. In the statutory Delta, the cover classes reported only go as high as 5%–10%.

13B.34.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Animals List.* California Natural Diversity Database. Periodic publications. July.

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ICF. 2017. Land Cover Mapping for the East Bay RCIS.

ICF. 2018. Land Cover Mapping for the Sand Hill Wind Project.

U.S. Fish and Wildlife Service. 2005. *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon*. December 15. Portland, Oregon.

Witham, C. W., R. F. Holland and J. Vollmar. 2014. *Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012* [ds1070]. Report Prepared for U.S. Fish and Wildlife Service and Bureau of Reclamation CVPIA Habitat Restoration Program. Sacramento, California.

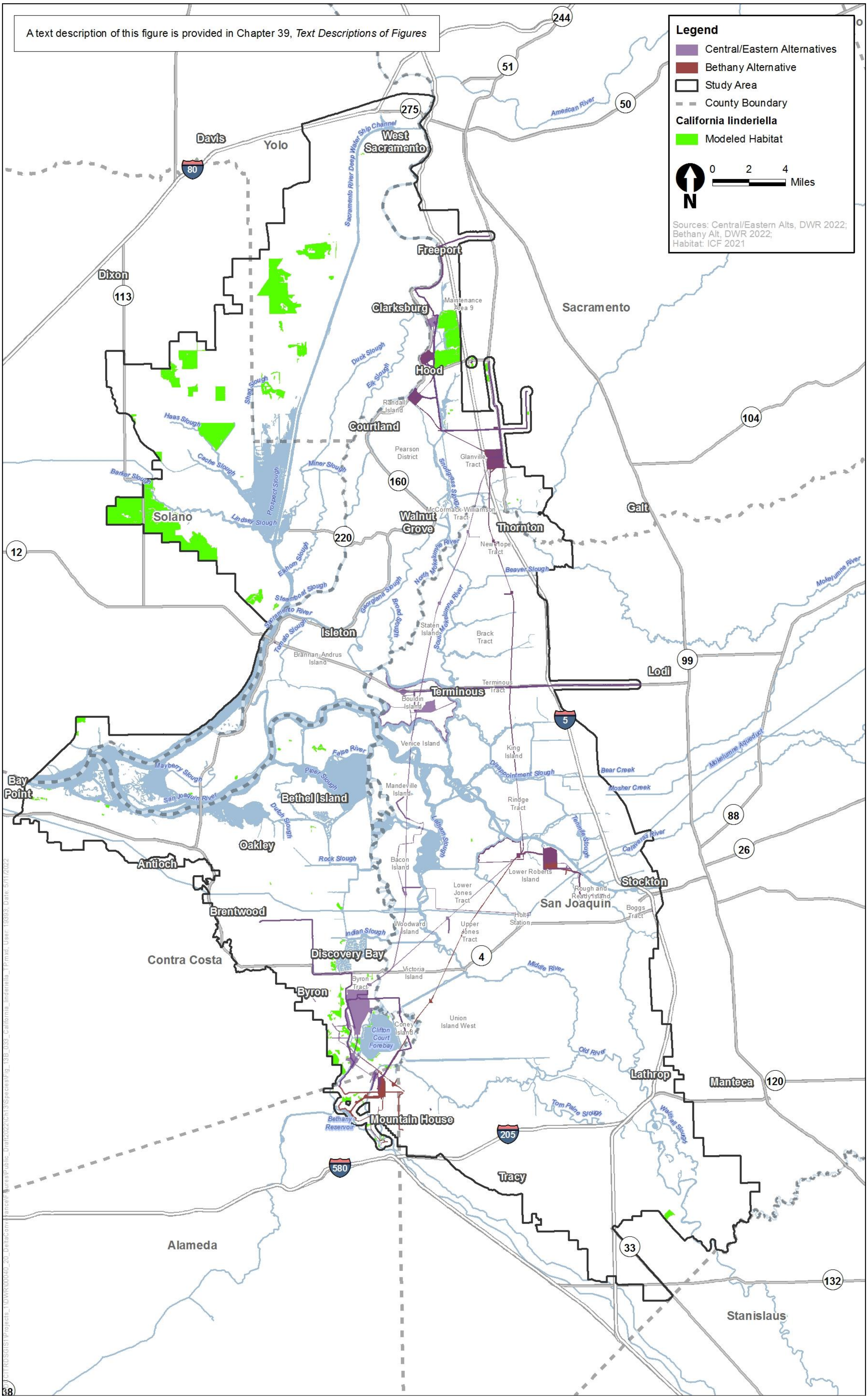

Figure 13B.34-1. California Linderiella Modeled Habitat in the Study Area

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13B.35 Vernal Pool Tadpole Shrimp (*Lepidurus packardi*)

13B.35.1 Legal Status

Vernal pool tadpole shrimp is listed as endangered throughout its range under the federal ESA (59 FR 48136). Critical habitat was designated for the species in 2006 (U.S. Fish and Wildlife Service 2020).

13B.35.2 Range and Distribution within the Study Area

Historically, vernal pool tadpole shrimp probably did not occur outside of the Central Valley and Central Coast regions (U.S. Fish and Wildlife Service 2005:II–204). Currently, vernal pool tadpole shrimp occurs in the Central Valley of California and the San Francisco Bay Area (U.S. Fish and Wildlife Service 2005:II–204). The species has a patchy distribution across the Central Valley of California from Shasta County southward to northwestern Tulare County (U.S. Fish and Wildlife Service 2007:4). In the Central Coast Vernal Pool Region identified in the Vernal Pool Recovery Plan, the vernal pool tadpole shrimp is found in the San Francisco Bay National Wildlife Refuge and on private land in Alameda County near Milpitas (U.S. Fish and Wildlife Service 2007:14; California Department of Fish and Wildlife 2020). The largest concentration of vernal pool tadpole shrimp occurrences is found in the Southeastern Sacramento Vernal Pool Region identified in the Vernal Pool Recovery Plan, where the species occurs on a number of public and private lands in Sacramento County (U.S. Fish and Wildlife Service 2005:II-206, 2007:14).

Within the study area, vernal pool tadpole shrimp has the potential to occur throughout but is generally limited to known areas of suitable habitat in and around Stone Lakes in Sacramento County, within the Yolo Bypass, within Solano County, and in eastern Contra Costa County near Clifton Court Forebay.

Fourteen CNDDB records for vernal pool tadpole shrimp are within the study area, which occur in an area southwest of Montezuma Hills (1), in the Jepson Prairie area (6), in the Yolo Bypass (4), in the Stone Lakes area (2), and one in an area just north of the Cosumnes River Preserve (California Department of Fish and Wildlife 2020).

13B.35.3 Habitat Requirements

Vernal pool tadpole shrimp occur in a wide variety of seasonal habitats, including vernal pools, ponded clay flats, alkaline pools, ephemeral stock ponds, and roadside ditches. Habitats where vernal pool tadpole shrimp have been observed range in size from small (less than 25 square feet), clear, vegetated vernal pools to highly turbid alkali scald pools to large (more than 100 acres) winter lakes (U.S. Fish and Wildlife Service 2007:3; Helm 1998:132,137). These pools and other ephemeral wetlands must dry out and be inundated again to remain suitable for the vernal pool tadpole shrimp. Any cysts remaining in the soil once the pool has dried remain dormant until the pool refills in order to hatch. Vernal pool tadpole shrimp can hatch multiple times in a single inundation event so long as the habitat remains inundated, sometimes for six months or more (U.S. Fish and Wildlife Service 2005:II–207).

In a study using large plastic pools to simulate natural vernal pools, Helm found that vernal pool tadpole shrimp can reproduce as early as 41 days following hatching, with the average being 54 days (Helm 1998:133). Site-specific conditions (primarily water temperature) have been shown to affect time to reach reproductive maturity (Helm 1998:132).

13B.35.4 Seasonal Patterns

Like other vernal pool branchiopods, vernal pool tadpole shrimp are linked to the cycles of their ephemeral habitats. Vernal pool tadpole shrimp eggs, or cysts, remain dormant in the soil when their vernal pool habitats are dry. The cysts remain in the soil until later rainy seasons when conditions are right for hatching (59 FR 48138).

13B.35.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.35.5.1 GIS Model Data Sources

The vernal pool tadpole shrimp model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.35.5.2 Habitat Model Description

The vernal pool tadpole shrimp habitat model includes vernal pools, alkaline seasonal wetlands, and some seasonal wetlands. Vernal pool complexes in the western part of the study area often occur in a mosaic with alkaline seasonal wetlands; many of the species that occur in the vernal pool complex also occur in the alkaline seasonal wetland complex within this mosaic of natural communities. The modeled habitat relies on both aquatic resource delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the Great Valley Vernal Pool Data, the Sand Hill Wind Repowering SEIR Land Cover Dataset, the East Bay RCIS 2017 Land Cover Dataset, the Delta Vegetation and Land Use Update, and the Great Valley Ecoregion 2018 Vegetation dataset. The extent of modeled habitat in the study area is depicted in Figure 13B.35-1.

13B.35.5.2.1 Geographic Limits

The entire study area.

13B.35.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the DWR 2020 Aquatic Resources Delineation (Witham et al. 2014; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
    - Alkaline wetland
    - Vernal pool

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Alkaline seasonal wetland complex
    - Alkaline wetland
- Other seasonal wetlands
    - Seasonal wetlands

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the Delta Vegetation and Land Use Update (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019):

- Vernal pool complex
    - All types

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Alkaline seasonal wetland complex
    - All types

Outside the delineation study area, density class information from the Great Valley Vernal Pool Data (Witham at al. 2014) was used to report an estimated wetted acre. This includes the following cover classes: <2%, 2%–5%, 5%–10%, >10%, and 100% for individual pools. In the statutory Delta, the cover classes reported only go as high as 5%–10%.

13B.35.6 References Cited

California Department of Fish and Wildlife. 2020. California Natural Diversity Database. Available: https://wildlife.ca.gov/data/cnddb. Accessed: March 2, 2020.

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Helm, B. 1998. Biogeography of Eight Large Branchiopods Endemic to California. In C. W. Witham, E. T. Bauder, D. Belk, W. R. Ferrin, Jr., and R. Orduff (eds.), *Ecology, Conservation, and Management of Vernal Pool Ecosystems*—Proceedings from a 1996 Conference, 124–139. Sacramento, CA: California Native Plant Society.

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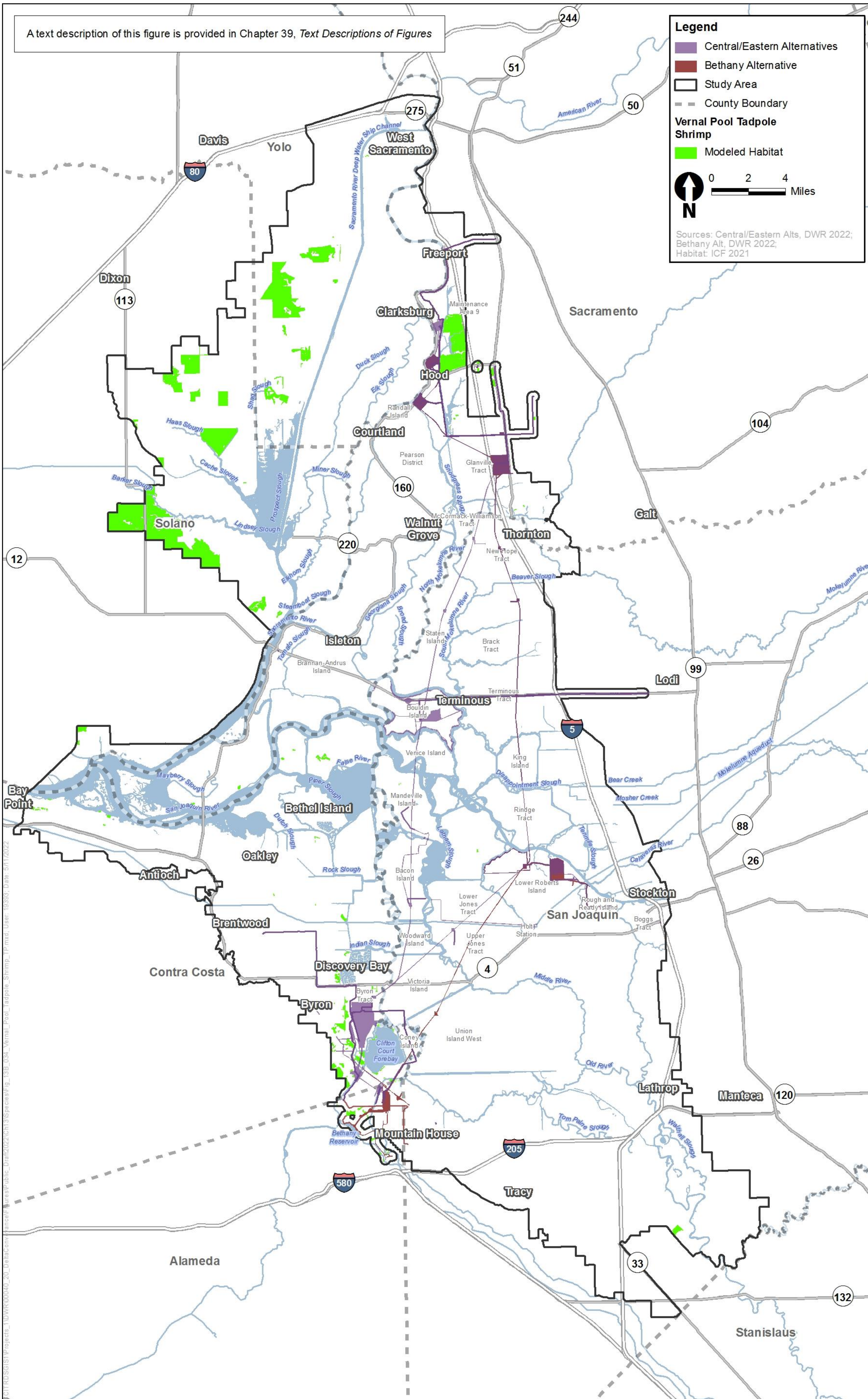
U.S. Fish and Wildlife Service. 2007. *Vernal Pool Tadpole Shrimp (*Lepidurus packardii*) 5-Year Review: Summary and Evaluation*. Sacramento, California.

U.S. Fish and Wildlife Service. 2020. Environmental Conservation Online System - Species Profile for Vernal Pool Tadpole Shrimp. Available: https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=2246 . Accessed: August 14, 2020.

Witham, C. W., R. F. Holland, and Vollmar, J. 2014. Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012 [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip. Accessed: April 29, 2020.



1
2 **Figure 13B.35-1. Vernal Pool Tadpole Shrimp Modeled Habitat in the Study Area**

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13B.36 Hairy Water Flea (*Dumontia oregonensis*)

13B.36.1 Legal Status

Hairy water flea has a NatureServe ranking of G1G3/S1 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:12).

13B.36.2 Range and Distribution within the Study Area

Hairy water flea was originally described in 2003 from the Agate Desert in Oregon and has since been documented in California in Sacramento and Solano counties (Interagency Special Status/Sensitive Species Program 2018:3–4).

Within the study area, hairy water flea has the potential to occur throughout but is generally limited to known areas of suitable habitat in and around Stone Lakes in Sacramento County, within the Yolo Bypass, within Solano County, and in eastern Contra Costa County near Clifton Court Forebay.

There are no CNDDB occurrences of hairy water flea in the study area (California Department of Fish and Wildlife 2020b).

13B.36.3 Habitat Requirements

Hairy water fleas are found in seasonal wetlands, including vernal pools, wet prairies, temporary creeks, and managed agricultural fields, typically where vegetation cover is over 60% (Interagency Special Status/Sensitive Species Program 2018:3, 5). In California, it is associated with tall flatsedge (*Cyperus eragrostis*), pale spikerush (*Eleocharis macrostachya*), and western mannagrass (*Glyceria occidentalis*) (Interagency Special Status/Sensitive Species Program 2018:5).

13B.36.4 Seasonal Patterns

Hairy water fleas emerge as pools fill with seasonal rains and enter dormancy when pools are dry. The species is likely present from October through April and has been collected from January through April (Interagency Special Status/Sensitive Species Program 2018:2–3).

13B.36.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.36.5.1 GIS Model Data Sources

The hairy water flea model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.36.5.2 Habitat Model Description

The hairy water flea habitat model includes vernal pools, alkaline seasonal wetlands, and some seasonal wetlands. Vernal pool complexes in the western part of the study area often occur in a mosaic with alkaline seasonal wetlands; many of the species that occur in the vernal pool complex also occur in the alkaline seasonal wetland complex within this mosaic of natural communities. The modeled habitat relies on both aquatic resource delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the Great Valley Vernal Pool Data, the Sand Hill Wind Repowering SEIR Land Cover Dataset, the East Bay RCIS 2017 Land Cover Dataset, the Delta Vegetation and Land Use Update, and the Great Valley Ecoregion 2018 Vegetation dataset. The extent of modeled habitat in the study area is depicted in Figure 13B.36-1.

13B.36.5.2.1 Geographic Limits

The entire study area.

13B.36.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the DWR 2020 Aquatic Resources Delineation (Witham et al. 2014; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Vernal pool complex
  - Alkaline wetland
  - Vernal pool

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Alkaline seasonal wetland complex
  - Alkaline wetland
- Other seasonal wetlands
  - Seasonal wetlands

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the Delta Vegetation and Land Use Update (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019):

- Vernal pool complex
    - All types

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Alkaline seasonal wetland complex
    - All types

Outside the delineation study area, density class information from the Great Valley Vernal Pool Data (Witham at al. 2014) was used to report an estimated wetted acre. This includes the following cover classes: <2%, 2%–5%, 5%–10%, >10%, and 100% for individual pools. In the statutory Delta, the cover classes reported only go as high as 5%–10%.

13B.36.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Animals List.* California Natural Diversity Database. Periodic publications. July.

California Department of Fish and Wildlife. 2020b. California Natural Diversity Database. Available: https://wildlife.ca.gov/data/cnddb. Accessed: March 2, 2020.

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California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

California Department of Water Resources and GEI Consultants Inc. 2020. *Aquatic Resources Delineation Report – Delta Conveyance Project.* March 31, 2020 (updated June 23, 2020).

Chico State Research Foundation, Geographic Information Center. 2018. Great Valley Ecoregion Vegetation [ds2362]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2600_2699/ds2632.zip . Accessed: June 9, 2020.

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Interagency Special Status/Sensitive Species Program. 2018. Dumontia oregonensis *Species Fact Sheet*. DOI Bureau of Land Management/ USDA Forest Service. Available: https://www.fs.fed.us/r6/sfpnw/issssp/planning-documents/species-guides.shtml . Accessed: August 14, 2020.

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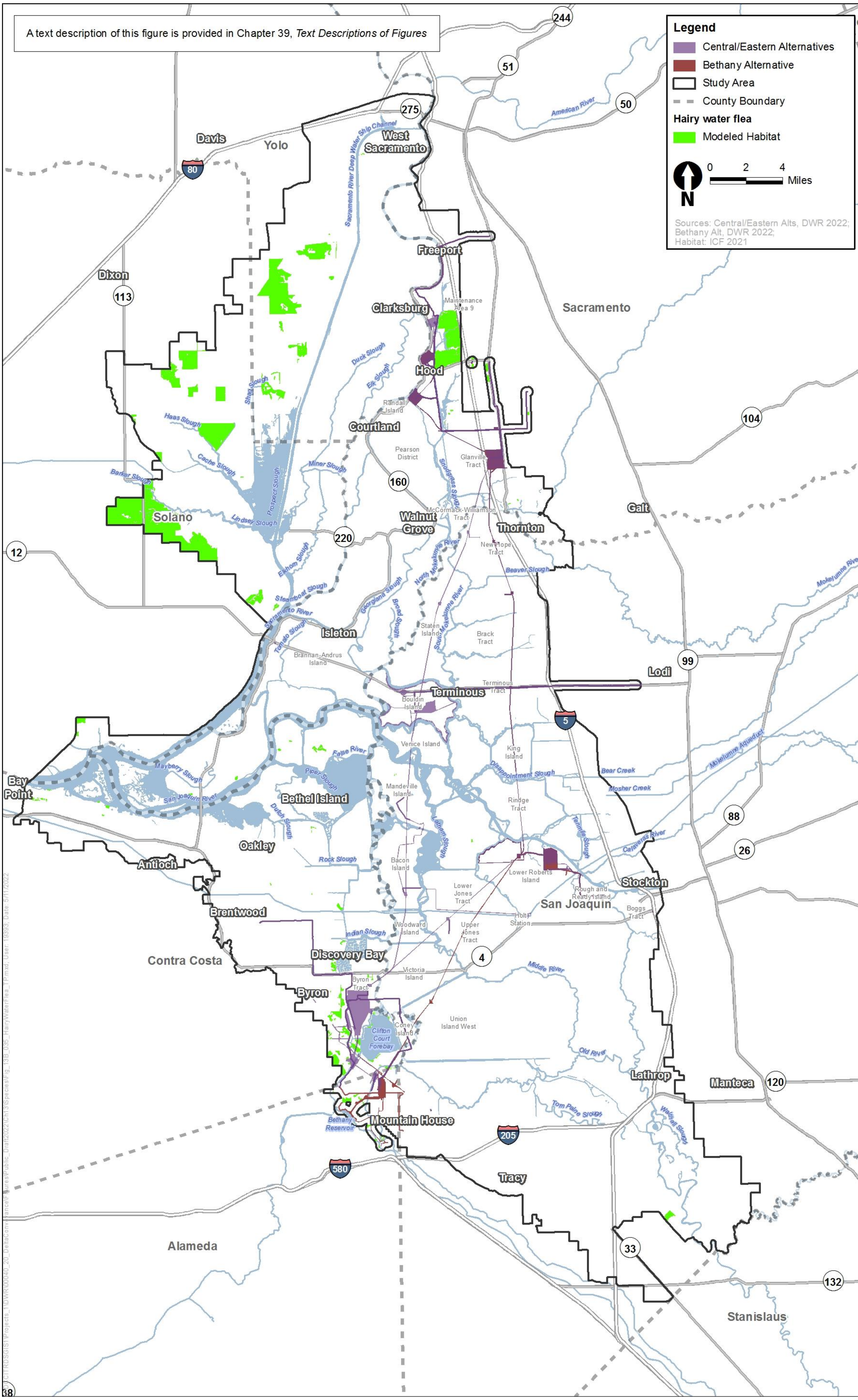

Figure 13B.36-1. Hairy Water Flea Modeled Habitat in the Study Area

13B.37 Antioch Dunes Anthicid Beetle (*Anthicus antiochensis*)

13B.37.1 Legal Status

Antioch Dunes anthicid beetle has a NatureServe ranking of G1/S1 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:16).

13B.37.2 Range and Distribution within the Study Area

Antioch Dunes anthicid beetle is endemic to California. It has been detected at Antioch Dunes in Contra Costa County as well as several sites along the Sacramento River in Glenn, Tehama, Shasta, and Solano Counties and one site at Nicolaus on the Feather River in Sutter County (California Department of Fish and Wildlife 2006).

Antioch Dunes anthicid beetle has the potential to occur in suitable habitat throughout the study area.

There are two CNDDB occurrences of Antioch Dunes anthicid beetle within the study area, one at the Antioch Dunes and one just north of Rio Vista (California Department of Fish and Wildlife 2020b).

13B.37.3 Habitat Requirements

Antioch Dunes anthicid beetle typically occurs on interior sand dunes and sand bars. Antioch Dunes anthicid beetles are thought to be microscavengers, feeding on dead insects and soil fungi at night and remaining inactive in burrows during the day (California Department of Fish and Wildlife 2006).

13B.37.4 Seasonal Patterns

Adults overwinter and emerge in the spring to lay eggs. A second generation of adults emerge in early summer (California Department of Fish and Wildlife 2006).

13B.37.5 Species Habitat Suitability Model

Due to the specific habitat requirements of the species, which occurs at a finer scale than the land cover data used in the EIR, no model was developed for this species.

13B.37.6 References Cited

California Department of Fish and Wildlife. 2006. Special Status Invertebrate Species Accounts—*Anthicus antiochensis*. Available: https://wildlife.ca.gov/Data/CNDDB/Invertebrates#insects-coleoptera. Accessed: August 21, 2020.

California Department of Fish and Wildlife. 2020a. *Special Animals List*. California Natural Diversity Database. Periodic publications. July.

California Department of Fish and Wildlife. 2020b. California Natural Diversity Database. Available: https://wildlife.ca.gov/data/cnddb. Accessed: March 2, 2020.

13B.38 Sacramento Anthicid Beetle (*Anthicus sacramento*)

13B.38.1 Legal Status

Sacramento anthicid beetle has a NatureServe ranking of G1/S1 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:16).

13B.38.2 Range and Distribution within the Study Area

Sacramento anthicid beetle is endemic to California, and it has been detected in several locations along the Sacramento and San Joaquin Rivers from Shasta to San Joaquin Counties and one site at Nicolas on the Feather River in Sutter County (California Department of Fish and Wildlife 2006).

Sacramento anthicid beetle has the potential to occur in suitable habitat throughout the study area.

There are seven CNDDB occurrences of Sacramento anthicid beetle within the study area, four along the San Joaquin River in the southern most portion of the study area and three around Rio Vista (California Department of Fish and Wildlife 2020b).

13B.38.3 Habitat Requirements

Sacramento anthicid beetle typically occurs in interior sand dunes and sand bars as well as in dredge spoil heaps. Like other species in its genus, Sacramento anthicid beetles are thought to be microscavengers, feeding on dead insects and soil fungi (California Department of Fish and Wildlife 2006).

13B.38.4 Seasonal Patterns

Adults are most commonly collected in June, July, and August, likely with two generations produced each year (California Department of Fish and Wildlife 2006).

13B.38.5 Species Habitat Suitability Model

Due to the specific habitat requirements of the species, which occur at a finer scale than the land cover data used in the EIR, no model was developed for this species.

13B.38.6 References Cited

California Department of Fish and Wildlife. 2006. Special Status Invertebrate Species Accounts—*Anthicus sacramento*. Available: https://wildlife.ca.gov/Data/CNDDB/Invertebrates#insects-coleoptera. Accessed: August 14, 2020.

California Department of Fish and Wildlife. 2020a. *Special Animals List*. California Natural Diversity Database. Periodic publications. July.

California Department of Fish and Wildlife. 2020b. California Natural Diversity Database. Available: https://wildlife.ca.gov/data/cnddb. Accessed: March 2, 2020.

13B.39 Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

13B.39.1 Legal Status

Valley elderberry longhorn beetle is listed as threatened under the federal ESA (45 FR 52803). Critical habitat was designated for valley elderberry longhorn beetle in 1980 (45 FR 52803).

13B.39.2 Range and Distribution within the Study Area

Valley elderberry longhorn beetle is one of three species of *Desmocerus* in North America and one of two subspecies of *D. californicus*. The valley elderberry longhorn beetle subspecies is a narrowly defined, endemic taxon, limited to portions of the Central Valley mostly below 500 feet elevation (U.S. Fish and Wildlife Service 2017:4).

At the time of the listing, the species was only known from Merced, Yolo, and Sacramento counties (U.S. Fish and Wildlife Service 2019:1) Subsequent surveys throughout the Central Valley discovered more locations and the current presumed range is now believed to extend from Shasta County to Madera County below 500 feet in elevation (U.S. Fish and Wildlife Service 2019:1). Previous descriptions of the range included areas that overlap with California elderberry longhorn beetle (*D. californicus californicus*) (U.S. Fish and Wildlife Service 2019:1). Little is known about the historical abundance of valley elderberry longhorn beetle.

The study area is known to support elderberry shrubs, but occurrences of the species are rare in the study area. There are four CNDDB occurrences within the study area, which include one on Union Island along Middle River, two within the vicinity of West Sacramento, and one along the Sacramento River near Sacramento (California Department of Fish and Wildlife 2020).

13B.39.3 Habitat Requirements

Valley elderberry longhorn beetle is closely associated with elderberry (*Sambucus* spp.). Elderberry shrubs are an obligate host plant for larvae and are necessary for the completion of the life cycle (U.S. Fish and Wildlife Service 2017:4). The two main species of elderberry used by this species are the blue elderberry (*Sambucus nigra* ssp. *caerulea*, formerly *S. mexicana*) and red elderberry (*S. racemosa*) (79 FR 55876). Elderberry is a component of riparian habitats throughout the Central Valley; however, elderberry shrubs can also be present in non-riparian valley oak and blue oak woodland habitats as well as in grasslands (U.S. Fish and Wildlife Service 2017:6), which may extend beyond riparian zones. Although this shrub occasionally occurs outside riparian areas, shrubs supporting the greatest beetle densities are located in areas with significant riparian zones (79 FR 55878).

Shrub characteristics and other environmental factors appear to have an influence on use by the valley elderberry longhorn beetle, with higher occupancy rates in riparian habitat types (79 FR 55878). Occupancy of elderberry shrubs varies based on elderberry condition, water availability, elderberry density, and the health of the riparian habitat, indicating that healthy riparian systems supporting dense elderberry clumps are the primary habitat of the beetle (U.S. Fish and Wildlife

Service 2017:7). However, some studies have demonstrated that valley elderberry longhorn beetles prefer elderberry shrubs with low to moderate levels of damaged stems (79 FR 55878).

13B.39.4 Seasonal Patterns

Adult valley elderberry longhorn beetles' flight season is from March to July (U.S. Fish and Wildlife Service 2017:11), with most records from late April to mid-May (79 FR 55877). The adult beetles feed on the elderberry foliage and possibly its flowers. During this time of activity, the beetles mate, and the females lays eggs on the living elderberry plant host. The eggs are typically placed singly within crevices in the bark or at junctions between branches or between leaf petioles and stems. Eggs hatch within a few days and soft-bodied larvae emerge. The larvae are on the surface of the elderberry from a few minutes to several hours and then bore to the center of the elderberry stems where they create a feeding gallery in the pith at the center of the stem. The larvae develop for 1 to 2 years feeding on pith. The late instar larvae chew through the inner bark, all or most of the way to the surface, then return inside plugging the holes with wood shavings. The larvae move back down the feeding gallery to an enlarged pupal chamber packed with frass. Here the larvae metamorphose into pupae between January and April (79 FR 55876).

The length of pupation is thought to be about one month with the emergent adult remaining in the chamber for up to several weeks. Adults complete the hole in the outer bark and emerge during the flowering season of elderberry shrubs (79 FR 55876).

13B.39.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.39.5.1 GIS Model Data Sources

The valley elderberry longhorn beetle model uses the following datasets:

- Delta 2017 Land Use Survey (Land IQ 2019)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.39.5.2 Habitat Model Description

The habitat model for valley elderberry longhorn beetle includes both riparian and other potential habitat. The "other potential habitat" portion of the model includes some agricultural land cover types as well as some seasonal wetlands mapped by DWR. Though frequent vegetation management in agricultural lands may limit the development of suitable shrubs, elderberry shrubs in rural areas are typically found on fence rows, along roadsides, and in areas that are not subject to active tilling or vegetation management. The extent of modeled habitat in the study area is depicted in Figure 13B.39-1.

13B.39.5.2.1 Geographic Limits

The model boundary includes the entire study area, based on the range described in the Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) (U.S. Fish and Wildlife Service 2017:4).

13B.39.5.2.2 Additional Model Parameters

Riparian Habitat

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018, 2019):

- Valley/foothill riparian
  - All types

Other Potential Habitat

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021).

- Other seasonal wetland
  - Seasonal wetland

Seasonal wetlands were individually selected by DWR staff that conducted the wetland delineation. These areas may have had some past disturbance but currently consist of herbaceous vegetation with some scattered shrubs. Though seasonally wet, these areas have the potential to support elderberry shrubs.

Modeled habitat also includes the following types from the Delta 2017 Land Use Survey (Land IQ 2019), the Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a), and the Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016), and Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018, 2019):

- Agriculture

- Semi-ag/rights-of-way
- Upland herbaceous

- Grassland
  - All types

13B.39.6 References Cited

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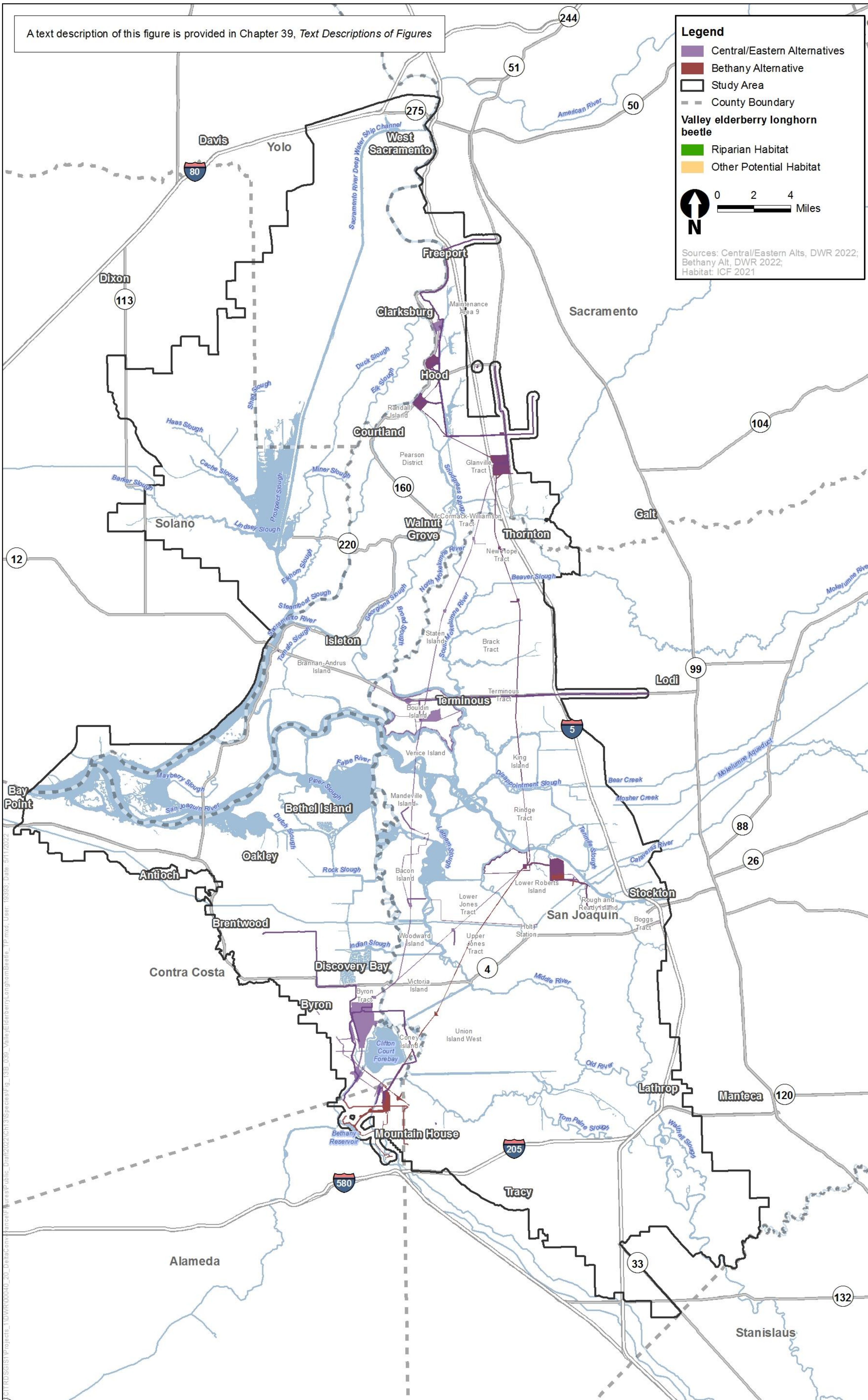

Figure 13B.39-1. Valley Elderberry Longhorn Beetle Modeled Habitat in the Study Area

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13B.40 Delta Green Ground Beetle (*Elaphrus viridis*)

13B.40.1 Legal Status

Delta green ground beetle is listed as threatened under the federal ESA but is not listed under CESA. It has a NatureServe ranking of G1S1 and is included on CDFW's Special Animals List (California Department of Fish and Wildlife 2020a:17). Critical habitat was designated for the delta green ground beetle in 1980 (U.S. Fish and Wildlife Service 2020).

13B.40.2 Range and Distribution within the Study Area

Delta green ground beetle is endemic to California, and it has only been detected in the greater Jepson Prairie area in Solano County (U.S. Fish and Wildlife Service 2017). The current known range of this federally listed threatened species is generally bound by Travis Air Force Base to the west, State Route 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007:7).

Within the study area, suitable habitat is limited to vernal pool complex and grassland in an approximate 1,800-acre area west of State Route 113 to the western edge of the study area, which is east of Travis Air Force Base (Figure 13B-36). There is one CNDDB occurrence that overlaps with the study area, which is a compilation of multiple observations over multiple year across Jepson Prairie (California Department of Fish and Wildlife 2020b).

13B.40.3 Habitat Requirements

Delta green ground beetle typically occurs in the grassland-vernal pool complex and possibly in more open areas such as edges of pools, trails, roads, and ditches; however, this assumption may be because delta green ground beetles are more difficult to detect in denser grassland cover. Larvae hide under dense vegetation or cracks in the ground. Similar to other beetles in the genus, delta green ground beetles are thought to be generalized insect predators, possibly feeding primarily on springtails (*Collembola*) (U.S. Fish and Wildlife Service 2017).

13B.40.4 Seasonal Patterns

Adults seem to be active from February through mid-May, producing one generation per year (U.S. Fish and Wildlife Service 2017).

13B.40.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.40.5.1 GIS Model Data Sources

The delta green ground beetle model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019, California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

13B.40.5.2 Habitat Model Description

The habitat model for delta green ground beetle is limited to vernal pool complex (all types) and grasslands. The extent of modeled habitat in the study area is depicted in Figure 13B.40-1.

13B.40.5.2.1 Geographic Limits

The species is limited to the western portion of the study area in Solano County, west of State Route 113 to the western edge of the study area, south of Hastings Road, and north of Creek Road (Figure 13B-36).

13B.40.5.2.2 Additional Model Parameters

Modeled habitat includes the following vegetation type from the Delta Vegetation and Land use Update (Chico State Research Foundation, Geographical Information Center 2019):

- Grassland
    - All types

Modeled habitat also includes the following type from the DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019, California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Vernal pool complex
    - All types

13B.40.6 References Cited

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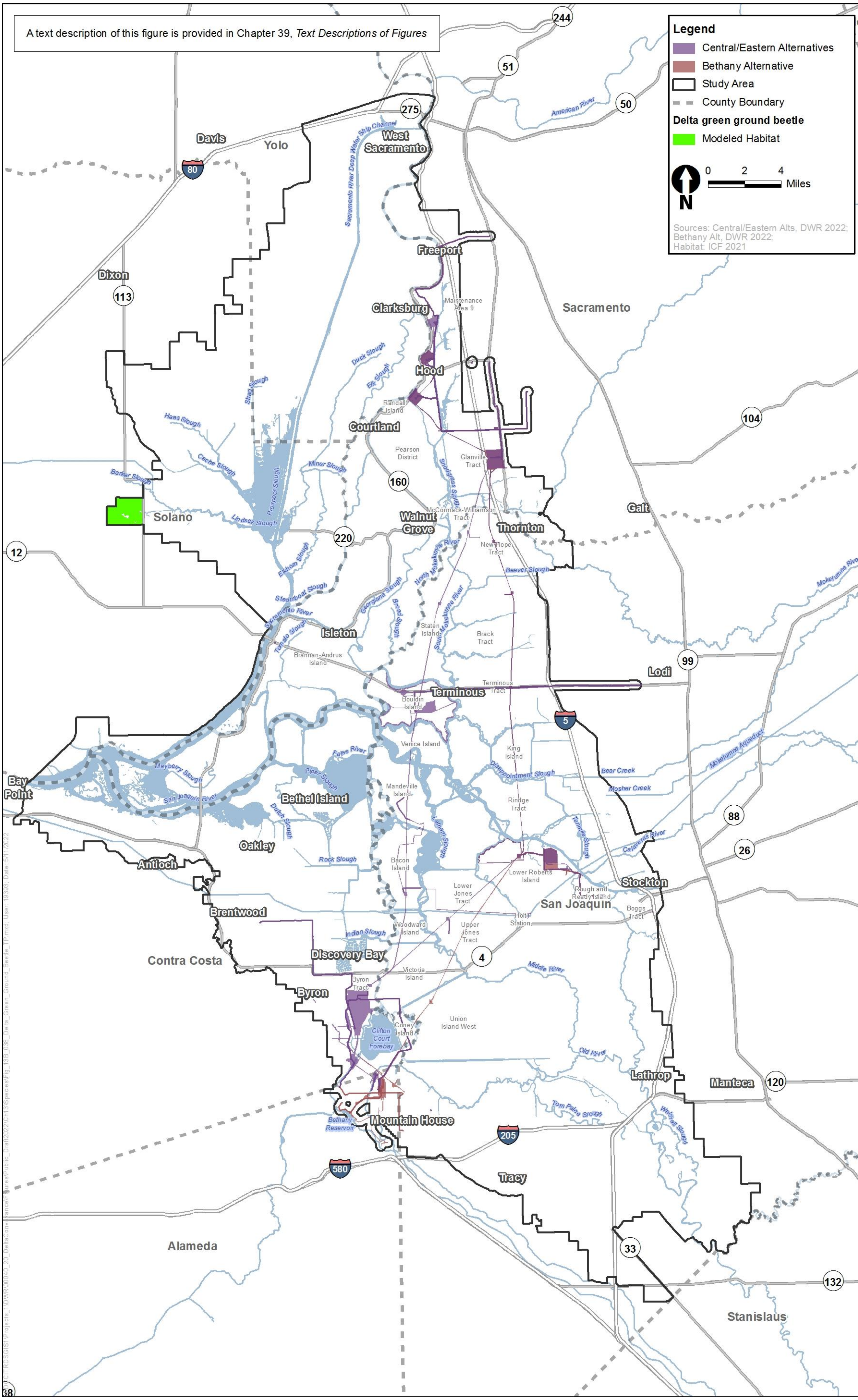

Figure 13B.40-1. Delta Green Ground Beetle Modeled Habitat in the Study Area

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13B.41 Ricksecker's Water Scavenger Beetle (*Hydrochara rickseckeri*)

13B.41.1 Legal Status

Ricksecker's water scavenger beetle has a NatureServe ranking of G2?/S2? and is included on CDFW's Special Animals List, but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:17).

13B.41.2 Range and Distribution within the Study Area

Ricksecker's water scavenger beetle is known from current and historic records to occur in Lake, Sonoma, Marin, San Mateo, Alameda, Solano, Placer, and Sacramento counties (California Department of Fish and Wildlife 2020b; Short et al. 2017:465).

Within the study area, Ricksecker's water scavenger beetle has the potential to occur throughout but is generally limited to known areas of suitable habitat in and around Stone Lakes in Sacramento County, within the Yolo Bypass, within Solano County, and in eastern Contra Costa County near Clifton Court Forebay.

There are two CNDDB occurrences of Ricksecker's water scavenger beetle in the study area, which include one in the Cosumnes River Preserve on the eastern edge of the study area and one in Solano County on the western edge of the study area.

13B.41.3 Habitat Requirements

Ricksecker's water scavenger beetle is an aquatic beetle typically known from shallow water habitats. Specific habitat requirements for this species are not known but may include a variety of aquatic habitats, including artificial ponds. Both adults and larvae of this species are aquatic (NatureServe 2020). According to CNDDB records (California Department of Fish and Wildlife 2020b), the species is frequently found in vernal pools but is also found in perennial habitats.

13B.41.4 Seasonal Patterns

All known records for the species are between December and July, with most in April and May, and recent observations suggest the species may have a short life cycle that corresponds with the wetting and drying of vernal pools (Short et al. 2017:466-467).

13B.41.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.41.5.1 GIS Model Data Sources

The Ricksecker's water scavenger beetle model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.41.5.2 Habitat Model Description

The Ricksecker's water scavenger beetle habitat model includes vernal pools, alkaline seasonal wetlands, and some seasonal wetlands. Vernal pool complexes in the western part of the study area often occur in a mosaic with alkaline seasonal wetlands; many of the species that occur in the vernal pool complex also occur in the alkaline seasonal wetland complex within this mosaic of natural communities. The modeled habitat relies on both aquatic resource delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the Great Valley Vernal Pool Data, the Delta Vegetation and Land Use Update, the Great Valley Ecoregion 2018 Vegetation dataset, the Sand Hill Wind Repowering SEIR Land Cover dataset (ICF 2018), and the East Bay RCIS 2017 Land Cover dataset (ICF 2017). The extent of modeled habitat in the study area is depicted in Figure 13B.41-1

13B.41.5.2.1 Geographic Limits

The entire study area.

13B.41.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the DWR 2020 Aquatic Resources Delineation (Witham et al. 2014; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
    - Alkaline wetland
    - Vernal pool

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Alkaline seasonal wetland complex
    - Alkaline wetland

- Other seasonal wetlands
  - Seasonal wetlands

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the Delta Vegetation and Land Use Update (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019):

- Vernal pool complex
  - All types

Modeled habitat also includes the following types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018), the Sand Hill Wind Repowering SEIR Land Cover dataset (ICF 2018), and the East Bay RCIS 2017 Land Cover dataset (ICF 2017):

- Alkaline seasonal wetland complex
  - All types

Outside the delineation study area, density class information from the Great Valley Vernal Pool Data (Witham at al. 2014) was used to report an estimated wetted acre. This includes the following cover classes: <2%, 2%–5%, 5%–10%, >10%, and 100% for individual pools. In the statutory Delta, the cover classes reported only go as high as 5%–10%.

13B.41.6 References Cited

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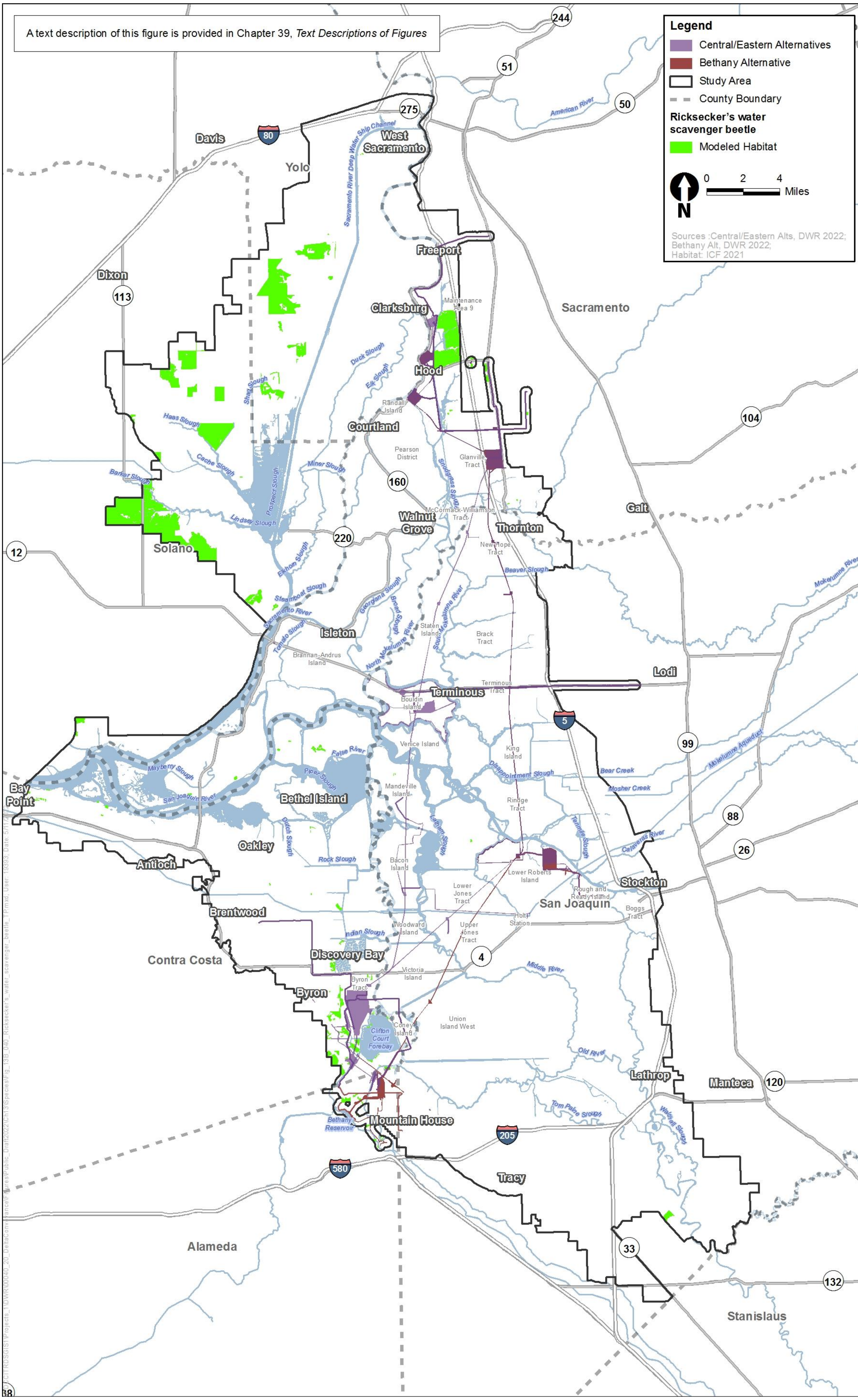

Figure 13B.41-1. Ricksecker's Water Scavenger Beetle Modeled Habitat in the Study Area

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13B.42 Curved-Foot Hygrotus Diving Beetle (*Hygrotus curvipes*)

13B.42.1 Legal Status

Curved-foot hygrotus diving beetle has a NatureServe ranking of G1/S1 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:18).

13B.42.2 Range and Distribution within the Study Area

Curved-foot hygrotus diving beetle is only known from the eastern portions of Alameda and Contra Costa Counties (Entomological Consulting Ltd. 2005:3; California Department of Fish and Wildlife 2020b).

The species range in the study area is limited to areas of suitable habitat in Alameda and Contra Costa Counties. There are six CNDDB occurrences in the study area, three of which are in Alameda County east of Bethany Reservoir and three are in Contra Costa County from around Byron Airport north to Oakley (California Department of Fish and Wildlife 2020b).

13B.42.3 Habitat Requirements

Preferred habitat for the curved-foot hygrotus diving beetle is small, seasonal mineralized pools, small ponds, and pools in intermittent streams (Entomological Consulting Ltd. 2005:4). Most of the known occupied sites are fringed by salt and salt-tolerant vegetation (Entomological Consulting LTD. 2005:4). Other areas where the species has been found include ditches and canals (California Department of Fish and Wildlife 2020b).

13B.42.4 Seasonal Patterns

Little is known about the seasonal patterns of the species but given that its preferred habitat is seasonal waterbodies, it is likely adapted to completing most of its life cycle during the winter and spring.

13B.42.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.42.5.1 GIS Model Data Sources

The curved-foot hygrotus model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Vernal Pool Data (Witham et al. 2014)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- National Hydrography Dataset (U.S. Geological Survey 2020)

13B.42.5.2 Habitat Model Description

The curved-foot hygrotus habitat model includes vernal pools, alkaline seasonal wetlands, seasonal wetlands, streams, ponds, and agricultural ditches. The modeled habitat relies on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the National Hydrography Dataset, Great Valley Vernal Pool Data, the Delta Vegetation and Land Use Update, Sandhill Hill Land Cover Dataset, and the East Bay RCIS Land Cover Dataset. The extent of modeled habitat in the study area is depicted in Figure 13B.42-1.

13B.42.5.2.1 Geographic Limits

Alameda and Contra Costa counties.

13B.42.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Vernal pool complex
    - Alkaline wetland
    - Vernal pool

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Alkaline seasonal wetland complex
    - Alkaline wetland
- Other seasonal wetlands
    - Seasonal wetlands
- Agricultural
    - Seasonal wetlands
    - Agricultural ditch

- Nontidal perennial aquatic
  - Natural channel
  - Depression

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Vernal Pool Data and the Delta Vegetation and Land Use Update (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019).

- Vernal Pool Complex
  - All types

Modeled habitat also includes the following types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and National Hydrography Dataset (U.S. Geological Survey 2020).

- Alkaline seasonal wetland complex
  - All types
- Nontidal perennial aquatic
  - Water
- Agricultural
  - Ditch

13B.42.6 References Cited

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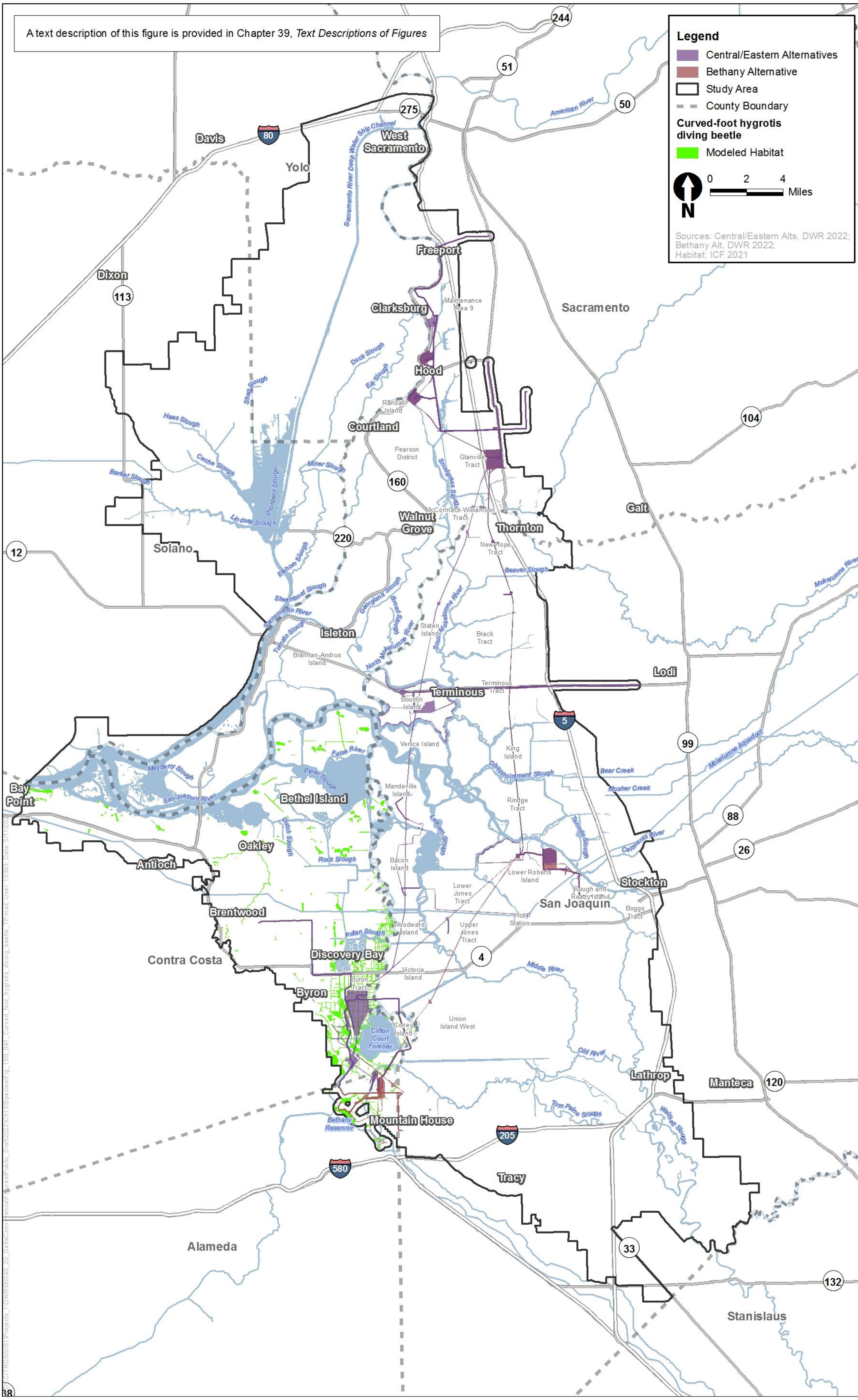

Figure 13B.42-1. Curved-Foot Hygrotus Diving Beetle Modeled Habitat in the Study Area

13B.43 Molestan Blister Beetle (*Lytta molesta*)

13B.43.1 Legal Status

Molestan blister beetle has a NatureServe ranking of G2/S2 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:18).

13B.43.2 Range and Distribution within the Study Area

Molestan blister beetle is endemic to California, and its current known range is limited to the Central Valley (California Department of Fish and Wildlife 2006:1).

The species is assumed to have a potential to occur throughout the study area. There is one CNDDB record of the species within the study area, which is an undated museum collection from the Brentwood area (California Department of Fish and Wildlife 2020b).

13B.43.3 Habitat Requirements

Molestan blister beetle occurs in grasslands and vernal pools (Entomological Consulting Ltd. 2005:4; California Department of Fish and Wildlife 2006:1). Very little is known about the life history or behavior of this species. Other species in the genus *Lytta* oviposit in the underground nests of solitary bees, where their larvae consume pollen stores and parasitize larval bees (California Department of Fish and Wildlife 2006:2; Entomological Consulting, LTD. 2005:4). Recorded hosts include Anthophorid, Andrenid, and Colletid bees (Entomological Consulting Ltd. 2005:4). Known adult food sources for species in the genus *Lytta* include Leguminosae, Convolvulaceae, Compositae, Papaveraceae, Rosaceae, and *Erodium* (Entomological Consulting Ltd. 2005:4).

13B.43.4 Seasonal Patterns

Molestan blister beetle has been collected from early April through early July (California Department of Fish and Wildlife 2006:2).

13B.43.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.43.5.1 GIS Model Data Sources

A model was developed for terrestrial vernal pool invertebrates that includes both molestan blister beetle and vernal pool andrenid bee and includes the following data sources.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)

- Great Valley Vernal Pool Data (Witham et al. 2014)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.43.5.2 Habitat Model Description

The model for terrestrial vernal pool invertebrates was developed for both molestan blister beetle and vernal pool andrenid bee. These species can utilize both the upland portion and aquatic portion, once dry, of vernal pool complexes. The extent of modeled habitat in the study area is depicted in Figure 13B.43-1.

13B.43.5.2.1 Geographic Limits

The entire study area.

13B.43.5.2.2 Additional Model Parameters

The model includes the following types.

- Vernal pool complex (all types)

13B.43.6 References Cited

California Department of Fish and Wildlife. 2006. *Special Status Invertebrate Species Accounts*—Lytta molesta. Available: https://wildlife.ca.gov/Data/CNDDB/Invertebrates#insects-coleoptera. Accessed: August 14, 2020.

California Department of Fish and Wildlife. 2020a. *Special Animals List*. California Natural Diversity Database. Periodic publications. July.

California Department of Fish and Wildlife. 2020b. March 2020. California Natural Diversity Database. Available: https://wildlife.ca.gov/data/cnddb. Accessed: March 2, 2020.

California Department of Water Resources. 2020. Aquatic Resources Delineation Data (update). Received October 22, 2020.

California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

California Department of Water Resources and GEI Consultants Inc. 2020. *Aquatic Resources Delineation Report—Delta Conveyance Project*. March 31, 2020 (updated June 23, 2020).

Chico State Research Foundation, Geographical Information Center. 2018. Great Valley Ecoregion Vegetation [ds2362]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2600_2699/ds2632.zip. Accessed: June 9, 2020.

Chico State Research Foundation, Geographical Information Center. 2019. Delta Vegetation and Land Use Update – 2016 [ds2855]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip. Accessed: March 6, 2020.

Entomological Consulting Ltd. 2005. *County Crossings Insect and Invertebrates Site Assessment, County Crossings Development, Antioch, Contra Costa County, California*. Prepared for RCL Ecology.

Witham, C. W., R. F. Holland, and J. Vollmar. 2014. *Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012* [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip. Accessed: April 29, 2010.

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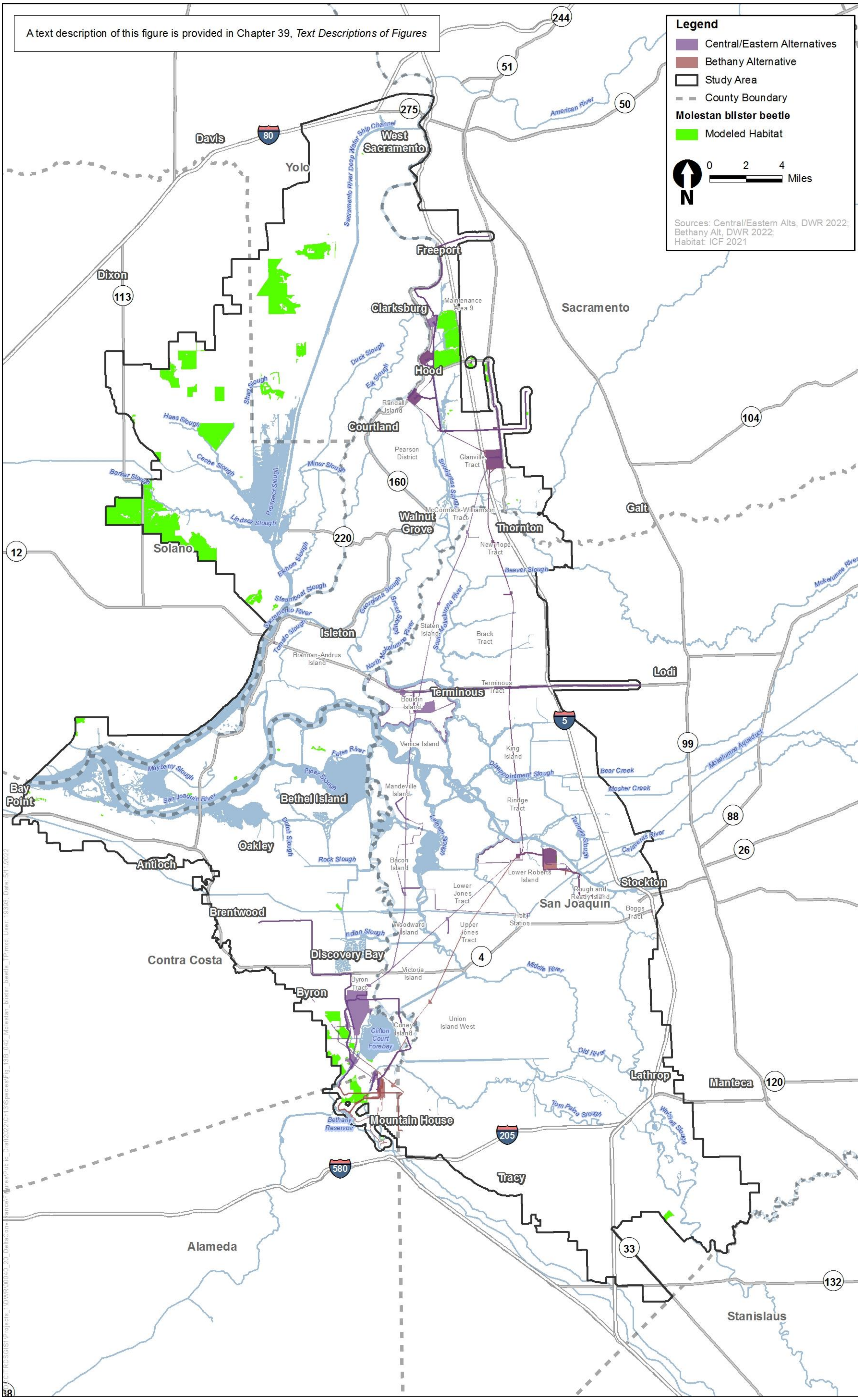

Figure 13B.43-1. Molestan Blister Beetle Modeled Habitat in the Study Area

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13B.44 Blennosperma Vernal Pool Andrenid Bee (*Andrena blennospermatis*)

13B.44.1 Legal Status

Blennosperma vernal pool andrenid bee has a NatureServe ranking of G2/S2 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:26).

13B.44.2 Range and Distribution within the Study Area

Blennosperma vernal pool andrenid bee is endemic to California, and it has been detected at sites in the Inner North Coast Ranges and Tehama, Solano, San Joaquin, Sacramento, El Dorado, and Placer Counties (California Department of Fish and Wildlife 2006:1).

The species is assumed to have potential to occur throughout the study area where suitable habitat is present. There are two CNDDB records of the species within the study area, both of which are in the Jepson Prairie area in the northwestern portion of the study area (California Department of Fish and Wildlife 2020b).

13B.44.3 Habitat Requirements

The species occurs in uplands around vernal pools. This species is a solitary, ground nesting bee that feeds exclusively on pollen from flowers in the genus *Blennosperma* (California Department of Fish and Wildlife 2006:2).

13B.44.4 Seasonal Patterns

Adults emerge from shallow underground brood nests in early spring to mate, and females then construct new nest chambers that are provisioned with *Blennosperma* flower pollen for the developing larva. The larvae passes through several instars, undergoes pupation in the fall, and overwinters in the cell as an adult. The active flight period for females ranges from late February to late April, with males emerging slightly earlier and dying off sooner than females (California Department of Fish and Wildlife 2006:2).

13B.44.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.44.5.1 GIS Model Data Sources

A model was developed for terrestrial vernal pool invertebrates that includes both molestan blister beetle and Blennosperma vernal pool andrenid bee and includes the following data sources.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Vernal Pool Data (Witham et al. 2014)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)

13B.44.5.2 Habitat Model Description

The model for terrestrial vernal pool invertebrates was developed for both molestan blister beetle and Blennosperma vernal pool andrenid bee. These species can utilize both the upland portion and aquatic portion, once dry, of vernal pool complexes. The extent of modeled habitat in the study area is depicted in Figure 13B.44-1.

13B.44.5.2.1 Geographic Limits

The entire study area.

13B.44.5.2.2 Additional Model Parameters

The model includes the following types.

- Vernal pool complex (all types)

13B.44.6 References Cited

California Department of Fish and Wildlife. 2006. *Special Status Invertebrate Species Accounts* – Andrena blennospermatis. Available: https://wildlife.ca.gov/Data/CNDDB/Invertebrates#insects-hymenoptera. Accessed: August 14, 2020.

California Department of Fish and Wildlife. 2020a. *Special Animals List*. California Natural Diversity Database. Periodic publications. July.

California Department of Fish and Wildlife. 2020b. March 2020. California Natural Diversity Database. Available: https://wildlife.ca.gov/data/cnddb. Accessed: March 2, 2020.

California Department of Water Resources. 2020. Aquatic Resources Delineation Data (update). Received October 22, 2020.

California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

California Department of Water Resources and GEI Consultants Inc. 2020. *Aquatic Resources Delineation Report – Delta Conveyance Project*. March 31, 2020 (updated June 23, 2020).

Chico State Research Foundation, Geographical Information Center. 2018. Great Valley Ecoregion Vegetation [ds2362]. Geographic Information Center. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2600_2699/ds2632.zip. Accessed: June 9, 2020.

Chico State Research Foundation, Geographical Information Center. 2019. Delta Vegetation and Land Use Update – 2016 [ds2855]. Geographic Information Center. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip. Accessed: March 6, 2020.

Witham, C. W., R. F. Holland, and J. Vollmar. 2014. Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012 [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip. Accessed: April 29, 2010.

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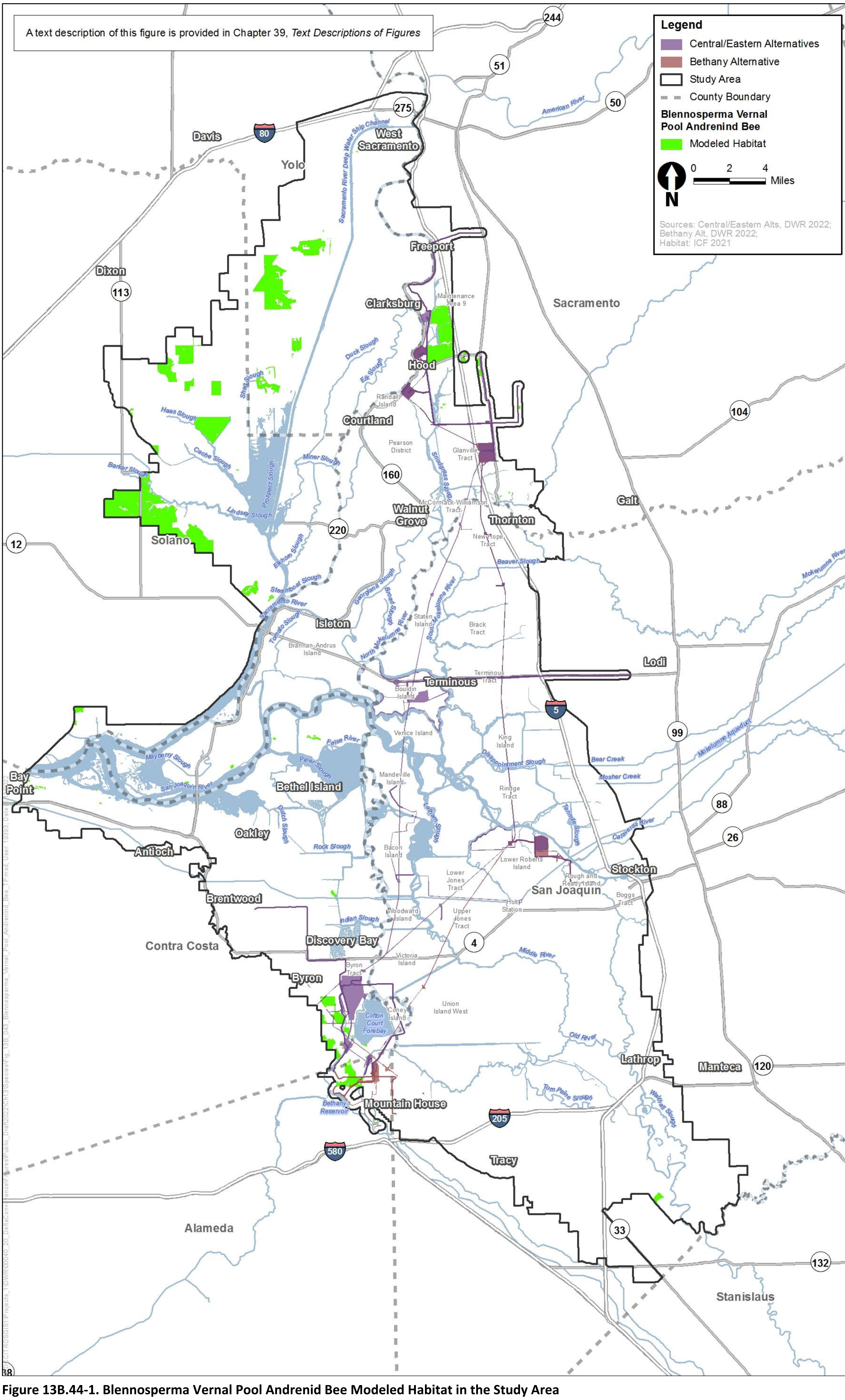

1
2 **Figure 13B.44-1. Blennosperma Vernal Pool Andrenid Bee Modeled Habitat in the Study Area**

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13B.45 Crotch Bumble Bee (*Bombus crotchii*)

13B.45.1 Legal Status

Crotch bumble bee has a NatureServe ranking of G3G4/S1S2 and is a candidate for listing as endangered under the CESA (California Department of Fish and Wildlife 2020a:26).

13B.45.2 Range and Distribution within the Study Area

The current range of this species is from coastal California to the Sierra-Cascade Crest, extends into western and southern Nevada, and into Baja California, Mexico (Koch et al. 2012:82-84; California Department of Fish and Wildlife 2019:16).

Crotch bumble bee has potential to occur throughout the study area where suitable habitat exists. There are two CNDDB occurrences within the study area, one collection from 1926 near Antioch and one from 1959 near Tracy (California Department of Fish and Wildlife 2020b).

13B.45.3 Habitat Requirements

Habitat for this species is not specific because the food plant genera used by Crotch bumble bee (*Antirrhinum, Phacelia, Clarkia, Dendromecon, Eschscholzia,* and *Eriogonum*) are widely distributed in different habitats (Koch et al. 2012:82). Like most other species of bumble bees, Crotch bumble bees typically nest in underground cavities such as animal burrows, though nests have also been reported in aboveground structures that provide suitable cavities (Koch et al. 2012:9).

13B.45.4 Seasonal Patterns

Colonies are established by mated queens who produce female workers to forage for pollen and nectar, defend the colony, and feed developing larvae, with individual colonies remaining active for only one season (Koch et al. 2012:9). The flight period for Crotch bumble bee queens in California is from late February to late October and the period for works and males in California is from late March through September (California Department of Fish and Wildlife 2019:17). Little is known about overwintering sites but other bumble bee species are known to overwinter in soft soil or under leaf litter and debris (California Department of Fish and Wildlife 2019:17).

13B.45.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.45.5.1 GIS Model Data Sources

The Crotch bumble bee model uses the following datasets:

- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.45.5.2 Habitat Model Description

The habitat model was developed for both Crotch bumble bee and western bumble bee (*Bombus occidentalis*). Habitat types were selected based on where listed food plants and nesting sites described Section 13B.45.3, *Habitat Requirements* are most likely to occur in the study area. The extent of modeled habitat in the study area is depicted in Figure 13B.45-1.

13B.45.5.2.1 Geographic Limits

Entire study area.

13B.45.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the Delta Vegetation and Land Use Update (Chico State Research Foundation 2019), the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018), and the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Alkaline seasonal wetlands
  - All types

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018):

- Grassland
  - All types

Modeled habitat includes the following types from the DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
  - All types

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Other seasonal wetlands

13B.45.6 References Cited

California Department of Fish and Wildlife. 2019. *Evaluation of the petition from the Xerces Society, Defenders of Wildlife, and the Center for Food Safety to list four species of bumble bees as endangered under the California Endangered Species Act*. Report to the Fish and Game Commission. April 4, 2019.

California Department of Fish and Wildlife. 2020a. *Special Animals List* (p.26). California Natural Diversity Database. Periodic publications. July.

California Department of Fish and Wildlife. 2020b. California Natural Diversity Database. Available: https://wildlife.ca.gov/data/cnddb. Accessed: March 2, 2020.

California Department of Water Resources. 2020. Aquatic Resources Delineation Data (update). Received October 22, 2020.

California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

California Department of Water Resources and GEI Consultants Inc. 2020. *Aquatic Resources Delineation Report—Delta Conveyance Project*. March 31, 2020 (updated June 23, 2020).

Chico State Research Foundation, Geographic Information Center. 2018. *Great Valley Ecoregion Vegetation* [ds2362]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2600_2699/ds2632.zip . Accessed: June 9, 2020.

Chico State Research Foundation, Geographic Information Center. 2019. *Delta Vegetation and Land Use Update—2016* [ds2855]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip . Accessed: March 6, 2020.

ICF. 2017. Land Cover Mapping for the East Bay RCIS.

ICF. 2018. Land Cover Mapping for the Sand Hill Wind Project.

Koch, J., Strange, J. P., Williams, P. 2012. *Bumble bees of the western United States*. USDA Forest Service Research Notes. Publication FS-972.

Witham, C. W., R. F. Holland, and J. Vollmar. 2014. Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012 [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip. Accessed: April 29, 2020.

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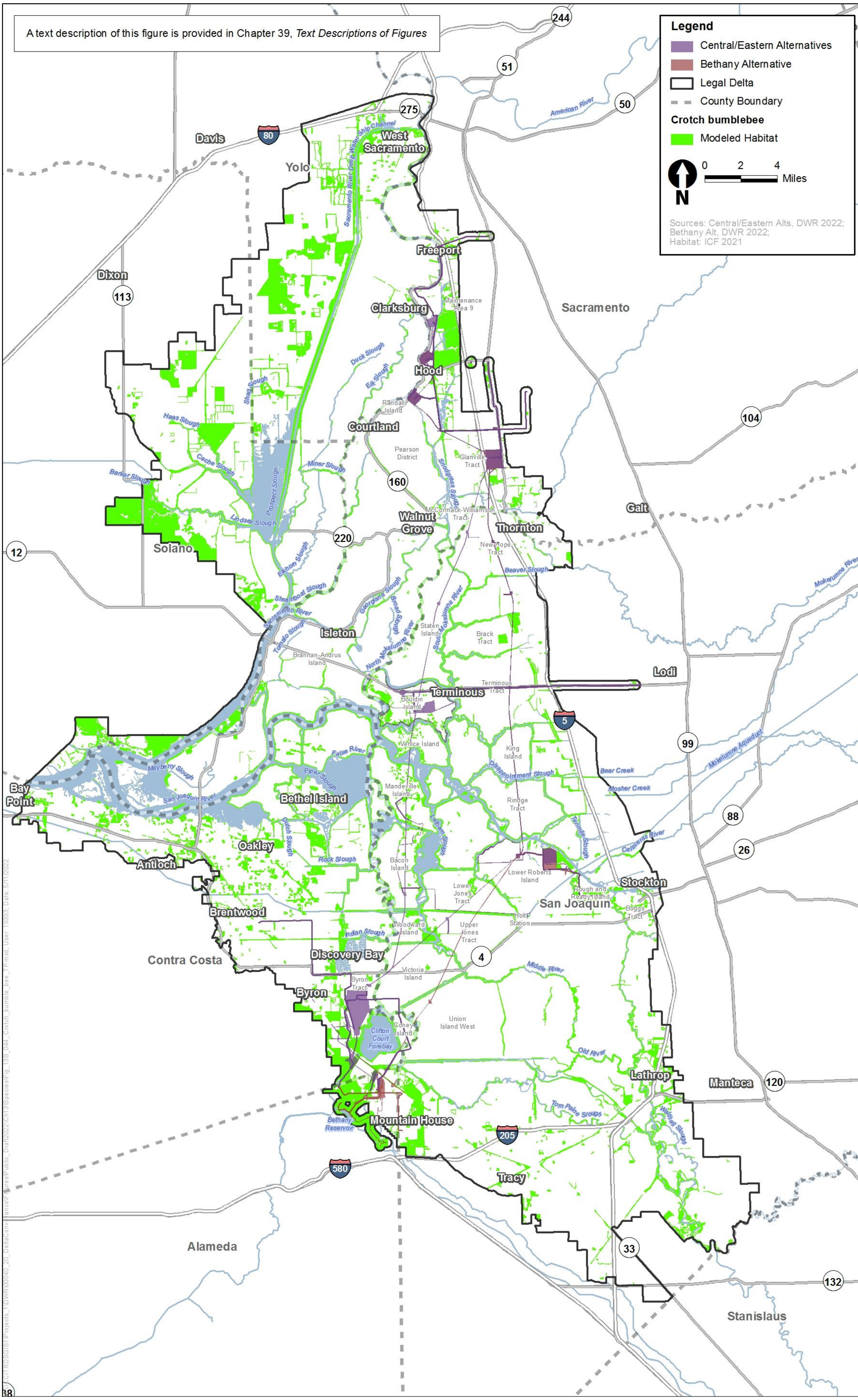

Figure 13B.45-1. Crotch Bumble Bee Modeled Habitat in the Study Area

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13B.46 Western Bumble Bee (*Bombus occidentalis*)

13B.46.1 Legal Status

Western bumblebee has a NatureServe ranking of G2G3/S1 and is a candidate for listing as endangered under CESA (California Department of Fish and Wildlife 2020:26).

13B.46.2 Range and Distribution within the Study Area

Western bumble bee occurs along the West Coast and Mountain West of North America. In California the species occurs throughout the state, though populations from Central California to the northern border have declined sharply since the late 1990s, particularly from lower elevation sites (Hatfield et al. 2015).

Western bumble bee has potential to occur throughout the study area where suitable habitat exists. There are six CNDDB occurrences within the study area, the most recent being from 1979 (#215), which include one from the Antioch Dunes, one just outside of Pittsburg, one near Oakley, one near Brentwood, one near Lathrop, and one near Jepson Prairie (California Department of Fish and Wildlife 2020); however, it should be noted that there have not been systematic surveys throughout the study area and a lack of more recent records does not mean they are no longer present or at additional locations.

13B.46.3 Habitat Requirements

The habitat for this species varies widely and includes open grassy areas, urban parks and gardens, chaparral and scrub lands, and mountain meadows. Like most other species of bumblebees, western bumblebees typically nest in underground cavities such as animal burrows, though nests have also been reported in aboveground structures that provide suitable cavities. Western bumble bees are generalist foragers and are known to visit a variety of flowering plants throughout the colony's life cycle, which is from early February to late November. Generally, the density of floral resources in an area directly affects the number of new queens that a colony can produce(Hatfield et al. 2015:5-6).

13B.46.4 Seasonal Patterns

Colonies are established by mated queens who produce female workers to forage for pollen and nectar, defend the colony, and feed developing larvae. Within California, the flight period for western bumblebee is from early February to late November, with individual colonies remaining active for only one season. As winter approaches the old queen, workers, and males die, and the new queens continue to forage for nectar before finding a suitable location to overwinter. Very little is known about hibernacula, or overwintering sites, used by the new queens (Hatfield et al. 2015:5-6).

13B.46.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.46.5.1 GIS Model Data Sources

The western bumble bee model uses the following datasets:

- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center2019)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.46.5.2 Habitat Model Description

The habitat model was developed for both Crotch bumble bee and western bumble bee. Habitat types were selected based on where flowering plants and nesting sites described in Section 13B,45.3, *Habitat Requirements* are most likely to occur in the study area; however, some specific areas they can occur in, such as urban parks and gardens, where not able to be captured in the underlying land cover data. Though the model likely misses some areas where they may occur it also likely overestimates the extent of habitat in other portions of the study area. The extent of modeled habitat in the study area is depicted in Figure 13B.46-1.

13B.46.5.2.1 Geographic Limits

Entire study area.

13B.46.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019), the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018), and the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Alkaline seasonal wetlands
    - All types

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019) and the

Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018):

- Grassland
  - All types

Modeled habitat includes the following types from the DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
  - All types

Modeled habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Other seasonal wetlands

13B.46.6 References Cited

California Department of Fish and Wildlife. 2020. *Special Animals List*. California Natural Diversity Database. Periodic publications. July.

California Department of Water Resources. 2020. Aquatic Resources Delineation Data (update). Received October 22, 2020.

California Department of Water Resources. 2021. Aquatic Resources Delineation Data (update). Received March 10, 2021.

California Department of Water Resources and GEI Consultants Inc. 2020. *Aquatic Resources Delineation Report—Delta Conveyance Project*. March 31, 2020 (updated June 23, 2020).

Chico State Research Foundation, Geographic Information Center. 2018. Great Valley Ecoregion Vegetation [ds2362]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2600_2699/ds2632.zip . Accessed: June 9, 2020.

Chico State Research Foundation, Geographic Information Center. 2019. Delta Vegetation and Land Use Update—2016 [ds2855]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2800_2899/ds2855.zip . Accessed: March 6, 2020.

Hatfield, R., Jepsen, S., Thorp, R., Richardson, L., Colla, S. & Foltz Jordan, S. 2015. *Bombus occidentalis. The IUCN Red List of Threatened Species 2015*. Available: https://www.iucnredlist.org/species/44937492/46440201 . Accessed: August 13, 2020.

ICF. 2017. Land Cover Mapping for the East Bay RCIS.

ICF. 2018. Land Cover Mapping for the Sand Hill Wind Project.

Witham, C. W., R. F. Holland, and Vollmar, J. 2014. Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012 [ds1070]. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/1000_1099/ds1070.zip. Accessed: April 29, 2020.

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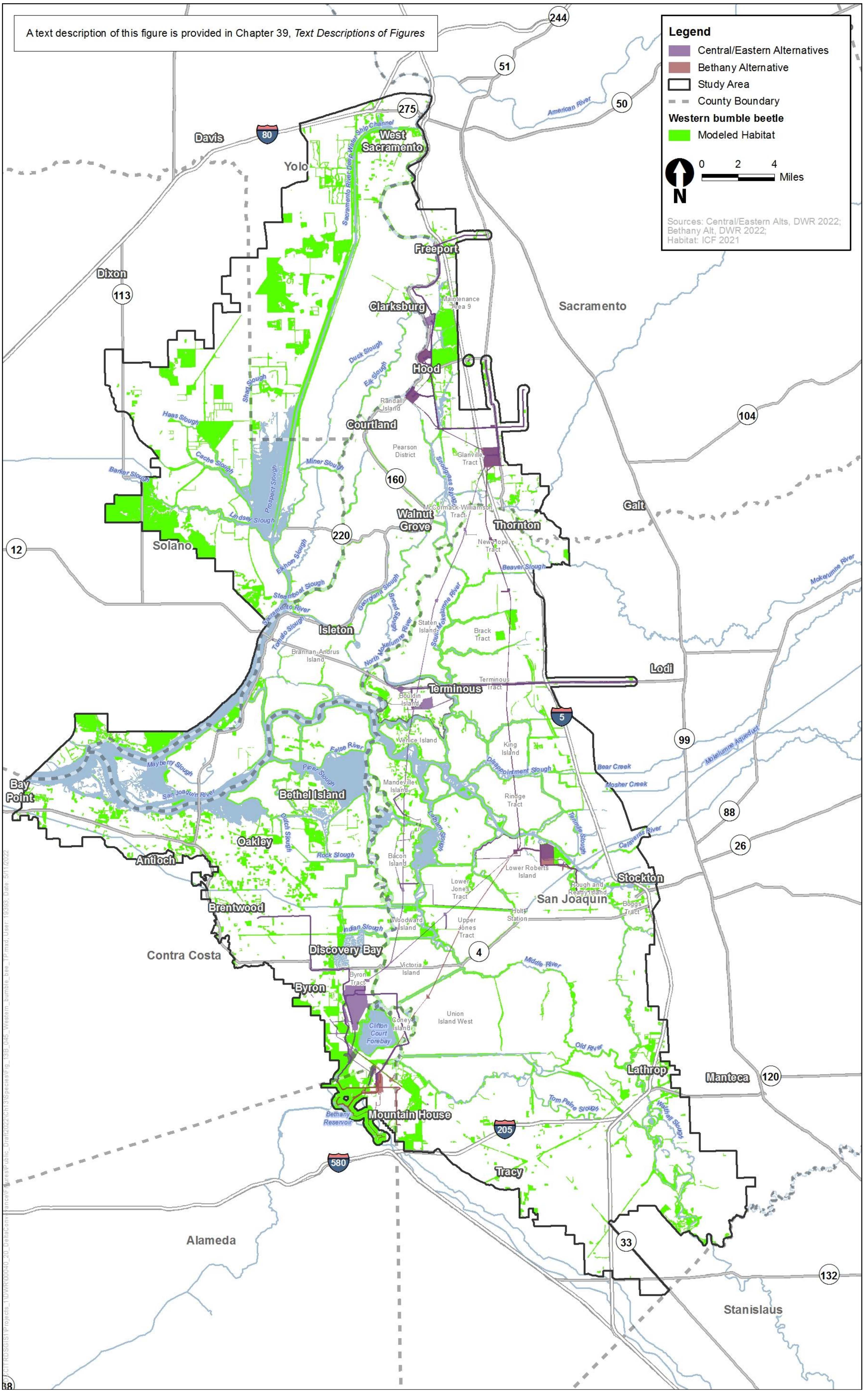

Figure 13B.46-1. Western Bumble Bee Modeled Habitat in the Study Area

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13B.47 California Tiger Salamander (*Ambystoma californiense*)

13B.47.1 Legal Status

California tiger salamander Central California distinct population segment (DPS) is listed as threatened under ESA and as threatened under CESA (U.S. Fish and Wildlife Service 2020; California Department of Fish and Wildlife 2020a:39). Final designation of critical habitat for the Central California DPS of California tiger salamander was published in the *Federal Register* on August 23, 2005 (U.S. Fish and Wildlife Service 2020).

13B.47.2 Range and Distribution within the Study Area

California tiger salamander historically occurred throughout the Central Valley and surrounding foothills, from Yolo County south to Tulare County, and in the south coast ranges from north of Monterey Bay to San Luis Obispo County, although many of the populations in the Central Valley are now extirpated. Currently, the Central California DPS of this species is distributed along the foothills of the Central Valley and Inner Coast Range from Sacramento and Yolo Counties in the north, to San Luis Obispo, Kern, Kings, and Tulare Counties in the south (U.S. Fish and Wildlife Service 2017:I-2). There are also isolated populations in Sonoma and Santa Barbara Counties, which are listed as endangered under ESA and threatened under CESA.

California tiger salamander has a potential to occur in the study area generally in areas west of the Yolo Basin but including the Tule Ranch Unit of the Yolo Basin Wildlife Area, which includes western Yolo County and Solano County, and portions of eastern Contra Costa and Alameda Counties, and western portions of San Joaquin County.

There are numerous extant California tiger salamander CNDDB occurrences west of the Clifton Court Forebay area and several occurrences in the Jepson Prairie portion of the study area (California Department of Fish and Wildlife 2020b).

13B.47.3 Habitat Requirements

California tiger salamander are found in annual grassland, vernal pool complexes, open mixed woodland and oak savanna communities in lowland and foothill regions of central California where suitable aquatic sites, such as vernal pools, seasonal ponds or constructed ponds, are available for breeding (U.S. Fish and Wildlife Service 2009). The species is typically found at elevations from sea level to 2,000 feet, although the known elevational range extends up to 3,940 feet (U.S. Fish and Wildlife Service 2017:I-2).

The suitability of California tiger salamander habitat is proportional to the abundance of upland refuge sites near aquatic breeding sites. Adult California tiger salamanders are terrestrial and spend much of the year in the underground burrows of small mammals, such as California (Beechey) ground squirrels (*Otospermophilus beecheyi*) (Loredo et al. 1996:283; Trenham 2001:343–344) and Botta's pocket gopher (*Thomomys bottae*) (Jennings 1996:194). Active rodent burrow systems are considered an important component of California tiger salamander upland habitat (Loredo et al.

1996:283), as inactive burrow systems begin to deteriorate and collapse over time. Therefore, active ground-burrowing rodent populations are likely needed to sustain California tiger salamander populations. California tiger salamander is known to move up to 1.3 miles into upland habitat from aquatic habitat (USFWS 2017:I-4; Orloff 2007:26).

Historically, vernal pools and other seasonal rain pools were the primary breeding habitat of California tiger salamanders (Barry and Shaffer 1994:159); however, the species is now known to reproduce in seasonal and perennial human-made ponds (U.S. Fish and Wildlife Service 2017:I-5). In the East Bay Regional Park District in Contra Costa and Alameda Counties, California tiger salamanders breed almost exclusively in seasonal and perennial stock ponds (Bobzien and DiDonato 2007:7). The presence of predatory fish and bullfrogs (*Lithobates catesbeianus*) can affect the habitat suitability of perennial ponds, making them less suitable than ephemeral ponds. Barry and Shaffer (1994:163) note that annual draining can prevent predatory species from establishing. The species is not known to breed in streams or rivers; however, breeding has been documented in ditches that contain seasonal wetland habitat and in slow-moving swales and creeks near other suitable breeding habitat (U.S. Fish and Wildlife Service 2017:I-5).

The proximity of refuge sites to aquatic breeding sites also affects the suitability of salamander habitat. Based on capture data from a single-season study at Olcott Lake in Jepson Prairie Preserve in Solano County, Trenham and Shaffer (2005:1163) estimated that 95% of adult and subadult tiger salamanders occurred within approximately 0.4 mile of the breeding pond. Their model also suggests that 85% of subadults were concentrated between 0.1 and 0.4 miles from the pond.

13B.47.4 Seasonal Patterns

Adults typically migrate to ponds to breed following rainy periods from November to April (U.S. Fish and Wildlife Service 2017:I-2). Breeding generally occurs from December through March (Stebbins 2003:154). Eggs are laid individually or in clumps on submerged vegetation and debris in shallow water and generally hatch in 10 to 28 days (Jennings and Hayes 1994:12; U.S. Fish and Wildlife Service 2017:I-3). Development through metamorphosis requires 3–6 months, beginning late spring or early summer. Post-metamorphic juveniles disperse from breeding sites at night during the late spring or early summer to upland burrows or soil crevices (U.S. Fish and Wildlife Service 2017:I-3).

13B.47.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.47.5.1 GIS Model Data Sources

The California tiger salamander model uses the following datasets:

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.47.5.2 Habitat Model Description

The habitat model for California tiger salamander includes both aquatic and upland habitats. The modeled aquatic habitat relies on both delineation data that were collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the Great Valley Ecoregion 2018 Vegetation Dataset, the Delta Vegetation and Land Use Update, and the Great Valley Vernal Pool Data.

The modeled upland habitat is limited to areas within 1.24 miles of suitable aquatic habitat, based on USFWS' 2003 *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander* (U.S. Fish and Wildlife Service and California Department of Fish and Game 2003:4). For areas along the western edge of the study area, upland habitat was also identified by reviewing aerial photographs for aquatic habitat outside of, but within 1.24 miles of, the study area. The extent of modeled habitat in the study area is depicted in Figure 13B.47-1.

13B.47.5.2.1 Geographic Limits

West of the Yolo Basin (which includes portions of Yolo and Solano Counties) but including the Tule Ranch Unit of the CDFW Yolo Basin Wildlife Area. Includes the portion of the study area in southern Solano County. Within the Contra Costa, Alameda, and San Joaquin Counties portion of the study area, habitat for the California tiger salamander is modeled in the area starting near Antioch, then south on State Route (SR) 4 to Balfour Road, then east on Balfour Road to Byron Highway, then south Byron Highway to SR 4, then east to the western bank of Old River, then south along the western bank to Old River's confluence with Italian Slough, then continue south along the western bank of Italian Slough to where Italian Slough turns to the west at which point the geographic limits cross Italian slough and continue south along the western edge of Clifton Court Forebay and the start of the California Aqueduct until Byron Highway at which point the limits continue southeast on Bryon Highway to Interstate (I-)205 and then west on I-205 to the edge of the study area. In Sacramento County south of the Cosumnes River and east of I-5, which is within the range of the species but no records in this portion of the statutory Delta. Also, in San Joaquin County on the eastern edge of the statutory Delta where suitable habitat occurs east of I-5, there is a CNDDB record just south of SR 120 near Manteca in the statutory Delta (California Department of Fish and Wildlife 2020b).

13B.47.5.2.2 Additional Model Parameters

Aquatic

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
  - Vernal pool

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and the Great Valley Vernal Pool Data (Witham et al. 2014):

- Vernal pool complex
  - *Distichlis spicata*
  - California annual herb/grass group
  - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Mediterranean California naturalized annual and perennial grassland

Upland

Inside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), and the Great Valley Vernal Pool Data (Witham et al. 2014):

- Vernal pool complex
  - All types
- Grassland
  - All types
- Alkaline seasonal wetland complex
  - *Distchlis spicata*

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), and the Great Valley Vernal Pool Data (Witham et al. 2014):

- Vernal pool complex
  - *Allenrolfea occidentalis*
  - *Frankenia salina*
  - *Suaeda moquinii*

- Alkaline wetland
- Grassland
  - All types
- Alkaline seasonal wetland complex
  - *Distchlis spicata*

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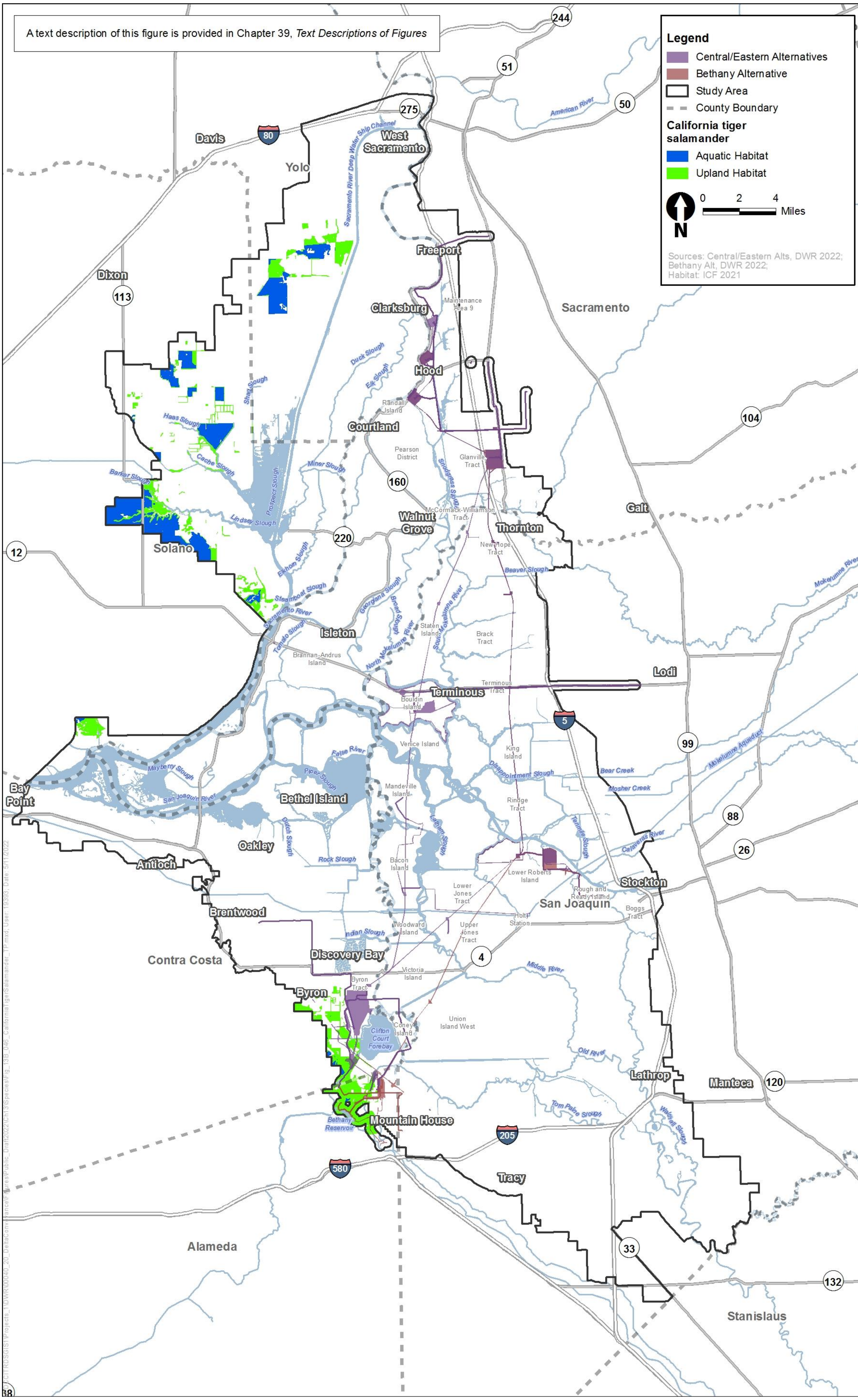

Figure 13B.47-1. California Tiger Salamander Modeled Habitat in the Study Area

13B.48 Western Spadefoot (*Spea hammondii*)

13B.48.1 Legal Status

The western spadefoot is a CDFW Species of Special Concern and has no federal status (California Department of Fish and Wildlife 2020a:42).

13B.48.2 Range and Distribution within the Study Area

The western spadefoot is found throughout the Central Valley and coastal lowlands from the Shasta County in Northern California to Baja California in Mexico, at elevations ranging from sea level to 4,500 feet (Jennings and Hayes 1994:94; Stebbins and McGinnis 2012:157).

The species range overlaps completely with the study area but there are no records for western spadefoot toad in the study area (California Department of Fish and Wildlife 2020b).

13B.48.3 Habitat Requirements

This species occurs in grasslands, mixed woodland, open chaparral, and pine oak woodlands, with shallow temporary pools or washes. Adults remain in underground burrows for most of the year and typically make movements on rainy nights (California Department of Fish and Game 2000). On land, movement is generally thought to be nocturnal, with adults in Southern California moving as much as 860 feet between burrows and breeding ponds (Baumberger et al. 2019:6). Juveniles and adults are able to dig burrows up to 8 inches deep (Thomson et al. 2016:133), but will also make use of existing mammal burrows, and may have a preference for burrowing in or adjacent to existing small mammal burrows (Baumberger et al. 2019:12). Breeding occurs in temporary pools and drainages, although breeding can also occur in human-made water sources such as cattle ponds (Thomson et al. 2016:133).

13B.48.4 Seasonal Patterns

Breeding coincides with the rainy season and varies depending on rainfall and region (Thomson et al. 2016:132). Eggs are laid in clusters and usually hatch in 3 to 4 days, with the average larval period reported to last 58 days (Thomson et al. 2016:132). Juveniles leave natal ponds shortly after metamorphosis from April to June (Thomson et al. 2016:133).

13B.48.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.48.5.1 GIS Model Data Sources

The western spadefoot toad model uses the following datasets:

- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc.

2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- DWR 2020 Aquatic Resources Delineation Data (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Great Valley Vernal Pool Data (Witham et al. 2014)

13B.48.5.2 Habitat Model Description

The western spadefoot toad model includes both aquatic and upland habitat. The modeled aquatic habitat relies on both delineation data that were collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found outside the delineation study area in the Delta Vegetation and Land Use Update, the Great Valley Ecoregion 2018 Vegetation Dataset, and the Great Valley Vernal Pool Data.

The modeled upland habitat includes suitable habitats within 1,200 feet of modeled aquatic habitat. While it is not known how far western spadefoot toads may range from aquatic habitat into upland habitat, research suggests that upland habitat, on average, falls within 1,207 feet of aquatic habitat (U.S. Fish and Wildlife Service 2005:II-231, Baumberger et al. 2019:10). The extent of modeled habitat in the study area is depicted in Figure 13B.48-1.

13B.48.5.2.1 Geographic Limits

The model boundary includes the entire study area, based on the species distribution described in Thomson et al. (2016:133).

13B.48.5.2.2 Additional Model Parameters

Aquatic

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Vernal pool complex
  - Vernal pool
- Nontidal perennial aquatic
  - Depression

Some of the mapped depressions in the interior Delta were excluded from the model because based on aerial reviews they either lacked supporting uplands, appeared to be heavily managed wetlands, and/or were perennial.

Outside the Delineation Study Area

Modeled habitat includes the following types from the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018), the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and the Great Valley Vernal Pool Data (Witham et al. 2014):

- Vernal pool complex
  - *Distichlis spicata*
  - California annual herb/grass group
  - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - Mediterranean California naturalized annual and perennial grassland
- Nontidal perennial aquatic
  - Water

Upland

Inside the Delineation Study Area

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018), Great Valley Vernal Pool Data (Witham et al. 2014), and the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019):

- Grassland
  - All types
- Alkaline seasonal wetland complex
  - *Distchlis spicata*
- Vernal pool complex
  - All types

Outside the Delineation Study Area

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018) and the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and the Great Valley Vernal Pool Data (Witham et al. 2014):

- Grassland
  - All types

- Alkaline seasonal wetland complex
  - *Distchlis spicata*
- Vernal pool complex
  - *Allenrolfea occidentalis*
  - *Suaeda moquinii*

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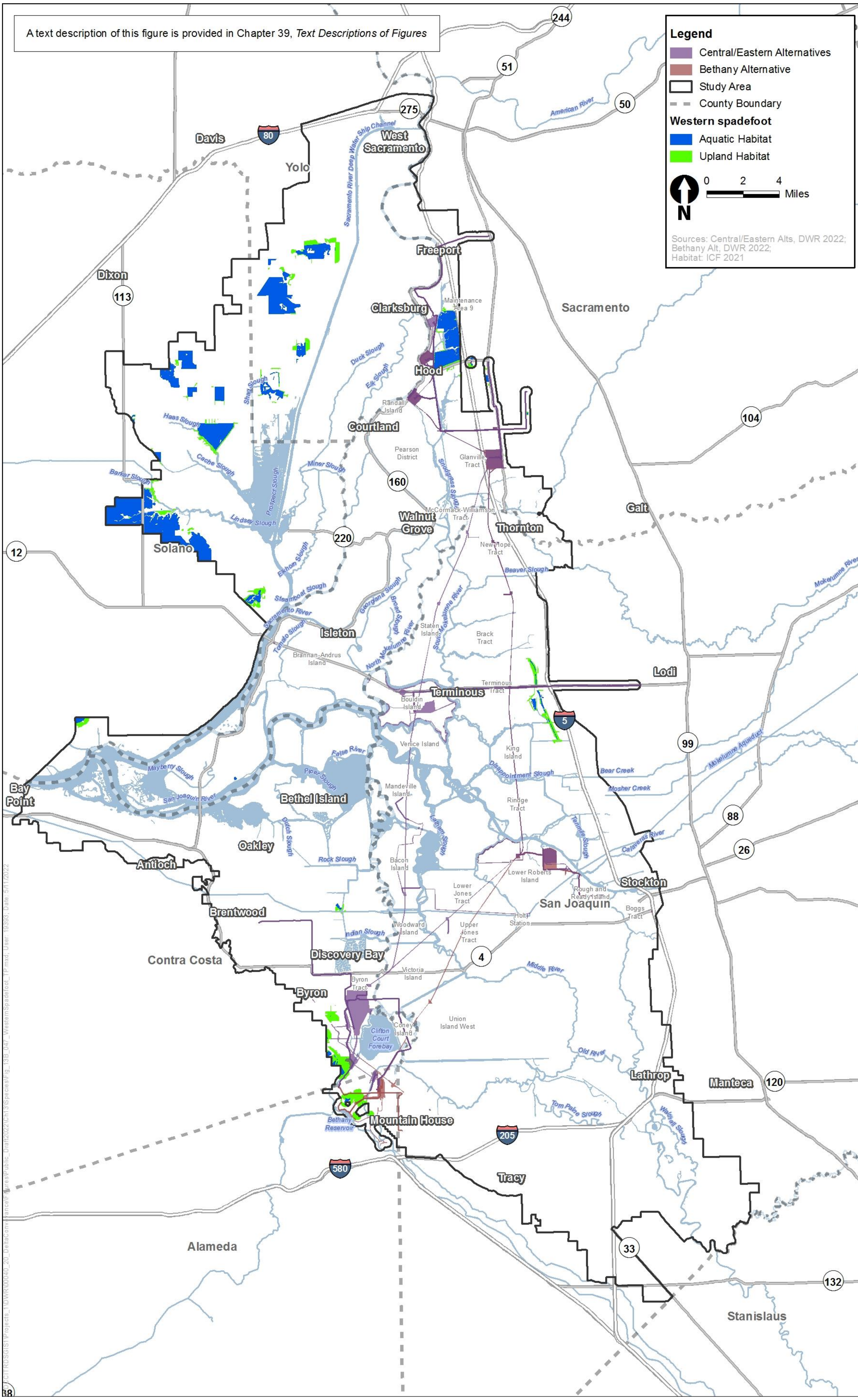

Figure 13B.48-1. Western Spadefoot Modeled Habitat in the Study Area

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13B.49 California Red-Legged Frog (*Rana draytonii*)

13B.49.1 Legal Status

California red-legged frog is listed as threatened under ESA (U.S. Fish and Wildlife Service 2020) and is identified as a CDFW Species of Special Concern (California Department of Fish and Wildlife 2020a:43). Critical habitat for the species was designated in 2006 and revised in 2010 (U.S. Fish and Wildlife Service 2020). A portion of critical habitat unit CCS-2B overlaps with a portion of the study area southwest of Clifton Court Forebay.

13B.49.2 Range and Distribution within the Study Area

California red-legged frog is endemic to central California, with a range historically extending from southern Mendocino County southward along the interior Coast Ranges to northern Baja California, Mexico, and inland from the vicinity of Redding, Shasta County, California, along Sierra Nevada foothills south to Fresno County at elevations from sea level to approximately 5,000 feet (Nafis 2020; Thomson et al. 2016). Currently, populations are known from the San Francisco Bay Area and Coast Ranges, the Sierra Nevada, and a few populations in Ventura, Los Angeles, and Riverside Counties (Thomson et al. 2016:103–104). U.S. Fish and Wildlife Service (2017) notes that while the California red-legged frog is still locally abundant in portions of the San Francisco Bay Area and the central coast, only isolated populations have been documented elsewhere within the species' historical range, including the Sierra Nevada, northern Coast Ranges, and northern Transverse Ranges.

California red-legged frog has potential to occur in the western most portion of the study area in eastern Contra Costa and Alameda Counties and portions of western San Joaquin County.

There are 16 CNDDB occurrences of California red-legged frog in the study area split between Contra Costa and Alameda Counties (California Department of Fish and Wildlife 2020b).

13B.49.3 Habitat Requirements

California red-legged frog utilizes a variety of habitats, including various aquatic systems and riparian and upland habitats (U.S. Fish and Wildlife Service 2002:12). Hayes and Jennings (1988:146–147) describe aquatic breeding habitat requirements for California red-legged frog as coldwater pond habitats (including stream pools) with emergent and submergent vegetation, providing suitable cover for young and adults and ensuring successful reproduction. Optimal habitats are described as deep-water ponds or pools at least 2.3 feet deep along low-gradient streams with dense stands of overhanging willows and a fringe of cattails between the willow roots and overhanging willow limbs. Hayes and Jennings (1988:152) also note that California red-legged frogs may prefer pools along intermittent streams rather than backwater pools along perennial streams, possibly for predator avoidance, particularly American bullfrogs (*Lithobates catesbeianus*). California red-legged frog uses a variety of aquatic habitats that meet these requirements including ponds, marshes, low-gradient streams, and lagoons (Thomson et al. 2016:102–103).

California red-legged frogs often disperse from breeding sites to various aquatic, riparian, and upland estivation habitats during the summer (66 FR 14628); however, it is common for individuals to remain in the breeding area year-round (66 FR 14628; Bulger et al. 2003:92; Fellers and Kleeman 2007:279–282). Adults may take refuge during dry periods in rodent holes or leaf litter in riparian habitats (U.S. Fish and Wildlife Service 2002:14). Within riparian areas, microhabitats utilized by California red-legged frogs include blackberry thickets, logjams, and root tangles (Fellers and Kleeman 2007:281).

California red-legged frogs travel through a variety of upland habitat types (e.g., grassland, riparian, woodlands) to reach breeding and nonbreeding sites, upland refugia and foraging habitats, or new breeding locations (Bulger et al. 2003:87–91; Fellers and Kleeman 2007:283–284). Frogs typically travel much shorter distances between aquatic and upland refugia and foraging habitats than when dispersing between breeding and nonbreeding aquatic habitats (Bulger et al. 2003:93–94). In one study, 90% of radio-tagged California red-legged frogs that did not make overland movements (i.e., non-migrating frogs) were found within 200 feet of aquatic habitat throughout the year; the farthest non-migrating movement was 427 feet from water and was in response to summer rain (Bulger et al. 2003:93). In another study, a radio-tagged California red-legged frog moved at least 0.9 mile and up to 1.7 mile over several months during the breeding season (Fellers and Kleeman 2007:282–283). The furthest documented dispersal distance has been 2.2 miles (Bulger et al. 2003:92).

13B.49.4 Seasonal Patterns

California red-legged frogs are most likely to make overland migrations through upland habitats at night during wet weather (Bulger et al. 2003:89; Fellers and Kleeman 2007:279). Breeding occurs between late November and late April (Thomson et al. 2016:102). Eggs hatch in 6–14 days, depending on water temperature (Thomson et al. 2016:102), with tadpoles undergoing metamorphosis in 4 to 7 months, although in some locations they have been known to overwinter (Nafis 2020) at some sites, completing metamorphosis the following spring (Fellers et al. 2001:156–157).

13B.49.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.49.5.1 GIS Model Data Sources

The California red-legged frog model uses the following datasets.

- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.49.5.2 Habitat Model Description

The model for California red-legged frog includes aquatic, upland, and dispersal habitat. The upland portion of the model includes areas within 300 feet of modeled aquatic habitat (refer to Section 13B.49.3, *Habitat Requirements*). The dispersal portion of the model includes areas within 2 miles of modeled aquatic habitat, which takes into consideration the previous studies discussed in Section 13B.49.3 and guidance from USFWS' 2005 *Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog* (U.S. Fish and Wildlife Service 2005). The extent of modeled habitat in the study area is depicted in Figure 13B.49-1.

13B.49.5.2.1 Geographic Limits

The model is restricted to the area starting near Antioch, then south on SR 4 to Balfour Road, then east on Balfour Road to Byron Highway, then south Byron Highway to SR 4, then east to the western bank of Old River, then south along the western bank to Old River's confluence with Italian Slough, then continues south along the western bank of Italian Slough to where Italian Slough turns to the west, at which point the geographic limits cross Italian Slough and continue south along the western edge of Clifton Court Forebay and the start of the California Aqueduct until Byron Highway, at which point the limits continue southeast on Bryon Highway to I-205 and then west on I-205 to the edge of the study area.

13B.49.5.2.2 Additional Model Parameters

Aquatic

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Tidal perennial aquatic
    - Natural channel
    - Tidal channel
- Nontidal freshwater perennial emergent wetland
    - Freshwater emergent wetland
- Tidal freshwater emergent wetland
    - Freshwater emergent wetland
- Valley/foothill riparian
    - Scrub shrub wetland

- Nontidal perennial aquatic
  - Natural channel
  - Depression

Outside the Delineation Study Area

Modeled habitat includes the following types from: Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).

- Nontidal freshwater perennial emergent wetland
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh
  - Naturalized warm-temperate riparian and wetland group
- Tidal freshwater emergent wetland
  - *Carex barbarae*
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh
- Nontidal perennial aquatic
  - *Azolla (filiculoides, microphylla)*
  - *Eichhornia crassipes*
  - *Lemna (minor) and relatives*
  - *Ludwigia (hexapetala, peploides)*
  - Naturalized temperate Pacific freshwater vegetation
  - Temperate freshwater floating mat
  - Temperate Pacific freshwater aquatic bed
  - Water

Upland

Modeled upland habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), and Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).

- Grassland
  - All types

- Valley/foothill riparian
  - All types
- Alkaline seasonal wetland complex
  - All types

Modeled habitat also includes the following types from the DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Vernal pool complex
  - All types

Dispersal

Modeled dispersal habitat includes the following types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021).

- Agricultural
  - All types

Modeled dispersal habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation, and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Grassland
  - All types
- Valley/foothill riparian
  - All types
- Alkaline seasonal wetland complex
  - All types

Modeled habitat also includes the following types from the DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Vernal pool complex
  - All types

13B.49.6 References Cited

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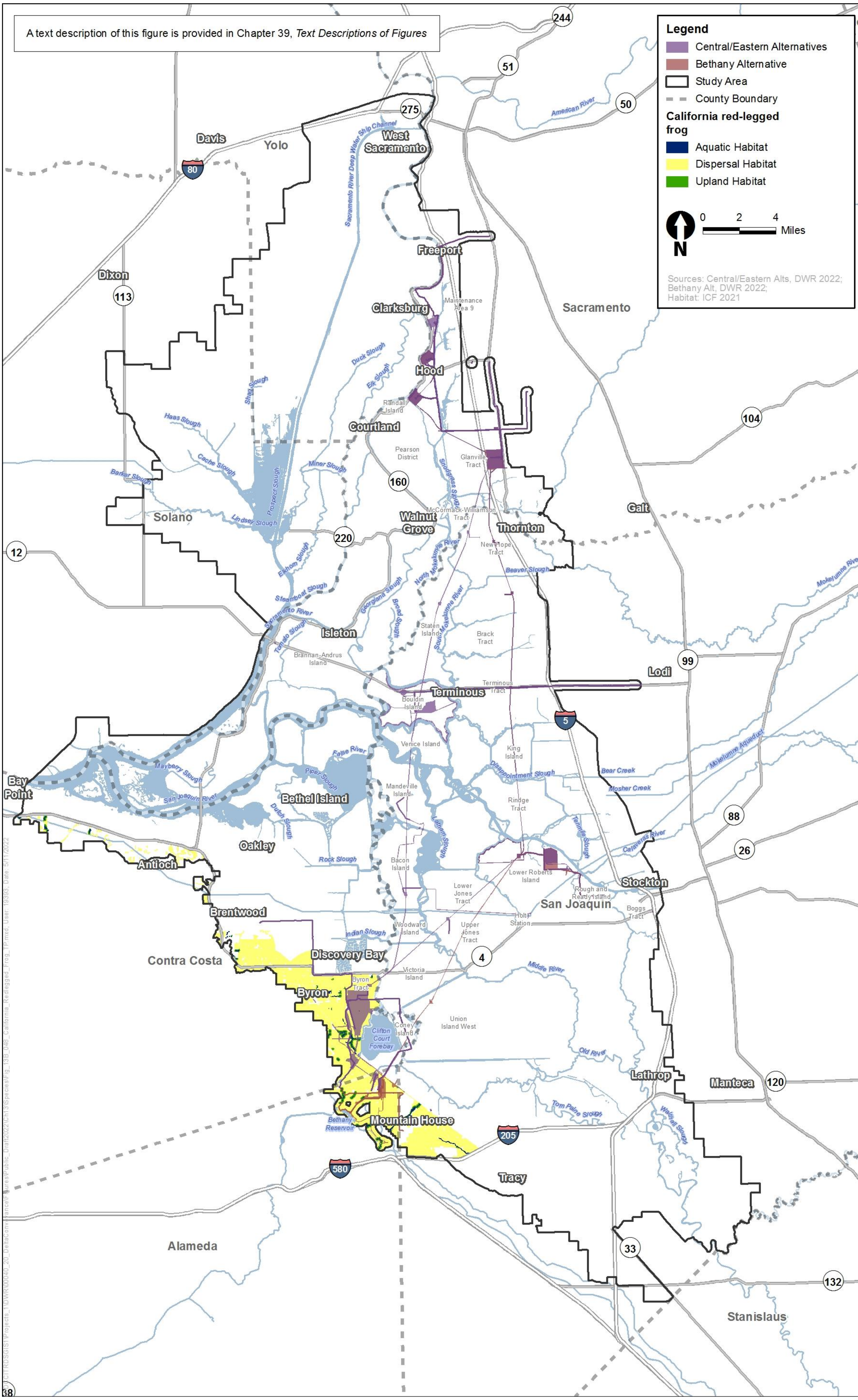

Figure 13B.49-1. California Red-Legged Frog Modeled Habitat in the Study Area

13B.50 Western Pond Turtle (*Emys marmorata*)

13B.50.1 Legal Status

Western pond turtle is under review for listing under ESA and is a CDFW Species of Special Concern (U. S. Fish and Wildlife Service 2020; California Department of Fish and Wildlife 2020a:44).

13B.50.2 Range and Distribution within the Study Area

Western pond turtle is found throughout of California, from the Pacific Coast inland to the Sierra Nevada foothills to elevations as high as 6,700 feet above sea level (Thomson et al. 2016:300).

The study area is within the range of western pond turtle as depicted in Thomson et al. (2016:297). There are numerous records of western pond turtle throughout the study area (California Department of Fish and Wildlife 2020b).

13B.50.3 Habitat Requirements

Western pond turtles are a highly aquatic species and can be found in a variety of habitat types including streams, rivers, sloughs, lakes, ponds, reservoirs, marshes, seasonal ponds, and other wetland habitats (Thomson et al. 2016:300). They require basking sites such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks for thermoregulation, and access to suitable upland habitat with loose soils for nesting, dispersal and overwintering (Thomson et al. 2016:300). Proximity of nesting site to aquatic habitat is dependent on availability, and the nest site is usually within 300 feet of the aquatic habitat but can be up to 1,640 feet away (Thomson et al. 2016:299).

13B.50.4 Seasonal Patterns

Western pond turtles are active year-round in warmer locations but will spend winter months in colder climates in a state of dormancy often burrowing into loose soil or leaf litter on land, or using undercut banks, snags, rocks or bottom mud in ponds (Thomson et al. 2016:299–300). Breeding occurs from spring through fall, with nesting taking place from spring to early summer. Females lay from one to 13 eggs, which will hatch in the fall, although the young will remain in the nest until the following spring (Thomson et al. 2016:299).

13B.50.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.50.5.1 GIS Model Data Sources

The western pond turtle model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- Delta 2017 Land Use Survey (Land IQ 2019)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- National Hydrography Dataset (U.S. Geological Survey 2020)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.50.5.2 Habitat Model Description

The habitat model for western pond turtle includes both aquatic and upland habitats. The modeled aquatic habitat relies on both delineation data that were collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area. The modeled upland habitat includes suitable habitats within 650 feet of modeled aquatic habitat, which are intended to include areas where most pond turtles may feed, reproduce, and overwinter. This distance was chosen as an intermediate distance between the 300-foot distance where turtles typically are found nesting and the greatest distance observed of 1,640 feet reported in Section 13B.50.3. This distance would likely be protective of the majority of turtles nesting in the study area and also takes into consideration the limitations of suitable habitat beyond that distance in the delta where most of the aquatic habitat is adjacent to agricultural areas, which are generally not suitable for breeding due to ongoing disturbance. The extent of modeled habitat in the study area is depicted in Figure 13B.50-1.

13B.50.5.2.1 Geographic Limits

The model boundary includes the entire study area, based on the species distribution described in Stebbins and McGinnis (2012:431) and Thomson et al. (2016:300).

13B.50.5.2.2 Additional Model Parameters

Aquatic

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021).

- Tidal perennial aquatic
    - Tidal channel
    - Natural channel
- Nontidal perennial aquatic
    - Depression
    - Natural channel
- Agricultural
    - Agricultural ditch
- Tidal freshwater emergent wetland
    - Freshwater emergent wetland
- Nontidal freshwater perennial emergent wetland
- Freshwater emergent wetland

Outside the Delineation Study Area

Modeled habitat includes the following types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Tidal freshwater emergent wetland
    - *Lepidium latifolium*
    - *Phragmites australis—Arundo donax*
    - *Schoenoplectus (acutus, californicus)*
    - *Schoenoplectus americanus*
    - *Typha (angustifolia, domingensis, latifolia)*
    - Arid west freshwater emergent marsh
- Nontidal freshwater perennial emergent wetland
    - *Lepidium latifolium*
    - *Phragmites australis—Arundo donax*
    - *Schoenoplectus (acutus, californicus)*
    - *Schoenoplectus americanus*
    - *Typha (angustifolia, domingensis, latifolia)*
    - Arid west freshwater emergent marsh
    - Naturalized warm-temperate riparian and wetland group
- Tidal brackish emergent wetland
    - *Bolboschoenus maritimus*

- *Lepidium latifolium*
- *Phragmites australis—Arundo donax*
- *Sarcocornia pacifica (Salicornia depressa)*
- *Schoenoplectus (acutus, californicus)*
- *Typha (angustifolia, domingensis, latifolia)*
- Arid west freshwater emergent marsh

- Nontidal brackish emergent wetland
  - *Bolboschoenus maritimus*
  - *Lepidium latifolium*
  - *Phragmites australis—Arundo donax*
  - *Sarcocornia pacifica (Salicornia depressa)*
  - *Schoenoplectus (acutus, californicus)*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid west freshwater emergent marsh
- Tidal perennial aquatic
  - All types, except conveyance channels west of Byron Highway.
- Nontidal perennial aquatic
  - All types, except conveyance channels.

Modeled habitat also includes the following types from the National Hydrography Dataset (U.S. Geological Survey 2020).

- Ditches

Upland

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Grassland
  - All types
- Valley foothill riparian
  - All types
- Alkaline seasonal wetland complex
  - All types

Modeled habitat includes the following types from the DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021).

- Vernal pool complex
  - All types

Modeled habitat also includes the following type from the Delta 2017 Land Use Survey (Land IQ 2019), the Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a), and the Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016).

- Agricultural
  - Upland herbaceous

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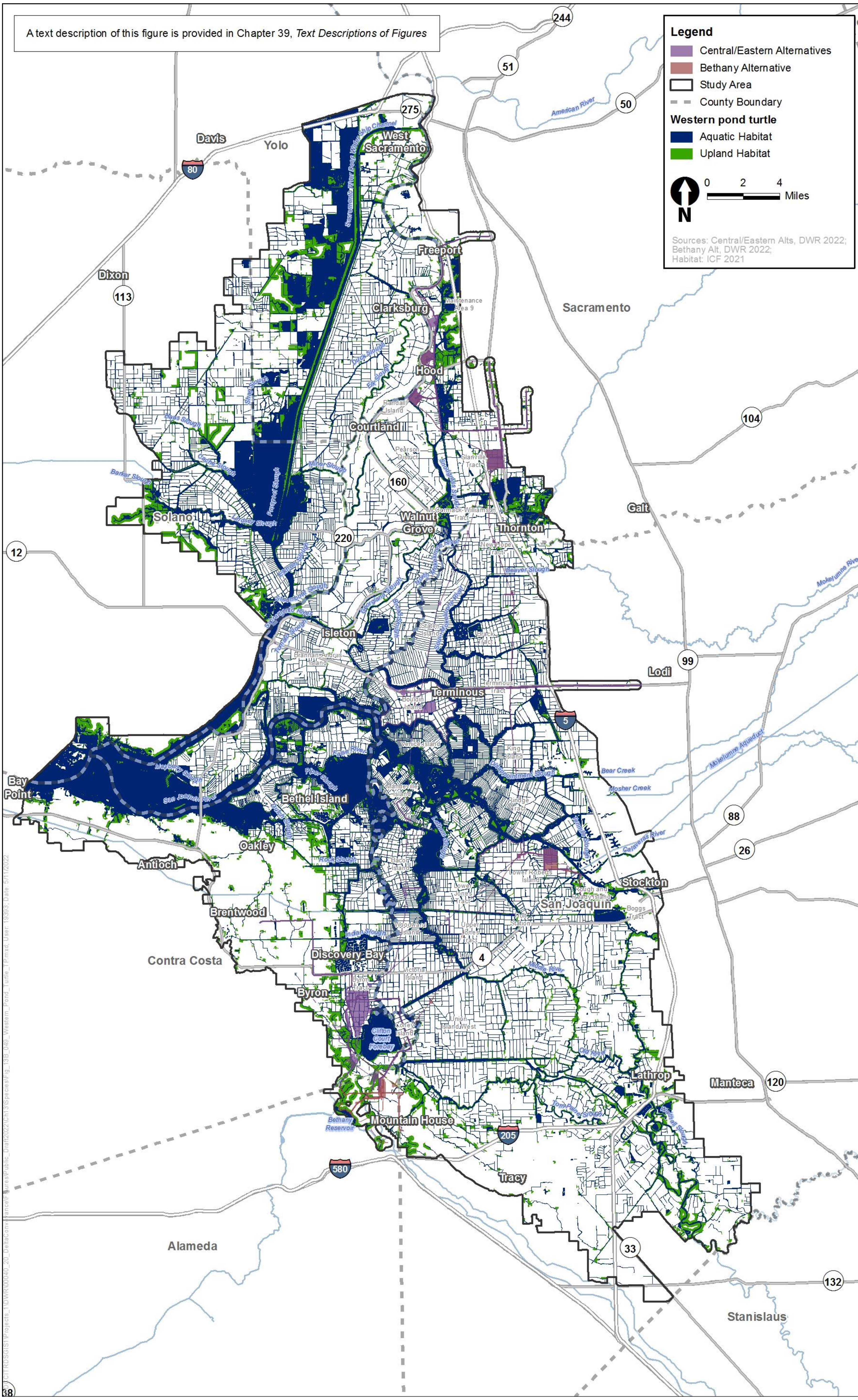

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2 **Figure 13B.50-1. Western Pond Turtle Modeled Habitat in the Study Area**

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13B.51 Coast Horned Lizard (*Phrynosoma blainvillii*)

13B.51.1 Legal Status

Coast horned lizard is a CDFW Species of Special Concern (California Department of Fish and Wildlife 2020a:45) and has no federal status.

13B.51.2 Range and Distribution within the Study Area

Coast horned lizard is found from Shasta County in the north to Baja California in the south and along the California coast inland to the Central Valley and Sierra Nevada foothills and west of the Mojave Desert (Thomson et al. 2016:221–222).

The species range overlaps with the entire study area. There are no CNDDB occurrences for coast horned lizard in the study area (California Department of Fish and Wildlife 2020b).

13B.51.3 Habitat Requirements

Coast horned lizards are found in a wide variety of habitat types including sage scrub, dunes, alluvial scrub, annual grassland, chaparral, oak woodland, riparian woodland, coniferous forest, Joshua tree woodland, and saltbush scrub (Thomson et al. 2016:221). In these habitats, coast horned lizard requires loose, fine soils for burrowing, open areas for thermoregulation, and shrub cover for refugia (Thomson et al. 2016:221), but Shedd et al (2011:94-95) found that in the absence of shrub cover they can utilize small mammal burrows such as those of the California kangaroo rat (*Dipodomys californicus*).

13B.51.4 Seasonal Patterns

Coast horned lizards are active from February through November, peaking in April and July. Breeding occurs from March to June, with average clutch sizes of 11 eggs laid likely beginning in May, with an incubation period of approximately 60 days. Hatchlings are active from mid- to late summer through November (Thomson et al. 2016:220).

13B.51.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.51.5.1 GIS Model Data Sources

The coast horned lizard model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)

- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- SSURGO (Natural Resources Conservation Service 2020)

13B.51.5.2 Habitat Model Description

The habitat model for coast horned lizard is limited to grasslands and riparian habitat with loose, fine soils. Soils were determined by selecting soil textural classes from the SSURGO database that could be used for burrowing. The extent of modeled habitat in the study area is depicted in Figure 13B.51-1.

13B.51.5.2.1 Geographic Limits

Entire study area.

13B.51.5.2.2 Additional Model Parameters

Modeled habitat includes the following vegetation types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Grassland
  - All types
- Riparian
  - All types

The model is further limited by the following SSURGO soil textural (Natural Resources Conservation Service 2020).

Textural Class

- Sand
- Loamy sand
- Fine sandy loam
- Sandy loam
- Coarse sandy loam
- Fine sand
- Variable

13B.51.6 References Cited

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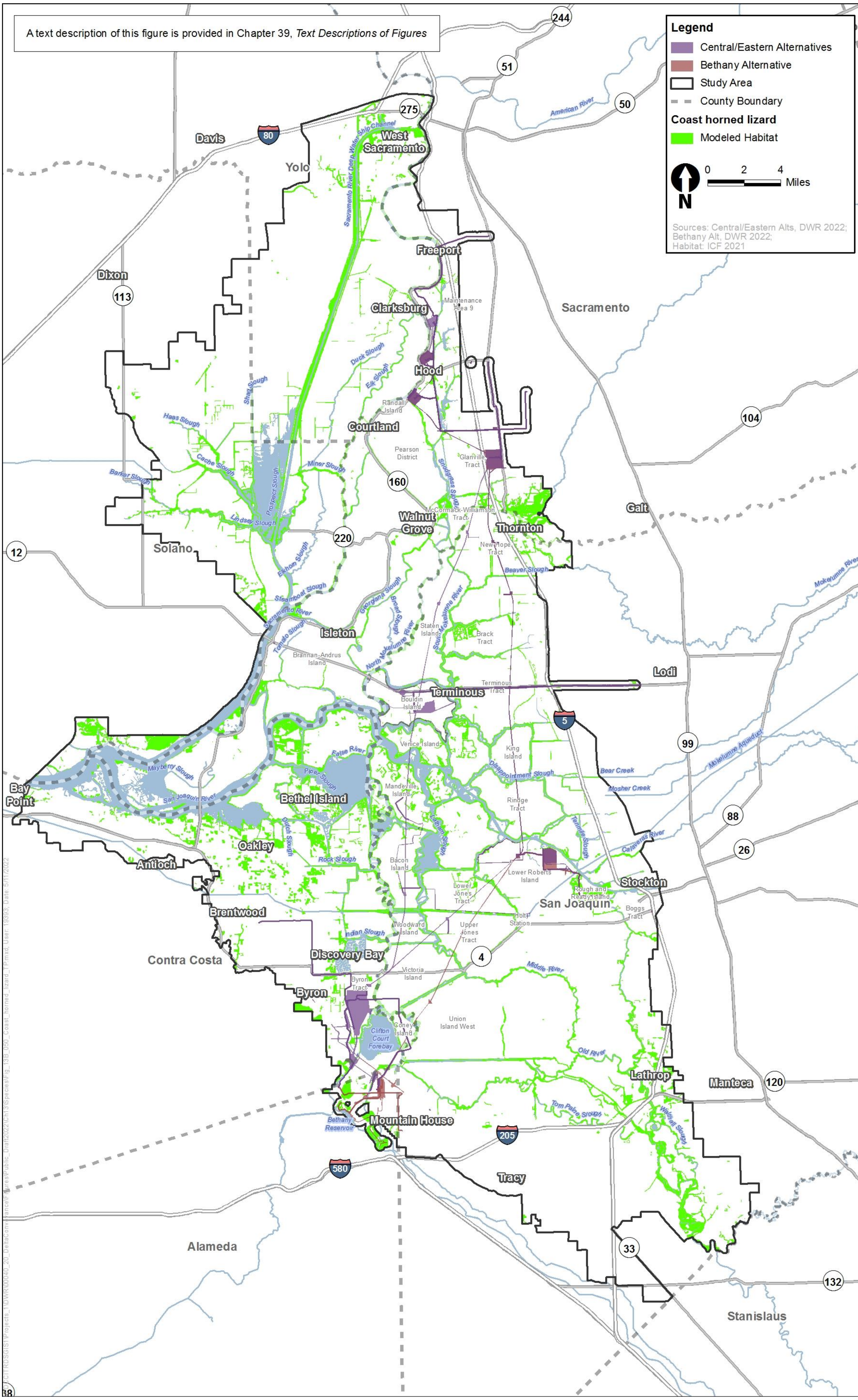

Figure 13B.51-1. Coast Horned Lizard Modeled Habitat in the Study Area

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13B.52 Northern California Legless Lizard (*Anniella pulchra*)

13B.52.1 Legal Status

Northern California legless lizard is identified as a CDFW Species of Special Concern and has no federal status (California Department of Fish and Wildlife 2020a:47). For the purposes of this analysis we rely on the treatment used in the preparation of the *California Amphibian and Reptile Species of Special Concern* (Thomson et al 2016), which addresses the California legless lizard as a single species but acknowledges the most recent information on the genetics of the five clades across the state, which CDFW has since acknowledged as five distinct species, with Northern California legless lizard representing the northern most species (Thomson et al 2016:88, California Department of Fish and Wildlife 2020a:47)

13B.52.2 Range and Distribution within the Study Area

Northern California legless lizard ranges from Central San Joaquin County and Contra Costa County south to Santa Barbara, Ventura and Los Angeles Counties through the Coast Ranges, in parts of the San Joaquin Valley, the western edge of the Sierra Nevada Mountains, at elevations from sea level to 5,900 feet (Thomson et al. 2016:189, Nafis 2020).

The range for Northern California legless lizard overlaps with the southern half of the study area, excluding the Sacramento, Yolo, and Solano County portions of the study area.

There are five CNDDB occurrences in the western post portion of the study area in Contra Costa County, ranging from Brentwood north to Antioch (California Department of Fish and Wildlife 2020b).

13B.52.3 Habitat Requirements

Northern California legless lizard is regionally found in coastal sand dunes, chaparral, pine-oak woodland, desert scrub, open grassland, and riparian areas (Thomson et al. 2016:188). Microhabitat requirements include sandy or loose loamy substrates conducive to burrowing (Thomson et al. 2016:188), may prefer lower lying areas in dune habitat due to the presence of increased soil moisture (Kuhnz et al. 2005:395).

13B.52.4 Seasonal Patterns

Breeding occurs between early spring and July, with an average gestation of four months (Thomson et al. 2016:188). Coastal and southern populations are likely active year-round and inland populations may enter a period of dormancy during cold months (Thomson et al. 2016:188).

13B.52.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.52.5.1 GIS Model Data Sources

The California legless lizard model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- SSURGO (Natural Resources Conservation Service 2020)
- California Legless Lizard Range Map (California Department of Fish and Wildlife 2018)

13B.52.5.2 Habitat Model Description

The habitat model for northern California legless lizard is limited to grasslands and valley/foothill riparian habitat with loose, sandy soils. Soils were determined by selecting soil textural classes from the SSURGO database that could be used for burrowing. The extent of modeled habitat in the study area is depicted in Figure 13B.52-1.

13B.52.5.2.1 Geographic Limits

The model is limited to Contra Costa County, Alameda County, and San Joaquin County, based on the species distribution described in Thomson et al. (2016:187–189) and in GIS data from the California Wildlife Habitat Relationship System (California Department of Fish and Wildlife 2018).

13B.52.5.2.2 Additional Model Parameters

Modeled habitat includes the following vegetation types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).

- Grassland
  - All types
- Valley/foothill riparian
  - All types

The model is further limited by the following SSURGO soil textural classes (Natural Resources Conservation Service 2020).

Textural Class

- Sand
- Loamy sand
- Fine sandy loam
- Sandy loam
- Coarse sandy loam
- Fine sand

- Variable

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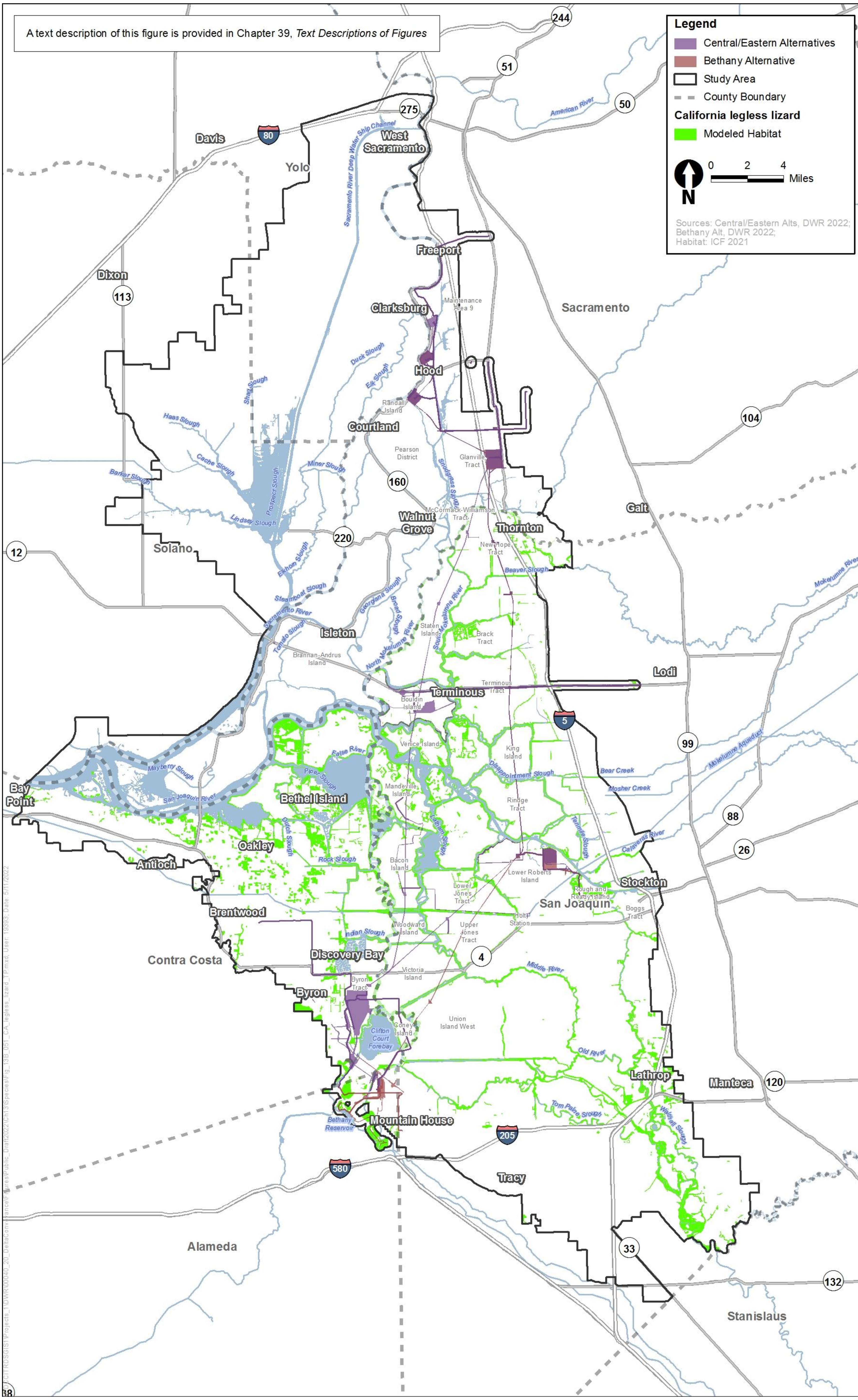

Figure 13B.52-1. Northern California Legless Lizard Modeled Habitat in the Study Area

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13B.53 California Glossy Snake (*Arizona elegans occidentalis*)

13B.53.1 Legal Status

California glossy snake is identified as a CDFW Species of Special Concern and has no federal status (California Department of Fish and Wildlife 2020a:48).

13B.53.2 Range and Distribution within the Study Area

California glossy snake occurs from Contra Costa County south along the interior Coast Range into the southern San Joaquin Valley, into the Tehachapi Mountains and along the base of the Coast Range south to San Quintìn, Baja California, at elevations ranging from sea level to 5,900 feet (Thomson et al. 2016:258).

The currently depicted range in Thomson et al (2016:256) overlaps with the western most portion of the study area near Byron Airport and Bethany Reservoir in eastern Contra Costa and Alameda counties

There is one historical CNDDB occurrence in 1958 for California glossy from the Antioch Dunes, which is outside of the currently defined range (California Department of Fish and Wildlife 2020b).

13B.53.3 Habitat Requirements

California glossy snakes are found in open areas in desert, grasslands, shrublands, chaparral, and woodlands (Thomson et al. 2016:257). Unpublished survey data indicate California glossy snake prefers sandy soil habitats such as coastal dunes, alluvial creek beds, and ancient dunes on the marine terraces (Thomson et al. 2016:258). They are known to retreat to burrows during the day, using either existing mammal burrows, excavations under rocks, or creating burrows themselves (Thomson et al. 2016:257).

13B.53.4 Seasonal Patterns

California glossy snake is nocturnal and is generally active between late February and November, with activity peaking in May (Thomson et al. 2016:257). Little is known about their reproduction in the wild, but young of year are generally found in September (Thomson et al. 2016:257).

13B.53.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.53.5.1 GIS Model Data Sources

The California glossy snake model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- SSURGO (Natural Resources Conservation Service 2020)
- Glossy Snake Range Map (California Department of Fish and Wildlife 2016)

13B.53.5.2 Habitat Model Description

The habitat model for California glossy snake is limited to grasslands with sandy or loamy soils. Soils were determined by selecting soil textural classes from the SSURGO database that would have fine soils or loose soils. The extent of modeled habitat in the study area is depicted in Figure 13B.53-1.

13B.53.5.2.1 Geographic Limits

The model is limited to the range defined in Thomson et al. (2016:256) and available in GIS through the California Wildlife Habitat Relationship (CWHR) System (California Department of Fish and Wildlife 2016).

13B.53.5.2.2 Additional Model Parameters

Modeled habitat includes the following vegetation types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Grassland
  - All types

The model is further limited by the following SSURGO soil textural classes (Natural Resources Conservation Service 2020).

Textural Class

- Sand
- Loamy sand
- Fine sandy loam
- Sandy loam
- Coarse sandy loam
- Fine sand
- Variable

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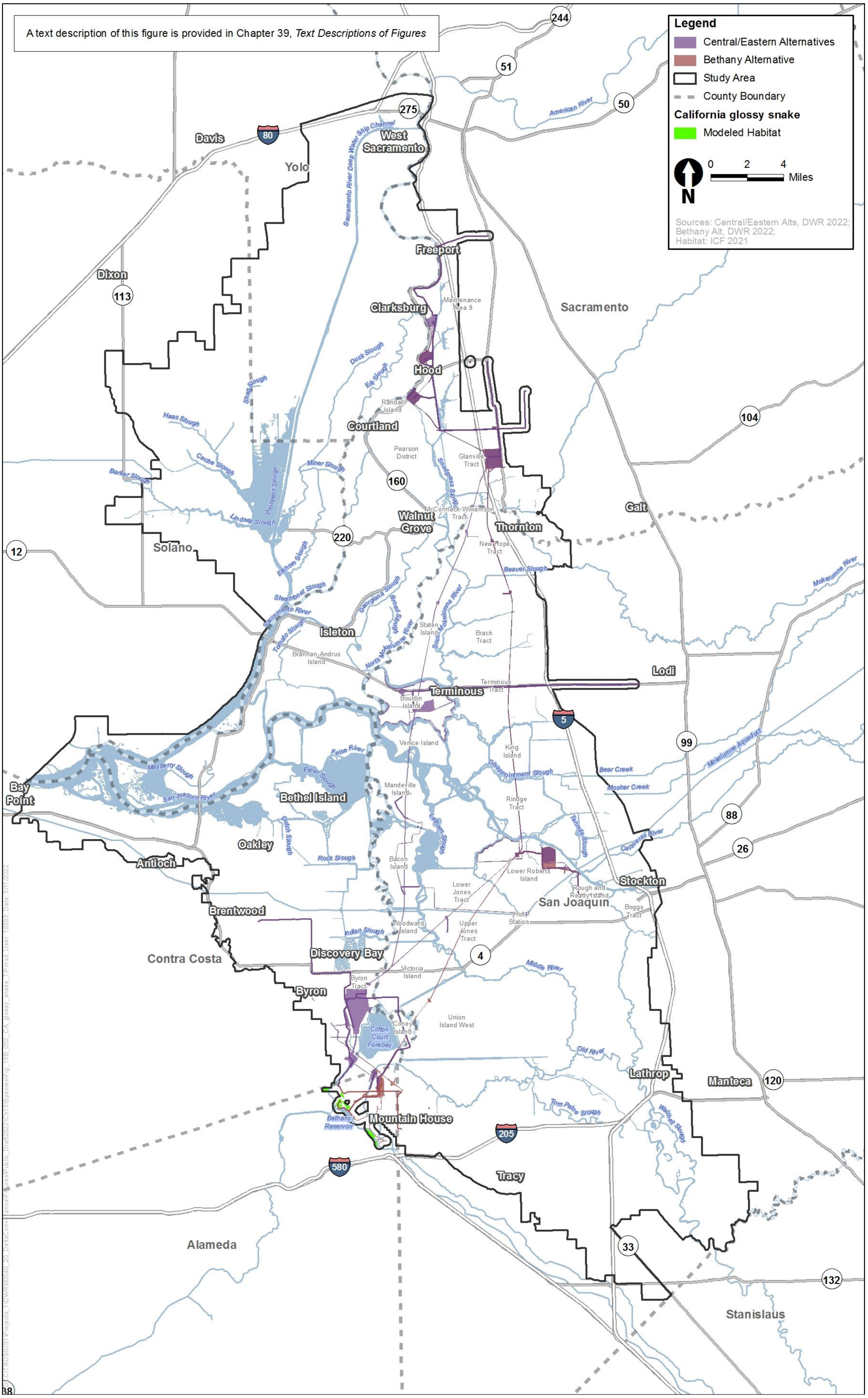

Figure 13B.53-1. California Glossy Snake Modeled Habitat in the Study Area

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13B.54 San Joaquin Coachwhip (*Masticophis flagellum ruddocki*)

13B.54.1 Legal Status

San Joaquin (whipsnake) coachwhip is identified as a CDFW Species of Special Concern and has no federal status (California Department of Fish and Wildlife 2020a:48).

13B.54.2 Range and Distribution within the Study Area

San Joaquin coachwhip is endemic to California, with the majority of the range extending from eastern Contra Costa County south through the interior Coast Range and into the southern San Joaquin Valley, with a disjunct population at the Sutter Buttes (Thomson et al. 2016:272–273).

In the study area, the species range is limited to portions of eastern Contra Costa and Alameda Counties and western San Joaquin County. There are no CNDDB occurrences within the study area; however, there are occurrences a few miles to the west (California Department of Fish and Wildlife 2020b).

13B.54.3 Habitat Requirements

San Joaquin coachwhip generally occurs in open, dry, treeless areas, including grassland and saltbush scrub. It often will climb into vegetation to scan for prey or shade and refuge, and it overwinters in mammal burrows (Thomson et al. 2016:273).

13B.54.4 Seasonal Patterns

San Joaquin coachwhips are diurnal and generally active starting in April to May, depending upon temperature, being most active during the warmest times of the day (Thomson et al. 2016:273). Mating is thought to occur in April and May with young emerging in late August to early September (California Department of Fish and Wildlife 2000). Adults may cease activity and retreat to mammal burrows as early as August (Thomson et al. 2016:273).

13B.54.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.54.5.1 GIS Model Data Sources

The San Joaquin coachwhip model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)

- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Soil Survey Geographic Database (SSURGO) (Natural Resources Conservation Service 2020)
- San Joaquin Coachwhip Range Map (California Department of Fish and Wildlife 2018)

13B.54.5.2 Habitat Model Description

The San Joaquin coachwhip model is limited to grasslands. The extent of modeled habitat in the study area is depicted in Figure 13B.54-1.

13B.54.5.2.1 Geographic Limits

The model is limited to the range defined in Thomson et al. (2016:273) and available in GIS through the California Wildlife Habitat Relationships (CWHR) System (California Department of Fish and Wildlife 2018).

13B.54.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Grasslands
    - All types

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Thomson, R. C., A. N. Wright, and B. Shaffer. 2016. *California Amphibian and Reptile Species of Special Concern*. Oakland, CA: University of California Press.

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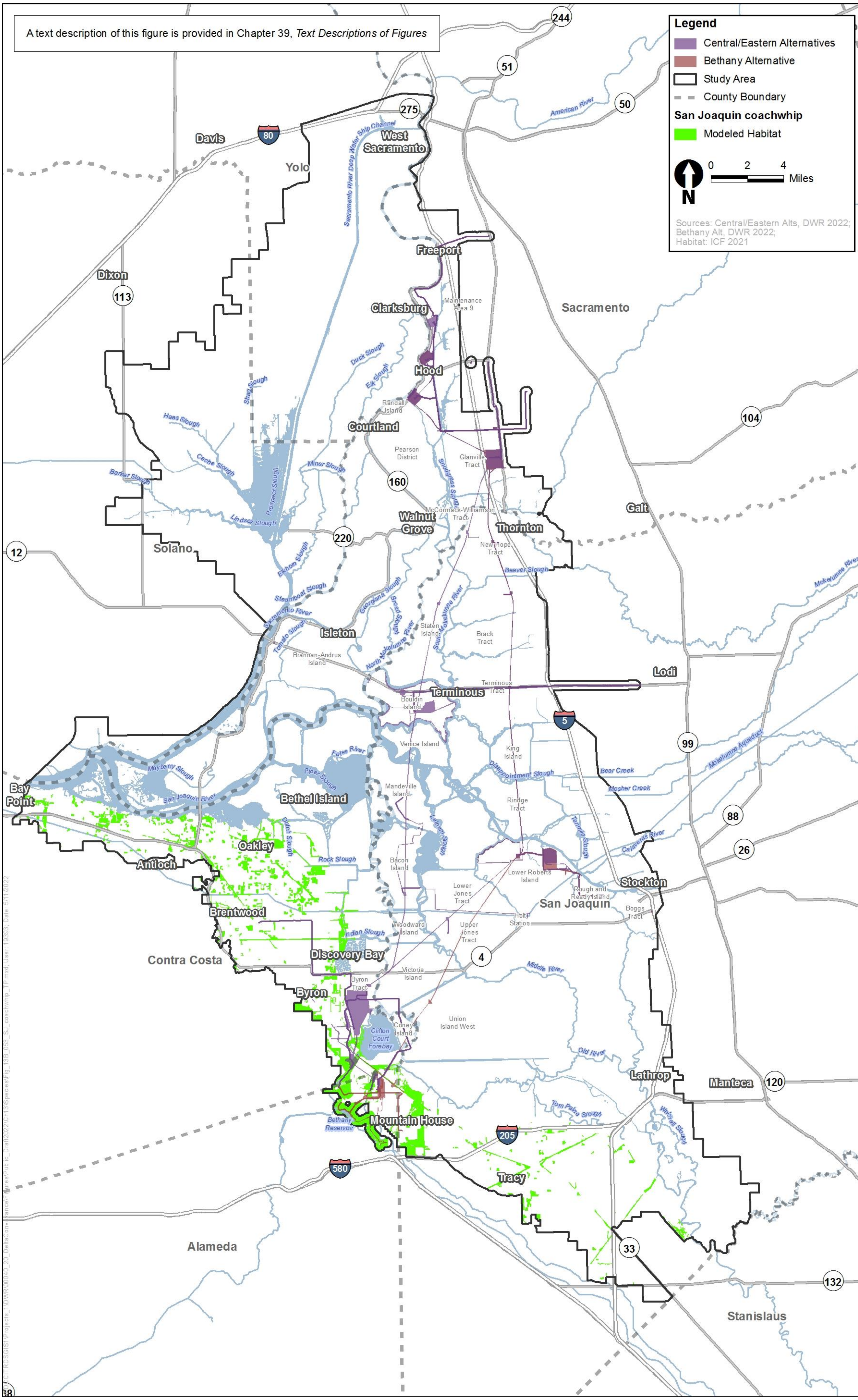

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2 **Figure 13B.54-1. San Joaquin Coachwhip Modeled Habitat in the Study Area**

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13B.55 Giant Garter Snake (*Thamnophis gigas*)

13B.55.1 Legal Status

Giant garter snake is listed as threatened under ESA and as threatened under CESA (California Department of Fish and Wildlife 2020a:48). Critical habitat has not been designated for giant garter snake.

13B.55.2 Range and Distribution within the Study Area

Giant garter snakes historically occurred throughout the Central Valley of California, although its current range has been reduced to fragmented populations from Glenn County to the edge of the Delta, and south from Merced to Fresno Counties. The current known distribution of giant garter snakes is variable and extends from near Chico in Butte County, south to the Mendota Wildlife Area in Fresno County (U.S. Fish and Wildlife Service 2020:4). There are nine recognized distinct populations of giant garter snake, which correspond to recovery units identified in the 2017 recovery plan: the Butte, Colusa, American, Yolo, Cosumnes-Mokelumne, Delta, San Joaquin, and Tulare Basins (U.S. Fish and Wildlife Service 2017:iii).

The entire study area falls within the range of giant garter snake where suitable habitat exists. The study area overlaps with three of the recovery units identified in the 2017 recovery plan: Yolo, Cosumnes-Mokelumne, and the Delta Basins (U.S. Fish and Wildlife Service 2017:II-3).

There are numerous CNDDB occurrences for giant garter snake throughout the study area north of Highway 4 (California Department of Fish and Wildlife 2020b).

13B.55.3 Habitat Requirements

Giant garter snake inhabits remaining natural wetland habitats in its range, which include marshes, ponds, small lakes, low-gradient streams with silt substrates, and managed waterways (U.S. Fish and Wildlife Service 2017:I-2). They are also known to use agricultural areas, which include irrigation ditches, drainage canals, rice fields, and their adjacent uplands (U.S. Fish and Wildlife Service 2017:I-2). Though a highly aquatic species, they do use adjacent uplands for thermoregulation, summer shelter in burrows, and as refugia for winter hibernacula (U.S. Fish and Wildlife Service 2017:I-2).

In aquatic habitats, giant garter snakes are usually associated with habitats that have emergent vegetation, which can provide cover and opportunities for basking, in particular tules (*Schoenoplectus acutus*) (U.S. Fish and Wildlife Service 2020:17). In the Sacramento Valley, giant garter snakes have been found to positively associate with rice fields. Though they do not spend much time in the rice fields themselves, the adjacent ditches and canals support populations of giant garter snakes largely due to the rice fields being a source of prey populations (U.S. Fish and Wildlife Service 2020:17; Reyes et al. 2017:70)

Terrestrial habitat adjacent to suitable aquatic habitat is also an important resource for giant garter snake (Halstead et al. 2015:633). Terrestrial habitat serves two purposes for giant garter snake. Near aquatic habitat, upland can be used for thermoregulation and summer shelter in nearby burrows; further away from aquatic habitat and above the high winter waters, the upland can provide refugia for brumation (U.S. Fish and Wildlife Service 2017:I-2). During the colder winter months (generally October 1 to April 1), giant garter snakes over-winter in upland areas that provide sufficient cover, which are usually mammal burrows and include human-made features such as riprap (U.S. Fish and Wildlife Service 2017:I-3). They may over-winter as far as 650 to 820 feet from the edge of aquatic habitat (U.S. Fish and Wildlife Service 2017:I-3). A study by Halstead et al. (2015:638) found that giant garter snakes spend more than half of their time in terrestrial habitat during the summer (U.S. Fish and Wildlife Service 2020:17). Halstead et al. (2015) found the average snake to be within 98 feet of water with 95% of observations within 33 feet of water with their model predicting that some individuals could be as far as 571 feet from water (U.S. Fish and Wildlife Service 2020:17; Halstead et al. 2015:639).

13B.55.4 Seasonal Patterns

Depending on annual conditions, giant garter snakes usually move underground into mammal burrows, crevices, or other similar cover around October 1 to avoid the cool temperatures of fall and winter (U.S. Fish and Wildlife Service 2017:I-5). Snakes emerge from winter retreats as early as April 1 (U.S. Fish and Wildlife Service 2017:I-6), although emergence is dependent on weather conditions. Breeding occurs from March through May with neonates born in July through September.

13B.55.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.55.5.1 GIS Model Data Sources

The giant garter snake model uses the following datasets.

- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

- National Hydrography Dataset (U.S. Geological Survey 2020)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)

13B.55.5.2 Habitat Model Description

The habitat model for giant garter snake includes both aquatic and upland habitats. The modeled aquatic habitat relies on both delineation data that were collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area.

The modeled upland habitat includes suitable habitat within 200 feet of modeled aquatic habitat. The 200-foot buffer stems from previous USFWS guidance on upland habitat when considering impacts on the species. Though the species is known to utilize uplands further than 200 feet, as discussed in Section 13.B.54.3, *Habitat Requirements* above, the model is intended to capture where the majority of actively used upland habitat occurs.

For the tidal perennial aquatic features of the model, modeled habitat only extends 20 feet into tidal perennial aquatic polygons from the edges of adjacent land. In tidal perennial aquatic features (e.g., the Sacramento and San Joaquin Rivers and tidal zones in the central Delta), giant garter snakes are likely limited to shallow, near-shore habitats providing emergent vegetation and vegetative cover. Accordingly, tidal perennial aquatic features are buffered internally by 20 feet to capture the near-shore habitat and exclude the relatively deep-water areas that are considered unsuitable. The Clifton Court Forebay and Discovery Bay are excluded from modeled tidal perennial aquatic features, as the aquatic habitat is not suitable for giant garter snake. The extent of modeled habitat in the study area is depicted in Figure 13B.55-1.

13B.55.5.2.1 Geographic Limits

Entire study area.

13B.55.5.2.2 Additional Model Parameters

Aquatic

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021):

- Tidal freshwater emergent wetland
    - Freshwater emergent wetland
- Nontidal freshwater perennial emergent wetland
    - Freshwater emergent wetland
- Agricultural
    - Agricultural ditch

- Nontidal perennial aquatic
  - Depression
  - Natural channel
- Tidal perennial aquatic
  - Tidal channel
  - Natural channel

Modeled habitat also includes the following types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021).

- Agricultural
  - Rice
  - Wild rice

Outside the Delineation Study Area

Modeled habitat includes the following types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021).

- Agricultural
  - Rice
  - Wild rice

Modeled habitat includes the following type from the National Hydrography Dataset (U.S. Geological Survey 2020).

- Agricultural
  - Ditches

Modeled habitat also includes the following types from the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018) and the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).

- Tidal perennial aquatic
  - All types
- Tidal freshwater emergent wetland
  - All types
- Nontidal freshwater emergent wetland
  - All types
- Nontidal perennial aquatic
  - All types

Upland

Modeled habitat includes the following type from the Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b), the Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016), and the Delta 2017 Land Use Survey (Land IQ 2019).

- Agricultural
  - Upland herbaceous

Modeled habitat includes the following type from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021).

- Agricultural
  - Mixed pasture

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018) and the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).

- Alkaline seasonal wetland complex
  - *Allenrolfea occidentalis*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Juncus arcticus (var. balticus, mexicanus)*
  - Western North American disturbed alkaline marsh and meadow
- Grassland
  - All types
- Valley/foothill riparian
  - All types

Modeled habitat includes the following types from the DCP vernal pool complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019, California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Vernal pool complex
  - All types

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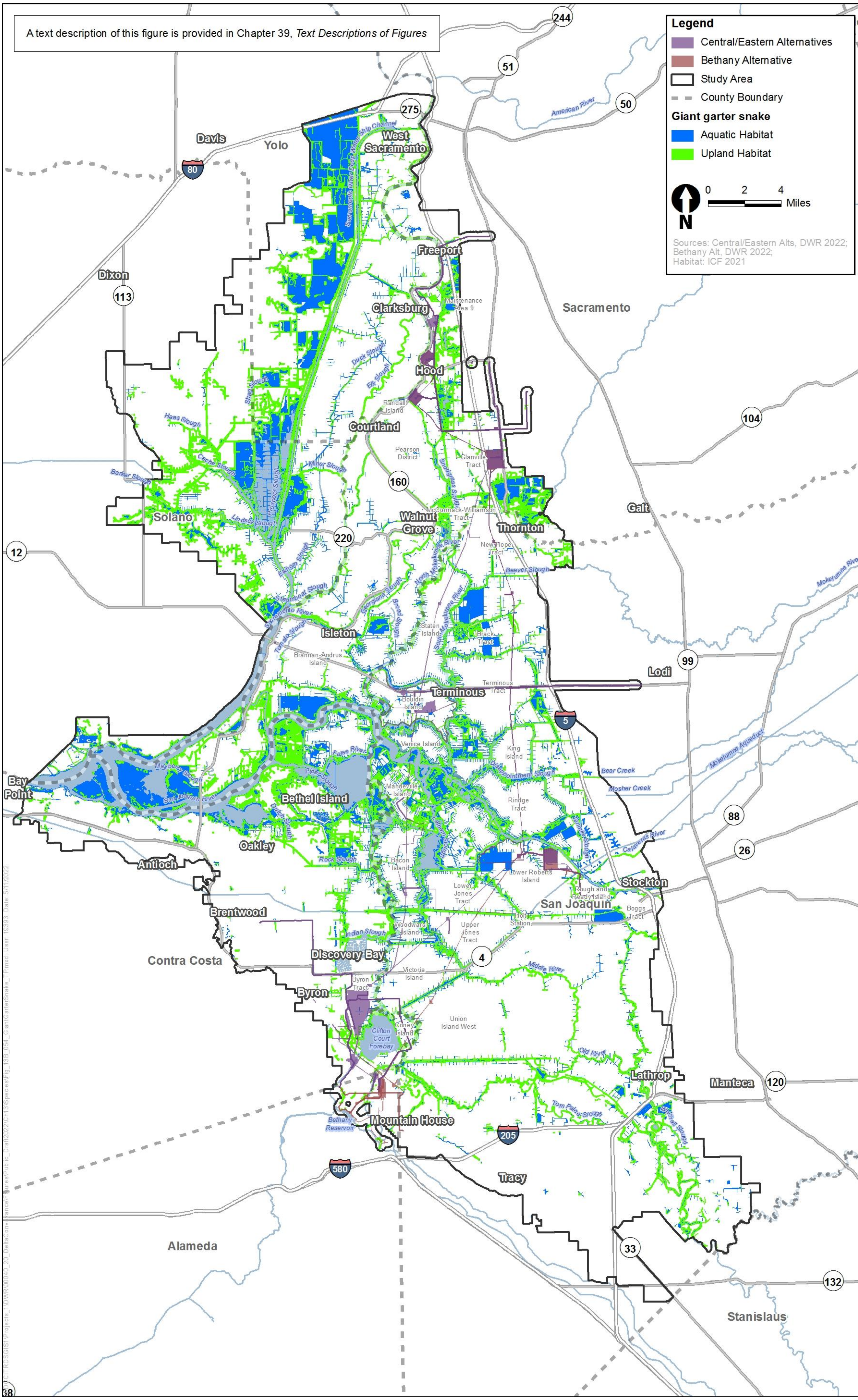

Figure 13B.55-1. Giant Garter Snake Modeled Habitat in the Study Area

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13B.56 Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*)

13B.56.1 Legal Status

The western distinct population segment (DPS) of the yellow-billed cuckoo was listed as threatened under the federal ESA on October 2, 2014 (79 FR 59991–60038). Western yellow-billed cuckoo is also listed as an endangered species under the CESA (California Department of Fish and Wildlife 2020a:59). Critical habitat for the western DPS of yellow-billed cuckoo was proposed on August 15, 2014 (57 FR 48547–48652) and a revision was proposed on February 27, 2020 (85 FR 11458–11594). There is no designated critical habitat for western yellow-billed cuckoo in the study area.

13B.56.2 Range and Distribution within the Study Area

The historical distribution of western yellow-billed cuckoo extended throughout the Central Valley Belding (1890:57). In the mid-1940s, Grinnell and Miller (1944:186) considered the Central Valley distribution to extend from Bakersfield to Redding.

Currently, the known populations of breeding western yellow-billed cuckoo are in several disjunct locations in California, Arizona, New Mexico, Texas, and northern Mexico (Halterman 1991:1, 5; Johnson et al. 2007:4; Dettling et al. 2015:1; Stanek 2014:14–15, 21–22; Parametrix Inc. and Southern Sierra Research Station 2015:65, 81). The only locations in California that currently sustain breeding populations include the Colorado River system in southern California, the South Fork Kern River east of Bakersfield, isolated sites along the Sacramento River in northern California, and a few occurrences have been detected near the Eel River (Laymon and Halterman 1989:273; Laymon 1998:2–4; Halterman 2001:2; Hammond 2011:4; Dettling et al. 2014:4; Stanek 2014:2). Many large riparian areas along the Sacramento River in Tehama County and along the Feather River in Yuba and Sutter Counties appear to be unoccupied, but represent potentially suitable habitat for western yellow-billed cuckoo (Gaines and Laymon 1984:59–60; Dettling et al. 2015:3, 4, 9–11). The current breeding population in California is estimated to be about 40–50 pairs (78 FR 61621–61666). Surveys conducted by Dettling et al. (2015:7) in 2010, 2012, and 2013 in 84 habitat patches along the Sacramento River and 31 habitat patches along the Feather River determined that there is a population of 30 pairs on the Sacramento River; western yellow-billed cuckoo was not detected along the Feather River.

There are no recently confirmed western yellow-billed cuckoo breeding locations in the study area (California Department of Fish and Wildlife 2020b); however, the species has been observed in the study area. In 2013, approximately 5 miles from the study area, there were two unconfirmed audible occurrences along the American River Parkway. These two occurrences were less than 5 miles apart along the river and heard on the same day (eBird 2021). In 2015 there was a confirmed visual occurrence along the American River near both 2013 audible occurrences and approximately 5 miles from the study area (eBird 2021). There are two records of western yellow-billed cuckoo observed at Cosumnes River Preserve on the same day in July 1996 and one observation of a cuckoo in flight at the Dow Wetlands Preserve in June 2005 (eBird 2021). In summer 2009, DWR detected one, or possibly two, yellow-billed cuckoos in a remnant patch of riparian forest near Delta Meadows (California Department of Water Resources 2011). However, breeding status was not confirmed. Historic and recent sightings of western yellow-billed cuckoo near the study area are presumed to be migrating birds. Most riparian corridors in the study area do not support sufficiently large riparian patches or the natural, geomorphic processes that provide suitable breeding habitat (Greco 2013:711–715). Several remnant riparian patches in the vicinity of Mandeville and Medford Islands provide riparian vegetation suitable for western yellow-billed cuckoo, but do not provide sufficiently large patch size to support breeding cuckoos. There have been very few occurrences of western yellow-billed cuckoo in the study area, and the birds found were likely to be migrating to northern breeding areas in the Sacramento Valley.

13B.56.3 Habitat Requirements

Western yellow-billed cuckoo is a riparian obligate species. Its primary habitat association is willow-cottonwood riparian forest, but other tree species such as white alder (*Alnus rhombifolia*) and box elder (*Acer negundo*) may be an important habitat element in some areas, including occupied sites along the Sacramento River (Laymon 1998:2–4, 11, 12). Nests are primarily in willow (*Salix* spp.) trees; however, other tree species are occasionally used, including Fremont cottonwood (*Populus fremontii*) and alder. Along the Sacramento River, orchards of English walnut (*Juglans regia*), prune and almond (*prunus* spp.) trees have also been reportedly used for nesting (Laymon 1998:1, 3). Potential habitat also occurs in valley marshland with willow riparian corridors, such as that found in the Llano Seco area of Butte County.

Patch size has been found to be the most important habitat variable to predict presence of western yellow-billed cuckoos on the Sacramento River (Girvetz and Greco 2009:24; Halterman 1991:3–4). Large patch sizes (minimum 50 acres to 100 acres, with a minimum width of 328.1 feet) are typically required for cuckoo occupancy (Laymon 1998; Riparian Habitat Joint Venture 2004:57). A willow-cottonwood forest patch greater than 1,980 feet wide and greater than 200 acres is classified as optimum habitat; a patch 660 to 1,980 feet wide and 102.5 to 200 acres is suitable; a patch 330 to 660 feet wide and 50 to 100 acres is marginal, and smaller patches are unsuitable (Laymon and Halterman 1998:272–273).

All studies indicate a highly significant association with relatively expansive stands of mature cottonwood-willow forests; however, western yellow-billed cuckoos will occasionally occupy a variety of marginal habitats, particularly at the edges of their range (Laymon 1998:2–4, 11, 12). Continuing habitat succession has also been identified as important in sustaining breeding populations (Laymon 1998:2–4, 11, 12). Meandering streams that allow for constant erosional and depositional processes create habitat for new rapidly growing young stands of willow, which create preferred nesting habitat conditions for western yellow-billed cuckoo (Greco 2013:711–715; Wohner et al. 2021:8–13). Lateral channel migration and point bar deposition that create new floodplains and channel bend cut-offs that create floodplain lakes are important processes that create viable western yellow-billed cuckoo habitat (Greco 2013:711–715).

13B.56.4 Seasonal Patterns

Yellow-billed cuckoos winter in South America from Venezuela to Argentina (Hughes 1999:3, 5, 11, 20; Sechrist et al. 2012:8) after a southern migration that extends from August to October (Laymon 1998:2–4). They migrate north and arrive at California breeding grounds between May and July, but primarily in June (Gaines and Laymon 1984:49; Hughes 1999:3, 5, 11, 20; 78 FR 61621).

13B.56.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.56.5.1 GIS Model Data Sources

The western yellow-billed cuckoo model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.56.5.2 Habitat Model Description

The western yellow-billed cuckoo model consists of migratory habitat. As described in Section 13B.56.2, *Range and Distribution within the Study Area*, there are no known breeding pairs in the study area; individuals detected in the study area are presumed to be migratory and the riparian habitat patches are not large enough, nor do they have the floodplain function necessary, to support breeding. However, because there is a known breeding population on the Sacramento River north of the study area, it is assumed that individuals likely migrate through the region. Consequently, the study area is assumed to provide migratory habitat for the western yellow-billed cuckoo. As described in Section 13B.56.3, *Habitat Requirements*, western yellow-billed cuckoo is a riparian obligate species and its primary habitat association is willow-cottonwood riparian forest. While riparian patch size is an important habitat component for breeding, there is no known minimum patch size for migratory habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.56-1.

13B.56.5.2.1 Geographic Limits

There is a known breeding population on the Sacramento River north of the study area, therefore it is assumed that individuals likely migrate through the region (Dettling et al. 2015:7). Consequently, the entire study area is assumed to provide migratory habitat for the western yellow-billed cuckoo.

13B.56.5.2.2 Additional Model Parameters

Modeled western yellow-billed cuckoo migratory habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
    - *Populus fremontii*
    - *Alnus rhombifolia*
    - *Fraxinus latifolia*
    - *Acer negundo*
    - *Juglans hindsii* and hybrids
    - *Salix gooddinggii*
    - *Salix lasiolepis*
    - *Salix lucida*
    - *Salix exigua*
    - *Platanus racemosa* alliance
    - *Salix laevigata* alliance
    - *Cornus sericea*
    - *Quercus lobata*
    - *Quercus agrifolia*
    - *Quercus wislizeni* (tree)
    - *Rosa californica*
    - *Sambucus nigra*
    - *Vitis californica*
    - *Rubus armeniacus*
    - *Cephalanthus occidentalis*
    - Californian broadleaf forest and woodland group
    - Southwestern North American riparian evergreen and deciduous woodland
    - Vancouverian riparian deciduous forest alliance
    - Southwestern North American introduced riparian scrub
    - Southwestern North American riparian/wash scrub

Modeled migratory habitat also includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer:

- Valley/foothill riparian
    - Forested wetland
    - Shrub scrub wetland

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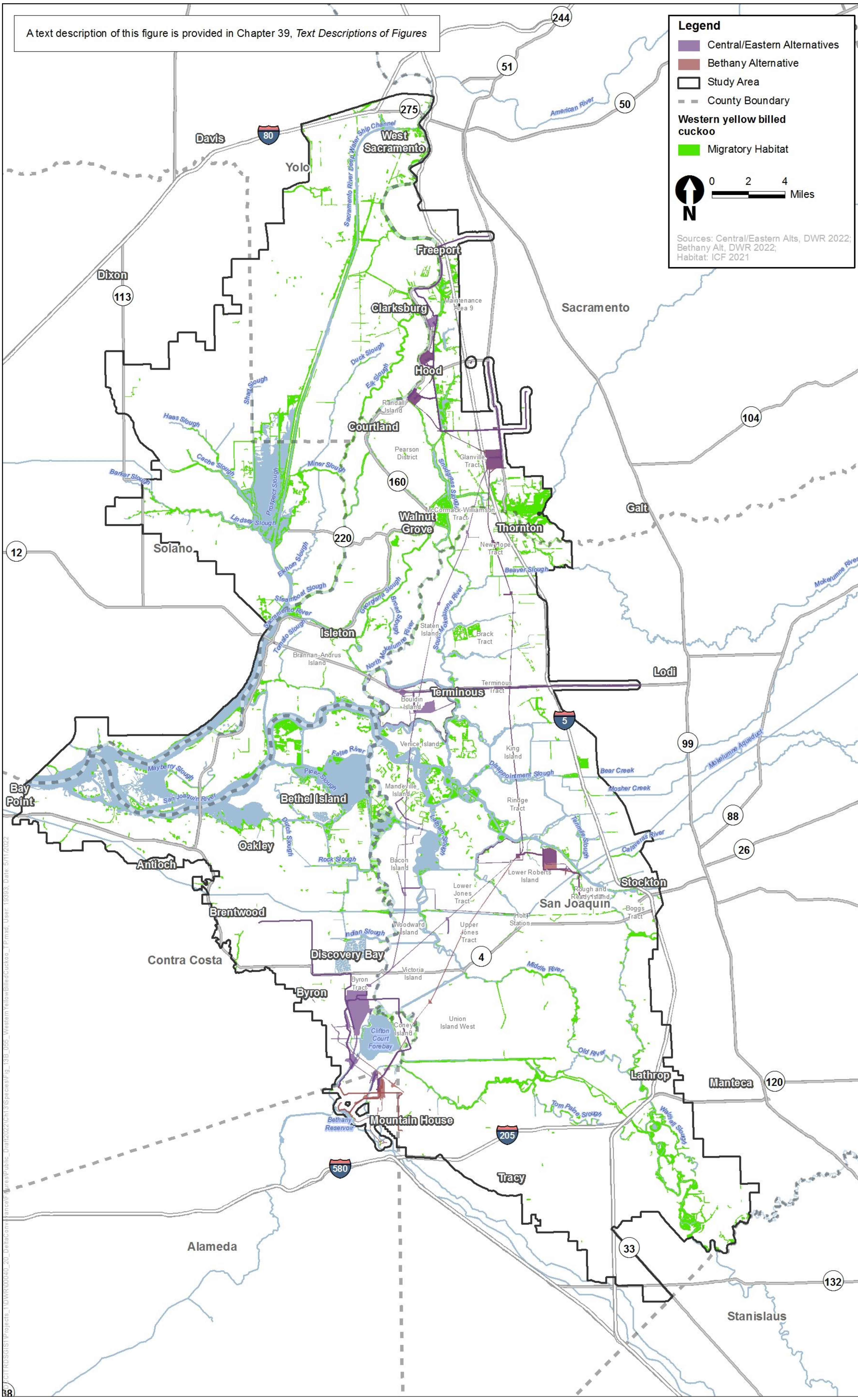

1
2 **Figure 13B.56-1. Western Yellow-Billed Cuckoo Modeled Habitat in the Study Area**

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13B.57 California Black Rail (*Laterallus jamaicensis coturniculus*)

13B.57.1 Legal Status

The California black rail is listed as a threatened species under CESA. It is also designated as a Fully Protected species in California. California black rail has no federal regulatory status; however, it is on the USFWS list of Birds of Conservation Concern (California Department of Fish and Wildlife 2020a:56).

13B.57.2 Range and Distribution within the Study Area

California black rail is one of two subspecies of black rail that inhabit North America. The historical range of the California black rail extended from Bodega Harbor and the San Francisco Bay, throughout the Sacramento–San Joaquin Delta (Delta), along the coast to northern Baja California, and at other southern California locales such as the Salton Sea and the lower Colorado River (Eddleman et al. 2020). Declines in populations of the black rail in California are a result of habitat loss and degradation along with an increase in exotic predators such as black rats and red foxes (Evens et al. 1991). Loss of tidal marsh habitat, primarily from coastal development, has resulted in the extirpation of populations from much of its coastal range, particularly in Southern California and much of the San Francisco Bay since the 1950s (Garrett and Dunn 1981:141–142; Evens et al. 1991:960).

The species persists in remaining tidal marshes in the San Francisco Bay estuary, Tomales Bay, Bolinas Lagoon, the Delta, Morro Bay, the Salton Sea, and the lower Colorado River (Manolis 1978:152–155; Evens et al. 1991:957–959; Eddleman et al. 2020). Several small, isolated populations also still exist in southeastern California and western Arizona (Evens et al. 1991:959). The species has also been found more recently at Bidwell Park in Chico, Butte County (Kemper and Manolis 1999), at several inland freshwater sites in the Sierra Nevada foothills in Butte, Yuba, and Nevada Counties (Aigner et al. 1995:157–158; Richmond et al. 2008:385), and in Clover Valley (City of Rocklin) in southern Placer County (Tecklin 2006:7–8).

Within the study area, suitable California black rail habitat is present in emergent wetlands and on remnant in-channel islands, and the species has been detected throughout the Delta during the breeding season (Tsao et al. 2015:14). The CNDDB reports 36 detections within the study area: in West Sacramento, adjacent to the Deep Water Shipping Channel, at Stone Lakes National Wildlife Refuge, along Lindsey Slough in Solano County, in the Shin Kee Tract Wetlands, and on mid-channel islands throughout the central Delta (California Department of Fish and Wildlife 2020b). Surveys conducted by DWR from 2009 to 2011 documented two additional California black rails adjacent to Empire Tract and on Mandeville Island (California Department of Water Resources 2011). California black rail have also been detected as recently as 2015 at the Cosumnes River Preserve in South Sacramento (Trochet 1999:3; Tsao et al. 2015:14).

13B.57.3 Habitat Requirements

California black rails inhabit saltwater, brackish, and freshwater marshes (Grinnell and Miller 1944:131; Manolis 1978:155). A highly secretive and rarely observed bird, it appears to have a preference in coastal areas for tidal salt marshes dominated by dense emergent vegetation with an open structure below. This provides a dense canopy for protective cover while providing nesting habitat and accessibility below the canopy (Evens and Page 1983:22–23). Rails are susceptible to predation by herons, egrets, northern harriers, short-eared owls, and several mammalian predators; a dense canopy that provides optimal cover is essential for survival (Evens and Page 1986:107–108).

California black rails tend to be associated with areas where *Schoenoplectus* (formerly *Scirpus*) spp. and *Salicornia* border each other. In the Suisun Bay, Evens et al. (1991:957) found black rails in areas with a mosaic of *Juncus* (40%), *Schoenoplectus* (30%), *Triglochin* (10%), *Grindelia* (<10%), *Distichlis* (less than 10%), and *Typha* (less than 10%). Data from Spautz et al. (2005:467) indicate that black rails prefer marshes that are close to water (bay or river), large, away from urban areas, and saline to brackish with a high proportion of *Salicornia*, *Grindelia*, *Bolboschoenus maritimus* ssp. *paludosus* (formerly *Scirpus maritimus*), *Juncus*, and *Typha*. Escape cover is critical to these birds. Nests are concealed in dense marsh vegetation near the upper limits of tidal flooding (Eddleman et al. 2020).

Away from coastal estuaries and salt marshes, California black rails are restricted to breeding in freshwater marshes with stands of tule, cattail, bulrush, and sedge (*Carex* spp.) (Eddleman et al. 2020). Within the Delta, California black rail presence is associated with both tall (greater than 1–5 meters [9–15 feet]) emergent wetland vegetation (*Scirpus* spp., *Typha* spp., *Phragmites australis*) and woody riparian shrub species (*Cornus sericea*, *Rubus armeniacus*, *Salix lasiolepis*, and *S. exigua*), in addition to dense, low stands of *Juncus* spp. and *Carex* spp. (Tsao et al. 2015:6).

A relatively narrow range of conditions is required for occupancy and successful breeding. Water depth is an important parameter for successful nest sites because rising water levels can prevent nesting or flood nests and reduce access to foraging habitat (Eddleman et al. 2020). Existing research shows that shallow water of roughly less than 1 inch in depth is used; however, California black rails occupy habitats where water levels fluctuate daily, and optimal habitats should have gently sloping landscapes to allow black rails to move into shallower water as levels change (Dodge 2019:6).

California black rails have been detected in the Delta in wetlands as small as 0.99 hectare (Tsao et al. 2015:15). Although California black rails have small home ranges in the breeding season in the north San Francisco Bay tidal marshes (less than 1 hectare; Tsao et al. 2009:603), the species has been shown to prefer large wetlands (Spautz et al. 2005:467), which likely provide greater opportunities for foraging and upland refuge (Tsao et al. 2015:16). Studies of other rail species show increased home range sizes outside of the breeding season (Bookhout and Stenzel 1987:445).

13B.57.4 Seasonal Patterns

Very little information is available on seasonal patterns, timing of reproduction, dispersal, or other activities. The breeding season begins as early as February with pair formation and extends through July. Egg laying peaks around May 1 (Eddleman et al. 2020). The species is considered a year-round resident in the San Francisco Bay Area and Sierra Nevada foothills (Hall and Beissinger 2017:2) although infrequent dispersal has been recorded between these two metapopulations (Hall and Beissinger 2017:216).

13B.57.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.57.5.1 GIS Model Data Sources

The California black rail model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants, Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.57.5.2 Midchannel island GIS layer (Aerial Information Systems 2011)Habitat Model Description

California black rail have been detected in patches of emergent wetland found along the perimeter of sloughs and on in-channel islands of larger watercourses in the study area (Tsao et al. 2015:6). The model identifies suitable habitat as tidal and nontidal freshwater and brackish emergent marsh with appropriate vegetation alliances, including pickleweed (*Sarcocornia pacifica*), bulrush (*Schoenoplectus* spp.), and cattail (*Typha* spp.).

The California black rail model has three components: Delta habitat, midchannel island primary habitat, and midchannel island secondary habitat. To capture unique habitat types on midchannel islands in the Delta, CDFW created a separate midchannel island GIS layer (Aerial Information Systems 2011). Primary and secondary modeled habitat on the midchannel include riparian and tidal and nontidal freshwater emergent wetland vegetation communities. When the riparian vegetation community types are adjacent to the selected emergent wetland types, the habitat is considered primary. Secondary habitat consists of those emergent wetland types when not directly adjacent to riparian vegetation patches.

For both the Delta and midchannel island model types, vegetation patches must meet a 2-acre minimum mapping unit requirement (Tsao et al. 2015:14). For midchannel islands, the 2-acre patch can be composed of both primary and secondary vegetation types. The model may underrepresent suitable in-channel island habitat, in that groups of small islands (less than 2 acres) that are close together may be excluded from the model based on the minimum patch size requirement; however, these islands may be viewed by California black rail as a single patch of suitable habitat, separated by small channels. Although the model may underrepresent some potential habitat, all suitable habitat would be surveyed prior to construction.

The modeled California black rail habitat relies on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area. The extent of modeled habitat in the study area is depicted in Figure 13B.57-1.

13B.57.5.2.1 Geographic Limits

The model boundary includes the entire study area, based on the species distribution throughout the Delta (Tsao et al. 2015:11–13).

13B.57.5.2.2 Additional Model Parameters

Delta Habitat

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Nontidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
- Tidal freshwater emergent wetland
  - Freshwater emergent wetland

Outside the Delineation Study Area

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion, Geographical Information Center 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018) layers:

- Nontidal brackish emergent wetland
  - Arid West freshwater emergent marsh
  - *Atriplex lentiformis*
  - *Atriplex prostrata—Cotula coronopifolia*
  - *Bolboschoenus maritimus*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - *Phragmites australis—Arundo donax*
  - *Sarcocornia pacifica (Salicornia depressa)*

    - *Schoenoplectus (acutus, californicus)*
    - Southwestern North American salt basin and high marsh group
    - Temperate Pacific tidal salt and brackish meadow
    - *Typha (angustifolia, domingensis, latifolia)*
- Nontidal freshwater perennial emergent wetland
    - Arid West freshwater emergent marsh
    - Californian warm temperate marsh/seep
    - *Lepidium latifolium*
    - Naturalized warm-temperate riparian and wetland group
    - *Phragmites australis—Arundo donax*
    - *Schoenoplectus (acutus, californicus)*
    - *Schoenoplectus americanus*
    - *Southwestern North American alk*aline marsh/seep vegetation
    - *Typha (angustifolia, domingensis, latifolia)*
- Tidal brackish emergent wetland
    - Arid West freshwater emergent marsh
    - *Atriplex lentiformis*
    - *Bolboschoenus maritimus*
    - *Distichlis spicata*
    - *Frankenia salina*
    - *Lepidium latifolium*
    - Naturalized warm-temperate riparian and wetland group
    - *Phragmites australis—Arundo donax*
    - *Sarcocornia pacifica (Salicornia depressa)*
    - *Schoenoplectus (acutus, californicus)*
    - Southwestern North American salt basin and high marsh group
    - Temperate Pacific tidal salt and brackish meadow
    - *Typha (angustifolia, domingensis, latifolia)*
- Tidal freshwater emergent wetland
    - Arid West freshwater emergent marsh
    - *Carex barbarae*
    - *Juncus arcticus* (var. *balticus, mexicanus*)
    - *Lepidium latifolium*

- Naturalized warm-temperate riparian and wetland group
- *Phragmites australis—Arundo donax*
- *Schoenoplectus* (*acutus, californicus*)
- *Schoenoplectus americanus*
- *Typha (angustifolia, domingensis, latifolia)*

Midchannel Island Primary and Secondary Habitat

Midchannel island primary and secondary habitats are restricted to the midchannel island GIS layer. Midchannel island primary habitat consists of the following brackish and freshwater marsh landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers when connected to (touching) the riparian vegetation types listed below (ICF 2018; ICF 2017; Chico State Research Foundation, Geographical Information Center 2019; Chico State Research Foundation, Geographical Information Center 2018; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021). Midchannel island secondary habitat consists of the following brackish and freshwater marsh landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers when not connected to (touching) riparian vegetation types.

Inside the Delineation Study Area

- Nontidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
- Tidal freshwater emergent wetland
  - Freshwater emergent wetland
- Valley/foothill riparian
  - *Cephalanthus occidentalis*
  - *Cornus sericea*
  - *Equisetum (arvense, variegatum, hyemale)*
  - *Grindelia (camporum, stricta)*
  - *Rosa californica*
  - *Rubus armeniacus*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*

    - *Salix lasiolepis*
    - *Salix lucida*
    - *Sambucus nigra*
    - Scrub Shrub Wetland
    - Southwestern North American introduced riparian scrub
    - Southwestern North American riparian/wash scrub
    - *Vitis californica*

Outside the Delineation Study Area

- Nontidal brackish emergent wetland
    - Arid West freshwater emergent marsh
    - *Atriplex lentiformis*
    - *Atriplex prostrata—Cotula coronopifolia*
    - *Bolboschoenus maritimus*
    - *Distichlis spicata*
    - *Frankenia salina*
    - *Lepidium latifolium*
    - Naturalized warm-temperate riparian and wetland group
    - *Phragmites australis—Arundo donax*
    - *Sarcocornia pacifica (Salicornia depressa)*
    - *Schoenoplectus (acutus, californicus)*
    - Southwestern North American salt basin and high marsh group
    - Temperate Pacific tidal salt and brackish meadow
    - *Typha (angustifolia, domingensis, latifolia)*
- Nontidal freshwater perennial emergent wetland
    - Arid West freshwater emergent marsh
    - Californian warm temperate marsh/seep
    - *Lepidium latifolium*
    - Naturalized warm-temperate riparian and wetland group
    - *Phragmites australis—Arundo donax*
    - *Schoenoplectus (acutus, californicus)*
    - *Schoenoplectus americanus*
    - Southwestern North American alkaline marsh/seep vegetation
    - *Typha (angustifolia, domingensis, latifolia)*

- Tidal Brackish Emergent Wetland
  - Arid West freshwater emergent marsh
  - *Atriplex lentiformis*
  - *Bolboschoenus maritimus*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - *Phragmites australis—Arundo donax*
  - *Sarcocornia pacifica (Salicornia depressa)*
  - *Schoenoplectus (acutus, californicus)*
  - Southwestern North American salt basin and high marsh group
  - Temperate Pacific tidal salt and brackish meadow
  - *Typha (angustifolia, domingensis, latifolia)*
- Tidal freshwater emergent wetland
  - Arid West freshwater emergent marsh
  - *Carex barbarae*
  - *Juncus arcticus* (var. *balticus, mexicanus*)
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - *Phragmites australis—Arundo donax*
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
- Valley/foothill riparian
  - *Cephalanthus occidentalis*
  - *Cornus sericea*
  - *Equisetum (arvense, variegatum, hyemale)*
  - *Grindelia (camporum, stricta)*
  - *Rosa californica*
  - *Rubus armeniacus*
  - *Salix exigua*
  - *Salix gooddingii*

- *Salix laevigata*
- *Salix lasiolepis*
- *Salix lucida*
- *Sambucus nigra*
- Scrub shrub wetland
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian/wash scrub
- *Vitis californica*

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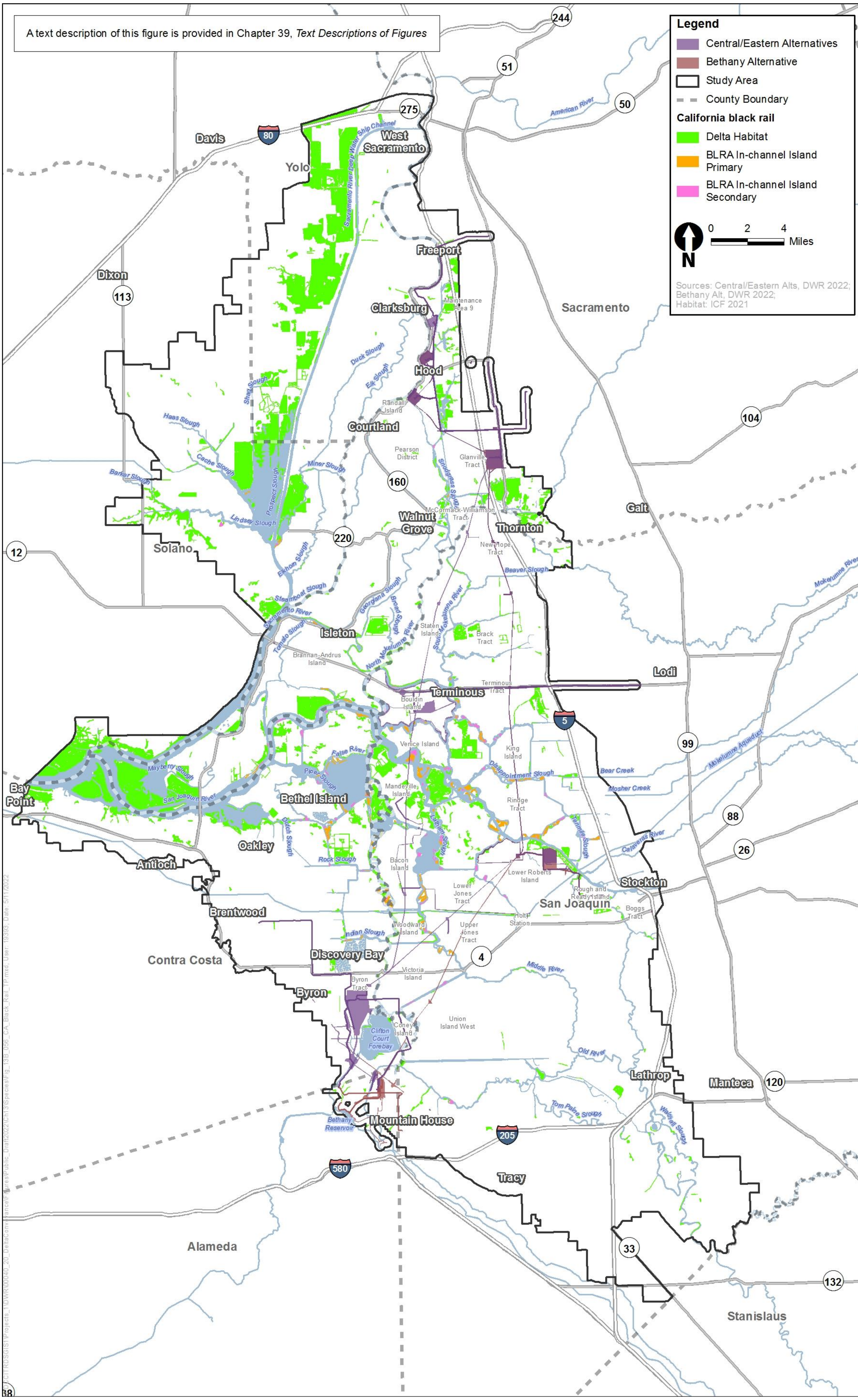

1
2 **Figure 13B.57-1. California Black Rail Modeled Habitat in the Study Area**

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13B.58 Greater Sandhill Crane (*Antigone canadensis tabida*)

13B.58.1 Legal Status

The greater sandhill crane is listed as a state threatened species under CESA. The greater sandhill crane is also designated as a state Fully Protected species (California Department of Fish and Wildlife 2020a:56). The greater sandhill crane has no federal regulatory status (California Department of Fish and Wildlife 2020a:56).

13B.58.2 Range and Distribution within the Study Area

The greater sandhill crane is one of six subspecies of sandhill crane in North America; three of which are nonmigratory and occupy ranges in the southeastern United States and Cuba. The remaining three are migratory and include the lesser and greater subspecies, both of which are further divided into distinct populations. The greater sandhill crane is divided into five migratory populations, all of which return to the same breeding territory and wintering sites each year. These include the Eastern Population, the Prairie Population, the Rocky Mountain Population, the Lower Colorado River Population, and the Central Valley Population. The Central Valley Population breeds in northeastern California, central and eastern Oregon, southwestern Washington, and southern British Columbia; and winters in the Central Valley of California (Littlefield and Ivey 2000:1–2).

Of the estimated 500,000 sandhill cranes in North America, an estimated 62,600 are greater sandhill cranes. An estimated 8,500 of these belong to the Central Valley Population (Littlefield and Ivey 2000:1, 11). Breeding surveys have recorded 1,151 breeding pairs in Oregon, 465 breeding pairs in California, 19 pairs in Washington, 11 pairs in Nevada, and an unknown number in British Columbia (Ivey and Herziger 2001:1).

Pogson and Lindstedt (1991:270) identified eight distinct wintering locations in the Central Valley from Chico/Butte Sink in the north to Pixley National Wildlife Refuge near Delano in the south, with over 95% of the Central Valley population of greater sandhill cranes in the Sacramento Valley between Butte Sink and the Delta. Use varies seasonally within this area probably as a function of the winter flooding regime and food resources. Surveys conducted in 2012–2013 estimated 8,500 greater sandhill cranes wintering in the Central Valley (Ivey et al. 2014a:15).

There are no CNDDB occurrences of greater sandhill crane within the study area (California Department of Fish and Wildlife 2020b). However, traditional sandhill crane roost sites and the general distribution of wintering sandhill cranes have been documented within the study area (Ivey et al. 2016:60; Figure 13B.58-1). The greater sandhill crane winter distribution is based on the proximity to known greater sandhill crane nighttime roosting sites. Roosting and foraging habitat is present throughout the study area and is used by cranes in years where suitable crop types and water levels are present (Figure 13B.58-1). Five areas are consistently managed to provide night roosts: Stone Lakes National Wildlife Refuge, Cosumnes River Preserve, Canal Ranch Tract, Bract Tract, and Staten Island. These five areas are of particular importance to sandhill cranes and support the majority of the sandhill cranes that winter in the Delta (Ivey et al. 2014a:13). While populations have shifted over the years in response to changing agricultural patterns, particularly the increase of orchards and vineyards, the islands and tracts traditionally receiving the highest crane use include Staten Island, Terminous Island, Canal Ranch, and New Hope Tract. Other areas receive occasional to regular use, including Bouldin Island, Empire Tract, King Island, Grand Island, Tyler Island, Ryer Island, Brannan Island, Twitchell Island, Bradford Island, Venice Island, Mandeville Island, and Webb, Holland, and Palm Tracts (Ivey et al. 2016:60; Ivey et al. 2014a:28–33).

The Cosumnes River floodplain, much of it protected within The Nature Conservancy's Cosumnes River Preserve, also supports significant winter crane use. Use may have increased in this area as continued conversion to vineyards on Delta Islands has reduced habitat availability in that area (Ivey et al. 2014a:27; Littlefield and Ivey 2000:23). As noted, crane use is entirely dependent on agricultural crop patterns. Conversion to unsuitable crop types effectively eliminates crane habitat. Over the last two decades, a substantial amount of conversion to vineyards has occurred on Delta islands and is considered among the most important conservation issues for the greater sandhill crane (Ivey et al. 2016:63). Several important traditionally used areas, such as portions of the Thompson-Folger Ranch along Peltier Road, have been converted to vineyards (Littlefield and Ivey 2000:11). Habitat loss from agricultural conversion, urbanization, and disturbances from increasing recreation activities in some areas threaten the long-term sustainability of key wintering areas for this species.

13B.58.3 Habitat Requirements

Greater sandhill cranes are primarily birds of open freshwater wetlands. In California, nesting typically occurs in wet meadows, with nests established in open habitat such as rushes *(Juncus spp.),* spikerush *(Eleocharis spp.),* grasses, and sedges *(Carex spp.),* and sometimes in bulrush and burreed (California Department of Fish and Game 1994:6–7). While breeding sites are on state and federal refuges or U.S. Forest Service lands, more than 60% are on private lands (Ivey and Herziger 2001:3).

Wintering habitat is found almost entirely in cultivated lands, and to a lesser extent in managed wetlands and grasslands. Greater sandhill cranes, like many birds, exhibit a high degree of fidelity to their wintering grounds (Ivey et al. 2015:522–523). Wintering habitat consists of two primary elements: secure roost sites, and sufficient nearby foraging habitat (Ivey et al. 2016:63). In the Delta, croplands and pastures account for the majority of foraging locations; corn is the most commonly used foraging habitat, followed by rice, pasture, oak savannah, fallow fields, wetlands, wheat, and sudan grass (Ivey 2015:74).

Loafing generally occurs midday when birds loosely congregate along levees, rice-checks, ditches, in alfalfa fields or pastures, or along shorelines of wetlands (Littlefield and Ivey 2000:11). Cranes will often loaf in rocky uplands or along gravel roads where they collect grit, which is important in the digestion of grain seeds (Littlefield and Ivey 2000:14). During the late afternoon and evening, cranes begin to congregate into large, dense communal groups where they remain until the following morning. Providing protection from predators during the night, roost sites are typically within 1 to 2.5 miles of foraging and loafing areas (Littlefield and Ivey 2000:11) and thus available roosting sites are an essential component of winter habitat. In a study of night roosts in the Delta, roosting habitat typically consisted of shallowly flooded open fields or seasonal wetlands of variable size (averaging 289 acres). Water depth is important and averages 4 inches (Ivey 2015:108). Ivey (2015:112) recommended that managed roost complexes be large (at least 250 acres) to give security from predators, with individual sites within a complex being at least 12 acres and dominated by shallow water.

Greater sandhill cranes are considered intolerant of excessive human disturbances and the level of disturbance may play a role in habitat selection (Lovvorn and Kirkpatrick 1981:848–850, 853–856). Excessive disturbances have caused cranes to abandon foraging and roosting sites; and repeated disturbance may affect their ability to feed and store the energy needed for survival. Ivey and Herziger (2003:25–28) documented disturbances of greater sandhill cranes on Staten Island, a high-use area, and found that aircraft, vehicles, hunting, and recreational activities (e.g., birding, walking, horseback riding, bicycling, boating) can cause cranes to run or fly away.

13B.58.4 Seasonal Patterns

Nesting generally begins in April and May and extends from July through August. By September, the Central Valley Population begins their migration and arrives onto the wintering grounds by late September, where the cranes remain until approximately late February to early March, when they begin their northward migration back to the breeding grounds (Ivey et al. 2014b:5). Local winter movements continue throughout the winter season in response to changes in flooded habitat and available food resources. The Butte Sink has been reported to support a large segment of the population (more than 50%) during October and November. Use then shifts to the Delta and the Cosumnes River floodplain during December and January, where an estimated two-thirds of the population resides for the remainder of the winter (Pogson and Lindstedt 1991:270; Littlefield and Ivey 2000:5–6).

13B.58.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.58.5.1 GIS Model Data Sources

The greater sandhill crane model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants, Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)

13B.58.5.2 Habitat Model Description

The greater sandhill crane wintering habitat model includes two types of habitat: roosting and foraging. Roosting habitat is primarily composed of managed seasonal wetlands and flooded cultivated lands such as corn and rice (Ivey et al. 2014c:15). Land cover types in the foraging habitat model include pasturelands, hay crops, grasslands, natural seasonal wetlands, and other annually rotated agricultural crops (Littlefield and Ivey 2000:13) that occur within the defined winter range. The extent of modeled habitat in the study area is depicted in Figure 13B.58-1.

13B.58.5.2.1 Geographic Limits

The greater sandhill crane habitat model is restricted to the sandhill crane winter use area. The winter use area is based on the sandhill crane range in the study area and was modified slightly from Ivey et al. 2016 to include areas identified by Ivey pers. Comm. 2013 and other additional potential use areas within 3 miles of roost sites (Ivey et al. 2015:526) based on professional judgement.

13B.58.5.2.2 Additional Model Parameters

Roosting Habitat

Greater sandhill crane modeled roosting habitat consists of polygons of known roost sites. Permanent roost sites are those used regularly, year after year (e.g., Cosumnes River Preserve, Stone Lakes National Wildlife Refuge, and other wetlands managed for sandhill cranes), while temporary sites are those used during some years (e.g., lands that do not provide suitable crops or flooding every year due to rotating agricultural practices [Ivey et al. 2014a:6]). Known roost sites are based on sandhill crane surveys in the study area conducted between 2002 and 2013 (Ivey et al. 2016), 2017–2019 (Tsao pers comm.), and 2017–2020 (Wells pers. Comm.). The roost site polygons were reviewed and revised by ICF and DWR biologists familiar with sandhill crane ecology; polygons were adjusted between permanent and temporary classifications if land use practices and associated sandhill crane use had changed since 2013 (Wells pers. Comm.). In addition, roost sites were removed from the model if the land had been converted to incompatible crop types (e.g., grapes, almonds, walnuts).

Foraging Habitat

Greater sandhill crane modeled foraging habitat includes the landcover types listed below within a 3-mile radius of known permanent and temporary roost sites but also within the boundary of the sandhill crane winter use area. The average foraging distance from roost sites by greater sandhill cranes is approximately 1.2 miles (1.9 km) within the Delta (Ivey et al. 2015:523). However, it is recommended that suitable land cover types within 3 miles of known roost sites be considered in conservation planning and foraging habitat management for greater sandhill crane (Ivey et al. 2015:526).

Throughout their wintering range in the Delta, sandhill cranes forage primarily in harvested corn fields, winter wheat fields, alfalfa fields, seasonal wetlands, irrigated pastures, and grasslands (Littlefield and Ivey 2000:13). Suitable foraging habitat is likely also a function of patch size. However, because there are insufficient data about winter habitat patch size, and because field sizes in the Delta are generally large enough to support foraging cranes, all suitable cover types are included in the model irrespective of patch size. A midchannel island GIS layer was used to exclude unsuitable habitat on midchannel islands in the Delta (Aerial Information Systems 2011). Because annually rotated crop types could convert to a more suitable or less suitable cover type in any given year, all crop types that are or could potentially rotate into a suitable cover type (i.e., grain and hay; field; and truck, nursery and berry crop types listed below) are included in the model as potentially suitable habitat. Therefore, these crop types are not differentiated based on their seasonal value and are instead combined into a category of seasonally rotated croplands. As a result, this model may overestimate the extent of available agricultural foraging habitat in any given year.

Modeled foraging habitat includes the following landcover types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019); Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018); DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants, Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Alkaline seasonal wetland complex
  - All types
- Grassland
  - All types
- Nontidal freshwater emergent wetland
  - *Schoenoplectus (acutus, californicus)*
  - *Polygonum lapathifolium—Xanthium strumarium*
  - Californian warm temperate marsh/seep
  - *Leymus cinereus—Leymus triticoides*
  - *Cynodon dactylon*
- Seasonal wetland
  - All types
- Tidal freshwater emergent wetland
  - Californian warm temperate marsh/seep
  - *Carex barbarae*
  - *Cynodon dactylon*
  - *Juncus arcticus* (var. *balticus, mexicanus*)
  - *Schoenoplectus (acutus, californicus)*
- Vernal pool complex
  - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Surveys (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Beans (dry)
- Corn, sorghum, and sudan
- Fallow
- Miscellaneous field crops
- Miscellaneous grain and hay
- Miscellaneous grasses
- Miscellaneous truck crops
- Mixed pasture
- Onions and garlic
- Peppers
- Potatoes and sweet potatoes
- Rice
- Safflower
- Sunflowers
- Tomatoes
- Unclassified fallow
- Upland herbaceous
- Wheat
- Wild rice
- Young perennials

13B.58.5.3 Habitat Value Categories

Greater sandhill cranes are closely associated with agricultural lands in the study area. Most of the land in the sandhill crane winter use area consists of agricultural land and is considered to have some value as foraging habitat for greater sandhill cranes. While the sandhill cranes are traditional to winter use areas (in that they return to the same wintering areas year after year), the agricultural landscape throughout the crane's use area is dynamic and subject to seasonal and annual changes in crop types. Because the greater sandhill crane is closely associated with specific agricultural crop types and patterns, use areas are also subject to change as crop patterns change. Because of the agricultural landscape's dynamic nature, and because crop patterns and conditions vary both seasonally and annually, only a portion of the agricultural landscape is suitable or available for foraging in any given season.

Sufficient information is available about the use of different agricultural crops to generally categorize crops based on their value as foraging habitat for the greater sandhill crane. Table 13B.58-1 categorizes modeled land cover types according to four relative value classes: very high, high, moderate, and low and provides the rationale for assigning crop types and other agricultural land uses to habitat value categories.

Table 13B.58-1. Greater Sandhill Crane Habitat Values

Habitat Value Class	Habitat	Rationale for Assignment of Value Class	Information Sources
Very high	Corn, rice	The primary food of sandhill cranes in agricultural areas is waste grain. Within the Delta wintering area, waste corn from harvested fields is generally regarded as the highest value forage for cranes. Fields traditionally planted with corn in the central Delta therefore considered to have the highest value ranking relative to other agricultural cover types. Rice is also considered a very high-value foraging cover type; however, it has a limited distribution within the crane use area.	Reinecke and Krapu 1986:74; Pogson and Lindstedt 1991; Littlefield and Ivey 2000
High	Wheat, freshwater emergent wetlands	Winter wheat provides high-value foraging habitat while available during November and December following initial planting but decreases in value during January and February as the vegetation height increases. Wetlands also provide high-value invertebrate prey and potential roosting sites if they meet crane roosting habitat needs (e.g., appropriate water depth, vegetation type, availability of berms and other adjacent uplands, and proximity to agricultural foraging habitats) and are thus also regarded as having high value.	Pogson and Lindstedt 1991; Littlefield and Ivey 2000
Moderate	Alfalfa and alfalfa mixtures, mixed pasture, miscellaneous grain and hay, mixed grain and hay	Alfalfa and pasture types provide medium-value foraging habitat for cranes, as these types are generally used temporarily based on crop growth, harvesting, irrigation, and grazing regimes. For example, use of alfalfa fields increases following cutting and during flood irrigation events. Other grain crops including oats also provide foraging value but are traditionally less abundant in the Delta or the growth/harvest regime is not optimal for crane foraging use.	Pogson and Lindstedt 1991; Littlefield and Ivey 2000

Habitat Value Class	Habitat	Rationale for Assignment of Value Class	Information Sources
Low	Fallow and unclassified fallow cropland, bushberries, young perennials, miscellaneous grasses, sorghum, miscellaneous truck crops, miscellaneous field crops, onions, garlic, peppers, potatoes, sweet potatoes, safflower, tomatoes, melons, squash, and cucumbers, beans (dry), grassland, alkaline seasonal wetlands, vernal pool complex, and upland herbaceous	A variety of other irrigated crops may receive occasional use by cranes during the winter if fields have been left fallow following harvest or immediately following planting. Grasslands provide more sustained value throughout the winter, but generally provide less foraging value than grain crops, pastures, and managed wetlands. Alkaline seasonal wetland, vernal pool complex, and upland herbaceous land cover may also provide suitable foraging habitat for cranes. Suitability, however, is dependent on flooding regimes, vegetation type and structure, and food availability. While under appropriate conditions, this type may provide high value to cranes, it is considered less predictable than managed wetlands, which are typically managed for waterfowl and other waterbirds and thus have a greater likelihood of providing suitable habitat conditions for cranes.	Pogson and Lindstedt 1991; Littlefield and Ivey 2000

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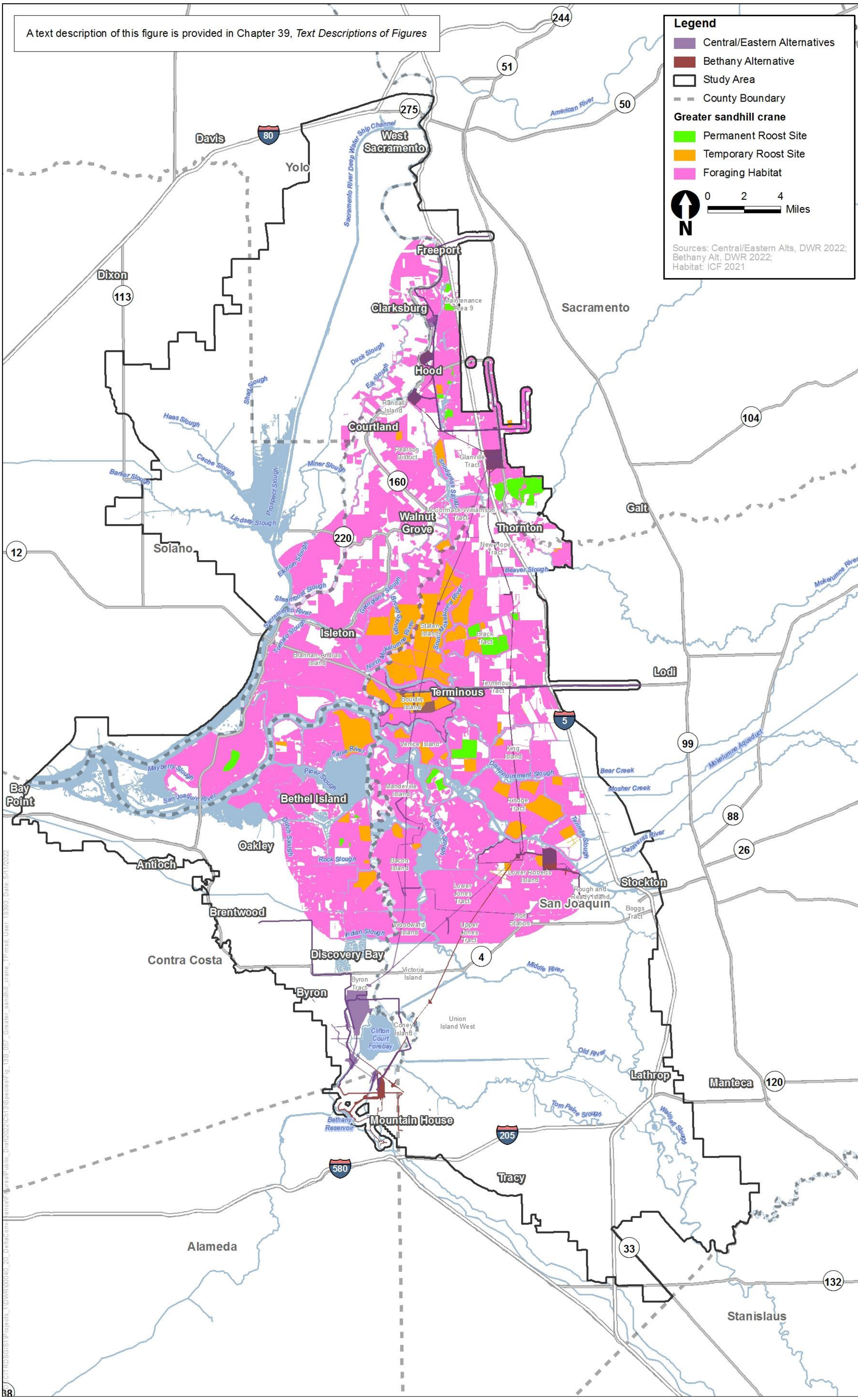

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2 **Figure 13B.58-1. Greater Sandhill Crane Modeled Habitat in the Study Area**

13B.59 Lesser Sandhill Crane (*Antigone canadensis canadensis*)

13B.59.1 Legal Status

Lesser sandhill crane is designated as a Species of Special Concern by the California Department of Fish and Wildlife (California Department of Fish and Wildlife 2020a:56). The lesser sandhill crane has no federal regulatory status (California Department of Fish and Wildlife 2020a:56).

13B.59.2 Range and Distribution within the Study Area

The lesser sandhill crane is one of six subspecies of sandhill crane in North America. The lesser sandhill crane subspecies is further divided into two populations based on the breeding ranges: the midcontinent population, which is not present in California, and the Pacific Flyway population, which breeds in southern Alaska and winters mainly in California's Central Valley (Littlefield 2008:168). The Pacific Flyway Population is the population present in the study area. This population of lesser sandhill crane breeds in Alaska and winters in the Central Valley of California (Littlefield 2008:168; Gerber et al. 2020).

There are no CNDDB occurrences of lesser sandhill crane within the study area (California Department of Fish and Wildlife 2020b). However, traditional sandhill crane roost sites and the general distribution of wintering sandhill cranes have been documented within the study area (Ivey et al. 2016:60, Figure 13B.59-1). The lesser sandhill crane winter distribution is based on the proximity to known greater sandhill crane nighttime roosting sites. Roosting and foraging habitat is present throughout the study area and is used by cranes in years where suitable crop types and water levels are present (Figure 13B.59-1). Five areas are consistently managed to provide night roosts: Stone Lakes National Wildlife Refuge, Cosumnes River Preserve, Canal Ranch Tract, Bract Tract, and Staten Island. These five areas are of particular importance to sandhill cranes and support the majority of the sandhill cranes that winter in the Delta (Ivey et al. 2014a:13). While populations have shifted over the years in response to changing agricultural patterns, particularly the increase of orchards and vineyards, the islands and tracts traditionally receiving the highest crane use include Staten Island, Terminous Island, Canal Ranch, and New Hope Tract. Other areas receive occasional to regular use, including Bouldin Island, Empire Tract, King Island, Grand Island, Tyler Island, Ryer Island, Brannan Island, Twitchell Island, Bradford Island, Venice Island, Mandeville Island, and Webb, Holland, and Palm Tracts (Ivey et al. 2016:60; Ivey et al. 2014a:28–33).

13B.59.3 Habitat Requirements

Lesser sandhill cranes forage in croplands (primarily corn and alfalfa) and pastures (Ivey 2015:74), and feed in larger flocks than do greater sandhill cranes (Ivey 2015:50). Lesser sandhill cranes were recorded to make up 73% of foraging flocks in the Central Valley, while the proportion of greater sandhill cranes in foraging flocks was 25% (Ivey et al. 2014a:9). Midday loafing typically occurs in wetlands and flooded fields along levees, rice-checks, ditches, and in alfalfa fields or pastures (Littlefield and Ivey 2000:11). Night roosting typically occurs in a variety of wetland habitats, including shallowly flooded open fields and seasonal wetlands (Littlefield

2008:170; Ivey 2015:108). Sandhill cranes (both greater and lesser) use similar roost sites and are both sensitive to human disturbance (Ivey 2015:109). Lesser sandhill cranes are less traditional in their movements than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey et al. 2015:523). Lesser sandhill cranes' average foraging flight radius from roost sites is approximately 2.8 miles, which is twice that of greater sandhill cranes (Ivey et al. 2015:523). However, it is recommended that suitable land cover types within 6 miles of known roost sites be considered in conservation planning and foraging habitat management for lesser sandhill crane (Ivey et al. 2015:526).

13B.59.4 Seasonal Patterns

Lesser sandhill cranes do not breed in California but are winter residents and migrants from mid-September to early April. Lesser sandhill cranes reach maximum densities during December and January and depart from late February to early March (Littlefield 2008:168; Ivey et al. 2014b:5).

13B.59.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.59.5.1 GIS Model Data Sources

The lesser sandhill crane model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)

13B.59.5.2 Habitat Model Description

The lesser sandhill crane wintering habitat model includes two types of habitat: roosting and foraging. Roosting habitat is primarily composed of managed seasonal wetlands and flooded cultivated lands such as corn and rice (Ivey et al. 2014c:15). Land cover types in the foraging habitat model include pasturelands, hay crops, grasslands, natural seasonal wetlands, and other annually rotated agricultural crops (Littlefield and Ivey 2000:13) that occur within the defined winter range. The extent of modeled habitat in the study area is depicted in Figure 13B.59-1.

13B.59.5.2.1 Geographic Limits

The lesser sandhill crane habitat model is restricted to the sandhill crane winter use area. The sandhill crane winter use area is based on the lesser sandhill crane range in the study area and was modified slightly from Ivey et al. 2016 to include areas identified by Ivey pers. Comm. 2013 and other additional potential use areas within 6 miles of roost sites (Ivey et al. 2015:526) based on professional judgment.

13B.59.5.2.2 Additional Model Parameters

Roosting Habitat

Lesser sandhill crane modeled roosting habitat consists of polygons of known roost sites. Permanent roost sites are those used regularly year after year (e.g., Cosumnes River Preserve, Stone Lakes National Wildlife Refuge, and other wetlands managed for sandhill cranes), while temporary sites are those only used during some years (e.g., lands that do not provide suitable crops or flooding every year due to rotating agricultural practices [Ivey et al. 2014a:6]). Known roost sites are based on sandhill crane surveys in the study area that were conducted from 2002 to 2013 (Ivey et al. 2016), from 2017 to 2019 (Tsao pers. Comm. 2020), and from 2017 to 2020 (Wells pers. Comm. 2020). The roost site polygons were reviewed and revised by ICF and DWR biologists familiar with sandhill crane ecology; polygons were adjusted between permanent and temporary classifications if land use practices and associated sandhill crane use had changed since 2013 (Wells pers. Comm. 2020). In addition, roost sites were removed from the model if land had been converted to incompatible crop types (e.g., grapes, almonds, walnuts). Lesser sandhill crane roosting habitat is identical to greater sandhill crane roosting habitat in the model except for two additional lesser sandhill crane roost sites just south of the study area in Stanislaus County.

Foraging Habitat

Lesser sandhill crane modeled foraging habitat includes the landcover types listed below within a 6-mile radius of known permanent and temporary roost sites but also within the boundary of the sandhill crane winter use area. The average foraging distance from roost sites by lesser sandhill cranes average foraging flight radius from roost sites is approximately 2.8 miles, (4.5 km) within the Sacramento San Joaquin Delta (Ivey et al. 2015:523). However, it is recommended that suitable land cover types within 6 miles of known roost sites be considered in conservation planning and foraging habitat management for lesser sandhill crane (Ivey et al. 2015:526). Throughout their wintering range in the Delta, sandhill cranes forage primarily in harvested corn fields, winter wheat fields, alfalfa fields, seasonal wetlands, irrigated pastures, and grasslands (Pogson and Lindstedt 1991:273; Littlefield and Ivey 2000:13). Suitable foraging habitat is likely also a function of patch size. However, because there are insufficient data about winter habitat patch size, and because field sizes in the Delta are generally large enough to support foraging cranes, all suitable cover types are included in the model, irrespective of patch size. A midchannel island GIS layer was used to exclude unsuitable habitat on midchannel islands in the Delta, (Aerial Information Systems 2011). Because annually rotated crop types could convert to a more suitable or less suitable cover type in any given year, all crop types that are or could potentially rotate into a suitable cover type (i.e., grain and hay;

field; and truck, nursery and berry crop types listed below) are included in the model as potentially suitable habitat. Therefore, these crop types are not differentiated based on their seasonal value and are instead combined into a category of seasonally rotated croplands. As a result, this model may overestimate the extent of available agricultural foraging habitat in any given year.

Modeled foraging habitat includes the following landcover types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Alkaline seasonal wetland complex
  - All types
- Grassland
  - All types
- Nontidal freshwater emergent wetland
  - *Schoenoplectus (acutus, californicus)*
  - *Polygonum lapathifolium—Xanthium strumarium*
  - Californian warm temperate marsh/seep
  - *Leymus cinereus—Leymus triticoides*
  - *Cynodon dactylon*
- Seasonal wetland
  - All types
- Tidal freshwater emergent wetland
  - Californian warm temperate marsh/seep
  - *Carex barbarae*
  - *Cynodon dactylon*
  - *Juncus arcticus (*var. *balticus, mexicanus)*
  - *Schoenoplectus (acutus, californicus)*
- Vernal pool complex
  - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Surveys (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures

- Beans (dry)
- Corn, sorghum, and sudan
- Fallow
- Miscellaneous field crops
- Miscellaneous grain and hay
- Miscellaneous grasses
- Miscellaneous truck crops
- Mixed pasture
- Onions and garlic
- Peppers
- Potatoes and sweet potatoes
- Rice
- Safflower
- Sunflowers
- Tomatoes
- Unclassified fallow
- Upland herbaceous
- Wheat
- Wild rice
- Young perennials

13B.59.5.3 Habitat Value Categories

Lesser sandhill cranes are closely associated with agricultural lands in the study area. Most of the land in the sandhill crane winter use area consists of agricultural land and is considered to have some value as foraging habitat for lesser sandhill cranes. While sandhill cranes are traditional to winter use areas (in that they return to the same wintering areas year after year), the agricultural landscape throughout the Delta is dynamic and subject to seasonal and annual changes in crop types. Because the sandhill crane is closely associated with specific agricultural crop types and patterns, use areas are also subject to change as crop patterns change. Because of the agricultural landscape's dynamic nature, and because crop patterns and conditions vary both seasonally and annually, only a portion of the agricultural landscape is suitable or available for foraging in any given season.

Sufficient information is available about the use of different agricultural crops to generally categorize crops based on their value as foraging habitat for the sandhill crane. Table 13B.59-1 categorizes modeled land cover types according to four relative value classes: very high, high, moderate, and low and provides the rationale for assigning crop types and other agricultural land uses to habitat value categories.

Table 13B.59-1. Lesser Sandhill Crane Habitat Values

Habitat Value Class	Habitat	Rationale for Assignment of Value Class	Information Sources
High	Corn, alfalfa and alfalfa mixtures, mixed pasture, rice	The primary food of sandhill cranes in agricultural areas is waste grain. Within the Delta wintering area, waste corn from harvested fields is generally regarded as the highest value forage for cranes. Fields traditionally planted with corn in the central Delta therefore considered to have the highest value ranking relative to other agricultural cover types. Alfalfa and pasture types also provide very high-value foraging habitat for cranes, as these types are generally used temporarily based on crop growth, harvesting, irrigation, and grazing regimes. For example, use of alfalfa fields increases following cutting and during flood irrigation events. Rice is also considered a high-value foraging cover type; however, it has a limited distribution within the sandhill crane winter crane use area.	Reinecke and Krapu 1986:74; Pogson and Lindstedt 1991; Littlefield and Ivey 2000
Moderate	Wheat, miscellaneous grain and hay, freshwater emergent wetlands	Other grain crops including oats also provide foraging value but are traditionally less abundant in the Delta or the growth/harvest regime is not optimal for sandhill crane foraging use.	Littlefield and Ivey 2000
Low	Fallow and unclassified fallow cropland, bushberries, young perennials, miscellaneous grasses, sorghum, miscellaneous truck crops, miscellaneous field crops, onions, garlic, peppers, potatoes, sweet potatoes, safflower, tomatoes, melons, squash, and cucumbers, beans (dry), grassland, alkaline seasonal wetlands, vernal pool complex, and upland herbaceous	A variety of other irrigated crops may receive occasional use by cranes during the winter if fields have been left fallow following harvest or immediately following planting. Grasslands provide more sustained value throughout the winter, but generally provide less foraging value than grain crops, pastures, and managed wetlands. Alkaline seasonal wetland, vernal pool complex, and upland herbaceous land cover may also provide suitable foraging habitat for sandhill cranes. Suitability, however, is dependent on flooding regimes, vegetation type and structure, and food availability. While under appropriate conditions, this type may provide high value to cranes, it is considered less predictable than wetlands, which are typically managed for waterfowl and other waterbirds and thus have a greater likelihood of providing suitable habitat conditions for sandhill cranes.	Pogson and Lindstedt 1991; Littlefield and Ivey 2000

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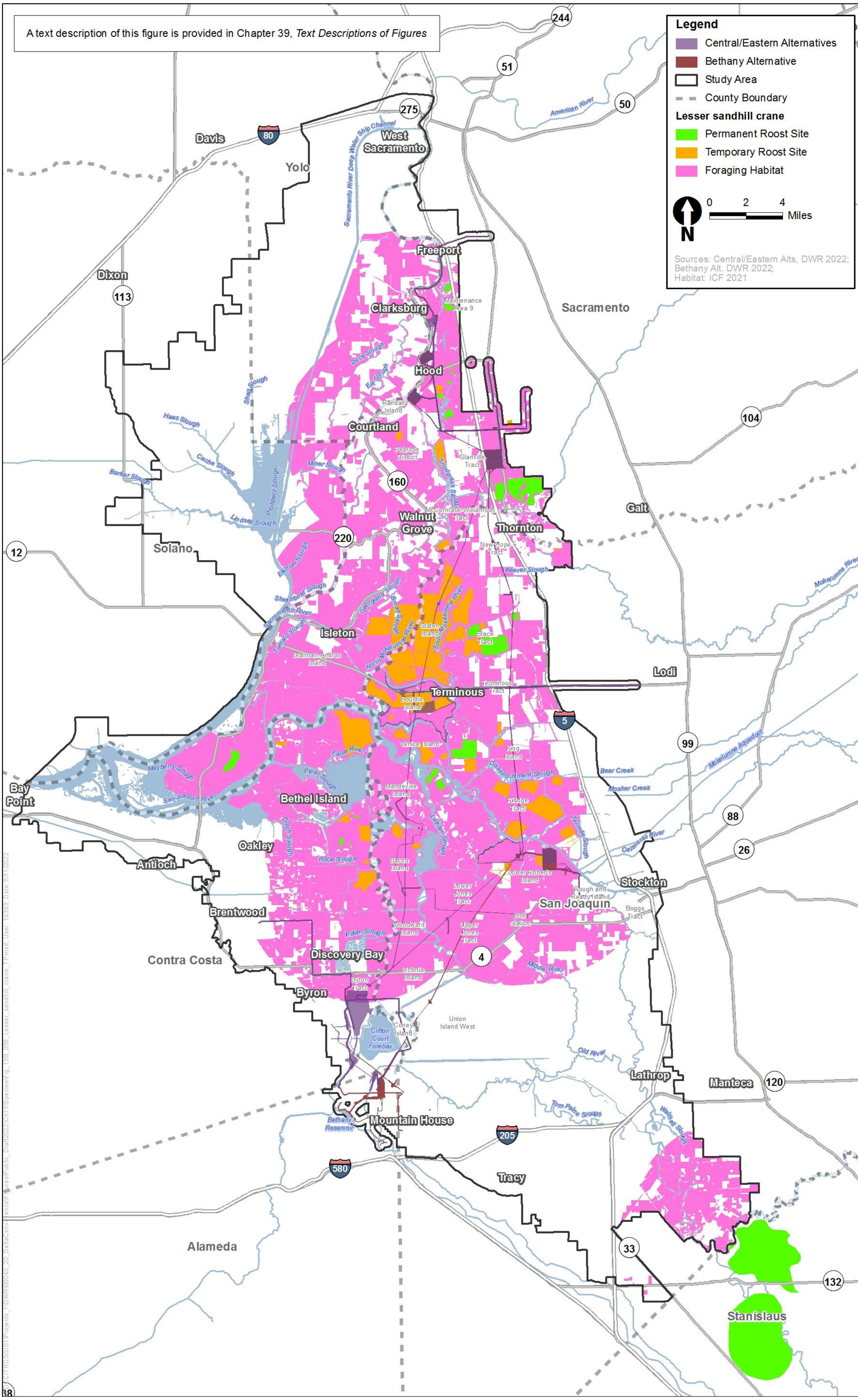
Tsao, Danika. Wildlife Biologist. California Department of Water Resources. Sacramento, California. 2020—Email transmittal of a PDF showing the location of sandhill crane roost sites on Bouldin Island that were identified during surveys conducted by California Department of Water Resources.

Wells, Emily. Wildlife Biologist. Conservation Farms and Ranches. Staten Island, California. May 29, 2020—Email transmittal of a GIS layer of proposed revisions to permanent and temporary sandhill crane roost site classifications in the vicinity of Staten Island, California.



1 Figure 13B.59-1. Lesser Sandhill Crane Modeled Habitat in the Study Area

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13B.60 California Least Tern (*Sterna antillarum browni*)

13B.60.1 Legal Status

California least tern is listed as endangered under the ESA and CESA. The species was listed by the California Fish and Game Commission pursuant to CESA (Fish and Game Code, Sections 2050 et seq.) on June 27, 1971, and by USFWS pursuant to ESA on October 13, 1970 (35 FR 8491). California least tern is also designated as a state fully protected species (California Department of Fish and Wildlife 2020:58). Critical habitat has not been designated for the California least tern.

13B.60.2 Range and Distribution within the Study Area

The historical breeding range of California least tern extends along the Pacific Coast from approximately Moss Landing to the southern tip of Baja California (Grinnell and Miller 1944:175). However, since about 1970, colonies have been reported north to San Francisco Bay (U.S. Fish and Wildlife Service 2020:7). The nesting range in California is somewhat discontinuous as a result of the availability of suitable estuarine shorelines, where California least tern often establish breeding colonies. Marschalek (2006:7) identified six geographic population clusters along the Pacific Coast in California, including San Diego, Camp Pendleton, Los Angeles/Orange County, Ventura County, San Luis Obispo/Santa Barbara County, and San Francisco Bay. As of 2016, most of the California population is concentrated in four counties: Ventura, San Diego, Orange, and Los Angeles (U.S. Fish and Wildlife Service 2020:8).

Statewide surveys in 2016 estimated a minimum of 3,989 breeding pairs, which represented the lowest count since 2002, with about 86% of the breeding colonies occurring in southern California; however, the minimum fledgling count in 2016 (1,612) was higher than in 2015 (1,514). The San Francisco Bay and central coast areas had the highest minimum fledgling-to maximum pair ratio (1.37). Statewide, the growth of the breeding population has been dramatic since state and federal listing of the California least tern, from only several pairs counted in the late 1960s to a current minimum of 3,989 pairs (Frost 2017:11).

Recently, seven California least tern nesting sites have been reported from the vicinity of the Delta. One site (the Pittsburg Power Plant) is in the study area (U.S. Fish and Wildlife Service 2020:9). California least terns also recently began nesting at the Pittsburg Power Plant in Pittsburg, California, although with less success. Frost (2017:11) documented one breeding pair at this site in 2016, but no fledglings. The Pittsburg site was not surveyed in 2017 (U.S. Fish and Wildlife Service 2020:95–96).

Three additional locations have been reported from just outside the study area, including Napa-Sonoma Marshes Wildlife Area Green Island Unit on the Napa River, east of the San Pablo Bay National Wildlife Refuge and northwest of American Canyon, where a minimum of 60 breeding pairs and 79 nests produced between five and six fledglings (Frost 2017:11), and along a gravel road between treatment ponds at the Sacramento Regional Wastewater Treatment Plant (Bufferlands) east of Interstate 5 (I-5), where terns were recorded in 9 of 10 years between 2008 and 2017, and a single pair attempted to nest in 8 of those years (Conard 2018:35). At the third location, Montezuma Wetlands on the eastern edge of Suisun Marsh near Collinsville, California least tern have nested since 2006. This colony site was unintentionally created by an interim phase of a wetlands restoration project (i.e., restoration of California least tern nesting habitat was not the goal of the wetlands project) (Marschalek 2008:14). A pile of sand and shells formed during excavation of the wetland restoration site attracted terns to the site, which to date has prevented completion of the restoration project. Frost (2017: 12) reports a minimum of four breeding pairs, six nests, and one fledgling from this breeding colony in 2016. USFWS (2020:95–96) reports a minimum of seven breeding pairs and a fledglings-per-pair ratio minimum of 0.63 in 2017.

There is one record of a California least tern foraging in the Clifton Court Forebay from 1994 (eBird 2021). However, California least tern is not expected to be foraging at the forebay because it is 20 miles from the nearest nesting site (Pittsburg), which is currently not supporting breeding.

The study area is on the eastern fringe of the more successful breeding area of South San Francisco Bay. The locations of current or historical colonies are greater than 2 miles from construction areas, the typical distance California least terns will travel from their colonies to forage (Atwood and Minsky 1983:70). For this reason, it is very unlikely that California least terns will forage in or near the water conveyance facility footprint.

13B.60.3 Habitat Requirements

California least tern nest in loose colonies on barren or sparsely vegetated sandy or gravelly substrates above the high tide line along the coastline and in lagoons and bays of the California coast. Colonies are always near water that provides foraging opportunities. Foraging typically occurs in shallow estuaries or lagoons (Thompson et al. 2020; U.S. Fish and Wildlife Service 2020:19). California least tern typically forage within 1 to 2 miles of their nest site, although foraging terns have been recorded up to 5 miles from a nest site (U.S. Fish and Wildlife Service 2020:6). Nest sites are shallow depressions without nesting material, typically in barren sandy or gravelly substrate in areas that are free of human or predatory disturbance (U.S. Fish and Wildlife Service 2020:18–19).

In the San Francisco Bay Area and Suisun Bay, nesting colonies are typically located in abandoned salt ponds and along estuarine shores, often using artificially or incidentally created habitat (Rigney and Granholm 2005) and foraging occurs in the bay or large river estuaries.

13B.60.4 Seasonal Patterns

California least terns are migratory and are present at nesting areas from mid-April to late September (Frost 2017:4; Patton 2002:6). Courtship generally occurs during April and May and usually takes place away from the nesting area on exposed tidal flats or beaches. Nesting begins by mid-May. Wintering areas are largely unknown but are suspected to be along the Pacific Coast of Central and South America (Rigney and Granholm 2005:1).

13B.60.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.60.5.1 GIS Model Data Sources

The California least tern model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.60.5.2 Habitat Model Description

The Delta is at the northern limit of the species range where some small breeding populations occur (as described in Section 13B.60.2, Range and Distribution within the Study Area). As described in Section 13B.60.3, Habitat Requirements, foraging typically occurs in shallow estuaries or lagoons (U.S. Fish and Wildlife Service 2020:19). Consequently, modeled foraging habitat includes all areas mapped as tidal perennial aquatic. The modeled foraging habitat relies on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the data sets outside the delineation study area. The extent of modeled habitat in the study area is depicted in Figure 13B.60-1.

Nesting habitat is barren or sparsely vegetated sandy or gravelly substrates above the high tide line along the coastline (U.S. Fish and Wildlife Service 2020:18). In the Delta, nesting colonies are often in artificially or incidentally created habitat (Rigney and Granholm 2005:1–3; Marschalek 2008:14) such as gravel roads, debris piles, and other conditions that mimic a natural sandy or gravelly substrate as evidenced by recent breeding occurrences in human-modified or artificial habitats at the Montezuma Wetlands, Pittsburg Power Plant, and the Bufferlands. Although future nesting habitat could occur incidentally in the Delta, it is not possible to accurately predict where; therefore, suitable nesting habitat cannot be modeled.

13B.60.5.2.1 Geographic Limits

Because California least tern have been recorded foraging in the study area (eBird 2021) and future nesting habitat could occur incidentally in the Delta, habitat is modeled throughout the study area.

13B.60.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Tidal perennial aquatic
    - Tidal channel

- Natural channel
- Conveyance channel

Outside the Delineation Study Area

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation datasets (Chico State Research Foundation, Geographical Information Center 2018).

- Tidal perennial aquatic
  - *Azolla (filiculoides, microphylla)*
  - *Eichhornia crassipes*
  - *Lemna (minor)* and relatives
  - *Ludwigia (hexapetala, peploides)*
  - Naturalized temperate Pacific freshwater vegetation
  - Temperate Pacific freshwater aquatic bed
  - Tidal channel
  - Water

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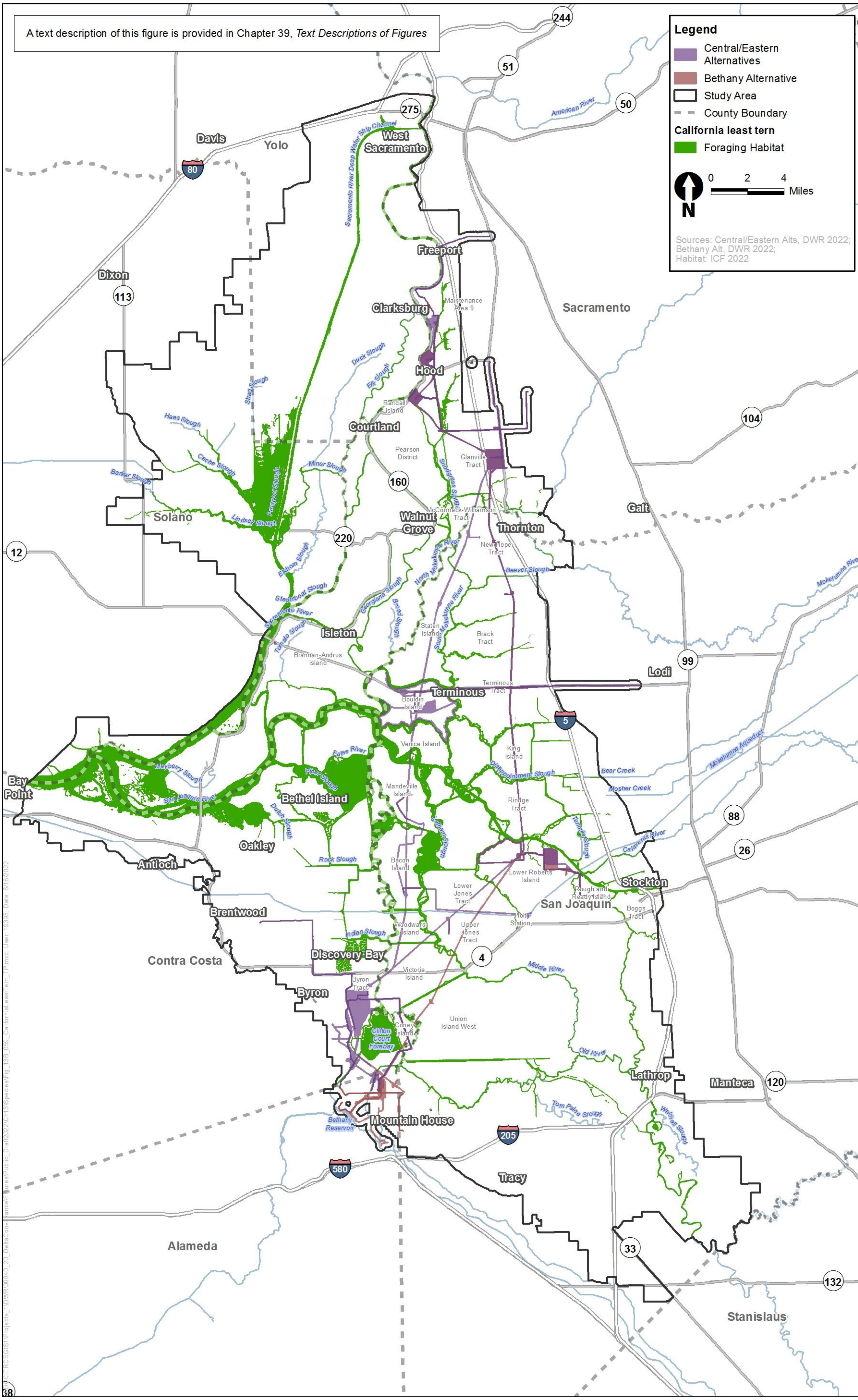

Figure 13B.60-1. California Least Tern Modeled Habitat in the Study Area

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13B.61 Double-Crested Cormorant (*Phalacrocorax auritus*)

13B.61.1 Legal Status

Double-crested cormorant is on the CDFW's Watch List. Double-crested cormorant has no federal regulatory status (California Department of Fish and Wildlife 2020a:52).

13B.61.2 Range and Distribution within the Study Area

In California, double-crested cormorant occurs year-round in fresh, salt, and estuarine waters along the coast and on inland lakes. In the Central Valley, the species occurs in lacustrine and riverine habitats (Granholm 2008).

The double-crested cormorant also occurs throughout the study area during the breeding and wintering seasons. The CNDDB reports only four nesting locations within the study area on Sherman Island, northern Stone Lakes, and in the Sacramento Regional Wastewater Treatment Plant Bufferlands (California Department of Fish and Wildlife 2020b). Surveys conducted from 2009 to 2011 documented 28 active double-crested cormorant nest sites on midchannel islands adjacent to Bouldin Island, Mandeville Island, and Bacon Island, and in the vicinity of Clifton Court Forebay (California Department of Water Resources 2011). Many of these records are nesting colonies composed of multiple species including great egrets (*Ardea alba*) or great blue herons (*Ardea herodias*). Most nesting habitat for double-crested cormorants in the study area consists of riparian woodlands or eucalyptus trees along large and small drainages.

13B.61.3 Habitat Requirements

Double-crested cormorant occurs on ponds, lakes, artificial impoundments, slow-moving rivers, lagoons, estuaries, and open coastlines. The species requires suitable habitat for foraging, daytime loafing, and nighttime roosting. Roosting and loafing areas may include exposed rocks, sandbars, shipwrecks, transmission wires, or trees. Dense roosts, loafing areas, and breeding colonies can consist of hundreds to thousands of individuals, and feeding flocks may consist of tens to hundreds (Dorr et al. 2020). The species feeds mainly on fish, and prefers water less than 30 feet deep with a rocky or gravel bottom, typically within 1.5 miles from shore and within 5 to 10 miles of a roost or nest colony (Dorr et al. 2020; Granholm 2008).

Waterbirds such as the double-crested cormorant typically use rookeries (i.e., colonial nest sites) that often include interspecies nesting (e.g., great egret, great blue heron). Double-crested cormorants nest beside water on cliffs, rugged slopes, in live or dead trees, and on artificial sites such as bridges, abandoned docks, or nesting towers (Dorr et al. 2020; Granholm 2008).

13B.61.4 Seasonal Patterns

Along the California coast, the population increases in winter as double-crested cormorants from inland and farther north migrate to lowlands in coastal and southern areas (Dorr et al. 2020;

Granholm 2008). The species breeds primarily from April to July or August, with most egg laying occurring from April to June (Granholm 2008).

13B.61.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.61.5.1 GIS Model Data Sources

The double-crested cormorant model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographic Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.61.5.2 Habitat Model Description

Modeled double-crested cormorant nesting habitat includes all riparian forest and some willow scrub habitats regardless of size, density, or distance to water. Rookeries are typically adjacent to or near water; therefore, the model likely overestimates suitable nesting habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.61-1.

Geographic Limits

Double-crested cormorant rookeries are protected throughout California and occurrences have been documented throughout the Delta (eBird 2021); therefore, nesting habitat is modeled throughout the entire study area.

13B.61.5.2.1 Additional Model Parameters

Modeled nesting habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographic Information Center 2018) layers.

- Valley/foothill riparian
  - *Acer negundo*
  - *Ailanthus altissima*
  - *Alnus rhombifolia*

- Californian broadleaf forest and woodland
- *Eucalyptus* spp.—*Ailanthus altissima*—*Robinia pseudoacacia*
- *Fraxinus latifolia*
- Introduced North American acemose nean woodland and forest
- *Juglans hindsii and Hybrids*
- *Platanus racemosa*
- *Populus fremontii*
- *Quercus agrifolia*
- *Quercus lobata*
- *Quercus wislizeni* (tree)
- *Robinia pseudoacacia*
- *Salix exigua*
- *Salix gooddingii*
- *Salix laevigata*
- *Salix lasiolepis*
- *Salix lucida*
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian evergreen and deciduous woodland
- Southwestern North American riparian/wash scrub
- *Tamarix* spp.
- Vancouverian riparian deciduous forest

Modeled nesting habitat also includes the following landcover types from the DWR Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Forested wetland
- Scrub shrub wetland

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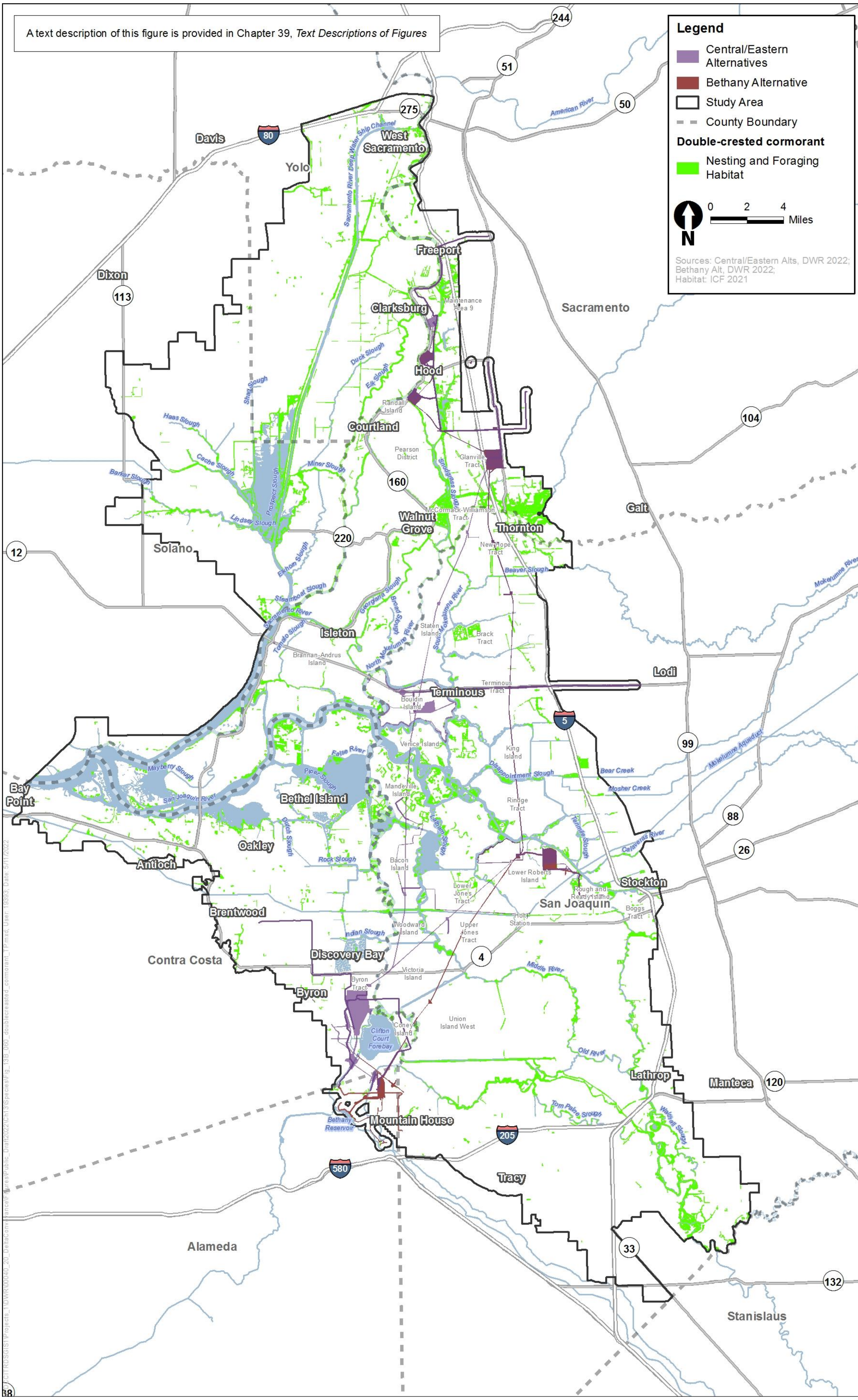

Figure 13B.61-1. Double-Crested Cormorant Modeled Habitat in the Study Area

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13B.62 Least Bittern (*Ixobrychus exilis*)

13B.62.1 Legal Status

Least bittern is a California Species of Special Concern and is on the USFWS Birds of Conservation Concern list (California Department of Fish and Wildlife 2020:53).

13B.62.2 Range and Distribution within the Study Area

Least bittern ranges from southeast Canada through the United States and Mexico south to Costa Rica (Poole et al. 2020). In California, least bitterns are a common summer resident at the Salton Sea and Colorado River and are rare to uncommon in summer in San Diego County and the Sacramento and San Joaquin Valleys. The species breeds locally in the Owens Valley and Mojave Desert, and in northeastern California, breeding records exist in Siskiyou, Modoc, and Lassen Counties (Sterling 2008:138; Graholm 2008). Currently, remaining core population centers in California are in the Sacramento Valley, Salton Sink, and lower Colorado River Valley (Sterling 2008:138). Within the study area, least bittern have been recorded within the Stone Lakes National Wildlife Refuge, Sacramento Regional Wastewater Treatment Plant Bufferlands, Cosumnes River Preserve, Shin Kee Tract Wetlands, Holland Tract, as well as on Sherman Island and the Dow Wetlands in the western portion of the study area (eBird 2021).

13B.62.3 Habitat Requirements

Breeding habitat includes freshwater and brackish marshes with dense emergent vegetation, interspersed with clumps of woody plants and open water (Sterling 2008:139; Poole et al. 2020). Nests are typically built up to 2.5 feet (.75 meter) above water in live or dead stalks of emergent vegetation over water that is 1 foot (.3 meter) deep or more (Sterling 2008:139; Granholm 2008). Nests are usually within 33 feet (10 meters) of open water, channels, or small openings in vegetation (Poole et al. 2020). Emergent vegetation is also used for foraging, where least bitterns feed mainly on small fish and insects by stalking along the open-water edge of emergent vegetation (Granholm 2008; Poole et al. 2020).

13B.62.4 Seasonal Patterns

The species is primarily a summer resident in California, with most least bitterns migrating south to Mexico for winter (October to March) (Granholm 2008). Some remain in Southern California in the Salton Sink, the lower Colorado River valley, and coastal Orange and San Diego Counties (Sterling 2008:137). Least bitterns arrive on breeding grounds in California from late March to May, with egg-laying occurring from mid-April to early July (Granholm 2008).

13B.62.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.62.5.1 GIS Model Data Sources

The least bittern model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.62.5.2 Habitat Model Description

The habitat model for least bittern consists of nesting and foraging habitat. The modeled habitat relies on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area. Modeled least bittern nesting and foraging habitat includes all emergent wetland landcover types, regardless of patch size, density, or structure; therefore, the model likely overestimates suitable habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.62-1.

13B.62.5.2.1 Geographic Limits

Although the species range (Sterling 2008) only overlaps with the northern portion of the study area, there have been multiple occurrences recorded outside of the recorded current range (eBird 2021). Because least bittern is a secretive species and not easily detected, the published range may be underestimated; therefore, least bittern nesting and foraging habitat is modeled throughout the entire study area.

13B.62.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled nesting and foraging habitat includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layers:

- Tidal freshwater emergent wetland
  - Freshwater emergent wetland
- Nontidal perennial freshwater emergent wetland
  - Freshwater emergent wetland

Outside the Delineation Study Area

Modeled nesting and foraging habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Tidal brackish emergent wetland
  - All types
- Nontidal brackish emergent wetland
  - All types
- Tidal freshwater emergent wetland
  - All types
- Nontidal perennial freshwater emergent wetland
  - All types

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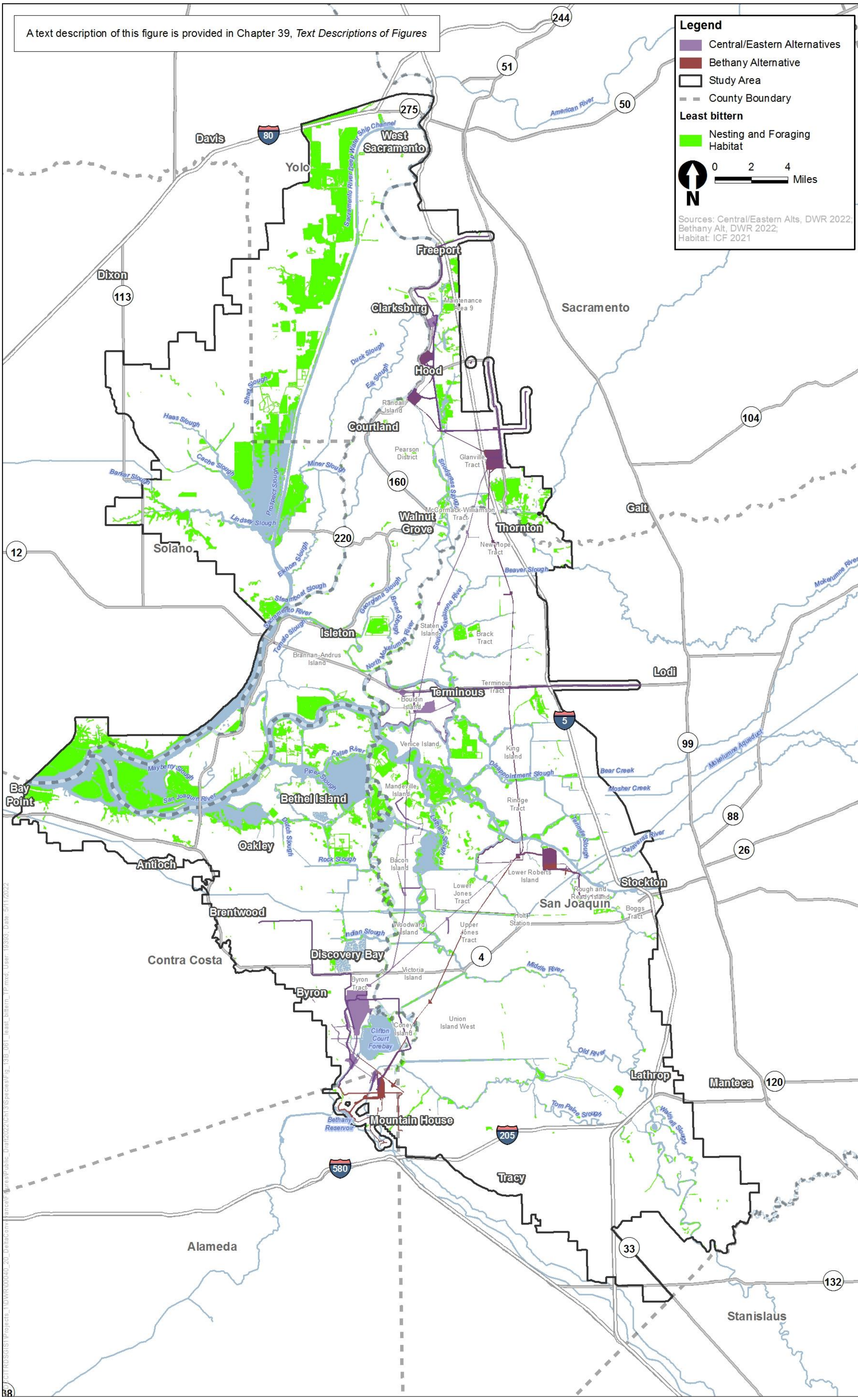

Figure 13B.62-1. Least Bittern Modeled Habitat in the Study Area

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13B.63 Great Blue Heron (*Ardea herodias*)

13B.63.1 Legal Status

Great blue heron has a NatureServe ranking of G5S4 and is included on CDFW Special Animals List but is not listed under the ESA or CESA (California Department of Fish and Wildlife 2020a:52).

13B.63.2 Range and Distribution within the Study Area

Great blue heron occurs year-round throughout California. The species is commonly found in shallow estuaries and fresh and saline emergent wetlands but may also occur in riverine and rocky marine shores, croplands, pastures, and mountains above foothills. Many rookeries are scattered throughout Northern California, while few are found in Southern California (Granholm 2008).

The great blue heron occurs throughout the study area during the breeding and wintering seasons. The CNDDB, reports only five nesting locations within the study area on Decker Island, northern Stone Lakes, the Sacramento Regional Wastewater Treatment Plant Bufferlands, and on a mid-channel island north of Mandeville Island (California Department of Fish and Wildlife 2020b). Surveys from 2009 to 2011 documented 74 active great blue heron nest sites in southern Stone Lakes, Liberty Island, Brannan Island, White Slough, and on mid-channel islands adjacent to Medford Island, Mandeville Island, Bouldin Island, Bacon Island, Rindge Tract, Woodward Island, Union Island, and in the vicinity of Clifton Court Forebay (California Department of Water Resources 2011). Many of these records are nesting colonies composed of multiple species including great egrets or double-crested cormorants. Most nesting habitat for great blue heron in the study area consists of riparian woodlands or eucalyptus trees along large and small drainages.

13B.63.3 Habitat Requirements

The great blue heron mostly nests in rookeries (colonial nest sites) that are typically up to 500 nests, with some studies showing the number of nests positively related to the area of nearby foraging habitat (Vennesland and Butler 2020). In California, the species often nests in mixed colonies with great egrets (Granholm 2008). Nests are usually built in secluded tall snags or live trees, up to 98 feet (30 meters) or more above the ground (Granholm 2008; Vennesland and Butler 2020). Nests can be found in lowland swamps, upland forests, islands, riparian woodlands, forest-bordered lakes and ponds, and occasionally on the ground or in shrubs where trees are not available (Vennesland and Butler 2020).

Foraging habitat includes wetlands and various waterbodies and water courses, and occasionally upland areas. Great blue heron feeds mainly on fish, usually searching for prey by wading or standing in shallow water less than 12 inches (Granholm 2008; Vennesland and Butler 2020).

13B.63.4 Seasonal Patterns

In California, the species is largely nonmigratory, but disperses from nesting colonies to outlying areas after breeding in June or July and arrives back on breeding grounds in February (Gill and Mewaldt 1979:7; Granholm 2008). Egg-laying occurs in late February or March (Granholm 2008).

13B.63.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.63.5.1 GIS Model Data Sources

The great blue heron model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.63.5.2 Habitat Model Description

Modeled great blue heron nesting habitat includes all riparian forest and some willow scrub habitats regardless of size, density, or distance to water. Rookeries are typically adjacent to or near water, therefore, the model likely overestimates suitable nesting habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.63-1.

13B.63.5.2.1 Geographic Limits

Great blue heron rookeries are protected throughout California and occurrences have been documented throughout the Delta, therefore nesting habitat is modeled throughout the entire study area, which overlaps with the year-round range for the species (California Wildlife Habitat Relationship System 1995).

13B.63.5.2.2 Additional Model Parameters

Modeled nesting habitat includes the following landcover types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and Great Valley Ecoregion 2018 Vegetation layers (Chico State Research Foundation, Geographical Information Center 2018):

- Valley/foothill riparian
  - *Acer negundo*
  - *Ailanthus altissima*
  - *Alnus rhombifolia*
  - Californian broadleaf forest and woodland
  - Eucalyptus spp.—*Ailanthus altissima*—*Robinia pseudoacacia*

  - *Fraxinus latifolia*
  - Introduced North American Mediterranean woodland and forest
  - *Juglans hindsii* and hybrids
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Quercus wislizeni* (tree)
  - *Robinia pseudoacacia*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*
  - *Salix lasiolepis*
  - *Salix lucida*
  - Southwestern North American introduced riparian scrub
  - Southwestern North American riparian evergreen and deciduous woodland
  - Southwestern North American riparian/wash scrub
  - Vancouverian riparian deciduous forest

Modeled nesting habitat also includes the following landcover types from the DWR Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Forested wetland
- Scrub shrub wetland

13B.63.6 References Cited

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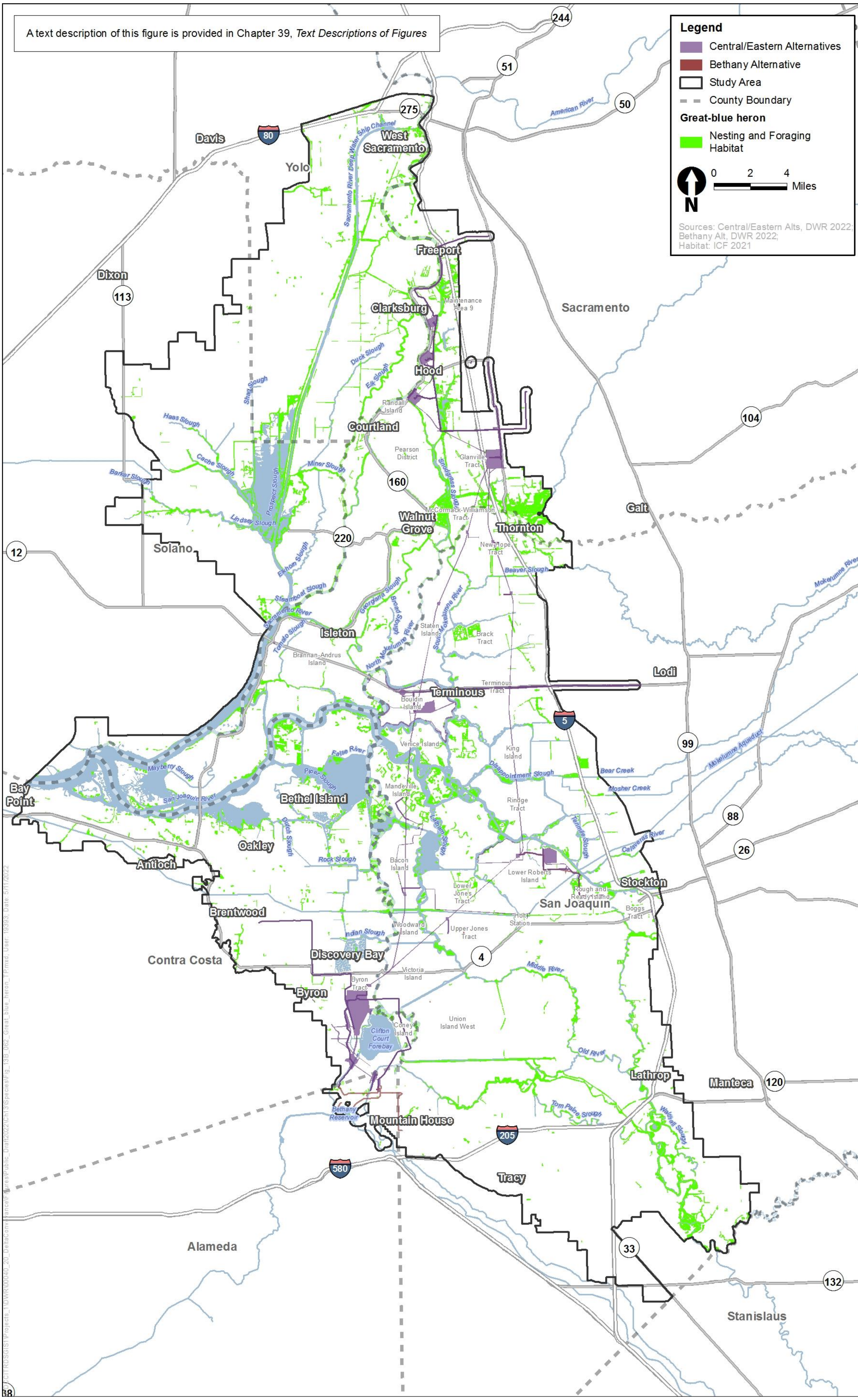

Figure 13B.63-1. Great Blue Heron Modeled Habitat in the Study Area

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13B.64 Great Egret (*Ardea alba*)

13B.64.1 Legal Status

Great egret has a NatureServe ranking of G5S4 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:52).

13B.64.2 Range and Distribution within the Study Area

Great egret occurs year-round in wetlands throughout California, excluding high mountains and deserts. Breeding in California occurs in eastern Siskiyou and Modoc Counties, along the coast in Humboldt and Monterey Counties and the San Francisco Bay Area, at scattered locations in the Central Valley from Glenn and Butte Counties south to Tulare and Kern Counties, and along the Colorado River and Salton Sea (McCrimmon et al. 2020).

Great egret occurs throughout the study area during the breeding and wintering seasons. The CNDDB, reports only two nesting locations within the study area in northern Stone Lakes and at the Sacramento Regional Wastewater Treatment Plant Bufferlands (California Department of Fish and Wildlife 2020b). Surveys from 2009 to 2011 documented 27 active great egret nest sites in Stone Lakes, Liberty Island, Brannan Island, White Slough, on midchannel islands adjacent to Mandeville Island, on Lower Roberts Island, Union Island, and in the vicinity of Clifton Court Forebay (California Department of Water Resources 2011). Many of these records are nesting colonies composed of multiple species including great blue herons or double-crested cormorants. Most nesting habitat for great egrets in the study area consists of riparian woodlands or eucalyptus trees along large and small drainages.

13B.64.3 Habitat Requirements

Suitable habitat occurs mainly in lowlands, both inland and along the coast, and includes various wetland habitats. Nesting colonies are usually located in lakes, ponds, marshes, estuaries, human-made impoundments, and islands. Waterbirds such as the great egret typically use rookeries (colonial nest sites) that often include interspecies nesting with other species in this group. In California, the species often nests in mixed colonies with great blue herons. Nests are typically built on islands or over water, near the top of trees, bushes, or woody vegetation that is sheltered from winds (Granholm 2008; McCrimmon et al. 2020).

Great egrets forage mainly on fish along shorelines in shallow water. Foraging habitat includes various freshwater, marine, and estuarine wetlands, and sometimes upland habitats and flooded agricultural fields (McCrimmon et al. 2020).

13B.64.4 Seasonal Patterns

Great egret is a yearlong resident in California but disperses widely from nesting colonies after breeding. Nesting occurs primarily from March to July, during which time populations are concentrated near colonies (Granholm 2008).

13B.64.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.64.5.1 GIS Model Data Sources

The great egret model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.64.5.2 Habitat Model Description

Modeled great egret nesting habitat includes all riparian forest and some willow scrub habitats regardless of size, density, or distance to water. Rookeries are typically adjacent to or near water, therefore, the model likely overestimates suitable nesting habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.64-1.

13B.64.5.2.1 Geographic Limits

Great egret rookeries are protected throughout California and occurrences have been documented throughout the Delta (eBird 2021) therefore nesting habitat is modeled throughout the entire study area, which overlaps with the year-round range for the species (California Wildlife Habitat Relationship System 1995).

13B.64.5.2.2 Additional Model Parameters

Modeled nesting habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
  - *Acer negundo*
  - *Ailanthus altissima*
  - *Alnus rhombifolia*
  - Californian broadleaf forest and woodland

- Eucalyptus spp.—*Ailanthus altissima*—*Robinia pseudoacacia*
- *Fraxinus latifolia*
- Introduced North American Mediterranean woodland and forest
- *Juglans hindsii* and hybrids
- *Platanus racemosa*
- *Populus fremontii*
- *Quercus agrifolia*
- *Quercus lobata*
- *Quercus wislizeni* (tree)
- *Robinia pseudoacacia*
- *Salix exigua*
- *Salix gooddingii*
- *Salix laevigata*
- *Salix lasiolepis*
- *Salix lucida*
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian evergreen and deciduous woodland
- Southwestern North American riparian/wash scrub
- Vancouverian riparian deciduous forest

Modeled nesting habitat also includes the following landcover types from the DWR Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Forested wetland
- Scrub shrub wetland

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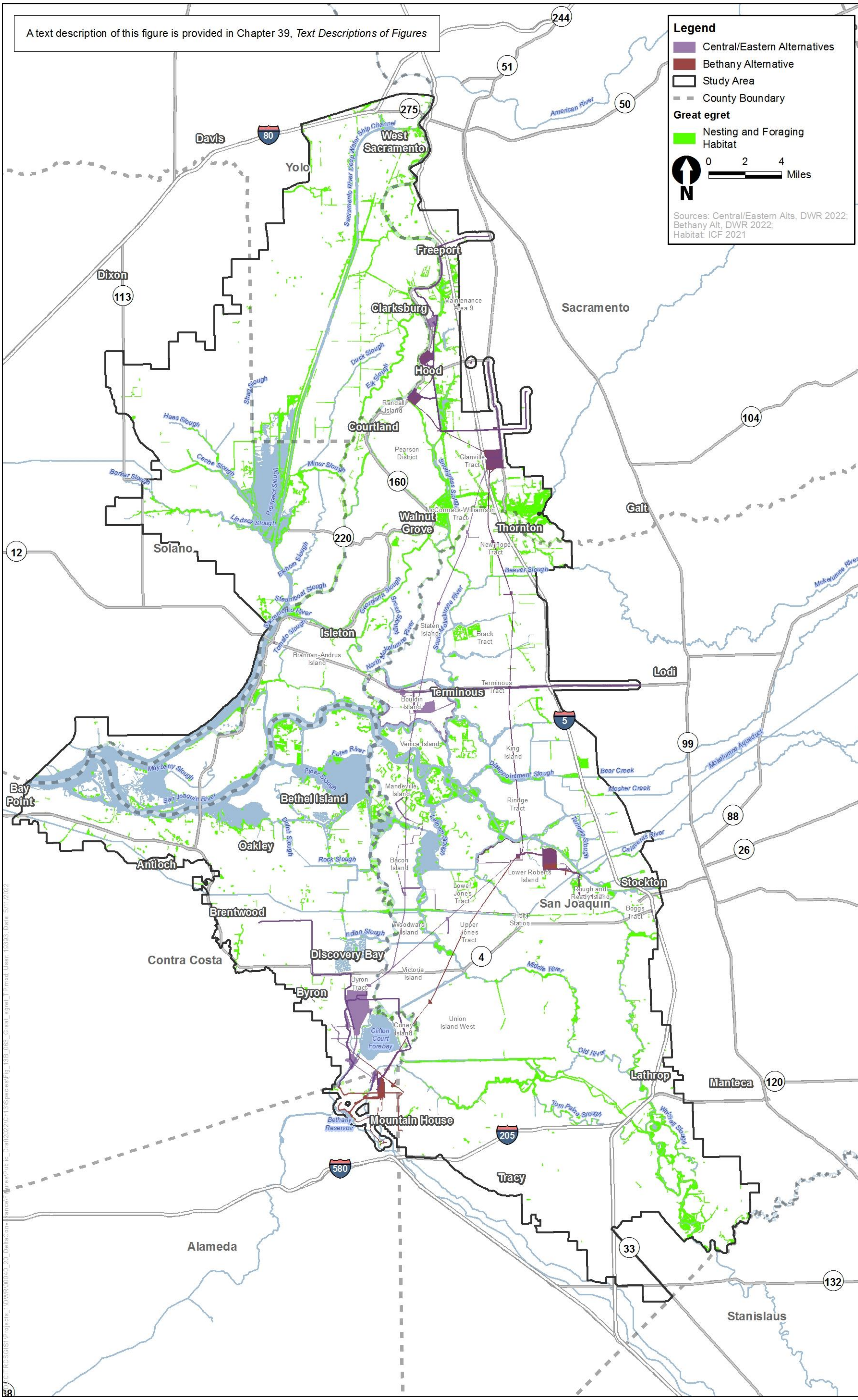

Figure 13B.64-1. Great Egret Modeled Habitat in the Study Area

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13B.65 Snowy Egret (*Egretta thula*)

13B.65.1 Legal Status

Snowy egret has a NatureServe ranking of G5S4 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:53).

13B.65.2 Range and Distribution within the Study Area

Snowy egrets are found throughout much of California, breeding mainly in Siskiyou, Modoc, and San Diego Counties, Humboldt Bay, San Francisco Bay, Sacramento and San Joaquin Valleys, Salton Sea, and Colorado River (Parsons and Master 2020).

Snowy egrets occur throughout the study area during the breeding and wintering seasons. There are no CNDDB recorded nesting locations within the study area (California Department of Fish and Wildlife 2020b) but surveys from 2009 to 2011 documented three active snowy egret nest sites in upper and lower Stone Lakes and on Liberty Island (California Department of Water Resources 2011). Most nesting habitat for snowy egrets in the study area consists of riparian trees along large and small drainages and emergent wetlands.

13B.65.3 Habitat Requirements

Preferred habitat for snowy egrets includes coastal estuaries, fresh and saline emergent wetlands, ponds, rivers, irrigation ditches, and wet fields (Granholm 2008). Waterbirds such as the snowy egret typically use rookeries (colonial nest sites) that often include interspecies nesting with other species in this group (Parsons and Master 2020). Nests are placed in dense emergent vegetation or in low trees in proximity to suitable foraging areas. Snowy egrets feed on a wide variety of prey, including fish, crustaceans, and insects in shallow water or along shores of various wetland or aquatic habitats (Granholm 2008).

13B.65.4 Seasonal Patterns

Adult snowy egrets are mainly year-round residents in California, although individuals disperse from nesting colonies after breeding. In southern and central California, breeding occurs from late March to mid-May, and in northern California, from late April to late August (Granholm 2008).

13B.65.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.65.5.1 GIS Model Data Sources

The snowy egret model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.65.5.2 Habitat Model Description

The habitat model for snowy egret is composed of potential nesting/rookery habitat. The modeled habitat relies on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area. Modeled snowy egret nesting habitat includes all riparian forest and some willow scrub habitats and brackish and freshwater emergent wetlands regardless of size, density, structure, or, in the case of riparian vegetation, distance to water. Rookeries are typically adjacent to or near water, therefore, the model likely overestimates suitable nesting habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.65-1.

13B.65.5.2.1 Geographic Limits

Snowy egret rookeries are protected throughout California and the species is common in the Central Valley year-round (Granholm 2008), therefore nesting habitat is modeled throughout the entire study area.

13B.65.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled nesting habitat includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer:

- Nontidal Freshwater Perennial Emergent Wetland
  - Freshwater Emergent Wetland
- Tidal Freshwater Emergent Wetland
  - Freshwater Emergent Wetland
- Valley Foothill Riparian
  - Forested Wetland
  - Scrub Shrub Wetland

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019) and the Great

Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018) layers:

- Valley/foothill riparian
  - *Acer negundo*
  - *Ailanthus altissima*
  - *Alnus rhombifolia*
  - Californian broadleaf forest and woodland
  - *Cornus sericea*
  - Eucalyptus spp. —*Ailanthus altissima—Robinia pseudoacacia*
  - *Fraxinus latifolia*
  - Introduced North American Mediterranean woodland and forest
  - *Juglans hindsii* and hybrids
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Quercus wislizeni* (tree)
  - *Robinia pseudoacacia*
  - *Rosa californica*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*
  - *Salix lasiolepis*
  - *Salix lucida*
  - *Sambucus nigra*
  - Southwestern North American introduced riparian scrub
  - Southwestern North American riparian evergreen and deciduous woodland
  - Southwestern North American riparian/wash scrub
  - Vancouverian riparian deciduous forest

Outside the Delineation Study Area

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019) and the Great

Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018) layers:

- Nontidal brackish emergent wetland
    - All types
- Nontidal freshwater perennial emergent wetland
    - All types
- Tidal brackish emergent wetland
    - All types
- Tidal freshwater emergent wetland
    - All types
- Valley/foothill riparian
    - *Acer negundo*
    - *Ailanthus altissima*
    - *Alnus rhombifolia*
    - Californian broadleaf forest and woodland
    - *Cornus sericea*
    - Eucalyptus spp.—*Ailanthus altissima*—*Robinia pseudoacacia*
    - *Fraxinus latifolia*
    - Introduced North American Mediterranean woodland and forest
    - *Juglans hindsii* and hybrids
    - *Platanus racemosa*
    - *Populus fremontii*
    - *Quercus agrifolia*
    - *Quercus lobata*
    - *Quercus wislizeni* (tree)
    - *Robinia pseudoacacia*
    - *Rosa californica*
    - *Salix exigua*
    - *Salix gooddingii*
    - *Salix laevigata*
    - *Salix lasiolepis*
    - *Salix lucida*
    - *Sambucus nigra*

- Southwestern North American introduced riparian scrub
- Southwestern North American riparian evergreen and deciduous woodland
- Southwestern North American riparian/wash scrub
- Vancouverian riparian deciduous forest

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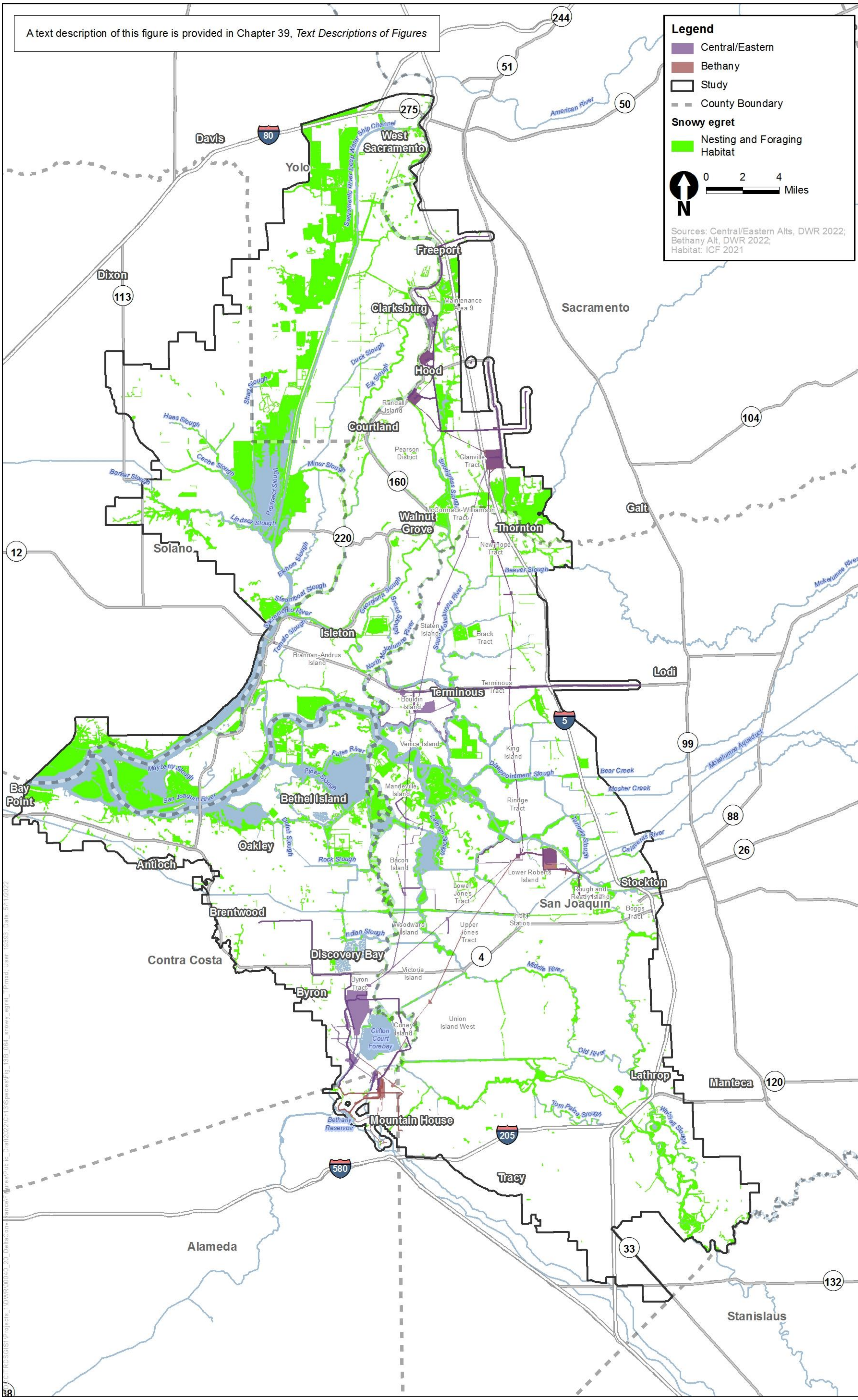

Figure 13B.65-1. Snowy Egret Modeled Habitat in the Study Area

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13B.66 Black-Crowned Night Heron (*Nycticorax nycticorax*)

13B.66.1 Legal Status

Black-crowned night heron has a NatureServe ranking of G5S4 and is included on CDFW's Special Animals List but is not listed under the federal ESA or CESA (California Department of Fish and Wildlife 2020a:53).

13B.66.2 Range and Distribution within the Study Area

Black-crowned night heron occurs year-round in lowlands and foothills throughout California (Granholm 2008).

Black-crowned night herons occur throughout the study area during the breeding and wintering seasons. There are no CNDDB recorded nesting locations within the study area (California Department of Fish and Wildlife 2020b) but surveys conducted from 2009 to 2011 documented four active black-crowned night heron nest sites in Stone Lakes, on New Hope Tract, and in the vicinity of Clifton Court Forebay (California Department of Water Resources 2011). Most nesting habitat for black-crowned night heron in the study area consists of riparian trees and shrub/scrub along large and small drainages and in emergent wetlands.

13B.66.3 Habitat Requirements

Black-crowned night herons breed in fresh or brackish emergent wetlands, dense-foliaged trees, and dense shrubbery near foraging areas (Granholm 2008). Waterbirds such as the black-crowned night heron typically use rookeries (colonial nest sites) that often include interspecies nesting with other species in this group. Colonies are usually located on islands or swamps over water, with live trees as preferred nest sites; however, the species may also nest on the ground (Hothem et al. 2020).

Black-crowned night herons feed on a wide range of prey by standing or wading along shallow margins of lacustrine, riverine, emergent wetland, and occasionally marine subtidal habitats (Granholm 2008). The species may also feed in pastures, rice fields, and crop fields (Hothem et al. 2020).

13B.66.4 Seasonal Patterns

Breeding of black-crowned night herons in California occurs mainly from February to July or August. Black-crowned night herons are yearlong residents in California but disperse widely from nesting colonies after breeding. Many individuals migrate southward from northern California in winter (Granholm 2008).

13B.66.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.66.5.1 GIS Model Data Sources

The black-crowned night heron model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.66.5.2 Habitat Model Description

The habitat model for black-crowned night heron is composed of potential nesting/rookery habitat. The modeled habitat relies on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area. Modeled black-crowned night heron nesting habitat includes all riparian forest and some willow scrub habitats and brackish and freshwater emergent wetlands regardless of size, density, structure, or, in the case of riparian vegetation, distance to water. Rookeries are typically adjacent to or near water, therefore, the model likely overestimates suitable nesting habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.66-1.

13B.66.5.2.1 Geographic Limits

Black-crowned night heron rookeries are protected throughout California and therefore nesting habitat is modeled throughout the entire study area, which is within with the year-round range for the species (California Wildlife Habitat Relationship System 1995).

13B.66.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled nesting habitat includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer.

- Nontidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
- Tidal freshwater emergent wetland
  - Freshwater emergent wetland
- Valley/foothill riparian
  - Forested wetland

- Scrub shrub wetland

Modeled habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
  - *Acer negundo*
  - *Ailanthus altissima*
  - *Alnus rhombifolia*
  - Californian broadleaf forest and woodland
  - *Cornus sericea*
  - *Eucalyptus* spp.—*Ailanthus altissima*—*Robinia pseudoacacia*
  - *Fraxinus latifolia*
  - Introduced North American Mediterranean woodland and forest
  - *Juglans hindsii* and hybrids
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Quercus wislizeni* (tree)
  - *Robinia pseudoacacia*
  - *Rosa californica*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*
  - *Salix lasiolepis*
  - *Salix lucida*
  - *Sambucus nigra*
  - Southwestern North American introduced riparian scrub
  - Southwestern North American riparian evergreen and deciduous woodland
  - Southwestern North American riparian/wash scrub
  - Vancouverian riparian deciduous forest

Outside the Delineation Study Area

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Nontidal brackish emergent wetland
    - All types
- Nontidal freshwater perennial emergent wetland
    - All types
- Tidal brackish emergent wetland
    - All types
- Tidal freshwater emergent wetland
    - All types
- Valley/foothill riparian
    - *Acer negundo*
    - *Ailanthus altissima*
    - *Alnus rhombifolia*
    - Californian broadleaf forest and woodland
    - *Cornus sericea*
    - *Eucalyptus* spp.—*Ailanthus altissima*—*Robinia pseudoacacia*
    - *Fraxinus latifolia*
    - Introduced North American Mediterranean woodland and forest
    - *Juglans hindsii* and hybrids
    - *Platanus racemosa*
    - *Populus fremontii*
    - *Quercus agrifolia*
    - *Quercus lobata*
    - *Quercus wislizeni* (tree)
    - *Robinia pseudoacacia*
    - *Rosa californica*
    - *Salix exigua*
    - *Salix gooddingii*
    - *Salix laevigata*

- *Salix lasiolepis*
- *Salix lucida*
- *Sambucus nigra*
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian evergreen and deciduous woodland
- Southwestern North American riparian/wash scrub
- Vancouverian riparian deciduous forest

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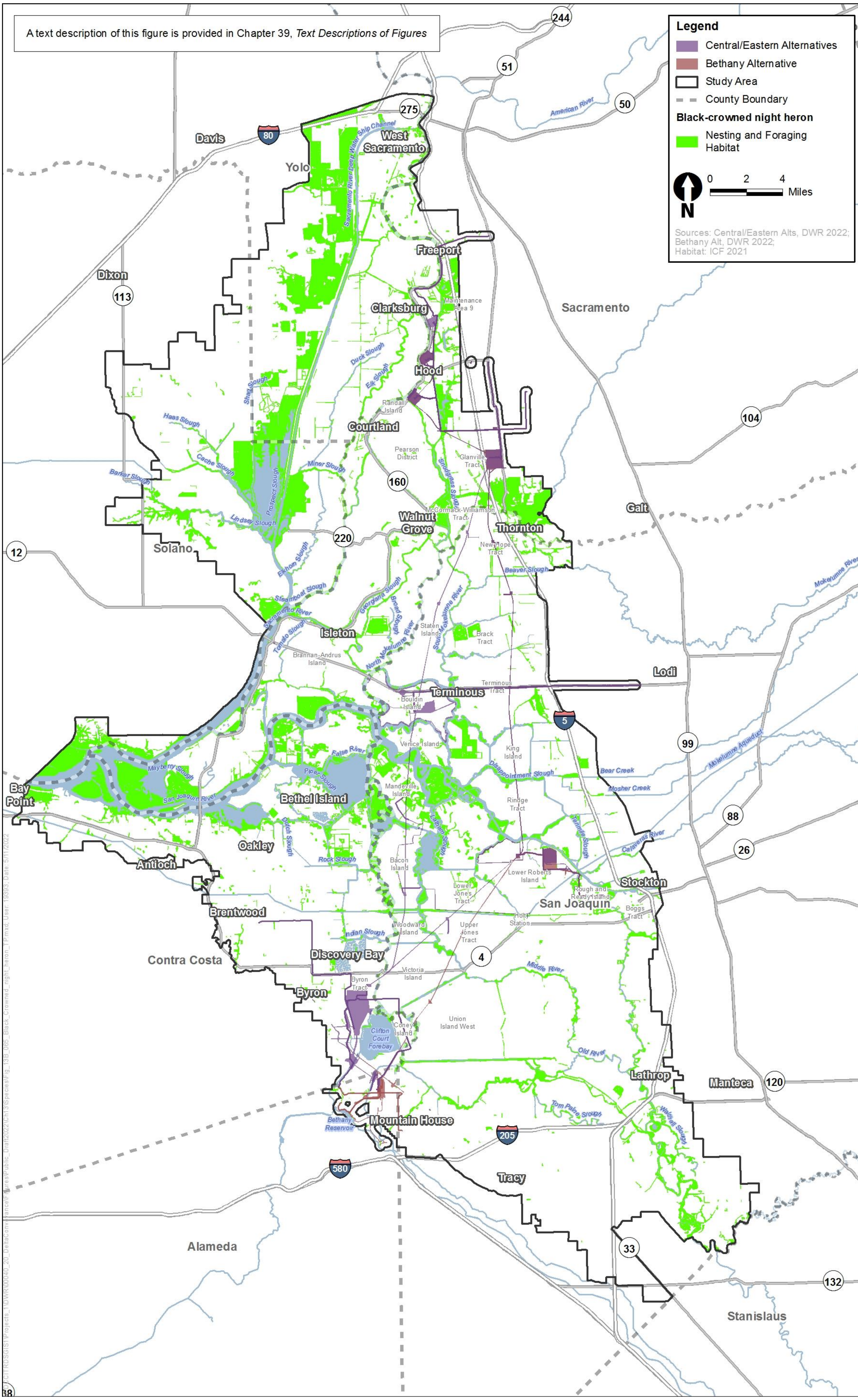

1
2 **Figure 13B.66-1. Black-Crowned Night Heron Modeled Habitat in the Study Area**

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13B.67 Osprey (*Pandion haliaetus*)

13B.67.1 Legal Status

Osprey has no federal legal status; however, it is included on the CDFW Watch List (California Department of Fish and Wildlife 2020a:54).

13B.67.2 Range and Distribution within the Study Area

In California, ospreys breed primarily in Northern California along the western slope of the Sierra Nevada south to Bass Lake, and along the coast south to the San Francisco Bay. Small populations also breed at Mono Lake and in Southern California. Most ospreys overwinter south of the U.S., although some remain in California yearlong (Bierregaard et al. 2020).

Although osprey are frequently observed in the study area during the breeding and wintering seasons (Ebird 2021), nesting is not common. There are no CNDDB recorded nesting locations within the study area (California Department of Fish and Wildlife 2020b), but surveys conducted from 2009 to 2011 documented five active osprey nest sites along the Sacramento Deepwater Ship Channel on Liberty Island and along the Sacramento River on Little Egbert Tract (California Department of Water Resources 2011).

13B.67.3 Habitat Requirements

Ospreys can be found in a variety of habitats where there is adequate foraging habitat and open nest sites. Ospreys are primarily a tree–nesting species, although they will also nest on cliffs, boulders, and man-made structures. Nests are typically placed near the tops of trees or over water to avoid predators (Bierregaard et al. 2020).

Ospreys forage in a wide range of aquatic habitats, including saltwater marshes, lagoons, ponds, estuaries, rivers, reservoirs, and lakes, ideally where there is shallow, clear water without thick vegetation (Bierregaard et al. 2020). Ospreys rely on fish for 99% of their diet; therefore, they tend to nest within 12.5 miles (20 km) of water, an energetically feasible commuting distance (Bierregaard et al. 2020).

13B.67.4 Seasonal Patterns

Ospreys arrive at nesting grounds mid-March to early April and breed March to September. Most ospreys in California migrate south to Central and South America for winter (Polite 2008).

13B.67.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.67.5.1 GIS Model Data Sources

The osprey model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation Report (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.67.5.2 Habitat Model Description

The habitat model for osprey includes both nesting and foraging habitats. Modeled nesting habitat includes riparian forest regardless of size, density, or distance to water. Modeled foraging habitat relies on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area. Modeled foraging habitat includes all tidal aquatic and non-tidal perennial aquatic landcover regardless of the size of the waterway. Osprey may be less likely to forage in small tributaries and channels; therefore, the model likely overestimates both suitable nesting and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.67-1.

13B.67.5.2.1 Geographic Limits

Nesting and foraging habitat is modeled throughout the entire study area, which overlaps with the year-round range for the species (Hunting 2004).

13B.67.5.2.2 Additional Model Parameters

Nesting Habitat

Modeled nesting habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers:

- Valley/foothill riparian
    - *Acer negundo*
    - *Ailanthus altissima*
    - *Alnus rhombifolia*
    - *Californian broadleaf forest and woodland*
    - *Eucalyptus* spp.—*Ailanthus altissima*—*Robinia pseudoacacia*

  - *Fraxinus latifolia*
  - *Introduced North American Mediterranean woodland and forest*
  - *Juglans hindsii and Hybrids*
  - *Platanus racemosa*
  - *Populus fremontii*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Quercus wislizeni* (tree)
  - *Robinia pseudoacacia*
  - *Southwestern North American riparian evergreen and deciduous woodland*
  - *Vancouverian riparian deciduous forest*

Modeled nesting habitat also includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer:

- Valley/foothill riparian
  - Forested wetland

Foraging Habitat

Inside the Delineation Study Area

Modeled foraging habitat includes the following types from the DWR 2020 Aquatic Resources Delineation Report (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021):

- Nontidal perennial aquatic
  - Conveyance channel
  - Depression
  - Natural channel
- Tidal perennial aquatic
  - Natural channel
  - Tidal channel
  - Water

Outside the Delineation Study Area

Modeled foraging habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical

Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers:

- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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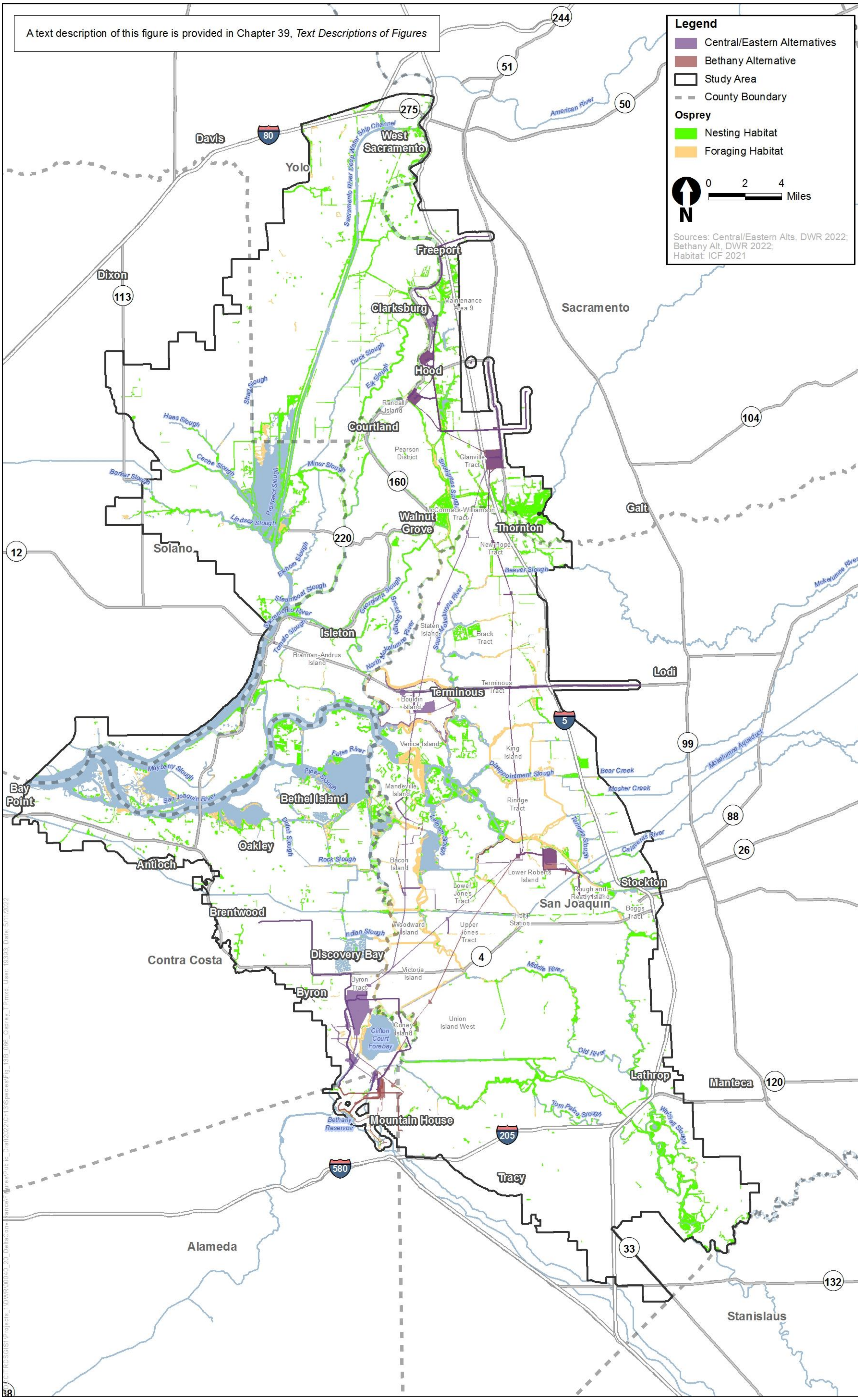

Figure 13B.67-1. Osprey Modeled Habitat in the Study Area

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13B.68 White-Tailed Kite *(Elanus leucurus)*

13B.68.1 Legal Status

White-tailed kite is designated as a fully protected species in California. The white-tailed kite has no federal regulatory status (California Department of Fish and Wildlife 2020a:55).

13B.68.2 Range and Distribution within the Study Area

White-tailed kite is present year-round in California, Oregon, and Washington. Within North America, the white-tailed kite breeding range is concentrated in California (Dunk 2020). The species occupies nearly all areas up to the western Sierra Nevada foothills and southeastern deserts and is a common year-round resident in the Central Valley, other lowland valleys, and along the entire length of the coast (Dunk 2020). Although the white-tailed kite is probably resident through most of its breeding range, dispersal occurs during the nonbreeding season, leading to a winter range expansion that includes most of California (Dunk 2020).

White-tailed kite occurs throughout the study area during the breeding and wintering seasons (eBird 2021). CNDDB reports nine nesting locations within the study area: one in West Sacramento, one east of Courtland, three in the vicinity of Oakley, one on Terminous Tract, one west of Antioch, one northwest of Yolano Road in Solano County, and one in the southwest corner of the study area adjacent to the Delta Mendota Canal (California Department of Fish and Wildlife 2020b). Surveys conducted by DWR from 2009 to 2011 documented 15 additional white-tailed kite nest sites, primarily in the vicinity of Stone Lakes National Wildlife Refuge and White Slough, but also on Empire Tract and on Bradford Island (California Department of Water Resources 2011).

13B.68.3 Habitat Requirements

White-tailed kite inhabits low-elevation grasslands, agricultural areas, wetlands, and oak woodlands (Dunk 2020). White-tailed kites nest in a variety of forested habitats including riparian woodlands, oak woodlands, and oak savannah and typically occupy narrow riparian habitats in addition to roadside trees or tree rows (Estep 2007:3711).

White-tailed kite nests have been documented in a variety of tree species, including valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), willows (*Salix* spp.), interior live oak (*Quercus wislizeni*), box elder (*Acer negundo*), ornamental trees, and occasionally in tall shrubs (Dixon et al. 1957:159; Estep 2007:Table A-2; Estep 2008:Appendix C; Dunk 2020). Nest trees are selected for structure and security, and typically have a dense canopy or are within a dense group of trees, such as riparian forest or oak woodland. Territory size is variable and regulated primarily by prey abundance and vegetation structure (i.e., accessibility of prey; Dunk 2020). During the breeding season, kites generally restrict their foraging territories to an approximately 1 square mile around the nest (Warner and Rudd 1975:227).

White-tailed kites use a variety of foraging habitat types, but those that support larger and more accessible prey populations are more suitable. The presence and abundance of white-tailed kites is strongly correlated with the presence of meadow voles (Hawbecker 1940:110; Dixon et al. 1957:158; Niemela 2007:39). As a result, population cycles of meadow voles can also influence nesting and wintering abundance of white-tailed kites. Preferred foraging habitat includes alfalfa and other hay crops, irrigated pastures, and some cultivated habitats, particularly sugar beets and tomatoes, both of which can support relatively large populations of voles (Estep 1989:18) and which have been highly correlated with the density of white-tailed kite nest sites (Erichsen et al. 1995:5). The species also forages in dry pastures, annual grasslands, rice stubble fields, and occasionally in orchards (Erichsen 1995:25).

White-tailed kites roost communally during the winter, sometimes in concentrations of hundreds of birds. This roosting behavior usually occurs in large trees, but sometimes occurs in other upland habitats (Polite 2005).

13B.68.4 Seasonal Patterns

The breeding season is from approximately February to October, with peak activity from May through August (Polite 2005). Females typically incubate eggs for approximately 28 days and young fledge in approximately 25 to 40 days (Polite 2005). Although apparently a resident bird throughout most of its breeding range, dispersal occurs during the nonbreeding season, resulting in some range expansion during the winter. While population changes and local and regional movements appear to be somewhat predictable based on vole and other rodent cycles (Dunk and Cooper 1994:593), it remains unknown whether in northern California this constitutes a migration movement or nomadic response to changes in the prey populations (Dunk 2020).

13B.68.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.68.5.1 GIS Model Data Sources

The white-tailed kite model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc.

2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)

- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.68.5.2 Habitat Model Description

The white-tailed kite model consists of nesting habitat and foraging habitat. Modeled nesting habitat on the valley floor includes all riparian forest and some willow scrub habitats regardless of width or density. Therefore, the model may overestimate the extent of suitable riparian nesting habitat. On the valley floor, kites also nest in isolated trees along irrigation canals, windbreaks and other tree rows, roadside trees, and in trees around rural residences (Erichsen 1995:25–29, 31). Because these habitats are often below the minimum mapping unit, nonriparian nesting habitat may be underrepresented here. Although the model focuses on riparian habitats, impact assessments include all potential nesting habitat types and all suitable habitat would be surveyed prior to project construction. White-tailed kites also roost in these habitats during winter.

Modeled foraging habitat consists of the natural community and agricultural types listed below. Landcover types are considered available year-round; however, flooded seasonal wetlands receive less use during periods of inundation. Pasture types are mostly perennial; alfalfa is semi-perennial (3 to 7 years); and all other types are annually or seasonally rotated irrigated crops, only some of which provide suitable foraging habitat for white-tailed kite. Therefore, the model may overestimate the extent of suitable foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.68-1.

13B.68.5.2.1 Geographic Limits

The model maps the distribution of suitable white-tailed kite nesting and foraging habitat throughout the study area, which overlaps with the year-round range for the species (Hunting 2004).

13B.68.5.2.2 Additional Model Parameters

Nesting Habitat

Modeled nesting habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
    - *Acer negundo*
    - *Alnus rhombifolia*
    - Californian broadleaf forest and woodland
    - *Eucalyptus* spp.—*Ailanthus altissima*—*Robinia pseudoacacia*
    - *Fraxinus latifolia*

- Introduced North American Mediterranean woodland and forest
- *Juglans hindsii* and hybrids
- *Platanus racemosa*
- *Populus fremontii*
- *Quercus agrifolia*
- *Quercus lobata*
- *Quercus wislizeni* (tree)
- *Salix exigua*
- *Salix gooddingii*
- *Salix laevigata*
- *Salix lasiolepis*
- *Salix lucida*
- Southwestern North American riparian evergreen and deciduous woodland
- Vancouverian riparian deciduous forest

Modeled nesting habitat also includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layer.

- Valley/foothill riparian
  - Forested wetland
  - Shrub scrub wetland

Foraging Habitat

Modeled foraging habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types

- Vernal pool complex
  - All types
- Nontidal brackish emergent wetland
  - *Atriplex lentiformis*
  - *Atriplex prostrata—Cotula coronopifolia*
  - Barren
  - Californian mixed annual/perennial freshwater vernal pool/swale bottomland
  - *Cynodon dactylon*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - *Sarcocornia pacifica (Salicornia depressa)*
  - Southwestern North American salt basin and high marsh group
  - Temperate Pacific tidal salt and brackish meadow
  - Western North American disturbed alkaline marsh and meadow
- Nontidal freshwater perennial emergent wetland
  - Californian warm temperate marsh/seep
  - *Cynodon dactylon*
  - Freshwater emergent wetland
  - *Lepidium latifolium*
  - *Polygonum lapathifolium—Xanthium strumarium*
  - Southwestern North American alkaline marsh/seep vegetation
- Other seasonal wetland
  - All types
- Tidal brackish emergent wetland
  - Arid West freshwater emergent marsh
  - *Atriplex lentiformis*
  - *Cynodon dactylon*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Lepidium latifolium*
  - *Mesembryanthemum* spp.—*Carpobrotus spp.*

- Naturalized warm-temperate riparian and wetland group
- *Sarcocornia pacifica (Salicornia depressa)*
- Southwestern North American salt basin and high marsh group
- Temperate Pacific tidal salt and brackish meadow

- Tidal freshwater emergent wetland
  - *Carex barbarae*
  - *Cynodon dactylon*
  - Freshwater emergent wetland
  - *Juncus arcticus* (var. *balticus, mexicanus*)
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - Tidal freshwater emergent wetland

Modeled foraging habitat also includes the following agricultural landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County land use survey layers (Land IQ 2019; California Department of Water Resources 2016, 2020b).

- Alfalfa and alfalfa mixtures
- Beans (dry)
- Corn, sorghum, and sudan
- Fallow
- Miscellaneous field crops
- Miscellaneous grain and hay
- Miscellaneous grasses
- Miscellaneous truck crops
- Mixed pasture
- Onions and garlic
- Peppers
- Safflower
- Seasonal wetland
- Sunflowers
- Tomatoes
- Unclassified fallow
- Upland herbaceous
- Wheat

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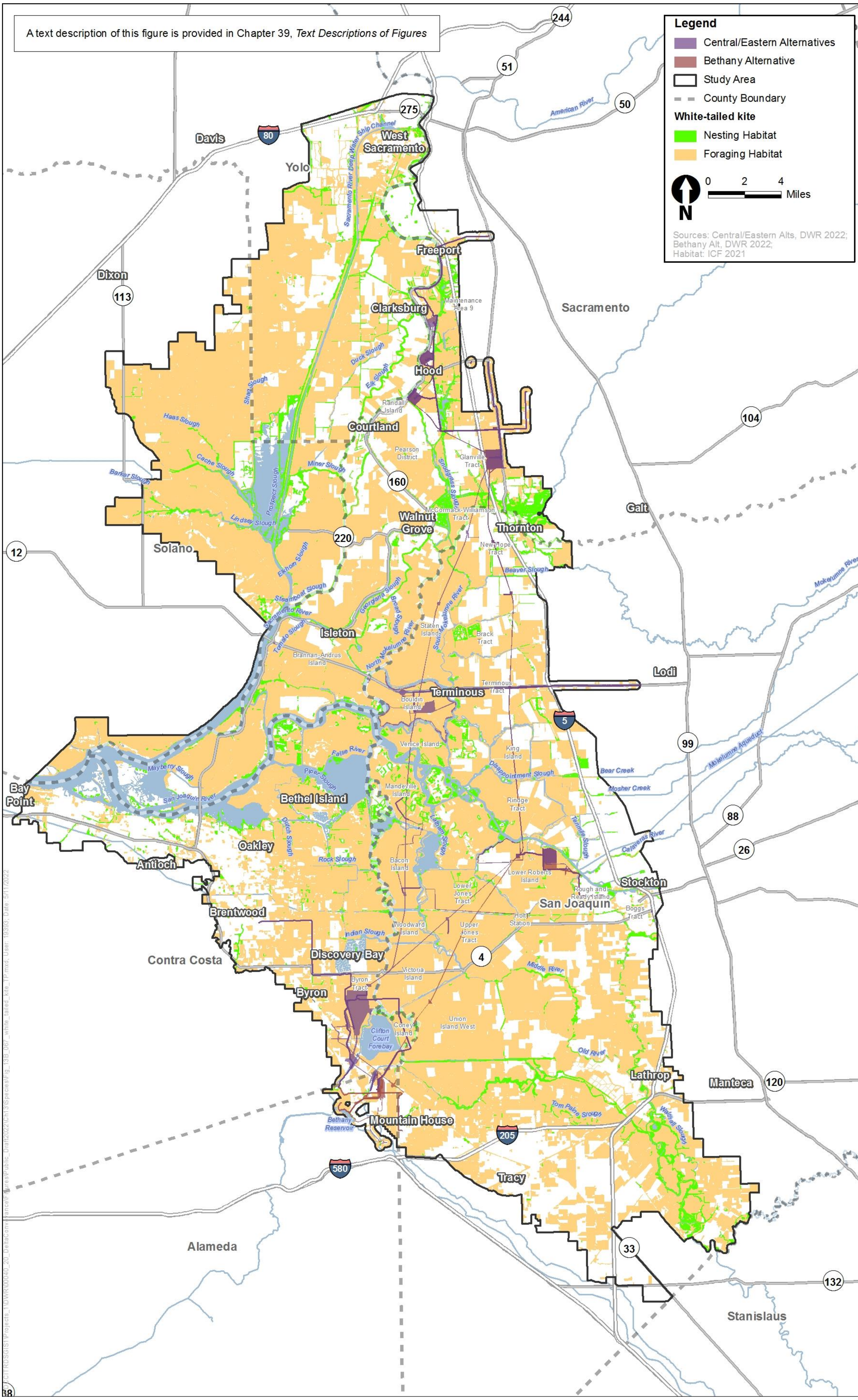

Figure 13B.68-1. White-Tailed Kite Modeled Habitat in the Study Area

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13B.69 Golden Eagle (*Aquila chrysaetos*)

13B.69.1 Legal Status

Golden eagle is included on the CDFW Watch List and is a CDFW Fully Protected Species. Golden eagle is also a USFWS Bird of Conservation Concern (California Department of Fish and Wildlife 2020a:54).

13B.69.2 Range and Distribution within the Study Area

Golden eagle has a year-round range up to 11,500 feet (3822 m) throughout California, except the center of the Central Valley, where it occurs only in winter (Polite and Pratt 2008; Hunting 2004).

Suitable foraging habitat is distributed throughout the study area, although there are few recorded observations of golden eagle in the Delta (eBird 2021). There are no CNDDB records of nesting golden eagles in the study area (California Department of Fish and Wildlife 2020b). However, known nest sites and breeding territories have been surveyed by USGS and are primarily concentrated in the southwestern portion of the study area in Contra Costa and Alameda Counties (Wiens pers comm.).

13B.69.3 Habitat Requirements

Golden eagles nest on cliffs and in large trees, most frequently in open habitats with canyons and escarpments (Polite and Pratt 2008). Cliff nest substrates may be composed of various rock types, but loosely cemented materials are typically avoided. A wide variety of trees may also be used, and live trees are used more frequently than dead ones (Kochert et al. 2020).

Golden eagles feed primarily on lagomorphs and rodents in open grasslands, deserts, savannahs, and early successional stages of forest and shrub habitats (Polite and Pratt 2008). The species often occurs near mountains and rolling hills where they can hunt from soaring or low contoured flight (Kochert et al. 2020).

13B.69.4 Seasonal Patterns

Golden eagles are found year-round in California, although some may move downslope for winter, or upslope after the breeding season. Some golden eagles migrate into California for winter. Golden eagles breed from late January through August, with a peak in March through July. Egg laying occurs from early February to mid-May (Polite and Pratt 2008).

13B.69.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.69.5.1 GIS Model Data Sources

The golden eagle model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.69.5.2 Habitat Model Description

The habitat model for golden eagle consists of foraging habitat. Modeled golden eagle foraging habitat includes grassland, seasonal wetlands (including alkaline seasonal wetland and vernal pool complex), and agricultural lands of similar structure, regardless of size. Isolated, narrow, patches of modeled habitat, especially those surrounded by urban landcover or water, are unlikely to be suitable for the species; therefore, the model likely overestimates foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.69-1.

A habitat model was not developed for suitable nesting habitat (e.g., cliffs, large trees) because the species has been well studied in the region and traditional nest sites and breeding territories have been identified in the southwest portion of the study area (Wiens pers. Comm.) These nest sites and breeding territories will be used to analyze potential impacts on breeding golden eagles.

13B.69.5.2.1 Geographic Limits

Golden eagle winter foraging habitat is modeled throughout the entire study area, which overlaps with the winter range for the species (Hunting 2004). Known nest sites and breeding territories recorded by USGS occur in the southwestern portion of the study area.

13B.69.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information

Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021):

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetland
  - All types

  Vernal pool complex
  - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers:

- Alfalfa and alfalfa mixtures
- Fallow
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Seasonal wetland
- Unclassified fallow
- Upland herbaceous
- Wheat

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13B.69.6.2 Personal Communications

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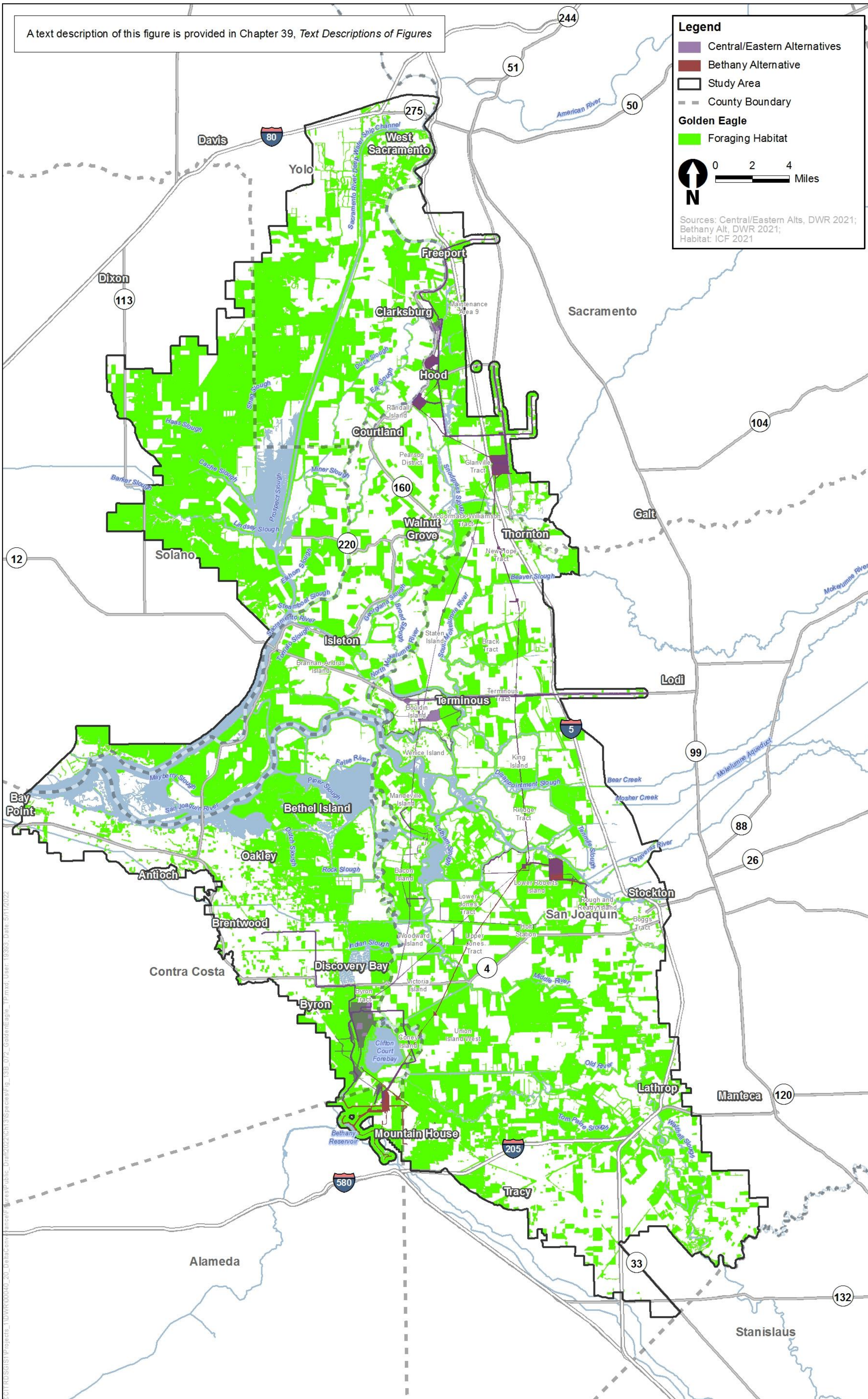

Figure 13B.69-1. Golden Eagle Modeled Habitat in the Study Area

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13B.70 Northern Harrier (*Circus hudsonius*)

13B.70.1 Legal Status

Northern harrier is a California Species of Special Concern (California Department of Fish and Wildlife 2020a:54). The species has no federal regulatory status (California Department of Fish and Wildlife 2020a:54).

13B.70.2 Range and Distribution within the Study Area

The northern harrier is a year-round resident in California and its breeding range covers the northeastern plateau, the northern coast, Central Valley, central coast, and portions of the southern coast and southern deserts. In the non-breeding season, northern harrier can be found in most lowland areas in California when migrants arrive in the state (Davis and Niemela 2008:149, 151–152).

The CNDDB reports one northern harrier nesting location in the study area just southeast of Clifton Court Forebay; two nesting locations are just south of the city of Mountain House; and one northeast of Bethany Reservoir (California Department of Fish and Wildlife 2020b). Surveys conducted from 2009 to 2011 documented 44 active northern harrier nest sites throughout the central Delta and in the vicinity of Clifton Court Forebay (California Department of Water Resources 2011). Northern harrier have been documented year-round throughout the Delta (eBird 2021).

13B.70.3 Habitat Requirements

Breeding and foraging habitat for northern harrier includes treeless habitats with adequate prey, cover, and perches (such as fence posts). Suitable habitat includes freshwater marshes, brackish and saltwater marshes, wet meadows, margins of lakes, rivers, and streams, grasslands, weed fields, croplands, sagebrush flats, and desert sinks (Davis and Niemela 2008:152). Nests are built of sticks or grasses and typically placed on the ground in wet areas of tall, dense vegetation. Tall grasses are also used for cover (Polite 2008; Smith et al. 2020).

Northern harriers forage over open habitats for rodents, passerines, reptiles, and frogs (Smith et al. 2020). California voles (*M. Californicus)* are also an important prey item and are typically found in large numbers in wet habitats (Davis and Niemela 2008:152). The species tends to forage over vegetated, often wet fields more than in grazed or harvested fields (Smith et al. 2020).

13B.70.4 Seasonal Patterns

Northern harrier is a year-round resident in California. The population in California increases in the nonbreeding season as northern harriers from farther north migrate to southern lowlands for winter (Davis and Niemela 2008:150). Breeding occurs from April to September, with peak in June through July (Polite 2008).

13B.70.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.70.5.1 GIS Model Data Sources

The northern harrier model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.70.5.2 Habitat Model Description

The habitat model for northern harrier consists of nesting and foraging habitat. Modeled habitat includes grassland, seasonal wetlands (including alkaline seasonal wetland and vernal pool complex) agricultural lands, and emergent wetlands. The model may overestimate suitable habitat because land cover types were included regardless of patch size, structure, or density. The modeled habitat relies on both delineation data that were collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in datasets from outside the delineation study area. The extent of modeled habitat in the study area is depicted in Figure 13B.70-1.

13B.70.5.2.1 Geographic Limits

Northern harrier nesting and foraging habitat is modeled throughout the entire study area, which overlaps with the year-round range of the species (Niemela 2008).

13B.70.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled nesting and foraging habitat includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Nontidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
- Other seasonal wetlands
  - All types
- Tidal freshwater emergent wetland
  - Freshwater emergent wetland

Modeled nesting and foraging habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018), and the DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Alkaline seasonal wetland complex
  - All types
- Grassland
  - All types
- Vernal pool complex
  - All types

Modeled nesting and foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Fallow
- Melons, squash, and cucumbers
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture

- Rice
- Seasonal wetland
- Tomatoes
- Unclassified fallow
- Upland herbaceous
- Wheat
- Wild rice

Outside the Delineation Study Area

Modeled nesting and foraging habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018), and the DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021):

- Alkaline seasonal wetland complex
  - All types
- Grassland
  - All types
- Nontidal brackish emergent wetland
  - All types
- Nontidal freshwater perennial emergent wetland
  - All types
- Tidal brackish emergent wetland
  - All types
- Tidal freshwater emergent wetland
  - All types
- Vernal pool complex
  - All types

Modeled nesting and foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Fallow

- Melons, squash, and cucumbers
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Rice
- Seasonal wetland
- Tomatoes
- Unclassified fallow
- Upland herbaceous
- Wheat
- Wild rice

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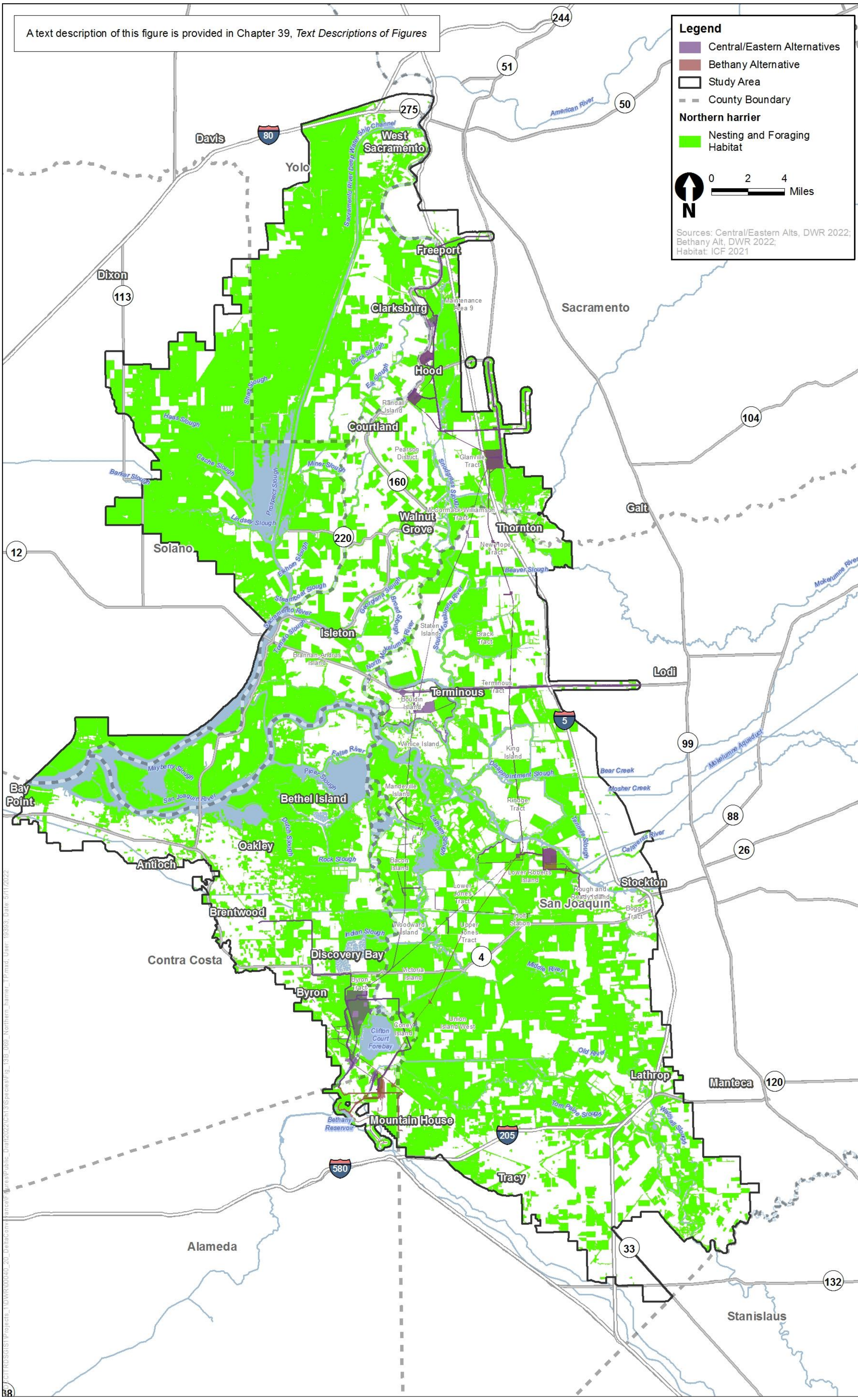

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2 **Figure 13B.70-1. Northern Harrier Modeled Habitat in the Study Area**

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13B.71 Cooper's Hawk (*Accipiter cooperii*)

13B.71.1 Legal Status

Cooper's hawk is included on CDFW's Watch List (California Department of Fish and Wildlife 2020a:54). The species has no federal regulatory status (California Department of Fish and Wildlife 2020a:54).

13B.71.2 Range and Distribution within the Study Area

In California, the year-round range of the Cooper's hawk includes most of the wooded portions of the state (Polite 2008) and overlaps with the entire study area (Hunting 2004). Breeding occurs in the southern Sierra Nevada foothills, New York Mountains, Owens Valley, and southern California, below 9000 feet (Polite 2008).

The Cooper's hawk occurs throughout the study area during the breeding and wintering seasons. There are no CNDDB records of Cooper's hawk (California Department of Fish and Wildlife 2020b), and surveys conducted by DWR from 2009 to 2011 documented one active Cooper's hawk nest along the Sacramento River on Brannan Island (California Department of Water Resources 2011). However, Cooper's hawks have been documented year-round throughout the study area (eBird 2021). Most nesting habitat for Cooper's hawk in the study area consists of riparian trees along large and small drainages and isolated non-riparian trees (Figure 13B.71-1).

13B.71.3 Habitat Requirements

Suitable habitat for Cooper's hawk includes deciduous, mixed, and coniferous forests, and riparian habitat. Cooper's hawk nests in various tree species in dense stands, occasionally nesting in isolated trees in more open habitat. The species will also nest in suburban and urban areas. Nests are typically placed 26 to 49 feet above the ground in trees with 64–95% canopy closure (Rosenfield et al. 2020) and are usually near streams (Polite 2008).

Cooper's hawk hunts in patchy woodland and habitat edges, mainly for passerines and small mammals. The species has been known to drown prey, and foraging usually occurs near water or riparian vegetation (Polite 2008).

13B.71.4 Seasonal Patterns

Cooper's hawk is a year-round resident in California; however, individuals will move downslope and south after the breeding season and return in spring. The species population increases in the nonbreeding season as Cooper's hawk from farther north migrate into California. Breeding occurs from March through August, peaking in May through July (Polite 2008).

13B.71.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.71.5.1 GIS Model Data Sources

The Cooper's Hawk nesting habitat model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.71.5.2 Habitat Model Description

The Cooper's hawk model consists of nesting habitat that includes the valley foothill riparian vegetation types listed below. The model does not distinguish habitat value according to overstory composition, tree density, structure, or patch size. Therefore, it may overestimate the extent of suitable riparian nesting habitat. However, Cooper's hawk also nest in a variety of other native and nonnative trees including roadside trees, windbreaks, oak groves, isolated trees, and trees around rural residences. These nesting habitat types are not sufficiently captured by this model primarily due to the small mapping units that would be required, and thus potential nonriparian nesting habitat is underestimated by the model. Although the model focuses on riparian habitats, impact assessments include all potential nesting habitat types. The extent of modeled nesting habitat in the study area is depicted in Figure 13B.71-1. Foraging habitat is not modeled but impacts on foraging habitat are described in the impact analysis

13B.71.5.2.1 Geographic Limits

The year-round range of Cooper's hawk overlaps with the entire study area (Hunting 2004).

13B.71.5.2.2 Additional Model Parameters

Modeled nesting habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
  - *Acer negundo*
  - *Ailanthus altissima*
  - *Alnus rhombifolia*
  - Californian broadleaf forest and woodland
  - *Eucalyptus* spp.—*Ailanthus altissima*—*Robinia pseudoacacia*

- *Fraxinus latifolia*
- Introduced North American Mediterranean woodland and forest
- *Juglans hindsii* and hybrids
- *Platanus racemosa*
- *Populus fremontii*
- *Quercus agrifolia*
- *Quercus lobata*
- *Quercus wislizeni* (tree)
- *Robinia pseudoacacia*
- *Salix exigua*
- *Salix gooddingii*
- *Salix laevigata*
- *Salix lasiolepis*
- *Salix lucida*
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian evergreen and deciduous woodland
- Southwestern North American riparian/wash scrub
- Vancouverian riparian deciduous forest

Modeled nesting habitat also includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer.

- Valley/foothill riparian
  - Forested wetland
  - Shrub scrub wetland

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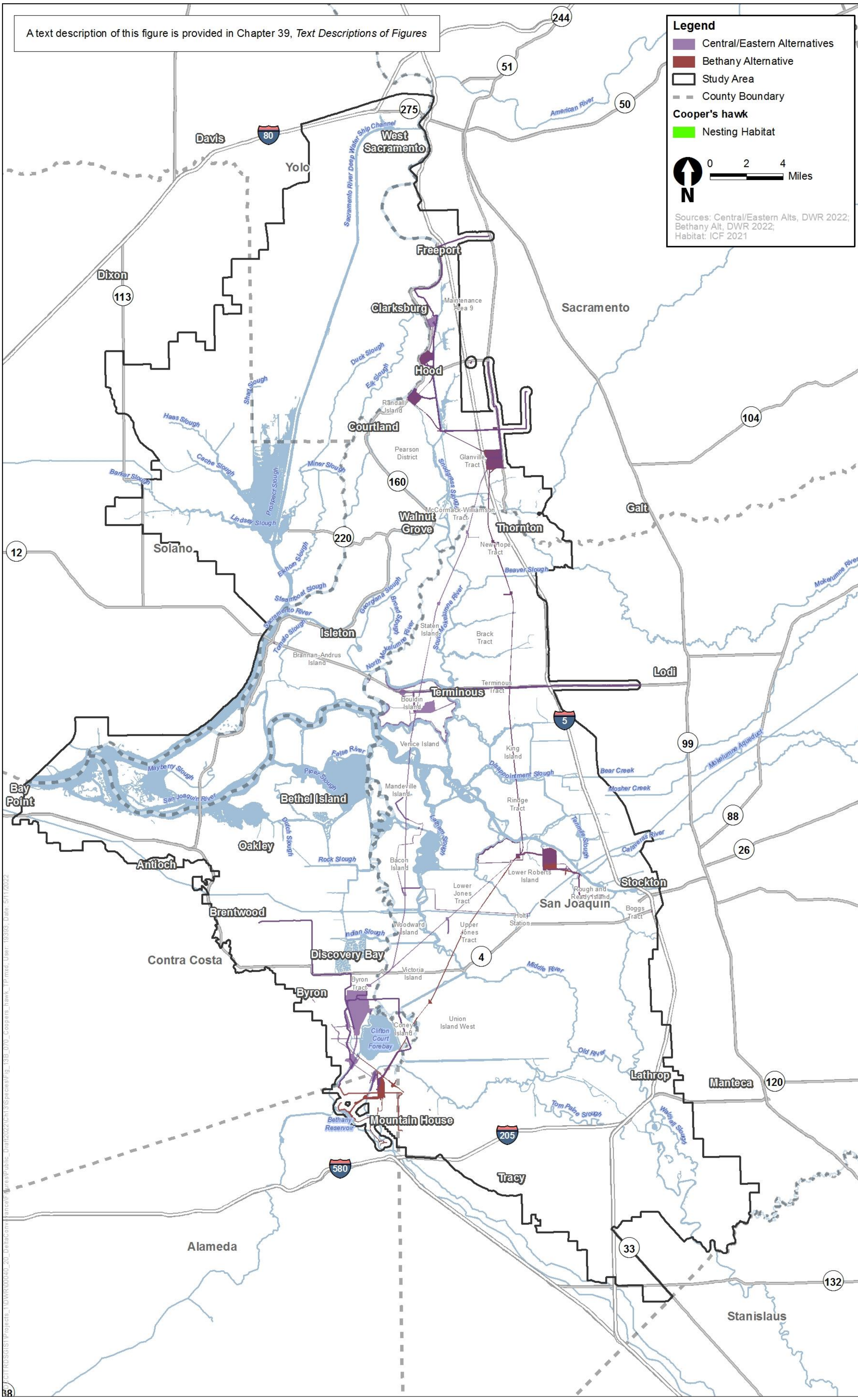

Figure 13B.71-1. Cooper's Hawk Modeled Habitat in the Study Area

13B.72 Swainson's Hawk (*Buteo swainsoni*)

13B.72.1 Legal Status

The Swainson's hawk is listed as a threatened species under the CESA (California Department of Fish and Wildlife 2020a:54). The Swainson's hawk has no federal regulatory status; however, the species is included on the USFWS list of Birds of Conservation Concern (California Department of Fish and Wildlife 2020a:54).

13B.72.2 Range and Distribution within the Study Area

Swainson's hawk nests in the grassland plains and agricultural regions of western North America from southern Canada (and possibly in the northern provinces and territories and Alaska) to northern Mexico (California Department of Fish and Wildlife 2016:5). Other than a few documented small wintering populations in the United States (Herzog 1996:876–878; Bechard et al. 2020), most populations in the species winter primarily in the pampas of Argentina. The Central Valley population, however, winters mainly between Mexico and central South America (Airola et al. 2019:237).

The 2007 statewide population estimate for California was 2,081 breeding pairs (Anderson et al. 2007:2). Nearly 95% of Swainson's hawks in California are found in the Central Valley (Anderson et al. 2007:3). Over 75% of the statewide population occurs within Yolo, Sacramento, Solano, and San Joaquin Counties (Anderson et al. 2007:4).

There are numerous (greater than 400) nesting records for Swainson's hawk throughout the study area where riparian and isolated trees are present (California Department of Fish and Wildlife 2020b).

13B.72.3 Habitat Requirements

In the Central Valley, nests are constructed in riparian woodlands, isolated trees, trees along roadsides, bordering fields, along the edges of remnant oak woodlands, and in small groves (Estep 2008:4-5). The majority of known nests in the Central Valley occur along narrow stringers of remnant riparian forest (Estep 2008:4-5; Estep 1984:20–21; Schlorff and Bloom 1984:827, 832; Bechard et al. 2020). Nests are usually constructed as high as possible in the tree, which provides good visibility and nest protection (Estep 2008:4-5). Swainson's hawks most commonly nest in large native trees such as valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), Hinds' walnut (*Juglans hindsii*), and willows (*Salix* spp.), and in nonnative trees, such as eucalyptus (*Eucalyptus* spp.) (Estep 2007:33, 2008:6–15). Nesting pairs will often use the same nesting territories and nesting trees year after year (Estep 2008:4–5). Many nest sites in the Central Valley have been occupied annually since 1979 and banding studies have shown a high degree of both nest and mate fidelity (Estep 2008:4–5).

Swainson's hawk historically foraged in open grasslands and prairies; however, with substantial conversion of grasslands for farming practices, Swainson's hawks have shifted their foraging to include agricultural lands that provide large rodent prey populations amid low, open vegetation (California Department of Fish and Wildlife 2016:5, 7). Foraging habitat value is a function of patch size, the ability to access prey (vegetation cover), and prey abundance (Estep 2008:4–7, 2009:2). In the Central Valley, land use or specific crop type and management practices determine the foraging value of a field at any given time. Important land cover or agricultural crops for foraging are alfalfa and other hay, disked fields, fallow fields, dryland pasture, and perennial grassland (Estep 1989:33; Babcock 1995:197; Woodbridge 1998:9–10). Central Valley Swainson's hawk preys on small mammals, birds, toads, crayfish, and insects. The primary prey species during the breeding season are California voles (*Microtus* spp.), pocket gophers (*Thomomys bottae*), and deer mice (*Peromyscus maniculatus*) (Estep 1989:19–20).

Home ranges are highly variable depending on landcover type, and fluctuate throughout the breeding season with changes in vegetation structure from growth and harvesting of crops, and annually from crop rotation (Estep 1989:24; Woodbridge 1991:40–41; Babcock 1995:196). High-value crop types such as alfalfa, fallow fields, and pastures allow for smaller home ranges, whereas larger home ranges are associated with landcover with reduced prey availability, such as vineyards and orchards, or reduced prey abundance such as flooded fields (Estep 1989:30; Woodbridge 1991:40–41; Babcock 1995:197). Although Swainson's hawk have been recorded foraging up to 18 miles from a nest site, traveling more than 3 to 5 miles from a nest site to find high-value foraging sites may reduce reproductive success (Estep 1989:23, 40, 2008:4-8; England et al. 1995:185).

Swainson's hawks are highly responsive to farming and management activities that expose and concentrate prey, such as cultivating, harvesting, and disking (Estep 1989:23). During these activities, particularly late in the season, Swainson's hawks will hunt behind tractors searching for exposed prey (California Department of Fish and Game 1994:6; Estep 1989:23). Other activities, such as flood irrigation, also expose prey and attract foraging Swainson's hawks (Estep 1989:23).

13B.72.4 Seasonal Patterns

Swainson's hawks arrive on their breeding grounds in the Central Valley between March and April and begin nest-building and egg-laying shortly after arrival (California Department of Fish and Wildlife 2016:5–6). Incubation of eggs lasts approximately 35 days and most young fledge approximately 6 weeks after hatching (typically by early July; California Department of Fish and Wildlife 2016:5–6). Post-breeding foraging flocks of up to 100 birds, often congregate on recently mowed or disked fields such as alfalfa or other row crops (California Department of Fish and Wildlife 2016:9) Migration back to the wintering grounds begins mid-August and most individuals leave California by October (California Department of Fish and Wildlife 2016:5–6).

13B.72.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.72.5.1 GIS Model Data Sources

The Swainson's hawk model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.72.5.2 Habitat Model Description

As described in Section 13B.72.3, Habitat Requirements, Swainson's hawk nesting habitat includes valley/foothill riparian vegetation types with valley oak and/or cottonwood-dominated riparian forests considered optimal nesting habitat for this species. Swainson's hawks also nest in a variety of other native and nonnative isolated trees (e.g., Oregon ash (*Fraxinus latifolia*), box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), and *Eucalyptus* spp.) such as those on roadsides, in windbreaks, and around rural residences. Individual or small clumps of isolated trees are not mapped in the Delta and therefore this type of nesting habitat is not captured by the model. This underestimation of non-riparian habitat in the model is offset by the overestimation of potential riparian habitat. Riparian habitats are overestimated because not all riparian habitat is suitable for Swainson's hawk nesting, but all riparian habitat is considered suitable in the model.

Foraging habitat is also described in Section 13B.72.3, and includes grasslands, managed and natural seasonal wetland types, and agricultural types such as irrigated pastures and hays and seasonally rotated croplands. The grain and hay, field, truck, nursery and berry crop types listed below are seasonally rotated and, therefore, the value of individual fields for foraging changes each year. These crop types are not differentiated based on their seasonal value in the model and are instead combined into a category of seasonally rotated croplands. As a result, this model overestimates the extent of available agricultural foraging habitat in any given year as suitable, seasonally rotated crops are exchanged with non-suitable crop types. To maintain consistency with CDFW guidance (California Department of Fish and Game 1994:12–13), a minimum foraging patch size of 5 acres is used. The extent of modeled habitat in the study area is depicted in Figure 13B.72-1.

13B.72.5.2.1 Geographic Limits

This model maps the distribution of suitable Swainson's hawk nesting and foraging habitat throughout the study area, which overlaps with the year-round range for the species (Battistone 2011).

13B.72.5.2.2 Additional Model Parameters

Nesting

Modeled nesting habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Valley/foothill riparian
    - *Alnus rhombifolia*
    - *Fraxinus latifolia*
    - *Acer negundo*
    - *Juglans hindsii* and hybrids
    - *Populus fremontii*
    - *Salix gooddingii*
    - *Quercus agrifolia*
    - *Quercus wislizeni* (tree)
    - *Quercus lobata*
    - Southwestern North American riparian evergreen and deciduous woodland
    - California broadleaf forest and woodland
    - Vancouverian riparian deciduous forest
    - *Eucalyptus* spp.—*Ailanthus altissima–Robinia pseudoacacia*
    - Introduced North American Mediterranean woodland and forest
    - *Salix exigua*
    - *Salix laevigata*
    - *Salix lasiolepis*
    - *Platanus acemose* alliance

Modeled nesting habitat also includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Forested wetland

Foraging

Modeled foraging habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical

Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers with a patch size of at least 5 acres (California Department of Fish and Game 1994 12–13).

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetland
  - All types
- Vernal pool complex
  - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County, Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers with a patch size of at least 5 acres (California Department of Fish and Game 1994 12–13).

- Agricultural
  - Wheat
  - Miscellaneous grain and hay
  - Safflower
  - Miscellaneous field crops
  - Corn, sorghum, and sudan
  - Beans (dry)
  - Sunflowers
  - Alfalfa and alfalfa mixtures
  - Miscellaneous grasses
  - Mixed pasture
  - Miscellaneous truck crops
  - Young perennials
  - Carrots
  - Cole crops
  - Melons, squash, and cucumbers
  - Onions and garlic

- Bush berries
- Strawberries
- Tomatoes
- Peppers
- Fallow
- Unclassified fallow
- Upland herbaceous

13B.72.5.3 Habitat Value Categories

Most of the Delta consists of agricultural land and most is considered to have some value as foraging habitat for Swainson's hawk. However, the value of crop types differs widely due to their growth and structure, which influences accessibility by foraging hawks, and in prey abundance, which influences the availability of prey. Because of the dynamic nature of the agricultural landscape and the variability of crop patterns and conditions seasonally and annually, only a proportion of the agricultural landscape is suitable or available for foraging in any given season or year.

Sufficient information is available on the growth and structure of different agricultural crops and the prey abundance and use of different crop types to generally categorize crops based on their value as foraging habitat. Table 13B.72-1 categorizes modeled land cover types according to three relative value classes: high, medium, and low. These value classes correspond to the mitigation requirement for the Swainson's hawk with regard to sustaining maintaining medium to high-value types on protected mitigation lands.

Table 13B.72-1. Swainson's Hawk Foraging Habitat Value Classes

Habitat Value Class	Habitat	Rationale for Assignment of Value Class	Information Sources
High value	Alfalfa and alfalfa mixtures	Alfalfa has the highest value because it is semiperennial (up to 5 years before rotation), which increases prey abundance; has a relatively low profile such that prey are accessible season-long; and has a management regime (mowing and irrigation) which further increases prey accessibility.	Estep 1989:34–35, 2009:15–17; Swolgaard et al. 2008:191–194
Medium value	Mixed pasture, miscellaneous grasses, upland herbaceous, grasslands, managed wetlands, alkaline seasonal wetlands, vernal pool complex, tomatoes, miscellaneous field crops, wheat, miscellaneous grain and hay	These pasture types provide a relatively consistent vegetation structure and rodent prey populations. There is less seasonal variability with respect to prey abundance and accessibility compared with grain and vegetable crops, but they lack the management practices that enhance prey accessibility found in alfalfa. Certain row crops, such as beets and tomatoes, have a relatively high value because they support large rodent prey populations, are accessible season-long because of their relatively low vegetation profile, and they are harvested prior to migration, when an abundance of prey becomes available. Most grain crops provide value during and following harvesting, when prey become accessible. Grasslands are generally available season-long but	Estep 1989:34–35, 2009:7–38; Swolgaard et al. 2008:191–194

Habitat Value Class	Habitat	Rationale for Assignment of Value Class	Information Sources
		provide lower prey abundance compared with higher value agricultural habitats, don't provide a peak period of high-value abundance and accessibility like some agricultural crops (e.g., tomatoes), and in some cases grass height reduces prey accessibility during a portion of the breeding season.	
Low value	Cole crops, corn, sorghum, and sudan, dry beans, field crops, miscellaneous truck crops/young perennials, miscellaneous truck crops, carrots, melons, squash, cucumbers, onions and garlic, peppers, truck/ nursery/berry crops, miscellaneous field crops, safflower, sunflower	The truck and berry/field crop agriculture types are suitable for a portion of the breeding season depending on their structure and planting/harvesting regime. In general, they produce less prey abundance and less prey availability than the other agriculture types listed above.	Estep 1989:34–35, 2009:7–38; Swolgaard et al. 2008:191–194

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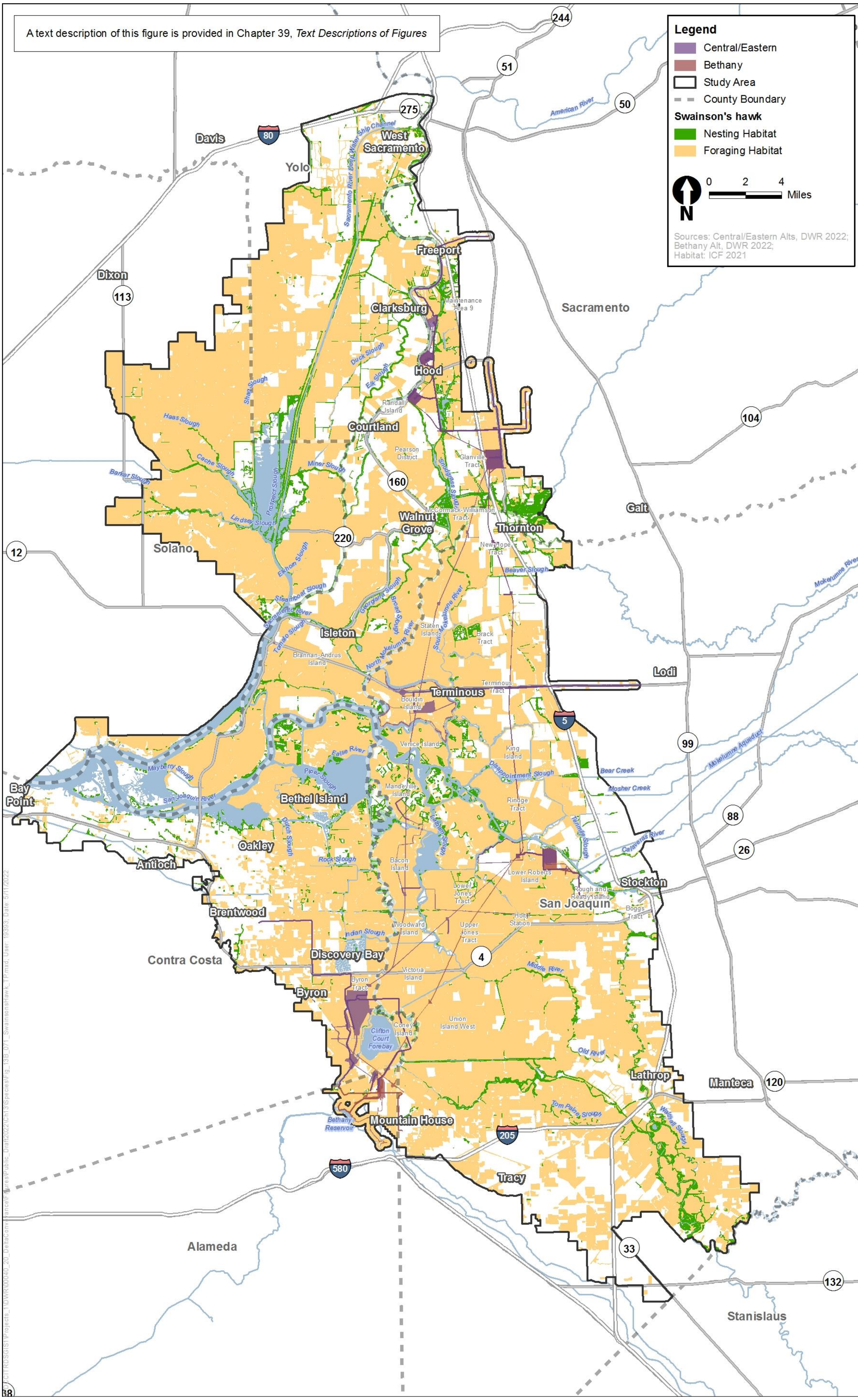

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2 **Figure 13B.72-1. Swainson's Hawk Modeled Habitat in the Study Area**

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13B.73 Ferruginous Hawk (*Buteo regalis*)

13B.73.1 Legal Status

Ferruginous hawk is included on the CDFW Watch List and is one of USFWS's Birds of Conservation Concern (California Department of Fish and Wildlife 2020a:54).

13B.73.2 Range and Distribution within the Study Area

In California, ferruginous hawks winter in low elevations in the Modoc Plateau, Central Valley, Coast Ranges, and southwestern California (Polite and Pratt 2008). Ferruginous hawks have been recorded breeding in northeast California (Ng et al. 2020).

The study area is outside of the nesting range for the species; however, foraging habitat is present throughout the study area, particularly in the southwest portion where there are large patches of grassland and pasture. Ferruginous hawks have been observed during winter months throughout the Delta (eBird 2021). The CNDDB reports two occurrences of ferruginous hawk foraging within the study area: one just northwest of the Sacramento Regional Wastewater Treatment Plant and one in the southwest portion of the study area just north of Bethany Reservoir (California Department of Fish and Wildlife 2020b).

13B.73.3 Habitat Requirements

Nesting does not occur in the study area; however, foraging habitat is present. Suitable habitat for ferruginous hawk includes open grassland (and crop types of similar structure such as pasture and alfalfa), sagebrush flats, desert scrub, low foothills, and fringes of pinyon-juniper habitats. Ferruginous hawks primarily feed on lagomorphs, ground squirrels, and mice, hunting from perches or low flight (Polite and Pratt 2008). In California, foraging takes place primarily in open grassland and arid areas, where prey is abundant. Roosting occurs on cliffs, haystacks, utility structures, on the ground, or in trees (Ng et al. 2020).

13B.73.4 Seasonal Patterns

Ferruginous hawks are migratory and winter in California, generally from September to April. Breeding occurs from Oregon into Canada, with egg laying beginning in April (Polite and Pratt 2008).

13B.73.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.73.5.1 GIS Model Data Sources

The ferruginous hawk model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.73.5.2 Habitat Model Description

The ferruginous hawk model consists of winter foraging habitat, because the species does not nest in the study area. Foraging habitat includes grassland, seasonal wetlands (including alkaline seasonal wetland and vernal pool complex), and agricultural lands of similar structure, regardless of size. Isolated, narrow patches of modeled habitat, especially those surrounded by urban landcover or water, are unlikely to be suitable for the species; therefore, the model likely overestimates winter foraging habitat for the species. The extent of modeled habitat in the study area is depicted in Figure 13B.73-1.

13B.73.5.2.1 Geographic Limits

Ferruginous hawk winter foraging habitat is modeled throughout the entire study area, which overlaps with the winter range for the species (Hunting 2004).

13B.73.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) and DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of

Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetland
  - All types
- Vernal pool complex
  - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Fallow
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Seasonal wetland
- Unclassified fallow
- Upland herbaceous
- Wheat

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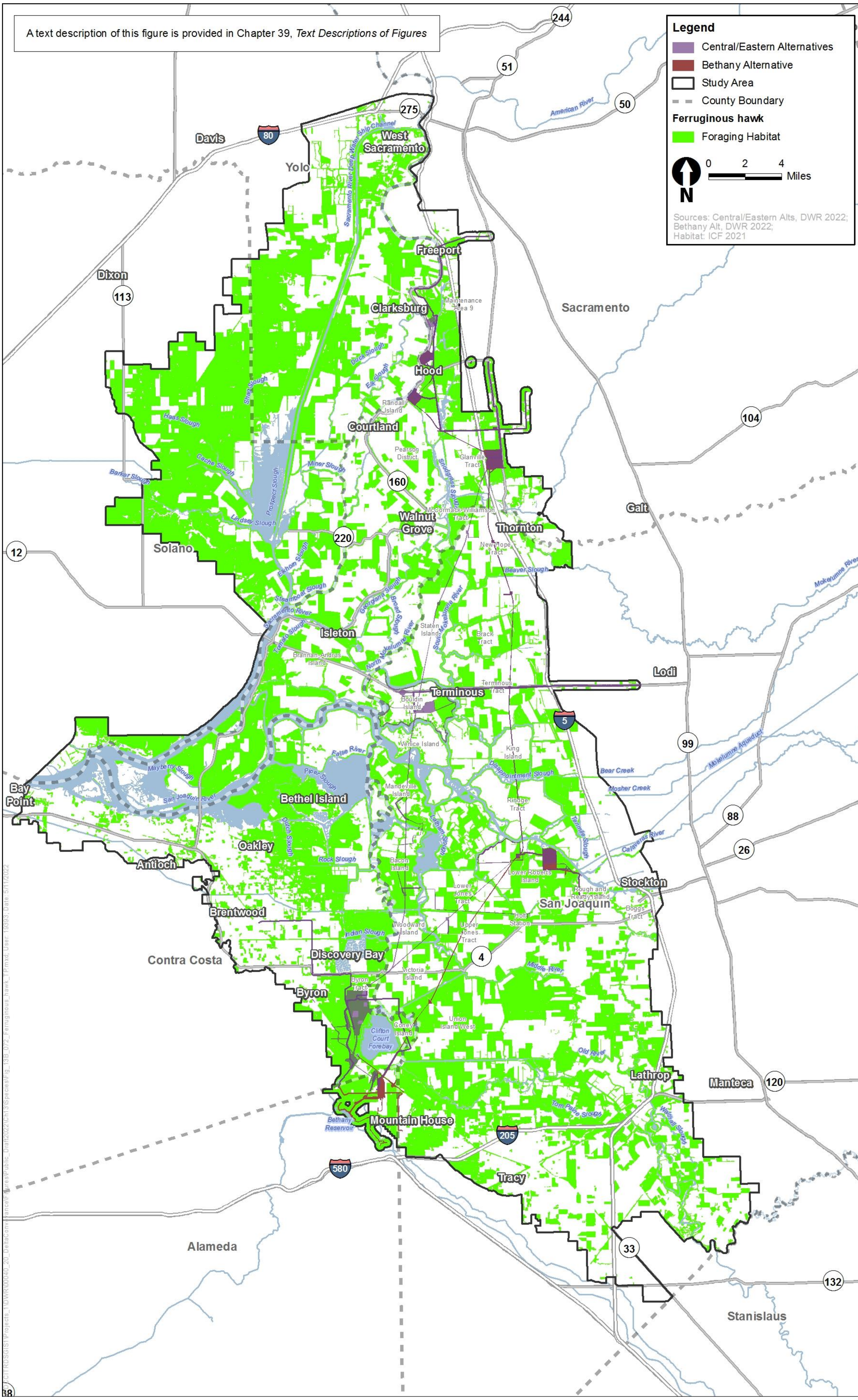

Figure 13B.73-1. Ferruginous Hawk Modeled Habitat in the Study Area

13B.74 Burrowing Owl (*Athene cunicularia*)

13B.74.1 Legal Status

Burrowing owl is designated as a state Bird Species of Special Concern by CDFW (California Department of Fish and Wildlife 2020a:59). Burrowing owl has no federal regulatory status; however, the species is designated as a Bird of Conservation Concern by USFWS (California Department of Fish and Wildlife 2020a:59).

13B.74.2 Range and Distribution within the Study Area

Burrowing owls were once widespread and generally common over western North America. The owl's range has contracted in recent decades, however, and populations have generally diminished throughout the species range (Poulin et al. 2020). In California, burrowing owls are widely distributed in suitable habitat throughout the lowland portions of the state (Gervais et al. 2008:219) and approximately 69% of the statewide burrowing owl population occurs in the agricultural region of the Imperial Valley (Wilkerson and Siegel 2010:9). Burrowing owls appear to be resident year-round throughout much of central and southern California, and migrants from other areas of western North America may also winter in California (Gervais et al. 2008:219; Poulin et al. 2020). Breeding populations in the middle Central Valley occur primarily in lowland areas of Yolo, Solano, Sacramento, Contra Costa, and San Joaquin Counties (Wilkerson and Siegel 2010:9).

Burrowing owl is a year-round resident in the study area (eBird 2021); however, local migratory patterns and the extent to which migrants occupy the study area during the nonbreeding season are unclear. The CNDDB reports 148 occurrences within the study area, primarily concentrated in the higher value grasslands and pasturelands west of the Sacramento Deep Water Ship Channel in Yolo and Solano Counties, and in the grassland habitats along the western edge of the study area, roughly between Brentwood/Antioch and Tracy (California Department of Fish and Wildlife 2020b). Surveys conducted by DWR from 2009 to 2011 documented 34 additional burrowing owl occurrences in the southwest corner of the study area, where the habitat is alkaline grassland-scrub habitat that is heavily disturbed, has extensive patches of bare ground, and has substantial ground squirrel activity (California Department of Water Resources 2011).

13B.74.3 Habitat Requirements

Burrowing owls are found in open, well-drained grasslands, agricultural and range lands, and desert habitats often associated with burrowing animals. They also occupy golf courses, airports, road and levee embankments, and other disturbed sites where there is sufficient friable soil for burrows (Wilkerson and Siegel 2010:29; Gervais et al. 2008:221–222; Poulin et al. 2020). Because burrowing owls typically use the burrows created by other species, particularly the California ground squirrel, presence of these species is usually a key indicator of potential occurrence of owls (Poulin et al. 2020).

In northern California, most reported nest sites occur in abandoned ground squirrel burrows. Other mammal burrows and various burrow surrogates, such as culverts, pipes, rock piles, and artificially constructed burrows are also used (Rosenberg et al. 1998:14). Burrowing owls favor areas with short, sparse vegetation to facilitate detection of predators and hunting (Coulombe 1971:163; Zarn 1974:14; Plumpton and Lutz 1993a:177–178). Typical habitats are treeless, with minimal shrub cover and woody plant encroachment, and have low vertical density of vegetation and low foliage height diversity (Plumpton and Lutz 1993a:176–178; Poulin et al. 2020).

Burrowing owls are tolerant of human-altered open spaces, such as areas surrounding airports, golf courses, and military lands where burrows may be readily adopted (Thomsen 1971:177; Gervais et al. 2008:221; Rosenberg et al. 2009:7). Burrowing owls may use burrows in open areas adjacent to unimproved and improved roads (Brenckle 1936:167; Wilkerson and Siegel 2010:29); a modest volume of vehicle traffic does not appear to significantly affect behaviors or reproductive success (Plumpton and Lutz 1993b:615), but presumably may also be a source of collision-related mortality (Rosenberg et al. 2009:41). As semicolonial raptors, colony size is indicative of habitat value and quantity. Colony size is also positively correlated with annual site reuse by breeding burrowing owls; larger colonies are more likely to persist over time than colonies containing fewer pairs or single nesting pairs (DeSante et al. 1997:45).

Burrowing owls forage in open grasslands, pastures, agricultural fields and field edges, fallow fields, and along the edges of roads and levees. Low vegetation aids in maximizing visibility and access. Short perches such as fence posts are often used to enhance visibility (Poulin et al. 2020). They will defend the immediate vicinity of the nest, and average territory size within which burrowing owls may forage is 450 acres (California Department of Fish and Game 2012:21).

13B.74.4 Seasonal Patterns

The breeding season (defined as starting at pair bonding and lasting to fledging) generally occurs from February to August, with peak activity occurring from April through July (California Department of Fish and Game 2012:20; Poulin et al. 2020). Pairs may be resident at breeding sites throughout the year or disperse out of the area during the nonbreeding season. Burrowing owls have a strong affinity for previously occupied nesting and wintering habitats and often return to burrows used in previous years, especially if they were reproductively successful (DeSante et al. 1997:45).

13B.74.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.74.5.1 GIS Model Data Sources

The burrowing owl model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)

- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.74.5.2 Habitat Model Description

The habitat model for burrowing owl includes both high-value and low-value habitats. Optimal nesting locations for burrowing owls are in an open landscape with level to gently sloping topography, sparse or low grassland or pasture cover, and a high density of burrows (California Department of Fish and Game 2012:20). Burrowing owls occur primarily in grassland habitats where vegetation is low to maximize visibility and access (Gervais et al. 2008:221). Thus, grassland habitats (including upland herbaceous landcover) are ranked as high-value habitat for burrowing owls. Additional high-value habitat includes: (1) pastures that are occasionally manipulated through mowing, disking, irrigation, and other related practices that maintain a relatively constant vegetation structure, and (2) some seasonally wet habitats (vernal pool complex and alkaline seasonal wetland) that consist primarily of annual grassland types likely to support ground squirrels (Haug and Oliphant 1990:31–32, 34; Klute et al. 2003:21). The model likely overestimates high-value habitat because it does not exclude vegetation structure that is unsuitable (e.g., ungrazed grasslands or levee slopes with tall vegetation). Other suitable high-value habitat features such as culverts, piles of concrete rubble, and pipes (Gervais et al. 2008:221) are not identified in the landcover mapping; however, all suitable habitat would be surveyed prior to construction.

Burrowing owls occasionally occur in lower value managed habitats, including seasonal wetlands that are dry during the breeding season and cultivated fields (e.g., irrigated crops) that provide periodic or seasonal foraging value resulting from management activities and changes in vegetation structure. These are mostly managed habitats that support appropriate vegetation structure but that are less likely to support ground squirrel populations (due to ground or vegetation management activities) and thus are less likely to contain burrowing owl burrows (Haug and Oliphant 1990:31–32, 34; Klute et al. 2003:21). Low-value habitat is typically used only for foraging and only when the vegetation structure is suitable for foraging. This model overestimates the extent of available low-value habitat in any given year because suitable, seasonally rotated crops are exchanged with unsuitable crop types, flooding regimes of seasonal wetlands may vary, and because ground squirrel burrows in low-value habitat are likely limited to the edges of fields along berms or fence rows. Low-value habitat also includes agricultural ditches, some of which may provide suitable habitat for the species. The extent of modeled habitat in the study area is depicted in Figure 13B.74-1.

13B.74.5.2.1 Geographic Limits

Burrowing owl habitat is modeled throughout the entire study area which overlaps with the year-round range for the species (Burkett 2008).

13B.74.5.2.2 Additional Model Parameters

High-Value Habitat

Modeled high-value habitat includes the following landcover types from Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Vernal pool complex
  - All types

Modeled high-value habitat also includes the following agricultural landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey layers (Land IQ 2019; California Department of Water Resources 2016, 2020b).

- Miscellaneous grasses
- Mixed pasture
- Upland herbaceous
- Developed
  - Barren

Low-Value Habitat

Because low-value burrowing owl habitat is primarily used for foraging, vegetation types are only included in the model if they occur within a 0.5-mile radius of high-value habitat. This distance is based on an underlying assumption that an owl will forage in all directions from a nest at the edge of high-value habitat and assumes an average territory size of 450 acres (California Department of Fish and Game 2012:21). A circle with an area of 450 acres has a radius of approximately 0.47 mile, which was rounded to 0.5 mile.

Modeled low-value habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Other seasonal wetland
  - All types

Modeled low-value habitat also includes the following agricultural landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey layers (Land IQ 2019; California Department of Water Resources 2016, 2020b).

- Agricultural ditch
- Alfalfa and alfalfa mixtures
- Corn, sorghum, and sudan
- Fallow
- Miscellaneous field crops
- Miscellaneous grain and hay
- Miscellaneous truck crops
- Onions and garlic
- Peppers
- Safflower
- Seasonal wetland
- Sunflowers
- Tomatoes
- Unclassified fallow
- Wheat
- Young perennials
- Developed
  - Semi-agricultural/right of way

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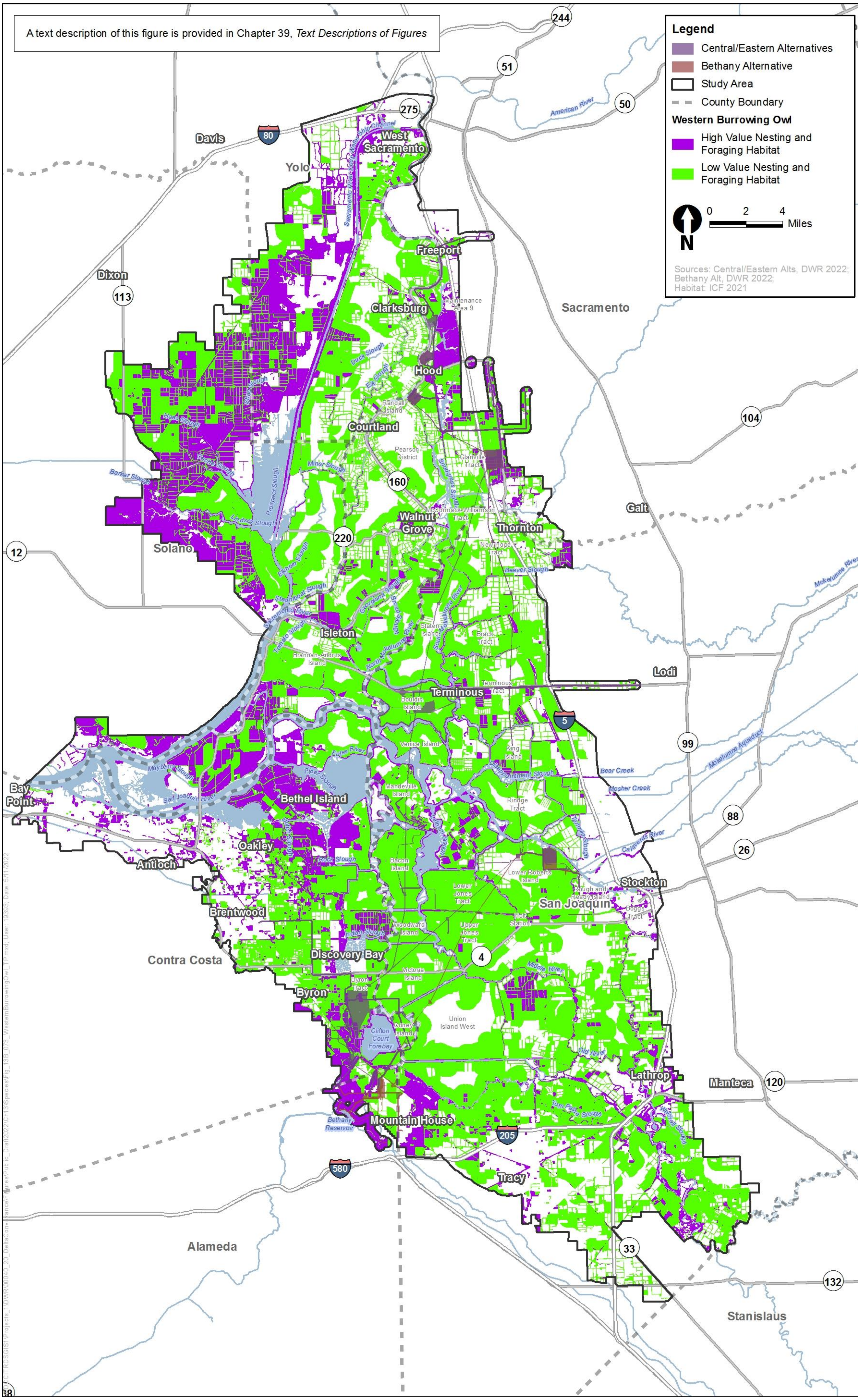

Figure 13B.74-1. Burrowing Owl Modeled Habitat in the Study Area

13B.75 Short-Eared Owl (*Asio flammeus*)

13B.75.1 Legal Status

Short-eared owl is a California Species of Special Concern (California Department of Fish and Wildlife 2020a:59). The species has no federal regulatory status (California Department of Fish and Wildlife 2020a:59).

13B.75.2 Range and Distribution within the Study Area

In California, the short-eared owl occurs either as a yearlong resident or as a winter visitor. The yearlong range is patchily distributed throughout the state, including portions of the Sacramento and San Joaquin Valleys, northeastern California, and a few scattered coastal sites. Breeding in California occurs most regularly in the Suisun Marsh and northeastern California (Roberson 2008:242–245). Winter migrants occur more widely in the Central Valley and along the coast (Polite 2005).

Although suitable nesting and foraging habitat is present throughout the study area, there is a low potential for short-eared owls to nest. There are no CNDDB records of short-eared owl in the study area (California Department of Fish and Wildlife 2020b). Short-eared owls have been documented as late as March through May at Cosumnes River Preserve, Woodbridge Ecological Reserve, Sherman Island, Bethel Island, Trapper Slough, and the Byron Airport Preserve (eBird 2021), and suitable nesting habitat is present at these locations. Short-eared owls are known to winter in the study area and have been documented in the fall and winter months throughout the Delta (eBird 2021).

13B.75.3 Habitat Requirements

Suitable habitat for short-eared owl includes annual and perennial grasslands, prairies, dunes, meadows, irrigated fields, and saline and fresh emergent wetlands. The species is typically found in open areas with few trees, where there are suitable elevated perches as well as dense grass, brush, or wetlands for roosting and nesting. Nests are placed in a depression on dry ground where it can be concealed by vegetation (Polite 2005).

Short-eared owls forage in open areas that support small mammal populations. The species feeds primarily on voles and other small mammals, but may also eat birds, reptiles, amphibians, and arthropods (Polite 2005). Owl abundance may be related to small mammal populations; owls breed more when food availability, particularly California voles, is high (Roberson 2008:245–246).

13B.75.4 Seasonal Patterns

Short-eared owl breeds from March through July, with egg-laying occurring from April to May. Some short-eared owls occur year-round in California; in winter, owls also migrate to California from the north, generally occurring between October and March (Polite 2005; Roberson 2008:243).

13B.75.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.75.5.1 GIS Model Data Sources

The short-eared owl model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographic Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.75.5.2 Habitat Model Description

The habitat model for short-eared owl consists of nesting and foraging habitat. Modeled habitat includes grassland, seasonal wetlands (including alkaline seasonal wetland and vernal pool complex) agricultural lands, and emergent wetlands. The model may overestimate suitable habitat because land cover types were included regardless of patch size, structure, or density, and short-eared owls require open grasslands with short vegetation. The modeled habitat relies on both delineation data that were collected for a smaller portion of the study area in what is called the delineation study area, and suitable habitats found in datasets outside the delineation study area. The extent of modeled habitat in the study area is depicted in Figure 13B.75-1.

13B.75.5.2.1 Geographic Limits

Short-eared owl nesting and foraging habitat is modeled throughout the entire study area, which overlaps with the wintering and year-round range of the species (Hunting 2008).

13B.75.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled nesting and foraging habitat includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Nontidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
- Other seasonal wetlands
  - All types
- Tidal freshwater emergent wetland
  - Freshwater emergent wetland

Modeled nesting and foraging habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographic Information Center 2019), the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018), and the DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Alkaline seasonal wetland complex
  - All types
- Grassland
  - All types
- Vernal pool complex
  - All types

Modeled nesting and foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers:

- Alfalfa and alfalfa mixtures
- Fallow
- Melons, squash, and cucumbers
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture

- Rice
- Seasonal wetland
- Tomatoes
- Unclassified fallow
- Upland herbaceous
- Wheat
- Wild rice

Outside the Delineation Study Area

Modeled nesting and foraging habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographic Information Center 2019), the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018), and the DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Alkaline seasonal wetland complex
  - All types
- Grassland
  - All types
- Nontidal brackish emergent wetland
  - All types
- Nontidal freshwater perennial emergent wetland
  - All types
- Tidal brackish emergent wetland
  - All types
- Tidal freshwater emergent wetland
  - All types
- Vernal pool complex
  - All types

Modeled nesting and foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Fallow

- Melons, squash, and cucumbers
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Rice
- Seasonal wetland
- Tomatoes
- Unclassified fallow
- Upland herbaceous
- Wheat
- Wild rice

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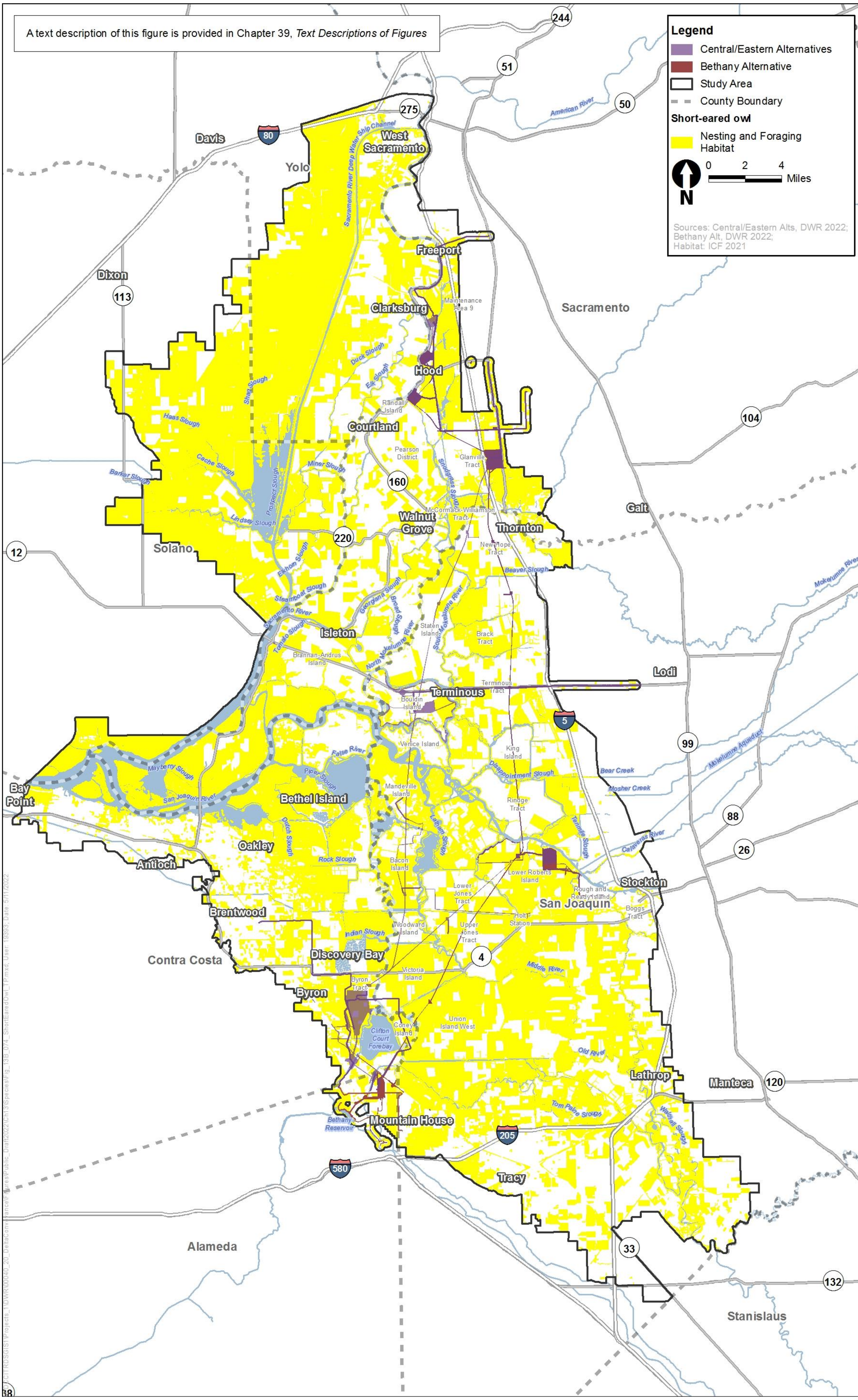

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2 **Figure 13B.75-1. Short-Eared Owl Modeled Habitat in the Study Area**

13B.76 Loggerhead Shrike (*Lanius ludovicianus*)

13B.76.1 Legal Status

Loggerhead shrike is a California Species of Special Concern and a USFWS Bird of Conservation Concern (California Department of Fish and Wildlife 2020a:61).

13B.76.2 Range and Distribution within the Study Area

Loggerhead shrike occurs year-round throughout California, except for the northwest, heavily forested higher mountains, and higher areas of deserts (Humple 2008:272). During the breeding season, abundance is highest in portions of the Central Valley, coast ranges, and southeastern deserts. In winter, abundance is highest throughout the San Joaquin Valley, the south-central and southern coasts, and the southeastern deserts (Humple 2008:272–273).

Loggerhead shrike occurs throughout the study area during the breeding and wintering seasons (eBird 2021). The CNDDB reports three nesting locations within the study area: one south of the City of Lathrop, one east of the City of Oakley, and one along Mountain House Creek (California Department of Fish and Wildlife 2020b). However, heavy urbanization has occurred at these locations and they may no longer provide suitable habitat for the species (Humple 2008:274). Surveys conducted by DWR from 2009 to 2011 documented 25 active loggerhead shrike nest sites, primarily in the vicinity of Clifton Court Forebay (California Department of Water Resources 2011).

13B.76.3 Habitat Requirements

Loggerhead shrike use a variety of open habitats, including pastures, old orchards, cemeteries, golf courses, agricultural fields, riparian areas, and woodlands (Yosef 2020). In the Central Valley, loggerhead shrike show a positive association with grasslands, irrigated pasture, and grain and hay crops, and also use row crops for foraging (Pandolfino and Smith 2012:82–83). Loggerhead shrike have also been detected in alkaline seasonal wetland (California Department of Water Resources 2011).

Loggerhead shrike nest in shrubs and trees surrounded by open habitat, and often select nest sites based on degree of cover (Yosef 2020). Nests are generally placed 3–6 feet above the ground (Humple 2008:274; Yosef 2020). Loggerhead shrike feed primarily on large insects, and require grasses, forbs, or bare ground for hunting. They also require tall shrubs, trees, fences, or power lines for hunting perches, as well as thorny plants or barbed wire fences to impale and store prey (Humple 2008:274).

13B.76.4 Seasonal Patterns

Loggerhead shrike are found year-round in California; however, breeding populations in the north are migratory. The resident populations in the south increase in winter as loggerhead shrike migrate from northern areas. Breeding occurs from January or February to July, with egg laying from March to May (Humple 2008:272; Granholm 2008).

13B.76.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.76.5.1 GIS Model Data Sources

The loggerhead shrike model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Midchannel island GIS layer (Aerial Information Systems 2011)

13B.76.5.2 Habitat Model Description

The loggerhead shrike model consists of nesting and foraging habitat. Loggerhead shrike nest in shrubs and trees surrounded by open habitat (Yosef 2020). Riparian forest and some willow scrub habitats are included to represent the nesting component of nesting and foraging habitat regardless of the density of the vegetation. Modeled nesting habitat excludes valley foothill riparian landcover on midchannel islands using a GIS constraint layer (Aerial Information Systems 2011) and valley foothill riparian landcover that is adjacent to wetlands and open water because these do not provide suitable nesting or foraging habitat. However, the model likely overestimates nesting habitat as not all riparian vegetation included in the model may provide the appropriate structure or density for nesting. Isolated nonriparian trees are typically below the minimum mapping unit; therefore, nonriparian nesting habitat may be underrepresented. However, impact assessments include all potential nesting habitat types. Cultivated lands and grassland natural communities (including vernal pool complex and alkaline seasonal wetland) are included in the model to represent the foraging component of modeled habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.76-1.

13B.76.5.2.1 Geographic Limits

Loggerhead shrike habitat is modeled to the extent of the entire study area, which overlaps with the year-round range for the species (Humple 2008:271).

13B.76.5.2.2 Additional Model Parameters

Modeled nesting and foraging habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetlands
  - All types
- Vernal pool complex
  - All types

Modeled nesting and foraging habitat includes the following agricultural landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer, DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) and the Delta, Sacramento County, and San Joaquin County Land Use Survey layers (Land IQ 2019; California Department of Water Resources 2016, 2020b).

- Alfalfa and alfalfa mixtures
- Fallow
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Seasonal wetland
- Unclassified fallow

- Upland herbaceous
- Wheat

Modeled nesting and foraging habitat also includes valley foothill riparian landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018), and DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) that are not within the midchannel island GIS layer (Aerial Information Systems 2011), and that are not adjacent to (i.e., touching) nontidal brackish emergent wetland, nontidal freshwater perennial emergent wetland, tidal brackish emergent wetland, tidal freshwater emergent wetland, or tidal perennial aquatic landcover.

- Valley foothill riparian
  - All types

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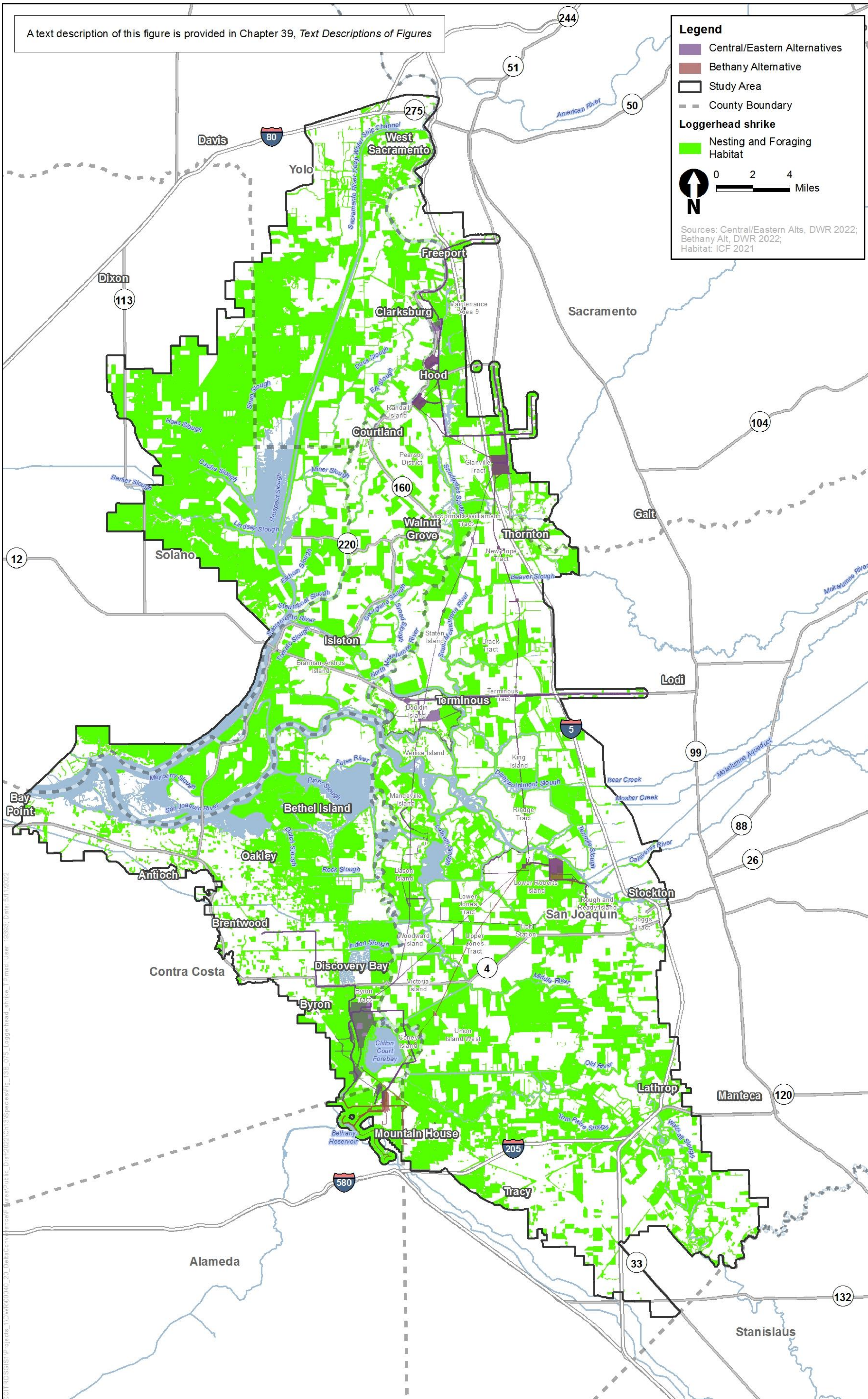

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2 **Figure 13B.76-1. Loggerhead Shrike Modeled Habitat in the Study Area**

13B.77 Least Bell's Vireo (*Vireo bellii*)

13B.77.1 Legal Status

Least Bell's vireo was listed as endangered under the ESA on May 2, 1986 (51 FR 16474–16482). The species is also listed as endangered under the CESA (California Department of Fish and Wildlife 2020a:62). Final designation of critical habitat for least Bell's vireo was published in the *Federal Register* on February 2, 1994 (59 FR 14845–4867).

13B.77.2 Range and Distribution within the Study Area

Least Bell's vireo, a riparian obligate, is one of four subspecies of Bell's vireo and is the only subspecies that breeds entirely in California and northern Baja California (Kus 2002:2). Least Bell's vireo had a historical distribution that extended from coastal Southern California through the San Joaquin and Sacramento Valleys as far north as Tehama County near Red Bluff (Kus 2002:2; U.S. Fish and Wildlife Service 1998:7). The Sacramento and San Joaquin Valleys were the center of the historical breeding range supporting 60% to 80% of the population (51 FR 16474). Least Bell's vireo also occurred along western Sierra Nevada foothill streams and in riparian habitats of the Owens Valley, Death Valley, and Mojave Desert (Kus 2002:2; Grinnell and Miller 1944:175, 186–187, 383–385; U.S. Fish and Wildlife Service 1998:7). Least Bell's vireo has been reported to occur from elevations ranging from –175 feet in Death Valley to 4,100 feet in Bishop, Inyo County (Grinnell and Miller 1944:175, 186–187, 383–385). Historical accounts described the subspecies as common to abundant but no reliable population estimates are available prior to the federal listing of least Bell's vireo in 1986 (U.S. Fish and Wildlife Service 1998:7).

Coinciding with widespread loss of riparian vegetation throughout California (Katibah 1984:23), Grinnell and Miller (1944:384) began to detect population declines in the Sacramento and San Joaquin Valleys by the 1930s. Surveys conducted in late 1970s (Goldwasser et al. 1980:742) detected no least Bell's vireo in the Sacramento and San Joaquin Valleys, and the subspecies was considered extirpated from the region. By 1986, USFWS determined that least Bell's vireo had been extirpated from most of its historical range and numbered approximately 300 pairs statewide (Kus 2002:2). Since federal listing in 1986, populations have gradually increased, and the subspecies has recolonized portions of its historical range. By 1998, the total population was estimated at 2,000 pairs and recolonization was reported along the Santa Clara River in Ventura County, the Mojave River in San Bernardino County, and sites in Monterey and Inyo Counties (Kus and Beck 1998:63; Kus 2002:2; U.S. Fish and Wildlife Service 2006:7). A single nest was reported from Santa Clara County near Gilroy in 1997 (Kus 2002:2). Still, the distribution remained largely restricted to San Diego County (76%) and Riverside County (16%) (U.S. Fish and Wildlife Service 2006:7).

By 2005, the population had reached an estimated 2,968 breeding pairs (Allen and Kus 2020:2) with increases in most Southern California counties and San Diego County (primarily Camp Pendleton Marine Corps Base) supporting roughly half of the current population (U.S. Fish and Wildlife Service 2006:6–7). Recent occurrences have suggested a range expansion to the northern extent of the subspecies' historical breeding range.

Least Bell's vireo are rarely observed in the Central Valley. According to eBird (2021), the species has been observed at eight distinct locations in the Central Valley between 2005 and 2019. There are no CNDDB records of least Bell's vireo breeding in the study area since at least the 1970s. Two singing males were detected in the Yolo Bypass Wildlife Area in mid-April 2010, and again in 2011 (California Department of Fish and Wildlife 2020b). No least Bell's vireo were detected in the Yolo Bypass Wildlife Area during surveys in 2012. A singing male was detected in 2013, and surveys were not conducted in 2014 (Whisler pers. Comm.). No least Bell's vireo were detected in the Yolo Bypass Wildlife Area in 2015 or 2016, and the site appears to have been abandoned because there have been no subsequent observations (Ebird 2021). Singing males were detected at Bradford Island in 2018 and 2019 (eBird 2021).

The next-nearest known nest site since the 1930s is approximately 7 miles south of the study area at the San Joaquin River National Wildlife Refuge in the San Joaquin and Tuolumne River floodplain (Howell et al. 2010:105–109). This occurrence includes three nests between 2005 and 2007, all in a recently restored portion of San Joaquin River National Wildlife Refuge lands known as "Hagemann's Fields 6 and 9." The 2005 and 2006 nests were successful. The 2007 nest was not successful in that only a female was observed in the area, and though a nest was constructed and the female laid eggs, the nest failed. The 2005 and 2006 nests were in a 3-year-old arroyo willow with understory plants including mugwort (*Artemisia douglasiana*), sunflower (*Helianthus annuus*), gumplant (*Grindelia hirsutula*), and creeping wild rye (*Leymus triticoides*). The 2007 nest was in a dead arroyo willow (Howell et al. 2010:105–109). One individual was also seen in the San Joaquin River National Wildlife Refuge along Ingram Creek in 2012 and 2016 (eBird 2021).

13B.77.3 Habitat Requirements

Least Bell's vireo is an obligate riparian breeder that typically inhabits willow riparian forest supporting a dense, shrubby understory of mesic species such as mulefat (*Baccharis salicifolius*) (Goldwasser 1981:7; Gray and Greaves 1981:609–610; Franzreb 1989:4–6). Oak woodland with a willow riparian understory is also used in some areas (Gray and Greaves 1981:606), and individuals sometimes enter adjacent chaparral, coastal sage scrub, or desert scrub habitats to forage (Kus 2002:8; Kus and Miner 1989:299). Goldwasser (1981:14) and Salata (1983:63) believed that structure and composition of vegetation below 3 and 4 meters, respectively, were critical. Salata (1983:63) also reported the importance of a mix of tree size classes, with a mean height of 8 meters. Gray and Greaves (1981:610) recommended protection of ground cover and low shrub layers. Vireo occur in disproportionately high frequencies in the wider sections (i.e., greater than 250 meters) of the riparian relative to site availability (Kus 2002:7).

Early successional riparian habitat typically supports the dense shrub cover required for nesting and a diverse canopy for foraging. Although least Bell's vireo tends to prefer early successional habitat, breeding site selection does not appear to be limited to riparian stands of a specific age (Goldwasser 1981:14; Franzreb 1989:6; Kus et al. 2020). If willows and other species are not managed, within 5 to 10 years they form dense thickets and become suitable nesting habitat (Goldwasser 1981:15–16; Kus 1998:77). Tall canopy tends to shade out the shrub layer in mature stands, but least Bell's vireo will continue to use such areas if patches of understory exist. In mature habitat, understory vegetation consists of species such as California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversilobum*), California blackberry (*Rubus ursinus*), grape (*Vitis californica*), and perennials that can conceal nests.

Least Bell's vireo use upland habitat, in many cases coastal sage scrub, adjacent to riparian habitat. Vireo along the edges of riparian corridors maintain territories that incorporate both habitat types, and a significant proportion of pairs with territories encompassing upland habitat place at least one nest there (Kus and Miner 1989:302).

Territory size ranges from 0.5 to 7.5 acres, but on average are between 1.5 and 2.5 acres in southern California (U.S. Fish and Wildlife Service 1998:14–15). Spatial differences in riparian habitat structure, patch size, and numerous other factors result in differences in the density of territories. Patch size and crowding does not influence least Bell's vireo reproductive success, at least not through the mechanisms of singing rates and attraction of predators (U.S. Fish and Wildlife Service 1998:14–15).

Least Bell's vireo are insectivorous and prey on a wide variety of insects, including bugs, beetles, grasshoppers, moths, and especially caterpillars (Chapin 1925:25; Bent 1950:258–259; U.S. Fish and Wildlife Service 1998:19). Foraging occurs at all levels of the canopy but appears to be concentrated in the lower to middle level strata, particularly when pairs have active nests (Grinnell and Miller 1944:385; Goldwasser 1981:15; Gray and Greaves 1981:610; Salata 1983:52–57). Foraging occurs most frequently in willows (Salata 1983:54; U.S. Fish and Wildlife Service 1998:20), but occurs on a wide range of riparian species and even some non-riparian plants that may host relatively large proportions of large prey (U.S. Fish and Wildlife Service 1998:20).

13B.77.4 Seasonal Patterns

Least Bell's vireo winter in Mexico in southern Baja California (Kus 2002:2). Least Bell's vireo arrive on its breeding grounds in southern California in mid- to late March, with males arriving slightly before females (Kus 2002:2–3). Most individuals leave their breeding grounds by September, although individuals have been recorded leaving as early as late July and remaining into late November (Kus 2002:3).

13B.77.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.77.5.1 GIS Model Data Sources

The least Bell's vireo model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.77.5.2 Habitat Model Description

Least Bell's vireo typically nest in willow-dominated habitats and early successional riparian habitat typically supports the dense shrub cover required for nesting and a diverse canopy for foraging (Riparian Habitat Joint Venture 2004:19, 44, 56, 73, 87). Although least Bell's vireo tends to prefer early successional habitat, breeding site selection does not appear to be limited to riparian stands of a specific age. Therefore, in addition to all willow-dominated types, all other riparian habitats that may consist of a dense shrub layer are included in the model. The extent of modeled habitat in the study area is depicted in Figure 13B.77-1.

13B.77.5.2.1 Geographic Limits

The primary populations of least Bell's vireo currently occur in Southern California; however, over the last decade or more, sporadic occurrences of individuals displaying breeding behavior or successful nesting have been reported in the Delta (refer to Section 13B.77.2, *Range and Distribution within the Study Area*, for additional details). This is considered evidence that least Bell's vireo may be slowly expanding their population back into their historical range. At the time of this writing, least Bell's vireo is not assumed to be a resident of the Delta; thus, the model identifies areas of potential recolonization. Because there are so few occurrences in or around the Delta from which to confidently determine a range within the Delta, the entire Delta is assumed to have potential to provide recolonization habitat.

13B.77.5.2.2 Additional Model Parameters

Modeled least Bell's vireo habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
    - *Salix gooddinggii*
    - *Salix lasiolepis*
    - *Vitis californica*
    - *Salix exigua*
    - *Salix lucida*
    - *Populus fremontii*
    - *Alnus rhombifolia*
    - *Fraxinus latifolia*
    - *Acer negundo*
    - *Juglans hindsii and Hybrids*
    - *Baccharis pilularis*
    - *Rosa californica*

- *Cornus sericea*
- *Quercus agrifolia*
- *Quercus wislizeni* (tree)
- *Quercus lobata*
- *Rubus armeniacus*
- *Sambucus nigra*
- *Platanus racemosa*
- *Salix laevigata*
- *Cephalanthus occidentalis*
- Californian broadleaf forest and woodland group
- Southwestern North American riparian evergreen and deciduous woodland
- Vancouverian riparian deciduous forest alliance
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian/wash scrub

Modeled habitat also includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer.

- Valley/foothill riparian
  - Forested wetland
  - Shrub scrub wetland

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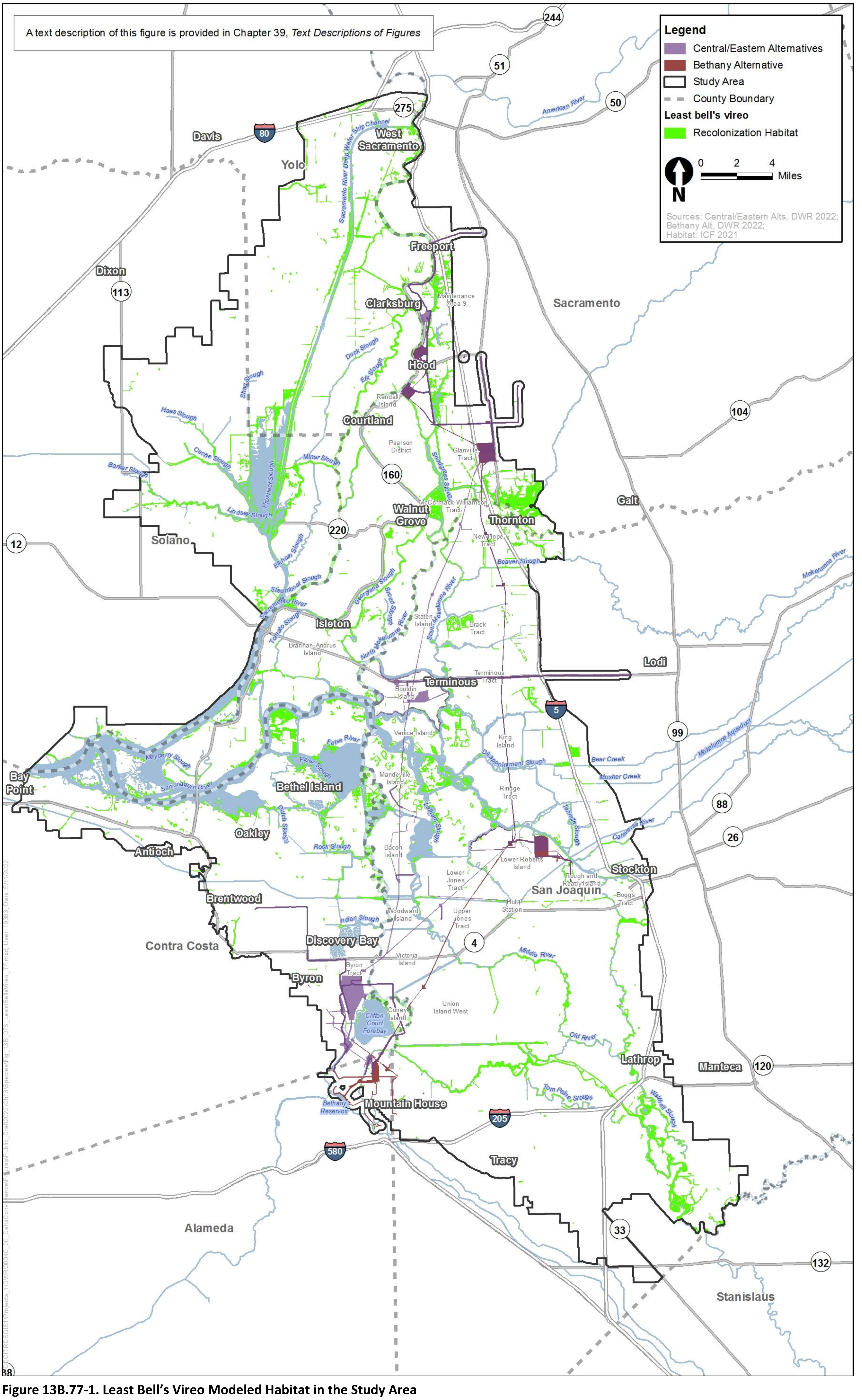

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2 **Figure 13B.77-1. Least Bell's Vireo Modeled Habitat in the Study Area**

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13B.78 California Horned Lark (*Eremophila alpestris actia*)

13B.78.1 Legal Status

California horned lark is included on the CDFW Watch List (California Department of Fish and Wildlife 2020a:63) but has no federal regulatory status (California Department of Fish and Wildlife 2020a).

13B.78.2 Range and Distribution within the Study Area

The year-round range of California horned lark encompasses open habitats within California's central and southern coast and the San Joaquin Valley (Grinnell and Miller 1944:270; Shuford and Gardali 2008:58).

The CNDDB reports only three nesting locations in the southwest portion of the study area: two are located just south of the city of Mountain House and one is located northeast of Bethany Reservoir (California Department of Fish and Wildlife 2020b). However, California horned lark have been documented year-round throughout the Delta (eBird 2021).

13B.78.3 Habitat Requirements

Suitable habitat for California horned lark consists of open habitats with low, sparse vegetation, including grasslands, agricultural fields, and grazed pastures. Grasses, forbs, rocks, and soil clods provide cover. Nests are placed on the ground in depressions in open areas, often on bare ground (Green 2008; Beason 2020). Nests often have a tuft of grass or a rock sheltering the windward side (Beason 2020).

California horned lark feed primarily on insects, snails, and spiders in the breeding season, as well as seeds in the non-breeding season. The species forages along the ground, searching for food in low vegetation and bare fields (Green 2008; Beason 2020).

13B.78.4 Seasonal Patterns

California horned lark is a year-round resident in California. Breeding occurs from March through July, peaking in May. After breeding, California horned lark may form large flocks that forage and roost together, with populations augmented by winter migrants from outside California (Green 2008).

13B.78.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.78.5.1 GIS Model Data Sources

The California horned lark model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.78.5.2 Habitat Model Description

The habitat model for California horned lark consists of nesting and foraging habitat. Modeled habitat includes grassland, seasonal wetlands (including alkaline seasonal wetland and vernal pool complex), and agricultural lands of similar structure, regardless of size. The extent of modeled habitat in the study area is depicted in Figure 13B.78-1.

13B.78.5.2.1 Geographic Limits

California horned lark nesting and foraging habitat is modeled throughout the entire study area, which overlaps with the year-round range for the species (California Wildlife Habitat Relationship System 2007).

13B.78.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of

Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetland
  - All types
- Vernal pool complex
  - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019, California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Fallow
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Seasonal wetland
- Unclassified fallow
- Upland herbaceous
- Wheat

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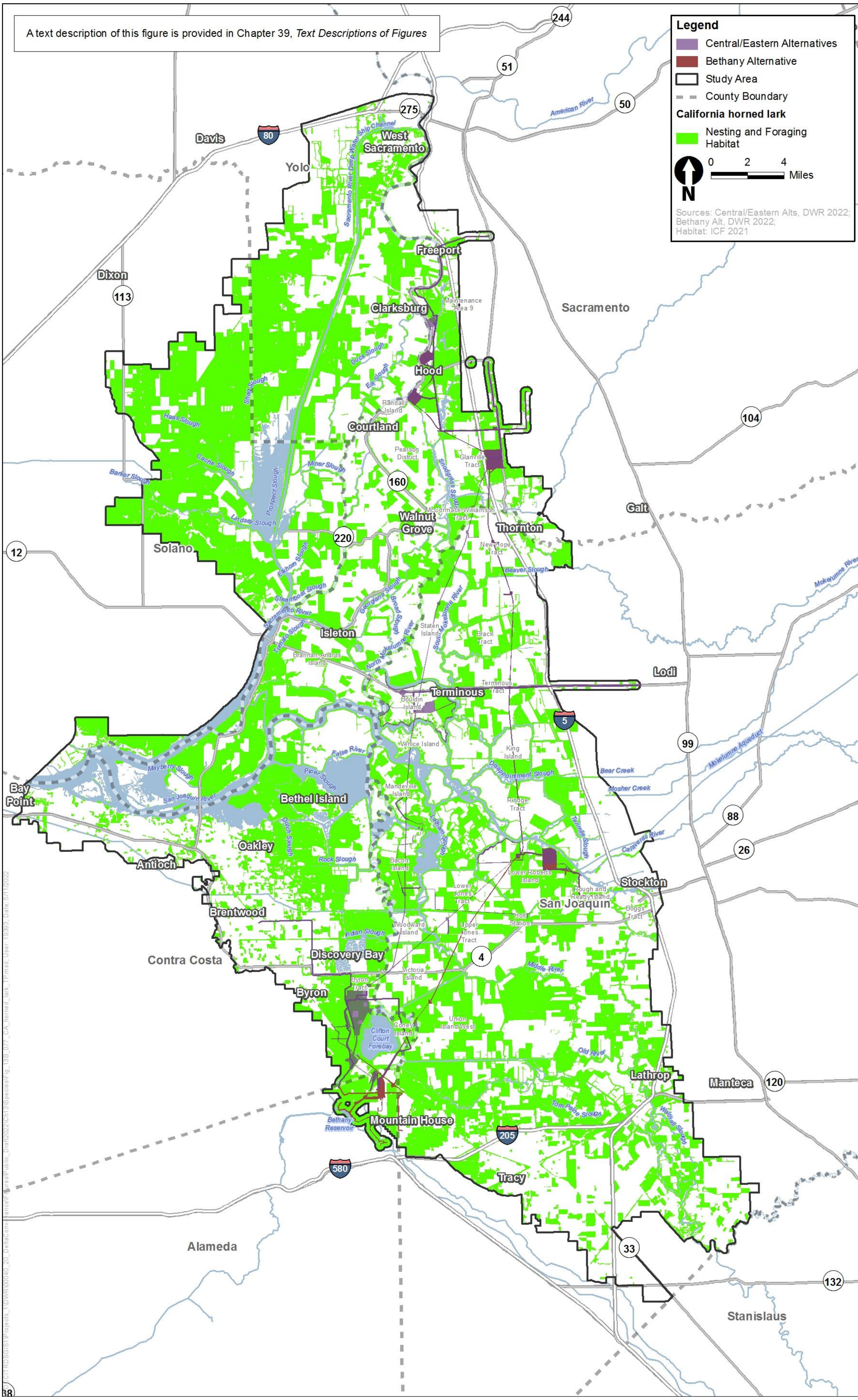

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2 **Figure 13B.78-1. California Horned Lark Modeled Habitat in the Study Area**

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13B.79 Bank Swallow (*Riparia riparia*)

13B.79.1 Legal Status

The bank swallow is a threatened species under CESA. The bank swallow has no federal regulatory status (California Department of Fish and Wildlife 2020a:63).

13B.79.2 Range and Distribution within the Study Area

Bank swallows are colonial nesting birds that breed in North America, Europe, and Asia, and winter in Central and South America and Africa (Garrison 1998). Despite their expansive range, the distribution of the species is limited to disjunct locations that provide suitable habitat (Grinnell and Miller 1944:274–275). Approximately 70%–90% of the breeding population in California occurs along the Sacramento River and its tributaries, where nesting habitat has been greatly reduced by bank protection (Bank Swallow Technical Advisory Committee 2013:10; California Department of Fish and Game 1992:ii).

Bank swallows are not known to nest in the study area and based on a review of aerial imagery (Maxar 2020), most of the Delta lacks suitable bank swallow nesting habitat (steep vertical banks that lack revetment). The CNDDB reports one occurrence within the study area in the Brannan Island State Recreation Area along the west levee bank of Sevenmile Slough, where several birds were observed in June 2000 (California Department of Fish and Wildlife 2020b). Additional observations have been recorded in the study area, particularly in the west Delta (eBird 2021), and the species is expected to migrate through the study area to and from breeding locations.

13B.79.3 Habitat Requirements

Bank swallows create their burrows in vertical banks along rivers, streams, or other waters (Bank Swallow Technical Advisory Committee 2013:3). The species is dependent on dynamic river processes to erode of vertical banks and create suitable burrow substrate (Garrison 1998; Moffat et al. 2005:391–392; Garrison and Turner 2020). Bank swallow nests in banks with sandy loam soils that provide a friable substrate for burrow excavation (Bank Swallow Technical Advisory Committee 2013:6). Revetment has been placed on most of the natural banks within the breeding range of the species, preventing erosion and therefore removing a substantial proportion of available nesting habitat (Bank Swallow Technical Advisory Committee 2013:20–22). Bank swallows nest in colonies and the number of nesting pairs and burrows varies widely. Up to 6,000 burrows have been recorded within a single colony (Garrison 1998).

Bank swallows forage for insects over water and landcover adjacent to colonies, including wetlands, grassland, riparian woodland, orchards, agricultural fields, shrublands, and upland woodlands (Bank Swallow Technical Advisory Committee 2013:14; California Department of Fish and Game 1992:2). Bank swallows have been reported to travel up to 5–6 miles (8–10 kilometers) from a colony to forage (Garrison 1998) although they are commonly observed foraging within approximately 164–656 feet (50–200 meters) of nesting colonies when nestlings are present (Garrison 1998).

13B.79.4 Seasonal Patterns

Bank swallow is a colonial-breeding migrant, arriving in California in March (California Department of Fish and Game 1992:2; Garrison 1998). Peak egg-laying occurs between mid-April and mid-May and most juveniles fledge the burrows by mid-July (Bank Swallow Technical Advisory Committee 2013:11). Bank swallows depart for their wintering grounds in Central and South America by August (California Department of Fish and Game 1992:2; Garrison 1998).

13B.79.5 Species Habitat Suitability Model

Because the specific habitat requirements of the species (steep, vertical banks that lack revetment) occur at a finer scale than the land cover data used in the EIR, no model was developed for this species.

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13B.80 Grasshopper Sparrow (*Ammodramus savannarum*)

13B.80.1 Legal Status

Grasshopper sparrow is designated as a Species of Special Concern by CDFW. The yellow-breasted chat has no federal regulatory status (California Department of Fish and Wildlife 2020a:65).

13B.80.2 Range and Distribution within the Study Area

The species breeding range in California is fragmented throughout the state west of the Cascade-Sierra Nevada crest, from Mendocino and Trinity Counties south to San Diego County (Dobkin and Granholm 2008). In the Central Valley, loss of native and nonnative grassland through agriculture and urbanization have further fragmented the grasshopper sparrow's patchy breeding distribution (Unitt 2008:394).

There are few records of breeding grasshopper sparrows in the Delta (eBird 2021). The CNDDB reports only two nesting locations within the study area in its northwest portion (California Department of Fish and Wildlife 2020b). Surveys conducted from 2009 to 2011 documented one grasshopper sparrow nest in the southwest portion of the study area in the vicinity of Clifton Court Forebay (California Department of Water Resources 2011).

13B.80.3 Habitat Requirements

Preferred habitat for grasshopper sparrows consists of short to middle-height, moderately open grasslands with scattered shrubs. The species has also been recorded in grassland-like cultivated lands such as alfalfa (Grinnell and Miller 1944:490), alkaline meadows, and native bunchgrasses; outside of California, patchy bare ground has also been observed as an important habitat component (Unitt 2008:396). Areas with extensive shrub cover are avoided, and large tracts of habitat are preferred over small ones. Nests are placed on the ground, well-concealed by grasses (Vickery 2020).

Grasshopper sparrows primarily feed on grasshoppers and other insects in summer, and grass and forb seeds in winter. The species searches for food on the ground or low vegetation (Unitt 2008:397; Vickery 2020).

13B.80.4 Seasonal Patterns

In California, grasshopper sparrows occur primarily in summer, arriving from March to May, and migrate south in August or September. Some may winter in California, mostly on the southern coast (Unitt 2008:394; Dobkin and Granholm 2008). Breeding occurs from early April to mid-July, peaking in May and June (Dobkin and Granholm 2008).

13B.80.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.80.5.1 GIS Model Data Sources

The grasshopper sparrow model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.80.5.2 Habitat Model Description

The habitat model for grasshopper sparrow consists of nesting and foraging habitat. Modeled habitat includes grassland, seasonal wetlands (including alkaline seasonal wetland and vernal pool complex), and agricultural lands. The model does not identify vegetation structure, and includes tall grasses and dense vegetation stands, which do not provide suitable habitat for the species;, therefore, the model likely overestimates suitable nesting and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.80-1.

13B.80.5.2.1 Geographic Limits

Grasshopper sparrow nesting and foraging habitat is modeled throughout the entire study area, which overlaps with the breeding range for the species (Unit 2008).

13B.80.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land

Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex dataset (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetland
  - All types

  Vernal pool complex
  - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and the Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Fallow
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Seasonal wetland
- Unclassified fallow
- Upland herbaceous
- Wheat

13B.80.6 References Cited

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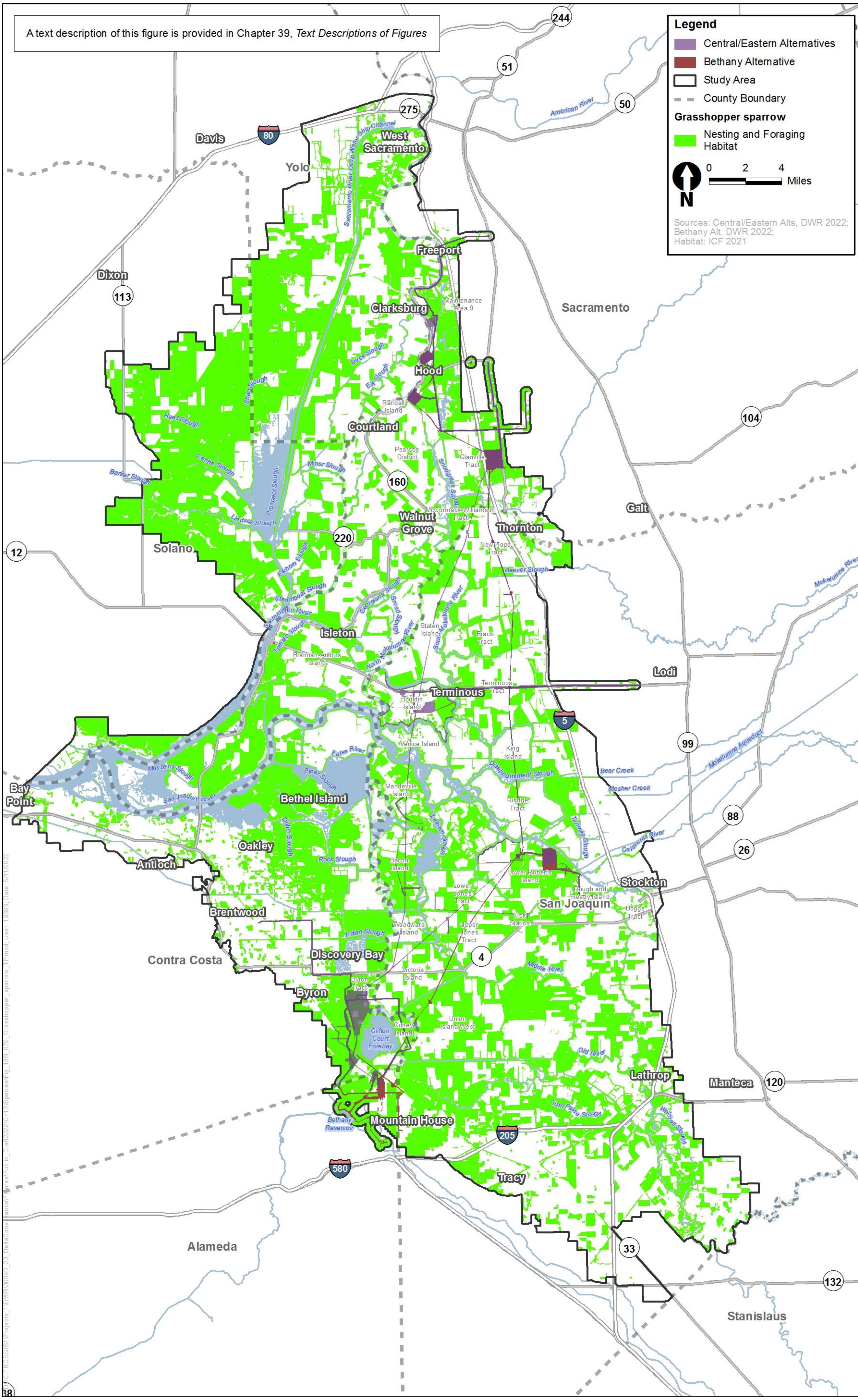

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2 **Figure 13B.80-1. Grasshopper Sparrow Modeled Habitat in the Study Area**

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13B.81 Modesto Song Sparrow (*Melospiza melodia*)

13B.81.1 Legal Status

Modesto song sparrow has no federal legal status; however, it is identified by CDFW as a Species of Special Concern (California Department of Fish and Wildlife 2020a:65).

13B.81.2 Range and Distribution within the Study Area

Song sparrows are found year-round throughout California, except for higher mountains and much of the southeastern deserts. The taxonomic status of the Modesto song sparrow is currently under review, and further research is necessary to determine its status as a valid subspecies [Gardali 2008:401). The Modesto population of song sparrow is endemic to the north-central portion of the Central Valley, with the highest densities occurring in the Butte Sink and Delta (Grinnell and Miller 1944:551; Gardali 2008:401).

Modesto song sparrow are ubiquitous year-round throughout the study area (eBird 2021). The CNDDB reports 84 nesting locations throughout the northern and central Delta (California Department of Fish and Wildlife 2020b). Riparian forest and scrub shrub vegetation and emergent wetland that provides suitable nesting and foraging habitat for the species occurs throughout the study area.

13B.81.3 Habitat Requirements

Little is known about the specific habitat requirements for the Modesto song sparrow (Gardali 2008:402). However, emergent marsh and riparian scrub provide breeding habitat (Grinnell and Miller 1944:551). In addition, the species has been observed to nest in valley oak riparian forests with a dense blackberry understory, vegetated irrigation canals and levees, and recently planted valley oak restoration sites (Dybala et al. 2017:7; Gardali 2008:402). Nests are commonly concealed by overhead vegetation and placed on the ground or low in vegetation (Arcese et al. 2020). Song sparrows forage on bare ground and leaf litter under and around bushes for seeds and insects (Marshall 1948:213; Gardali 2008:402).

13B.81.4 Seasonal Patterns

Modesto song sparrow occurs year-round (Grinnell and Miller 1944:551). Breeding occurs from mid-March to early August (Gardali 2008:402).

13B.81.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.81.5.1 GIS Model Data Sources

The Modesto song sparrow model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographic Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.81.5.2 Habitat Model Description

The habitat model for Modesto song sparrow consists of nesting and foraging habitat. The modeled habitat includes riparian and emergent wetland vegetation (including seasonal wetlands) and relies on both delineation data that were collected for a smaller portion of the study area in what is called the delineation study area, and suitable vegetation types found in datasets outside the delineation study area. The extent of modeled habitat in the study area is depicted in Figure 13B.81-1.

13B.81.5.2.1 Geographic Limits

Modesto song sparrow nesting and foraging habitat is modeled throughout the entire study area, which overlaps with the year-round range of the species (Gardali 2008:400).

13B.81.5.2.2 Additional Model Parameters

Inside the Delineation Study Area

Modeled habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021).

- Nontidal freshwater perennial emergent wetland
    - Freshwater emergent wetland
- Other seasonal wetlands
    - All types
- Valley foothill riparian
    - Forested wetland
    - Shrub scrub wetland

Modeled nesting and foraging habitat also includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018) layers.

- Valley foothill riparian

- All types

Outside the Delineation Study Area

Modeled nesting and foraging habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018) layers.

- Nontidal brackish emergent wetland
    - All types
- Nontidal freshwater perennial emergent wetland
    - All types
- Tidal brackish emergent wetland
    - All types
- Tidal freshwater emergent wetland
    - All types
- Valley foothill riparian
    - All types

13B.81.6 References Cited

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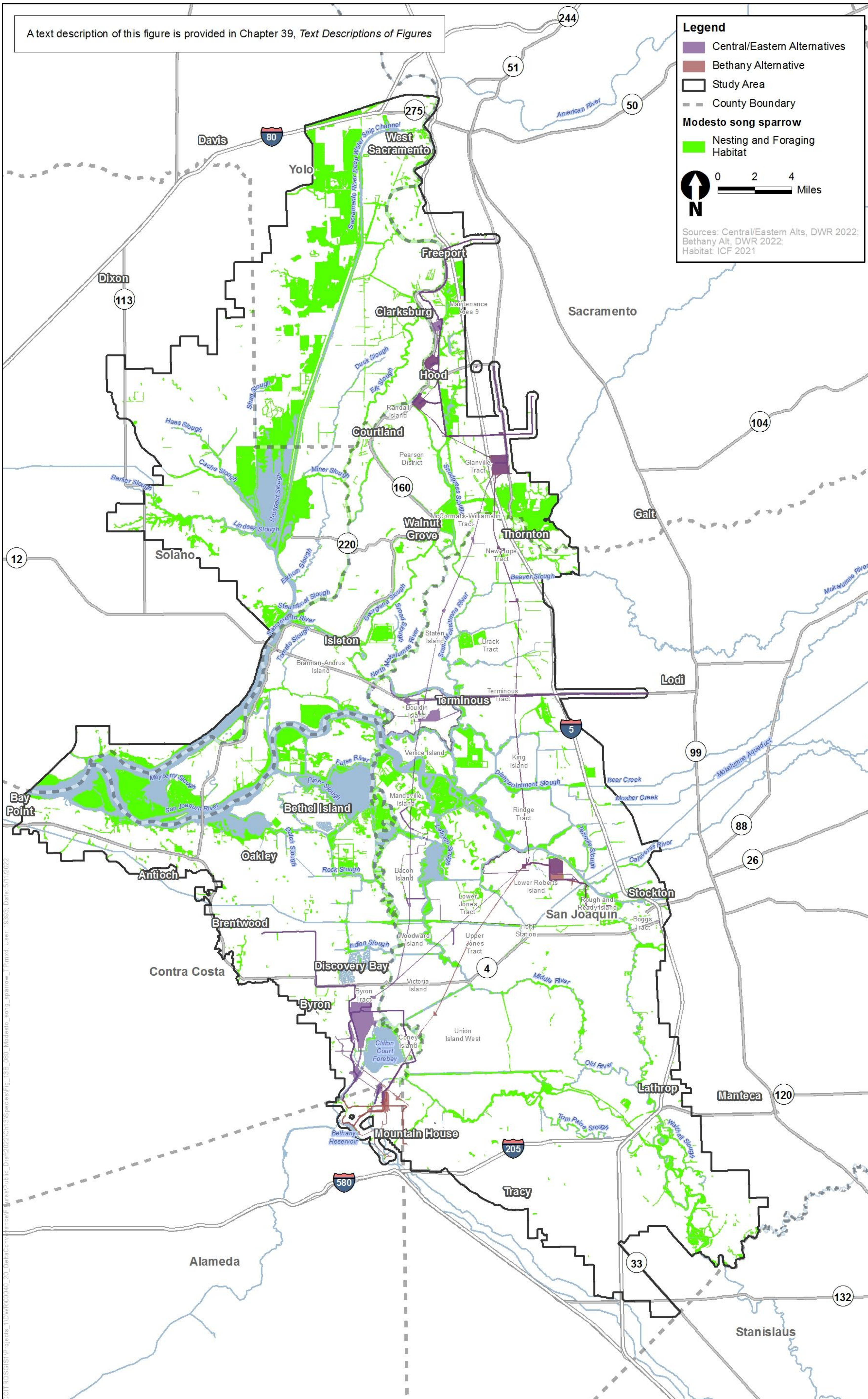

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2 **Figure 13B.81-1. Modesto Song Sparrow Modeled Habitat in the Study Area**

13B.82 Suisun Song Sparrow (*Melospiza melodia maxillaris*)

13B.82.1 Legal Status

The Suisun song sparrow has no federal regulatory status; however, it is designated as a Bird of Conservation Concern by USFWS and is identified by CDFW as a Species of Special Concern (California Department of Fish and Wildlife 2020a:65).

13B.82.2 Range and Distribution within the Study Area

The Suisun song sparrow is one of 24 subspecies of *Melospiza melodia*, and one of three that occur in the San Francisco Bay estuary (Modesto song sparrow [*M. m. mailliardi*] may be a fourth subspecies; however, its taxonomic status is currently under review, and further research is necessary to determine its status as a valid subspecies [Gardali 2008:401]). The Suisun song sparrow is endemic to the salt marshes of the Suisun Bay. Its year-round range is confined to tidal salt and brackish marshes of the Suisun Bay area from the Carquinez Strait east to Antioch at the confluence of the San Joaquin and Sacramento Rivers (Grinnell and Miller 1944:551; Spautz and Nur 2008:406). The current range remains relatively unchanged since Grinnell and Miller's (1944:551) description. However, the current distribution of the species in this area is defined by the extent of remaining tidal marsh habitats in the Suisun Bay (Spautz and Nur 2008:407).

The subspecies occurs in virtually every tidal marsh in Suisun Bay; however, densities differ widely based on habitat conditions and suitability (Spautz and Nur 2008:407).

Suisun song sparrow nesting and foraging habitat is present in the wetlands and adjacent upland vegetation in the western portion of the study area. The CNDDB reports seven occurrences within the study area: two on lower Sherman Island (Kimball Island), and two on Browns Island, one just south of New York Slough (south of Browns Island), one on Chipps Island, and one just north of the City of Baypoint (California Department of Fish and Wildlife 2020b).

13B.82.3 Habitat Requirements

Suisun song sparrows are associated with tidal marsh habitats dominated by *Salicornia*, *Spartina*, and *Grindelia*. In brackish marsh habitats, these types are interspersed mostly with *Schoenoplectus* (formerly known as *Scirpus*) and *Typha*. Dense vegetation is required for nesting sites, song perches, and refuge from predators (Marshall 1948:204–205, 212). There is also an association with tidal channels in areas where *Salicornia* or *Spartina* are the dominant landscape cover and *Grindelia* or shrubs occur along the edges of the channels, providing nesting and perching habitat (Spautz and Nur 2008:407).

While dense vegetation is characteristic, exposed ground is important for foraging. In tidal marsh habitats, openings in the dense *Salicornia*, created by small mammals or tidal action, are required for foraging access. In *Schoenoplectus*/*Typha*-dominated habitats, plant spacing needs to be sufficient to provide openings for foraging and movement on the ground (Marshall 1948:213).

There is a positive correlation between Suisun song sparrow abundance and shrub cover, particularly *Grindelia stricta* and *Baccharis pilularis,* marsh size, and proportion of adjacent natural upland and the density of Suisun song sparrows is greater along upland edges of large marshes, especially where shrubs are present (Spautz et al. 2006:255–257; Spautz and Nur 2008:408).

During the fall and winter, adults and young may range up to 600 feet from the territory and occupy adjacent seasonal marshes or grasslands, but continue to occupy the same general area and return to the same breeding territory each year (Walton 1975:6).

13B.82.4 Seasonal Patterns

The Suisun song sparrow is nonmigratory and occupies the same territory year-round. Breeding occurs from early March to July (Spautz and Nur 2008:406).

13B.82.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.82.5.1 GIS Model Data Sources

The Suisun song sparrow model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.82.5.2 Habitat Model Description

Modeled Suisun song sparrow nesting and foraging habitat includes tidal brackish and tidal freshwater emergent wetlands regardless of patch size or density. Modeled habitat also includes an upland component, which consists of alkaline seasonal wetland, grassland, riparian, and vernal pool complex land cover within 600 feet of emergent wetlands (Walton 1975:6). The extent of modeled habitat in the study area is depicted in Figure 13B.82-1.

13B.82.5.2.1 Geographic Limits

Suisun song sparrow habitat in the study area is geographically constrained to the Delta west of Sherman Island using a GIS constraint layer (Figure 13B.82-1). Suisun song sparrows are found exclusively in tidal marshes and adjacent uplands and have been detected as far east as Kimball Island in the western Delta (Spautz and Nur 2008).

13B.82.5.2.2 Additional Model Parameters

Modeled nesting and foraging habitat includes the following landcover types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Tidal brackish emergent wetland
  - Arid West freshwater emergent marsh
  - *Atriplex lentiformis*
  - *Bolboschoenus maritimus*
  - *Cynodon dactylon*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - *Sarcocornia pacifica (Salicornia depressa)*
  - *Schoenoplectus (acutus, californicus)*
  - Southwestern North American salt basin and high marsh group
  - Temperate Pacific tidal salt and brackish meadow
  - *Typha (angustifolia, domingensis, latifolia)*
- Tidal freshwater emergent wetland
  - Arid West freshwater emergent marsh
  - *Carex barbarae*
  - *Cynodon dactylon*
  - Freshwater emergent wetland
  - *Juncus arcticus (*var. *balticus, mexicanus)*
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - Tidal freshwater emergent wetland
  - *Typha (angustifolia, domingensis, latifolia)*

Suisun song sparrow nesting and foraging habitat also consists of the below landcover types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018), and DCP Vernal Pool Complex (Witham et al.

2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layers if they are within 600 feet (Walton 1975) of tidal brackish emergent wetland or tidal freshwater wetland landcover types.

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetlands
  - All types
- Valley/foothill riparian
  - *Baccharis pilularis*
  - *Cephalanthus occidentalis*
  - *Cornus sericea*
  - *Equisetum (arvense, variegatum, hyemale)*
  - *Grindelia (camporum, stricta)*
  - *Rosa californica*
  - *Rubus armeniacus*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*
  - *Salix lasiolepis*
  - *Salix lucida*
  - Scrub shrub wetland
  - Southwestern North American introduced riparian scrub
  - Southwestern North American riparian/wash scrub
- Vernal pool complex
  - All types

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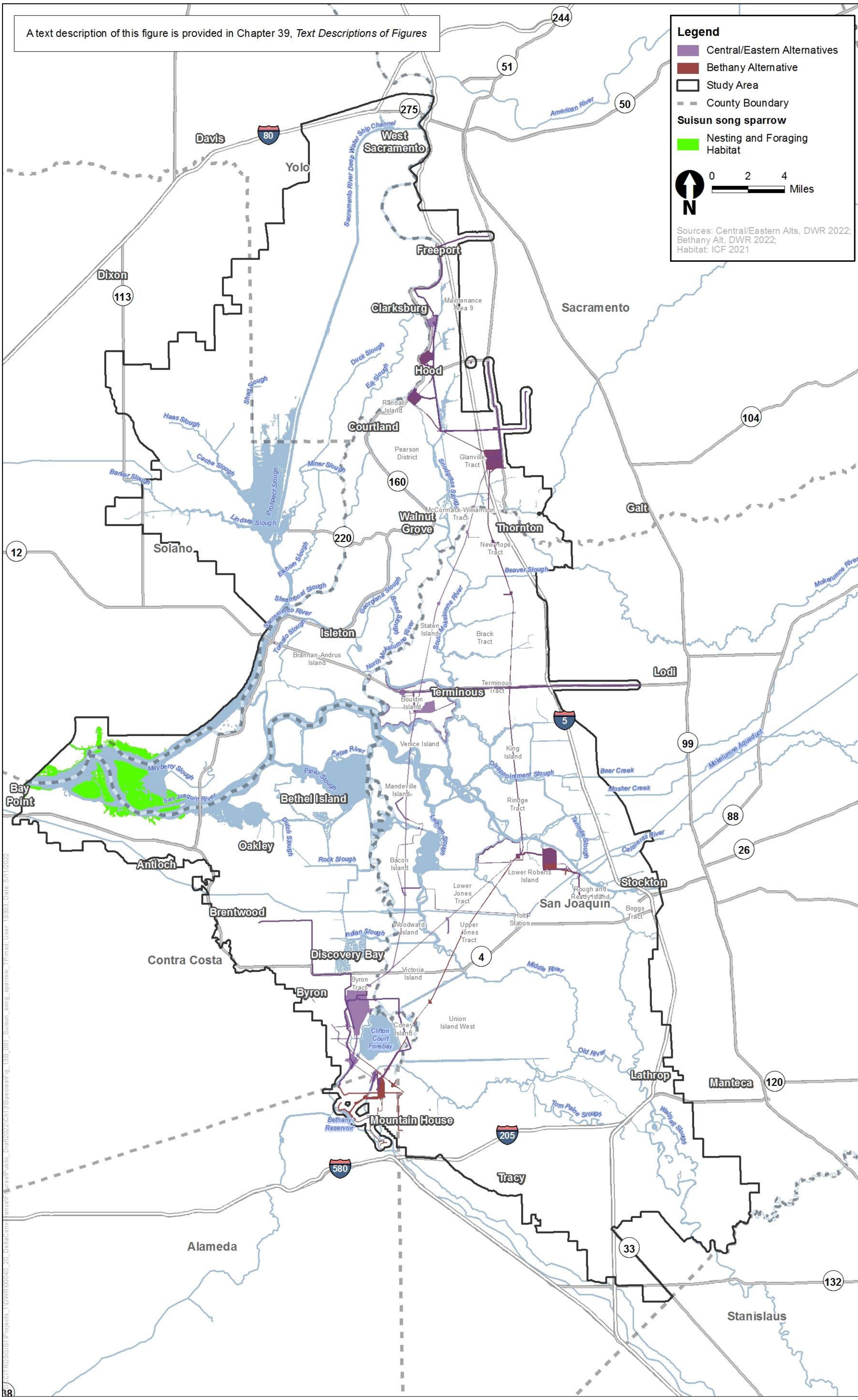

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2 **Figure 13B.82-1. Suisun Song Sparrow Modeled Habitat in the Study Area**

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13B.83 Yellow-Breasted Chat (*Icteria virens*)

13B.83.1 Legal Status

Yellow-breasted chat is designated as a state Bird Species of Special Concern by CDFW. The yellow-breasted chat has no federal regulatory status (California Department of Fish and Wildlife 2020a).

13B.83.2 Range and Distribution within the Study Area

Yellow-breasted chat is a neotropical migrant songbird. Its breeding range extends from southern Canada to Mexico, with a few birds also wintering in southern California (Comrack 2008:352). Yellow-breasted chats are widespread summer residents of eastern North America; however, they have a much more fragmented distribution in western North America (Eckerle and Thompson 2020; Lovette et al. 2004:158). In western North America, their breeding range includes southeast Alberta, southern Saskatchewan, southwest and south-central British Columbia, the eastern half of Washington and Oregon, and portions of California, Idaho, Utah, Nevada, Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Arizona, New Mexico, and Texas (Eckerle and Thompson 2020). Grinnell and Miller (1944:415) reported that chats bred throughout California exclusive of higher mountains and coastal islands and were more numerous toward the interior. In migration, chats were similarly widespread and less restricted to dense riparian plant growth. In California, the species is currently still widely distributed; however, its breeding range is thought to be approximately 35% of its historical range, and breeding yellow-breasted chats are now rare or absent in much of the Central Valley (Comrack 2008:353).

Yellow-breasted chat occurs throughout the study area during breeding and migration (eBird 2021). There are no CNDDB records of yellow-breasted chat in the study area (California Department of Fish and Wildlife 2020b). However, surveys conducted by DWR from 2009 to 2011 documented 47 active yellow-breasted chat nest sites at Stone Lakes National Wildlife Refuge, on Empire Tract, upper Mandeville Island, Bradford Island, Sherman Island, and on a midchannel island just north of Union Island (California Department of Water Resources 2011). The species has also been recorded between May and August at the Cosumnes River Preserve, along White Slough, and on Staten Island, Medford Island, Holland Tract, and Bethel Island (eBird 2021).

13B.83.3 Habitat Requirements

Yellow-breasted chats nest and forage in dense riparian thickets of willows, vines, and brush associated with streams and other wetland habitats (Ricketts and Kus 2000). The species has been classified as an open-canopy obligatory species (i.e., it prefers open overstory and brushy understory), with population density directly related to shrub density to a height of 4.5 meters (14.8 feet) (Crawford et al. 1981:689–690). Some taller trees, such as tall willows (*Salix* spp.), cottonwood (*Populus* spp.), alder (*Alnus* spp.) and sycamore (*Platanus* spp.) are also required for song perches (Ricketts and Kus 2000). Several studies indicate a strong association with early successional vegetation, including clearcut areas and powerline corridors with dense shrubby vegetation such as Himalayan blackberry (*Rubus armeniacus*), wild grape (*Vitis* spp.), and/or willows, with sapling-sized trees as opposed to mature riparian forest (Kroodsma 1982:84–88; Melhop and Lynch 1986:233; Annand and Thompson 1997:163, 167; Comrack 2008:355).

Kroodsma (1982:84–85, 88) also reported a preference for blackberry thickets and avoidance of areas with a high percentage of grass cover.

A variety of trees and shrubs are used as nest substrate, including willow, alder, and blackberry (Kroodsma 1982:84–85, 88). During migration, yellow-breasted chats use habitat similar to their breeding habitat (Comrack 2008:351).

13B.83.4 Seasonal Patterns

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala (Comrack 2008:352). Departure for wintering grounds occurs from August to September (Comrack 2008:352).

13B.83.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.83.5.1 GIS Model Data Sources

The yellow-breasted chat model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.83.5.2 Habitat Model Description

The yellow-breasted chat model consists of nesting and migratory habitat. Yellow-breasted chat nesting and migratory habitat includes all valley riparian types with a shrub component that includes blackberry, California wild rose, dogwood, coyote bush, willow, and other shrub species, and an overstory component that includes valley oak, coast live oak, Fremont cottonwood, white alder, box elder, Oregon ash, willow, or walnut. The extent of modeled habitat in the study area is depicted in Figure 13B.83-1.

13B.83.5.2.1 Geographic Limits

Yellow-breasted chat habitat is modeled to the extent of the entire study area, which overlaps with the year-round range for the species (Comrack 2008:351).

13B.83.5.2.2 Additional Model Parameters

Modeled nesting and migratory habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
  - *Acer negundo*
  - *Alnus rhombifolia*
  - *Baccharis pilularis*
  - Californian broadleaf forest and woodland
  - *Cephalanthus occidentalis*
  - *Cornus sericea*
  - *Fraxinus latifolia*
  - *Juglans hindsii* and hybrids
  - *Populus fremontii*
  - *Quercus agrifolia*
  - *Quercus lobata*
  - *Quercus wislizeni* (tree)
  - *Rosa californica*
  - *Rubus armeniacus*
  - *Salix exigua*
  - *Salix gooddingii*
  - *Salix laevigata*
  - *Salix lasiolepis*
  - *Salix lucida*
  - *Sambucus nigra*
  - Southwestern North American riparian evergreen and deciduous woodland
  - Southwestern North American riparian/wash scrub
  - Vancouverian riparian deciduous forest
  - *Vitis californica*

Modeled nesting and migratory habitat also includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer.

- Valley/foothill riparian
    - Forested wetland
    - Shrub scrub wetland

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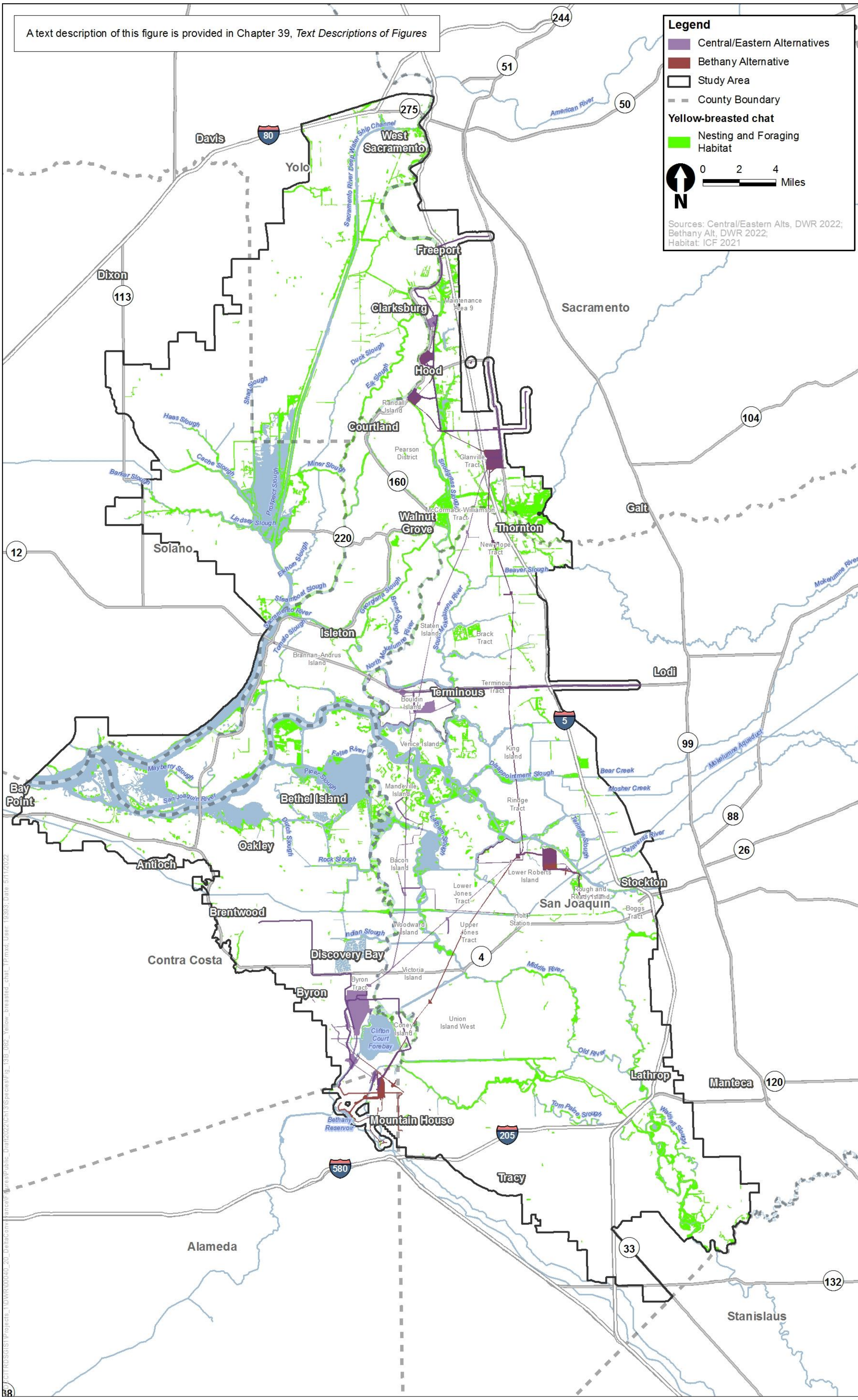

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2 **Figure 13B.83-1. Yellow-Breasted Chat Modeled Habitat in the Study Area**

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13B.84 Yellow-Headed Blackbird (*Xanthocephalus xanthocephalus*)

13B.84.1 Legal Status

Yellow-headed blackbird has no federal regulatory status; however, the species is designated by CDFW as a Species of Special Concern (California Department of Fish and Wildlife 2020a:67).

13B.84.2 Range and Distribution within the Study Area

In California, yellow-headed blackbird breeds east of the Cascade Range and Sierra Nevada, in the Central Valley, portions of the Coast ranges, and in southern California in the Imperial and Colorado River valleys (Granholm 2008). In winter, yellow-headed blackbirds occur in the Central Valley and the Imperial and Colorado River valleys (Jaramillo 2008:445).

The CNDDB reports only two nesting locations in the study area: one just north of the City of Lathrop and one along the Sacramento River west of the Sacramento Regional Wastewater Treatment Plant (California Department of Fish and Wildlife 2020b). Surveys conducted from 2009 to 2011 documented one nest site on a midchannel island adjacent to Medford Island (California Department of Water Resources 2011). There are records of the species between May and August at the Cosumnes River Preserve in the western Delta (east of Mandeveille Island, and on Bethel and Sherman Islands), in the Shin Kee Tract wetlands, and in the vicinity of White Slough (eBird 2021). Suitable nesting and foraging habitat are present throughout the study area.

13B.84.3 Habitat Requirements

Yellow-headed blackbirds breed in colonies in emergent wetland with dense vegetation, such as cattails and tules (Granholm 2008). Nests are placed within emergent vegetation, typically .5 to 3 feet above the water surface and over water from 2 to 4 feet deep. Emergent vegetation is also used for roosting and cover (Bent 1958:104–105; Granholm 2008).

During the breeding season, yellow-headed blackbirds feed primarily on aquatic insects, and forage within breeding territories (when resources are abundant), or in uplands adjacent to wetlands. In the non-breeding season, the species forages for seeds in agricultural fields, such as small grain, milo, sunflower, and corn fields, as well as in fallow fields (Twedt and Crawford 2020). Yellow-headed blackbirds will also forage in open pastures, cattle pens, and feedlots (Kaufman 1996).

13B.84.4 Seasonal Patterns

Yellow-headed blackbird occurs in California as a migrant and summer resident from April to September or early October, and breeds from mid-April to late July. Most of the species migrates south to Mexico for winter; however, a portion of the population stays to winter in the southern Central Valley and Imperial Valley (Jaramillo 2008:445; Granholm 2008).

13B.84.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.84.5.1 GIS Model Data Sources

The yellow-headed blackbird model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographic Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Important Farmland Datasets (Farmland Mapping Staff 2016a, 2016b, 2016c, 2016d, 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.84.5.2 Habitat Model Description

The habitat model for yellow-headed blackbird consists of nesting and foraging habitat. Modeled nesting habitat includes brackish and freshwater emergent wetland vegetation and relies on both delineation data that were collected for a smaller portion of the study area in what is called the delineation study area, and suitable vegetation types found in datasets outside the delineation study area. Modeled foraging habitat includes grassland, seasonal wetlands (including alkaline seasonal wetland and vernal pool complex) and agricultural lands including feedlots and dairies. The extent of modeled habitat in the study area is depicted in Figure 13B.84-1.

13B.84.5.2.1 Geographic Limits

Yellow-headed blackbird habitat is modeled to the extent of the entire study area, which overlaps with the breeding and year-round range of the species (Jaramillo 2008).

13B.84.5.2.2 Additional Model Parameters

Nesting

Inside the Delineation Study Area

Modeled nesting habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Nontidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
- Tidal freshwater emergent wetland
  - Freshwater emergent wetland

Outside the Delineation Study Area

Modeled nesting habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018) layers.

- Nontidal brackish emergent wetland
  - Arid west freshwater emergent marsh
  - Naturalized warm-temperate riparian and wetland group
  - *Schoenoplectus (acutus, californicus)*
  - *Typha (angustifolia, domingensis, latifolia)*
- Nontidal freshwater perennial emergent wetland
  - Arid west freshwater emergent marsh
  - Naturalized warm-temperate riparian and wetland group
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
- Tidal brackish emergent wetland
  - Arid west freshwater emergent marsh
  - Naturalized warm-temperate riparian and wetland group
  - *Schoenoplectus (acutus, californicus)*
  - *Typha (angustifolia, domingensis, latifolia)*
- Tidal freshwater emergent wetland
  - Arid west freshwater emergent marsh

    - Naturalized warm-temperate riparian and wetland group
    - *Schoenoplectus (acutus, californicus)*
    - *Schoenoplectus americanus*
    - Tidal freshwater emergent wetland
    - *Typha (angustifolia, domingensis, latifolia)*

Foraging

Modeled foraging habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers.

- Alkaline seasonal wetland
    - All types
- Grassland
    - All types
- Other seasonal wetlands
    - All types
- Vernal pool complex
    - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers.

- Alfalfa and alfalfa mixtures
- Fallow
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Rice
- Sunflowers
- Unclassified fallow
- Upland herbaceous
- Wheat

- Wild rice

Modeled foraging habitat also includes the following semiagricultural land cover types (Farmland Mapping Staff 2016a, 2016b, 2016c, 2016d, 2018).

- Livestock feedlots
- Dairies
- Poultry farms

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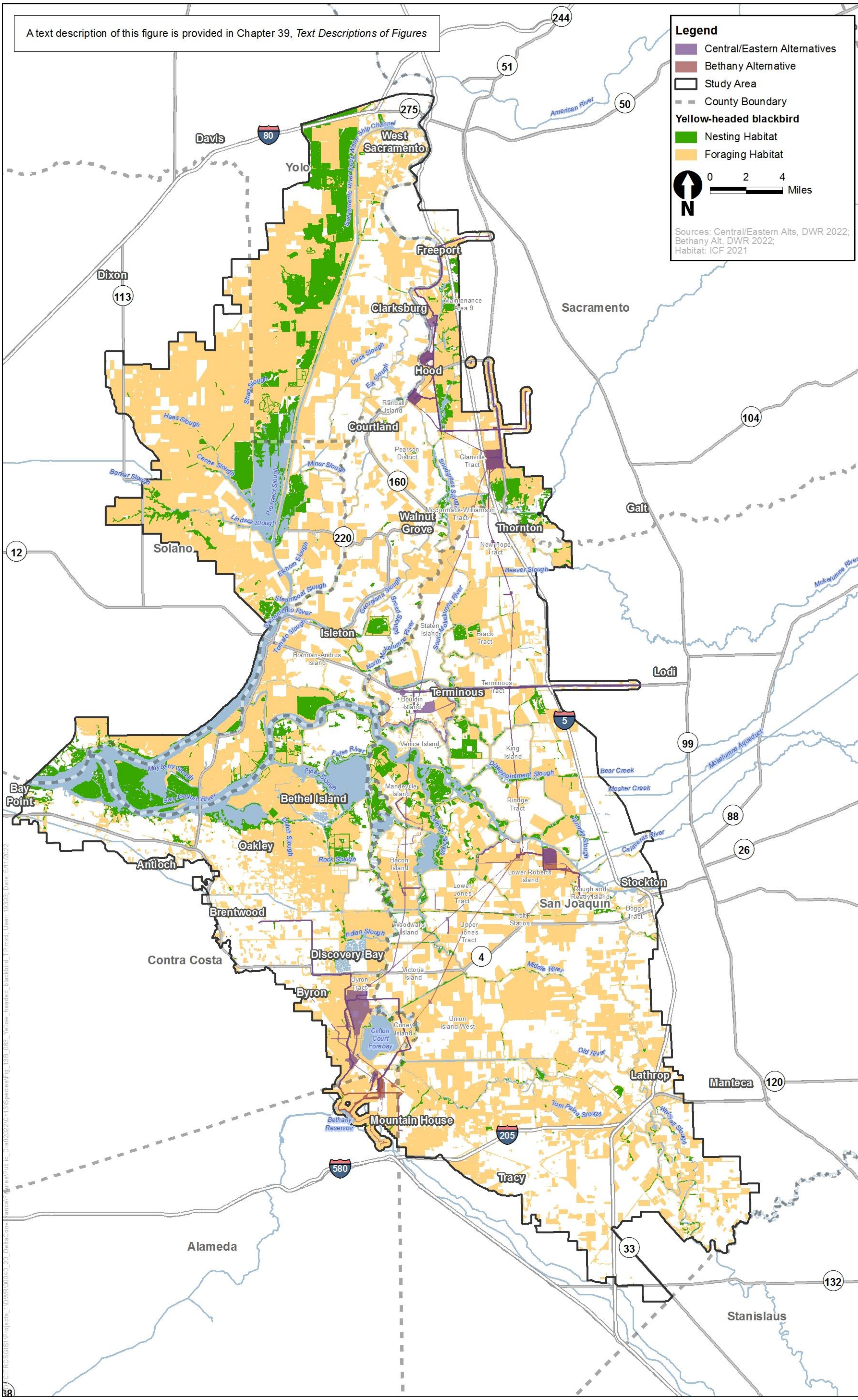

Figure 13B.84-1. Yellow-Headed Blackbird Modeled Habitat in the Study Area

13B.85 Tricolored Blackbird (*Agelaius tricolor*)

13B.85.1 Legal Status

Tricolored blackbird was listed as threatened by the California Fish and Game Commission pursuant to CESA (Fish and Game Code, Sections 2050 *et seq.)* on April 19, 2018, and is designated as a California Species of Special Concern (California Department of Fish and Wildlife 2020a). Tricolored blackbird has no federal regulatory status; however, the species is protected under the federal Migratory Bird Treaty Act and is designated as a Bird of Conservation Concern by USFWS (U.S. Fish and Wildlife Service 2019:52). A petition was submitted to USFWS in 2004 and was denied in 2006, based on insufficient scientific evidence to warrant listing the species under the federal ESA. Another petition was submitted to USFWS on February 3, 2015, to list tricolored blackbird under the ESA; on September 18, 2015, USFWS issued a 90-day finding of the petition stating that listing may be warranted and requested more information (80 FR 56423–56432). In 2019, the USFWS issued a 12-month finding on the petition that listing the tricolored blackbird as endangered or threatened is not warranted (84 FR 41694–41699).

13B.85.2 Range and Distribution within the Study Area

Tricolored blackbird is a colonial nesting passerine bird that is largely restricted to California. The species forms some of the largest colonies of any North American passerine bird, which may contain tens of thousands of breeding pairs (Beedy et al. 2020). Most of the California breeding population of tricolored blackbird occurs in the Central Valley (California Department of Fish and Wildlife 2018:40; Beedy et al. 2020). Statewide surveys conducted in 2017 documented 51% of breeding birds in Merced and Kern Counties (Meese 2017:11). While the geographic extent of tricolored blackbird's range has been largely unchanged since the 1930s (Neff 1937:61–81; DeHaven et al. 1975:168–171, 178–179; Beedy et al. 1991:1; Beedy 2008:437–439; Hamilton 1998:225; California Department of Fish and Wildlife 2018:40; Beedy et al. 2020), substantial annual variation in centers of breeding abundance have been regularly documented over the past 70 years, particularly between the Sacramento and San Joaquin Valleys (California Department of Fish and Wildlife 2018:59). These shifts in abundance are indicative of the tricolored blackbird's ability to adapt to variation in food supply and nesting substrate (California Department of Fish and Wildlife 2018:59). Wintering tricolored blackbirds often form huge, mixed species flocks that forage across the landscape. The Delta and central coast are recognized as major wintering areas for tricolored blackbirds (Beedy 2008:439; California Department of Fish and Wildlife 2018:14).

Based upon recent survey results, tricolored blackbird appears to be an uncommon breeder in the Delta (Meese pers. comm.). Historical nesting activity was generally restricted to the northern and southern ends of the Delta. There are 11 sites where breeding occurred at least once between 2005 and 2020 that are within the study area. Most of these breeding records are single-year occurrences but tricolored blackbirds do sometimes nest at the same site, sometimes in sequential years and sometimes with one or more years in between. These nesting sites range from having as few as 3 to as many as 2,000 breeding adults per site (Meese pers. comm.; California Department of Fish and Wildlife 2020b). The Delta is recognized as an important wintering area for tricolored blackbirds (Hamilton 2004; Beedy 2008:438). Tricolored blackbirds are nomadic during the nonbreeding season; therefore, roost site locations vary annually (California Department of Fish and Wildlife

2018:16). The species roosts and forages in large, mixed, wintering flocks with other blackbird species throughout the study area including Sherman Island (eBird 2021; Tricolored Blackbird Portal 2021).

13B.85.3 Habitat Requirements

Tricolored blackbirds nest colonially, enabling them to synchronize their timing of nest building and egg laying (Beedy et al. 2020). Tricolored blackbird typically nests in areas with open accessible water, a nesting substrate that is protected from ground predators (e.g., vegetation that is flooded, thorny, or spiny), and suitable foraging habitat (e.g., pastures, dry seasonal pools, agricultural fields such as alfalfa and sunflower) that provides abundant insect prey (Hamilton et al. 1995:25; California Department of Fish and Wildlife 2018:27; Beedy et al. 2020). Open water within 1,640 feet (500 meters) of nesting substrate is a requirement for colony settlement (Hamilton 2004). Breeding colonies have been recorded in freshwater marshes, willows, blackberries, thistles, and nettles, and more recently in triticale and other grain fields in the San Joaquin Valley (California Department of Fish and Wildlife 2018:24–27). Most breeding tricolored blackbirds forage within 5 miles of their colony sites (California Department of Fish and Wildlife 2018:28; U.S. Fish and Wildlife Service 2019:24). Foraging is typically concentrated in areas that support abundant insect populations, a vital food resource for provisioning nestlings (Beedy 2008:440). Foraging habitat includes grasslands, alkaline seasonal wetlands, vernal pools, pastures and agricultural crops such as alfalfa and rice, which produce a high abundance of insects, in addition to cattle feedlots and dairies, which supply grains for foraging individuals (California Department of Fish and Wildlife 2018:28).

Roosting by tricolored blackbirds during the fall and winter generally occurs in emergent wetlands consisting of cattails (*Typha* spp.) and bulrushes (*Schoenoplectus* spp.; U.S. Fish and Wildlife Service 2019:12) During the nonbreeding season, tricolored blackbirds often congregate at dairy feedlots to consume grains and other livestock feed, or forage on insects, grains, and other plant material in grasslands and agricultural fields (Beedy et al. 2020).

13B.85.4 Seasonal Patterns

In the Central Valley, breeding typically occurs between mid-March and mid-August (California Department of Fish and Wildlife 2018:31). Females typically lay 3 to 4 eggs and incubate them for 11 to 14 days (Emlen 1941:216–217; Orians 1961:287, 297, 310); then both parents feed young until they fledge approximately 9 to 14 days after hatching (U.S. Fish and Wildlife Service 2019:11). The colony itself remains active and in various stages of the breeding cycle for an extended period, which may last more than 90 days, but generally requires a minimum of 50 days for a complete breeding cycle (Beedy et al. 2020). Many tricolored blackbirds reside throughout the year in the Central Valley of California. Individual tricolored blackbirds may occupy and breed at several sites, or renest at the same site during a given breeding season, depending on environmental conditions and their previous nesting success (Hamilton 1998:225; Beedy et al. 2020; Meese 2006:5). In the fall, after the nesting season, large roosts form at managed wildlife refuges and other marshes near abundant food supplies such as cultivated rice (*Oryza sativa*) and water grass (*Echinochloa crus-galli*) (Beedy et al. 2020). During winter, many tricolored blackbirds move from the Sacramento Valley to the Delta, central and southern San Joaquin Valley, and to the dairy farms in coastal areas such as Point Reyes and Monterey County (Beedy and Hamilton 1997:17–19).

13B.85.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.85.5.1 GIS Model Data Sources

The tricolored blackbird model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Delta 2017 Land Use Survey (Land IQ 2019)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020b)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021)
- Important Farmland Datasets (Farmland Mapping Staff 2016a, 2016b, 2016c, 2016d, 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.85.5.2 Habitat Model Description

The tricolored blackbird model consists of three components: previously occupied colony habitat, potential nesting habitat, and foraging habitat. Overwintering habitat is not modeled because the available scientific literature does not thoroughly describe tricolored blackbird nonbreeding habitat (California Department of Fish and Wildlife 2018:23–30; U.S. Fish and Wildlife Service 2019:24) and the loss of overwintering roosting habitat is not likely to result in injury or mortality of individuals. However, emergent vegetation within modeled previously occupied colony habitat and potential nesting habitat could also support overwintering tricolored blackbird night roosts (U.S. Fish and Wildlife Service 2019:12).

The modeled previously occupied colony habitat and potential nesting habitat rely on both delineation data that was collected for a smaller portion of the study area, in what is called the delineation study area, and suitable habitats found in the datasets outside the delineation study area. Foraging habitat includes grasslands; seasonal wetlands; shrublands; riparian scrub; agricultural lands such as hay, pastures (including alfalfa), and sunflowers; and growing or stored grain crops in agricultural lands (such as livestock feedlots and dairies). During the breeding season, tricolored blackbirds typically forage within 3.1 miles (5 kilometers) of a colony site (California Department of Fish and Wildlife 2018:28; U.S. Fish and Wildlife Service 2019:24); therefore, the modeled foraging habitat includes suitable landcover types within 3.1 miles of modeled previously occupied colony habitat and potential nesting habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.85-1.

13B.85.5.2.1 Geographic Limits

The model includes the entire study area because although the tricolored blackbird is an uncommon breeder in the Delta, there is potential habitat and there are records of known colonies distributed throughout the study area, as described in 13B.85.2 *Range and Distribution within the Study Area*.

13B.85.5.2.2 Additional Model Parameters

Previously Occupied Colony Habitat

Previously occupied colony habitat has had active nesting within the past 15 years (2005–2020). Colony locations consist of either a CNDDB breeding colony polygon (California Department of Fish and Wildlife 2020b) or a Tricolored Blackbird Portal colony location (Meese pers. comm.). Colony locations from the Tricolored Blackbird Portal were buffered by 373 feet to convert a point location into a polygon. A circle with a radius of 373 feet has an area of 10 acres, which is the average area of a tricolored blackbird colony (California Department of Fish and Wildlife 2018:16, 28–29). Previously occupied colony habitat was modeled using the following methods.

- If a colony location consisted of a CNDDB polygon from the past 15 years, previously occupied colony habitat includes suitable nesting land cover types (listed below) within the mapped boundary of the CNDDB polygon.
- If a buffered Tricolored Blackbird Portal colony point was located within the boundary of a CNDDB polygon from the past 15 years, previously occupied colony habitat includes suitable nesting land cover types (listed below) within the mapped boundary of the CNDDB polygon. If a Tricolored Blackbird Portal colony point did not overlap with a CNDDB polygon, previously occupied habitat includes the suitable nesting land cover types (listed below) within the 373-foot buffer around the colony point.
- If a CNDDB or Tricolored Blackbird Portal colony occurrence reported nesting in mustard or stinging nettle, previously occupied colony habitat was mapped as including suitable nesting land cover types (listed below) and vegetation types within the grassland natural community (as nettle and mustard stands typically occur within the grassland natural community).

Inside the Delineation Study Area

Modeled previously occupied colony habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021).

- Nontidal freshwater perennial emergent wetland
    - Freshwater emergent wetland
- Tidal freshwater emergent wetland

  - Freshwater emergent wetland
- Valley/foothill riparian
  - Scrub shrub wetland

Modeled previously occupied colony habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), and the Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) datasets.

- Valley/foothill riparian
  - *Rubus armeniacus*
  - *Sambucus nigra*
  - *Salix lasiolepis*
  - *Vitis californica*
  - *Salix exigua*
  - *Rosa californica*
  - *Salix gooddingii*
  - Southwestern North American riparian/wash scrub
  - *Salix laevigata*
  - *Salix lucida*
  - Southwestern North American introduced riparian scrub

Outside the Delineation Study Area

Modeled previously occupied colony habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Nontidal freshwater perennial emergent wetland
  - *Schoenoplectus americanus*
  - *Schoenoplectus (acutus, californicus)*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh
  - *Salix lasiolepis*
  - Naturalized warm-temperate riparian and wetland group
- Nontidal brackish perennial emergent wetland
  - Arid West freshwater emergent marsh

- *Schoenoplectus (acutus, californicus)*
- *Typha (angustifolia, domingensis, latifolia)*
- Naturalized warm-temperate riparian and wetland group

- Valley/foothill riparian
  - *Rubus armeniacus*
  - *Sambucus nigra*
  - *Salix lasiolepis*
  - *Vitis californica*
  - *Salix exigua*
  - *Rosa californica*
  - *Salix gooddingii*
  - Southwestern North American riparian/wash scrub
  - *Salix laevigata*
  - *Salix lucida*
  - Southwestern North American introduced riparian scrub
- Tidal freshwater emergent wetland
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh
  - Tidal freshwater emergent wetland
  - Naturalized warm-temperate riparian and wetland group
- Tidal brackish emergent wetland
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh
  - Naturalized warm-temperate riparian and wetland group

Potential Nesting Habitat

Potential nesting habitat includes the same following natural community and vegetation types when they do not overlap with previously occupied colony habitat (defined above).

Inside the Delineation Study Area

Modeled potential nesting habitat includes the following types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021):

- Nontidal freshwater perennial emergent wetland
  - Freshwater emergent wetland
- Tidal freshwater emergent wetland
  - Freshwater emergent wetland
- Valley/foothill riparian
  - Scrub shrub wetland

Modeled potential nesting habitat also includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Valley/foothill riparian
  - *Rubus armeniacus*
  - *Sambucus nigra*
  - *Salix lasiolepis*
  - *Vitis californica*
  - *Salix exigua*
  - *Rosa californica*
  - *Salix gooddingii*
  - Southwestern North American riparian/wash scrub
  - *Salix laevigata*
  - *Salix lucida*
  - Southwestern North American introduced riparian scrub

Outside the Delineation Study Area

Modeled potential nesting habitat includes the following types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico Research Foundation, Geographical Information Center 2019), and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Nontidal freshwater perennial emergent wetland
  - *Schoenoplectus americanus*
  - *Schoenoplectus (acutus, californicus)*

  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh
  - *Salix lasiolepis*
  - Naturalized warm-temperate riparian and wetland group
- Nontidal brackish perennial emergent wetland
  - Arid West freshwater emergent marsh
  - *Schoenoplectus (acutus, californicus)*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Naturalized warm-temperate riparian and wetland group
- Valley/foothill riparian
  - *Rubus armeniacus*
  - *Sambucus nigra*
  - *Salix lasiolepis*
  - *Vitis californica*
  - *Salix exigua*
  - *Rosa californica*
  - *Salix gooddingii*
  - Southwestern North American riparian/wash scrub
  - *Salix laevigata*
  - *Salix lucida*
  - Southwestern North American introduced riparian scrub
- Tidal freshwater emergent wetland
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh
  - Tidal freshwater emergent wetland
  - Naturalized warm-temperate riparian and wetland group
- Tidal brackish emergent wetland
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - *Typha (angustifolia, domingensis, latifolia)*
  - Arid West freshwater emergent marsh

    - Naturalized warm-temperate riparian and wetland group

Foraging Habitat

Modeled foraging habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021), and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020a, California Department of Water Resources 2021) layers that occur within 3.1 miles (5 kilometers) of previously occupied colony habitat or potentially suitable colony habitat.

- Alkaline seasonal wetland
    - All types
- Grassland
    - All types
- Other seasonal wetlands
    - All types
- Vernal pool complex
    - All types

Modeled foraging habitat also includes the following landcover types from the 2018 Statewide Crop Mapping (Land IQ and DWR 2021) layer and Delta, Sacramento County, and San Joaquin County Land Use Survey (Land IQ 2019; California Department of Water Resources 2016, 2020b) layers that occur within 3.1 miles (5 kilometers) of previously occupied colony habitat or potentially suitable colony habitat.

- Alfalfa and alfalfa mixtures
- Fallow
- Miscellaneous grain and hay
- Miscellaneous grasses
- Mixed pasture
- Rice
- Sunflowers
- Unclassified fallow
- Upland herbaceous
- Wheat
- Wild rice

Modeled foraging habitat also includes the following semiagricultural land cover types (Farmland Mapping Staff 2016a, 2016b, 2016c, 2016d, 2018).

- Livestock feedlots
- Dairies
- Poultry farms

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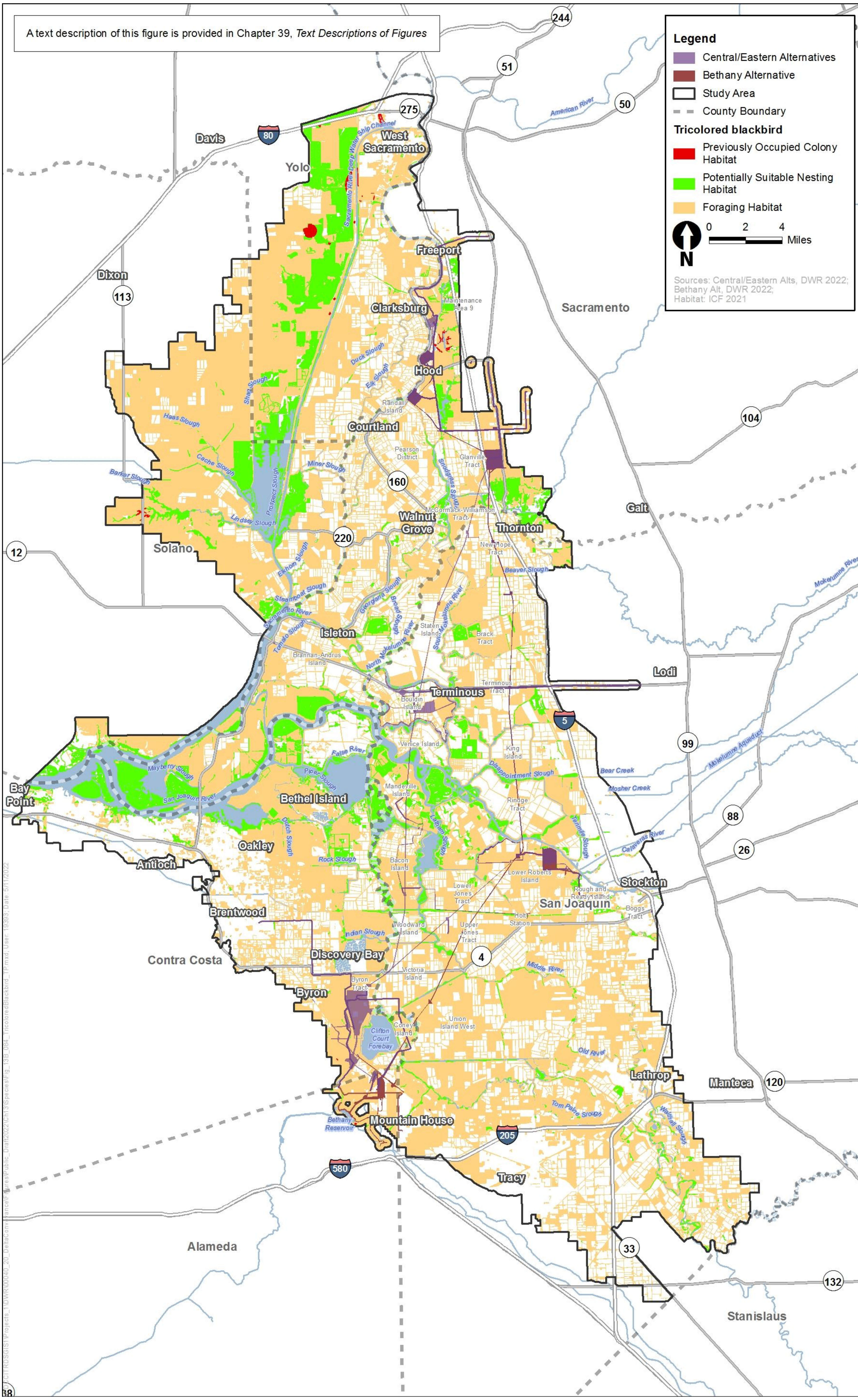

1
2 **Figure 13B.85-1. Tricolored Blackbird Modeled Habitat in the Study Area**

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13B.86 Saltmarsh Common Yellowthroat (*Geothlypis trichas sinuosa*)

13B.86.1 Legal Status

Saltmarsh common yellowthroat is designated as a Species of Special Concern by CDFW (California Department of Fish and Wildlife 2020a:67). Saltmarsh common yellowthroat has no federal regulatory status; however, the species is designated as a Bird of Conservation Concern by USFWS (California Department of Fish and Wildlife 2020a:67).

13B.86.2 Range and Distribution within the Study Area

The saltmarsh common yellowthroat is endemic to California; its primary range is within the San Francisco Bay region, with its eastern limits reaching to Alameda County and Suisun Bay. The four main areas of the species' current range include coastal riparian and wetland areas of western Marin and San Mateo Counties, and the tidal marsh systems of San Pablo Bay and southern San Francisco Bay. Some birds winter along the coast south to San Diego County (Grinnell and Miller 1944:413; Gardali and Evens 2008:346–347).

Saltmarsh common yellowthroat nesting and foraging habitat occurs in the wetlands and adjacent upland vegetation in the western portion of the study area. The CNDDB reports four occurrences within the study area: two on lower Sherman Island (Kimball Island), and two on Browns Island (California Department of Fish and Wildlife 2020b).

13B.86.3 Habitat Requirements

Breeding habitat primarily consists of emergent wetland, but occasionally riparian and grassland habitats will be used (Green 2008). Saltmarsh common yellowthroats primarily occupy brackish marsh, but are also found in riparian woodland/swamp, freshwater marsh, salt marsh, and uplands (Gardali and Evens 2008:348). Nests are typically placed on the ground or within 3 inches of the ground (Green 2008). Nests are well-concealed in dense vegetation, such as poison hemlock, cattails, tules, and some shrubs (Gardali and Evens 2008:348). Saltmarsh common yellowthroats feed mainly on insects and spiders, foraging on the ground and in low vegetation (Guzy and Ritchison 2020).

13B.86.4 Seasonal Patterns

Saltmarsh common yellowthroats occurs year-round in its breeding range (Grinnell and Miller 1944:413; Gardali and Evens 2008:347). Breeding occurs from mid-March to late July (Gardali and Evens 2008:347).

13B.86.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.86.5.1 GIS Model Data Sources

The saltmarsh common yellowthroat model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018)
- DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographic Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)

13B.86.5.2 Habitat Model Description

Modeled saltmarsh common yellowthroat nesting and foraging habitat includes tidal brackish and tidal freshwater emergent wetlands regardless of patch size or density. Modeled habitat also includes an upland component which consists of alkaline seasonal wetland, grassland, riparian, and vernal pool complex land cover within 600 feet of emergent wetlands (distance is based on the use of upland habitat by similar wetland passerines [Walton 1975:6]). The extent of modeled habitat in the study area is depicted in Figure 13B.86-1.

13B.86.5.2.1 Geographic Limits

Saltmarsh common yellowthroat habitat in the study area is geographically constrained to the Delta west of Sherman Island using a GIS constraint layer (Figure 13B.86-1). Saltmarsh common yellowthroat occurrences have been recorded as far east as Kimball Island in the western Delta (California Department of Fish and Wildlife 2020b) although the identity of the subspecies is unconfirmed (Gardali and Evens 2008:348).

13B.86.5.2.2 Additional Model Parameters

Modeled nesting and foraging habitat includes the following landcover types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographic Information Center 2018) layers.

- Tidal brackish emergent wetland
  - Arid west freshwater emergent marsh
  - *Atriplex lentiformis*
  - *Bolboschoenus maritimus*
  - *Cynodon dactylon*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group

  - *Sarcocornia pacifica (Salicornia depressa)*
  - *Schoenoplectus (acutus, californicus)*
  - Southwestern North American salt basin and high marsh group
  - Temperate Pacific tidal salt and brackish meadow
  - *Typha (angustifolia, domingensis, latifolia)*
- Tidal freshwater emergent wetland
  - Arid west freshwater emergent marsh
  - *Carex barbarae*
  - *Cynodon dactylon*
  - Freshwater emergent wetland
  - *Juncus arcticus (var. balticus, mexicanus)*
  - *Lepidium latifolium*
  - Naturalized warm-temperate riparian and wetland group
  - *Schoenoplectus (acutus, californicus)*
  - *Schoenoplectus americanus*
  - Tidal freshwater emergent wetland
  - *Typha (angustifolia, domingensis, latifolia)*

Saltmarsh common yellowthroat nesting and foraging habitat also consists of the following landcover types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019), Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018), and DCP Vernal Pool Complex (Witham et al. 2014; Chico State Research Foundation, Geographical Information Center 2019; California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layers if they are within 600 feet (Walton 1975) of tidal brackish emergent wetland or tidal freshwater wetland landcover types.

- Alkaline seasonal wetland
  - All types
- Grassland
  - All types
- Other seasonal wetlands
  - All types
- Valley/foothill riparian
  - *Baccharis pilularis*
  - *Cephalanthus occidentalis*

- *Cornus sericea*
- *Equisetum (arvense, variegatum, hyemale)*
- *Grindelia (camporum, stricta)*
- *Rosa californica*
- *Rubus armeniacus*
- *Salix exigua*
- *Salix gooddingii*
- *Salix laevigata*
- *Salix lasiolepis*
- *Salix lucida*
- Scrub shrub wetland
- Southwestern North American introduced riparian scrub
- Southwestern North American riparian/wash scrub

- Vernal pool complex
  - All types

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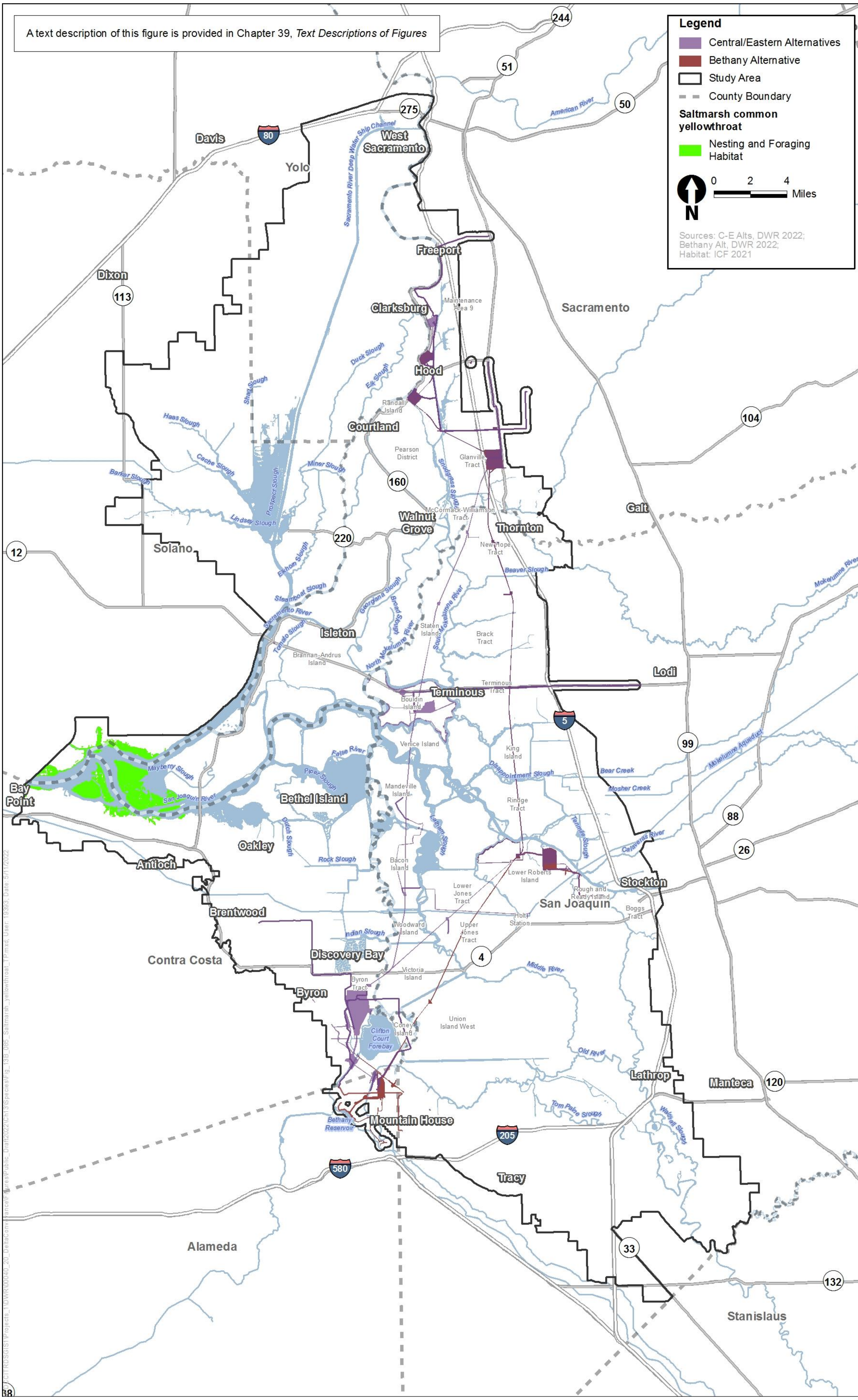

Figure 13B.86-1. Saltmarsh Common Yellowthroat Modeled Habitat in the Study Area

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13B.87 Yellow Warbler (*Setophaga petechia*)

13B.87.1 Legal Status

Yellow warbler is a California Species of Special Concern and a USFWS Bird of Conservation Concern (California Department of Fish and Wildlife 2020a:67).

13B.87.2 Range and Distribution within the Study Area

Yellow warbler was once a common breeder in the Central Valley (Grinnell and Miller 1944:398); however, the species is largely extirpated as a breeder in the Sacramento Valley, the Delta and San Joaquin Valley (Heath 2008:334). The species breeds widely in northeastern California, the Cascade Range, and Sierra Nevada, and breeds locally in northwestern California, the central and southern coasts, and the southern deserts (Heath 2008:333–335).

The yellow warbler is not known to breed in the study area and there are no CNDDB records of yellow warbler in the study area (California Department of Fish and Wildlife 2020b). There are records of the species throughout the Delta between May and August (eBird 2021), but it is likely that many of these individuals are migrants. Nesting territories have been recorded just south of the study area in the San Joaquin River National Wildlife Refuge (Dettling et al. 2012: 48–49). Potential nesting and foraging habitat, referred to as "recolonization habitat" is present throughout the study area in riparian scrub shrub primarily along large and small drainages.

13B.87.3 Habitat Requirements

Yellow warbler usually breeds in riparian woodlands with cottonwoods, willows, alders, and other small trees and shrubs, but will also breed in montane chaparral, open ponderosa pine, and mixed conifer habitats. The species is typically found in open to medium-density forests and woodlands with a dense shrubby understory. Nests are placed in saplings or shrubs 2 to 16 feet above the ground. Yellow warbler feeds primarily on insects and spiders, and conifers are avoided for foraging, with the species preferring the upper canopy of deciduous trees and shrubs (Grinnell and Miller 1944:400; Green 2008).

13B.87.4 Seasonal Patterns

In California, yellow warbler is typically found as a summer resident from April through October. The species migrates south to Central and South America to winter; however, small numbers winter in lowlands in the Imperial and Colorado River Valleys. Breeding occurs from mid-April to early August, peaking in June (Green 2008; Heath 2008:333).

13B.87.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.87.5.1 GIS Model Data Sources

The yellow warbler recolonization habitat model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

13B.87.5.2 Habitat Model Description

Because the species is not known to nest in the study area, the yellow warbler model identifies recolonization habitat, which includes the valley/foothill riparian vegetation types listed below. Yellow warbler typically nest in early successional riparian vegetation or regenerating canopy species stands (Riparian Habitat Joint Venture 2004:46); therefore, the model includes all willow-dominated vegetation types in addition to other riparian habitats that may consist of a dense shrub layer. The model does not distinguish habitat value according to overstory composition, density, structure, or patch size. Therefore, it may overestimate the extent of suitable riparian habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.87-1.

13B.87.5.2.1 Geographic Limits

Yellow warbler is not known to breed in the study area; however, over the last decade, observations have been reported in the Delta during the breeding season and breeding territories and successful nesting have been reported just south of the study area (refer to Section 13B.87.2, *Range and Distribution within the Study Area*, for additional details). Because there are so few occurrences in or around the Delta from which to confidently determine a range within the Delta, the entire study area is assumed to have potential to provide recolonization habitat.

13B.87.5.2.2 Additional Model Parameters

Modeled recolonization habitat includes the following landcover types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018) layers.

- Valley/foothill riparian
  - *Salix gooddinggii*
  - *Salix lasiolepis*
  - *Vitis californica*
  - *Salix exigua*

  - *Salix lucida*
  - *Populus fremontii*
  - *Alnus rhombifolia*
  - *Fraxinus latifolia*
  - *Acer negundo*
  - *Juglans hindsii* and hybrids
  - *Baccharis pilularis*
  - *Rosa californica*
  - *Cornus sericea*
  - *Quercus agrifolia*
  - *Quercus wislizeni* (tree)
  - *Quercus lobata*
  - *Rubus armeniacus*
  - *Sambucus nigra*
  - *Platanus racemosa*
  - *Salix laevigata*
  - *Cephalanthus occidentalis*
  - Californian broadleaf forest and woodland group
  - Southwestern North American riparian evergreen and deciduous woodland
  - Vancouverian riparian deciduous forest alliance
  - Southwestern North American introduced riparian scrub
  - Southwestern North American riparian/wash scrub

Modeled recolonization habitat also includes the following landcover types from the DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020, California Department of Water Resources 2021) layer.

- Valley/foothill riparian
  - Forested wetland
  - Shrub scrub wetland

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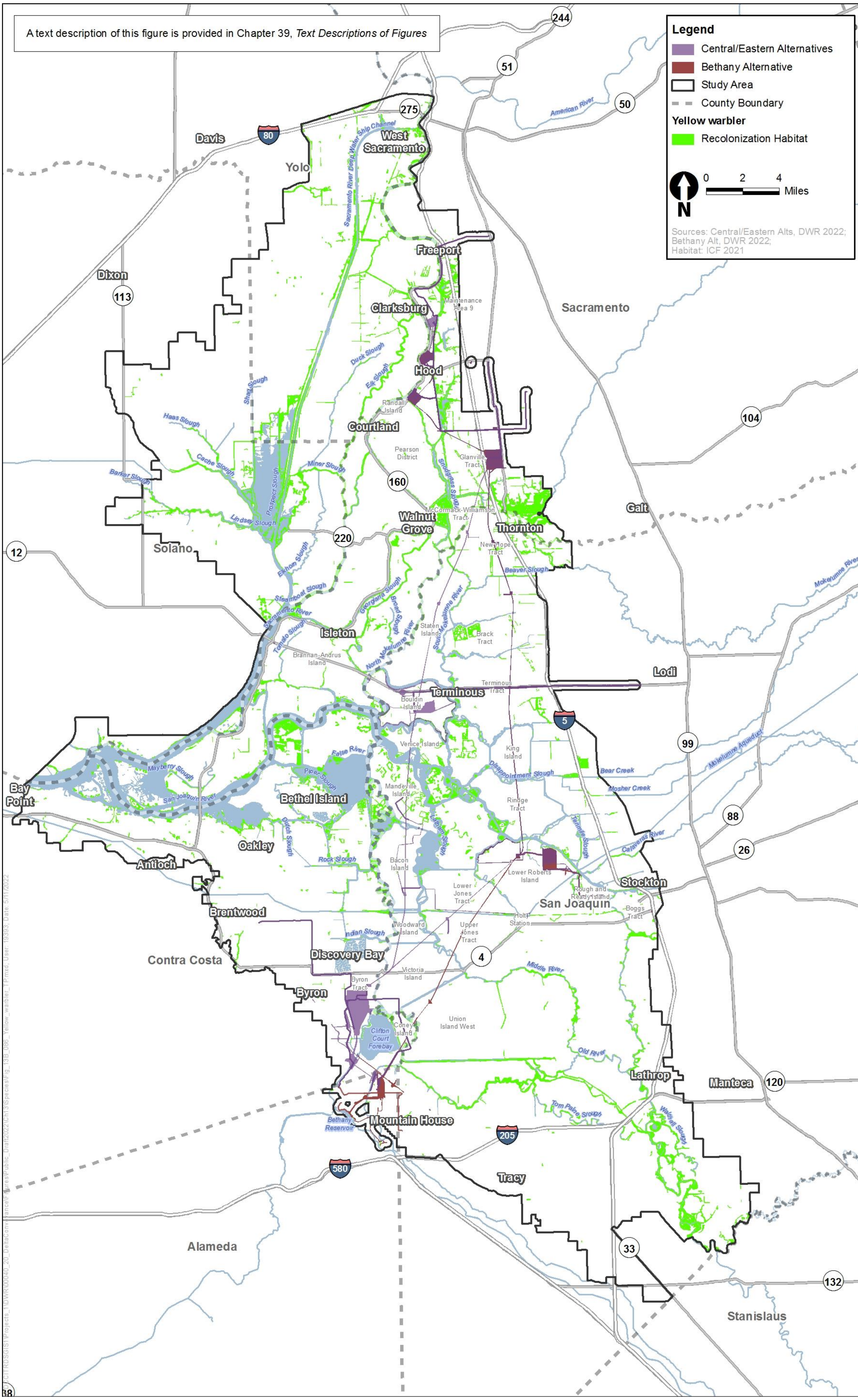

1
2 **Figure 13B.87-1. Yellow Warbler Modeled Habitat in the Study Area**

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13B.88 Pallid Bat (*Antrozous pallidus*)

13B.88.1 Legal Status

Pallid bat is identified as a CDFW species of special concern and by the Western Bat Working Group (WBWG) as a high priority species (California Department of Fish and Wildlife 2020a:70). The species has no federal status.

13B.88.2 Range and Distribution within the Study Area

Pallid bat occurs throughout California except for in the high Sierra Nevada from Shasta to Kern counties (Szewczak and Pierson 1997).

Pallid bat has a potential to occur throughout the study area where suitable habitat exists. There are no CNDDB occurrences of pallid bat in the study area (California Department of Fish and Wildlife 2020b).

13B.88.3 Habitat Requirements

Habitat includes grasslands, shrublands, woodlands, and forests from sea level up through mixed conifer forests (Harris 1984:70). The species is most common in open, dry habitats with rocky areas for roosting (Harris 1984:70). Pallid bat typically roosts in caves, crevices, mines, and occasionally in hollow trees and buildings (Harris 1984:70). Pallid bats are also known to roost in exfoliating bark on pines, valley oaks (*Quercus lobata*), and in riparian trees and bridges (Rambaldini 2005). The species forages on a variety of insets and arachnids over open ground, usually 2-8 feet above ground level (Harris 1984:70).

13B.88.4 Seasonal Patterns

Mating occurs from late October to February, and young are born from April to July (Harris 1984:70). Young are usually weaned by August and maternity colonies disperse between August and October (Rambaldini 2005). Winter habits are poorly known, but this species apparently does not migrate long distances between summer and winter sites (Rambaldini 2005).

13B.88.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.88.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)

- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographic Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.88.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.88-1.

13B.88.5.2.1 Geographic Limits

Entire study area.

13B.88.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types
- Agriculture

  - All types
- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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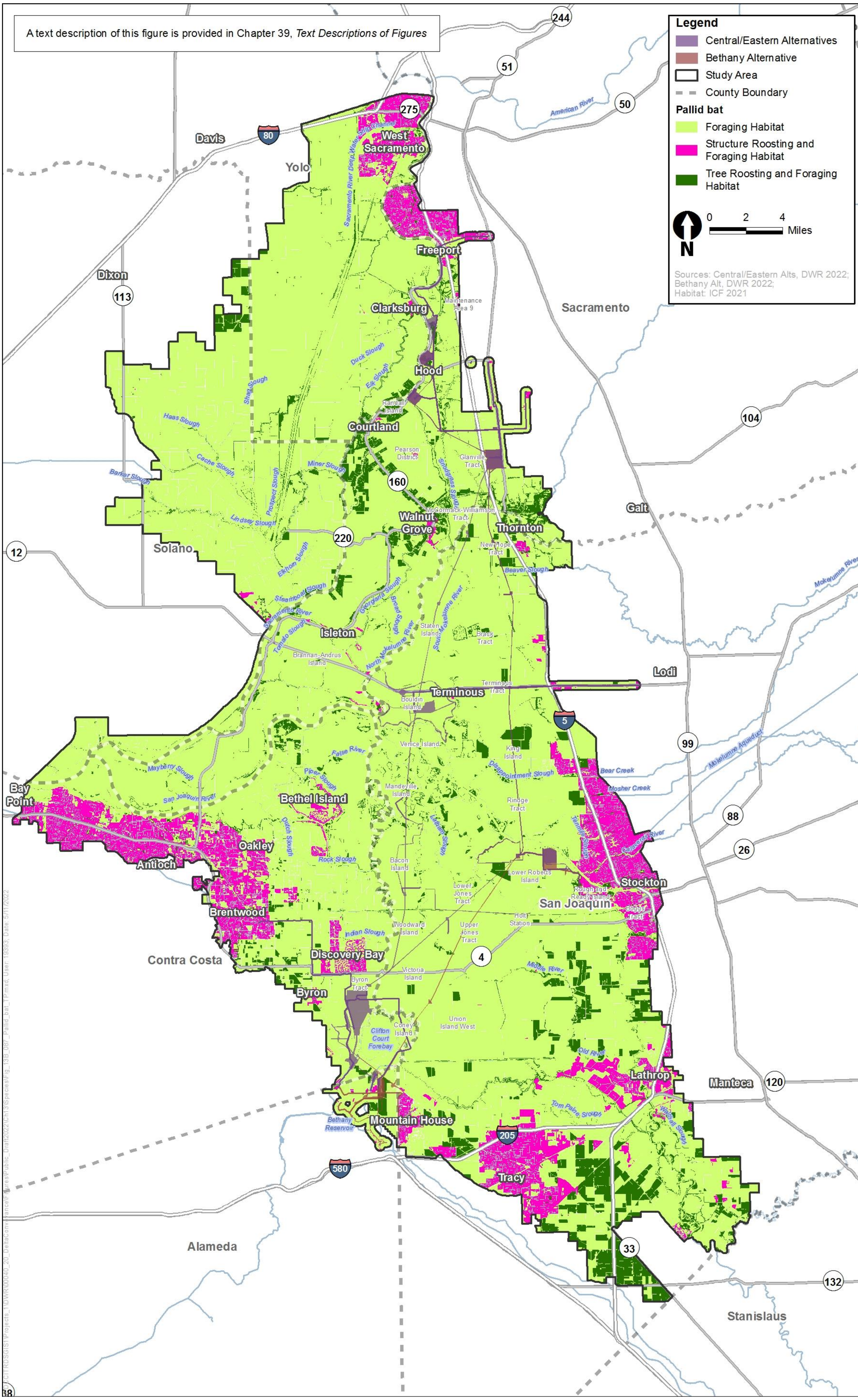

1 Figure 13B.88-1. Pallid Bat Modeled Habitat in the Study Area

13B.89 Townsend's Big-Eared Bat (*Corynorhinus townsendii*)

13B.89.1 Legal Status

Townsend's big-eared bat is identified as a CDFW Species of Special Concern and by the WBWG as a high priority species (California Department of Fish and Wildlife 2020a:70). The species has no federal status.

13B.89.2 Range and Distribution within the Study Area

Townsend's big-eared bat is found throughout California except for the high Sierra (Szewczak and Pierson 1997). A recent study that assessed the current distribution of Townsend's big-eared bat within California found maternity and winter roosts throughout California (Harris et al. 2019:101–102).

Townsend's big-eared bat has a potential to occur throughout the study area where suitable habitat exists. There are no CNDDB occurrences of Townsend's big-eared bat in the study area (California Department of Fish and Wildlife 2020b).

13B.89.3 Habitat Requirements

This species requires caves, mines, tunnels, buildings, or other human-made structures for roosting, and may use separate sites for night, day, hibernation, or maternity roosts (Harris 1984:68). Forages in flight or by gleaning prey from foliage, feeding primarily on small moths but also feeds on beetles and a variety of soft-bodied insects (Harris 1984:68). The species is extremely sensitive to disturbance of roosting site (Harris 1984:68) so not likely to roost in structures with a lot of human disturbance.

13B.89.4 Seasonal Patterns

Maternity colonies form between March and June and break up beginning in August (Piaggio 2005; Harris 1984:68). Most mating occurs from October to February (Piaggio 2005). Hibernation generally occurs from October to April (Harris 1984:68).

13B.89.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.89.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.89.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.89-1.

13B.89.5.2.1 Geographic Limits

Entire study area.

13B.89.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types

- Agriculture
  - All types
- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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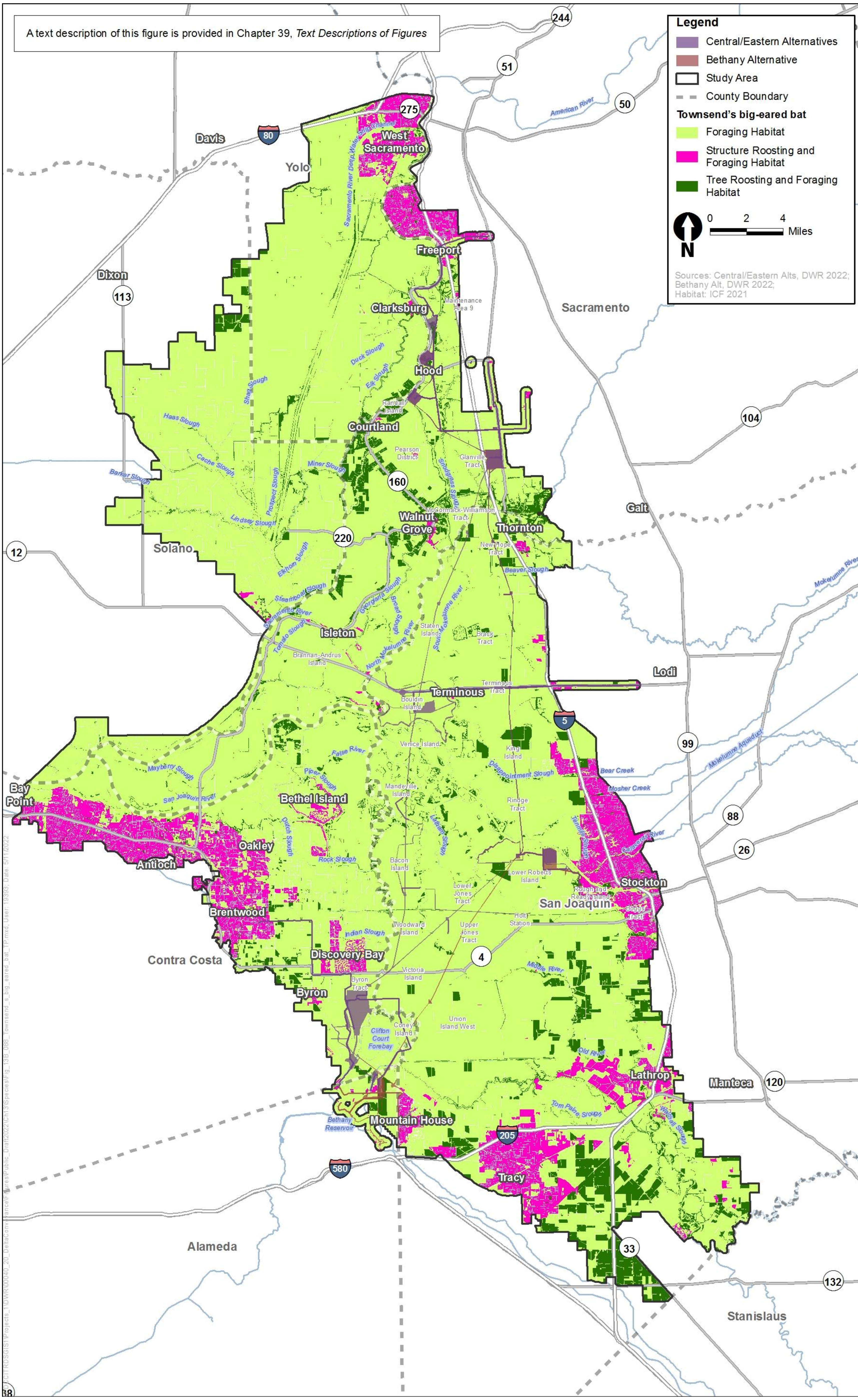

Figure 13B.89-1. Townsend's Big-Eared Bat Modeled Habitat in the Study Area

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13B.90 Big Brown Bat (*Eptesicus fuscus*)

13B.90.1 Legal Status

Big brown bat is identified by the WBWG as low priority (Western Bat Working Group 1998). The species has no formal state or federal status.

13B.90.2 Range and Distribution within the Study Area

Big brown bat occurs throughout California (Rainey 2000).

The species range overlaps with the entire study area. There are no CNDDB occurrences for big brown bat in the study area (California Department of Fish and Wildlife 2020).

13B.90.3 Habitat Requirements

Big brown bat is known to roost in variety of anthropomorphic structures, which include buildings, mines, and bridges, and to a lesser extent in trees (Harris 1984). They are also found in caves, crevices in cliff faces, and large-diameter snags (Perkins 1998). Forages over open habitats among scattered trees and in residential areas at a about 20-30 feet above the ground, feeding on a variety of insects (Harris 1984).

13B.90.4 Seasonal Patterns

Big brown bats mate in late fall before hibernation. Implantation is delayed until spring, and they give birth in late May or early June (Harris 1984). Maternal colonies may persist into August (Harris 1984).

13B.90.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.90.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.90.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.90-1.

13B.90.5.2.1 Geographic Limits

Entire study area.

13B.90.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
    - All types
- Agriculture
    - Orchard
        - All types

Structure Roosting

- Developed
    - Urban

Foraging

- Valley/foothill riparian
    - All types
- Agriculture
    - All types
- Developed
    - All types
- Grasslands

- All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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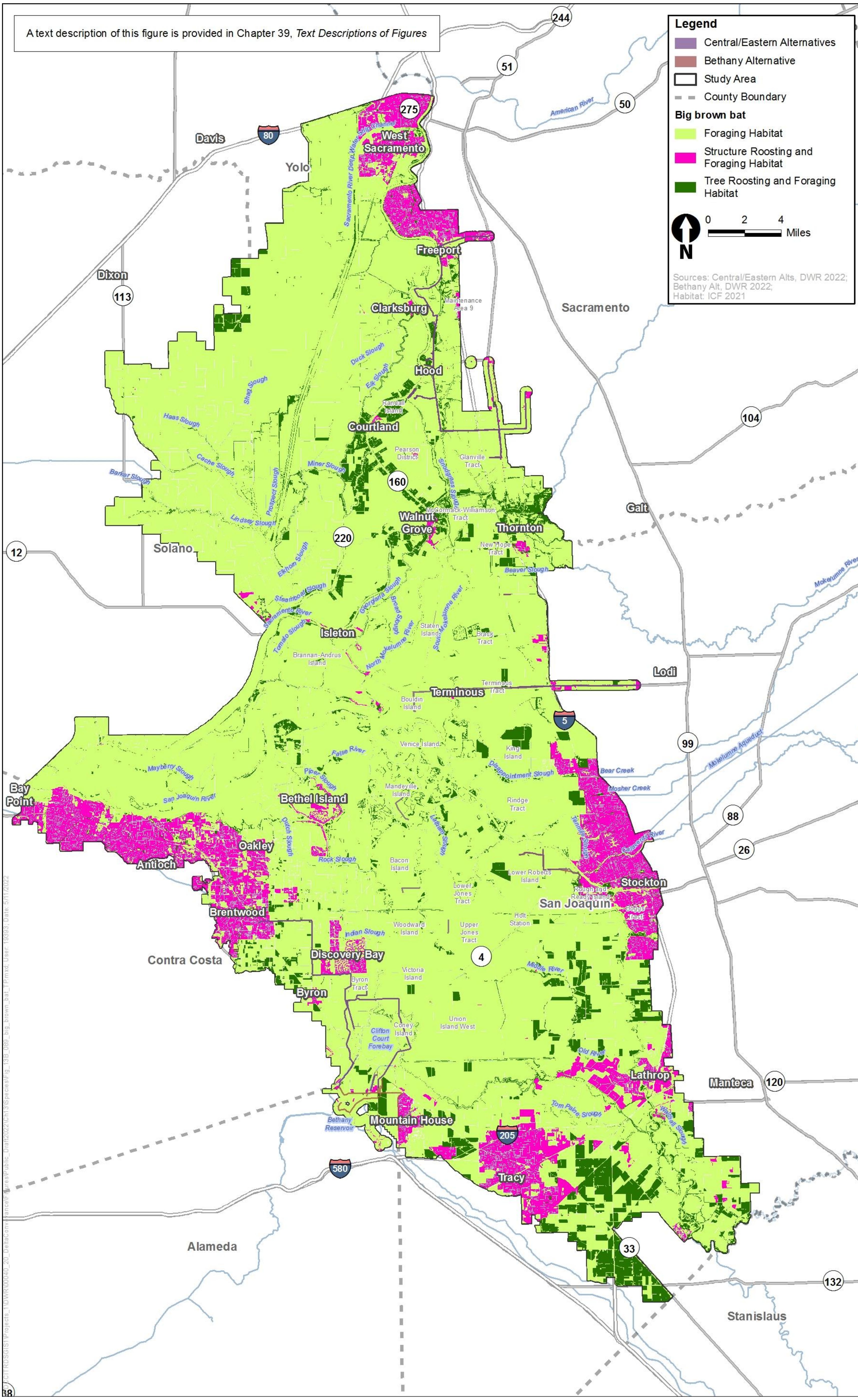

Figure 13B.90-1. Big Brown Bat Modeled Habitat in the Study Area

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13B.91 Silver-Haired Bat (*Lasionycteris noctivagans*)

13B.91.1 Legal Status

Silver-haired bat is identified by the WBWG as moderate priority species and has a NatureServe ranking of G5S3/S4 (California Department of Fish and Wildlife 2020a:70). The species has no formal federal status.

13B.91.2 Range and Distribution within the Study Area

The distribution of silver-haired bat includes coastal and montane forests from the Oregon border south along the coast to San Francisco Bay, and along the Sierra Nevada and Great Basin region to Inyo County. It also occurs in southern California from Ventura and San Bernardino Counties south to Mexico and on some of the Channel Islands. This species is also recorded in Sacramento, Stanislaus, Monterey and Yolo Counties. There are only a few scattered breeding locations known in the San Francisco Bay Area, Central Valley, or central coast (California Department of Fish and Wildlife 2005).

The species range does not technically overlap with the study area (Rainey 2000); however, there are isolated observations in the CNDDB to the west in the Bay Area and just to the north in Davis (California Department of Fish and Wildlife 2020b).

13B.91.3 Habitat Requirements

Silver-haired bat typically roosts in tree cavities, crevices and under loose bark. They may also use leaf litter, buildings, mines and caves. Breeding occurs in coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley/foothill and montane riparian habitats, and may occur in any habitat during migration (California Department of Fish and Wildlife 2005). The species forages less than 20 feet above the ground over forest streams, ponds, and open brushy areas (California Department of Fish and Wildlife 2005).

13B.91.4 Seasonal Patterns

Mating begins in late August, with delayed fertilization until spring, and young are born from May to July (California Department of Fish and Wildlife 2005).

13B.91.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.91.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.91.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.91-1.

13B.91.5.2.1 Geographic Limits

Entire study area.

13B.91.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types

- Agriculture
  - All types
- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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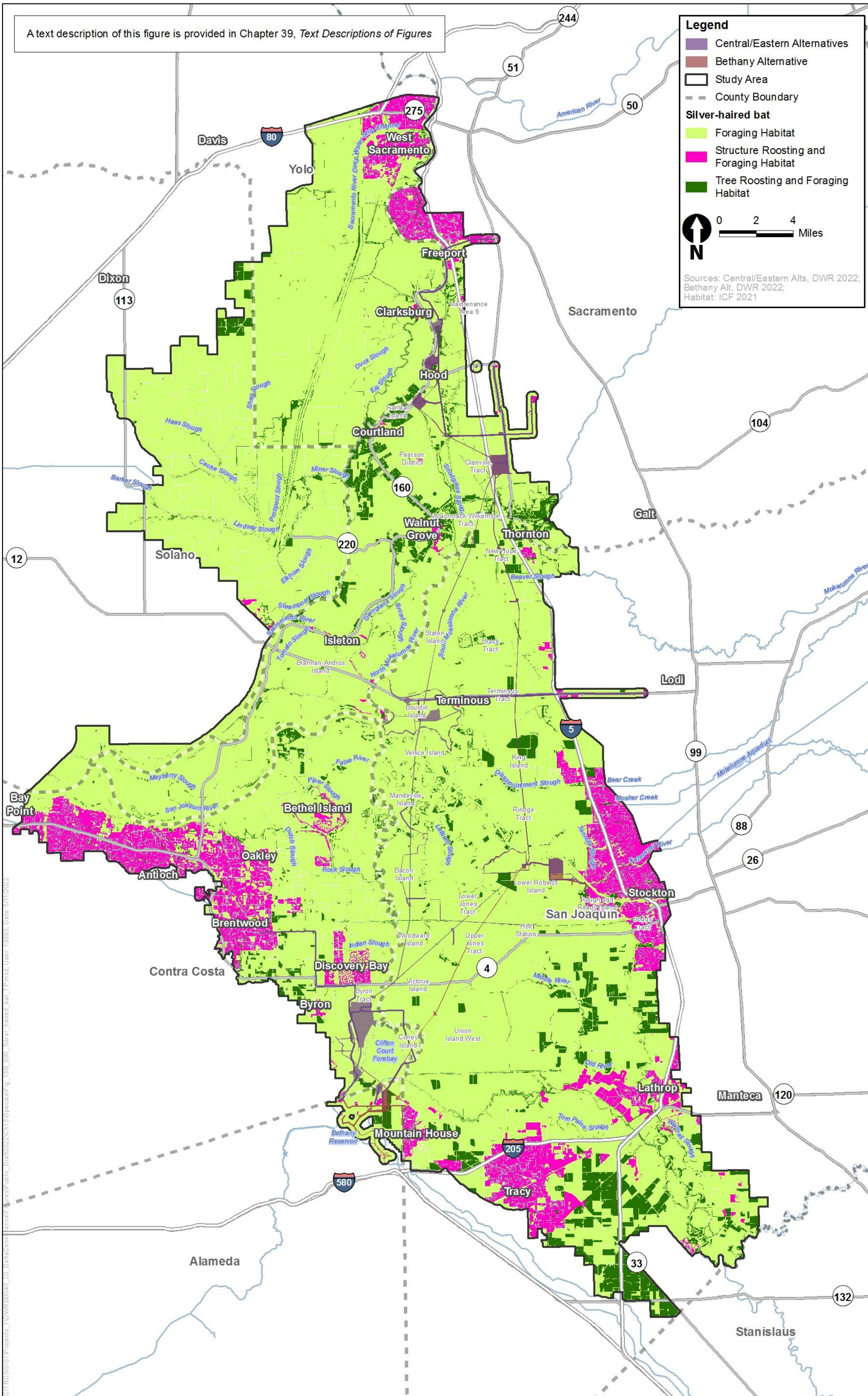

Figure 13B.91-1. Silver-Haired Bat Modeled Habitat in the Study Area

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13B.92 Western Red Bat (*Lasiurus blossevillii*)

13B.92.1 Legal Status

Western red bat is identified as a CDFW Species of Special Concern and by the WBWG as a high priority species (California Department of Fish and Wildlife 2020a:71). The species has no federal status.

13B.92.2 Range and Distribution within the Study Area

Western red bat is locally common in some areas of California, occurring from Shasta County to the Mexico border, west of the Sierra Nevada/Cascade crest and deserts. Their winter range includes western lowlands and coastal regions south of San Francisco Bay. Short migrations occur between summer and winter ranges, and migrants may be found outside the normal range (Harris 1984:60).

Western red bat has the potential to occur throughout the study area where suitable habitat exists. There are five CNDDB occurrences of western red bat across the central and western portions of the study area (California Department of Fish and Wildlife 2020b).

13B.92.3 Habitat Requirements

Roosting habitat for western red bat includes forests and woodlands from sea level up through mixed conifer forests. Western red bat roosts primarily in trees (less often in shrubs), typically in edge habitats adjacent to streams, fields, or urban areas. The species prefers roost sites that are protected from above, open below, and located above dark ground-cover. They form nursery colonies, and family groups are known to roost together. Foraging habitat includes grasslands, shrublands, open woodlands and forests, and croplands (Harris 1984:60).

13B.92.4 Seasonal Patterns

Western red bat mating occurs in August and September, with delayed fertilization until the spring, and young are born from late May through early July (Harris 1984:60).

13B.92.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.92.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.92.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.92-1.

13B.92.5.2.1 Geographic Limits

The entire study area.

13B.92.5.2.2 Additional Model Parameters

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat.

13B.92.5.2.3 Geographic Limits

The entire study area.

13B.92.5.2.4 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types
- Agriculture
  - All types
- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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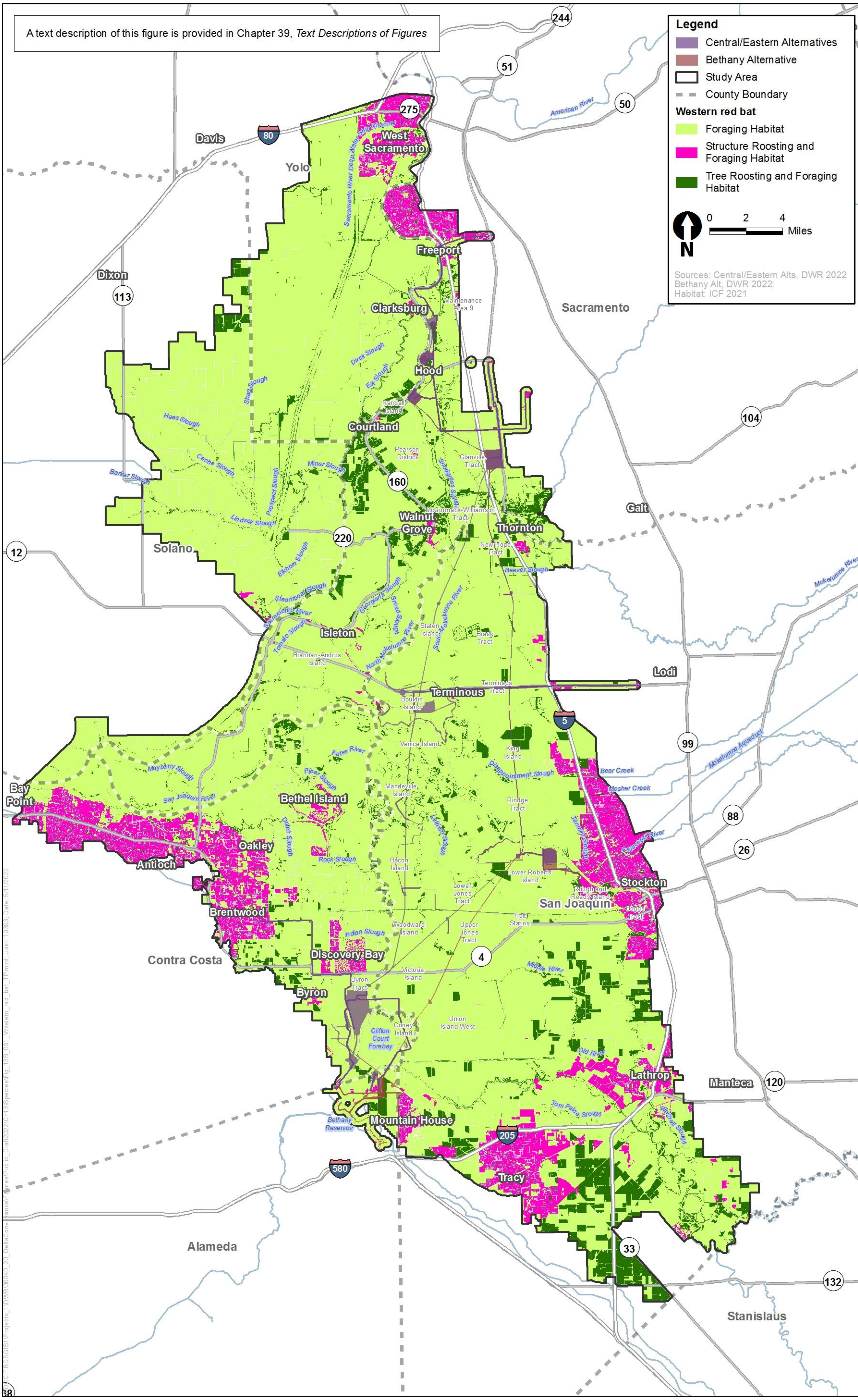

Figure 13B.92-1. Western Red Bat Modeled Habitat in the Study Area

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13B.93 Hoary Bat (*Lasiurus cinereus*)

13B.93.1 Legal Status

Hoary bat is identified by the WBWG as Moderate priority and has a NatureServe ranking of G5/S4 (California Department of Fish and Wildlife 2020a:71). The species has no federal status.

13B.93.2 Range and Distribution within the Study Area

This species is the most widespread North American bat and may be found nearly everywhere in California from sea level to 13,200 feet, although its distribution is patchy in southeastern deserts. It is a common, solitary species that winters along the coast and in southern California and breeds inland and north of the winter range (Harris 1984:62).

Hoary bat has a potential to occur throughout the study area where suitable habitat exists. There are two CNDDB occurrences of hoary bat on Brannan Island, in the west-central portion of the study area (California Department of Fish and Wildlife 2020b).

13B.93.3 Habitat Requirements

Hoary bat generally roosts in dense foliage of medium to large trees that are hidden from above, with few branches below, and have ground cover of low reflectivity. This species prefers open habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for foraging. Breeding habitat includes all woodlands and forests with medium to large-size trees and dense foliage (Harris 1984:62). Forages in open areas and habitat edges, feeding primarily on moths, although various flying insects are taken (Harris 1984:62).

13B.93.4 Seasonal Patterns

Hoary bats mate in the fall in their winter range, with fertilization delayed until the following spring. Young are born from mid-May through early July (Harris 1984:62).

13B.93.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.93.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)

- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.93.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.93-1.

13B.93.5.2.1 Geographic Limits

Entire study area.

13B.93.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
    - All types
- Agriculture
    - Orchard
        - All types

Structure Roosting

- Developed
    - Urban

Foraging

- Valley/foothill riparian
    - All types
- Agriculture
    - All types

- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All type

13B.93.6 References Cited

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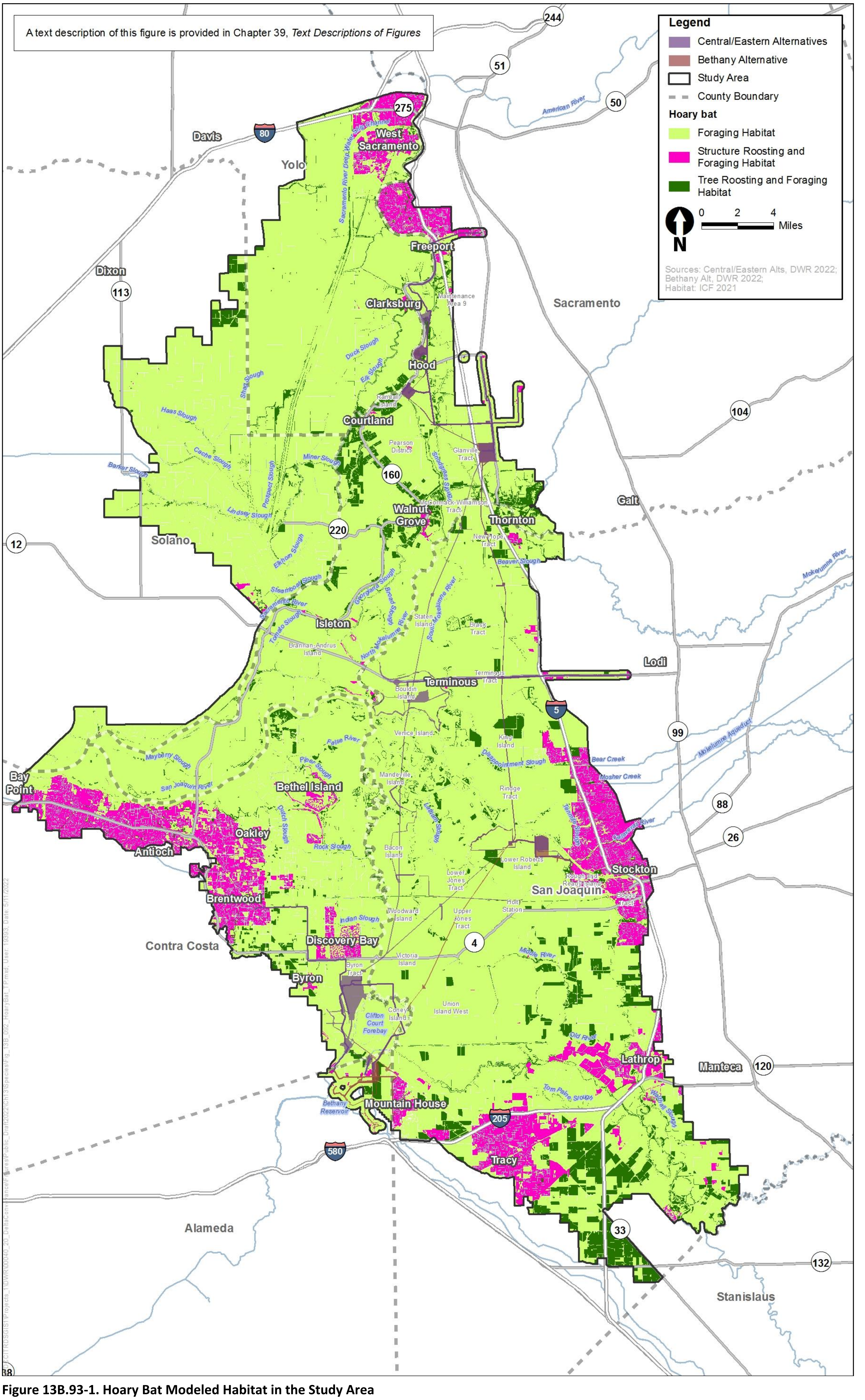

Figure 13B.93-1. Hoary Bat Modeled Habitat in the Study Area

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13B.94 California Myotis (*Myotis californicus*)

13B.94.1 Legal Status

California myotis is identified by the WBWG as low priority (Western Bat Working Group 1998). The species has no formal state or federal status.

13B.94.2 Range and Distribution within the Study Area

California myotis is commonly found throughout California, below 6,000 ft elevation (Harris 1984).

The species range overlaps with the entire study area. There are no CNDDB occurrences for California myotis in the study area (California Department of Fish and Wildlife 2020).

13B.94.3 Habitat Requirements

Habitat for California myotis includes desert, chaparral, woodland, and forest from sea level up through ponderosa pine, mixed conifer, and Jeffrey pine. California myotis roosts alone or in small groups in crevices and cavities in trees and rocks and will occasionally roost in human structures. Maternity colonies of up to 52 individuals have been documented in large snags and under tree bark. They forage over a variety of habitats, including arid habitats, open lands, forest canopies, forest margins, and water (Harris 1984).

13B.94.4 Seasonal Patterns

California myotis mate in the fall, with young born from May through July (Harris 1984).

13B.94.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.94.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)

- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographic Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.94.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.94-1.

13B.94.5.2.1 Geographic Limits

Entire study area.

13B.94.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types
- Agriculture
  - All types
- Developed
  - All types
- Grasslands

  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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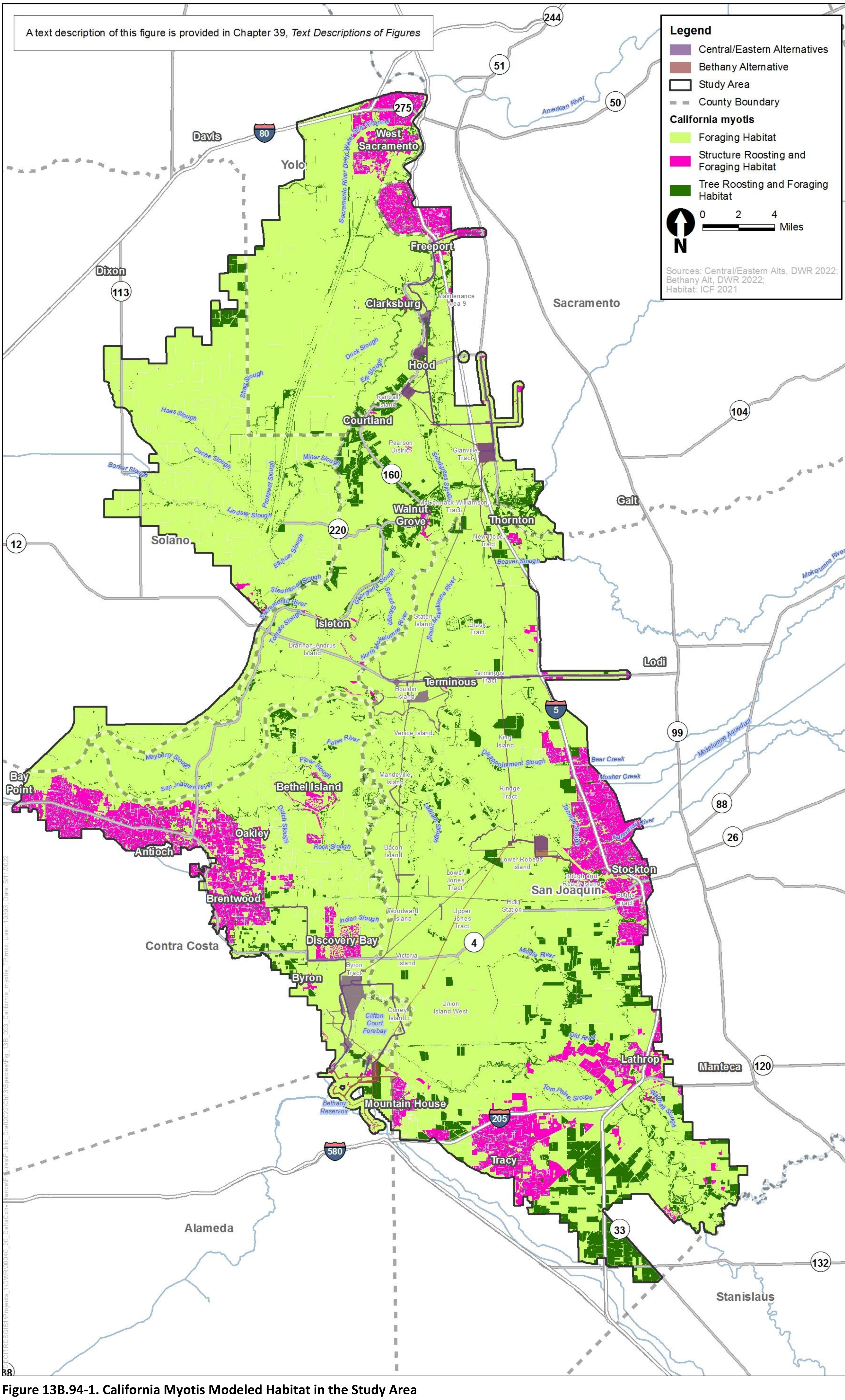

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2 **Figure 13B.94-1. California Myotis Modeled Habitat in the Study Area**

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13B.95 Little Brown Myotis (*Myotis lucifugus*)

13B.95.1 Legal Status

Little brown myotis has a NatureServe ranking of G3/S2S3 and is identified by the WBWG as moderate priority (California Department of Fish and Wildlife 2020a:71). The species has no formal federal status.

13B.95.2 Range and Distribution within the Study Area

Little brown myotis occurs in California from the Oregon border south along the coast to San Francisco Bay and along the Sierra Nevada/Cascades and Great Basin from the Oregon border to Kern County. An isolated population occurs in the San Bernardino Mountains (California Department of Fish and Wildlife 2005).

May potentially occur in the study area; however, its range is currently defined as to the west along the San Francisco Bay (Szewczak and Pierson 1997).

There are no CNDDB occurrences in the study area (California Department of Fish and Wildlife 2020).

13B.95.3 Habitat Requirements

Habitat for little brown myotis is most common in mid- to high-elevation forest and less common in valley foothill woodlands, redwood, mixed chaparral, sagebrush, coastal scrub, and grasslands. This species roosts in buildings, trees, under rocks or wood, and occasionally in caves (California Department of Fish and Wildlife 2005). Forages over water at margins of lakes, streams, and ponds, as well as along forest edges, feeding on small flying insects (California Department of Fish and Wildlife 2005).

13B.95.4 Seasonal Patterns

Little brown myotis makes fall latitudinal or elevational migrations to caves or mines of suitable temperature regime (above freezing with high humidity) for hibernation from September through November to March through May. Mating occurs in the fall, with fertilization delayed until the following spring. Young are born May to August (California Department of Fish and Wildlife 2005).

13B.95.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.95.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographic Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographic Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.95.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.95-1.

13B.95.5.2.1 Geographic Limits

Entire study area.

13B.95.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types

- Agriculture
  - All types
- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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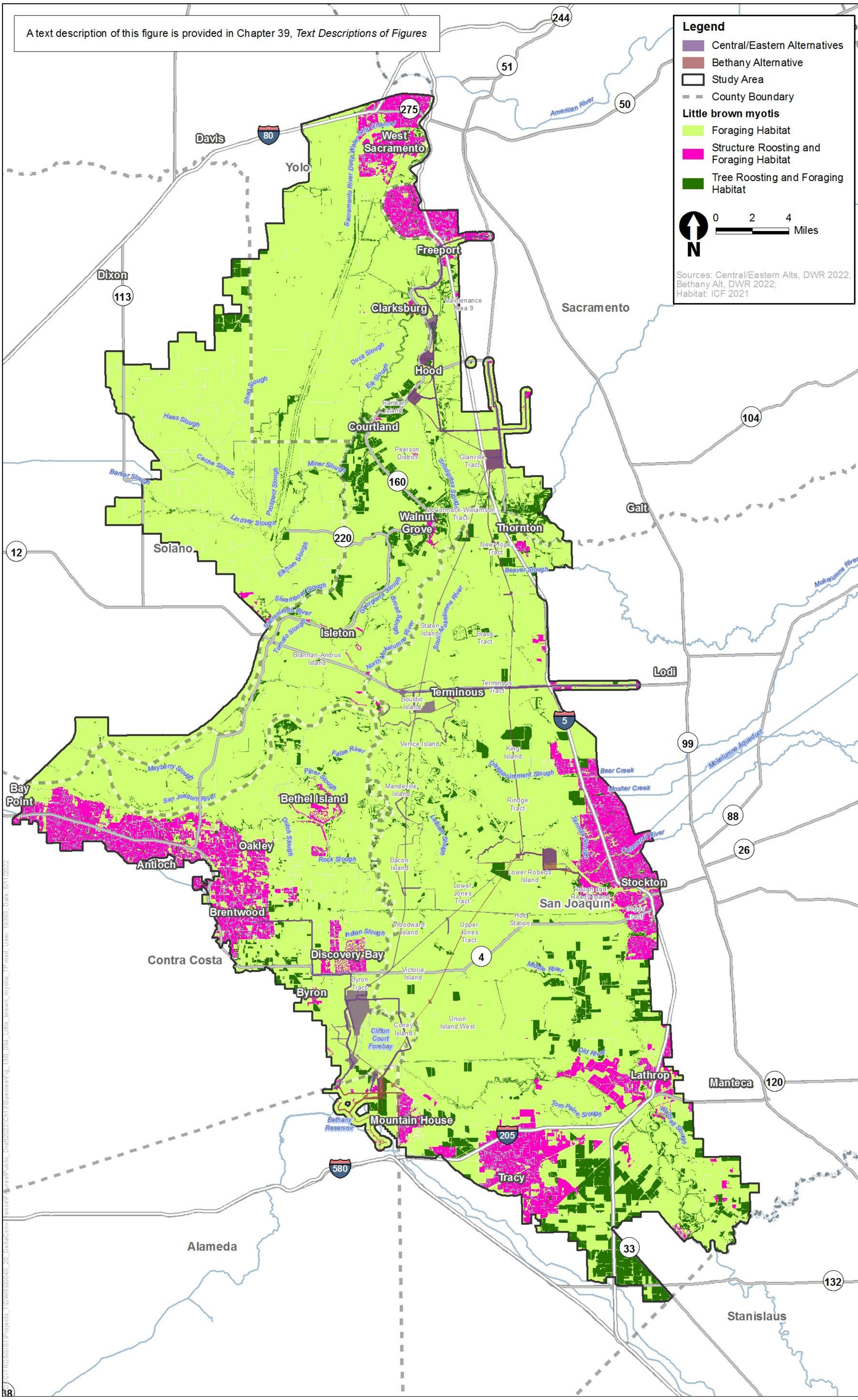

Figure 13B.95-1. Little Brown Myotis Modeled Habitat in the Study Area

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13B.96 Western Small-Footed Myotis (*Myotis ciliolabrum*)

13B.96.1 Legal Status

Western small-footed myotis is identified by the WBWG as moderate priority and has a NatureServe ranking of G5/S3 (California Department of Fish and Wildlife 2020a:71). The species has no formal federal status.

13B.96.2 Range and Distribution within the Study Area

This species occurs in coastal California from Contra Costa County south to the Mexico border, and on the west and east side of the Sierra Nevada, and in Great Basin and desert habitats from Modoc to Kern and San Bernardino Counties (Harris 1984).

The species range overlaps with the western portion of the study area in Contra Costa, Alameda, and San Joaquin Counties (Rainey 2000). There are no CNDDB occurrences for western small-footed myotis in the study area (California Department of Fish and Wildlife 2020b).

13B.96.3 Habitat Requirements

Primary habitat includes relatively arid wooded and brushy uplands near water, from sea level to 8,900 feet. Western small-footed myotis typically roosts in rock crevices, mines, caves, and occasionally in buildings, bridges, and other human structures. Forages among trees and water, feeding on a variety of small flying insects (Harris 1984).

13B.96.4 Seasonal Patterns

Mating occurs in the fall, and young are born from May through June with a peak in late May (Harris 1984).

13B.96.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.96.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets:

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)

- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.96.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.96-1.

13B.96.5.2.1 Geographic Limits

Entire study area.

13B.96.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types
- Agriculture
  - All types

- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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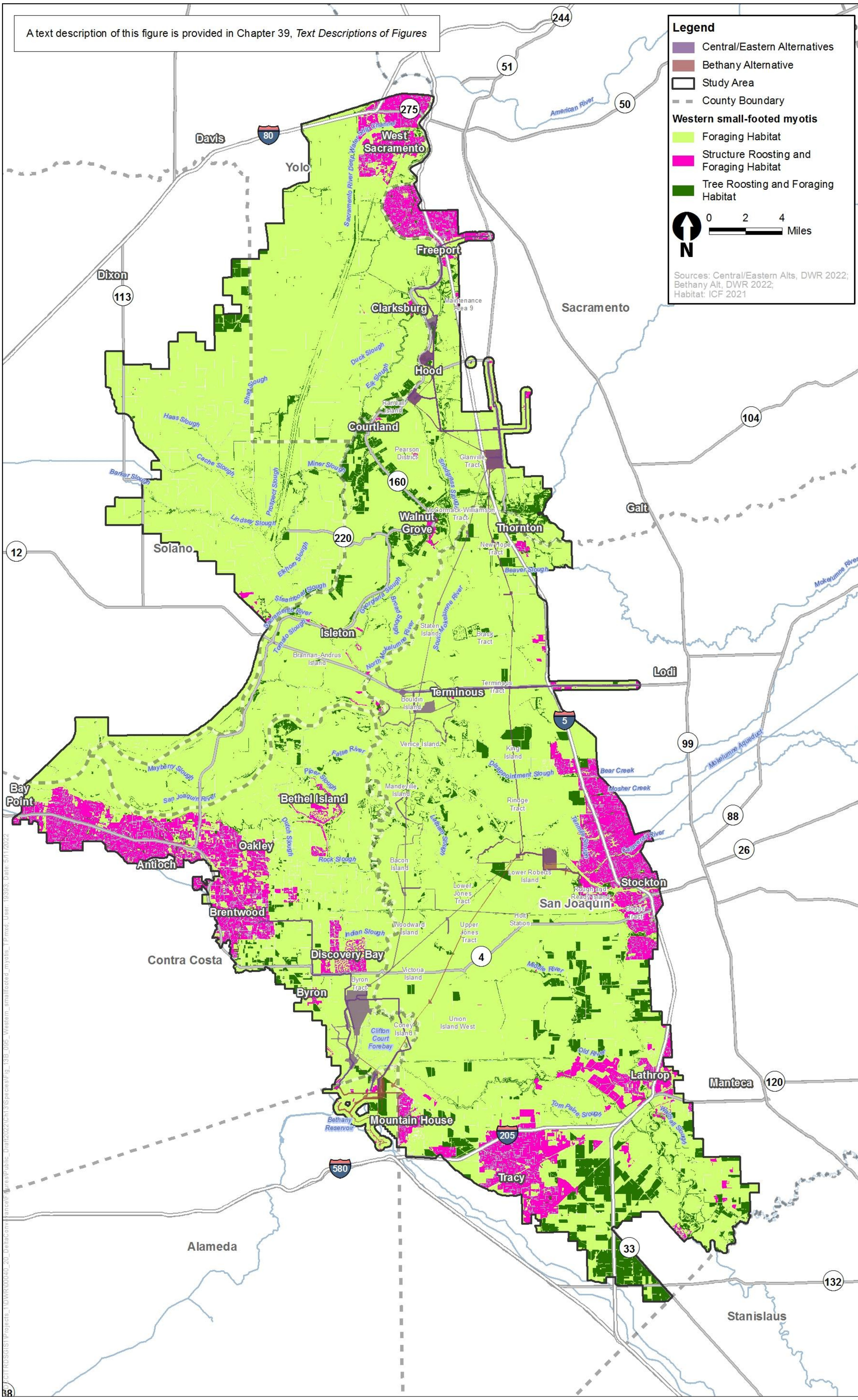

Figure 13B.96-1. Western Small-Footed Myotis Modeled Habitat in the Study Area

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13B.97 Yuma Myotis (*Myotis yumanensis*)

13B.97.1 Legal Status

Yuma myotis is identified by the WBWG as low to moderate priority and has a NatureServe ranking of G5/S4 (California Department of Fish and Wildlife 2020a:72). The species has no formal federal status.

13B.97.2 Range and Distribution within the Study Area

Yuma myotis is common and widespread throughout California from sea level to 11,000 feet (although uncommon above 8,000 feet), excluding the Mojave and Colorado Desert regions (Harris 1984).

The species range overlaps with entire study area (Rainey 2000). There are no CNDDB occurrences for Yuma myotis in the study area (California Department of Fish and Wildlife 2020b).

13B.97.3 Habitat Requirements

Yuma myotis habitat includes open forests and woodlands with water sources. The species roost in a variety of structures, including bridges, buildings, caves, mines, trees and rock crevices, and have been known to roost in cliff swallow nests. They typically forage low over water sources such as ponds, streams, and stock ponds, feeding on a wide variety of flying insects (Harris 1984).

13B.97.4 Seasonal Patterns

Yuma myotis mating occurs in the fall, and young are born late May to mid-June with a peak in early June (Harris 1984).

13B.97.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.97.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)

- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.97.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.97-1.

13B.97.5.2.1 Geographic Limits

Entire study area.

13B.97.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types
- Agriculture
  - All types
- Developed

  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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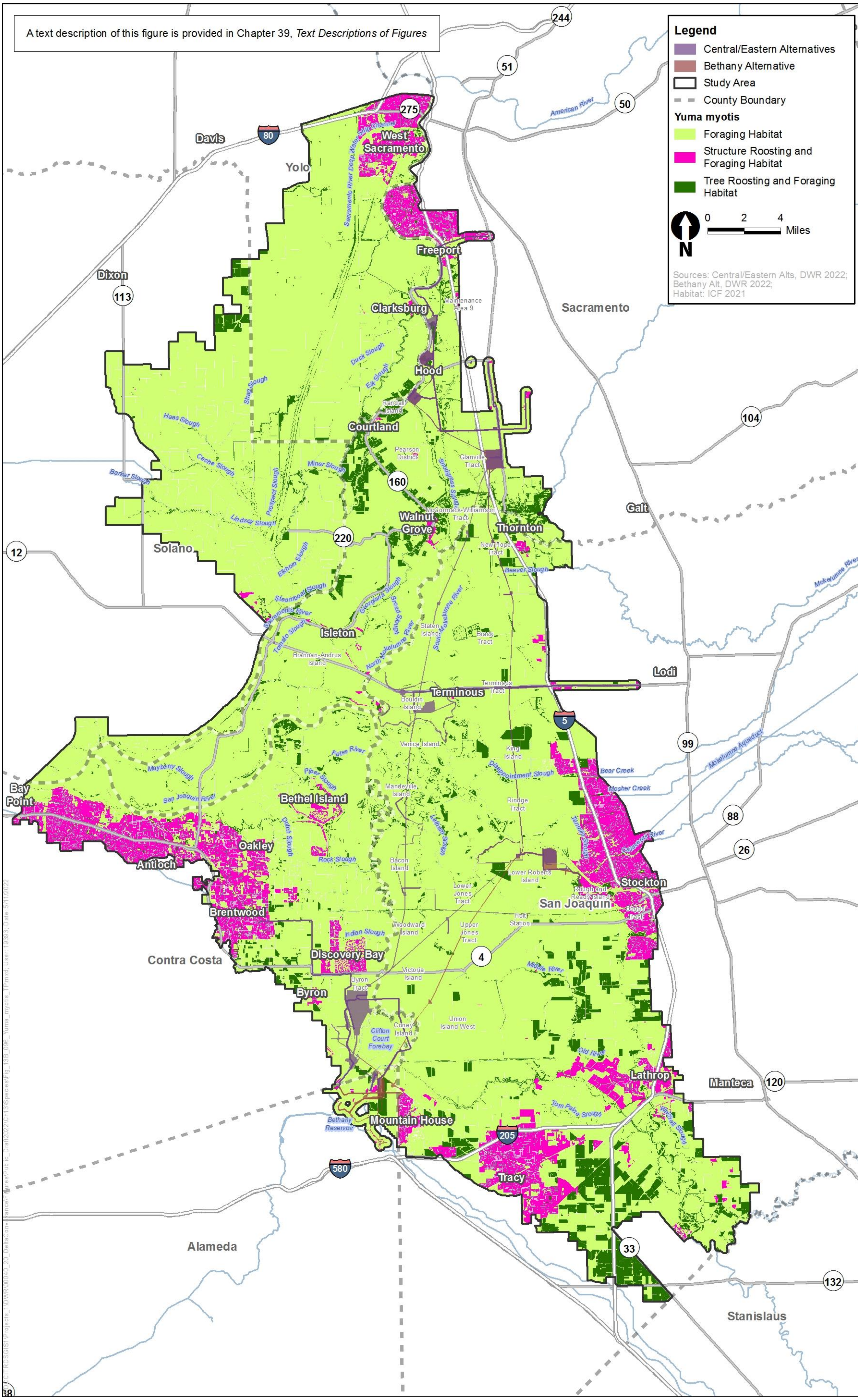

1
2 **Figure 13B.97-1. Yuma Myotis Modeled Habitat in the Study Area**

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13B.98 Western Pipistrelle (*Parastrellus hesperus*)

13B.98.1 Legal Status

Western pipistrelle is identified as a WBWG low priority species (Western Bat Working Group 1998). The species has no formal state or federal status.

13B.98.2 Range and Distribution within the Study Area

In California, western pipistrelle occur in the Central Valley, foothills, and Coast Ranges from Tehama County to Mexico, and in the deserts from Alpine County to Mexico. Scattered populations exist in eastern Modoc County, and Siskiyou, Lassen, and Trinity Counties (California Department of Fish and Wildlife 2005).

The species range overlaps with the entire study area (Rainey 2000). There are no CNDDB occurrences for western pipistrelle in the study area (California Department of Fish and Wildlife 2020).

13B.98.3 Habitat Requirements

Western pipistrelle are found in arid habitats and in lower elevation montane forests with significant rocky areas. Western pipistrelle typically roost in or under rocks, in crevices in cliffs, rocky slopes or scattered boulders (California Department of Fish and Wildlife 2005). Foraging occurs over water, rocky canyons, and along cliff faces, feeding on a wide variety of flying insects (California Department of Fish and Wildlife 2005).

13B.98.4 Seasonal Patterns

Western pipistrelle mating occurs in the fall, and young are born in June and July, with a peak in mid-June (California Department of Fish and Wildlife 2005).

13B.98.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.98.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)

- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.98.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.98-1.

13B.98.5.2.1 Geographic Limits

Entire study area.

13B.98.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types
- Agriculture
  - All types
- Developed

    - All types
- Grasslands
    - All types
- Tidal freshwater emergent marsh
    - All types
- Tidal brackish emergent marsh
    - All types
- Vernal pool complex
    - All types
- Alkaline seasonal wetland
    - All types
- Nontidal perennial freshwater emergent marsh
    - All types
- Nontidal perennial aquatic
    - All types
- Tidal perennial aquatic
    - All types

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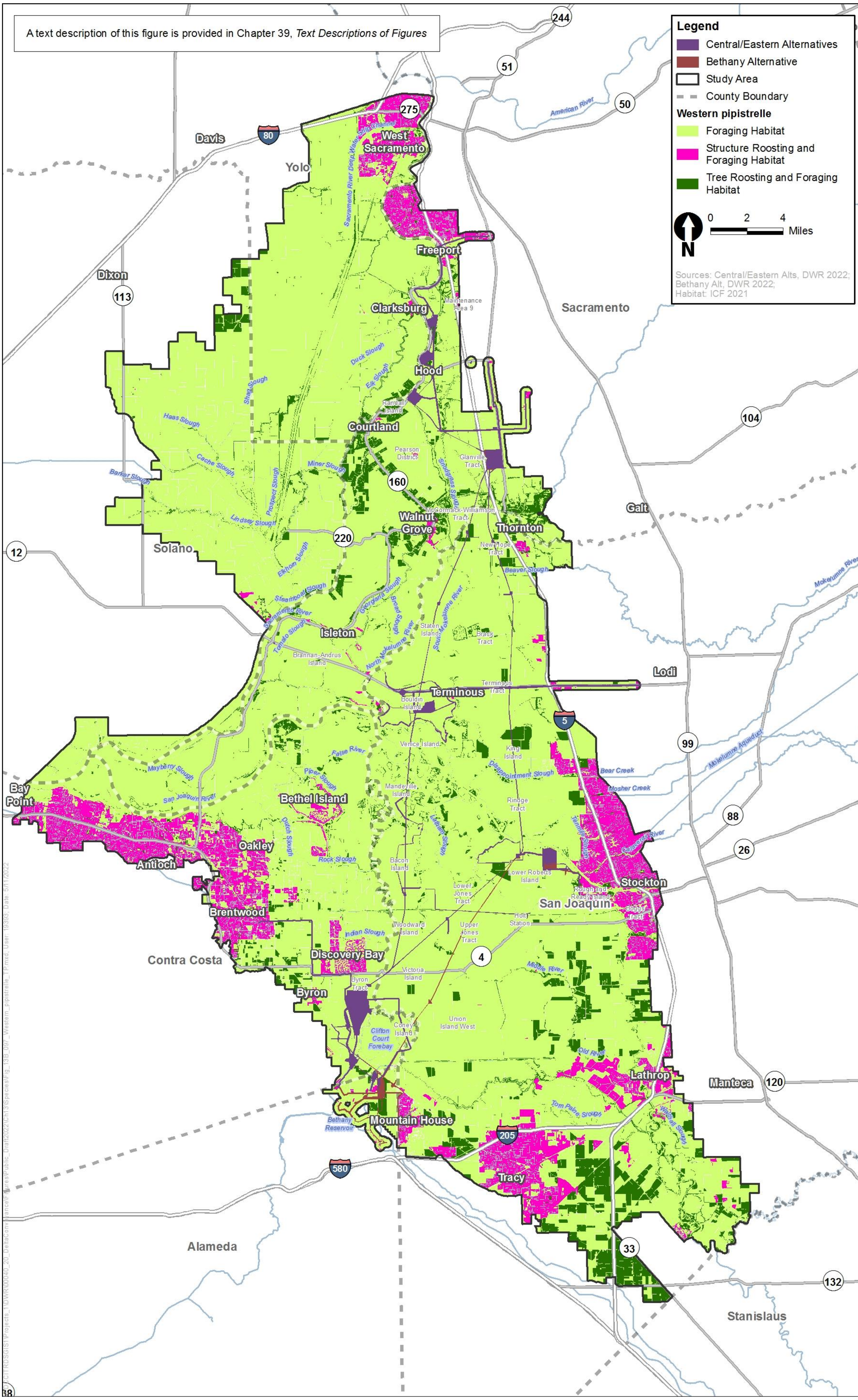

Figure 13B.98-1. Western Pipistrelle Modeled Habitat in the Study Area

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13B.99 Western Mastiff Bat (*Eumops perotis californicus*)

13B.99.1 Legal Status

Western mastiff bat are identified as a WBWG high priority species and a CDFW Species of Special Concern (California Department of Fish and Wildlife 2020a:72). The species has no formal federal status.

13B.99.2 Range and Distribution within the Study Area

Western mastiff bat are an uncommon resident in southeastern San Joaquin Valley and the Coastal Ranges specifically residing between Monterey County to southern California and from the California coast east to the Colorado Desert (Ahlborn 1990).

The species range overlaps with the western and eastern portions of the study area (Pierson 1997). There are no CNDDB occurrences in the study area (California Department of Fish and Wildlife 2020b).

13B.99.3 Habitat Requirements

Western mastiff bat occur in open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban. Roosting habitat includes crevices in vertical cliff faces, high buildings, trees and tunnels. They are highly mobile, with nocturnal foraging range exceeding 15 miles from roost sites (Ahlborn 1990). Foraging typically occurs from ground to tree level, though over rugged terrain will forage up to 195 feet above the ground, feeding primarily on hymenopterous insects (Ahlborn 1990).

13B.99.4 Seasonal Patterns

Mating occurs in early spring (March), and young are born from early April through August or September. From December to February, the species goes into daily torpor, resuming activity each night to feed, except when temperatures drop below 5 degrees Celsius (Ahlborn 1990).

13B.99.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.99.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets.

- Great Valley Vernal Pool Habitats (Witham et al. 2014)

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)
- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.99.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.99-1.

13B.99.5.2.1 Geographic Limits

Entire study area.

13B.99.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources.

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types

- Agriculture
  - All types
- Developed
  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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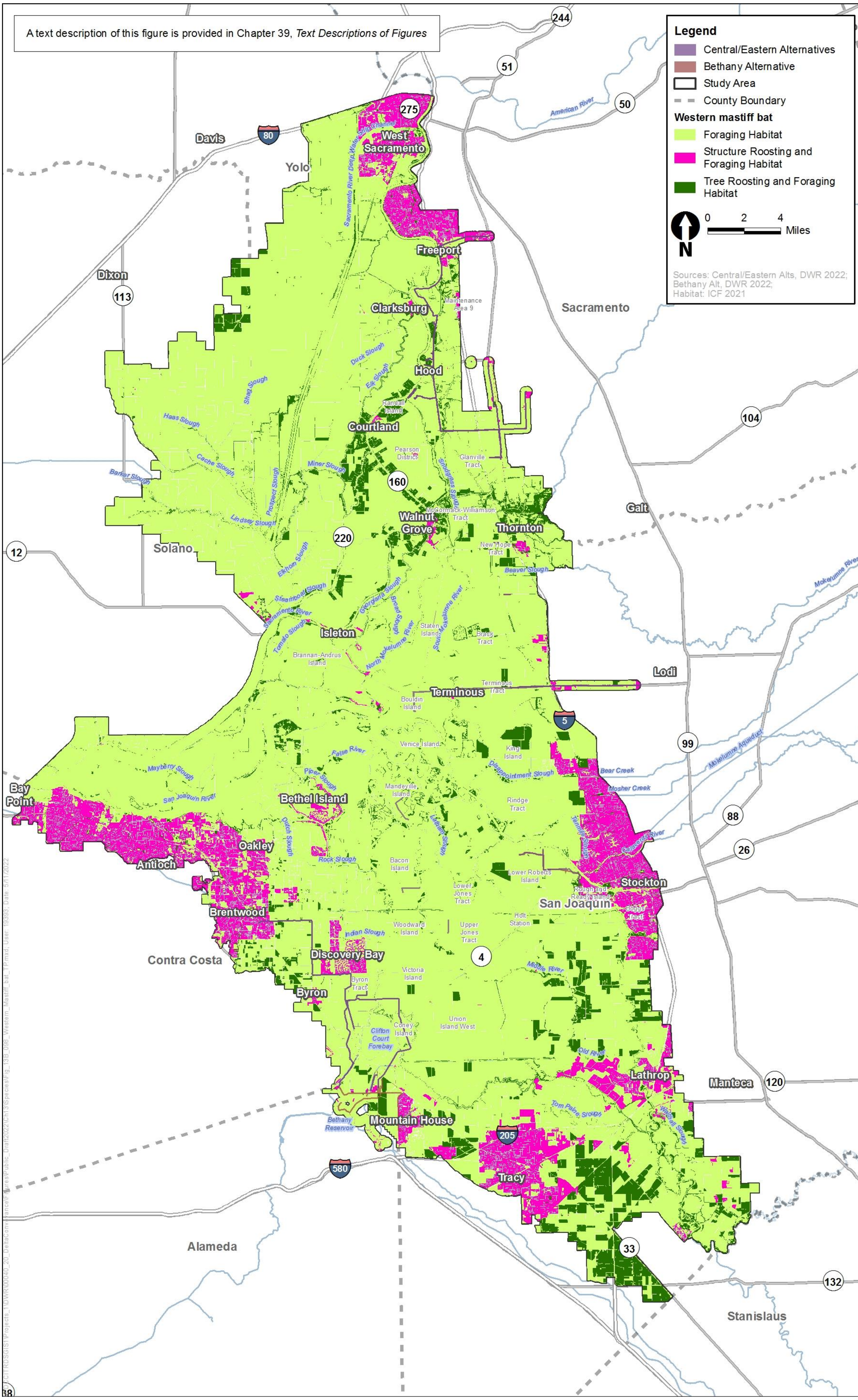

Figure 13B.99-1. Western Mastiff Bat Modeled Habitat in the Study Area

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13B.100 Mexican Free-Tailed Bat (*Tadarida brasiliensis*)

13B.100.1 Legal Status

Mexican free-tailed bat is identified by the WBWG as a low priority species (Western Bat Working Group 1998). The species has no formal state or federal status.

13B.100.2 Range and Distribution within the Study Area

Mexican free-tailed bat is common throughout California, although uncommon in high Sierra Nevada and the north coastal region (California Department of Fish and Wildlife 2005).

The species range overlaps with the entire study area (Rainey 2000). There are no CNDDB occurrences for Mexican free-tailed bat in the study area, but the species is fairly common in the region, and a large roost is known to occur in the Yolo Causeway (California Department of Fish and Wildlife 2020).

13B.100.3 Habitat Requirements

This species prefers open habitats such as woodlands, shrublands, and grasslands. Mexican free-tailed bat roosts in large colonies in bridges, buildings, caves, rock crevices, mines, and tunnels (California Department of Fish and Wildlife 2005). Forages at least 100 feet above ground level, feeding primarily on small moths (California Department of Fish and Wildlife 2005).

13B.100.4 Seasonal Patterns

Mating occurs in February to March, with birth occurring between mid-June and mid-July (California Department of Fish and Wildlife 2005).

13B.100.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.100.5.1 GIS Model Data Sources

A single model was developed for foraging and roosting habitat for all bats that uses the following datasets:

- Great Valley Vernal Pool Habitats (Witham et al. 2014)
- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Delta 2017 Land Use Survey (Land IQ 2019)
- 2018 Statewide Crop Mapping (Land IQ and DWR 2021)

- Draft San Joaquin County 2017 Land Use Survey (California Department of Water Resources 2020a)
- DWR 2020 Aquatic Resources Delineation (California Department of Water Resources and GEI Consultants Inc. 2020, California Department of Water Resources 2020b, California Department of Water Resources 2021)
- Great Valley Ecoregion 2018 Vegetation (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Sacramento County 2015 Land Use Survey (California Department of Water Resources 2016)

13B.100.5.2 Habitat Model Description

The model for bats includes tree roosting habitat, structure roosting habitat, and foraging habitat. The extent of modeled habitat in the study area is depicted in Figure 13B.100-1.

13B.100.5.2.1 Geographic Limits

Entire study area.

13B.100.5.2.2 Additional Model Parameters

Modeled habitat includes the following types from the GIS model data sources:

Tree Roosting

- Valley/foothill riparian
  - All types
- Agriculture
  - Orchard
    - All types

Structure Roosting

- Developed
  - Urban

Foraging

- Valley/foothill riparian
  - All types
- Agriculture
  - All types
- Developed

  - All types
- Grasslands
  - All types
- Tidal freshwater emergent marsh
  - All types
- Tidal brackish emergent marsh
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetland
  - All types
- Nontidal perennial freshwater emergent marsh
  - All types
- Nontidal perennial aquatic
  - All types
- Tidal perennial aquatic
  - All types

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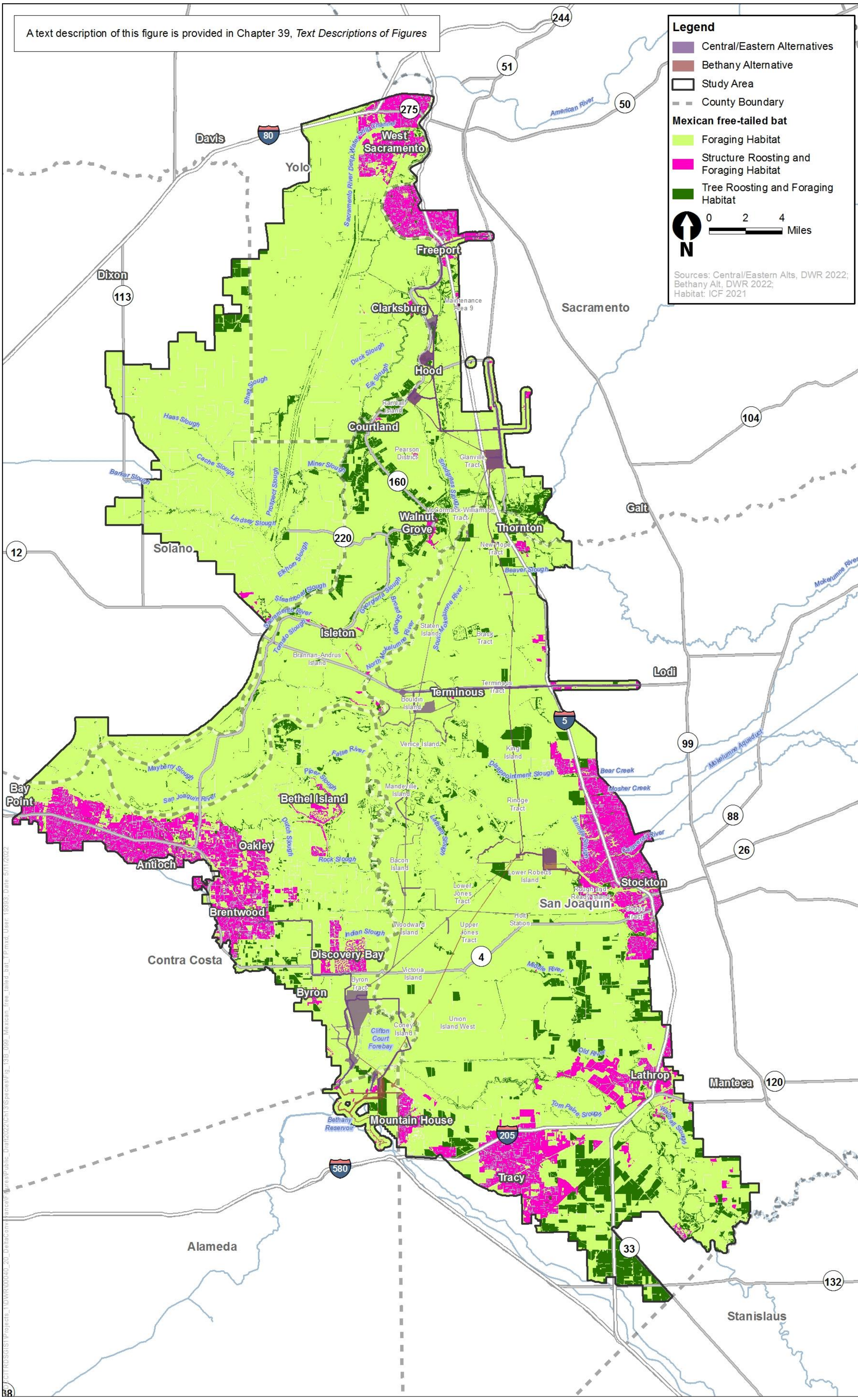

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2 **Figure 13B.100-1. Mexican Free-Tailed Bat Modeled Habitat in the Study Area**

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13B.101 San Joaquin Kit Fox (*Vulpes macrotis mutica*)

13B.101.1 Legal Status

San Joaquin kit fox is listed as endangered under ESA and threatened under CESA (California Department of Fish and Wildlife 2020a:76). Critical habitat has not been designated for San Joaquin kit fox.

13B.101.2 Range and Distribution within the Study Area

San Joaquin kit fox has historically occurred in semi-arid habitats of the San Joaquin Valley and in arid grassland of the adjacent foothills from as far north as Tracy, San Joaquin County and La Grange, Stanislaus County, south to Kern County (U.S. Fish and Wildlife Service 2020:15). A patchwork of surveys and data in the CNDDB indicate that kit fox was likely distributed throughout most of its historical range through the early 2000s (U.S. Fish and Wildlife Service 2020:27). The northern range for the species consists of a narrow band of habitat along the western edge of the San Joaquin Valley from the San Luis Reservoir in western Merced County north to central Alameda and Contra Costa Counties (Cypher et al. 2013:29). Historically kit fox was known to occur in Contra Costa, Alameda, and San Joaquin Counties, but more recently kit fox observations in the northern range have become rare, and no populations are known to be present (U.S. Fish and Wildlife Service 2020:15; California Department of Fish and Wildlife 2020b; Cypher et al. 2013:29). The northern part of the range is characterized by highly fragmented medium suitability habitat consisting primarily of dense grasslands dominated by wild oats, which may not be sufficient to sustain persistent populations of kit fox (Cypher et al. 2013:29).

In a more recent assessment of the species' status, the USFWS rated the condition of the northern most portion of the range (the Livermore Unit), which includes the western most portion of the study area, as being in a "very low" condition (U.S. Fish and Wildlife Service 2020:51). The USFWS defines very low condition as showing "no evidence of a current population" and having records that are over 10 years old (U.S. Fish and Wildlife Service 2020:50).

Within the study area, the range of the species, as currently depicted by USFWS (U.S Fish and Wildlife Service 2018), is limited to areas of suitable habitat generally around Bethany Reservoir and generally is outside of the statutory Delta.

There are nine CNDDB occurrences that overlap with the study area (California Department of Fish and Wildlife 2020b). These occurrences are generally to the west of Clifton Court Forebay and consist of observations that range from 1972 to 2000. Some observations consist of observed tracks and others adult and juvenile observations. The most recent occurrence from 2000 (#34) consists of an observation of dens (not adults), hearing a "yip," and relying on observations of Western Area Power Authority employees (California Department of Fish and Wildlife 2020b).

13B.101.3 Habitat Requirements

Optimal habitat for San Joaquin kit fox includes arid shrublands and grasslands characterized by sparse or no shrub cover, sparse ground cover with patches of bare ground, short vegetative structure (herbaceous vegetation <18 inches tall), and sandy to sandy-loam soils (Cypher et al.

2007:25). Vernal pool complexes and alkali meadows in general do not provide good denning habitat for kit fox because they have moist or waterlogged clay or clay-like soils (U.S. Fish and Wildlife Service 2020:17). Kit fox is strongly linked to areas where kangaroo rats are abundant (Cypher et al. 2007:25). Kit fox generally avoid steep terrain; slopes under 5 percent are optimal for kit fox and slopes greater than 15 percent are unsuitable (Cypher et al. 2007:25). Tall and dense vegetation is less optimal because it creates conditions that make it difficult for kit fox to detect approaching predators or to capture prey (Cypher et al. 2007:25). San Joaquin kit fox may construct their own dens, modify the burrow of other animals, or use manmade structures such as culverts and pipes (U.S. Fish and Wildlife Service 2020:20). Natal and pupping dens are generally found on flatter ground with slopes of about 6 degrees (U.S. Fish and Wildlife Service 2020:21).

13B.101.4 Seasonal Patterns

San Joaquin kit fox is generally active year-round, with mating occurring between November and December and pups born between February and April (U.S. Fish and Wildlife Service 2020:19). Juvenile dispersal occurs between June and late October (U.S. Fish and Wildlife Service 2020:19).

13B.101.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.101.5.1 GIS Model Data Sources

The San Joaquin kit fox model uses the following datasets:

- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)
- Soil Survey Geographic Database (SSURGO) (Natural Resources Conservation Service 2020)
- National Elevation Dataset (U.S. Geological Survey 2009a, 2009b, 2010)

13B.101.5.2 Habitat Model Description

The habitat model for San Joaquin kit fox includes grasslands where denning may occur and vernal pool complex and alkali seasonal wetland complex for dispersal and potential foraging. Habitat is further defined by soils and slopes. Soils were selected from the soil textural classes from the SSURGO database that could be used for establishing dens. Slope data was generated using the National Elevation Dataset (NED), which is a nationwide high-resolution elevation dataset. The extent of modeled habitat in the study area is depicted in Figure 13B.101-1.

13B.101.5.2.1 Geographic Limits

The geographic limits of the model are based on the range as defined by USFWS in GIS files obtained from USFWS's Environmental Conservation Online System (U.S. Fish and Wildlife Service 2018).

13B.101.5.2.2 Additional Model Parameters

Modeled habitat is broken down into high-, moderate-, and low-quality categories and includes vegetation types from the landcover mapped in portions of the study area west of the legal Delta

(ICF 2017, 2018), soils data from SSURGO (Natural Resources Conservation Service 2020), and slope data generated using the NED (U.S. Geological Survey 2009a, 2009b, 2010).

High Quality Habitat

High quality habitat is characterized by the vegetation communities listed below, by soils suitable for denning, and by areas with slopes <10%. Optimal habitat for kit foxes includes grasslands and areas with sandy to sandy-loam soils (Cypher et al. 2007:25). Natal dens appear to be restricted to slopes of 10% or less (U.S. Fish and Wildlife Service 2020:23). In their 2020 species status assessment report, USFWS considered units with slopes of less than or equal to 10% to be of high value (U.S. Fish and Wildlife Service 2020:49).

Hight quality habitat is limited to the following vegetation type from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018) and East Bay RCIS 2017 Land Cover Dataset (ICF 2017).

- Grassland
    - All types

High quality habitat is limited to the following SSURGO soil textural classes, which are sandy to sandy-loam soils that Cypher et al. (2007) considered being optimal for denning.

- Loam
- Fine sandy loam
- Silt loam
- Sandy clay loam
- Very fine sandy loam

High quality habitat is further limited to areas with the following slope from the NED.

- Slope ≤10%

Moderate Quality Habitat

Moderate quality habitat has the same vegetation and soil types as high quality habitat but is limited to areas with 11 to 30% slopes. Slopes greater than 15% are considered unsuitable (Cypher et al. 2007:25), and others have noted that most dens are found on slopes less than 30% (U.S. Fish and Wildlife Service 2020:23). In their 2020 species status assessment report, USFWS considered units with slopes ≤30% to be of moderate value (U.S. Fish and Wildlife Service 2020:50).

Low Quality Habitat

Low quality habitat is considered to be areas where kit fox may forage and disperse but where denning is unlikely. Low quality habitat includes vegetation types where denning is unlikely as a result of moist or waterlogged soils for an extended part of the year (U.S. Fish and Wildlife Service 2020:17). It also includes areas with slopes greater than 30%, which USFWS considered to be of low value in their 2020 species status assessment report (U.S. Fish and Wildlife Service 2020:50). Low quality habitat includes all soil types.

Low quality habitat is limited to the following vegetation types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018) and East Bay RCIS 2017 Land Cover Dataset (ICF 2017).

- Grassland (includes grasslands on all soil textural classes except those identified in the high and moderate quality habitats regardless of slope; and also includes those grasslands on slopes from the NED >30%, regardless of soil textural classes)
  - All types
- Vernal pool complex
  - All types
- Alkaline seasonal wetlands
  - All types

13B.101.6 References Cited

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U.S. Geological Survey. 2010. USGS NED ned19_n38x00_w121x75_ca_contracostaco_2008 1/9 arc-second 2010 15 x 15 minute IMG. Available: https://apps.nationalmap.gov/downloader. Accessed: February 18,2021

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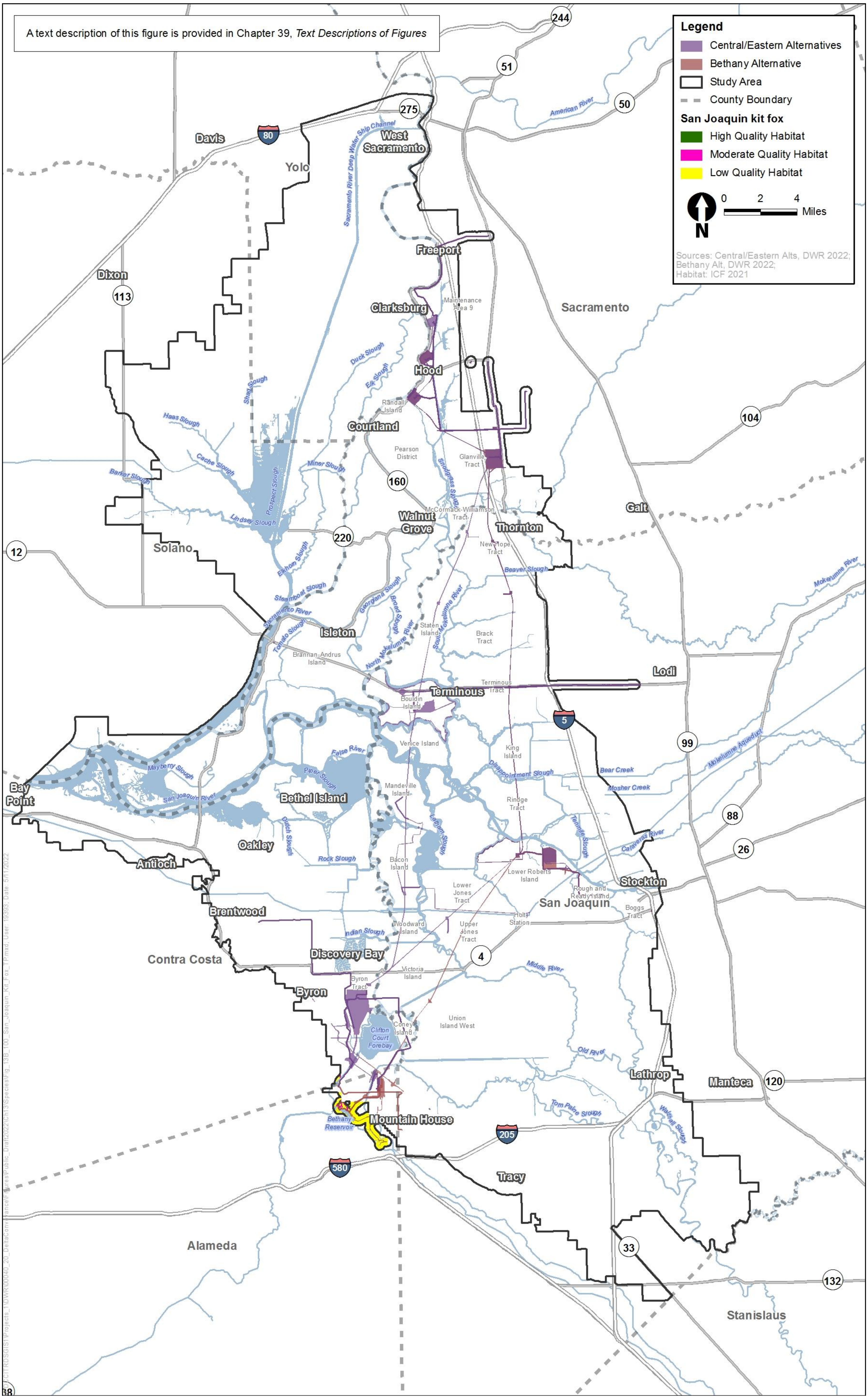

Figure 13B.101-1. San Joaquin Kit Fox Modeled Habitat in the Study Area

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13B.102 American Badger (*Taxidea taxus*)

13B.102.1 Legal Status

American badger is identified as a CDFW Species of Special Concern (California Department of Fish and Wildlife 2020a:81). The species has no formal federal status.

13B.102.2 Range and Distribution within the Study Area

American badger is an uncommon solitary species that is widely distributed throughout the state, except in the northern North Coast area. (Ahlborn 1990).

The study area is entirely within the range of the American badger, as depicted in the range map in the online version of the California Wildlife Habitat Relationships System (California Department of Fish and Game 2008). There are two museum records of badger in the study area from 1938: one located near Hood and one near Tracy (California Department of Fish and Wildlife 2020b).

13B.102.3 Habitat Requirements

American badger inhabits a variety of open, arid habitats but is most abundant in drier open stages of most shrub, forest, and herbaceous habitats with friable soils for burrowing. Home range typically varies in size between 5 and 1,800 acres but can become much larger during breeding season as males locate receptive females. Natal dens are constructed in dry, sandy soil with sparse overstory (Ahlborn 1990).

13B.102.4 Seasonal Patterns

Breeding occurs between July and August, with young born in March and April and dispersing after three to four months (Ahlborn 1990).

13B.102.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.102.5.1 GIS Model Data Sources

The American badger model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

- Soil Survey Geographic Database (SSURGO) (Natural Resources Conservation Service 2020)

13B.102.5.2 Habitat Model Description

The habitat model for American badger is limited to grasslands with friable soils. Friable soils were determined by selecting soil textural classes from the SSURGO database that could be used for establishing dens or that would likely support the establishment of ground squirrel, which would be soils that can be dug into (e.g., not cemented) and that can structurally maintain the shape of a den or burrow (e.g., not comprised of loose sand or silt). The extent of modeled habitat in the study area is depicted in Figure 13B.102-1.

13B.102.5.2.1 Geographic Limits

The entire study area.

13B.102.5.2.2 Additional Model Parameters

Modeled habitat includes the following vegetation types from the Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Grassland
  - All types

The model is further limited by the following SSURGO soil textural classes (Natural Resources Conservation Service 2020).

- Clay
- Silty clay
- Silty clay loam
- Clay loam
- Loam
- Fine sandy loam
- Silt loam
- Sandy clay loam
- Very fine sandy loam

13B.102.6 References Cited

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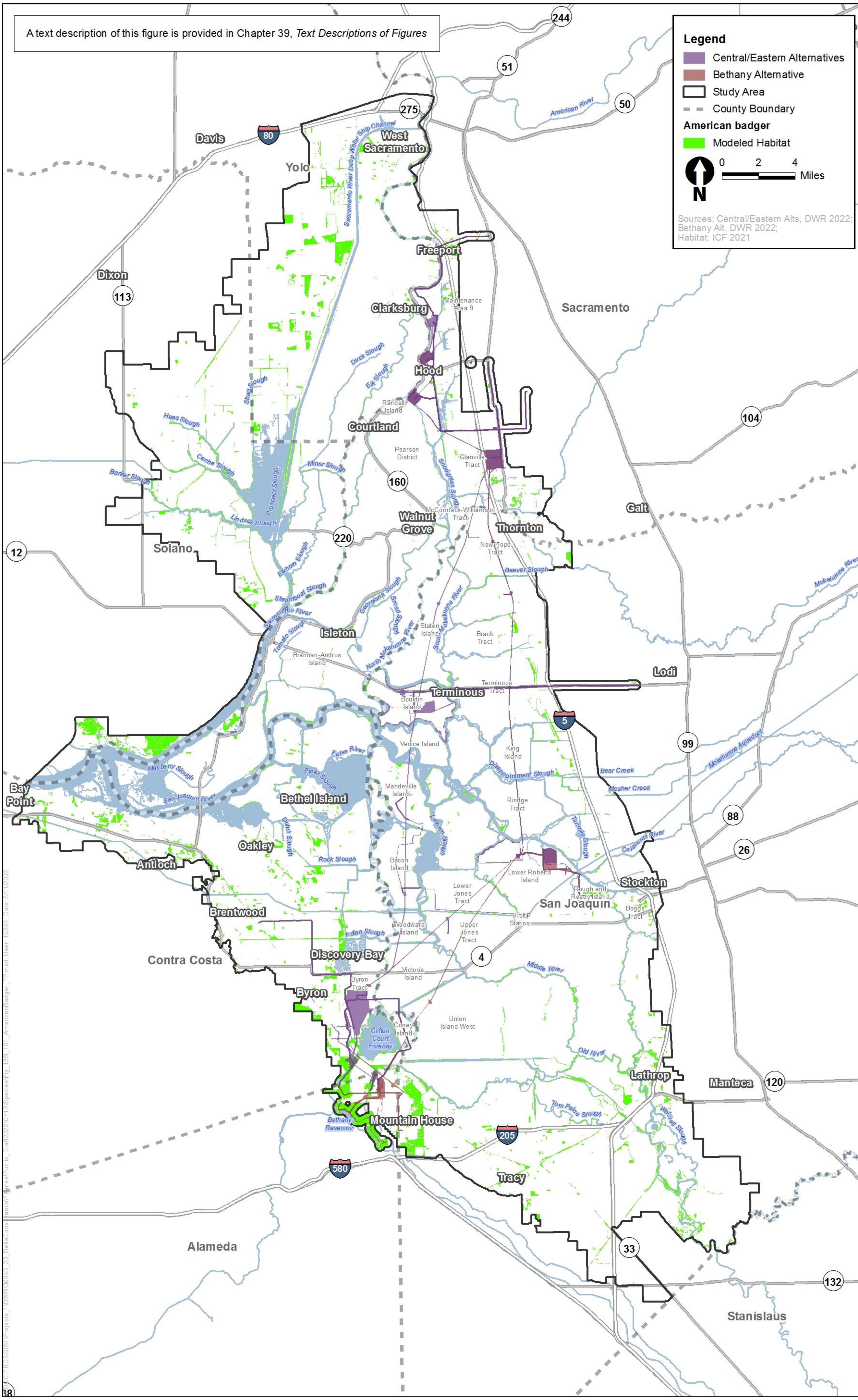

1
2 **Figure 13B.102-1. American Badger Modeled Habitat in the Study Area**

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13B.103 San Joaquin Pocket Mouse (*Perognathus inornatus*)

13B.103.1 Legal Status

San Joaquin pocket mouse has a NatureServe global and state rarity and imperilment ranking of G2G3 and S2S3, respectively (California Department of Fish and Wildlife 2020a:76). The species has no federal status applicable to the study area.

13B.103.2 Range and Distribution within the Study Area

The San Joaquin pocket mouse occurs between 1,100 and 2,000 ft elevation, spanning through the San Joaquin Valley, Delta, Sacramento Valley through Colusa County, and portions of the southern Coast Ranges (Harvey and Ahlborn 1990; Brylski 1997).

The study area is entirely within the range of San Joaquin pocket mouse, as depicted in the range map in the online version of the California Wildlife Habitat Relationships System (Brylski 1997). There are two records of San Joaquin pocket mouse in the study area: one from 2002 along the California aqueduct where it intersects with Byron Highway and a museum record from 1941 on Union Island (California Department of Fish and Wildlife 2020b).

13B.103.3 Habitat Requirements

Habitat includes shrubby ridgetops and hillsides in dry, open grasslands or scrub areas with friable soils (Harvey and Ahlborn 1990).

13B.103.4 Seasonal Patterns

Young are born and raised in burrows in the spring and early summer (Harvey and Ahlborn 1990).

13B.103.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.103.5.1 GIS Model Data Sources

The San Joaquin pocket mouse model uses the following datasets:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)
- Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018)
- Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018)
- East Bay RCIS 2017 Land Cover Dataset (ICF 2017)

- Soil Survey Geographic Database (SSURGO) (Natural Resources Conservation Service 2020)

13B.103.5.2 Habitat Model Description

The habitat model for San Joaquin pocket mouse is limited to grasslands with friable soils. Friable soils were determined by selecting soil textural classes from the SSURGO database that could be used for digging burrows, which would be soils that could be dug into (e.g., not cemented) and that could structurally maintain the shape of a burrow (e.g., not comprised of loose sand or silt). The extent of the modeled habitat in the study area is depicted in Figure 13B.103-1.

13B.103.5.2.1 Geographic Limits

Entire study area.

13B.103.5.2.2 Additional Model Parameters

Modeled habitat includes the following vegetation types from Sand Hill Wind Repowering SEIR Land Cover Dataset (ICF 2018), East Bay RCIS 2017 Land Cover Dataset (ICF 2017), Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation Dataset (Chico State Research Foundation, Geographical Information Center 2018).

- Grassland
  - All types

The model is further limited by the following SSURGO soil textural classes (Natural Resources Conservation Service 2020).

- Clay
- Silty clay
- Silty clay loam
- Clay loam
- Loam
- Fine sandy loam
- Silt loam
- Sandy clay loam
- Very fine sandy loam

13B.103.6 References Cited

Brylski, P. 1997. California Wildlife Habitat Relationships System Range Map for San Joaquin Pocket Mouse. Originally published in D. C. Zeiner, W. F. Laudenslayer, Jr., K. E. Mayer, and M. White (eds.). *California's Wildlife*. Vol. III Mammals. Sacramento, CA: California Department of Fish and Game. Updated by Brylski in 2005. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=2448&inline=1 . Accessed: February 22, 2021.

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Natural Resources Conservation Service. 2020. Soil Survey Geographic (SSURGO) Database for Alameda, Contra Costa, Sacramento, San Joaquin, and Yolo Counties, California. Available: http://soildatamart.nrcs.usda.gov. Accessed: June 2, 2020.

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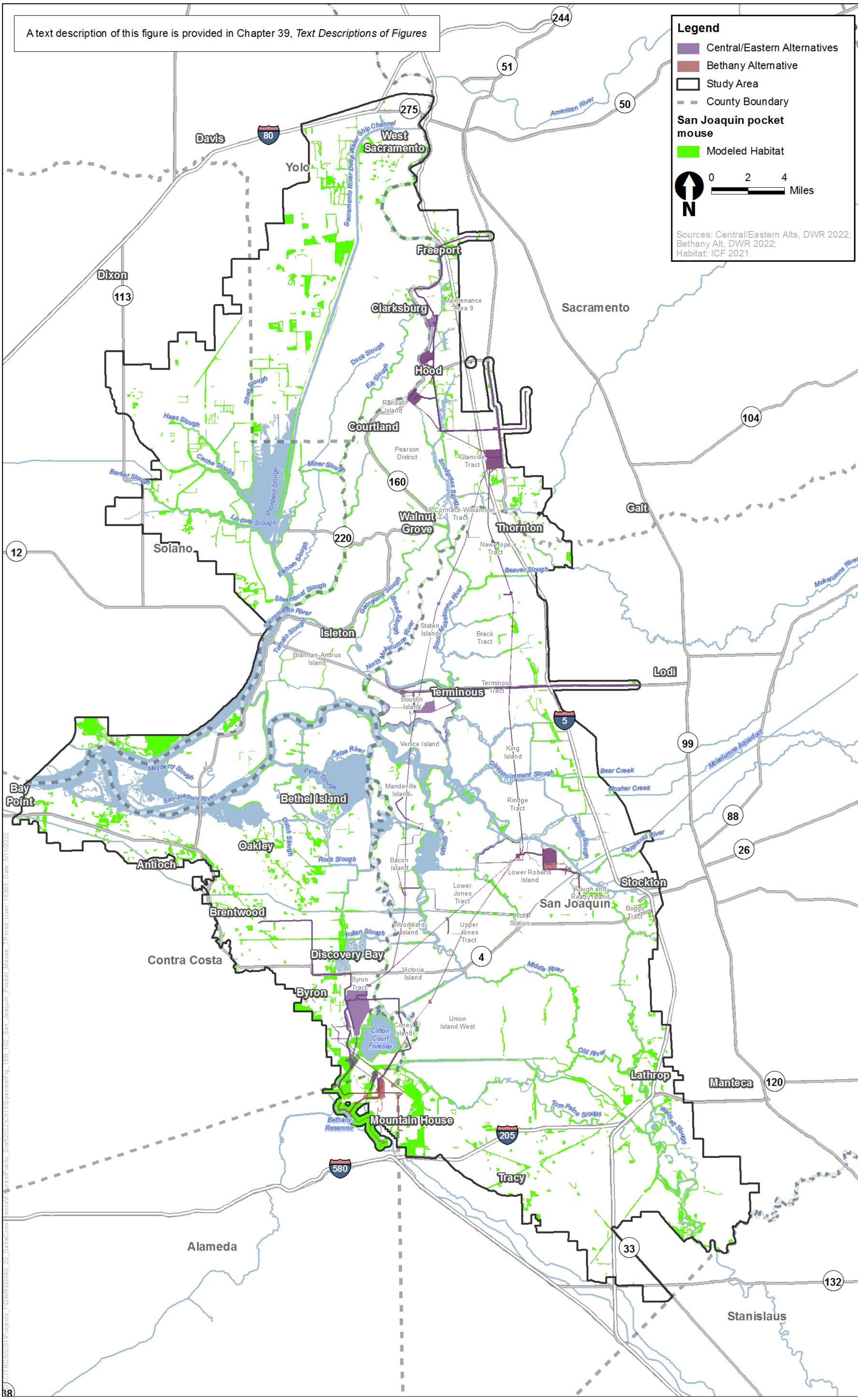

1
2 **Figure 13B.103-1. San Joaquin Pocket Mouse Modeled Habitat in the Study Area**

13B.104 Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*)

13B.104.1 Legal Status

Salt marsh harvest mouse is listed as endangered under both ESA and CESA and is a fully protected species under the Fish and Game Code (California Department of Fish and Wildlife 2020a:79). Critical habitat has not been designated for salt marsh harvest mouse.

13B.104.2 Range and Distribution within the Study Area

Salt marsh harvest mouse is endemic to salt marshes of San Francisco, San Pablo, and Suisun Bays (U.S. Fish and Wildlife Service 2013:viii).

Salt marsh harvest mouse habitat in the study area is limited to the western most portion of the Delta, from the western tip of Sherman Island westward. There are ten CNDDB occurrences of salt marsh harvest mouse in this area, spread out along both the southern and northern shores of this portion of the Delta (California Department of Fish and Wildlife 2020b).

13B.104.3 Habitat Requirements

Salt marsh harvest mouse is found primarily in tidal brackish emergent wetlands dominated by pickleweed (U.S. Fish and Wildlife Service 2013:133). The species is also known to use areas of managed wetland. Areas containing mixed wetland vegetation appear to be just as suitable for salt marsh harvest mouse as areas dominated by pickleweed (Sustaita et al. 2011:1504–1505). The species also requires escape cover during high tides (U.S. Fish and Wildlife Service 2013:28). The subspecies has been found using areas at least 330 feet from the wetland edge (U.S. Fish and Wildlife Service 2013:134).

13B.104.4 Seasonal Patterns

Salt marsh harvest mice breed from March to November (U.S. Fish and Wildlife Service 2013:132).

13B.104.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.104.5.1 GIS Model Data Sources

The salt marsh harvest mouse model uses the following dataset:

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019)

13B.104.5.2 Habitat Model Description

The salt marsh harvest mouse habitat model includes both tidal wetlands and upland habitats. The upland portion of the model includes habitat within 330 feet of wetland habitat, which is supported by previous studies cites in Section 13B.104.3. The extent of modeled habitat in the study area is depicted in Figure 13B.104-1.

13B.104.5.2.1 Geographic Limits

The model includes the Delta west of Sherman Lake and the western most portion of Sherman Island, based on CNDDB records of the species.

13B.104.5.2.2 Additional Model Parameters

Wetland

Modeled habitat includes the following types from the Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Tidal brackish emergent wetland
  - *Bolboschoenus maritimus*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Juncus arcticus* (var. *balticus, mexicanus*)
  - *Lepidium latifolium*
  - *Phragmites australis—Arundo donax*
  - *Polygonum lapathifolium—Xanthium strumarium*
  - *Sarcocornia pacifica* (*Salicornia depressa*)
  - *Schoenoplectus americanus*
  - *Schoenoplectus* (*acutus, californicus*)
  - *Typha* (*angustifolia, domingensis, latifolia*)
  - Californian warm temperate marsh/seep
  - Naturalized warm-temperate riparian and wetland group
- Nontidal brackish emergent wetland
  - *Bolboschoenus maritimus*
  - *Distichlis spicata*
  - *Frankenia salina*
  - *Lepidium latifolium*
  - *Phragmites australis - Arundo donax*
  - Sarcocornia pacifica (*Salicornia depressa*)

  - Schoenoplectus (*acutus, californicus*)
  - Typha (*angustifolia, domingensis, latifolia*)
  - Arid West freshwater emergent marsh
  - Naturalized warm-temperate riparian and wetland group
  - Temperate Pacific tidal salt and brackish meadow

Upland

Modeled upland habitat includes the following types from the Delta Vegetation and Land Use Update that occur within 330 feet of the wetland edge (Chico State Research Foundation, Geographical Information Center 2019) and the Great Valley Ecoregion 2018 Vegetation dataset (Chico State Research Foundation, Geographical Information Center 2018):

- Tidal brackish emergent wetland (upland components of this layer)
  - *Baccharis pilularis*
  - Mediterranean California naturalized annual and perennial grassland
  - Californian mixed annual/perennial freshwater vernal pool /swale bottomland
- Alkaline seasonal wetland complex
- Grassland
  - All types
- Valley/foothill riparian

13B.104.6 References Cited

California Department of Fish and Wildlife. 2020a. *Special Animals List*. California Natural Diversity Database. Periodic publications. July.

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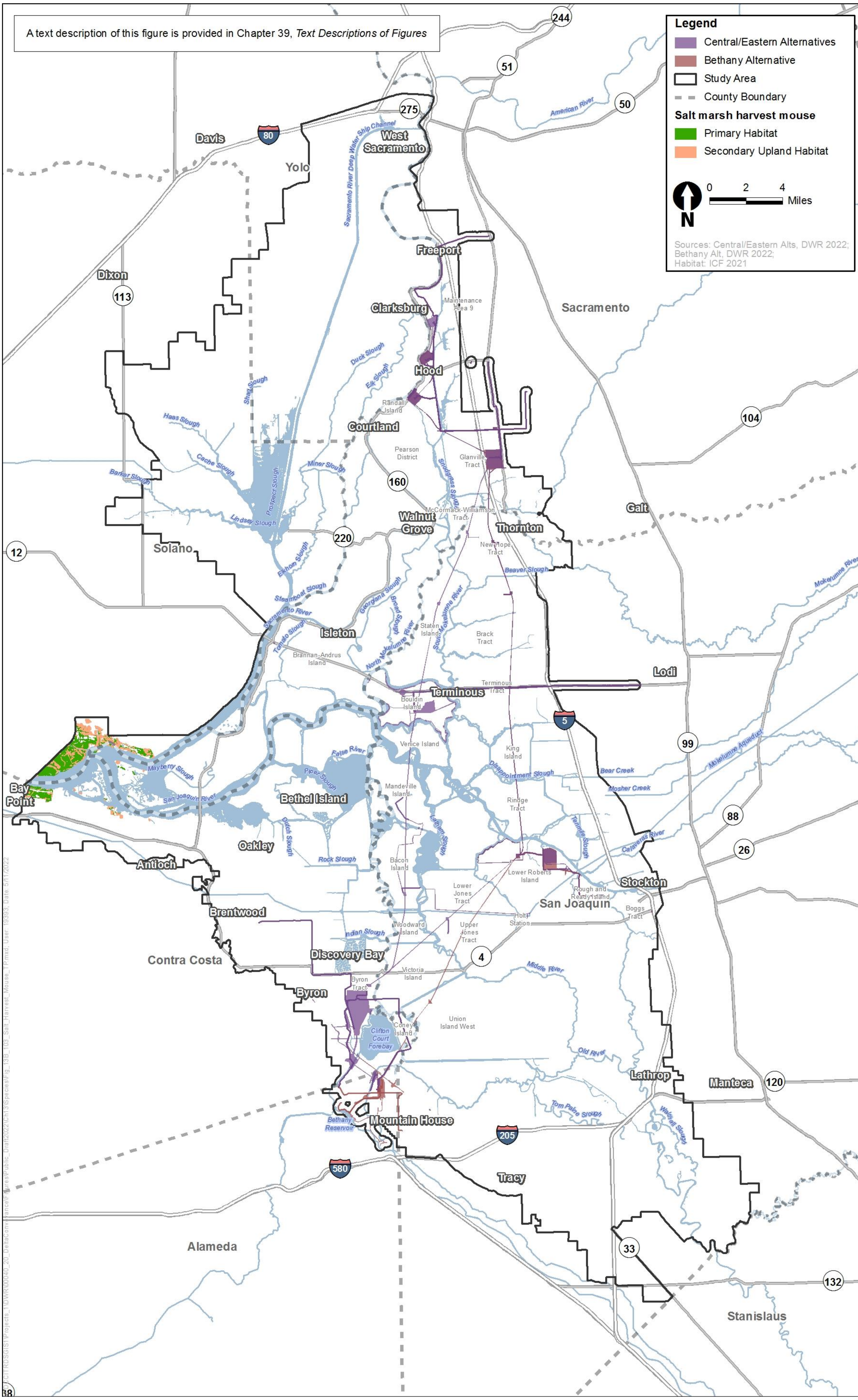

Figure 13B.104-1. Salt Marsh Harvest Mouse Modeled Habitat in the Study Area

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13B.105 Riparian Brush Rabbit (*Sylvilagus bachmani riparius*)

13B.105.1 Legal Status

Riparian brush rabbit is listed as endangered under ESA and CESA (California Department of Fish and Wildlife 2020a:73). Critical habitat has not been designated for riparian brush rabbit.

13B.105.2 Range and Distribution within the Study Area

One of eight subspecies of brush rabbit in California, its historical distribution may have extended along portions of the San Joaquin River and its tributaries on the valley floor from at least Stanislaus County to the Sacramento–San Joaquin River Delta (Delta) (U.S. Fish and Wildlife Service 1998:165). Populations are known to have historically occurred in riparian forests on the valley floor along the San Joaquin and Stanislaus Rivers and some tributaries of the San Joaquin River (U.S. Fish and Wildlife Service 1998:165).

The current range of riparian brush rabbit consists of two broad regions: the first being the area along the San Joaquin River between its confluence with the Tuolumne River north to its confluence with the Stanislaus River and then to the east up the Stanislaus River for approximately 4 miles; and the second region being disjunct local populations scattered throughout the South Delta, which includes the southern portion of the study area (California Department of Fish and Wildlife 2020b:9-10).

Within the study area, known occurrences of riparian brush rabbit are limited to the southern portion of the study area, which includes records on the San Joaquin River, Paradise Cut, Middle River, Tom Paine Slough, and the Southern Pacific Railroad (U.S. Fish and Wildlife Service 2020:12; California Department of Fish and Wildlife 2020b:10, 2020c). For the model described below, Old River is included due to proximity of records on Paradise Cut and Middle River (U.S. Fish and Wildlife Service 2020; California Department of Fish and Wildlife 2020b: 9-10).

13B.105.3 Habitat Requirements

Important components of riparian brush rabbit habitat include secondary successional willow/shrub and large patches of dense brush composed of riparian vegetation such as blackberry (*Rubus* spp.), California wild rose (*Rosa californica*), low-growing willows (*Salix* spp.), or other dense shrub species (Kelt et al. 2014:517, 522; Matocq et al. 2017:2). Other important habitat components include grasses and herbaceous forbs, scaffolding plants (dead or alive) for blackberry and rose to grow tall enough to withstand flood events, a tree overstory that is not closed, and high-ground refugia from flooding (Kelly et al. 2011:4). Generally, riparian forests that support a closed overstory canopy lack sufficient understory shrubs to support riparian brush rabbits. Small herbaceous openings in proximity to cover are also required for foraging, and higher-elevation areas are required to sustain populations during floods (U.S. Fish and Wildlife Service 1998:165, 167).

Sites inhabited by riparian brush rabbit usually have a mix of wild roses, blackberries, coyote bush (*Baccharis pilularis*), and grape vines (*Vitis californica*), with high volumes of roses and coyote bush in comparison to uninhabited sites (Williams and Basey 1986:5–8; U.S. Fish and Wildlife Service 1998:167; Kelly et al. 2011:4–5). More recent investigations of habitat use have indicated that they may prefer willow scrub dominated secondary successional plant communities in areas that have not been strongly managed for flood and fire suppression (Kelt et al. 2014:523; Matocq et al. 2017:2). Williams and Basey (1986:i, 9) also note that brush rabbit sites support significantly more ground litter and surface area of roses and significantly fewer willows than sites occupied by desert cottontails. This condition may indicate the presence of higher-elevation areas that are not flooded regularly or heavily, an important element of brush rabbit habitat (Williams and Basey 1986:12). Herbaceous forbs, such as mugwort (*Artemesia douglasiana*), stinging nettle (*Urtica dioica*), and gumplant (*Grindelia camporum*), at the edge of the brush/thicket habitat have been found to be an important habitat component for riparian brush rabbit. Mugwort provides cover, food, and is flood tolerant. Gumplant forms dense stands and thus provides important cover from predators while the rabbit forages (Kelly et al. 2011:3).

Grasslands adjacent to dense brush provide foraging opportunities (herbaceous vegetation) for riparian brush rabbits (Kelly et al. 2011:3). No scientific literature specifies the distance from riparian habitat at which riparian brush rabbits will forage.

Patch size is important, and fragmentation of intact riparian forests is a major issue restricting occupancy and overall distribution of the species. The minimum size of brushy vegetation patches required to fulfill riparian brush rabbit needs is unknown; however, it has been inferred that at least some patches of brush should be approximately 0.12 acre or larger (U.S. Fish and Wildlife Service 2020:23; California Department of Fish and Wildlife 2020b:8).

13B.105.4 Seasonal Patterns

Riparian brush rabbits typically breed from January to May (U.S. Fish and Wildlife Service 1998:165); however, onset and duration varies from year to year (U.S. Fish and Wildlife Service 2020:15)

13B.105.5 Species Habitat Suitability Model

The methods used to formulate species habitat suitability models, and the limitations of these models, are described in Section 13B.0.1.5, *Species Habitat Suitability Model Methods.*

13B.105.5.1 GIS Model Data Sources

The riparian brush rabbit model uses the following datasets.

- Delta Vegetation and Land Use Update (Chico State Research Foundation, Geographical Information Center 2019).

13B.105.5.2 Habitat Model Description

The habitat model for riparian brush rabbit includes both riparian and grassland habitat. Riparian vegetation types were selected based on the species requirements as defined above in the *Habitat Requirements* section. The extent of modeled habitat in the study area is depicted in Figure 13B.105-1.

13B.105.5.2.1 Geographic Limits

For purposes of this model, the model boundary is considered to represent the northern and western extent of all potentially occupied habitat in the study area. This assumption is based on the known distribution of the species and results of recent surveys in the study area (U.S. Fish and Wildlife Service 2020:12; California Department of Fish and Wildlife 2020b:10).

The habitat model is limited to the following areas.

- The mainstem of the San Joaquin River from an area just south of Frewert Road in San Joaquin County (37.845624, -121.32246) south to the southern edge of the study area (legal Delta).
- Old River from its confluence with Paradise Cut to the mainstem of the San Joaquin River.
- Middle River from the Howard Road Bridge (37.876920, -121.383509) south to its confluence with Old River.
- Tom Paine Slough from the San Joaquin River to its confluence with Old River (37.811245, -121.419253).
- Paradise Cut from its confluence with San Joaquin River to its confluence with Old River (37.811245, -121.419253).
- Southern Pacific Railroad alignment from Paradise Cut to San Joaquin River.

13B.105.5.2.2 Additional Model Parameters

The riparian portion of the model was limited to contiguous patches that are greater than or equal to 0.12 acre in size. Patch size is important, and fragmentation of intact riparian forests is a major issue restricting occupancy and overall distribution of the species. The minimum size of brushy vegetation patches required to fulfill riparian brush rabbit needs is unknown; however, it has been inferred that at least some patches of brush should be approximately 0.12 acre or larger (U.S. Fish and Wildlife Service 2020:23; California Department of Fish and Wildlife 2020b:8).

For the grassland portion of the model, grassland habitat includes where a grassland polygon abuts selected valley/foothill riparian and extends 500 feet from the edge of riparian. No scientific literature specifies the distance from riparian habitat at which riparian brush rabbits will forage; however, due to the nature of the mapped grassland polygons, many of which extend for miles, a distance of 500 feet was selected to represent the most contiguous habitat adjacent to riparian in the study area.

Modeled habitat includes the following types from the Delta Vegetation and Land Use Update dataset.

- Valley/foothill riparian
  - *Acer negundo*
  - *Alnus rhombifolia*
  - *Baccharis pilularis*
  - *Cephalanthus occidentalis*
  - *Cornus sericea*
  - *Fraxinus latifolia*

    - *Juglans hindsii* and hybrids
    - *Populus fremontii*
    - *Quercus lobata*
    - *Rosa californica*
    - *Rubus armeniacus*
    - *Salix exigua*
    - *Salix gooddinggii*
    - *Salix lasiolepis*
    - *Salix lucida*
    - *Sambucus nigra*
    - *Vitis californica*
    - Vancouverian riparian deciduous forest
    - Southwestern North American riparian evergreen and deciduous woodland
    - Southwestern North American riparian/wash scrub
    - California broadleaf forest and woodland
- Grassland (where contiguous with modeled riparian habitat and extending 500 feet from the edge of riparian)
    - All types

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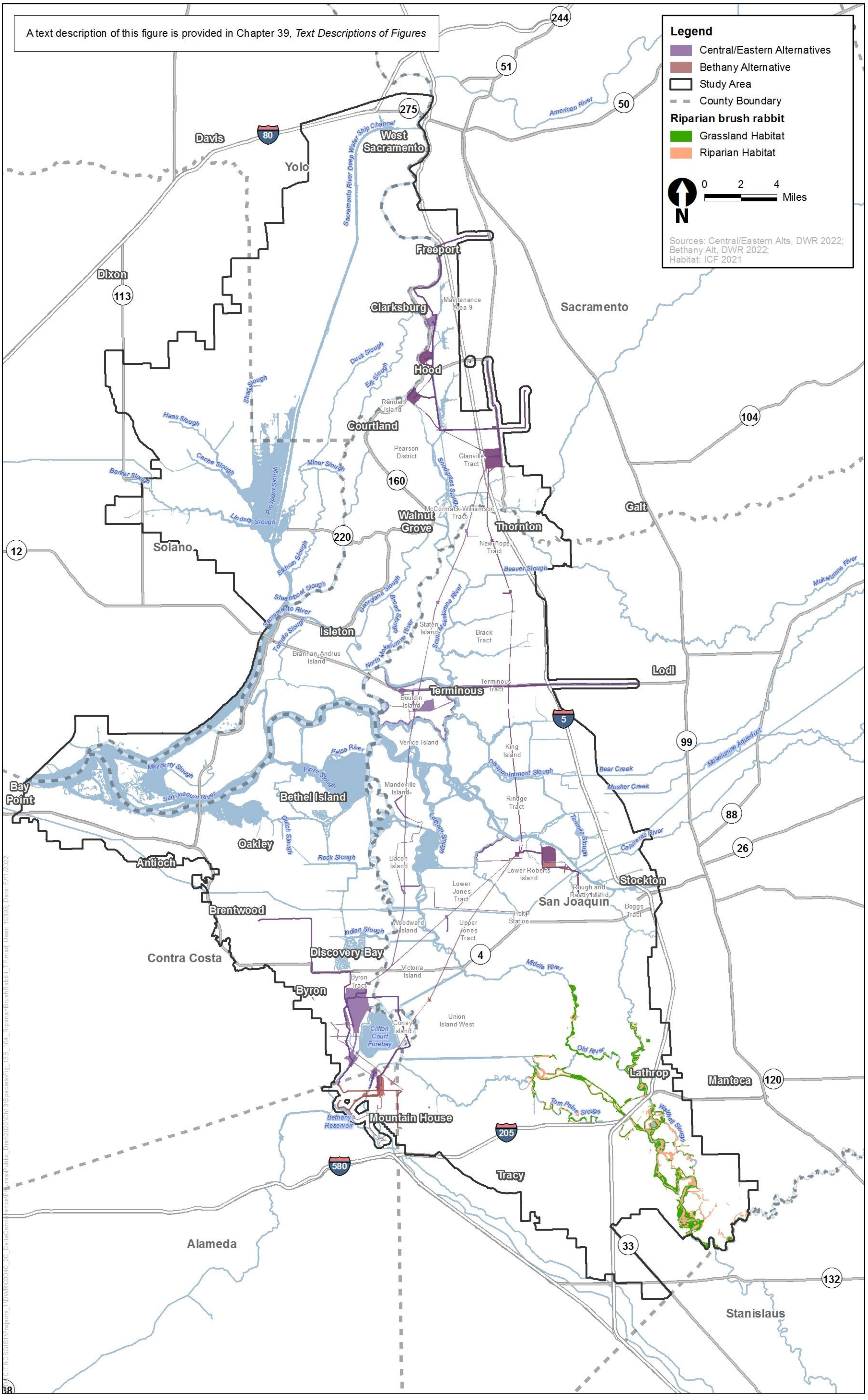

Figure 13B.105-1. Riparian Brush Rabbit Modeled Habitat in the Study Area

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Appendix J
General Conformity Determination

The definition of existing conditions, No Action Alternative, and cumulative impact conditions in this appendix are presented as provided by the California Department of Water Resources (the applicant) in the Delta Conveyance Project Draft Environmental Impact Report Appendix 3C, *Defining Existing Conditions, No Action Alternative, and Cumulative Impact Conditions* (California Department of Water Resources 2022) and therefore is presented from the California Environmental Quality Act perspective. However, the U.S. Army Corps of Engineers relied on this information when preparing its Draft Environmental Impact Statement. All chapter references in this appendix are to those in the Draft EIR, unless otherwise noted. Please refer to the Draft EIR for any information cross referenced.

This appendix provides the general conformity determination for the proposed Delta Conveyance Project. A general conformity determination is required by Section 176 of the Clean Air Act (CAA). The CAA requires states to submit a state implementation plan (SIP) for areas in nonattainment for federal standards. Section 176(c)(1) of the CAA prohibits federal agencies from engaging in, supporting, or providing financial assistance for licensing, permitting, or approving any activities that do not conform to an approved SIP.

The U.S. Environmental Protection Agency (EPA) enacted the federal general conformity regulation in 1993 (40 Code of Federal Regulations [CFR] Parts 5, 51, and 93). The purpose of the general conformity rule is to ensure that federal actions do not generate emissions that interfere with state and local agencies' SIPs and emission-reduction strategies to ensure attainment of the national ambient air quality standards (NAAQS). Specifically, projects that receive federal funding or require federal approval must demonstrate that they would not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with timely attainment or required interim emissions reductions toward attainment. Because the proposed action requires approvals from the U.S. Army Corps of Engineers (USACE) (federal lead agency), National Marine Fisheries Service, and the United States Fish and Wildlife Service, all direct and indirect emissions generated by the proposed action are subject to the general conformity rule.

J.1 Regulatory Background

The study area is subject to air quality regulations developed and implemented at the federal, state, and local levels. At the federal level, EPA is responsible for implementation of the CAA. EPA implements some portions of the CAA (e.g., certain mobile-source and other requirements) directly. State and local agencies implement other portions of the CAA (e.g., stationary-source requirements).

Responsibility for attaining and maintaining air quality in California is divided between the California Air Resources Board (CARB) and regional air quality districts. The Yolo-Solano Air Quality Management District (YSAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), Bay Area Air Quality Management District (BAAQMD), and San Joaquin Valley Air Pollution Control District (SJVAPCD) have jurisdiction over local air quality within the study area.

YSAQMD, SMAQMD, BAAQMD, and SJVAPCD are required to develop air quality plans for nonattainment criteria pollutants in their respective air districts. The *Sacramento Regional 8-Hour Attainment and Reasonable Further Progress Plan* was prepared to address ozone precursors within the Sacramento Federal Nonattainment Area (SFNA) (El Dorado County Air Quality Management District et al. 2017).[1] Affected air districts in the SFNA (Sacramento, Yolo, Placer, and El Dorado) have also adopted the *PM2.5 Implementation/ Maintenance Plan and Resignation Request for Sacramento PM2.5 Nonattainment Area* (El Dorado County Air Quality Management District et al. 2013). Finally, SMAQMD (2010) adopted the *PM10 Implementation/Maintenance Plan and Redesignation Request for Sacramento County* in October 2010.

BAAQMD and SJVAPCD have adopted air quality plans to improve air quality, protect public health, and protect the climate The *Bay Area 2001 Ozone Attainment Plan* was adopted to reduce ozone and achieve the NAAQS ozone standard in the San Francisco Bay Area Air Basin (SFBAAB) (Bay Area Air Quality Management District 2001). BAAQMD's (2017a) *Clean Air Plan: Spare the Air, Cool the Climate* provides a regional strategy to protect public health and protect the climate. SJVAPCD's *2016 Plan for the 2008 8-Hour Ozone Standard* and *2007 Ozone Plan* contain comprehensive lists of regulatory and incentive-based measures to reduce ozone precursors within the San Joaquin Valley Air Basin (SJVAB) (San Joaquin Valley Air Pollution Control District 2016a, 2007a). SJVAPCD's *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards*, *2016 Moderate Area Plan for the 2012 PM2.5 Standard, 2015 Plan for the 1997 PM2.5 Standard*, and *2007 PM10 Maintenance Plana and Request for Redesignation* likewise include strategies to reduce particulate matter (PM) emissions throughout the air basin (San Joaquin Valley Air Pollution Control District 2018, 2016b, 2015a, 2007b).

J.1.1 General Conformity Requirements

The general conformity rule applies to all federal actions located in nonattainment and maintenance areas that are not exempt from general conformity (are either covered by Transportation Conformity or listed in the rule), are not covered by a presumed-to-conform approved list,[2] or do not have clearly *de minimis* emissions. In addition, the general conformity rule applies only to direct and indirect emissions associated with the portions of any federal action that are subject to New Source Review for which a federal permitting agency has directly caused or initiated, has continued program responsibility for, or can practically control (i.e., stationary industrial sources requiring air quality permits from local air pollution control agencies are not subject to general conformity).

Federal projects must undertake an evaluation to determine whether all project emissions sources are subject to the general conformity rule. The analysis includes a stepwise process in which the federal agency determines the following.

1. **Is the emissions source located in a federal attainment area?** If yes, the emission source is not subject to general conformity and no additional analysis is required. If no, document whether the emission source is in a nonattainment or maintenance area and proceed to step 2.

2. **Does one or more of the specific exemptions apply to the project?** If yes, the project is exempt from general conformity and no further analysis is required. If no, proceed to step 3.

[1] Air districts in the SFNA consist of the SMAQMD and YSAQMD, as well as parts of Feather River Air Quality Management District, El Dorado County Air Quality Management District, and Placer County Air Pollution Control District.

[2] Category of activities designated by a federal agency as having emissions below *de minimis* levels or otherwise do not interfere with the applicable SIP or the attainment and maintenance of the NAAQS.

3. **Has the federal agency included the action on its list of presumed-to-conform actions?** If yes, the action is presumed to conform to the applicable SIP and the requirements of general conformity are satisfied. If no, proceed to step 4.
4. **Are the total direct and indirect emissions below the *de minimis* thresholds?** If yes, the action would not cause or contribute to new violations of air quality standards; the requirements of general conformity are satisfied. If no, the applicant must perform a conformity determination.

If, through the applicability analysis process, the federal agency determines that the general conformity regulations do not apply to the federal action, no further analysis or documentation is required. If, however, the general conformity regulations apply to the federal action, the federal agency must conduct a conformity evaluation in accordance with the criteria and procedures in the implementing regulations, publish a draft General Conformity Determination for public review, and publish the final General Conformity Determination. A general conformity determination is made by satisfying any of the following requirements.

- Showing that the emission increases caused by the federal action are included in the SIP.
- Obtaining a written statement from the entity responsible for the SIP that the total indirect and direct emissions from the action, along with other emissions in the area, will not exceed the total SIP emission budget.
- Fully offsetting the total direct and indirect emissions by reducing emissions of the same pollutant in the same nonattainment or maintenance area, or a nearby area as allowed under the CAA.
- Utilizing a combination of the above strategies.

The general conformity rule states that the applicability analysis can be (but is not required to be) completed concurrently with any analysis required under NEPA. The applicability analysis for the proposed action is described in Section J.4, *Applicability Analysis.*

J.1.2 Description of the Federal Action

The federal agency is only required to conduct a general conformity evaluation for the specific federal action associated with the selected alternative for a project or program (U.S. Environmental Protection Agency 1994). The positive conformity determination must be submitted before the federal action is approved. Each federal agency is responsible for determining conformity of those proposed actions over which it has jurisdiction. The general conformity determination presented in this appendix relates to those activities pertaining to the proposed action. A complete description of the proposed action is provided in Draft EIS Chapter 2, *Project Description and Alternatives*, and Appendix C, *Description of the Proposed Project and Alternatives.*

J.1.3 Relationship to NEPA

The general conformity regulations establish certain procedural requirements that must be followed when preparing a general conformity evaluation and are similar, but not identical, to those for conducting an air quality effects analysis under NEPA regulations. NEPA requires that the air quality impacts of the proposed action's implementation be analyzed and disclosed. For purposes of NEPA, the air quality impacts of the project were determined by identifying the project's associated incremental emissions and air pollutant concentrations and comparing them, respectively, to emissions thresholds and to the California ambient air quality standards (CAAQS) and NAAQS. The air quality impacts of the project under future Plus Project conditions were also compared to the future No Action conditions for NEPA purposes, and they were compared to existing conditions. The general conformity determination process and general findings are discussed in the Delta Conveyance Project Draft EIR Chapter 23, *Air Quality and Greenhouse Gases* (California Department of Water Resources 2022).

J.2 Air Quality Conditions in the Study Area

The study area encompasses the following three air basins: Sacramento Valley Air Basin (SVAB), SJVAB, and SFBAAB.

J.2.1 Meteorology and Climate

Air quality is affected by the rate and location of pollutant emissions and by meteorological conditions that influence movement and dispersal of pollutants in the atmosphere. Atmospheric conditions, such as wind speed, wind direction, and air temperature gradients, along with local topography, provide the link between air pollutant emissions and local air quality levels.

The SVAB has a Mediterranean climate characterized by hot, dry summers and cool, rainy winters. In general, the prevailing winds are moderate in strength and vary from moist clean breezes from the south to dry land flows from the north. The mountains surrounding the SVAB create a barrier to airflow that can trap air pollutants under certain meteorological conditions. The ozone season (May through October) in the Sacramento Valley is characterized by stagnant morning air or light winds with the Delta sea breeze arriving in the afternoon out of the southwest. Usually, the evening breeze transports the airborne pollutants to the north out of the Sacramento Valley (Yolo-Solano Air Quality Management District 2007).

The SJVAB has an inland Mediterranean climate that is characterized by warm, dry summers and cool winters. Although marine air generally flows into the basin from the Delta, the surrounding mountain ranges restrict air movement through and out of the valley. The vertical dispersion of air pollutants in the SJVAB is limited by the presence of persistent temperature inversion. Air pollutants tend to collect under an inversion, leading to higher concentrations of emitted pollutants. Conversely, precipitation and fog tend to reduce pollutant concentrations. Precipitation in the SJVAB decreases from north to south, with approximately 20 inches in the north, 10 inches in the middle, and less than 6 inches in the south (San Joaquin Valley Air Pollution Control District 2015b).

The SFBAAB has a coast climate that is influenced by marine air flow and the basin's proximity to the San Francisco Bay. Bay breezes push air onshore during the daytime and draw air offshore at night. During the summer months, the bay helps to cool the warm onshore flows, while it warms the air during the winter months. This mediating effect keeps temperatures relatively consistent throughout the year. In the westernmost portion of the SFBAAB, which encompasses the study area, the bay wind patterns can concentrate and carry air pollutants from other cities to the region, adding to the mix of pollutants that are emitted locally (Bay Area Air Quality Management District 2017b).

J.2.2 Ambient Air Quality

The existing air quality conditions in the study area can be characterized by monitoring data collected in the region. Air quality concentrations typically are expressed in terms of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). For the purposes of this analysis, three stations, one in each air basin closest to the project footprint, were selected to represent conditions along the project footprint: Sacramento T Street (SVAB), Stockton-Hazelton Street (SJVAB), and Bethel Island Road (SFBAAB). These stations were selected from the available monitoring network based on their proximity to the project footprint. The stations are about 7, 8, and 5 miles, respectively, to the nearest point along the conveyance alignment. The Sacramento T Street and Stockton-Hazelton Street stations are in downtown Sacramento and Stockton, respectively, and as such, monitored pollutant concentrations are influenced by urban emission sources (e.g., congested vehicles, buildings). Data from these stations are therefore more representative of existing conditions in portions of the project area nearest to cities and roadways. Emissions sources along more rural parts of the project area in Sacramento and San Joaquin counties (e.g., through the Delta) are much less concentrated, and as such, monitored pollutant concentrations from the Sacramento T Street and Stockton-Hazelton Street provide a conservative representation of ambient conditions.

Table J-1 summarizes the results of ambient monitoring at these stations for the most recent 3 years of available data (2018–2020). Some stations only monitor ozone, whereas others monitor carbon monoxide (CO), nitrogen dioxide (NO_2), and PM less than or equal to 10 microns in diameter (PM10), and/or PM less than or equal to 2.5 microns in diameter (PM2.5).

Between 2018 and 2020, monitored CO and NO_2 concentrations did not exceed any federal or state standards at any of the three monitoring locations. However, the state and federal standards for ozone and PM10 and federal standard for PM2.5 were exceeded.

Table J-1. Ambient Air Quality Monitoring Data along the Water-Conveyance Alignment (2018–2020)

	Sacramento T Street Station			Stockton-Hazelton Street			Bethel Island Road		
Pollutant Standards	2018	2019	2020	2018	2019	2020	2018	2019	2020
Ozone (O_3)									
Maximum 1-hour concentration (ppm)	0.097	0.100	0.112	0.088	0.098	0.100	0.093	0.082	0.107
Maximum 8-hour concentration (ppm)	0.084	0.074	0.076	0.077	0.077	0.074	0.078	0.072	0.085
Measured number of days standard exceeded									
CAAQS 1-hour (>0.09 ppm)	1	1	1	0	1	1	0	0	1
CAAQS 8-hour (>0.070 ppm)	1	1	3	1	2	2	1	1	2
NAAQS 8-hour (>0.070 ppm)	1	1	3	2	2	2	1	1	2
Carbon Monoxide (CO) [a]									
Maximum 8-hour concentration (ppm)	3.0	1.3	1.6	2.7	1.4	2.2	2.0	1.0	2.1
Maximum 1-hour concentration (ppm)	3.2	1.4	4.3	3.0	3.1	2.7	2.2	1.8	2.4
Measured number of days standard exceeded									
NAAQS 8-hour (>9 ppm)	0	0	0	0	0	0	0	0	0
CAAQS 8-hour (>9.0 ppm)	0	0	0	0	0	0	0	0	0
NAAQS 1-hour (>35 ppm)	0	0	0	0	0	0	0	0	0
CAAQS 1-hour (>20 ppm)	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide (NO_2)									
National maximum 1-hour concentration (ppm)	66.3	61.9	54.1	65.3	72.3	60.0	42.6	29.8	29.8
State maximum 1-hour concentration (ppm)	66	61	54	65	72	60	42	29	29
Annual average concentration (ppm)	9	9	9	12	12	11	5	4	4
Measured number of days exceeded									
CAAQS 1-hour (0.18 ppm)	0	0	0	0	0	0	0	0	0
NAAQS 1-hour (0.10 ppm)	0	0	0	0	0	0	0	0	0

Pollutant Standards	Sacramento T Street Station			Stockton-Hazelton Street			Bethel Island Road		
	2018	2019	2020	2018	2019	2020	2018	2019	2020
Particulate Matter (PM10)									
National maximum 24-hour concentration (µg/m3)	292.6	174.7	298.7	187.0	85.9	147.0	142.9	54.7	38.6
National second-highest 24-hour concentration (µg/m3)	252.7	90.7	232.2	173.6	68.3	113.8	53.7	53.0	21.2
State maximum 24-hour concentration (µg/m3)	309.5	179.1	292.8	198.6	89.1	148.5	151.0	57.0	40.0
State second-highest 24-hour concentration (µg/m3)	267.2	92.9	260.5	184.1	70.1	122.0	55.0	55.0	22.0
Annual average concentration (µg/m3)	29.2	20.2	31.1	28.7	24.4	33.5	10.0	7.9	7.6
Measured number of days standard exceeded									
NAAQS 24-hour (>150 µg/m^3)	6	1	4	2	0	0	0	0	0
CAAQS 24-hour (>50 µg/m^3)	22	24	59	5	7	12	2	2	0
CAAQS annual (> 20 µg/m^3)	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Particulate Matter (PM2.5)									
National maximum 24-hour concentration (µg/m3)	149.9	32.2	111.0	188.0	50.1	130.7	–	–	–
National second-highest 24-hour concentration (µg/m3)	108.8	31.1	76.8	150.6	49.4	122.2	–	–	–
State maximum 24-hour concentration (µg/m3)	263.3	37.1	150.4	188.0	50.1	130.7	–	–	–
State second-highest 24-hour concentration (µg/m3)	225.1	32.3	116.0	150.6	49.4	122.2	–	–	–
Annual average concentration (µg/m3)	12.8	7.7	–	17.5	9.3	14.3	–	–	–
Measured number of days standard exceeded									
NAAQS 24-hour (>35 µg/m^3)	3	0	6	25	6	23	–	–	–
NAAQS/CAAQS annual (>12 µg/m^3)	Yes	No	–	Yes	No	Yes	–	–	–
Sulfur Dioxide (SO_2)									
No data available									

Sources: California Air Resources Board 2021; U.S. Environmental Protection Agency 2021a.

µg/m^3 = micrograms per cubic meter; CAAQS = California ambient air quality standards; CO = carbon monoxide; NAAQS = national ambient air quality standards; O_3 = ozone; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; PM10 = particulate matter that is 10 microns in diameter and smaller; ppm = parts per million; SO_2 = sulfur dioxide; > = greater than; – = not applicable or there was insufficient or no data available to determine the value.

[a] SVAB data from the Bercut Drive station.

J.2.3 Emissions Inventories

CARB maintains an annual emission inventory for each county and air basin in the state. This inventory is used by YSAQMD, SMAQMD, BAAQMD, SJVAPCD, and CARB for regional air quality planning purposes and is the basis for the region's air quality plans, and includes such sources as stationary (e.g., landfills, electric utilities, mineral processes); area-wide (e.g., farming operations, construction/demolition activities, residential fuel combustion); and mobile sources (e.g., automobiles, aircraft, offroad equipment). The latest criteria pollutant emissions inventories (2017) for Yolo, Sacramento, San Joaquin, Alameda, and Contra Costa Counties are summarized in Tables J-2 through J-6.

Table J-2. Criteria Pollutant Emissions Inventory for Yolo County (2017 Data)

	Annual Emissions (tons per day)					
Source Type	ROG	CO	NO_X	SO_X	PM10	PM2.5
Stationary Sources						
Total fuel combustion	0.10	1.27	2.06	0.12	0.36	0.34
Total waste disposal	3.23	0.01	0.00	0.02	0.00	0.00
Total cleaning and surface coatings	1.19	0.00	0.00	0.00	0.01	0.01
Total petroleum production and marketing	1.10	0.04	0.01	0.01	0.00	0.00
Total industrial processes	0.51	0.14	0.08	0.07	1.94	0.65
Total stationary sources	6.13	1.46	2.15	0.22	2.31	1.00
Area-Wide Sources						
Total solvent evaporation	2.61	0.00	0.00	0.00	0.00	0.00
Total miscellaneous processes	1.37	6.88	0.45	0.03	23.33	3.72
Total area-wide sources	3.98	6.88	0.45	0.03	23.33	3.72
Mobile Sources						
Total on road mobile sources	1.53	12.13	4.22	0.01	0.41	0.19
Total off road mobile sources	2.28	16.25	3.28	0.00	0.21	0.19
Total mobile sources	3.81	28.38	7.50	0.01	0.62	0.38
Yolo County total	13.92	36.72	10.10	0.26	26.26	5.10

Source: California Air Resources Board 2019.

CO = carbon monoxide; NO_X = nitrogen oxide; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; PM10 = particulate matter that is 10 microns in diameter and smaller; ROG = reactive organic gases; SO_X = sulfur oxide.

Table J-3. Criteria Pollutant Emissions Inventory for Sacramento County (2017 Data)

	Annual Emissions (tons per day)					
Source Type	ROG	CO	NO_X	SO_X	PM10	PM2.5
Stationary Sources						
Total fuel combustion	0.27	2.76	1.83	0.05	0.26	0.25
Total waste disposal	0.79	0.04	0.07	0.01	0.02	0.01
Total cleaning and surface coatings	3.38	0.00	0.00	0.00	0.00	0.00
Total petroleum production and marketing	2.65	0.01	0.00	0.00	0.00	0.00
Total industrial processes	1.10	0.60	0.26	0.31	1.27	0.39
Total stationary sources	8.19	3.41	2.16	0.37	1.55	0.65

	Annual Emissions (tons per day)					
Source Type	ROG	CO	NO_X	SO_X	PM10	PM2.5
Area-Wide Sources						
Total solvent evaporation	13.44	0.00	0.00	0.00	0.01	0.01
Total miscellaneous processes	8.54	37.40	2.50	0.12	27.80	8.47
Total area-wide sources	21.98	37.40	2.50	0.12	27.81	8.48
Mobile Sources						
Total on road mobile sources	9.93	78.27	20.35	0.16	2.21	1.04
Total off road mobile sources	11.54	88.83	9.72	0.18	0.70	0.59
Total mobile sources	21.47	167.10	30.07	0.34	2.91	1.63
Sacramento County total	51.64	207.91	34.73	0.83	32.27	10.76

Source: California Air Resources Board 2019.
CO = carbon monoxide; NO_X = nitrogen oxide; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; PM10 = particulate matter that is 10 microns in diameter and smaller; ROG = reactive organic gases; SO_X = sulfur oxide.

Table J-4. Criteria Pollutant Emissions Inventory for San Joaquin County (2017 Data)

	Annual Emissions (tons per day)					
Source Type	ROG	CO	NO_X	SO_X	PM10	PM2.5
Stationary Sources						
Total fuel combustion	0.27	3.15	2.00	0.07	0.25	0.25
Total waste disposal	3.21	0.04	0.05	0.03	0.06	0.05
Total cleaning and surface coatings	3.13	0.00	0.00	0.00	0.12	0.11
Total petroleum production and marketing	1.14	0.02	0.01	0.00	0.00	0.00
Total industrial processes	3.05	0.02	0.25	0.62	0.97	0.32
Total stationary sources	10.80	3.23	2.31	0.72	1.40	0.73
Area-Wide Sources						
Total solvent evaporation	8.08	0.00	0.00	0.00	0.00	0.00
Total miscellaneous processes	7.24	9.23	1.46	0.06	24.57	4.83
Total area-wide sources	15.32	9.23	1.46	0.06	24.57	4.83
Mobile Sources						
Total on road mobile sources	5.15	40.23	15.32	0.08	1.34	0.69
Total off road mobile sources	8.08	50.23	12.99	0.05	0.87	0.77
Total mobile sources	13.23	90.46	28.31	0.13	2.21	1.46
San Joaquin County total	39.35	102.92	32.08	0.91	28.18	7.02

Source: California Air Resources Board 2019.
CO = carbon monoxide; NO_X = nitrogen oxide; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; PM10 = particulate matter that is 10 microns in diameter and smaller; ROG = reactive organic gases; SO_X = sulfur oxide.

Table J-5. Criteria Pollutant Emissions Inventory for Alameda County (2017 Data)

	Annual Emissions (tons per day)					
Source Type	ROG	CO	NO_X	SO_X	PM10	PM2.5
Stationary Sources						
Total fuel combustion	0.30	2.46	3.06	0.63	0.30	0.30
Total waste disposal	0.77	0.34	0.31	0.02	0.04	0.04

Source Type	Annual Emissions (tons per day)					
	ROG	CO	NO_X	SO_X	PM10	PM2.5
Total cleaning and surface coatings	7.88	0.00	0.00	0.00	0.00	0.00
Total petroleum production and marketing	1.71	0.00	0.00	0.00	0.01	0.01
Total industrial processes	2.40	0.43	0.25	0.78	3.33	1.33
Total stationary sources	13.06	3.23	3.62	1.43	3.68	1.68
Area-Wide Sources						
Total solvent evaporation	14.78	0.00	0.00	0.00	0.00	0.00
Total miscellaneous processes	1.83	9.68	2.38	0.06	11.52	3.21
Total area-wide sources	16.61	9.68	2.38	0.06	11.52	3.21
Mobile Sources						
Total on road mobile sources	9.92	76.60	26.10	0.18	2.70	1.30
Total off road mobile sources	9.87	97.76	13.25	0.30	0.61	0.54
Total mobile sources	19.79	174.36	39.35	0.48	3.31	1.84
Alameda County total	49.46	187.27	45.35	1.97	18.51	6.73

Source: California Air Resources Board 2019.

CO = carbon monoxide; NO_X = nitrogen oxide; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; PM10 = particulate matter that is 10 microns in diameter and smaller; ROG = reactive organic gases; SO_X = sulfur oxide.

Table J-6. Criteria Pollutant Emissions Inventory for Contra Costa County (2017 Data)

Source Type	Annual Emissions (tons per day)					
	ROG	CO	NO_X	SO_X	PM10	PM2.5
Stationary Sources						
Total fuel combustion	2.22	6.94	10.37	4.59	3.15	3.08
Total waste disposal	0.54	1.29	0.33	0.06	0.04	0.04
Total cleaning and surface coatings	2.81	0.00	0.00	0.00	0.00	0.00
Total petroleum production and marketing	9.39	1.75	0.27	1.41	2.30	1.86
Total industrial processes	4.87	0.97	2.52	7.24	1.42	0.79
Total stationary sources	19.83	10.95	13.49	13.30	6.91	5.77
Area-Wide Sources						
Total solvent evaporation	10.16	0.00	0.00	0.00	0.00	0.00
Total miscellaneous processes	1.66	17.36	2.01	0.07	8.51	3.43
Total area-wide sources	11.82	17.36	2.01	0.07	8.51	3.43
Mobile Sources						
Total on road mobile sources	5.64	45.09	11.41	0.09	1.40	0.66
Total off road mobile sources	11.70	76.01	10.48	0.26	0.80	0.65
Total mobile sources	17.34	121.10	21.89	0.35	2.20	1.31
Contra Costa County total	48.99	149.41	37.39	13.72	17.62	10.51

Source: California Air Resources Board 2019.

CO = carbon monoxide; NO_X = nitrogen oxide; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; PM10 = particulate matter that is 10 microns in diameter and smaller; ROG = reactive organic gases; SO_X = sulfur oxide.

J.3 Regulatory Procedures

The general conformity regulations establish certain procedural requirements that must be followed when preparing a general conformity evaluation. This section presents the major applicable procedural issues associated with the general conformity demonstration and a description of how these requirements are met. The procedures required for the general conformity evaluation are similar, but not identical, to those for conducting an air quality impact analysis pursuant to NEPA regulations. This draft General Conformity Determination is being released for public and agency review pursuant to 40 CFR Section 93.156, and the final General Conformity Determination would be published concurrent with record of decision for the federal action.

J.3.1 Use of Latest Planning Assumptions

The general conformity regulations require that the analysis use the latest planning assumptions based on data (e.g., population, employment, travel, and congestion) made available by the area's Metropolitan Planning Organizations (40 CFR § 93.159[a]).

As the analysis of emissions resulting from construction activities would not require the use of population, employment, travel, and congestion data, this section is not applicable to the project.

J.3.2 Use of Latest Emissions Estimation Techniques

The general conformity regulations require the use of the latest and most accurate emission estimation techniques available, unless such techniques are inappropriate (40 CFR § 93.159[b]). Emissions from construction activities and long-term operations and maintenance (O&M) were calculated using a combination of emission factors and methodologies from the California Emissions Estimator Model (CalEEMod), version 2016.3.2; the Emissions FACtors model (EMFAC2017 and CT-EMFAC2017);[3] the EPA's *AP-42 Compilation of Air Pollutant Emission Factors* (AP-42); and other relevant agency guidance and published literature. CalEEMod provides the latest emission factors for construction offroad equipment. It accounts for lower fleet population and growth factors because of the economic recession and updated load factors based on feedback from engine manufacturers. The use of emissions rates from CalEEMod reflects the recommendation of CARB to capture the latest offroad construction assumptions. CalEEMod default load factors (the ratio of average equipment horsepower utilized to maximum equipment horsepower) and useful life parameters were used for emissions estimates. Refer to the Delta Conveyance Project Draft EIR Appendix 23A, *Mass Emissions Estimation Methodology*, for detailed information on the emissions estimation techniques (California Department of Water Resources 2022).

J.3.3 Project Activities

J.3.3.1 Construction

Project-specific data, including construction equipment lists and the construction schedule, were used to forecast construction emissions associated with the project using construction activity data

[3] CARB released EMAFC2021 on January 15, 2021, but this version has not yet been approved by EPA for project-level conformity analyses. Accordingly, this analysis uses EMAFC2017, which was available at the time of notice of preparation of the Draft EIR and is the current EPA-approved version of EMFAC.

provided by the Delta Conveyance Design and Construction Authority (DCA). During peak construction periods, work would occur at several locations within the study area, with overlapping construction of various project components. Table J-7 summarizes the expected timeframe for construction of each of the physical project components (e.g., intakes), movement of reusable tunnel material (RTM), and on-site batching operations.

Table J-7. Construction Features and General Schedule

Physical Component	Expected Timeframe
Bethany Aqueduct	CY 5 to CY 10 (Alternative 5)
Batch plants [a]	CY 1 (Alternatives 1, 2b, 3, 4b); CY 1, CY 5, and CY 6 (Alternatives 2a, 4a); CY 1 and CY 5 (Alternatives 2c, 4c); CY 1 and CY 3 (Alternative 5)
Batch plants (operation)	CY 2 to CY 11 (Alternatives 1, 2b, 2c, 3, 4b, 4c); CY 2 to CY 12 (Alternatives 2a, 4a); Cy 1 and CY 2 to CY 13 (Alternative 5)
Bethany Reservoir Pumping Plant and Surge Basin	CY 3 to CY 13 (Alternative 5)
Bethany Discharge	CY 5 to CY 10 (Alternative 5)
Intakes	CY 1 to CY 12 (Alternatives 1, 2a, 2c, 3, 4a, 4c, 5); CY 1 to CY 11 (Alternatives 2b, 4b)
Levees [b]	CY 3 (all alternatives)
Park-and-ride lots	CY 1 (all alternatives)
Rail depots [c]	CY 1 (Alternatives 1, 2a, 2b, 2c); CY 1 and CY 2 (Alternatives 3, 4a, 4b, 4c, 5)
Roads	CY 1 to CY 12 (Alternatives 1, 2a, 2b, 2c); CY 1 to CY 13 (Alternatives 3, 4a, 4b, 4c, 5)
RTM handling	CT 5 to CY 12 (Alternatives 1, 2c, 2b); CY 10 to CY 13 (Alternatives 2a, 4c); 2029 to 2035 (Alternative 2b); 2030 to 2039 (Alternatives 3, 4a); CY 3 to CY 12 (Alternative 5)
Shafts and tunnel [d]	CY 1 to CY 12 (Alternatives 1, 2b, 2c, 3, 4b); CY 1 to CY 13 (Alternatives 2a, 4a, 4c, 5) CY 1 to CY 11 (Alternative 4a)
Southern Complex	CY 1 to CY 12 (Alternatives 1, 2b, 2c, 4b); CY 1 to CY 13 (Alternatives 2a, 4a, and 5); CY 1 to CY 11 (Alternative 4c)
Compensatory mitigation	CY 1 through CY 3 (all alternatives)

CY = construction year; RTM = reusable tunnel material.

[a] Only the Lambert Road Batch Plant and Bethany Complex Batch Plant (Alternative 5) are listed separately as "Batch Plant" features. The Bacon Island Batch Plant is included in the Bacon Island Shaft feature. Both concrete batch plants at the Southern Complex (Alternatives 1, 2a, 2b, 2c, 3, 4a, 4b, and 4c) are included in the Southern Complex feature.

[b] Levee work at the intakes is included in the Intakes feature.

[c] The Southern Complex rail depot is included in the Southern Complex feature (Alternatives 1, 2a, 2b, 2c, 3, 4a, 4b, and 4c).

[d] Shafts at the intakes and Southern/Bethany Complex are included in the Intakes and Southern/Bethany Complex features, respectively.

J.3.3.2 Operations and Maintenance

Project-specific data, including number of truck trips and equipment operating hours, were used to forecast maintenance emissions associated with the project using activity data provided by the DCA.

Maintenance will be conducted daily or at varying frequencies, depending on the type of activity. The following general activities will be needed to successfully maintain the project.

- **Daily**: Inspections, security checks, and operations oversight.
- **Weekly and semiweekly**: Inspections, janitorial service, well measurements, operability testing.
- **Monthly**: Inspections, cleaning, operability testing.
- **Quarterly**: General maintenance, animal burrow filling, weed management.
- **Semiannually**: Pressure washing, group maintenance, operability testing, debris and sediment removal.
- **Annually**: Inspections, general maintenance and repairs, jet washing and cleaning, operability testing and instrumentation calibration, refurbishment, lubrication, sediment removal, and surveying.
- **Long-term:** Various activities conducted every 2, 4, 5, 10, 15, and 30 years, including, but not limited to dewatering, repaving, recertification, special testing, and repairs.

Depending on the type of activity, project maintenance will generate emissions from heavy equipment, motor vehicles, marine vessels, truck loading (sediment removal), repaving, and circuit breakers. These activities would take place at the intakes, tunnel shafts, pumping plant, forebay, and control structures.

Long-term operation of the project would require the use of electricity for pumping. While fossil fuel–powered electrical-generating facilities emit criteria pollutants, these facilities are regulated and permitted at a maximum emissions level. Therefore, operational emissions associated with electricity consumption are not included in the analysis because these emissions have already been evaluated and accounted for in existing permit and environmental documents.

J.3.4 Emissions Scenarios

The general conformity regulations require that the analysis reflect certain emissions scenarios (40 CFR § 93.159[d]). Specifically, these scenarios generally include the evaluation of the direct and indirect emissions from a proposed project for the following years: (1) the year mandated in the CAA for attainment and for maintenance areas, the farthest year for which emissions are projected in the approved maintenance plan; (2) the year during which the total of direct and indirect emissions for the federal action are projected to be the greatest on an annual basis; and (3) any year for which the applicable SIP specifies an emissions budget.

Both the O&M and construction phases of the project must be analyzed, and the following applies to the project.

- Emissions generated during the project's O&M and construction phase, which would include the year with the greatest amount of total direct and indirect emissions, may be subject to general conformity regulations because they would increase regional emissions rates and, as such, have the potential to cause or exacerbate an exceedance of the NAAQS. Therefore, analyses were conducted to estimate the amounts of emissions that would be generated during the long-term operations and construction phase (for comparison with the general conformity applicability rates) and the potential effects of these emissions on local air quality levels. Emissions generated at the construction sites (e.g., tailpipe emissions from the on-site heavy-duty diesel equipment and fugitive dust emissions generated by vehicles traveling within the construction sites) and on the area's roadways by vehicles traveling to and from these sites (by vehicles transporting materials and the workers traveling to and from work) were considered.

- Air quality dispersion modeling would be required for this conformity analysis to estimate the project's localized effects on PM concentrations if the annual emissions of the pollutants generated during construction were to exceed the general conformity *de minimis* thresholds.
- Annual emissions were estimated for each year of the project's construction period. These emissions, which are the maximum values for the project, are described in more detail in Section J.6, *Estimated Emissions Rates and Comparison to* de minimis *Thresholds*, of this appendix.

J.4 Applicability Analysis

The general conformity rule applies to all federal actions located in nonattainment and maintenance areas that are not exempt from general conformity (are either covered by Transportation Conformity or listed in the rule), are not covered by a presumed-to-conform approved list,[4] or do not have clearly *de minimis* emissions. The first step in a general conformity evaluation is to determine whether the project is in a federal nonattainment or a maintenance area.

J.4.1 Attainment Status of the Study Area

EPA designates each county (or portions of counties) within California as attainment, maintenance, or nonattainment based on the area's ability to maintain ambient air concentrations below the air quality standards. Areas are designated as attainment if ambient air concentrations of a criteria pollutant are below the ambient standards. Areas are designated as nonattainment if ambient air concentrations are above the ambient standards. Areas previously designated as nonattainment that subsequently demonstrated compliance with the standards are designated as maintenance. Table J-8 summarizes the attainment status of the study area within SVAB, SJVAB, and SFBAAB with regard to the NAAQS.

Table J-8. Federal Attainment Status of the Study Area within SVAB, SJVAB, and SFBAAB

Pollutant	SVAB	SJVAB	SFBAAB
Ozone	Nonattainment (moderate/severe 15 [a])	Nonattainment (extreme)	Nonattainment (marginal)
Carbon Monoxide	Attainment	Attainment	Attainment
Coarse Particulate Matter (PM10)	Maintenance (moderate)	Maintenance (serious)	Attainment/Unclassified
Fine Particulate Matter (PM2.5)	Nonattainment (moderate)	Nonattainment (serious)	Nonattainment (moderate)
Nitrogen Dioxide (NO_2)	Attainment/Unclassified	Attainment/Unclassified	Attainment/Unclassified
Sulfur Dioxide (SO_2)	Attainment/Unclassified	Attainment/Unclassified	Attainment/Unclassified

Source: U.S. Environmental Protection Agency 2021b.

[4] Category of activities designated by a federal agency as having emissions below *de minimis* levels or otherwise do not interfere with the applicable SIP or the attainment and maintenance of the NAAQS.

CO = carbon monoxide; SVAB = Sacramento Valley Air Basin; NO_2 = nitrogen dioxide; O_3 = ozone; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; PM10 = particulate matter that is 10 microns in diameter and smaller; SFBAAB = San Francisco Bay Area Air Basin; SJVAB = San Joaquin Valley Air Basin; SO_2 = sulfur dioxide.

[a] The Sacramento metropolitan area is designated moderate nonattainment for the 2015 8-hour ozone standard and severe 15 nonattainment for the 2008 8-hour ozone standard. Areas classified as severe 15 must attain the NAAQS within 15 years of the effective date of the nonattainment designation.

Under federal designations, the study area is currently designated as severe, extreme, and marginal nonattainment for 8-hour ozone[5] in the SVAB, SJVAB, and SFBAAB, respectively; moderate/serious nonattainment for PM2.5 in the all air basins; and moderate and serious maintenance for PM10 in the SVAB and SJVAB, respectively. As such, USACE is required to demonstrate project-level compliance with the general conformity rule for nitrogen oxides (NO_X) and reactive organic gases (ROGs) (ozone precursors), PM2.5, PM10, and SO_2 (PM2.5 precursor[6]) if project-related emissions of these pollutants in the SVAB, SJVAB, or SFBAAB would exceed the general conformity *de minimis* thresholds.

J.4.2 Exemptions from General Conformity Requirements

As noted previously, the general conformity requirements apply to a federal action if the net project emissions equal or exceed certain *de minimis* emissions rates. The only exceptions to this applicability criterion are if the activity is on the federal agency's presumed-to-conform list (40 CFR § 93.153(f)), meets the narrow exemption for federal actions in response to an emergency or disaster (40 CFR § 93.153(e)), or is one of the following topical exemptions.

- Actions that would result in no emissions increase or an increase in emissions that is clearly below the *de minimis* levels (40 CFR § 93.153(c)(2)). Examples include administrative actions and routine maintenance and repair.
- Actions where the emissions are not reasonably foreseeable (40 CFR § 93.153(c)(3))
- Actions that implement a decision to conduct or carry out a conforming program (40 CFR § 93.153(c)(4))
- Actions that include major new or modified sources requiring a permit under the New Source Review program (40 CFR § 93.153(d)(1))
- Actions in response to emergencies or natural disasters (40 CFR § 93.153(d)(2))
- Actions that include air quality research not harming the environment (40 CFR § 93.153(d)(3))
- Actions that include modifications to existing sources to enable compliance with applicable environmental requirements (40 CFR § 93.153(d)(4))

[5] Ozone is a secondary pollutant (i.e., it is not emitted directly into the atmosphere, but is formed in the atmosphere from the photochemical reactions of ROGs and NO_X in the presence of sunlight), so its *de minimis* threshold is based on primary emissions of its precursor pollutants, NO_X and ROGs. If the net emissions of either NO_X or ROGs exceeds the *de minimis* applicability thresholds (U.S. Environmental Protection Agency 1994), the federal action is subject to a general conformity evaluation for ozone.

[6] Ammonia is also a precursor to PM2.5. However, neither construction nor operation of the project would result in material emissions of ammonia.

- Actions which include emissions from remedial measures carried out under the Comprehensive Environmental Response, Compensation and Liability Act that comply with other applicable requirements (40 CFR § 93.153(d)(5)).

None of these exemptions from general conformity apply to the proposed action.

J.4.3 Applicability for Federal Action

If it is determined a project is not exempt from general conformity, the applicability of the general conformity requirements to the federal action is evaluated by comparing total direct and indirect emissions for each calendar year to the appropriate general conformity *de minimis* thresholds.

In the event that total direct and indirect emissions of a pollutant attributable to the federal action are below the *de minimis* thresholds for a pollutant, that pollutant is excluded from general conformity requirements and no further analysis is required, as it is assumed these pollutants would conform to the SIP. Those pollutants that could not be excluded from applicability must undergo a general conformity evaluation.

If the general conformity evaluation indicates that total direct and indirect emissions of a pollutant attributable to the federal action are in excess of any of the general conformity *de minimis* thresholds, the applicant must perform a conformity determination. A conformity determination is made by satisfying any of the requirements identified in Section J.1.1, *General Conformity Requirements*.

J.4.4 *de minimis* Emissions Rates

The general conformity requirements would apply to the federal action for each pollutant for which the total of direct and indirect emissions caused by the federal action equal or exceed the *de minimis* emissions rates shown in Table J-9. These emissions rates are expressed in units of tons per year (tpy) and are compared to the total of direct and indirect emissions caused by the project in each air basin for the calendar year. Table J-9 shows the applicable threshold levels for the pollutants for which general conformity is required in the study area.

Table J-9. General Conformity Rule *de minimis* Thresholds for the Project (tons per year)

Air Basin	ROG	NO_X	CO [a]	PM10	PM2.5	SO_2 [b]
SVAB	25	25	None	100	100	100
SJVAB	10	10	None	100	70	70
SFBAAB	100	100	None	None	100	100

Source: 40 CFR Section 93.153.

SVAB = Sacramento Valley Air Basin; SJVAB = San Joaquin Valley Air Basin; SFBAAB = San Francisco Bay Area Air Basin; ROG = reactive organic gases; lbs = pounds; NO_X = nitrogen oxide; PM10 = particulate matter that is 10 microns in diameter and smaller; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; CO = carbon monoxide; SO_X = sulfur oxide.

[a] The project area is in attainment for CO (see Table J-8).

[b] Although the project area is in attainment for SO_2, because SO_2 is a precursor for PM2.5, the PM2.5 general conformity *de minimis* thresholds are used.

J.5 Project Activities Considered

As shown in the Delta Conveyance Project Draft EIR Chapter 23, *Air Quality and Greenhouse Gases*, Section 23.3.3, *Impacts and Mitigation Approaches*, the results of the regional analyses conducted for the project demonstrate that emissions generated during the long-term O&M would be less than the *de minimis* emissions rates shown in Table J-9 (California Department of Water Resources 2022). As such, no further analysis of the operational-period emissions is necessary for this General Conformity Determination. This section focuses on the emissions generated from the construction-period emissions for the project.

The analysis conducted for the Delta Conveyance Project Draft EIR and Draft EIS to estimate potential air quality impacts caused by on-site (e.g., demolition activities, construction equipment operations, and truck movements) and off-site (e.g., motor vehicle traffic effects because of truck trips) construction-phase activities included the following.

- Estimation of emissions generated by the construction activities, including fugitive dust emissions and emissions released from diesel-powered equipment and trucks based on the hours of operation of each piece of equipment.[7]
- Identification of heavily traveled truck routes to estimate the cumulative effects of on-site construction activity emissions and off-site traffic emissions.
- A dispersion modeling analysis of the major construction areas and haul routes.
- A comparison of the on-site and off-site modeling results to the applicable NAAQS for the applicable pollutants.

Emission rates for these activities were estimated based on the following.

- The number of hours per day and duration of each construction activity.
- The number and type of construction equipment to be used.
- Horsepower and utilization rates (hours per day) for each piece of equipment.
- The quantities of construction/demolition material produced and removed from each site.
- The quantities of on-site concrete batching and soil movement.
- The number of truck and locomotive trips needed to remove construction material and to bring the supply materials to each site.

J.5.1 Construction Emissions Estimation Methodology

Emissions for major construction activities were calculated based on information provided by the applicant, the DCA, and standard and accepted software tools, techniques, and emissions factors, as summarized below. Refer to Delta Conveyance Project Draft EIR Appendix 23A, *Mass Emissions Estimation Methodology*, for detailed information on the emissions estimation techniques (California Department of Water Resources 2022).

[7] It is possible changes in vehicle miles traveled, speeds, or idle times resulting from traffic detours during construction could result in additional emissions. However, it is unknown to what extent motorists will change their driving patterns as a result of traffic detours and impediments, and, as such, it would be speculative to quantify the effect of temporary roadway restrictions on criteria pollutant emissions.

- **Offroad Equipment**: Emission factors for offroad construction equipment (e.g., loaders, graders, bulldozers) were obtained from the CalEEMod (version 2016.3.2) User's Guide appendix, which provides values per unit of activity (in grams per horsepower-hour) (Trinity Consultants 2017a:Table 3.5). Analysts estimated exhaust emissions from offroad equipment using the CalEEMod emissions rate and activity data (operating hours per day) provided by the DCA.
- **On-Road Vehicles**: Motor vehicles (e.g., pickup trucks, flatbed trucks) would be required for material and equipment hauling, on-site crew and material movement, and employee commuting. Analysts estimated exhaust, tirewear, and brakewear emissions from on-road vehicles using the EMFAC2017 emissions model and activity data (trips and miles traveled per day) provided by the DCA and Fehr & Peers. Fugitive re-entrained road dust emissions associated with the vehicle trips were estimated using EPA's (2006a:Tables 13.2.2-1 and 13.2.2-2; 2011:Table 13.2.1-1) *Compilation of Air Pollutant Emission Factors* (AP-42), Sections 13.2.1 and 13.2.2.
- **Locomotives**: Tunnel segments, tunnel boring machine components, materials, and equipment may be delivered to the Twin Cities Complex, Lower Roberts Island, and Byron Tract by railroad. Locomotives would also be used on-site to transport construction materials and RTM to other Delta Conveyance construction sites. Locomotive emissions factors were obtained from EPA (2009:Table 1). Analysts estimated exhaust emissions from locomotives using EPA's emissions rates and activity data (ton-miles per day, engine operating hours per day) provided by the DCA.
- **Marine Vessels**: Marine vessels may be used to install riprap during the final intake construction phase and for preliminary field investigations. Criteria pollutant emissions factors were obtained from SMAQMD's Harborcraft, Dredge and Barge Emission Factor Calculator and CARB's Pleasure Craft (PC2014) Model. Analysts estimated exhaust emissions from marine vessels using emissions rates from SMAQMD and CARB and activity data (engine operating hours per day) provided by the DCA.
- **Helicopters:** Helicopters would be required for airborne magnetic surveys as part of preliminary field investigations and for installing towers along 8.3 miles of new 230 kilovolt transmission line to serve the Southern Complex for the central and eastern conveyance alignment alternatives. Emission factors per landing and take-off (LTO) and per operational cruising hour for a Bell 407, which is the expected helicopter type for the surveys, and a Hughes 500, which is the expected helicopter type for the transmission work, were obtained from the Federal Office of Civil Aviation (FOCA) (2015:16). Analysts estimated exhaust emissions from helicopters using the FOCA emissions rates and activity data (LTO per day, cruising hours per day) provided by the DCA.
- **Earth Movement, Demolition, and Paving**: Fugitive emissions from earth movement (i.e., site grading, bulldozing, dredging, truck/rail car loading, conveyor drops), demolition, and paving were quantified using emissions factors from the CalEEMod User's Guide (Trinity Consultants 2017b:8–10, 12–13, 17–18) and EPA's AP-42 (2006b:13.2.4-2; 2004:Table 11.19.2-2). Acres graded and borrowed, excavated, dredged, demolished, and paved quantities were provided by the DCA.
- **Stockpile Wind Erosion**: Stockpiles would be used to store RTM and other earthen materials. Emission factors for windblown fugitive dust were calculated using the methodology found in Section 9.3 of the Fugitive Dust Handbook (Countess Environmental 2006:9-8). Analysts

estimated resulting emissions using the calculated factors and the expected acres of stockpiling each year provided by the DCA.

- **Concrete Batching**: Fugitive dust emissions from concrete batching were estimated using concrete data from the DCA and emissions factors from EPA's (2006c:Tables 11.12-2 and 11.12-8) AP-42, Section 11.12.

J.5.2 Annual by Air Basin

Activities occurring within the SFBAAB, SVAB, and SJVAB were quantified and analyzed separately to compare emissions to appropriate *de minimis* thresholds. Emissions generated by construction of components that would occur exclusively within one air basin were wholly assigned to that air basin (e.g., intake construction in SVAB). Emissions estimates for components that span more than one air basin were apportioned based on the location of construction activity. Delta Conveyance Project Draft EIR Appendix 23B, *Air Quality and GHG Analysis Activity Data*, identifies the location(s) of each construction component among the four project area air districts (California Department of Water Resources 2022).

J.5.3 Annual Emissions Estimates

Analysts quantified daily criteria pollutant emissions generated by construction of each phase using the methods described above in Section J.5.1, *Construction Emissions Estimation Methodology*. Analysts converted the daily estimates to annual totals based on the detailed construction schedule. Based on current information, it is anticipated that preliminary field investigations would begin at the earliest in 2025, with construction of the project beginning about 2 years later. However, based on information available at the time of the analysis modeling, emissions were quantified assuming preliminary field investigations would begin in 2024 and project construction in 2026. It is projected that the emissions intensity of equipment and vehicle operation in 2027 would be lower than under 2026 conditions because of improvements in engine technology and regulations to reduce combustion emissions. Accordingly, the analysis reflects a conservative representation of emissions.

J.5.4 Environmental Commitments

Environmental commitments to reduce on-site construction emissions are identified in Appendix C1, *Environmental Commitments and Best Management Practices*, of the Draft EIS. These commitments have been incorporated into the project design and are considered a condition of project approval. Specifically, the following emissions benefits achieved by Environmental Commitments EC-7 and EC-9 through EC-12 were assumed in the modeling.[8]

[8] Environmental Commitment EC-8 requires all construction contractors to use diesel trucks that have model year engines manufactured or retrofitted ideally within the past 5 years of when the vehicles are brought to the individual construction sites, but no more than 8 years from overall project groundbreaking. The measure also encourages DWR to use electric or hybrid-electric vehicles over diesel counterparts. While this commitment will reduce emissions from diesel haul trucks by requiring newer model year engines (or electric vehicles), because there is flexibility to use vehicles that are up to 8 years old at the start of construction, the exact project fleet mix is unknown. Accordingly, analysts conservatively elected to use EMFAC's calendar year average emission factors to estimate emissions from haul trucks. This approach does not quantitatively capture the emissions benefits that will be achieved by Environmental Commitment EC-8, which will lead to use of newer and more electric vehicles for construction of the project, compared to the calendar year fleetwide average.

- Criteria pollutant reductions from use of Tier 4 offroad engines and renewable diesel (Environmental Commitment EC-7).
    - Emissions reductions from Tier 4 engines vary by pollutant and equipment type. Emissions from equipment for which Tier 4 standards have been adopted were modeled using Tier 4 emissions rates from CalEEMod (Trinity Consultants 2017a:Table 3.5). Emissions from equipment for which Tier 4 standards have not been adopted (generally equipment engines less than 25 horsepower) were modeled using calendar year average emissions rates.
    - No renewable diesel benefits were modeled for Tier 4 engines. The following reductions were modeled for all other equipment (California Environmental Protection Agency 2015:8):
        - PM, 30%
        - NOx, 10%
        - CO, 10%
- Criteria pollutant reductions from use of Tier 4 on-site locomotive engines (Environmental Commitment EC-9). Emissions reductions from Tier 4 engines vary by pollutant type. Emissions were modeled using Tier 4 emissions rates from EPA (2009:Table 1).
- Criteria pollutant reductions from use of model year 2010 or newer marine engines (Environmental Commitment EC-10). Emissions reductions vary by pollutant and analysis year. Emissions were modeled using emissions rates derived from SMAQMD's Harborcraft, Dredge and Barge Emission Factor Calculator.
- Fugitive dust reductions from earthmoving best management practices (BMP) (Environmental Commitment EC-11).
    - PM from ground disturbance (i.e., scraping and grading activities), 74% (Countess Environmental 2006:Table 3-7)
    - PM from unpaved vehicle travel (i.e., re-entrained road dust), 84% (Countess Environmental 2006:3)
    - PM from demolition, 36% (Countess Environmental 2006:Table 3-7)
    - PM from stockpile wind erosion, 90% (Countess Environmental 2006:Table 9-4)[9]
- Fugitive dust reductions from implementation of typical control measures at new concrete batch plants, such as water sprays, enclosures, and hoods (Environmental Commitment EC-12). Emissions were modeled using EPA AP-42 controlled emissions factors for concrete batch plants (U.S. Environmental Protection Agency 2006c:Tables 11.12-2 and 11.12-8).

The environmental commitments represent all feasible actions to reduce on-site construction emissions. The applicant has primary implementation responsibility for the environmental commitments. Please refer to the discussion in Appendix C1, *Environmental Commitments and Best Management Practices*, of the Draft EIS.

[9] Control efficacy achieved by watering the storage pile area. Dust control achieved through use of biopolymers has been shown to achieve significantly greater reductions, with tunnel laboratory experiments showing a 100% reduction in the soil loss rate (Lemboye et al. 2021:1). Because EC-11: *Fugitive Dust Control* requires stockpiles be stabilized with an organic biopolymer, limiting the control efficacy to 90% is conservative.

J.6 Estimated Emissions Rates and Comparison to *de minimis* Thresholds

Annual criteria pollutant emissions resulting from construction[10] of the action alternatives are presented in Table J-10. These values are the on-site emissions during each analysis year, plus annual off-site emissions. The modeling accounts for implementation of environmental commitments (see Section J.5.4, *Environmental Commitments*). Violations of the federal *de minimis* thresholds are shown in **bolded underline**.

J.7 Regional Effects

As shown in Table J-10, construction-phase emissions, compared to the *de minimis* thresholds, are as follows.

- Annual estimated NO_X emissions in the SVAB are greater than the applicability rate of 25 tpy between fifth and tenth years of construction, depending on the action alternative, with implementation of environmental commitments.
- Annual estimated NO_X emissions in the SJVAB are greater than the applicability rate of 10 tpy between fourth and tenth years of construction, depending on the action alternative, with implementation of environmental commitments.
- Annual estimated VOC, SO_2, PM10, and PM2.5 emissions are less than the applicability rates in the SVAB and SJVAB with implementation of environmental commitments.
- Annual estimated VOC, SO_2, NO_X, and PM2.5 emissions in the SFBAAB are less than the applicability rates in the SFBAAB with implementation of environmental commitments.

Therefore, a general conformity determination is required for the project for NO_X for the years during construction when the emissions would exceed the *de minimis* thresholds in the SVAB and SJVAB and do not meet any of the exceptions cited in 40 CFR Section 93.154(c). Because NO_X is a precursor to PM and can contribute to PM formation, NO_X emissions above the applicable PM2.5 and PM10 *de minimis* thresholds (100 tpy in Sacramento County and 70 tpy in SJVAB) trigger a potential secondary PM precursor impact. NO_X emissions in these quantities can contribute to PM formation, and thus conflict with the applicable PM10 and PM2.5 SIPs. However, as shown in Table J-10, the secondary PM precursor threshold is not triggered under any action alternative.

This draft General Conformity Determination identifies the applicant's commitment to reduce all NO_X emissions through emissions offsets through a memorandum of understanding (MOU) with SMAQMD and a project-level Voluntary Emissions Reduction Agreement (VERA) with SJVAPCD. Should the applicant be unable to enter what they regard as a satisfactory agreement with SMAQMD or SJVAPCD, the applicant would develop an alternative or complementary offsite mitigation program to reduce NO_X emissions.

[10] As discussed above, the total regional emissions for all applicable pollutants during the O&M phase would not exceed the *de minimis* emission thresholds. As such, only emissions generated during the construction phase were compared to the conformity threshold levels to determine conformity compliance.

Table J-10. Criteria Pollutant Emissions from Construction of the Proposed Action in the SVAB, SJVAB, and SFBAAB (tons/year)[a]

	SVAB						SJVAB						SFBAAB					
Year	ROG	NO_X	CO	PM10	PM2.5	SO_2	ROG	NO_X	CO	PM10	PM2.5	SO_2	ROG	NO_X	CO	PM10	PM2.5	SO_2
Alternative 1																		
PFIY 1	1	3	12	1	<1	<1	1	4	20	1	<1	<1	<1	1	4	<1	<1	<1
PFIY 2	1	3	11	1	<1	<1	1	4	20	1	<1	<1	<1	1	4	<1	<1	<1
CY 1	<1	7	5	3	1	<1	1	5	11	3	1	<1	<1	1	4	2	<1	<1
CY 2	1	11	22	6	2	<1	1	7	16	4	1	<1	1	5	32	1	<1	<1
CY 3	1	14	18	7	2	<1	1	8	17	3	1	<1	1	11	39	15	2	<1
CY 4	1	21	21	5	1	<1	2	**11**	31	6	2	<1	1	11	25	19	3	<1
CY 5	4	**57**	119	13	4	<1	2	**23**	29	9	2	<1	3	19	100	15	4	<1
CY 6	5	**67**	142	14	4	<1	2	**22**	28	8	2	<1	3	19	86	21	4	<1
CY 7	4	**54**	140	14	4	<1	1	**20**	22	9	2	<1	2	19	75	50	8	<1
CY 8	2	**31**	60	13	3	<1	1	**12**	15	8	2	<1	2	14	56	62	10	<1
CY 9	1	**26**	30	11	2	<1	1	9	12	10	2	<1	2	22	64	70	11	<1
CY 10	1	24	17	9	2	<1	1	**13**	11	11	2	<1	2	18	50	87	13	<1
CY 11	1	15	11	7	1	<1	<1	7	7	4	1	<1	1	9	29	78	12	<1
CY 12	<1	2	8	8	1	<1	<1	1	1	<1	<1	<1	<1	<1	2	<1	<1	<1
CY 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alternative 2b																		
PFIY 1	1	2	10	1	<1	<1	1	3	19	1	<1	<1	<1	1	4	<1	<1	<1
PFIY 2	1	2	9	1	<1	<1	1	3	19	1	<1	<1	<1	1	4	<1	<1	<1
CY 1	<1	7	4	3	<1	<1	1	5	11	3	1	<1	<1	1	4	2	<1	<1
CY 2	1	13	22	6	2	<1	1	7	17	4	1	<1	1	7	41	4	1	<1
CY 3	1	11	16	6	2	<1	1	6	15	2	1	<1	1	14	41	22	3	<1
CY 4	1	23	21	3	1	<1	2	**12**	32	5	2	<1	2	15	57	17	3	<1
CY 5	3	**43**	90	10	3	<1	2	**19**	25	7	2	<1	3	22	104	23	5	<1
CY 6	3	**49**	78	9	3	<1	1	**19**	22	6	2	<1	3	20	89	36	7	<1
CY 7	2	**40**	57	8	2	<1	1	**17**	16	6	2	<1	2	19	73	50	8	<1
CY 8	1	**27**	28	7	2	<1	1	**13**	11	6	1	<1	2	13	54	47	8	<1
CY 9	1	**26**	20	6	1	<1	1	**11**	10	6	1	<1	2	23	69	71	11	<1
CY 10	<1	12	9	2	1	<1	<1	7	7	7	1	<1	1	13	30	76	11	<1
CY 11	<1	7	13	5	1	<1	<1	2	2	1	<1	<1	<1	2	8	75	11	<1
CY 12	<1	1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1
CY 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	SVAB						SJVAB						SFBAAB					
Year	ROG	NO_X	CO	PM10	PM2.5	SO_2	ROG	NO_X	CO	PM10	PM2.5	SO_2	ROG	NO_X	CO	PM10	PM2.5	SO_2
CY 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alternative 3																		
PFIY 1	1	3	11	1	<1	<1	1	3	18	1	<1	<1	<1	1	4	<1	<1	<1
PFIY 2	1	2	10	1	<1	<1	1	3	18	1	<1	<1	<1	1	4	<1	<1	<1
CY 1	<1	6	5	3	1	<1	1	5	11	3	1	<1	<1	1	4	2	<1	<1
CY 2	1	9	22	5	2	<1	1	5	13	3	1	<1	1	5	32	1	<1	<1
CY 3	1	8	17	6	2	<1	<1	4	9	2	<1	<1	1	11	38	13	2	<1
CY 4	1	17	20	5	1	<1	1	8	18	6	1	<1	1	11	24	18	3	<1
CY 5	4	**57**	122	13	4	<1	2	**23**	28	9	2	<1	3	21	100	22	5	<1
CY 6	5	**70**	146	14	4	<1	2	**26**	31	8	2	<1	3	21	86	30	5	<1
CY 7	4	**55**	143	15	4	<1	2	**22**	27	7	2	<1	2	22	76	60	9	<1
CY 8	2	**32**	62	13	3	<1	1	**14**	19	5	1	<1	2	14	56	63	10	<1
CY 9	1	**27**	33	11	2	<1	1	**11**	17	6	1	<1	2	23	66	72	11	<1
CY 10	1	**25**	20	10	2	<1	1	**15**	18	9	2	<1	2	20	52	93	14	<1
CY 11	1	17	15	8	2	<1	1	7	10	9	2	<1	1	9	29	77	12	<1
CY 12	<1	4	9	10	2	<1	<1	2	1	6	1	<1	<1	2	6	73	11	<1
CY 13	<1	2	1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	4	73	11	<1
CY 14	0	0	0	0	0	0	0	0	0	0	0	0	<1	<1	<1	9	1	<1
Alternative 4b																		
PFIY 1	1	2	9	1	<1	<1	1	3	17	1	<1	<1	<1	1	4	<1	<1	<1
PFIY 2	<1	2	8	1	<1	<1	1	3	17	1	<1	<1	<1	1	4	<1	<1	<1
CY 1	<1	6	4	3	<1	<1	1	5	11	3	1	<1	<1	1	4	2	<1	<1
CY 2	1	11	25	6	3	<1	1	5	13	3	1	<1	2	7	47	4	1	<1
CY 3	<1	6	11	4	1	<1	<1	3	8	2	<1	<1	1	11	35	10	2	<1
CY 4	1	20	20	3	1	<1	1	10	18	6	2	<1	2	14	60	12	2	<1
CY 5	3	**42**	91	10	3	<1	1	**18**	25	8	2	<1	3	21	103	22	5	<1
CY 6	3	**49**	81	9	3	<1	1	**20**	24	7	2	<1	3	20	89	36	7	<1
CY 7	2	**38**	60	9	2	<1	1	**17**	22	6	2	<1	2	18	70	50	8	<1
CY 8	1	**26**	31	9	2	<1	1	**14**	17	4	1	<1	2	13	56	48	8	<1
CY 9	1	**25**	23	7	2	<1	1	**12**	16	5	1	<1	2	23	69	72	11	<1
CY 10	1	15	13	3	1	<1	<1	9	11	5	1	<1	1	11	24	74	11	<1
CY 11	1	12	18	5	1	<1	<1	3	4	5	1	<1	<1	6	15	76	12	<1
CY 12	<1	1	1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	2	<1	<1	<1
CY 13	0	0	0	0	0	0	<1	<1	<1	<1	<1	<1	0	0	0	0	0	0
CY 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	SVAB						SJVAB						SFBAAB					
Year	ROG	NO_X	CO	PM10	PM2.5	SO_2	ROG	NO_X	CO	PM10	PM2.5	SO_2	ROG	NO_X	CO	PM10	PM2.5	SO_2
Alternative 5																		
PFIY 1	1	2	11	1	<1	<1	1	3	17	1	<1	<1	<1	1	4	<1	<1	<1
PFIY 2	1	2	9	1	<1	<1	1	3	17	1	<1	<1	<1	1	4	<1	<1	<1
CY 1	<1	7	5	3	<1	<1	1	4	10	3	1	<1	<1	2	5	6	1	<1
CY 2	1	4	14	3	1	<1	<1	3	12	3	<1	<1	<1	1	2	2	<1	<1
CY 3	<1	4	12	4	1	<1	1	4	19	3	1	<1	<1	3	13	1	<1	<1
CY 4	1	18	21	5	1	<1	1	**10**	28	8	2	<1	1	13	46	5	1	<1
CY 5	4	**49**	118	12	4	<1	2	**22**	30	9	2	<1	2	20	71	14	3	<1
CY 6	4	**58**	142	13	4	<1	2	**25**	32	10	2	<1	2	15	57	33	5	<1
CY 7	4	**45**	140	14	4	<1	2	**21**	26	9	2	<1	2	15	55	35	5	<1
CY 8	2	**28**	61	12	3	<1	1	**16**	22	11	2	<1	2	20	72	38	6	<1
CY 9	1	**27**	33	12	3	<1	1	**15**	21	16	3	<1	2	22	81	39	6	<1
CY 10	1	20	19	9	2	<1	1	**16**	20	18	3	<1	2	26	69	41	6	<1
CY 11	1	11	13	8	2	<1	1	9	10	18	3	<1	1	7	21	5	1	<1
CY 12	<1	2	8	12	2	<1	<1	3	5	12	2	<1	<1	1	4	1	<1	<1
CY 13	<1	1	<1	<1	<1	<1	1	1	4	1	<1	<1	<1	<1	1	<1	<1	<1
CY 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Threshold	*25*	*25*	–	*100*	*100*	*100*	*10*	*10*	–	*100*	*70*	*70*	*100*	*100*	–	–	*100*	*100*

Sources: ICF modeling.

CO = carbon monoxide; NO_X = nitrogen oxide; PM10 = particulate matter that is 10 microns in diameter and smaller; PM2.5 = particulate matter that is 2.5 microns in diameter and smaller; ROG = reactive organic gases; SO_2 = sulfur dioxide.

[a] Emissions results include implementation of air quality environmental commitments (EC-7 and EC-9 through EC-12). Exceedances of federal *de minimis* thresholds are shown in **bolded underline**.

J.8 General Conformity Evaluation

For federal actions subject to a general conformity evaluation, the regulations delineate several ways an agency can demonstrate conformity (40 CFR § 93.158). This section summarizes the findings that were used to make the determination for the project.

J.8.1 Conformity Requirements for the Proposed Action

Based on the results shown in Table J-10, conformity determinations are required for construction-phase emissions for NO_X because annual estimated emissions are greater than the applicability rates of 25 tpy in the SVAB and 10 tpy in the SJVAB.

J.8.2 Compliance with Conformity Requirements

To support this draft General Conformity Determination, USACE demonstrates herein that the emissions of NO_X (a precursor to ozone) caused by the construction of the project would not result in an increase in regional NO_X emissions in the SVAB or SJVAB. This would be achieved by on-site controls and offsetting remaining NO_X emissions generated by the construction of the project in a manner consistent with the general conformity regulations.

The offsets are anticipated to be accomplished through an MOU and project-level VERA between the applicant and SMAQMD and SJVAPCD, respectively, or through an alternative or complementary offsite mitigation program. The requirement for the MOU and VERA would be implemented as part of the project as described in the mitigation measures from the Draft EIS, which are reproduced below.

Mitigation Measure AQ-1: Offset Construction-Generated Criteria Pollutants in the Sacramento Valley Air Basin

Performance Standard

Prior to issuance of construction contracts, the applicant will enter into a memorandum of understanding (MOU) with SMAQMD or develop an alternative or complementary mitigation program (as discussed below) to reduce NO_X and PM10. Emissions above the federal *de minimis* thresholds will be reduced to net zero (0). Emissions not above the *de minimis* thresholds, but above SMAQMD's thresholds, will be reduced to quantities below the air district's thresholds.

Emissions generated by project construction have been quantified as part of the Delta Conveyance Project Draft EIR (California Department of Water Resources 2022). Although this inventory could be used exclusively to inform the required mitigation commitment, the methods used to quantify emissions in the Delta Conveyance Project Draft EIR were conservative (California Department of Water Resources 2022). They also do not account for any additional reductions that may be achieved by future state and federal regulations that reduce the emissions intensity of equipment and vehicles, nor do they account for reduction strategies that may be implemented by the applicant pursuant to other mitigation measures (e.g., Mitigation Measure AQ-9). Accordingly, the Delta Conveyance Project Draft EIR likely overestimates actual emissions that would be generated by construction of the project (California Department of Water Resources 2022). The applicant may, therefore, reanalyze criteria pollutant emissions from construction of the project to update the required reduction commitment to achieve performance standard.

An updated emissions analysis conducted for the project will be performed using approved emissions models and methods available at the time of the reanalysis. The analysis must use the latest available engineering data for the project, inclusive of any required environmental commitments or emissions reduction strategies. Consistent with the methodology used in the Delta Conveyance Project Draft EIR (California Department of Water Resources 2022), emissions factors may account for enacted regulations that will influence future year emissions intensities (e.g., fuel efficiency standards for on-road vehicles).

Mitigation Agreement with SMAQMD

1. The applicant will enter into an MOU with SMAQMD to reduce NO_X and PM10 according to the performance standard described above.

   a. The mitigation offset fee amount will be determined at the time of mitigation to fund one or more emissions reduction projects within the SVAB (or in a nearby area of equal or higher nonattainment classification, as allowed under 40 CFR 93.158(2)). SMAQMD will require an additional administrative fee of no less than 5% of the total offset fee. The mitigation offset fee will be determined by the applicant and SMAQMD based on the type of projects available at the time of mitigation. This fee is intended to fund emissions reduction projects to achieve reductions. Documentation of payment will be provided to the applicant or its designated representative.

   b. The MOU will include details regarding the annual calculation of required offsets the applicant must achieve, funds to be paid, administrative fees, and the timing of the emissions reduction projects. Reduction projects may be administrated through SMAQMD's Heavy-Duty Low-Emission Vehicle Incentive Programs (HDLEVIP), which include the Carl Moyer and Sacramento Emergency Clean Air Transportation (SECAT) Programs. The HDLEVIP and associated incentive programs are managed and implemented by SMAQMD on behalf of all air districts within the Sacramento Federal Nonattainment Area. Example projects funded through the Carl Moyer Program include the following.

      - Independent Construction Caterpillar 633D Scraper Tier 2 Engine Repower
      - Kiewit Pacific Construction Caterpillar 16G Grader Diesel Catalyst Retrofit
      - Commercial Low-Emission Propane Generator
      - American Engineering & Asphalt Caterpillar 825C Compactor Tier 2 Engine Repower
      - B&D Geerts Construction Caterpillar 826C Compactor Tier 1 Engine Repower

      The SECAT program differs from the Carl Moyer Program in that it can only fund projects for on-road vehicles. However, the SECAT program can also finance operational emissions reductions, including facility modifications and out-of-cycle replacements; the Carl Moyer Program is only available to fund the incremental capital costs of control measures.

   c. Acceptance of the mitigation fee by SMAQMD will serve as an acknowledgment and commitment by SMAQMD to: (1) implement an emissions reduction project(s) within a timeframe to be determined based on the type of project(s) selected after receipt of the mitigation fee designed to achieve the emissions reduction objectives; and (2) provide documentation to the applicant or its designated representative describing the project(s) funded by the mitigation fee, including the amount of emissions reduced (tons per year) from the emissions reduction project(s). To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emissions reductions in the SVAB (or in a nearby area of equal or higher nonattainment classification, as allowed under 40 CFR 93.158(2)) that are real, surplus, quantifiable, enforceable, and will not otherwise be achieved through compliance with existing regulatory requirements or any other legal requirement. Funding will need to be received prior to contracting with participants and should allow enough time to receive and process applications to fund and implement off-site reduction projects prior to commencement of the project activities that are being offset. This will roughly equate to one year prior to the required mitigation; additional lead time may be necessary depending on the level of off-site emissions reductions required for a specific year.

Alternative or Complementary Mitigation Program

Should the applicant be unable to enter what they regard as a satisfactory agreement with SMAQMD, or should the applicant enter an agreement with SMAQMD but find themselves unable to meet the performance standards established above, the applicant will develop an alternative or complementary off-site mitigation program to reduce NO_X and PM10 emissions according to the performance standard described above.

The applicant will establish a program to fund emissions reduction projects through grants, emission reduction credits (ERCs), or similar mechanisms. The applicant may identify emissions reduction projects through consultation with SMAQMD, other regional air districts, CARB, CEC, local governments, transit agencies, or others, as needed. Potential projects could include but are not limited to the following.

- Alternative fuel, low-emissions school buses, transit buses, and other vehicles.
- Diesel engine retrofits and repowers.
- Locomotive retrofits and repowers.
- Electric vehicle or lawn equipment rebates.
- Electric vehicle charging stations and plug-ins.
- Video-teleconferencing systems for local businesses.
- Telecommuting start-up costs for local businesses.

As part of its alternative or complementary off-site mitigation program, the applicant will develop pollutant-specific formulas to monetize, calculate, and achieve emissions reductions in a cost-effective manner. Payments can be allocated to emissions reductions projects in a grant-like manner. The applicant will document the fee schedule basis, such as consistency with the CARB's Carl Moyer Program cost-effectiveness limits and capital recovery factors.

The applicant will conduct annual reporting to verify and document that emissions reductions projects achieve a 1:1 reduction with construction emissions to ensure claimed offsets meet the required performance standard. Each report should describe the projects that were funded over the prior year, identify emissions reduction realized by the funded projects, document compliance with mitigation requirements, and identify corrective actions (if any) needed to ensure the offsetting program achieves the performance standards for NOx and PM10. The applicant will retain a third-party expert to assist with its review and approval of the annual reports. Annual reports will be finalized and posted on the applicant's website by December 31 of the following year.

Mitigation Measure AQ-2: Offset Construction-Generated Criteria Pollutants in the San Joaquin Valley Air Basin

Performance Standard

Prior to issuance of construction contracts, the applicant will enter into a Voluntary Emissions Reduction Agreement (VERA) with the SJVAPCD or develop an alternative or complementary mitigation program (as discussed below) to reduce NO_X and PM10. Emissions above the federal *de minimis* thresholds will be reduced to net zero (0). Emissions not above the *de minimis* thresholds, but above SJVAPCD's thresholds, will be reduced to quantities below the air district's thresholds.

Emissions generated by project construction have been quantified as part of the Delta Conveyance Project Draft EIR (California Department of Water Resources 2022). Although this inventory could be used exclusively to inform the required mitigation commitment, the methods used to quantify emissions in the Delta Conveyance Project Draft EIR were conservative (California Department of Water Resources 2022). They also do not account for any additional reductions that may be achieved by future state and federal regulations that reduce the emissions intensity of equipment and vehicles, nor do they account for reduction strategies that may be implemented by the applicant pursuant to other mitigation measures (e.g., Mitigation Measure AQ-9). Accordingly, the Delta Conveyance Project Draft EIR likely overestimates actual emissions that would be generated by construction of the project (California Department of Water Resources 2022). The applicant may, therefore, reanalyze criteria pollutant emissions from construction of the project to update the required reduction commitment to achieve performance standard.

An updated emissions analysis conducted for the project will be performed using approved emissions models and methods available at the time of the reanalysis. The analysis must use the latest available engineering data for the project, inclusive of any required environmental commitments or emissions reduction strategies. Consistent with the methodology used in the Delta Conveyance Project Draft EIR (California Department of Water Resources 2022), emissions factors may account for enacted regulations that will influence future year emissions intensities (e.g., fuel efficiency standards for on-road vehicles).

Mitigation Agreement with SJVAPCD

1. The applicant will enter into a VERA with the SJVAPCD to reduce NO_X and PM10 according to the performance standard described above.
    a. The mitigation offset fee amount will be determined at the time of mitigation to fund one or more emissions reduction projects within the SJVAB (or in a nearby area of equal or higher nonattainment classification, as allowed under 40 CFR 93.158(2)). SJVAPCD will require an additional administrative fee of no less than 4% of the total offset fee.

The mitigation offset fee will be determined by the applicant and SJVAPCD based on the type of projects available at the time of mitigation. This fee is intended to fund emissions reduction projects to achieve reductions. Documentation showing receipt of payment will be provided to the applicant or its designated representative.

b. The VERA will include details regarding the annual calculation of required offsets the applicant must achieve, funds to be paid, administrative fee, and the timing of the emissions reduction projects. SJVAPCD's VERA is implemented through District Incentive Programs, which fund grants and projects to achieve emissions reductions in the SJVAB. Example programs funded through the VERA include the following.

- On-Road Truck Voucher Program
- Burn Clean Program
- Heavy Duty Engine Program
- Cordless Zero-Emission Commercial Lawn & Garden Equipment Demonstration Program
- Statewide School Bus Retrofit Program

c. Acceptance of the offset fee by SJVAPCD will serve as an acknowledgment and commitment by SJVAPCD to: (1) implement an emissions reduction project(s) within a timeframe to be determined based on the type of project(s) selected after receipt of the mitigation fee designed to achieve the emissions reduction objectives; and (2) provide documentation to the applicant or its designated representative describing the project(s) funded by the mitigation fee, including the amount of emissions reduced (tons per year) from the emissions reduction project(s). To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emissions reductions in the SJVAB (or in a nearby area of equal or higher nonattainment classification, as allowed under 40 CFR 93.158(2)) that are real, surplus, quantifiable, enforceable, and will not otherwise be achieved through compliance with existing regulatory requirements or any other legal requirement. Funding will need to be received prior to contracting with participants and should allow enough time to receive and process applications to fund and implement off-site reduction projects prior to commencement of the project activities that are being offset. This will roughly equate to 1 year prior to the required mitigation; additional lead time may be necessary depending on the level of off-site emissions reductions required for a specific year.

Alternative or Complementary Mitigation Program

Should the applicant be unable to enter what they regard as a satisfactory agreement with SJVAPCD, or should the applicant enter an agreement with SJVAPCD but find themselves unable to meet the performance standards established above, the applicant will develop an alternative or complementary off-site mitigation program to reduce NO_X and PM10 emissions according to the performance standard described above.

The applicant will establish a program to fund emissions reduction projects through grants, ERCs, or similar mechanisms. The applicant may identify emissions reduction projects through consultation with SJVAPCD, other regional air districts, CARB, CEC, local governments, transit agencies, or others, as needed. Potential projects could include but are not limited to the following.

- Alternative fuel, low-emissions school buses, transit buses, and other vehicles.
- Diesel engine retrofits and repowers.
- Locomotive retrofits and repowers.
- Electric vehicle or lawn equipment rebates.
- Electric vehicle charging stations and plug-ins.
- Video-teleconferencing systems for local businesses.
- Telecommuting start-up costs for local businesses.

As part of its alternative or complementary off-site mitigation program, the applicant will develop pollutant-specific formulas to monetize, calculate, and achieve emissions reductions in a cost-effective manner. Payments can be allocated to emissions reductions projects in a grant-like manner. The applicant will document the fee schedule basis, such as consistency with the CARB's Carl Moyer Program cost-effectiveness limits and capital recovery factors.

The applicant will conduct annual reporting to verify and document that emissions reductions projects achieve a 1:1 reduction with construction emissions to ensure claimed offsets meet the required performance standard. Each report should describe the projects that were funded over the prior year, identify emissions reduction realized by the funded projects, document compliance with mitigation requirements, and identify corrective actions (if any) needed to ensure the offsetting program achieves the performance standards for NOx and PM10. The applicant will retain a third-party expert to assist with its review and approval of the annual reports. Annual reports will be finalized and posted on the applicant's website by December 31 of the following year.

J.8.2.1 Offset Feasibility

Offsets are an enforceable mitigation measure by which the applicant will provide ton-for-ton offsets of emissions that exceed *de minimis* thresholds through a process that develops, funds, and implements emissions reduction projects.

The applicant will make a good faith effort to enter into separate contractual agreements with the SMAQMD and SJVAPCD in which the applicant agrees to mitigate the project's emissions by providing funds to SMAQMD and SJVAPCD to fund grants for projects that are designed to achieve emissions reductions, thus offsetting project-related effects on air quality. SMAQMD and SJVAPCD will be obligated under the agreements to seek and implement such emissions reduction projects, using the applicant's funds. The types of projects that have been used in the past to achieve such reductions include electrification of stationary internal combustion engines; replacing old trucks with new, cleaner, more efficient trucks; and a host of other stationary and mobile source emissions-reducing projects.

In implementing the offset agreements, SMAQMD and SJVAPCD will verify the actual emissions reductions that have been achieved because of completed grant contracts, monitor the emissions reduction projects, and confirm the enforceability of achieved reductions. The initial agreements are generally based on the projected maximum emissions that exceed thresholds as calculated by a district-approved air quality impact assessment or the project's EIR; the agreement then requires the proponent to deposit funds sufficient to offset those maximum emissions exceedances. However, because the goal is to mitigate actual emissions, SMAQMD and SJVAPCD have designed adequate flexibility into the agreement such that the final mitigation is based on actual emissions related to the project, based on factors including actual equipment used and hours of operation that the proponent tracks and reports to SMAQMD and SJVAPCD during construction. After the project is mitigated, SMAQMD and SJVAPCD will certify to the applicant that the mitigation is completed. Thus, the agreements provide the applicant with an enforceable mitigation measure that will result in emissions exceedances being fully offset by the applicant.

The applicant is currently coordinating with SJVAPCD to confirm that enough emissions reduction credits would be available to offset emissions generated by the project for all years in excess of the *de minimis* thresholds. The applicant has also engaged in extensive coordination with SMAQMD. Several SMAQMD incentive programs can be leveraged by the applicant to fund NOx reduction projects, including the HDLEVIP. While these existing air district programs are available and may be used by the applicant to achieve substantial emissions reductions, it is likely additional reductions in the SVAB will need to be secured through an alternative or complementary mitigation program. Accordingly, the applicant has investigated the availability of private market ERCs. The ERC registry for Sacramento County as of April 23, 2020, showed a total of more than 420 tons of annual NOx available from a large group of sources (Philley pers. comm.). This far exceed the maximum annual estimated NOx for project construction in SMAQMD (67 tons, per Table J-10). Should the applicant be unable to enter what they regard as a satisfactory agreement with SMAQMD, or should the applicant enter an agreement with SMAQMD but find themselves unable to achieve sufficient NOx offsets, the applicant may purchase the offsets needed to conform to the Sacramento Regional ozone SIP through ERCs. As discussed in Mitigation Measure AQ-1, the applicant may also elect to pursue other emissions reduction programs (e.g., locomotive retrofits and repowers) to secure the necessary offsets.

J.9 Consistency with Requirements and Milestones in Applicable SIP

The general conformity regulations state that notwithstanding the other requirements of the rule, a federal action may not be determined to conform unless the total of direct and indirect emissions from the federal action is in compliance or consistent with all relevant requirements and milestones in the applicable SIP (40 CFR § 93.158(c)). This includes, but is not limited to, such issues as reasonable further progress schedules, assumptions specified in the attainment or maintenance demonstration, prohibitions, numerical emissions limits, and work practice standards. This section briefly addresses how the construction emissions for the project were assessed for SIP consistency for this evaluation.

J.9.1 Applicable Requirements from U.S. Environmental Protection Agency

EPA promulgates requirements to support the goals of the CAA with respect to the NAAQS. Typically, these requirements take the form of rules regulating emissions from significant new sources, including emissions standards for major stationary point sources and classes of mobile sources, as well as permitting requirements for new major stationary point sources. Since states have the primary responsibility for implementation and enforcement of requirements under the CAA and can impose stricter limitations than EPA, EPA requirements often serve as guidance to the states in formulating their air quality management strategies.

J.9.2 Applicable Requirements from CARB

In California, to support the attainment and maintenance of the NAAQS, CARB is primarily responsible for regulating emissions from mobile sources. EPA has delegated authority to CARB to establish emissions standards for on-road and some non-road vehicles separate from the EPA vehicle emissions standards, although CARB is preempted by the CAA from regulating emissions from many non-road mobile sources, including marine craft. Emission standards for preempted equipment can only be set by EPA.

J.9.3 Applicable Requirements from Local Air Districts

To support the attainment and maintenance of the NAAQS in the SVAB, SJVAB, and SFBAAB, the YSAQMD, SMAQMD, SJVAPCD, and BAAQMD have primarily been responsible for regulating emissions from stationary sources. As noted above, these air districts develop and update their air quality management plans regularly to support the California SIP. While the plans contain rules and regulations geared to attain and maintain the NAAQS, these rules and regulations also have the much more difficult goal of attaining and maintaining the CAAQS.

J.9.4 Consistency with Applicable Requirements for the Department of Water Resources

The applicant already complies with, and would continue to comply with, a myriad of rules and regulations implemented and enforced by federal, state, regional, and local agencies to protect and enhance ambient air quality in the SVAB, SJVAB, and SFBAAB.

In particular, because of the long persistence of challenges to attain the ambient air quality standards in the SVAB, SJVAB, and SFBAAB, the rules and regulations promulgated by CARB, YSAQMD, SMAQMD, SJVAPCD, and BAAQMD are among the most stringent in the United States.

The applicant would continue to comply with all existing applicable air quality regulatory requirements for activities over which it has direct control and would meet in a timely manner all regulatory requirements that become applicable in the future.

The following are appropriate EPA, CARB, YSAQMD, SMAQMD, SJVAPCD, and BAAQMD rules which are standard practices and BMPs for construction, including control of emissions and exhaust.

- YSAQMD Regulation II, Rule 2.5 (Nuisance). This rule prohibits the discharge of any air contaminant that causes injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public or which cause to have a natural tendency to cause injury or damage to business or property.
- YSAQMD Regulation II, Rule 2.8 (Particulate Matter Concentration). This rule limits the emissions of particulate matter from any source operation which emits, or may emit dust, fumes, or total suspended particulate matter.

- SMAQMD Rule 403 (Fugitive Dust). This rule controls fugitive dust emissions through implementation of BMPs.
- SMAQMD Rule 404 (Particulate Matter). This rule restricts emissions of PM greater than 0.23 gram per cubic meter.
- SMAQMD Rule 412 (Stationary Internal Combustion Engines). This rule controls emissions of NO_X, CO, and non-methane hydrocarbons from stationary internal combustion engines greater than 50 brake horsepower.
- SMAQMD Rule 453 (Cutback and Emulsified Asphalt Paving). This rule limits the application of cutback and emulsified asphalt.
- SJVAPCD Rule 2010 (Permits Required). This rule requires any person constructing, altering, replacing, or operating any source operation which emits, may emit, or may reduce emissions to obtain an Authority to Construct or a Permit to Operate.
- SJVAPCD Rule 2201 (New and Modified Stationary-Source Review Rule). This rule applies to all new stationary sources and all modifications to existing stationary sources subject to SJVAPCD permit requirements that, after construction, emit or may emit one or more pollutants regulated by the rule.
- Rule 3135 (Dust Control Plan Fees). This rule requires the applicant to submit a fee in addition to a dust control plan. The purpose of this rule is to recover SJVAPCD's cost for reviewing these plans and conducting compliance inspections.
- SJVAPCD Rule 4002 (National Emission Standards for Hazardous Air Pollutants [NESHAP]). This rule incorporates the NESHAP from Part 61, Chapter I, Subchapter C, Title 40, CFR and the NESHAP for Source Categories from Part 63, Chapter I, Subchapter C, Title 40, CFR. The rule requires sources of hazardous air pollutants to comply with the standards, criteria, and requirements set forth therein.
- SJVAPCD Rule 4101 (Visible Emissions). This rule prohibits emissions of visible air contaminants to the atmosphere and applies to any source operation that emits or may emit air contaminants.
- SJVAPCD Rule 4102 (Nuisance). This rule applies to any source operation that emits or may emit air contaminants or other materials. In the event that the project or construction of the project creates a public nuisance, it could be in violation and subject to SJVAPCD enforcement action.
- SJVAPCD Rule 4641 (Cutback, Slow-Cure, and Emulsified Asphalt, Paving, and Maintenance Operations). This rule applies to the manufacture and use of cutback asphalt, slow-cure asphalt, and emulsified asphalt for paving and maintenance operations.
- SJVAPCD Rule 4701 (Internal Combustion Engines—Phase 1). This rule limits the emissions of NO_X, CO, and VOCs[11] from internal combustion engines. These limits are not applicable to standby engines as long as they are used fewer than 200 hours per year (e.g., for testing during non-emergencies).

[11] Various regulations use of the term "VOC," such as those for consumer products. VOC and ROG both refer to organic gases and are used interchangeably in this analysis, consistent with how they are referenced in the source CARB and air district materials.

- SJVAPCD Rule 4702 (Internal Combustion Engines—Phase 2). This rule limits the emissions of NO_X, CO, and VOC from spark-ignited internal combustion engines.
- SJVAPCD Rule 9510 (Indirect Source Review). This rule places application and emission-reduction requirements on projects that generate construction exhaust emissions that equal or exceed 2.0 tons of NO_X or PM10 exhaust. Rule 9510 is intended to mitigate a project's effect on air quality through project design elements or by payment of applicable off-site mitigation fees. Any applicant subject to District Rule 9510 is required to submit an Air Impact Assessment application to the district no later than when the applicant applies for final discretionary approval, and to pay any applicable off-site mitigation fees before issuance of the first building permit.
- SJVAPCD Regulation VIII (Fugitive PM10 Prohibitions). This is a series of rules (Rules 8011–8081) designed to reduce PM10 emissions (predominantly dust/dirt) generated by human activity, including construction, road construction, bulk materials storage, landfill operations, and other activities.
- BAAQMD Regulation 2, Rule 5 (New Source Review of Toxic Air Contaminant). This regulation outlines guidance for evaluating toxic air contaminant emissions and their potential health hazards.
- BAAQMD Regulation 6, Rule 1 (Particulate Matter). This regulation restricts emissions of PM darker than No. 1 on the Ringlemann Chart to less than 3 minutes in any 1 hour.
- BAAQMD Regulation 7 (Odorous Substances). This regulation establishes general odor limitations on odorous substances and specific emissions limitations on certain odorous compounds.
- BAAQMD Regulation 8, Rule 15 (Emulsified and Liquid Asphalts). This regulation limits emissions of VOCs caused by paving materials.
- BAAQMD Regulation 9, Rule 8 (Stationary Internal Combustion Engines). This regulation limits emissions of NO_X and CO from stationary internal combustion engines of more than 50 horsepower.

J.10 Reporting and Public Comments

The federal lead agency is issuing this General Conformity Determination for public and agency review for a 45-day period as required by 40 CFR Sections 93.155 and 93.156. Emissions from construction of the proposed action have been assessed and quantified using standard and accepted tools, techniques, and emissions factors. Additional technical details are provided in the Draft EIS and Draft EIS. The air quality analysis, including this draft Conformity Determination, is based on consultation with study area air districts.

J.10.1 Review Period

The General Conformity Determination will be available for a 45-day public review in conjunction with the Draft EIS. The federal lead agency will provide copies of this general conformity determination to the appropriate regional offices of EPA, CARB, YSAQMD SMAQMD, BAAQMD, SJVAPCD, and other coordinating agencies consistent with general conformity public noticing requirements. The federal lead agency will also announce the availability of the General Conformity

Determination in conjunction with the public noticing of the Final EIS and NEPA Record of Decision. Such notice will be published, at a minimum, in the *Federal Register*. A copy of this Conformity Determination will be made available on USACE's website, as well as at local libraries.

J.10.2 Revaluation and Redetermination of General Conformity

The general conformity regulations state that the status of a specific conformity determination lapses 5 years after the date of public notification for the final General Conformity Determination, unless the action has been completed or a continuous program has been commenced to implement the action (40 CFR § 93.157(a)). Because the federal action envisions a construction period extending more than 5 years, the final General Conformity Determination will remain active as a "continuous program."

J.11 Findings and Conclusion

Pursuant to 40 CFR Part 93 Subpart B, the federal lead agency has conducted a general conformity evaluation as part of the environmental review of the proposed action. The project is subject to the general conformity rule because it is in an area that is designed nonattainment for the 8-hour ozone and PM2.5 standards and a partial maintenance area for the PM10 standard. The federal agency conducted the general conformity evaluation in consultation with air districts in the study area (YSAQMD, SMAQMD, BAAQMD, and SJVAPCD). As a result of this review, USACE concluded, because project-generated emissions would either be fully offset (for construction phase) or are less than the *de minimis* thresholds (for operational phase), that the project's emissions can be accommodated in the SIP for the SVAB, SJVAB, and SFBAAB. USACE has determined that the project as designed would conform to the approved SIP based on the following.

- The applicant would commit that construction-phase NO_X emissions would be offset consistent with the applicable federal regulations through an MOU and project-level VERA with SMAQMD and SJVAPCD, respectively, or through an alternative or complementary offsite mitigation program.
- The applicant, SMAQMD and SJVAPCD would enter into a contractual agreement to mitigate the project's NO_X emissions by providing funds for SMAQMD's MOU and SJVAPCD's project-level VERA to fund grants for projects that achieve the necessary emissions reductions.
- SMAQMD and SJVAPCD would seek and implement the necessary emissions reduction measures, using DWR funds.
- SMAQMD and SJVAPCD would serve as administrators of the emissions reduction projects and verifiers of the successful mitigation effort.
- Should the applicant be unable to enter what they regard as a satisfactory agreement with SMAQMD or SJVAPCD, the applicant would develop an alternative or complementary offsite mitigation program to reduce NO_X emissions.

Therefore, USACE intends to issue a final determination that concludes that the project, as designed, conforms to the purpose of the approved SIP and is consistent with all applicable requirements.

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