

APPENDIX B: AQUATIC HABITATS DATABASE METHODS

B.1 Overview

Trout Unlimited worked with The Nature Conservancy of California (TNC) on an assessment of freshwater aquatic habitats in California and adjacent portions of Arizona, Nevada, and Oregon. The assessment will use available spatial information related to key aquatic species and habitats to help inform conservation actions. The following describes the data collection and management techniques used to gather and summarize the occurrence and distribution information for aquatic systems.

B.2 Methods – Data Collection and Management

TNC provided an ESRI file geodatabase schema for the project based on the standard ecoregional planning template. The geodatabase contains point, polygon, and line feature classes related to system occurrences and source and crosswalk tables related to the original, input data. The crosswalk table provides a means to compare the systems categories in the source data to the simplified naming conventions used in this assessment.

TU acquired spatial data (GIS format) related to the occurrence or distribution of freshwater streams, water bodies, and associated terrestrial vegetation communities that are permanently or seasonally inundated by freshwater. Once we identified a data source, we downloaded and archived the original data and used a series of general GIS data management steps to insert the appropriate data into the geodatabase. Table 1 describes the data sources included in the systems geodatabase. For the primary system types in the assessment area – river reaches and water body features – we worked with TNC’s Jeanette Howard and Kirk Klausmeyer to create a classification system for characterizing each feature based on abiotic factors (Higgins et al. 2005). For all features, we also provide a simplified name and code based on the classification within the original data. The methods we used to interpret and manage data are described below by feature type.

Table 1: Data sources used in the systems database listed in order of priority within polygon feature class

Data Source
USFWS. National Wetlands Inventory
EPA. National Hydrography Dataset Plus (Flowlines, Waterbodies, Area)
USGS and EPA. National Hydrography Dataset (1:24,000) (Points)
CDFG. California Natural Diversity Database, Feb 2011 Version
USGS. National Landcover Dataset 2006
CDF. Fire and Resource Assessment Program Multi-source Vegetation
USGS. Landfire Existing Vegetation Type
Holland, RF. Great Valley Vernal Pool Distribution (VP_2005)

Line Features

The National Hydrography Dataset – Plus v1.0 (EPA 2005), flowlines served as the sole original data source for line features in the systems database. The NHD-Plus dataset includes attribute information for each basic unit, or reach, related to local and upstream abiotic factors, and an inherent type. We used this information to characterize each reach based on four factors:

- Type, based on inherent NHD-Plus feature coding related to perennial, intermittent, and artificial stream types.
- Flow volume, based on NHD-Plus calculations of mean annual flow in cubic feet per second using the Unit Runoff method and interpreted based on geometrical intervals within the study area.
- Slope, based on NHD-Plus calculations of slope in percent and interpreted based on slope breaks related to geomorphic stream types described by Montgomery and Buffington (1998).
- Climate, based on NHD-Plus calculations of mean annual temperature of the reach and associated upstream contributing area in degrees Celsius and interpreted based on the isotherm associated with limits of salmonid distribution within the study area. The salmonidae family is widely associated with cool and cold water instream temperature regimes (Behnke 2002).

We assigned each reach a coded number (Sys_ID) and name (Sys_Name) based on the combination of these four factors. We did not assign a Sys_ID or Sys_Name to reaches lacking NHD-Plus attribute information and only assigned a type to artificial reaches. Table 2 describes the four abiotic factors and coding for streams in additional detail. As a final processing step, we merged the original data from four NHD-Plus Production Units into a single feature after coding features in each unit with a unique source ID and inserted the data into the geodatabase, excluding reaches associated with lakes and reservoirs.

Table 2: Categories and associated values used for characterizing line features in the aquatic habitats database

Category	Description	Values
Seasonality	Perennial	-
	Intermittent	-
	Artificial	-
Flow	Headwaters	0 – 1 CFS
	Creek or Small River	1 – 100 CFS
	Large River	> 100 CFS
	No Data	-
Slope	Pool/Riffle	0 – 4%
	Step Pool	4 – 8%
	Cascade/Colluvial	> 8%
	No Data	-
Climate	Coolwater	< 16°C
	Warmwater	≥ 16°C
	No Data	-

Polygon Features

We used two methods for interpreting and inserting polygon feature classes into the geodatabase – one for polygons that represent water bodies and another for polygons representing permanently or seasonally inundated terrestrial vegetation communities.

The NHD-Plus water bodies and the National Wetlands Inventory (USFWS 2011), or NWI, served as the data sources representing water bodies in the geodatabase. Both datasets have inherent typing information; Kirk Klausmeyer with TNC provided a simplified interpretation of the coding with the NWI. The NWI provides more detailed typing information and we used it as the primary source for typing where it was available. For all other portions of the study area, we used the NHD-Plus after excluding the features described as playa, ice mass, or swamp/marsh in the original data. We calculated the surface area and perimeter of each feature within a GIS and attributed each feature with climate information from the NHD-Plus data set. Some features required dissolving internal boundaries within the data for these area and perimeter calculations, but we preserved the original feature boundaries within the geodatabase. We used these abiotic factors to characterize each water body based on:

- Type, based on inherent NHD-Plus or NWI feature coding related to perennial, intermittent, and artificial water body types. We checked the typing of all NHD-Plus water bodies greater than 0.35 square kilometers against the National Inventory of Dams (US Army Corps of Engineers 2000) and aerial imagery to add or correct typing information, primarily to correct the artificial water body typing.
- Size, based on GIS calculations of the surface area of each feature in square kilometers and interpreted based on geometrical intervals within the study area.
- Shoreline complexity, based on the GIS calculations of perimeter length (kilometers) and area (square kilometers) and interpreted based on geometrical intervals of the Shoreline Development Index (SDI) within the study area. The SDI is a unitless ratio of perimeter to area ($\text{Perimeter}/2\sqrt{\text{Area}\cdot\pi}$) described by Lind (1985).
- Climate, based on NHD-Plus calculations of local mean annual temperature in degrees Celcius and interpreted based on the isotherm associated with limits of salmonid distribution within the study area. The salmonidae family is widely associated with cool and cold water instream temperature regimes (Behnke 2002).

We assigned each water body a coded number (Type_ID) and name (Type_Name) based on the combination of these four factors. We also assigned a more simple set of codes (Sys_Id, Sys_Name) to each water body based on an interpretation of the inherent typing of the data. Table 3 describes the four abiotic factors and coding for water bodies in additional detail. Table 4 describes the simplified systems number and naming coding; Table 5 provides the crosswalk from the original data typing to the codes in Table 4 by data source. The duplicative naming of Type_ID and Type_Name and Sys_ID and Sys_Name only occurs for water bodies.

Table 3: Categories and associated values used for characterizing water body features in the aquatic habitats database

Category	Description	Values
Seasonality	Perennial	-
	Intermittent	-
	Artificial	-
Size	Small	< 0.35 km ²
	Medium	0.35 – 5 km ²
	Large	>5 km ²
Shore Complexity	Simple	< 1.25 SDI
	Intermediate	1.25 – 5 SDI
	Complex	>5 SDI
Climate	Coolwater	< 16°C
	Warmwater	≥ 16°C

We used several data sources to represent terrestrial vegetation communities that are permanently or seasonally inundated by freshwater. For each dataset, we translated the original data source’s categorical naming structure into a common set of simplified systems. For raster data, we converted the source data to polygon features. Table 3 describes the simplified systems number and naming coding; Table 4 provides the crosswalk from the original data typing to the codes in Table 3 by data source. We appended these data into the systems geodatabase in an order that reflects our interpretation of their relative quality. We used fine-resolution data at the highest priority level, reflecting our high certainty in the likelihood of the data representing discrete features on the ground. We entered coarse-scale, remotely sensed data or generalized polygons in the last order. Table 1 shows the order of data entry by data source.

Point Features

We inserted point features into the systems geodatabase after interpreting the source data names into simplified systems described in Table 4.

Table 4: Final Systems names used in the point and polygon feature classes. These names represent a reduced set of aquatic habitat types derived from the source datasets. Habitat types in blue italics are included in the California Freshwater CSI summaries of aquatic habitats (open water types excluded).

Sys_ID	Sys_Name
1	Brackish emergent wetland (Impounded)
2	<i>Brackish forested/shrub-scrub wetland</i>
3	Brackish near shore lake (Impounded)
4	Deepwater estuarine
5	Deepwater estuarine (Impounded)
6	<i>Emergent wetland</i>

Sys_ID	Sys_Name
7	<i>Emergent wetland (Impounded)</i>
8	<i>Forested/shrub-scrub wetland</i>
9	<i>Forested/shrub-scrub wetland (Impounded)</i>
10	Intermittent brackish near shore lake (Impounded)
11	Intermittent lake interior
12	Intermittent lake interior (Impounded)
13	Intermittent near shore lake
14	Intermittent near shore lake (Impounded)
15	Intermittent salt near shore lake
16	Intermittent salt near shore lake (Impounded)
17	Intermittent tidal river
18	<i>Intertidal estuarine</i>
19	<i>Intertidal estuarine (Impounded)</i>
20	Lake interior
21	Lake interior (Impounded)
22	Near shore lake
23	Near shore lake (Impounded)
24	Permanent near shore lake
25	Permanent near shore lake (Impounded)
26	Permanent tidal river
27	<i>Permanently flooded emergent wetland</i>
28	<i>Permanently flooded emergent wetland (Impounded)</i>
29	<i>Permanently flooded wetland</i>
30	<i>Permanently flooded wetland (Impounded)</i>
31	Salt lake interior
32	Salt near shore lake (Impounded)
33	<i>Salt wetland</i>
34	<i>Salt wetland (Impounded)</i>
35	<i>Wetland</i>
36	<i>Wetland (Impounded)</i>
37	<i>Woody riparian</i>
38	<i>Emergent riparian</i>
39	<i>Brackish emergent wetland</i>
40	<i>Vernal pool</i>
41	<i>Rice</i>
42	<i>Wash</i>
43	Perennial open water (Natural)
44	Spring/seep
45	Ice
46	Open water (Artificial)
47	Open water (Ocean)
48	Intermittent open water (Natural)

Table 5: Crosswalk of original data classifications to final systems by point and polygon feature classes by source

1. National Hydrography Dataset (1:24,000).

Orig_Code	Orig_Name	Sys_ID	Sys_Name
-	Springseep	1	Spring/Seep

2. National Wetlands Inventory

Orig_Code	Orig_Name	Sys_ID	Sys_Name
-	PEM/UBK3h	1	Brackish emergent wetland (Impounded)
-	PSS7B9	2	Brackish forested/shrub-scrub wetland
-	L2UBK3h	3	Brackish near shore lake (Impounded)
-	E1AB3L	4	Deepwater estuarine
-	E1UBKLh	5	Deepwater estuarine (Impounded)
-	PEM	6	Emergent wetland
-	PEM/ABFh	7	Emergent wetland (Impounded)
-	PFO	8	Forested/shrub-scrub wetland
-	PFO/EMAh	9	Forested/shrub-scrub wetland (Impounded)
-	L2USC3h	10	Intermittent brackish near shore lake (Impounded)
-	L1ABG	11	Intermittent lake interior
-	L1ABFH	12	Intermittent lake interior (Impounded)
-	L2ABC	13	Intermittent near shore lake
-	L2AB3Fh	14	Intermittent near shore lake (Impounded)
-	L2USC1x	15	Intermittent salt near shore lake
-	L2USC1h	16	Intermittent salt near shore lake (Impounded)
-	R1UBT	17	Intermittent tidal river
-	E2AB/USM	18	Intertidal estuarine
-	E2ABMh	19	Intertidal estuarine (Impounded)
-	L1ABH	20	Lake interior
-	L1ABHh	21	Lake interior (Impounded)
-	L2AB	22	Near shore lake
-	L2ABKh	23	Near shore lake (Impounded)
-	L2AB3H	24	Permanent near shore lake
-	L2AB3Hh	25	Permanent near shore lake (Impounded)
-	R1ABV	26	Permanent tidal river
-	PEM/ABHx	27	Permanently flooded emergent wetland
-	PEM/UBHh	28	Permanently flooded emergent wetland (Impounded)
-	PAB/EMHx	29	Permanently flooded wetland
-	PAB/EMHh	30	Permanently flooded wetland (Impounded)
-	L1UBH7	31	Salt lake interior
-	L2UBK1h	32	Salt near shore lake (Impounded)
-	PUSC1x	33	Salt wetland
-	PUBF1h	34	Salt wetland (Impounded)
-	PAB	35	Wetland
-	PAB/EMCh	36	Wetland (Impounded)

4. California Natural Diversity Database

<i>Orig_Code</i>	<i>Orig_Name</i>	<i>Sys_ID</i>	<i>Sys_Name</i>
-	Alkali Seep	1	Spring/seep
-	Cismontane Alkali Marsh	2	Wetland
-	Coastal and Valley Freshwater Marsh	3	Wetland
-	Coastal Brackish Marsh	4	Brackish emergent wetland
-	Darlingtonia Seep	5	Spring/seep
-	Desert Fan Palm Oasis Woodland	6	Woody riparian
-	Fen	7	Forested/shrub-scrub wetland
-	Great Valley Cottonwood Riparian Forest	8	Woody riparian
-	Great Valley Mixed Riparian Forest	9	Woody riparian
-	Great Valley Valley Oak Riparian Forest	10	Woody riparian
-	Mojave Riparian Forest	11	Woody riparian
-	Montane Freshwater Marsh	12	Wetland
-	Northern Basalt Flow Vernal Pool	13	Vernal pool
-	Northern Claypan Vernal Pool	14	Vernal pool
-	Northern Coastal Salt Marsh	15	Salt wetland
-	Northern Hardpan Vernal Pool	16	Vernal pool
-	Northern Vernal Pool	17	Vernal pool
-	Northern Volcanic Ash Vernal Pool	18	Vernal pool
-	Northern Volcanic Mud Flow Vernal Pool	19	Vernal pool
-	San Diego Mesa Claypan Vernal Pool	20	Vernal pool
-	San Diego Mesa Hardpan Vernal Pool	21	Vernal pool
-	Sonoran Cottonwood Willow Riparian Forest	22	Woody riparian
-	Southern Coast Live Oak Riparian Forest	23	Woody riparian
-	Southern Coastal Salt Marsh	24	Salt wetland
-	Southern Cottonwood Willow Riparian Forest	25	Woody riparian
-	Southern Interior Basalt Flow Vernal Pool	26	Vernal pool
-	Southern Riparian Scrub	27	Woody riparian
-	Southern Sycamore Alder Riparian Woodland	28	Woody riparian
-	Southern Vernal Pool	29	Vernal pool
-	Sphagnum Bog	30	Emergent wetland
-	Transmontane Alkali Marsh	31	Wetland
-	Central Coast Arroyo Willow Riparian Forest	32	Woody riparian
-	Southern Mixed Riparian Forest	33	Woody riparian
-	Southern Riparian Forest	34	Woody riparian
-	Water Birch Riparian Scrub	35	Woody riparian

5. National Land Cover Dataset 2006

<i>Orig_Code</i>	<i>Orig_Name</i>	<i>Sys_ID</i>	<i>Sys_Name</i>
95	Emergent herbaceous wetland	6	Emergent wetland
90	Woody wetland	8	Forested/shrub-scrub wetland

10 - 13. National Hydrography Dataset Plus (1:100,000) Water bodies

Orig_Code	Orig_Name	Sys_ID	Sys_Name
39004	Lake/Pond: Hydrographic Category = Perennial	20	Lake interior
39001	Lake/Pond: Hydrographic Category = Intermittent	11	Intermittent lake interior
36100	Playa	13	Intermittent near shore lake
43617	Reservoir: Reservoir Type = Water Storage	21	Lake interior (Impounded)
37800	Ice Mass	45	Ice
43607	Reservoir: Reservoir Type = Evaporator	12	Intermittent lake interior (Impounded)
43612	Reservoir: Reservoir Type = Sewage Treatment Pond	21	Lake interior (Impounded)
46600	Swamp/Marsh	35	Wetland

14 - 17. National Hydrography Dataset Plus (1:100,000) Area

Orig_Code	Orig_Name	Sys_ID	Sys_Name
33600	Canal/Ditch	46	Open water (Artificial)
43100	Rapids	43	Perennial open water (Natural)
46006	Stream/River: Hydrographic Category = Perennial	43	Perennial open water (Natural)
48400	Wash	42	Wash
40307	Inundation Area: Inundation Control Status = Not Controlled	13	Intermittent near shore lake
46003	Stream/River: Hydrographic Category = Intermittent	48	Intermittent open water (Natural)
30700	Area to be Submerged	13	Intermittent near shore lake
33600	Canal/Ditch	46	Open water (Artificial)
33601	Canal/Ditch: Canal/Ditch Type = Aqueduct	46	Open water (Artificial)
36400	Foreshore	22	Near shore lake
40308	Inundation Area: Inundation Control Status = Controlled	14	Intermittent near shore lake (Impounded)
40307	Inundation Area: Inundation Control Status = Not Controlled	13	Intermittent near shore lake
43100	Rapids	43	Perennial open water (Natural)
44500	Sea/Ocean	47	Open water (Ocean)
45500	Spillway	46	Open water (Artificial)
46100	Submerged Stream	46	Open water (Artificial)

18. Fire and Resource Assessment Program Multi-source Vegetation (FRAP 2006)

Orig_Code	Orig_Name	Sys_ID	Sys_Name
15	Desert Riparian	37	Woody riparian
19	Desert Wash	42	Wash

Orig_Code	Orig_Name	Sys_ID	Sys_Name
21	Estuarine	18	Intertidal estuarine
22	Fresh Emergent Wetland	6	Emergent wetland
37	Montane Riparian	37	Woody riparian
41	Palm Oasis	37	Woody riparian
78	Rice	41	Rice
49	Saline Emergent Wetland	33	Salt wetland
56	Valley Foothill Riparian	37	Woody riparian
59	Wet Meadow	6	Emergent wetland

19. Landfire

Orig_Code	Orig_Name	Sys_ID	Sys_Name
95	Herbaceous Wetlands	6	Emergent wetland
2151	California Central Valley Riparian Woodland and Shrubland	37	Woody riparian
2152	California Montane Riparian Systems	37	Woody riparian
2154	Inter-Mountain Basins Montane Riparian Systems	37	Woody riparian
2155	North American Warm Desert Riparian Systems	42	Wash
2156	North Pacific Lowland Riparian Forest and Shrubland	37	Woody riparian
2157	North Pacific Swamp Systems	8	Forested/shrub-scrub wetland
2158	North Pacific Montane Riparian Woodland and Shrubland	37	Woody riparian
2159	Rocky Mountain Montane Riparian Systems	37	Woody riparian
2160	Rocky Mountain Subalpine/Upper Montane Riparian Systems	37	Woody riparian
2161	Northern Rocky Mountain Conifer Swamp	8	Forested/shrub-scrub wetland
2163	Pacific Coastal Marsh Systems	39	Brackish emergent wetland
2180	Introduced Riparian Vegetation	37	Woody riparian
2198	Recently Burned Herbaceous Wetlands	6	Emergent wetland

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