4.8 Wetlands

4.8.1 Introduction

Resource Issues
▶ Wetland location
▶ Wetland type
▶ Wetland function

Wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al. 1979). Wetlands exist within and adjacent to TVA reservoirs and tailwaters, and are influenced by surface water and groundwater connections to the water levels in these reservoirs and tailwaters. Wetlands depend on the timing and duration of the presence of water; consequently, they may be affected by reservoir operations. These changes can be measured by the following issues:

- **Wetland location—**Wetland locations may be altered by changes that affect the extents and geographic distributions of the wetlands, the rate of formation of new wetlands, or the connections between wetlands.
- **Wetland type—**Changes in the types of wetland water regimes present (the timing and duration of the presence of water) can result in changes in the types of wetland vegetation, as individual wetland plant species generally depend on specific types of water regimes.
- **Wetland function—**Changes in the wetland types present will change the overall environmental, social, and economic values of the functions provided by these wetlands.

The study area for measuring changes in wetland systems is the area of groundwater influence surrounding mainstem and tributary reservoirs and mainstem and tributary tailwaters. The groundwater area of influence was projected based on geologic modeling of the distance at which reservoir water levels cease to affect groundwater levels in the physiographic regions in the study area (see Appendices D2 and D4a). The types and acreages of potentially affected wetlands were estimated based on data selected from the National Wetlands Inventory (NWI). The NWI data include information on the type of vegetation, water regime, and setting. The wetlands included as potentially affected in this study meet the wetland definition used by the USFWS (Cowardin et al. 1979). This definition is the national standard for wetland mapping, monitoring, and data reporting as determined by the Federal Geographic Data Committee. The NWI data were compiled using high-altitude aerial photography with limited field verification. Some of the data are now over 15 years old. Because of their age and manner of acquisition, the data were not strictly interpreted in terms of changes in acreage.

4.8.2 Regulatory Programs and TVA Management Activities

Activities that affect wetlands in the TVA region are regulated under the CWA and state water quality programs. Any action that proposes discharge of dredge or fill materials in waters of the United States must apply to the USACE to receive a Section 404 permit. Some wetland systems are considered waters of the United States. A state has authority to grant water quality certification for a new federally permitted activity that may affect waterbodies under Section 401 of the CWA. The state performs a review of the activity to ensure that water quality standards are maintained and then approves or denies water quality certification. Denial of the certification results in denial of any CWA permit application.

Executive Order 11990—Protection of Wetlands requires all federal agencies to avoid construction in wetlands to the extent practicable and to mitigate potential impacts as appropriate.

4.8.3 Wetland Location

Existing Conditions

Wetland locations may be altered by any change that affects the extent and geographic distribution of the wetlands, the rate of formation of new wetlands, or the connections between wetlands. If there is a reduction in the water level or duration of the presence of water, wetlands may shrink, shift into areas with adequate water, or dry up and be lost entirely. When the duration of water is increased, wetlands may shift or expand upland where topography permits. New wetlands may form where suitable low-lying areas exist. Wetland habitat connectivity is an important function of wetland location. Natural habitat connections between wetlands and other adjacent natural habitats support biological diversity by serving as migration corridors for wetland plants and animals. These corridors allow native wetland species to move into new habitats as conditions change. Reduced habitat connectivity between wetlands and other adjacent natural habitats may reduce other wetland functions over time. Because of their proximity to the water, development and recreation pressures influence the location and connectivity of wetlands. As human populations associated with development have increased, many wetlands have become imperiled.

Based on the NWI, approximately 197,000 acres of wetlands are within the projected groundwater influence area of the TVA reservoir system[1] (Table 4.8-01). Approximately 55 percent of the wetlands in the projected groundwater influence area are found to occur along mainstem reservoirs, approximately 11 percent occur along tributary reservoirs, approximately 30 percent occur along mainstem tailwaters, and approximately 4 percent occur along tributary

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[1] This total acreage includes wetlands on Lake Barkley. Although it is not a TVA reservoir, Lake Barkley was included because it is hydrologically connected with Kentucky Lake. The Weekly Scheduling Model information shows that Lake Barkley and Kentucky Lake respond similarly under each policy alternative.

tailwaters (Table 4.8-01). Some of these potentially affected wetlands are present in local, state, and federally managed areas—including wildlife refuges, wildlife management areas, national forests, parks, and recreation areas—and TVA-designated sites, including small wild areas, habitat protection areas, and ecological study areas (Table 4.8-02 and Section 4.14, Managed Areas and Ecologically Significant Sites).

State and federal agencies have invested in infrastructure for controlling water levels to enhance and provide additional wetland functions in over 22,000 acres of wetlands associated with TVA reservoirs (Table 4.8-02). These controlled wetlands include national wildlife refuges (NWRs), wildlife management areas (WMAs), a waterfowl refuge, and a greentree reservoir (a forest that is flooded in winter for migratory bird use). In addition to water control structures, these wetlands contain improvements such as levees, access roads, signage, large-capacity hydraulic pumps, and monitoring equipment. These controlled wetlands and their associated improvements may be affected by changes in the timing and duration of reservoir water levels, which would affect the values and returns on the investments made by the state and federal agencies involved.

Potentially affected wetlands occur on flats between summer and winter pool elevations, on islands, along reservoir shorelines, in dewatering areas, in floodplains, on river terraces, along connecting rivers and streams, around springs and seeps, in natural depressions, in areas dammed by beaver, in and around constructed reservoirs and ponds (diked and/or excavated), and in additional areas that are isolated from other surface waters. In general, vegetated wetlands occur with greater frequency and size along the mainstem reservoirs and tailwaters than along the tributary reservoirs and tailwaters. This is due in part to the larger sized watersheds of mainstem reservoirs resulting in a greater volume of water; greater predictability of the annual hydrologic regime; shoreline and drawdown zone topography (wider and flatter floodplains, riparian zones, and drawdown zones and large areas of shallow water); and larger areas of relatively still, shallow-water areas. Wetlands tend to be smaller and do not occur as frequently on tributary reservoirs because of the relatively steep drawdown zones, the rolling to steep topography of adjacent lands, shoreline disturbance caused by wave action, and the lower predictability and shorter duration of summer pool levels.

Future Trends

While the CWA and TVA's SMI and Section 26a Permit Program would continue to influence activities that may encroach into wetlands on TVA reservoir lands, the wetlands surrounding TVA reservoirs would likely continue to face development and recreational pressures due to their proximity to the water. Large waterfront acreages may be fragmented by suburban development. Wetlands adjacent to TVA reservoirs may be affected by development on adjacent uplands. The remaining wetlands would likely play an increasingly important role in providing wetland functions, such as storing floodwaters, retaining sediments and stabilizing shorelines, protecting water quality, providing wildlife habitat, and enhancing the aesthetics of the shoreline.

Table 4.8-01 Wetland Amounts for Reservoirs and Tailwaters in the ROS EIS

Reservoirs	Combined Aquatic Beds and Flats (acres)	Emergent (acres)	Ponds (acres)	Forested (acres)	Scrub/ Shrub (acres)	All Types (acres)
Mainstem Reservoirs						
Barkley[1]	1,246	1,376	248	5,431	2,433	10,733
Chickamauga	5,756	115	213	426	430	6,940
Fort Loudoun	197	74	70	152	5	498
Guntersville	7,348	937	3,227	3,694	400	15,606
Kentucky	3,539	3,492	417	32,783	3,361	43,592
Nickajack	1,281	9	2,073	4	38	3,405
Pickwick	275	443	2,377	1,968	216	5,279
Watts Bar	610	19	52	285	85	1,051
Wheeler	2,523	1,811	9,533	4,593	1,700	20,160
Wilson	29	661	1,081	1,479	656	3,906
Subtotal	**22,804**	**8,937**	**19,291**	**50,815**	**4,324**	**111,182**
Tributary Reservoirs						
Apalachia	0	0	0	2	4	6
Bear Creek	17	8	100	146	0	271
Blue Ridge	2	2	3	1	0	8
Boone	2	7	8	28	11	56
Cedar Creek	1,238	23	177	315	40	1,793
Chatuge	581	11	14	48	14	668
Cherokee	2,995	89	43	43	53	3,223
Douglas	3,656	281	66	270	477	4,750
Fontana	6	4	6	39	8	63
Fort Patrick Henry	0	1	3	40	1	45
Great Falls	33	17	10	22	7	89
Hiwasee	23	15	1	21	106	166
Little Bear Creek	263	7	26	52	0	348
Melton Hill	158	73	101	48	10	390
Normandy	3	10	13	205	6	237
Norris	187	93	59	132	35	506
Nottely	4,329	17	88	106	11	4,551
Ocoee #1	0	115	0	5	2	122
Ocoee #2	0	0	0	0	0	0
Ocoee #3	20		9	1	101	131
South Holston	9	32	7	7	4	59

Table 4.8-01 Wetland Amounts for Reservoirs and Tailwaters in the ROS EIS (continued)

Reservoirs	Combined Aquatic Beds and Flats (acres)	Emergent (acres)	Ponds (acres)	Forested (acres)	Scrub/ Shrub (acres)	All Types (acres)
Tributary Reservoirs (continued)						
Tellico	17	155	75	350	83	680
Tims Ford	143	163	46	324	54	730
Upper Bear Creek	0	5	264	71	0	340
Watauga	752	2	1	13	16	784
Wilbur	21	7	0	0	0	27
Subtotal	**14,456**	**1,136**	**1,118**	**2,289**	**1,042**	**20,075**
Reservoir total	**37,260**	**10,073**	**20,427**	**53,104**	**10,366**	**131,257**

Tailwaters	Combined Aquatic Beds and Flats (acres)	Emergent (acres)	Ponds (acres)	Forested (acres)	Scrub/ Shrub (acres)	All Types (acres)
Mainstem Reservoirs						
Barkley[1]	14	393	101	2,540	151	3,199
Chickamauga	9	9	87	218	21	344
Fort Loudoun	131	17	5	62	26	241
Guntersville	21	1,221	5,370	5,333	2,209	14,154
Kentucky	64	288	356	13,200	497	14,405
Pickwick	290	1,852	209	12,921	2,099	17,371
Nickajack	498	632	190	44	976	2,340
Watts Bar	1,379	143	40	443	138	2,143
Wheeler	0	0	0	0	0	0
Wilson	527	94	1594	1,288	98	3,601
Subtotal	**2,933**	**4,649**	**7,952**	**36,049**	**6,215**	**57,814**
Tributary Reservoirs						
Apalachia	0	0	0	3	202	205
Bear Creek	5	372	2,452	2,227	145	5,201
Blue Ridge	2	8	2	2	6	20
Boone	0	0	0	0	0	0
Cedar Creek	81	0	29	117	9	236
Chatuge	0	18	19	22	5	64
Cherokee	71	18	3	13	2	107
Douglas	3	10	27	215	9	264

Table 4.8-01 Wetland Amounts for Reservoirs and Tailwaters in the ROS EIS (continued)

Tailwaters	Combined Aquatic Beds and Flats (acres)	Emergent (acres)	Ponds (acres)	Forested (acres)	Scrub/ Shrub (acres)	All Types (acres)
Tributary Reservoirs (continued)						
Fontana	0	0	0	0	3	3
Fort Patrick Henry	0	3	61	35	2	101
Great Falls	0	16	1	0	7	24
Hiwasee	0	0	0	0	0	0
Little Bear Creek	0	45	72	130	3	250
Melton Hill	2	10	72	101	30	215
Normandy	10	22	31	203	1	267
Norris	0	0	15	8	0	23
Nottely	4	3	16	19	10	52
Ocoee #1	1	2	0	31	0	34
Ocoee #2	0	0	0	0	0	0
Ocoee #3	0	0	0	0	0	0
South Holston	0	6	1	35	2	44
Tellico	0	0	0	0	0	0
Tims Ford	20	31	31	342	4	428
Upper Bear Creek	0	1	83	166	0	250
Watauga	0	0	0	0	0	0
Wilbur	0	6	7	123	6	142
Subtotal	**199**	**571**	**2,922**	**3,792**	**446**	**7,934**
Tailwater total	**3,132**	**5,220**	**10,874**	**39,841**	**6,661**	**65,748**
System total	**40,392**	**15,293**	**31,301**	**92,945**	**17,027**	**196,958**

[1] This table includes wetlands on Lake Barkley. Although not a TVA reservoir, Lake Barkley was included because it is hydrologically connected with Kentucky Lake. The Weekly Scheduling Model information shows that Lake Barkley and Kentucky Lake respond similarly under each policy alternative.

Source: National Wetland Inventory.

Table 4.8-02 Wetlands with Water-Level Control Structures

Wetland Name	Reservoir	Invested Agencies	Acres
Rankin WMA	Douglas	TWRA	1,255
Chota Waterfowl Refuge	Tellico	TWRA	100
Mud Creek Greentree Reservoir	Guntersville	ADCNR-JCWMA	290
Wannville Dewatering Unit	Guntersville	ADCNR-JCWMA	384
Raccoon Creek Dewatering Unit	Guntersville	ADCNR-JCWMA	1,040
Swan Creek Dewatering Unit	Wheeler	ADCNR	1,100
White Springs Dewatering Unit	Wheeler	USFWS-Wheeler NWR	1,700
Rockhouse Dewatering Unit	Wheeler	USFWS-Wheeler NWR	1,100
Penney Bottoms Dewatering Unit	Wheeler	USFWS-Wheeler NWR	50
Crabtree Slough Dewatering Unit	Wheeler	USFWS-Wheeler NWR	180
Devaney Impoundment	Wheeler	USFWS-Wheeler NWR	60
Dinsmore Slough Dewatering Unit	Wheeler	USFWS-Wheeler NWR	130
Display Pool	Wheeler	USFWS-Wheeler NWR	13
Duck River Dewatering Unit	Kentucky	USFWS-Tennessee NWR	4,688
Busseltown Dewatering Unit	Kentucky	USFWS-Tennessee NWR	204
Camden Dewatering Unit	Kentucky	TWRA/TVA	3,937
West Sandy Dewatering Unit	Kentucky	TWRA/TVA	3,730
Big Sandy Dewatering Unit	Kentucky	TWRA/TVA	1,738
Perryville Dewatering Unit	Kentucky	TVA	308
Gumdale Dewatering Unit	Kentucky	TVA	152
Yellow Creek WMA	Chickamauga	TWRA	35
Washington Ferry WMA	Chickamauga	TWRA	50
McKinley Branch	Chickamauga	TVA	75
Big Slough (Hiwassee Refuge)	Chickamauga	TWRA	15
Rogers Creek (Chickamauga WMA)	Chickamauga	TWRA	30
Johnson Bottoms	Chickamauga	TWRA	22
Candies Creek (Chickamauga WMA)	Chickamauga	TWRA	60
Total			**22,359**

Notes:

ADCNR-JCWMA = Alabama Department of Conservation and Natural Resources-Jackson County WildlifeManagement Areas.
NWR = National wildlife refuge.
TVA = Tennessee Valley Authority.
TWRA = Tennessee Wildlife Resources Agency.
USFWS = U.S. Fish and Wildlife Service.
WMA = Wildlife management area.

Source: TVA Natural Heritage Database.

4.8.4 Wetland Type

Existing Conditions

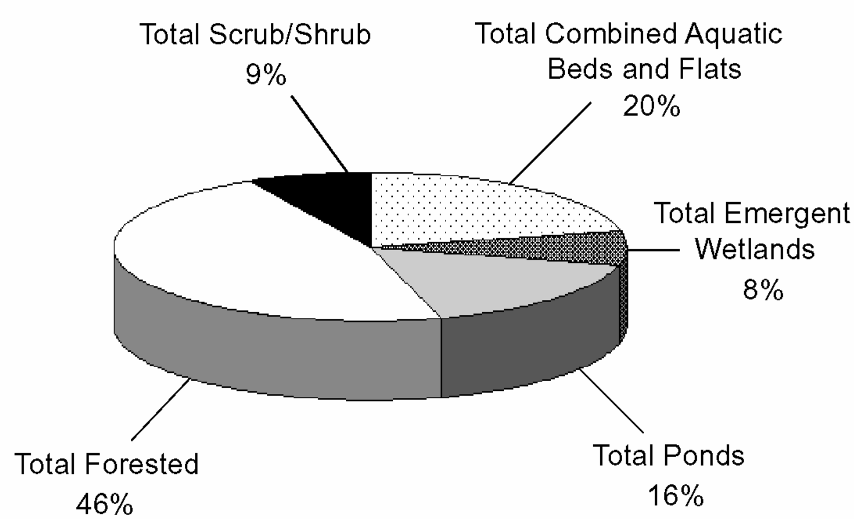
Vegetation Classes

Specific categories of wetland types were chosen for evaluation based on their sensitivity to potential changes and their association with critical wetland functions described in the next section. These categories include vegetation type (Figure 4.8-01) (the dominant form of plant life) and water-regime type (the timing and duration of the presence of water). Schematics of these wetland vegetation types and water regimes are shown in Figures 4.8-02, 4.8-03, and 4.8-04, as described in Classification of Wetlands and Deep Water Habitats (Cowardin et al. 1979). A summary of the wetland vegetation types and acreages associated with each hydropower project is presented in Table 4.8-01. Additional categories of wetlands were identified as areas of concern in public comments due to the high-profile functions and values they provide. These additional functional categories include shoreline wetlands, island wetlands, wetlands that are isolated from other surface waters, and wetlands with investments in infrastructure for controlling water levels to enhance and provide additional wetland functions (Table 4.8-02).

The potentially affected wetland types include:

- Aquatic beds—submersed areas supporting aquatic vegetation.
- Seasonally exposed flats—areas of non-persistently vegetated and non-vegetated mudflats, as well as flats of other natural and artificial substrate types such as mixtures of sand, silt, cobble, and gravel.
- Emergent wetlands—areas of low-growing marshes and wet meadows.
- Scrub/shrub wetlands—areas with shrubs and or saplings.
- Forested wetlands—swamp and bottomland areas with hardwood and other wetland tree species.
- Ponds—areas of constructed ponds, beaver ponds, and other naturally occurring ponds and seasonal pools.

A wide range of dominance types, water regimes, and special modifiers exist within these vegetation types. Descriptions and lists of the commonly occurring vegetation species in the ROS area wetlands can be found in Section 4.9 (Aquatic Plants) and Section 4.10 (Terrestrial Ecology). Almost half (47 percent) of the wetlands associated with the TVA reservoir system are classified as forested wetlands, approximately 20 percent are aquatic beds and flats, approximately 16 percent are ponds, approximately 8 percent are emergent wetlands, and approximately 9 percent are scrub/shrub (Figure 4.8-01). The locations and extents of aquatic beds and flats are combined for the purposes of this assessment since these categories overlap in nature. When aquatic beds are exposed, they function as flats; likewise, while flats are submersed, they sometimes develop aquatic bed vegetation.



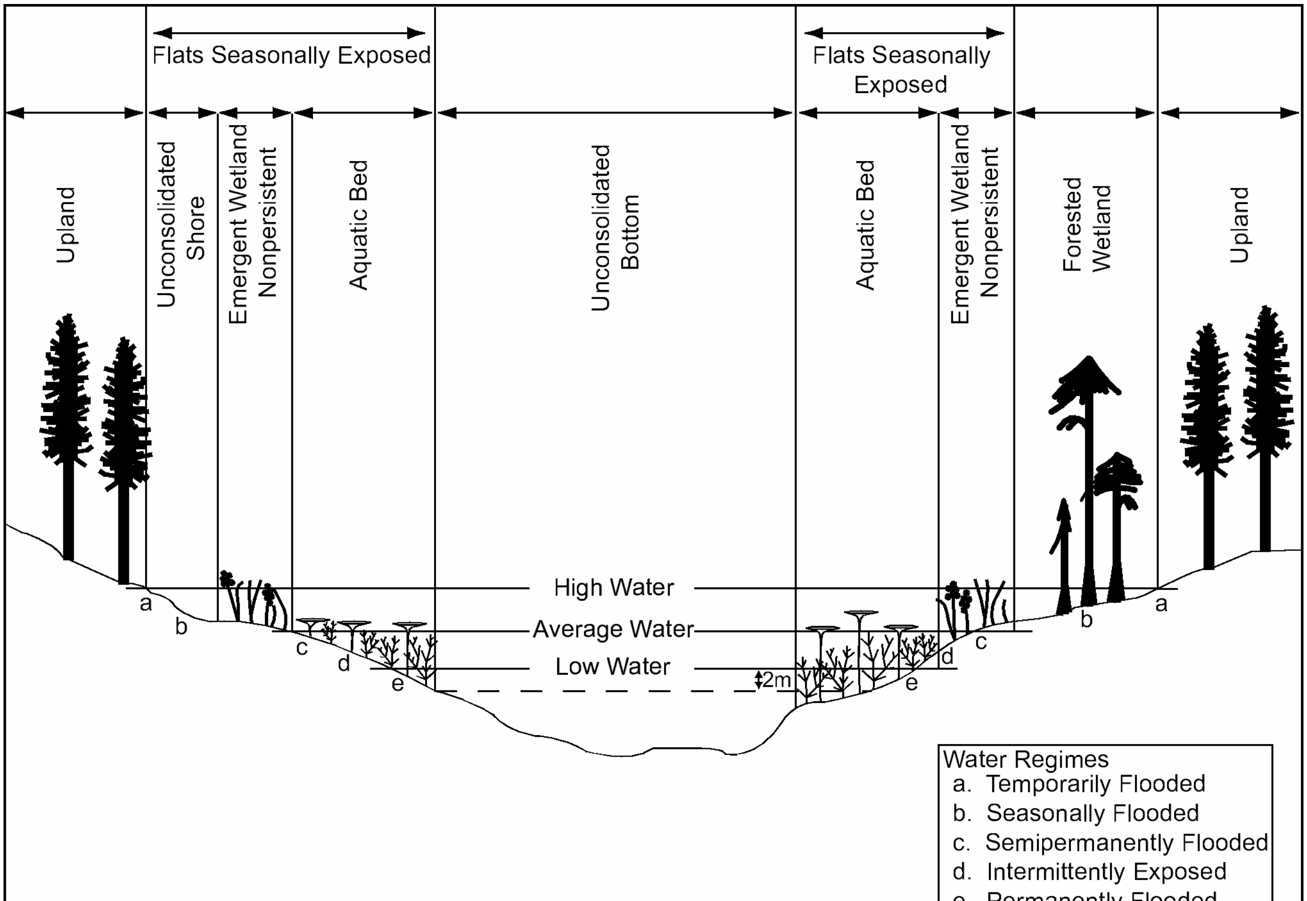
Note: Total acreage is approximately 197,000.
Source: TVA data.

Figure 4.8-01 Wetlands of the TVA Reservoir System by Vegetation Class

<u>Water Regimes</u>

The water-regime types of wetlands associated with the TVA reservoir system include:

- Temporarily flooded wetlands—normally have standing surface water for less than 2.5 weeks during the growing season;
- Seasonally flooded wetlands—may have standing water present for much of the growing season but normally dry up during late summer and fall;
- Semipermanently flooded wetlands—normally have standing water for most of the year;
- Permanently flooded wetlands—normally have standing water year round; and,
- Intermittently exposed wetlands—may experience up to a few weeks exposure a year during dry conditions.

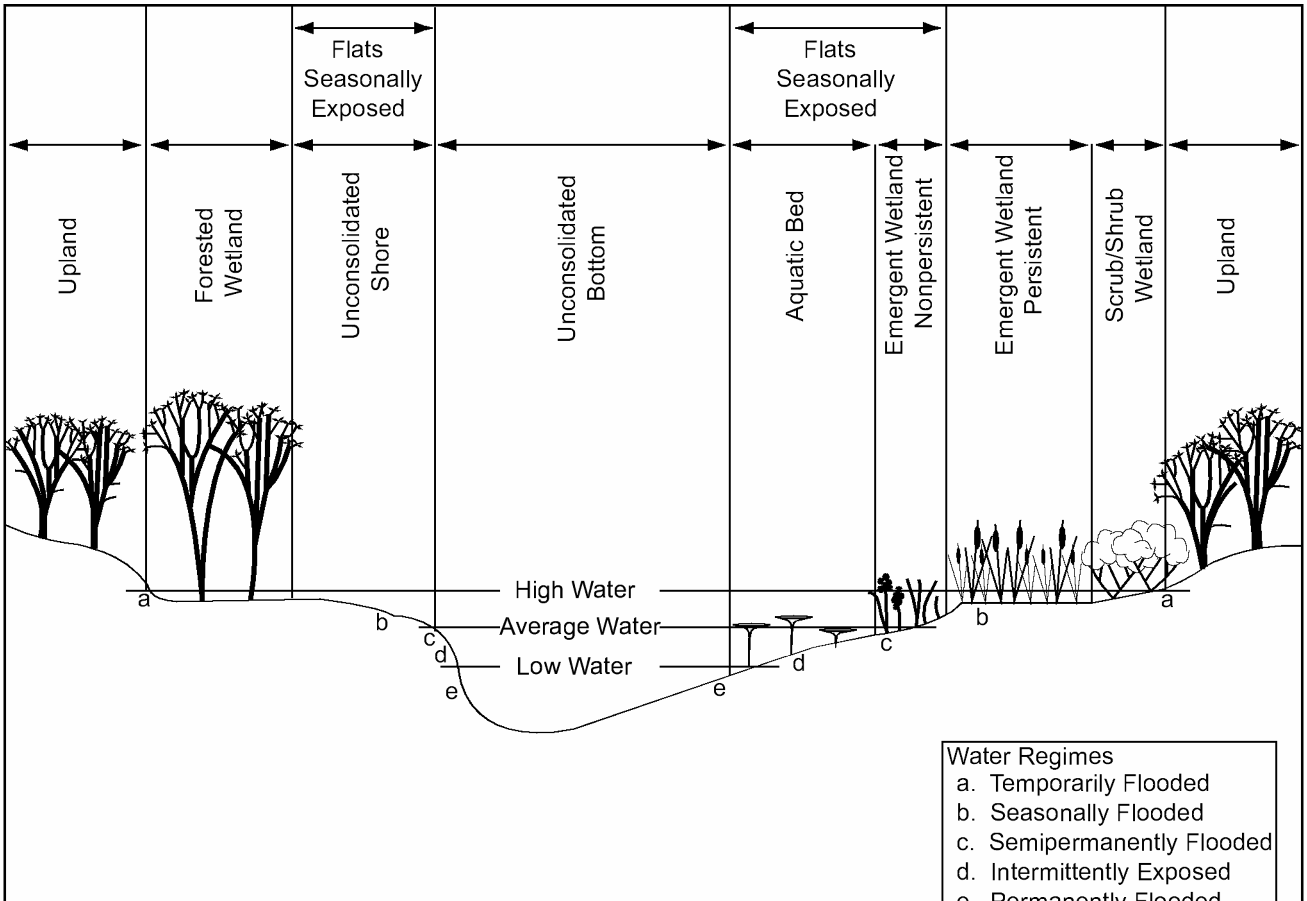


Source: Modified from Cowardin et al. 1979.

Figure 4.8-02 Wetland Reservoir Types and Locations (Lacustrine Wetlands)

A total of 37 percent of the wetlands associated with the TVA reservoir system are temporarily flooded, 41 percent are seasonally flooded, 10 percent are semipermanently flooded, 9 percent are permanently flooded, less than 1 percent are intermittently exposed, and 2 percent are artificially flooded (Figure 4.8-05).

Wetlands that are particularly sensitive to reservoir operations are shoreline wetlands, island wetlands, and isolated wetlands. Isolated wetlands are separated from other surface waters but influenced by groundwater. Only wetlands entirely isolated from all surface waters were identified as isolated in this study; the actual extent of wetlands in the groundwater influence area that may be considered isolated from a regulatory standpoint may be greater. Increasing rates of loss of isolated wetlands are being seen as a result of ongoing changes in the regulation of this type of wetland under the CWA. Following a Supreme Court ruling (SWANCC 2000), various estimates (USFWS, USEPA, USACE, the Association of State Wetland Managers [ASWM]) suggest that anywhere between 20 and 79 percent of the existing wetlands in the United States may lose protection under the CWA (Meltz and Copeland 2001, Paranteau 2002, Kusler 2002).



Source: Modified from Cowardin et al. 1979.

Figure 4.8-03 Tailwater Reservoir Types and Locations (Riverine Wetlands)

Future Trends

National wetlands trends studies (Dahl 2000) indicate that, between 1986 and 1997, fresh-water forested wetlands declined 2.3 percent, and fresh-water emergent declined 4.6 percent. Parts of these declines were due to conversion of forested and emergent wetlands to shrub wetlands (a gain of 6.6 percent) and fresh-water ponds (a gain of 13 percent) during the study period. Timber harvesting, agriculture, natural succession, beaver activity, changes in land use (including urban and rural development, mining, and recreation such as golf courses), and conversion of bottomland forests to managed pine plantations, played a role in these trends in wetland change. These trends are likely to continue to various degrees over the next 30 years.

National trend data do not include analyses of flats and aquatic bed coverage; however, TVA data indicate an increase in coverage of aquatic beds between the 1960s and 2000s.

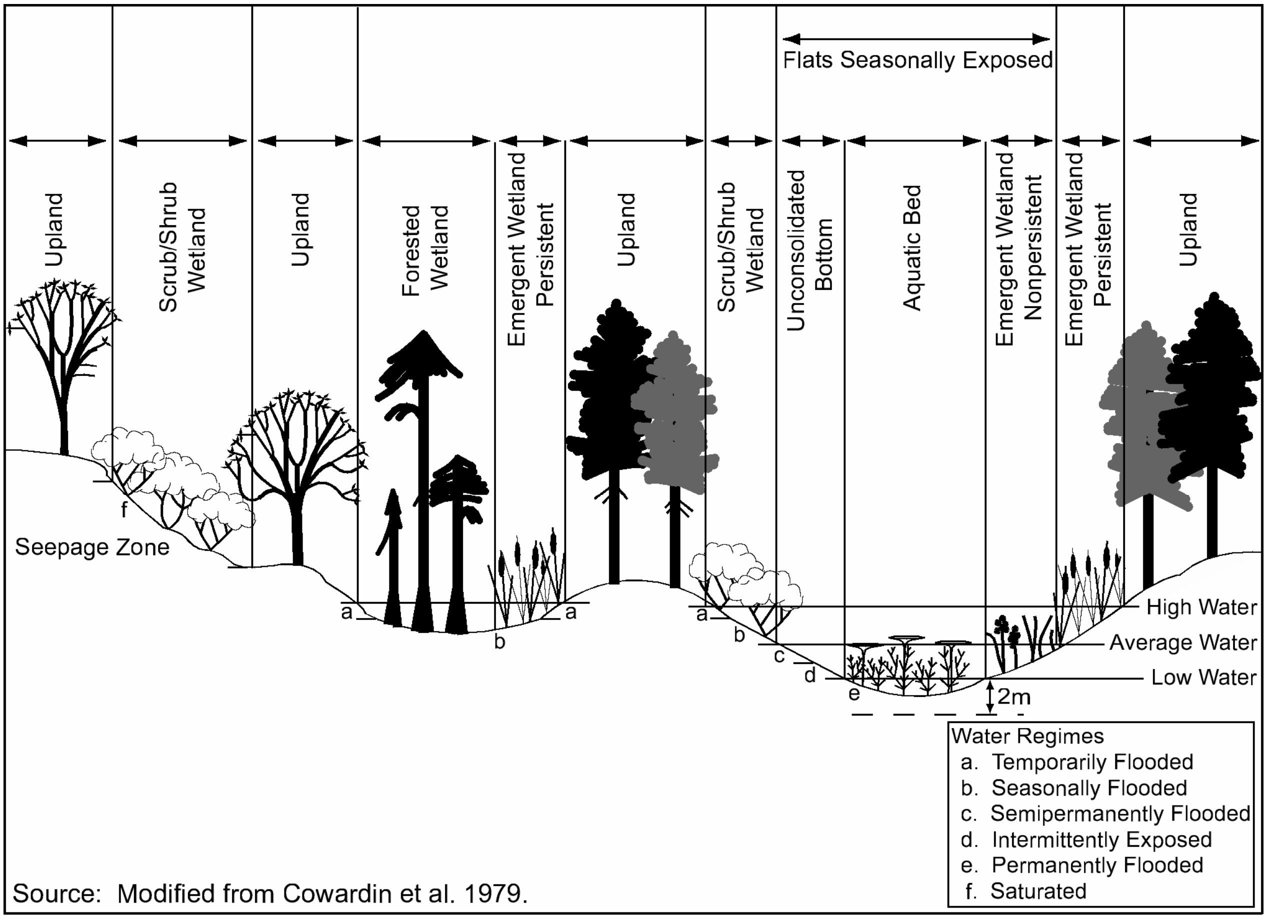
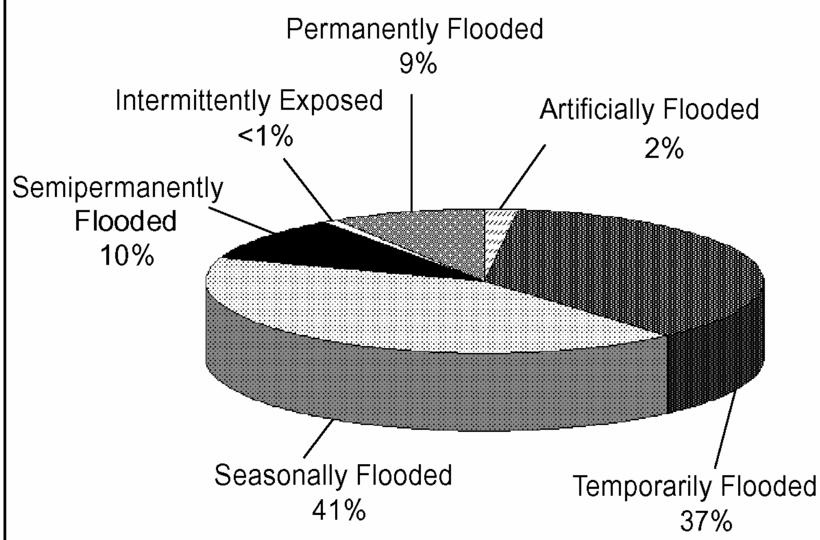


Figure 4.8-04 Other Wetland Types and Positions within the Area of Groundwater Influence (Palustrine System)

4.8.5 Wetland Functions

The environmental quality of rivers, watersheds, estuaries, and water supplies is closely tied to the functions of wetlands. The functions provided by the wetlands associated with the TVA reservoir system include stormwater storage, shoreline stabilization, sediment retention, removal and transformation of contaminants, carbon storage, nutrient cycling, food web support through the production of plants and invertebrates, water temperature modification, wildlife habitat, and support for biological and landscape diversity (Mitsch and Gosselink 1993, Tiner et al. 2002). Just as wetland types vary, the functions of individual wetlands also vary. Not all wetlands perform all wetland functions to the same degree. These functions are performed at different intensities, depending on the wetland type, its watershed position, its location in relation to the reservoir and adjacent land uses, and the level of environmental disturbance.



Note: Total acreage is approximately 197,000.
Source: TVA data.

Figure 4.8-05 Wetlands of the TVA Reservoir System by Water Regime

These wetland functions provide numerous benefits to the public, including floodwater reduction, water quality improvement, and aesthetic enhancement of the shoreline. Wetlands provide recreational opportunities to the public, including hunting, fishing, boating, hiking, wildflower and wildlife viewing, photography, educational use, and scientific study. Individual states gain economic benefits from recreational opportunities in wetlands that attract visitors from other states (U.S. Congress 1993). A disproportionately high number of rare species depend on wetlands. USFWS estimates that up to 43 percent of threatened and endangered species rely directly or indirectly on wetlands for their survival (http://www.epa.gov/watertrain/wetlands/text.html).

Certain wetland functions may be attributed to wetlands based on wetland type. All vegetated wetlands function to enhance water quality. Wetlands that are not permanently flooded may provide additional water storage during floods and storms. Vegetated shoreline fringe wetlands help stabilize streambanks and shorelines from floodwaters, wave action, and soil erosion and sedimentation. All vegetated wetlands that are permanently or semi-permanently flooded may serve to store carbon. Areas that store carbon help to prevent gases that promote global warming from entering the atmosphere. The continuous presence of water slows the rate of decomposition in these wetlands by reducing the availability of oxygen to organisms of decay; consequently, carbon-rich organic matter is stored in wetland soils. In similar ways, wetlands may help with nutrient cycling and food web support.

Scrub/shrub and forested wetlands are particularly well suited to bank protection and stabilization. All types of wetlands may provide habitat for plants and animals for breeding, nesting, refuge, or as a source of food. Surface-isolated and seasonally flooded wetlands are especially important in providing wetland and upland habitat interspersion functions. These wetlands are either never connected to other aquatic systems or they are not continuously connected. This lack or reduction in connection to other aquatic systems is a controlling factor in the development of unique biological communities in these wetlands. These habitat interspersion functions make these types of wetlands critical as breeding habitats for certain species of amphibians (salamanders and frogs) because certain predatory fish species are not able to establish populations. They also provide critical transient habitats for migratory birds. All types of wetlands provide opportunities for aesthetic and educational pursuits, hunting and fishing, hiking and exploring, boating, wildflower and wildlife viewing, and nature photography and filming. Section 4.7 (Aquatic Resources), Section 4.10 (Terrestrial Ecology), Section 4.13 (Threatened and Endangered Species), and Section 4.14 (Managed Areas and Ecologically Significant Sites) have additional discussion about wetland resources, functions, and values.