DRAFT

THE NATIONAL WETLANDS INVENTORY'S

Use of Mapping Conventions to Implement

"CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES"

A Guide to Understanding
National Wetlands Inventory
Mapping Codes

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INTRODUCTION

In 1979, the U.S. Fish and Wildlife Service adopted "Classification of Wetlands and Deepwater Habitats of the United States," by Cowardin et al. as the agency's official wetland classification system. The National Wetlands Inventory (NWI) is congressionally mandated to map wetlands of the United States and uses the Cowardin system to meet this mandate.

As with any classification system, familiarity comes through use. The Cowardin et al. (1979) wetland classification system is cartographically presented on NWI maps with the use of NWI mapping conventions. Although there exists thousands of potential classifications, in actual use and practicality, application of the Cowardin system is quite simple. The user determines the level of detail. If only generic information is required, then perhaps only the system (e.g., Lacustrine, Riverine, etc.) requires identification. If, however, greater detail is required, then Cowardin et al. allows the user to apply many levels of hierarchy.

In many areas of the United States, including portions of the Prairie Pothole Region (PPR) of the northern great plains, only a few Cowardin wetland classifications may be necessary. One PPR study involving several quadrangles, indicated that 93 percent of the wetlands classified were either Palustrine, emergent, temporarily flooded, seasonally flooded, or semipermanently flooded (NWI mapping codes = PEMA, PEMC, or PEMF). Simply by knowing one system (Palustrine), one class (emergent), and three water regimes (temporarily, seasonally, or semipermanently flooded), users can identify 93 percent of the wetlands in this area of high wetland density.

When the NWI completes mapping the contiguous United States, there will exist over 54,000 maps where the Cowardin system and NWI mapping conventions are applied. Use of this wetland information, including NWI digital data, requires some basic knowledge of the principles described in this booklet. For additional assistance, NWI staff can be reached by contacting the offices identified in Appendix 1.

APPLICATION

The NWI uses cartographic symbols to describe wetland types. Mapping symbology consists of a series of letters and numbers. After wetland delineation and classification are done on high altitude aerial photography, data are transferred onto hard copy 1:24,000 scale maps. The NWI digital data also utilize the same mapping symbology.

The Cowardin wetland classification system is hierarchical (e.g., systems, subsystems, classes, subclasses, and modifiers). As one proceeds through the Cowardin classification system, more details are revealed about the wetland. Consequently, more NWI mapping symbology is required to classify the wetland.

For example, how is the Cowardin et al. wetland classification system and NWI mapping conventions used to classify open water, slow moving, meandering wetland/deepwater habitats for the lower reaches of such major areas as the Missouri, Mississippi, Rio Grande, Potomac, Sacramento, and Ohio Rivers?

On NWI maps these major rivers and many like them are classified as R2UBH. The letter R (NWI symbology) refers to the Riverine system in Cowardin. The Cowardin Riverine (R) system includes,

> ". . . all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, . . . and (2) habitats with water containing ocean-derived salts . . . ."

Additional letters and numbers following the Riverine system (R) further describe more specifics about the Riverine system. For example, the Riverine system has four subsystems:

1 = tidal
2 = lower perennial
3 = upper perennial
4 = intermittent

Using the number 2 after the R results in a classification of R2, which describes the lower perennial subsystem (2) as,

> ". . . gradient is low . . . water velocity is slow . . . no tidal influence . . . water flows throughout the year . . . substrate is sand and mud . . . oxygen deficits may occur . . . floodplain is well developed . . . ."

The user proceeds through the Cowardin hierarchical classification from system Riverine (R) to subsystem lower perennial (2) to the next level, which is class.

The Cowardin et al. classification system has 11 classes. The class level provides additional information about the characteristics of the wetland. One of these 11 classes is unconsolidated bottom (UB). The unconsolidated bottom class includes:

> ". . . all wetland and deepwater habitats with at least 25% of the substrate composed of particles smaller than stones, and a vegetative cover less than 30% . . . with at least a semipermanently flooded water regime."

Adding the class unconsolidated bottom (UB) to the previously identified R2, the NWI mapping code for these rivers now becomes R2UB.

Moving through the hierarchy, the user may describe additional details about the wetland by using one of four subclasses available within the UB class. These subclasses include,

(1) cobble-gravel
(2) sand
(3) mud
(4) organic

Subclasses are not always available on NWI maps as they are often difficult, and many times impossible, to discern utilizing remote sensing technologies. Field work and research projects, however, will use these subclasses, and identify the appropriate sized substrate and select the corresponding number, e.g., (2) for a sand substrate.

Water regime modifiers, the next level after subclass, are used to further provide details about the wetland. Specific water regimes are used for specific classes. In the case of the unconsolidated bottom (UB) class, four water regimes are available:

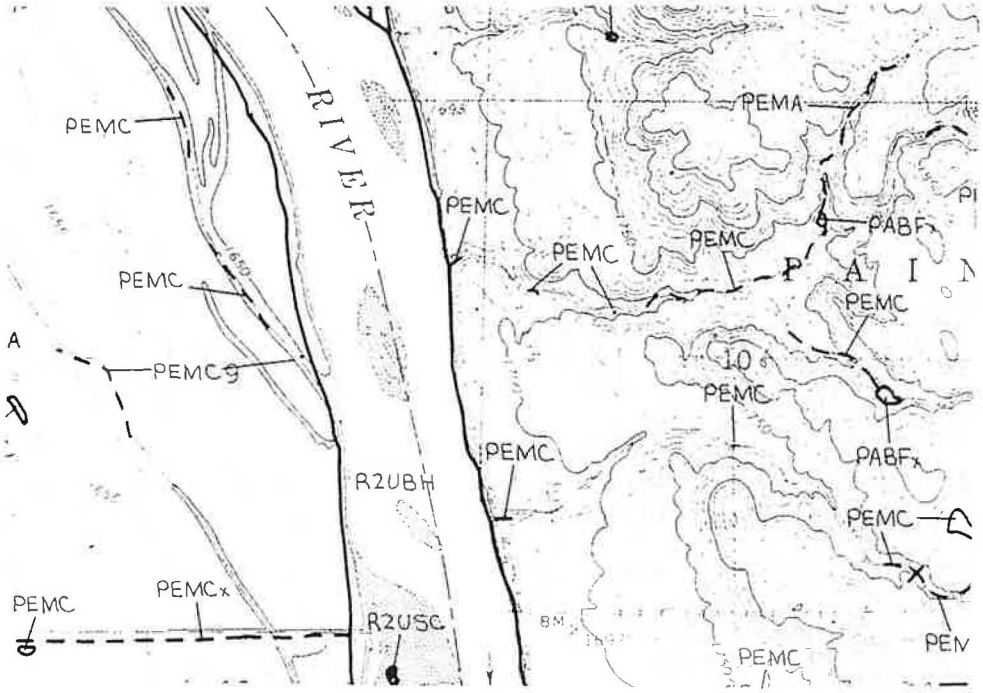
(L) subtidal
(H) permanently flooded
(G) intermittently exposed
(F) semipermanently flooded

A river that flows continuously, at all times, is considered permanently flooded, resulting in the selection of (H) and the subsequent NWI mapping code of R2UBH.

Therefore, the NWI mapping code of R2UBH (Map 1) is defined as [R = Riverine (in a channel), 2 = lower perennial (well developed floodplain), UB = unconsolidated bottom (sand or mud), H = permanently flooded (water always present)]. This NWI mapping code (R2UBH) describes habitat such as found throughout the lower reaches of the Missouri River (Figure 1).

Special modifiers such as one for beaver activity (b), partly drained (d), diked/impounded (h), and excavated (x), among others, also may be added.

Map 1. A portion of a National Wetlands Inventory map showing the wetland classification R2UBH.



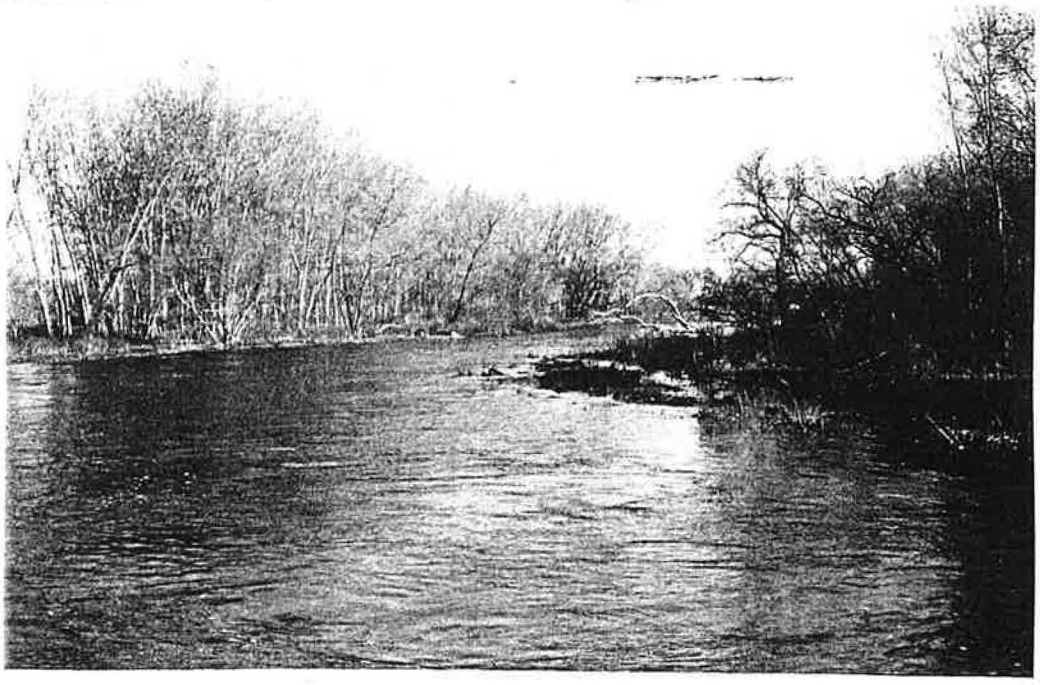


Figure 1. A picture of an R2UBH.

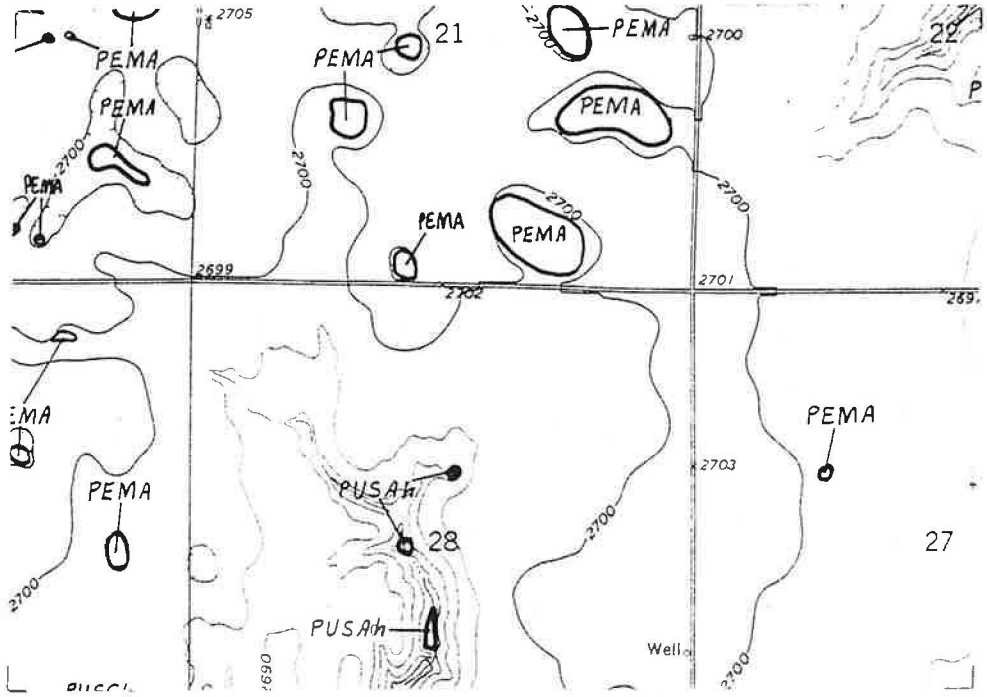
On the following pages, portions of NWI maps and examples of NWI mapping classifications such as the R2UBH just presented are coupled with actual photographs of the same type of wetland as it exists in the field. Information in this booklet, especially when used with other collateral data such as the NWI map legend, Cowardin et al. (1979), and other informational guides (e.g., "NWI Maps Made Easy"), provides NWI map users with sufficient information to accurately interpret NWI maps.

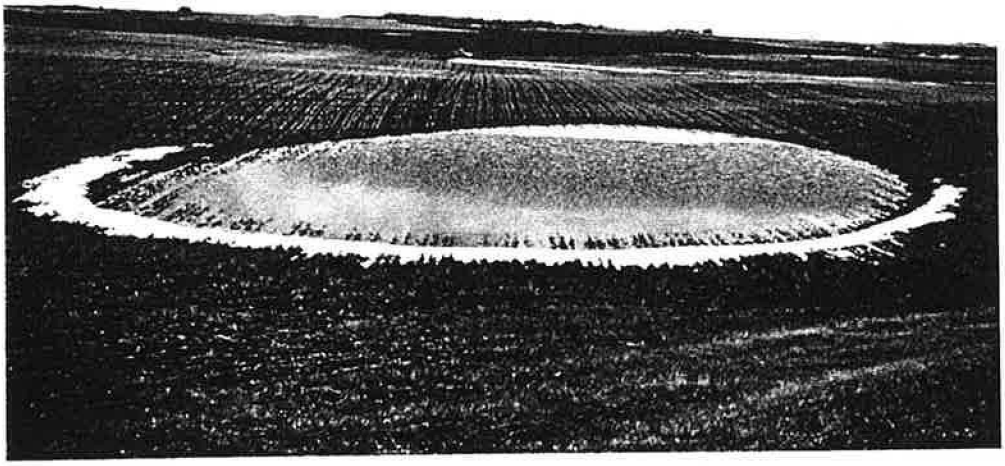
Most importantly, this booklet HELPS YOU TO ANSWER THE FOLLOWING QUESTION:

HOW DO I READ NWI MAPS AND CLASSIFY THESE WETLANDS?

PEMA = Palustrine, emergent, temporarily flooded

A PEMA wetland is at least 30 percent vegetated with emergent, erect, rooted, herbaceous vegetation and has surface water present for brief periods during the growing season. In early spring the PEMA may be open water because vegetative growth has not yet occurred.

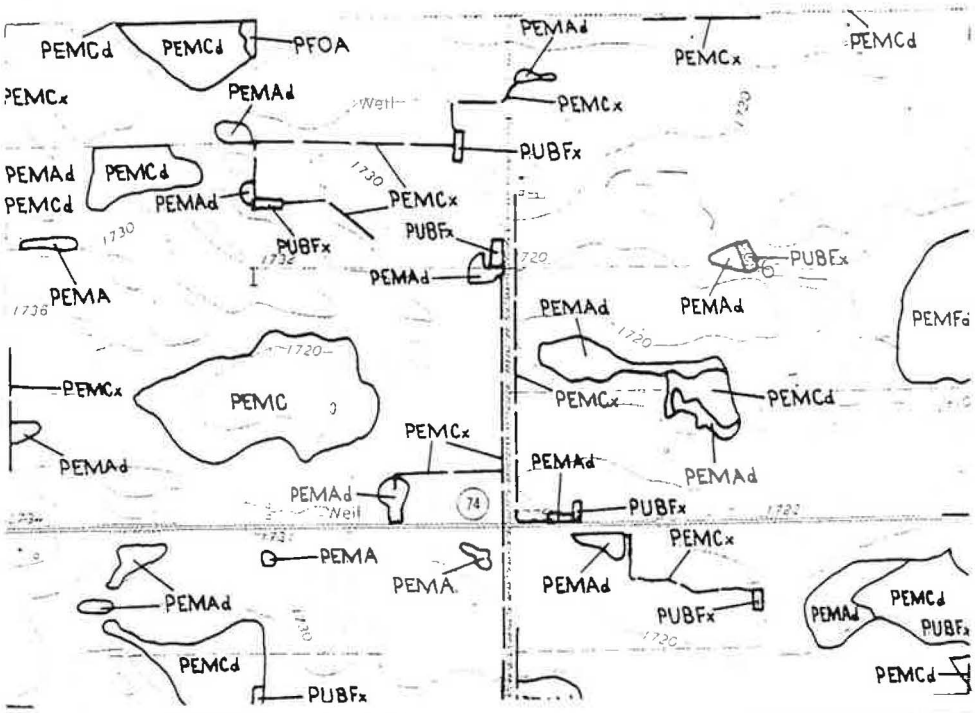


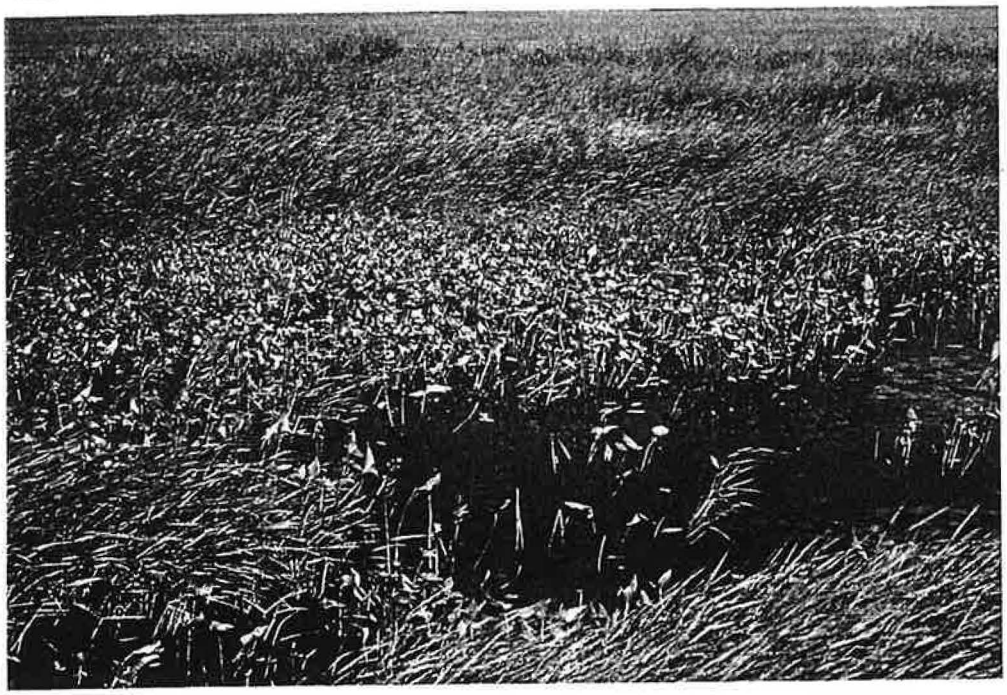


PEMA wetlands serve as waterfowl pair sites in the spring breeding season, thereby distributing breeding birds and reducing intraspecific competition. Water may be present after snow melt or after thunderstorm activity. Characteristic vegetation includes Hordeum jubatum, Echinocholea crusgalli, Poa palustris, calamagrostis inexpansa, and Rumex spp.

PEMC = Palustrine, emergent, seasonally flooded

A PEMC wetland is at least 30 percent vegetated with emergent, herbaceous vegetation and has surface water present for extended periods especially early in the growing season. In early spring the PEMC may be open water because vegetative growth has not yet occurred.

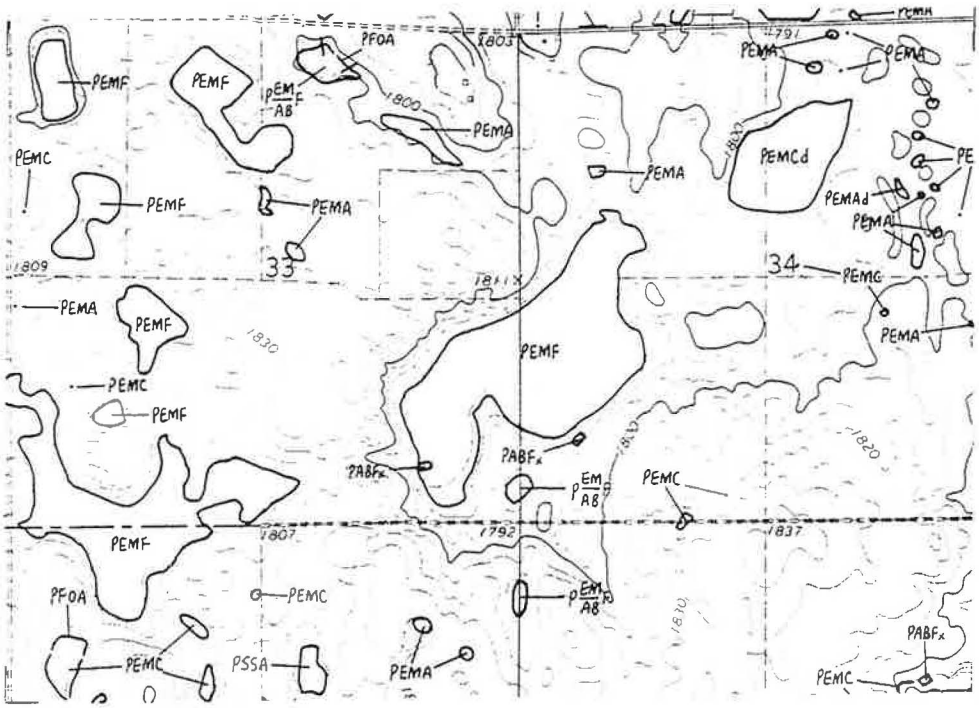




PEMC wetlands provide food sources for a variety of water birds and other animal life for higher food chain predators. They may serve as groundwater recharge sites, sources of hay, and aid in floodwater retention. Characteristic vegetation includes Carex spp., Beckmannia syzigachne, Eleocharis spp., Sagittaria cuneata, Alisma triviale, and Schlochloa festucacea.

PEMF = Palustrine, emergent, semipermanently flooded

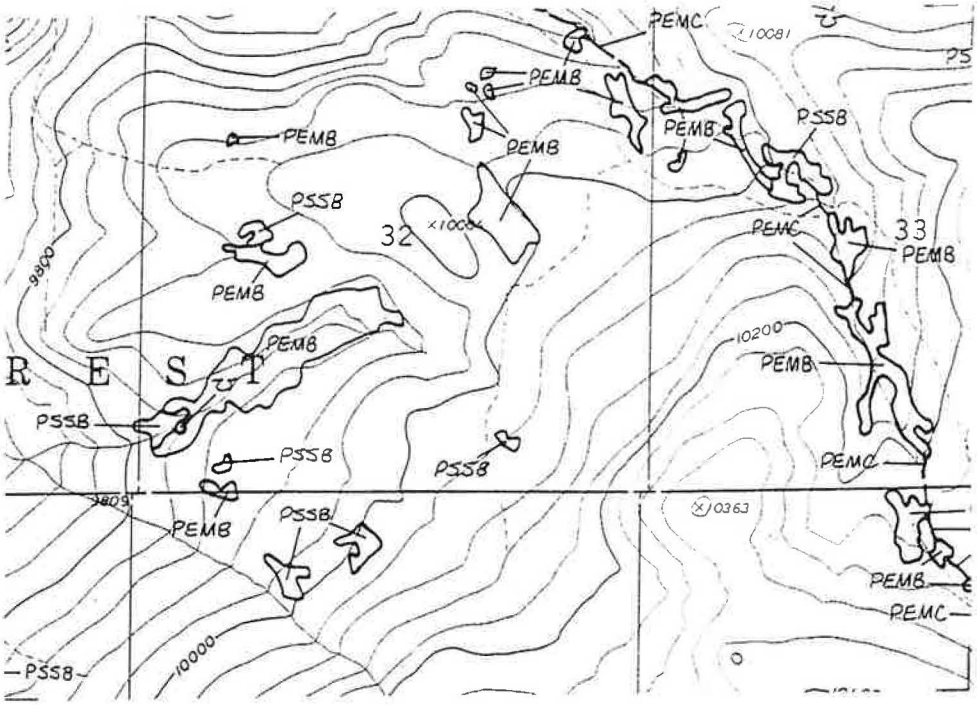
A PEMF wetland is at least 30 percent vegetated with erect, emergent, rooted, herbaceous vegetation and has surface water present throughout the growing season in most years. Aquatic beds are likely associated with open water areas.

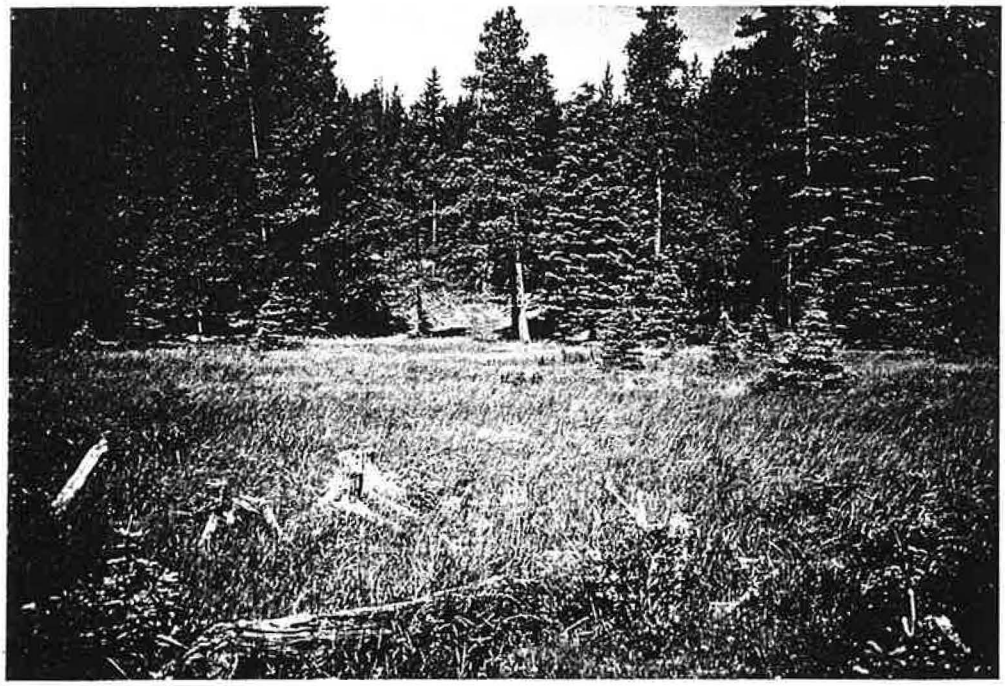


PEMF wetlands provide habitat for many waterbirds, protection for furbearers, and winter cover for resident species. They often aid in groundwater recharge, nutrient trapping, water source for cattle, and reduce flood attenuation. Characteristic vegetation includes Typha spp. and Scirpus spp.

PEMB = Palustrine, emergent, saturated

A PEMB wetland is at least 30 percent vegetated, usually 100 percent vegetated with herbaceous vegetation. A saturated surface exists during most of the growing season but surface water is seldom present.

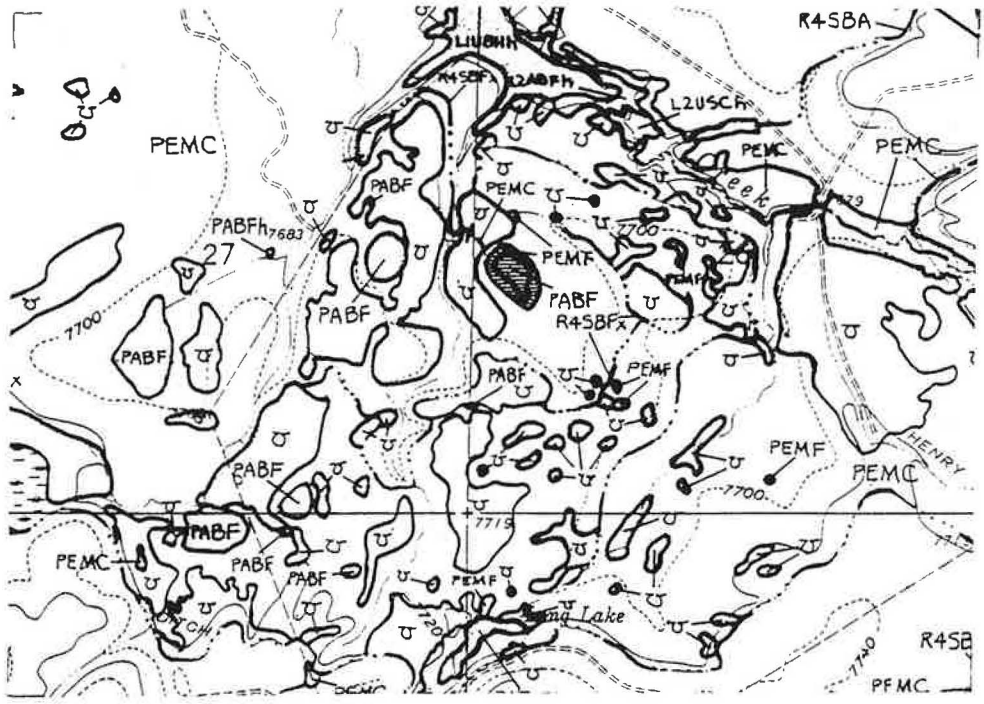


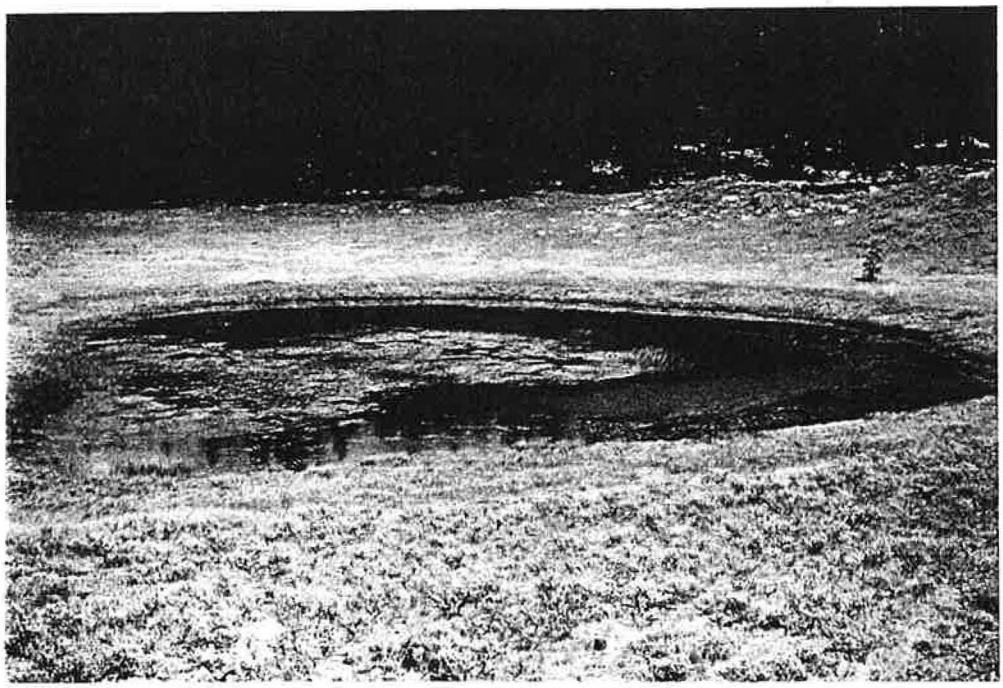


PEMB wetlands may be found throughout the United States. They are found in mountainous country often associated the glacial activity. Soils are often organic. Characteristic vegetation includes Pedicularis groenlandica, Limnorchis dilatata, and Bistorta bistortoides.

PABF = Palustrine, aquatic bed, semipermanently flooded

A PABF wetland is dominated by plants that grow principally on or below the surface of the water and has surface water present throughout most of the growing season in most years.

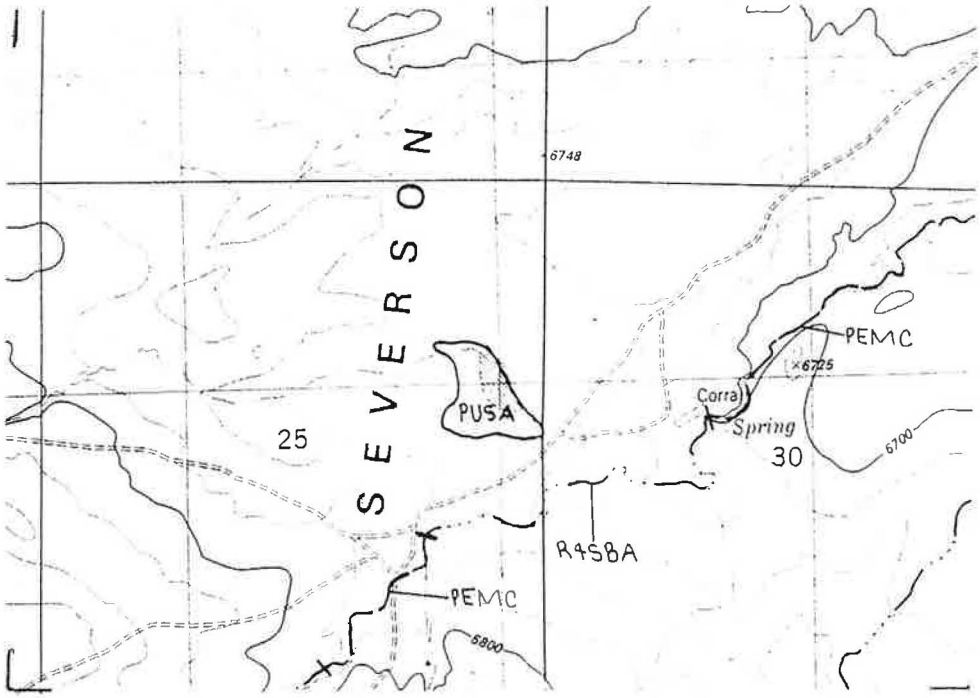




PABF wetlands serve many functions similar to the PEMF. They lack emergents due to water depth where aquatic beds become dominant. Characteristic vegetation includes Chara spp., Potamogeton spp., Ruppia maritima, Myriophyllum spp., Ceratophyllum demersum, and Ranunculus trichophyllus.

PUSA = Palustrine, unconsolidated shore, temporarily flooded

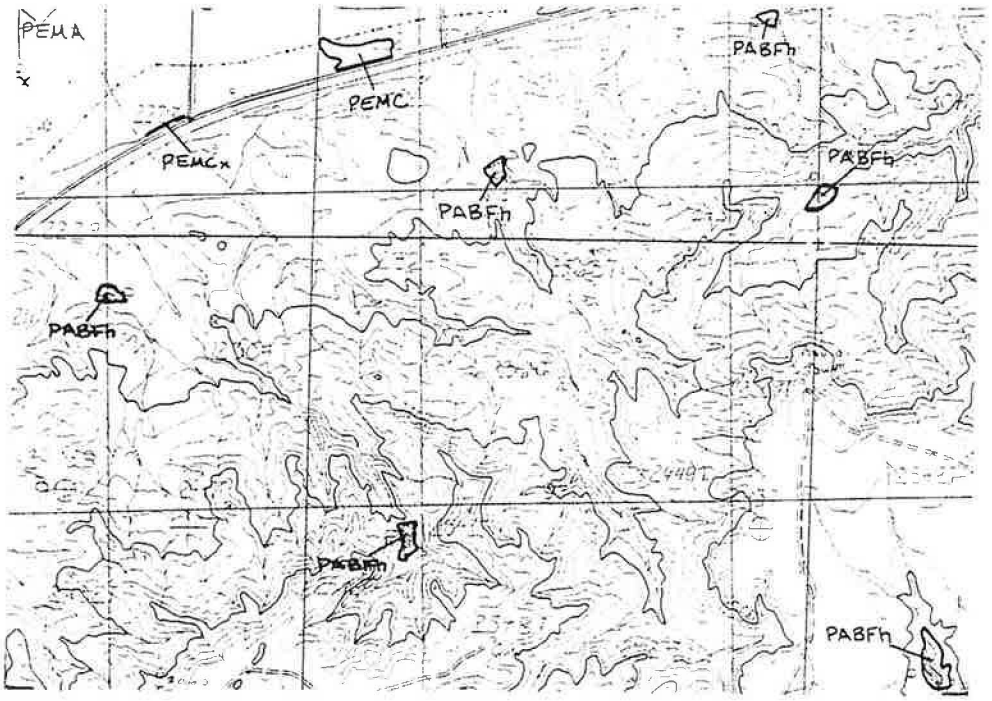
A PUSA wetland consists of a substrate of cobble-gravel size particles or smaller and less than 30 percent vegetation. Surface water is present for brief periods during the growing season.

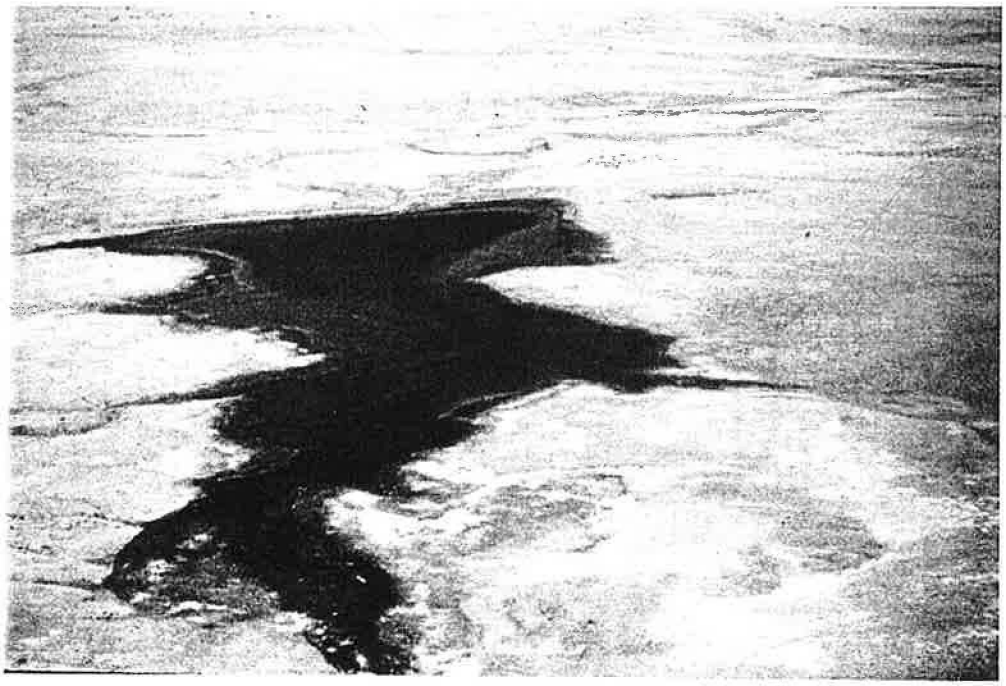


PUSA wetlands appear as exposed substrates that often have soils that are saline or alkali. Limited species that may occur, but in areal cover less than 30 percent, include Distichilis spicata and Salicornia spp.

PABFh = Palustrine, aquatic bed, semipermanently flooded, impounded

A PABFh wetland is commonly called a stockpond. It is similar to the PABF wetland except it is created or modified by a barrier or dam which obstructs the outflow of water.

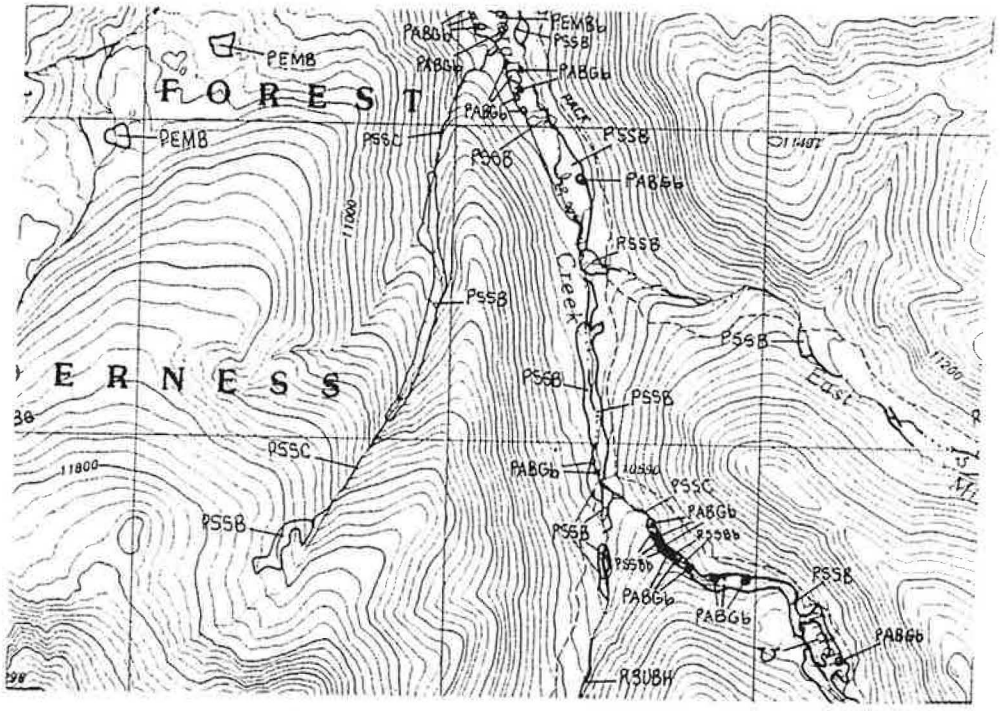




PABFh wetlands are constructed primarily for use by livestock but also may be constructed as part of an overall watershed management plan. PABFh wetlands often provide year-round water that benefit resident and migratory wildlife species.

PABGb = Palustrine. aquatic bed. intermittently exposed. beaver modifer

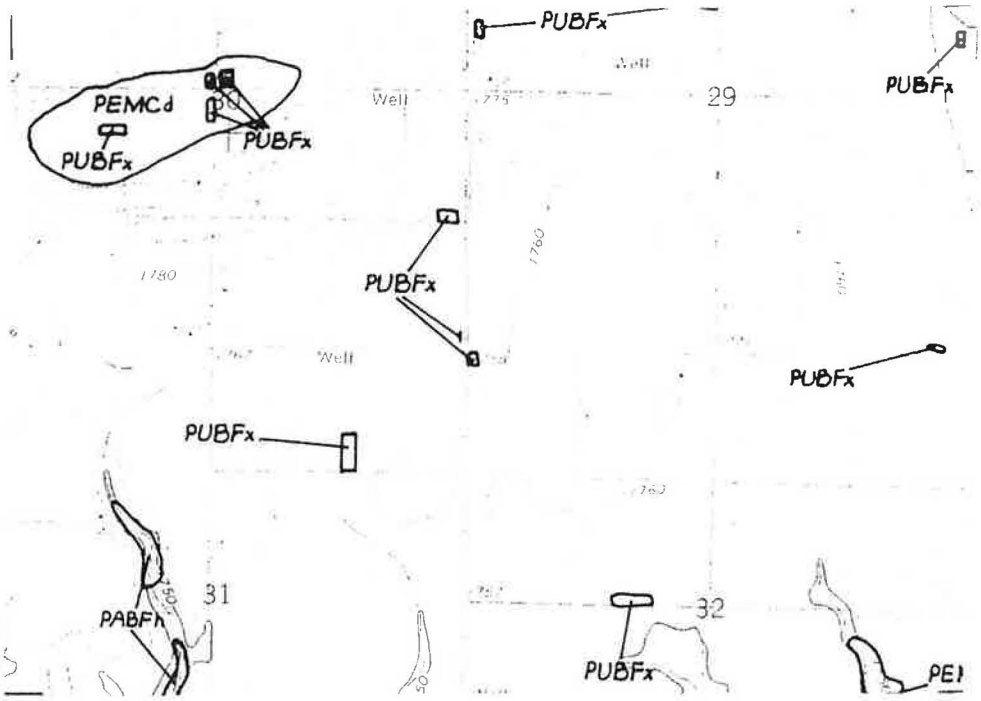
A PABGb wetland is dominated by plants that grow principally on or below the surface of the water and has surface water present in all years except drought. The wetland is modified by beaver activity.



PABGb wetlands usually arise from a flowing water situation to a still water situation because of beaver damming a stream. The quieter waters encourage growth of aquatic beds. The beaver pond becomes an integral aquatic component of the immediate environment and may last for decades.

PUBFx = Palustrine, unconsolidated bottom, semipermanently flooded, excavated

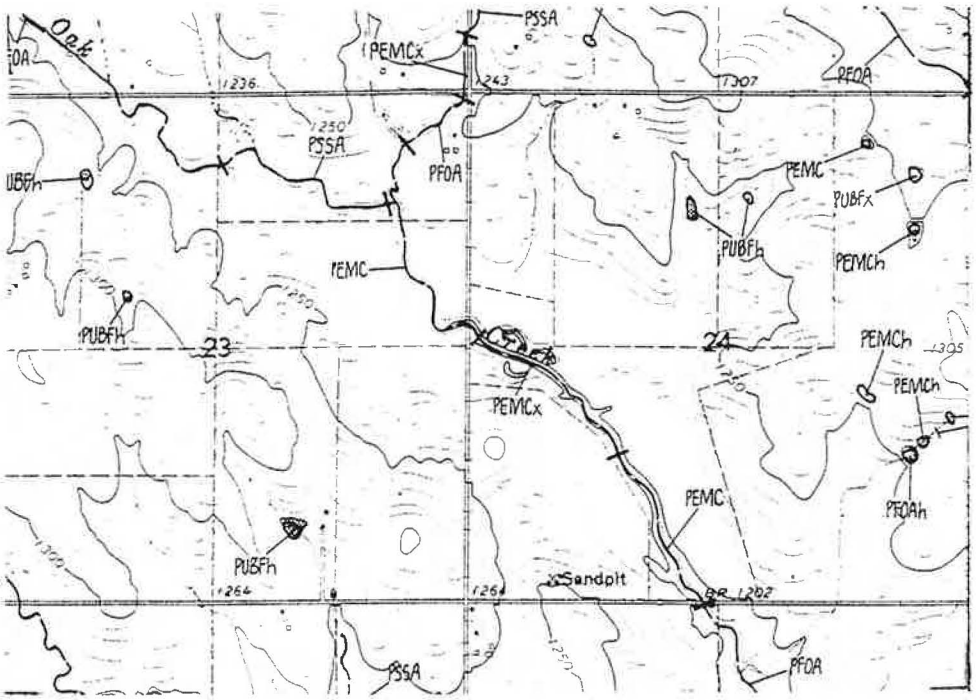
A PUBFx wetland is commonly called a dugout. It consists of an excavation with step sides usually producing an open water unconsolidated bottom substrate condition. Aquatic bed or emergents may occur, but less than 30 percent areal coverage.

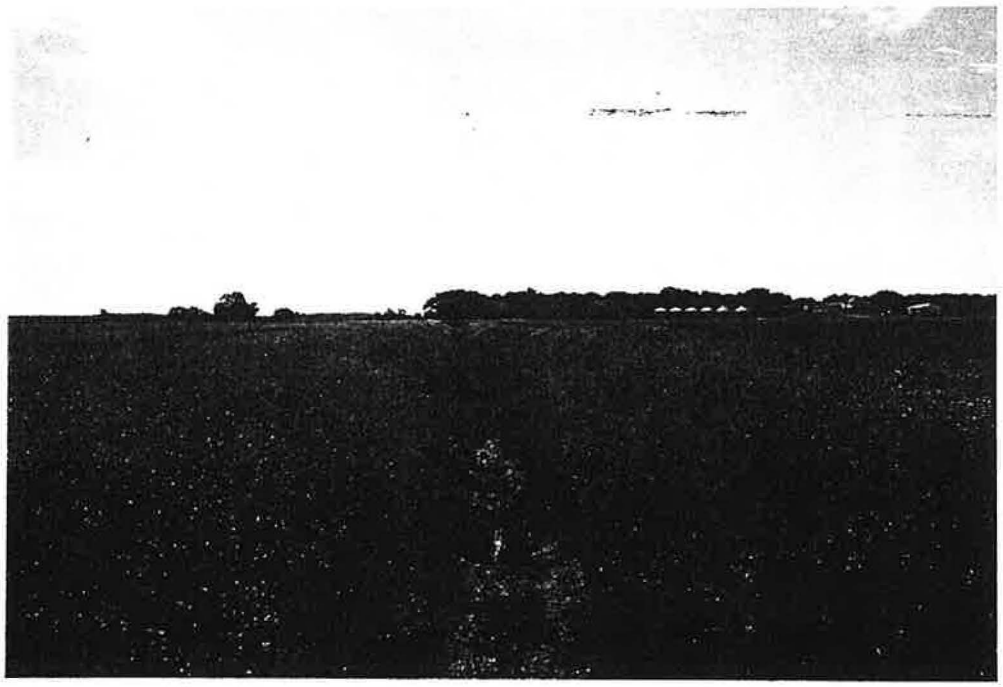


PUBFx wetlands are constructed for irrigation water return pits or for livestock. They are utilized by wildlife but to a far less extent compared to natural wetlands or shallow impoundments having sloped sides.

PEMCx = Palustrine, emergent, seasonally flooded, excavated

A PEMCx wetland maintains the vegetative characteristics and water regime of the PEMC wetland except it is excavated. This wetland is commonly a road ditch, drainage canal, or small, constructed pond.

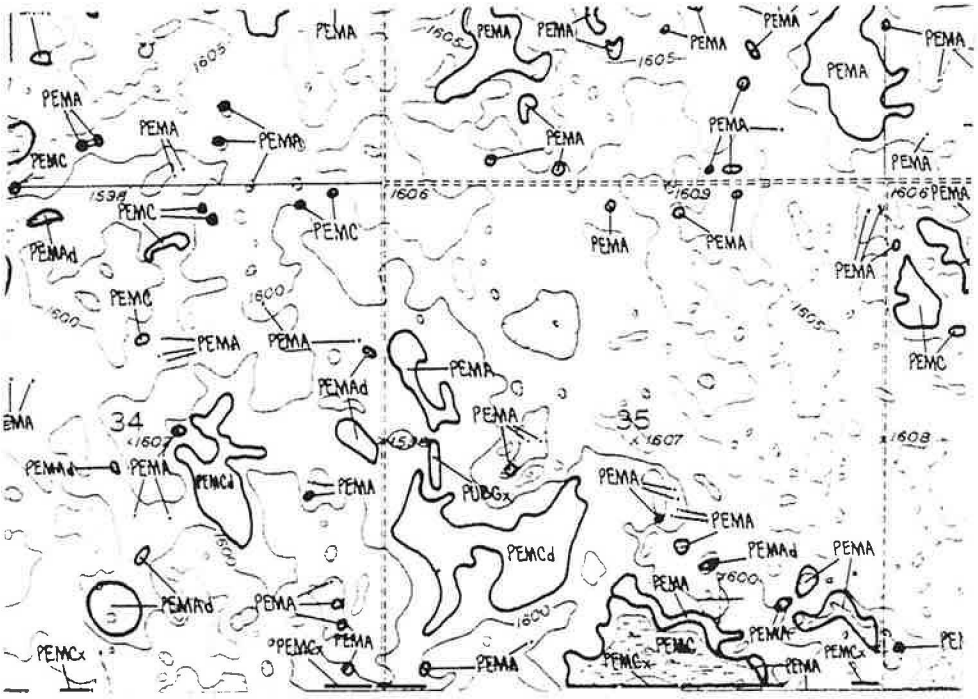


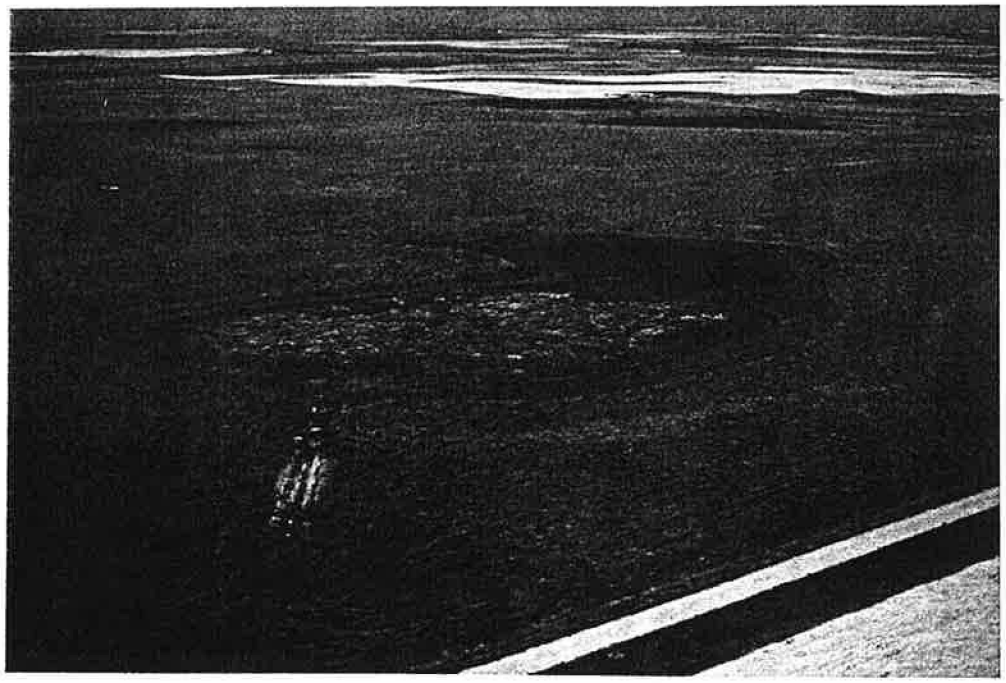


PEMCx wetlands are usually narrow and may have low-level berms as a result of spoil pile deposits or they may simply be a flat ditch. Although some habitat is provided by PEMCx wetlands, this type of ditch has more often either destroyed or adversely impacted millions of wetland acres.

PEMCd = Palustrine, emergent, seasonally flooded, partly drained

A PEMCd wetland has had the water level artificially lowered as a result of drainage. Nonetheless, a PEMCd still supports hydrophytes typical of the seasonally flooded water regime.

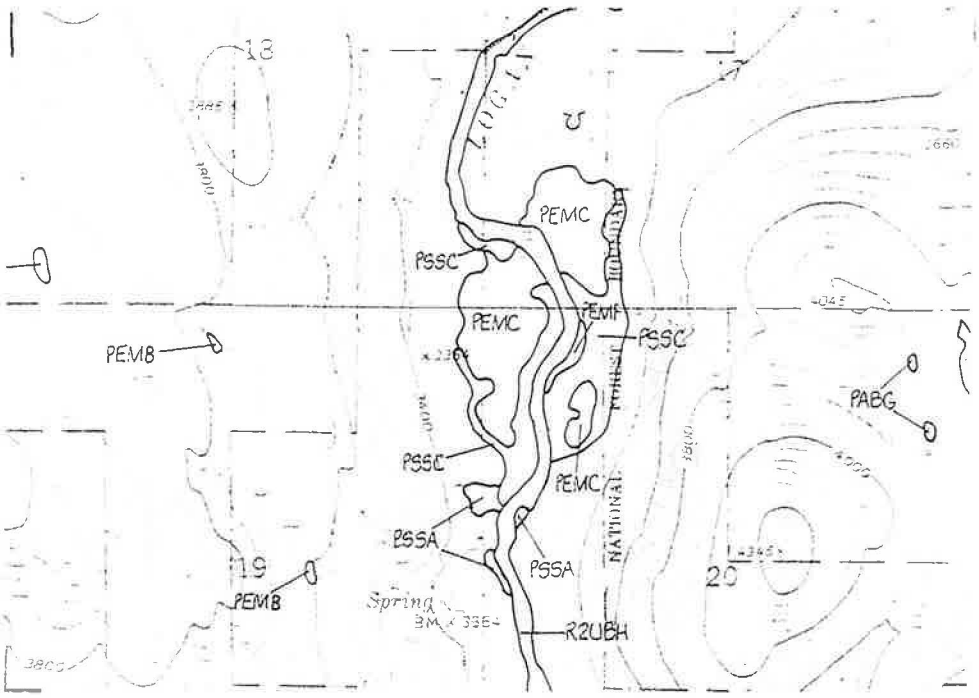


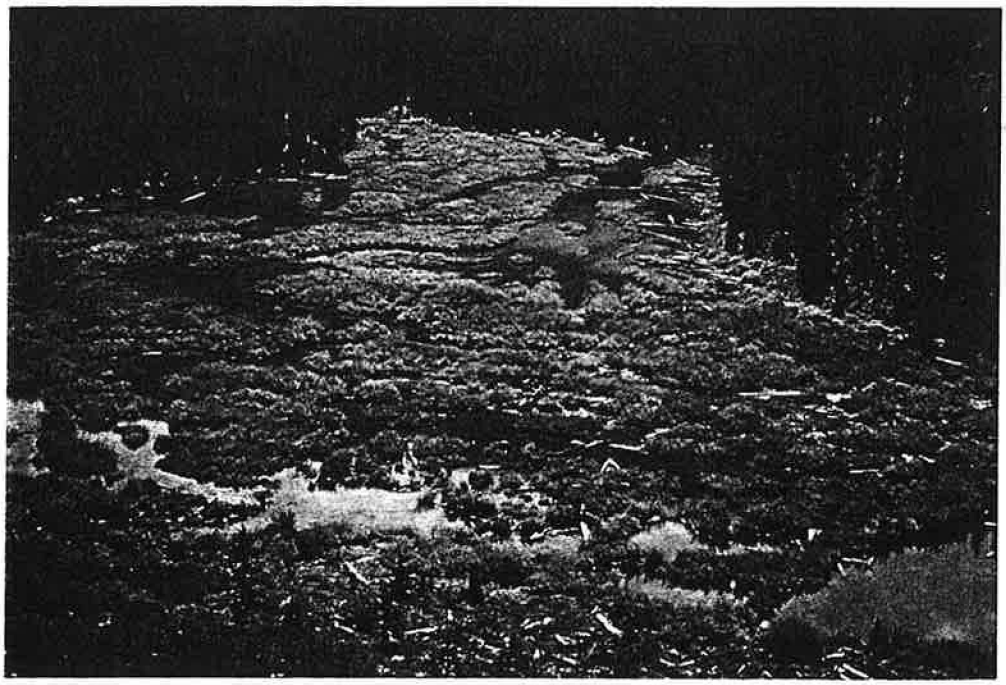


PEMCd wetlands have impacted water levels and may have lost a portion of their natural functions such as retention of flood waters and ground water recharge.

PSSC = Palustrine, scrub-shrub, seasonally flooded

A PSSC wetland is dominated with woody vegetation less than 20 feet tall and has surface water present during extended periods early in the growing season.

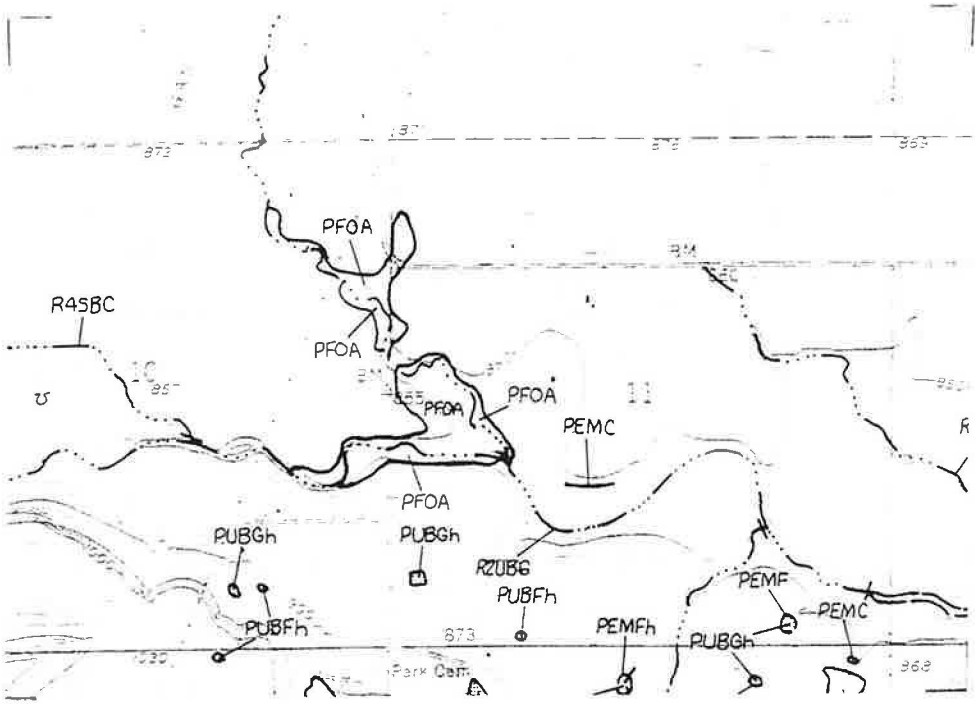




PSSC wetlands provide winter cover and food sources for many resident species. They are a critical component of the habitats identified as riparian occurring throughout the West. Species include Salix spp., Betula spp., and Alnus spp.

PFOA = Palustrine, forested, temporarily flooded

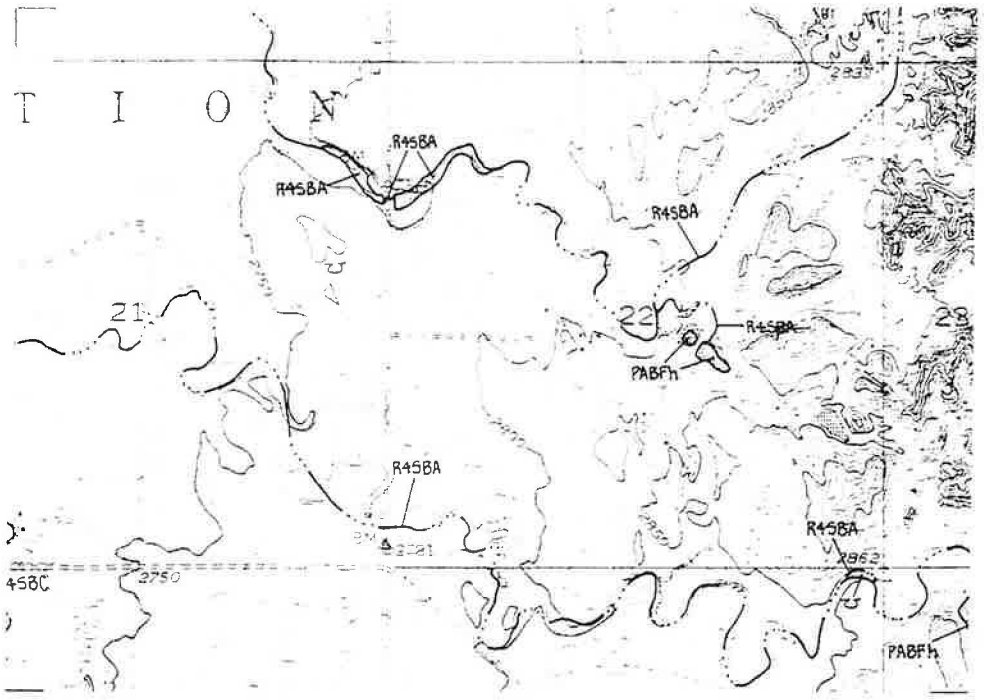
A PFOA wetland is dominated with woody vegetation greater than 20 feet tall and has water present for brief periods during the growing season.



PFOA wetlands are found only in the Palustrine and Estuarine systems. They are most common in the eastern United States such as the bottomland hardwoods, but also are critical habitat in the West, especially along river systems. Species include Populus spp., Nyssa spp., and Taxodium distichum.

R4SBA = Riverine, intermittent, streambed, temporarily flooded

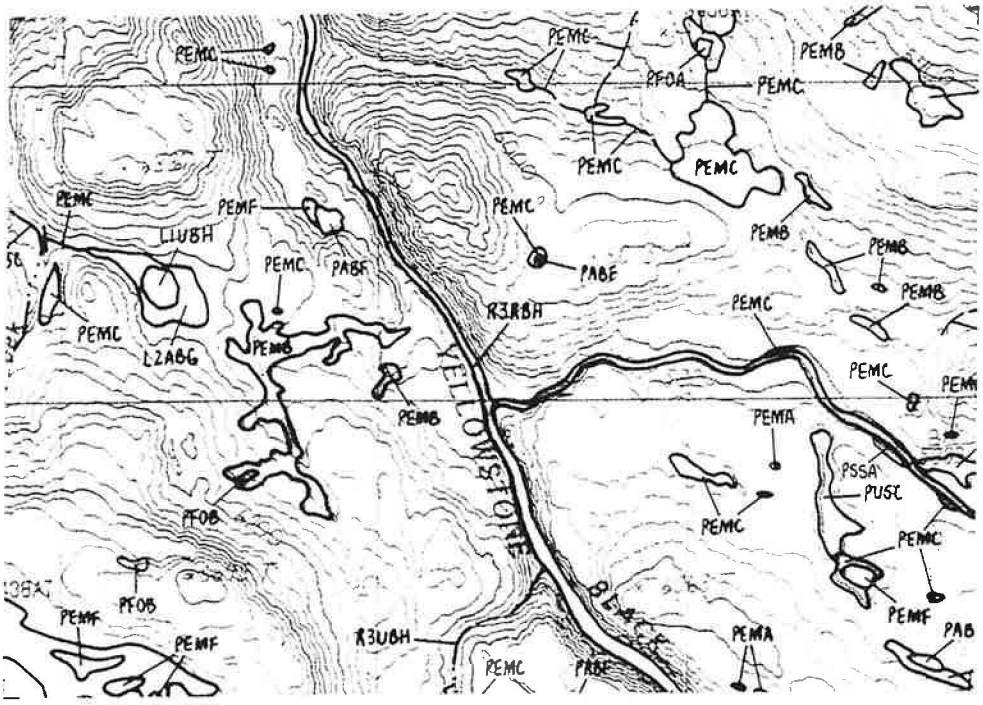
A R4SBA wetland is within a channel not dominated by vegetation, contains flowing water for only part of the year, and may have a variety of substrates from bedrock to organic.



R4SBA wetlands may exist as a narrow stream to a wide floodplain, yet temporarily flowing water still is characteristic over a nonvegetated substrate. These wetlands are subject to flash flooding and often have PSSA or PFOA along their borders.

R3RBH = Riverine, upper perennial, rock bottom, permanently flooded

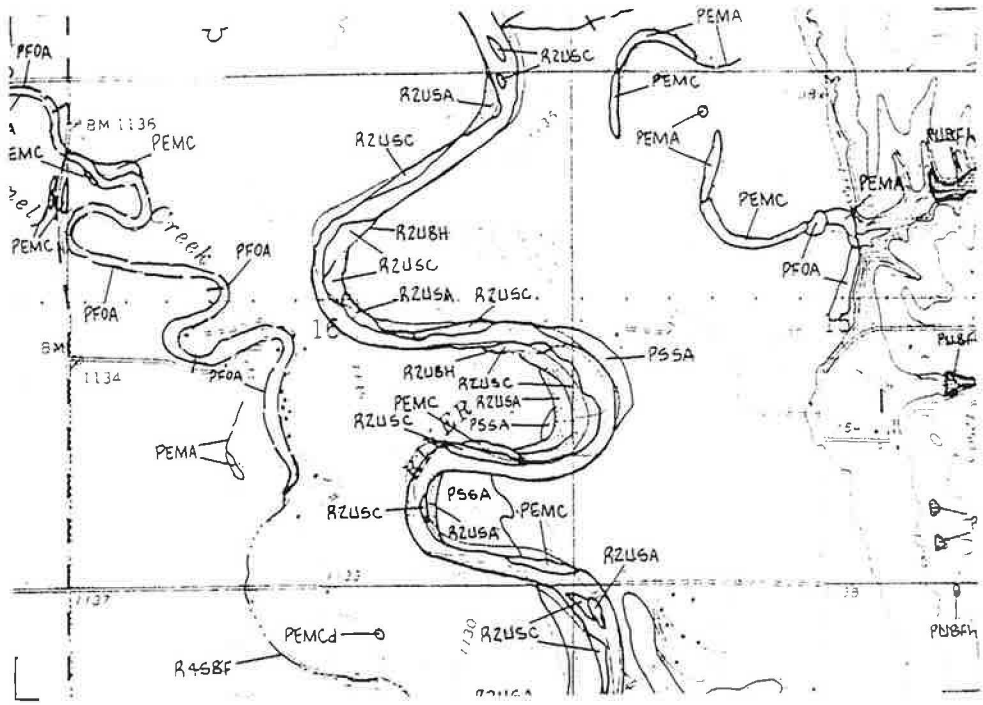
A R3RBH, as with all Riverine system wetlands, is found in an open channel. This particular Riverine classification further indicates a high gradient with fast water velocity and V-shaped valleys, bedrock or large boulders, and rocks and water flows year round.



R3RBH wetlands are perennial streams often associated with a trout fishery and white water canoeing. Its high gradient results in high dissolved oxygen with little floodplain development.

R2UBH = Riverine, lower perennial, unconsolidated bottom, permanently flooded.

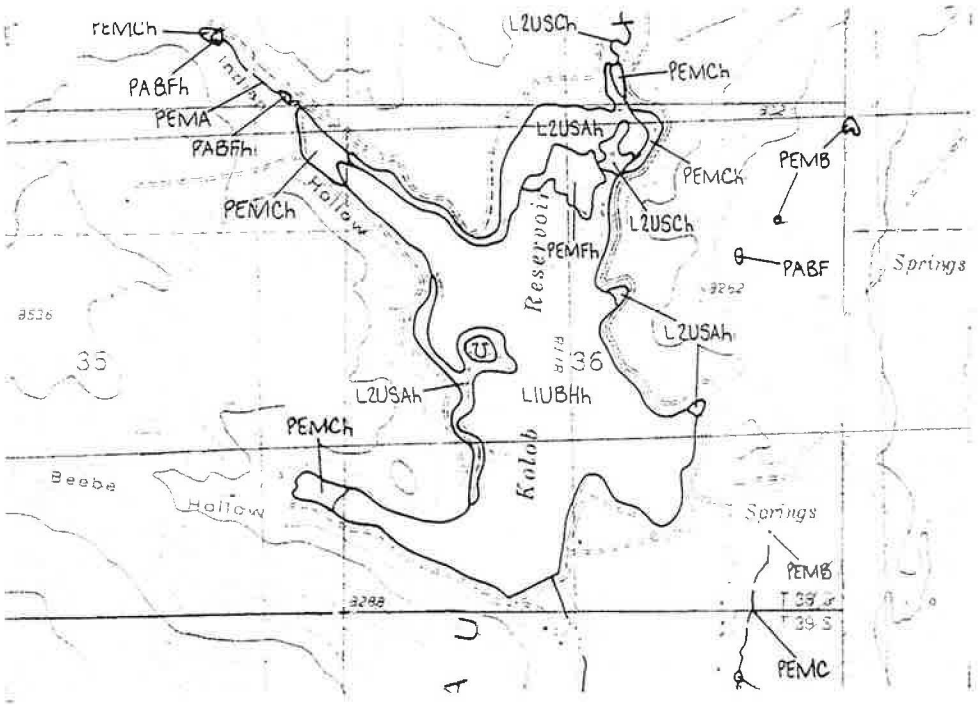
A R2UBH wetland is within an open channel. It has low velocity, low gradient, and a well-developed floodplain. The substrate is particle size of cobble-gravel or smaller and water flows year round.

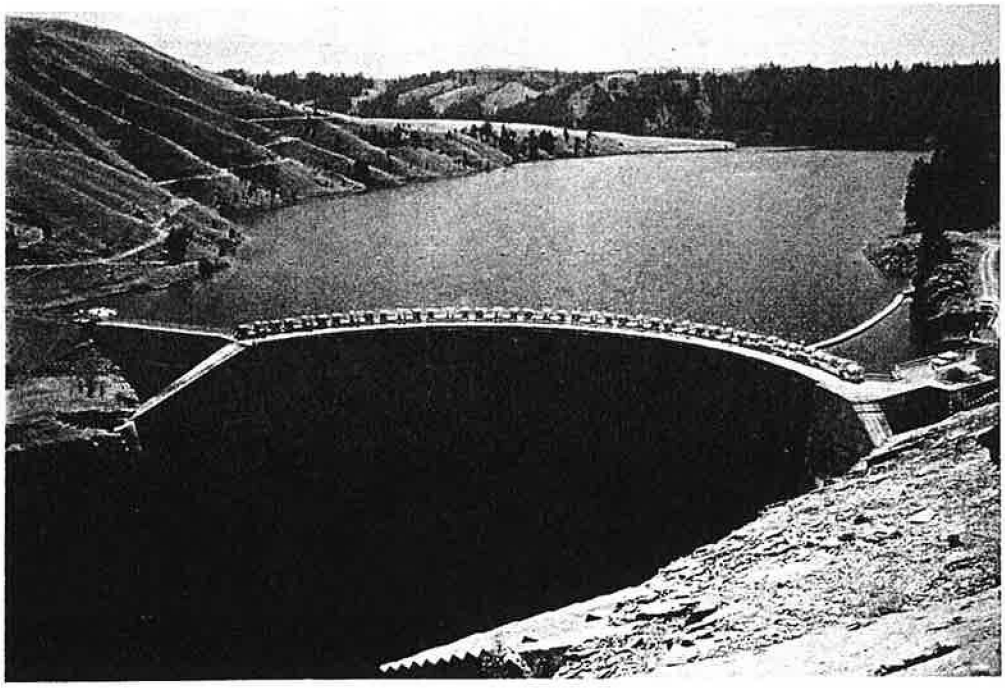


R2UBH wetlands occur as meandering streams and rivers with associated oxbows. Oxygen deficits may occur and true planktonic organisms are common. Adjacent PSSC and PFOA are common.

L1UBHh = Lacustrine, limnetic, unconsolidated bottom, permanently flooded, impounded

A L1UBHh wetland (deepwater habitat) is usually larger than 20 acres, deeper than 6.7 feet at low water, open water, never goes dry, and is created by an impoundment. It is a reservoir.

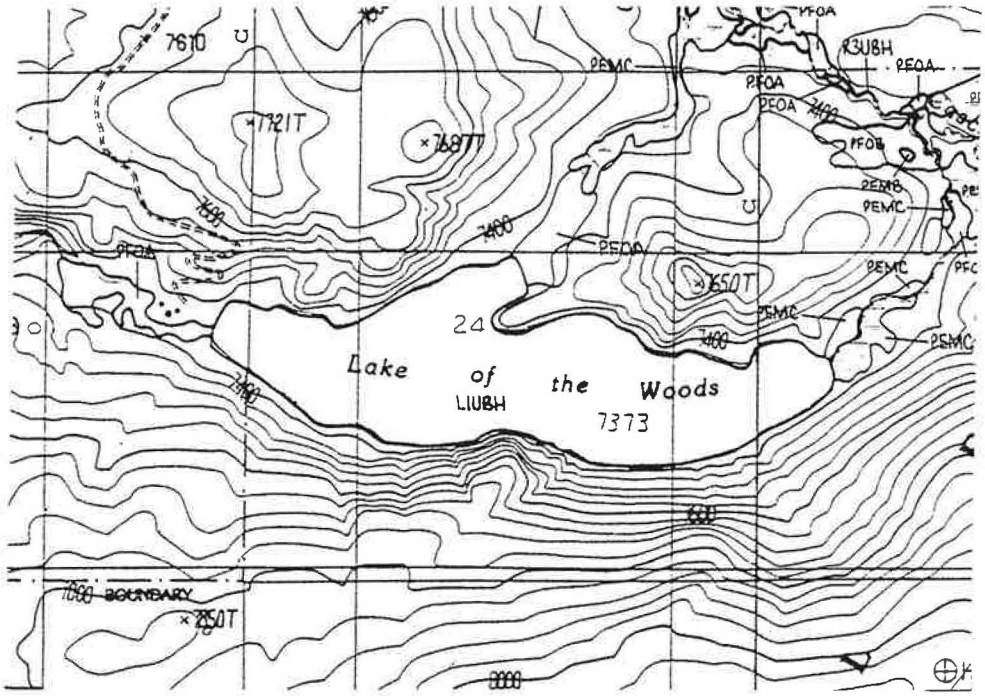


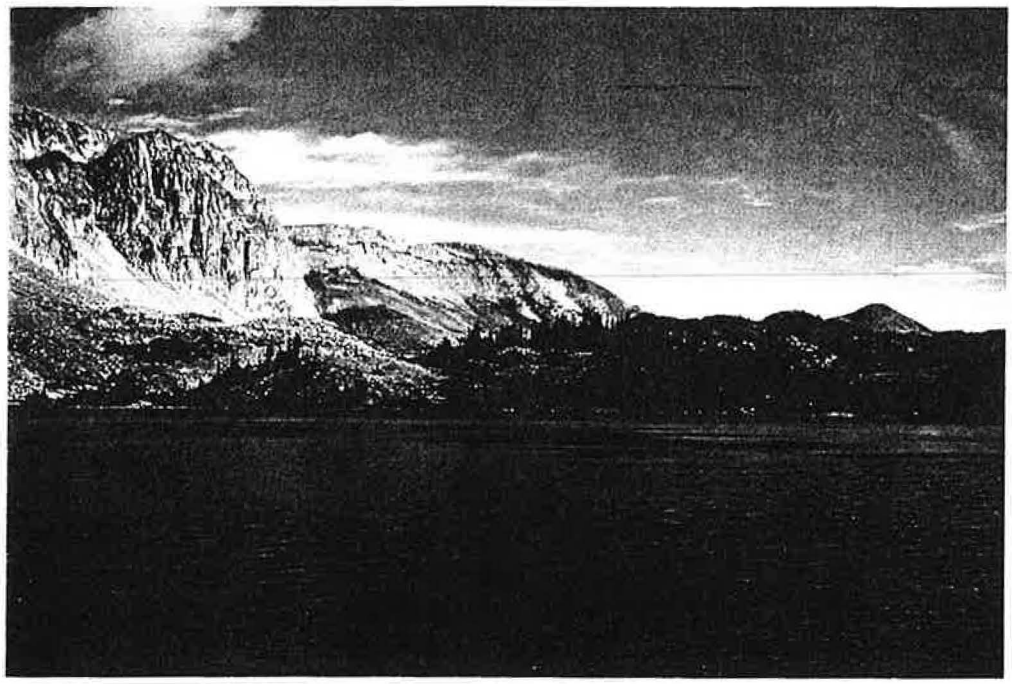


L1UBHh wetlands, or more accurately deepwater habitats, exist throughout the country as part of projects to provide flood control, irrigation, and municipal and industrial water. They are artificially regulated for these primary purposes.

L1UBH = Lacustrine, limnetic, unconsolidated bottom, permanently flooded

A L1UBH wetland (deepwater habitat) is usually larger than 20 acres, deeper than 6.7 feet at low water, open water appearance, substrate of cobble-gravel or smaller, and water is present in all years.

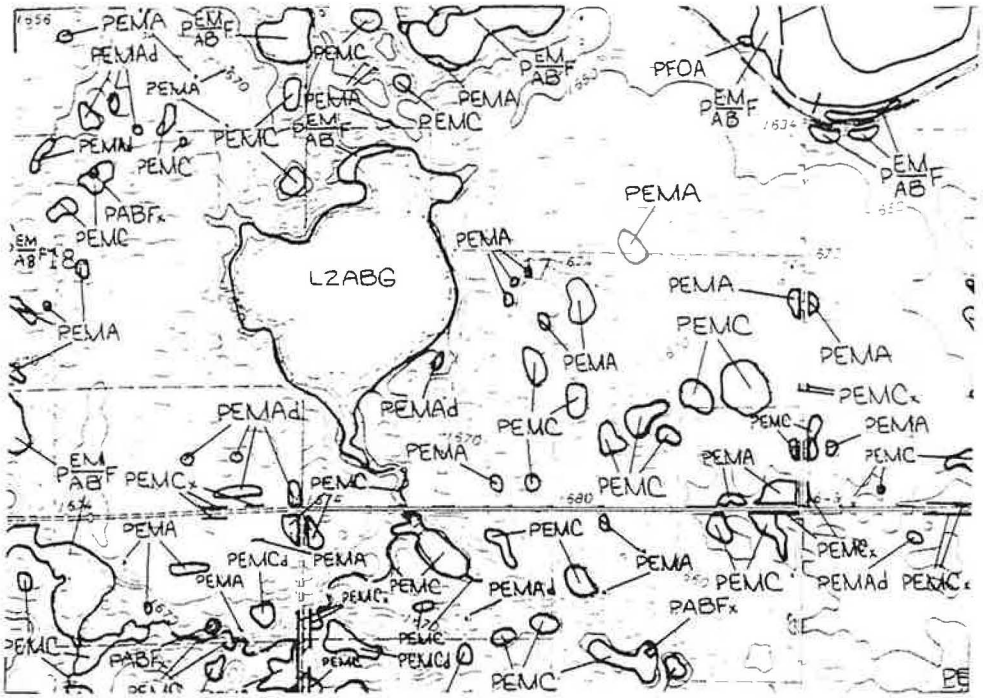




L1UBH wetlands (deepwater habitats) are typical lake fisheries with open water conditions, stratified temperature layers, turnover phenomona, and flatwater recreation.

L2ABG = Lacustrine, littoral, aquatic bed, intermittently exposed

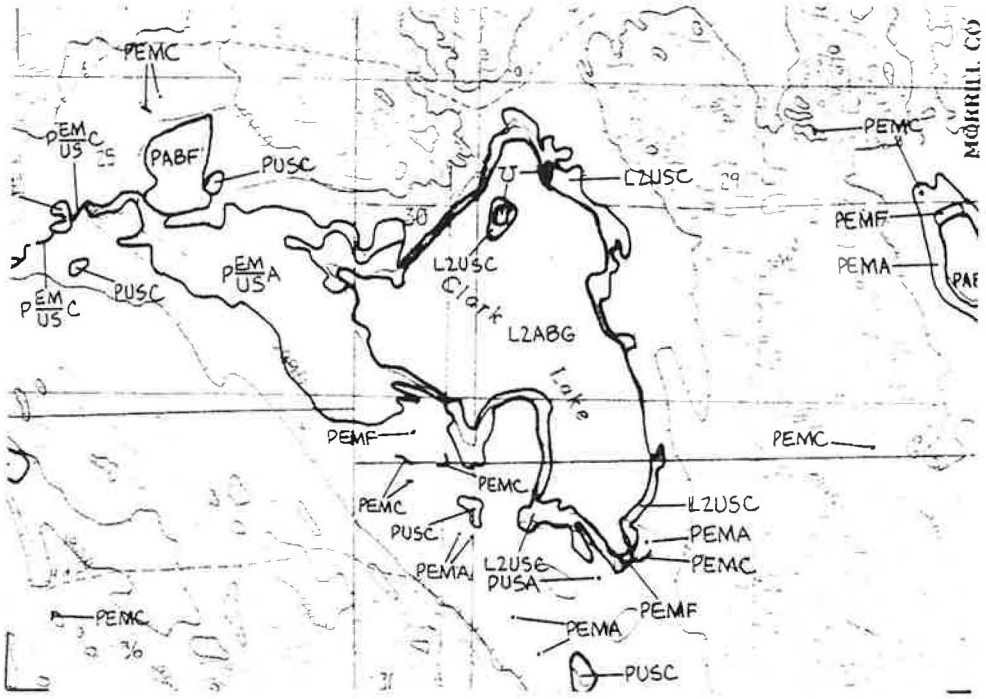
A L2ABG is typically characterized as over 20 acres, under 6.7 feet in depth, dominated with floating or rooted aquatic beds, and has water present throughout the growing season except during periods of drought.



L2ABG wetlands occur in shallow depressions and support a variety of floating and underwater plants including Nuphar spp., Potamogeton spp., and Ruppia spp., among many others.

L2USC = Lacustrine, littoral, unconsolidated shore, seasonally flooded

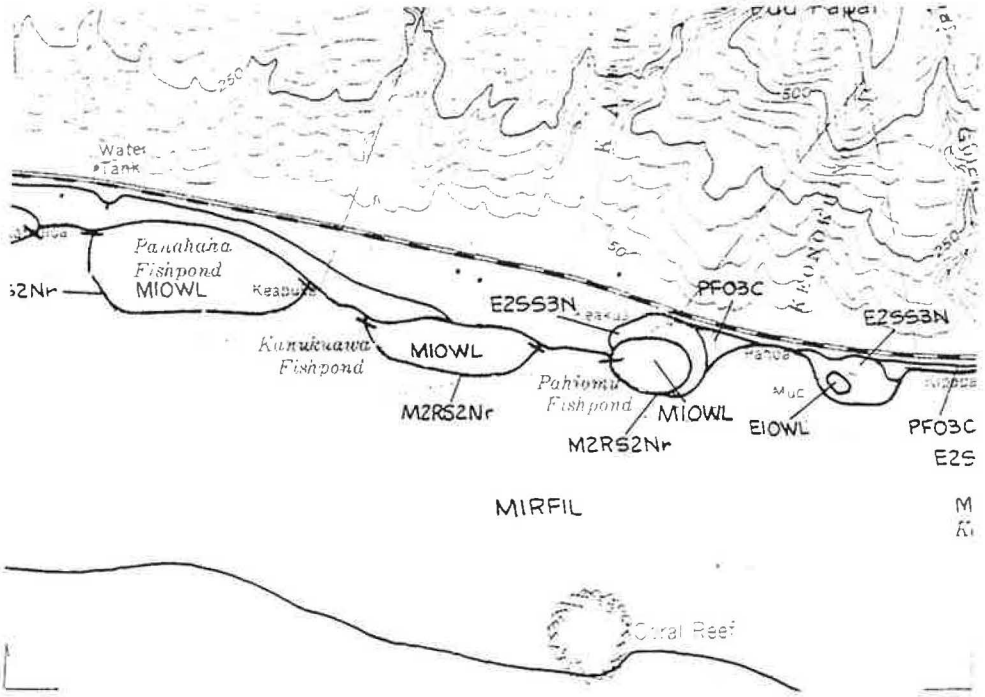
A L2USC wetland is typically over 20 acres, under 6.7 feet in depth, substrate of sand or mud, and has water present for extended periods during the growing season. It may be a separate wetland or the fringe of the shoreline of a larger, deeper lake.

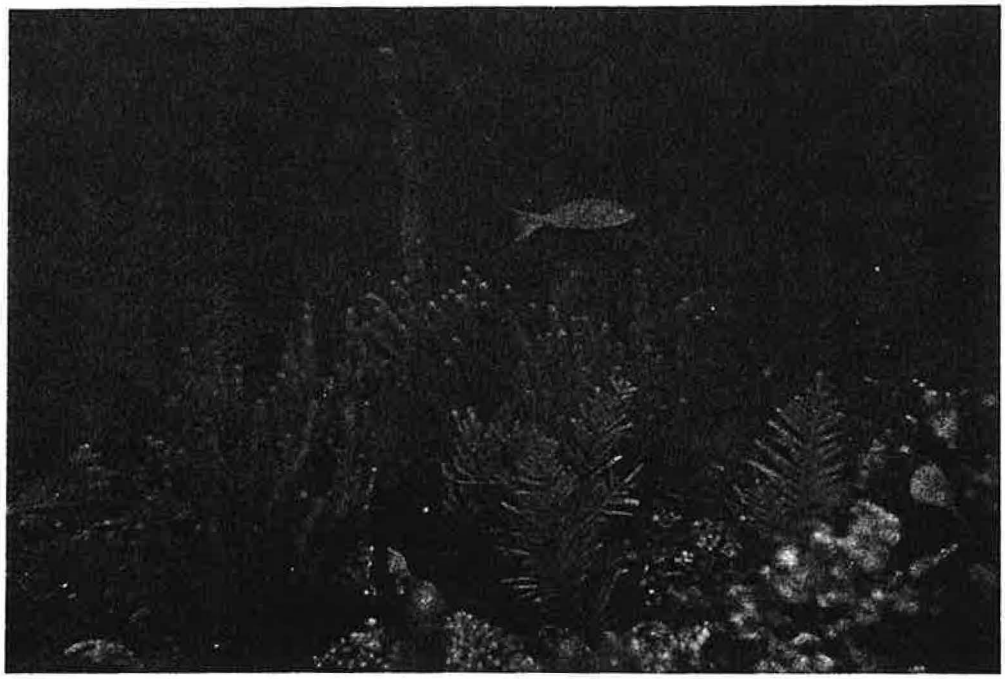


L2USC wetlands are shallow basins which dry annually to an exposed substrate. They are often saline or alkali and commonly have substrates of sand and mud. They have particular value to shorebirds because of food sources and a safety factor afforded by clear visibility.

M1RF1L = Marine, subtidal, reef, subtidal

An M1RF1L is the open ocean exposed to waves and currents with little or no dilution of salinity. Structures are formed by sedentary invertebrates and the substrate is continuously submerged.

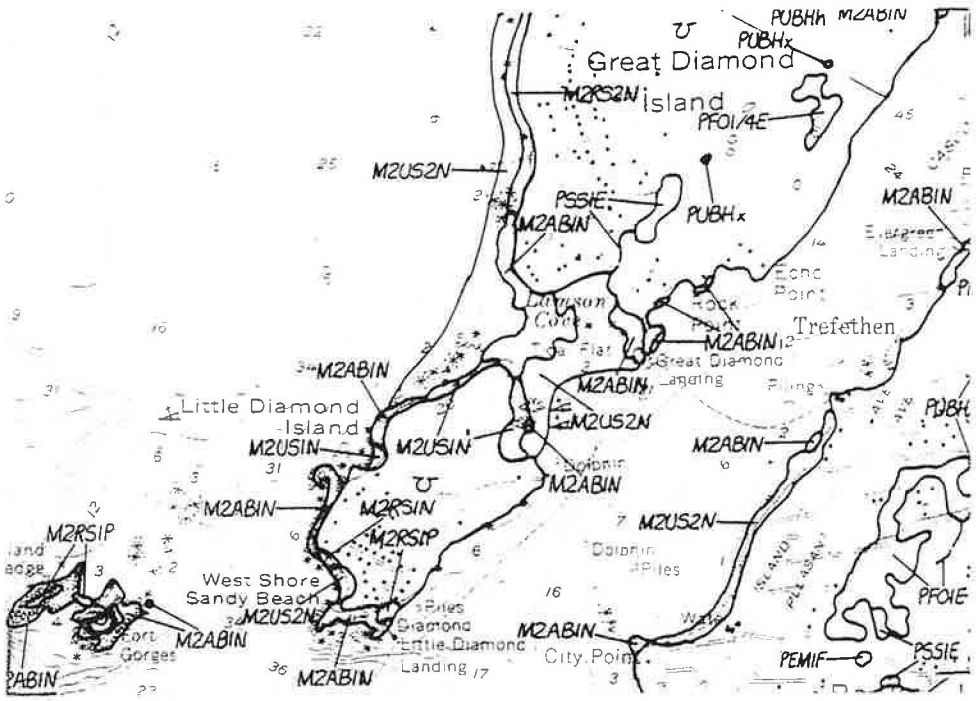




M1RF1L wetlands (deepwater habitat) may support extensive coral reefs supporting species such as Acropora and Porites. Water chemistry is often euhaline.

M2US2N = Marine, intertidal, unconsolidated shore, regularly flooded

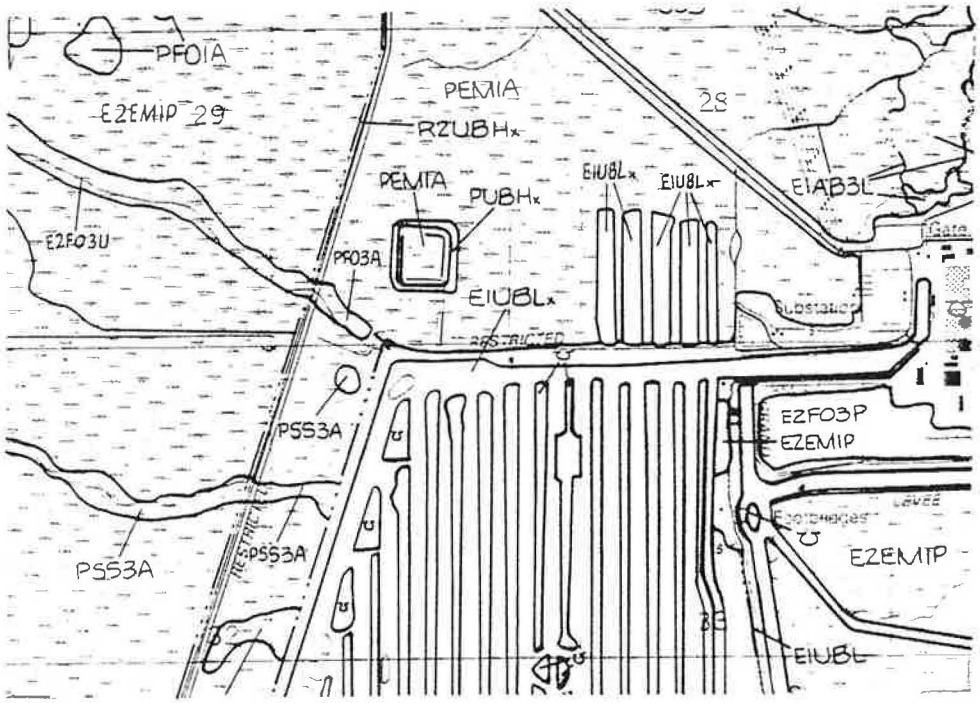
An M2US2N is the high energy coastline, exposed and flooded by tides with unvegetated substrate usually of cobble-gravel or sand. Tidal water alternately floods and exposes the land surface at least once daily.

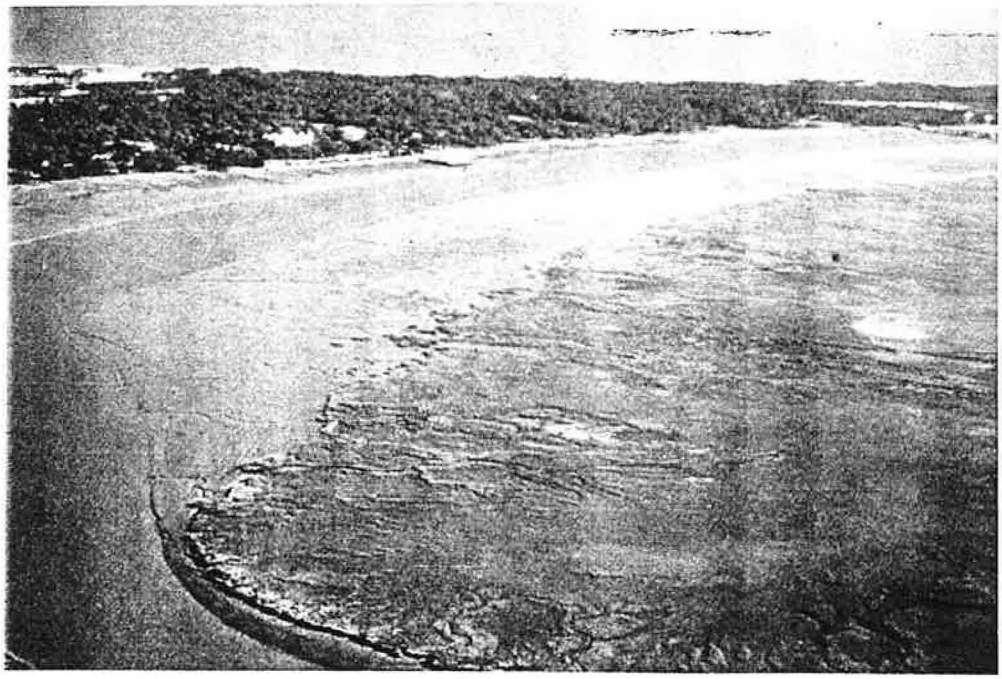


M2US2N are intertidal wetlands of exposed substrates as a result of continuous erosion. Faunal distribution is controlled by waves, currents, interstitial moisture, salinity, and grain size.

E1UBLx = Estuarine, subtidal, unconsolidated bottom, subtidal, excavated

An E1UBLx wetland has sporadic access to the open ocean, at least occasionally diluted by freshwater, usually a sand or mud substrate, and permanently flooded. The excavated portion is dredge activity.

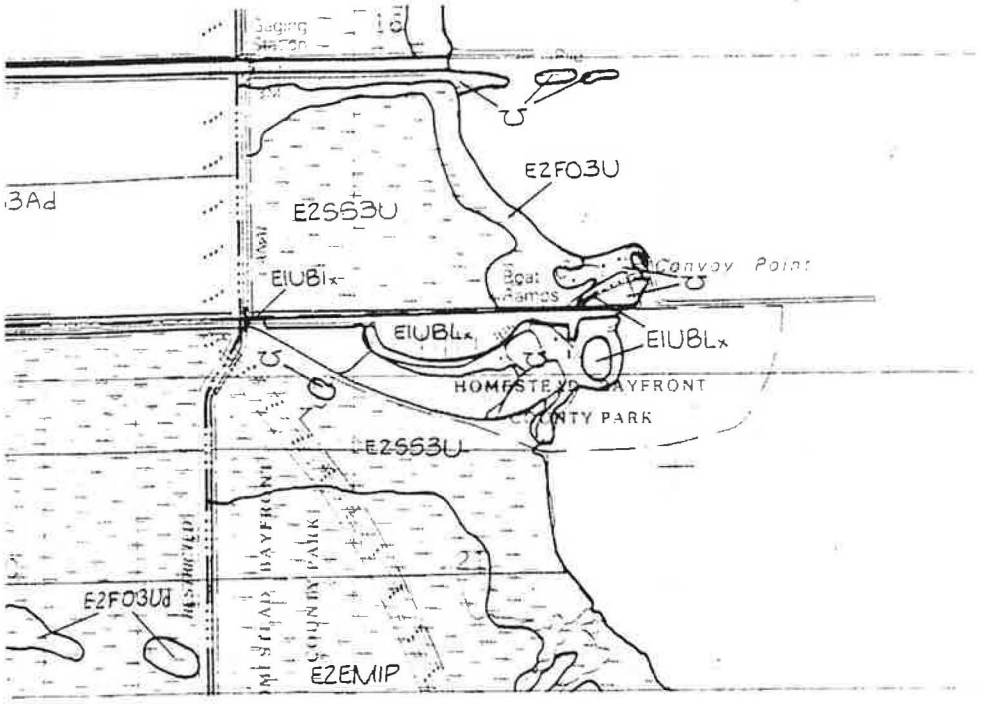




E1UBLx wetlands are permanently flooded, usually influenced more by adjacent land than by the ocean. The excavated portion is done to facilitate shipping.

E2SS3U = Estuarine, intertidal, scrub-shrub, broad-leaved evergreen, unknown

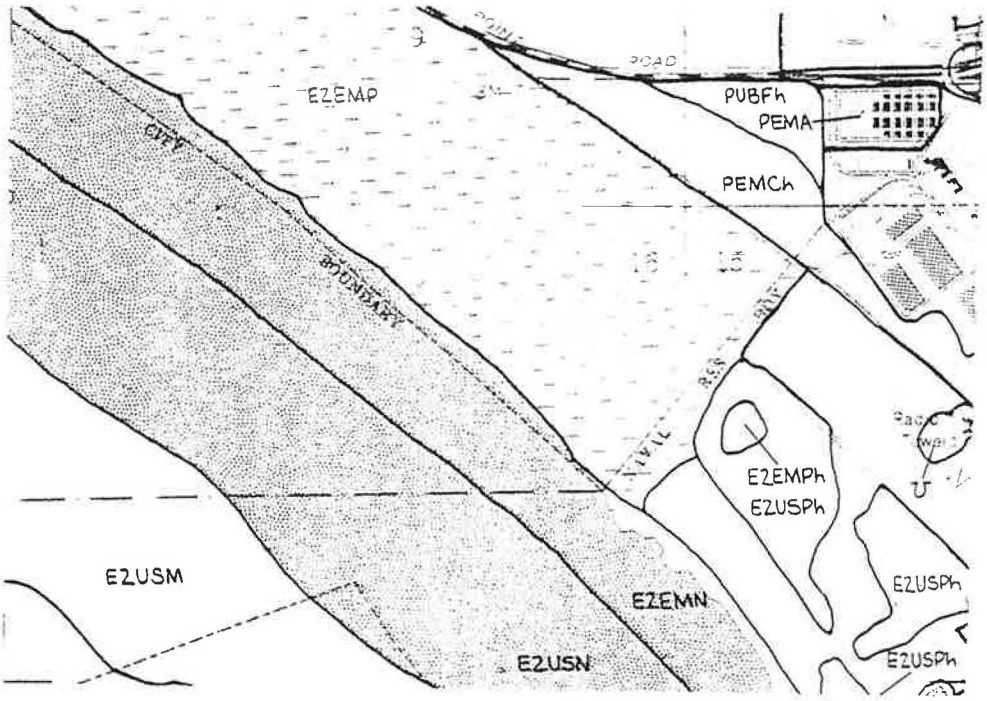
An E2SS3U wetland is dominated with woody vegetation less than 20 feet tall, exposed and flooded by tides but with an unknown water regime. Salinity is diluted by runoff from the land.

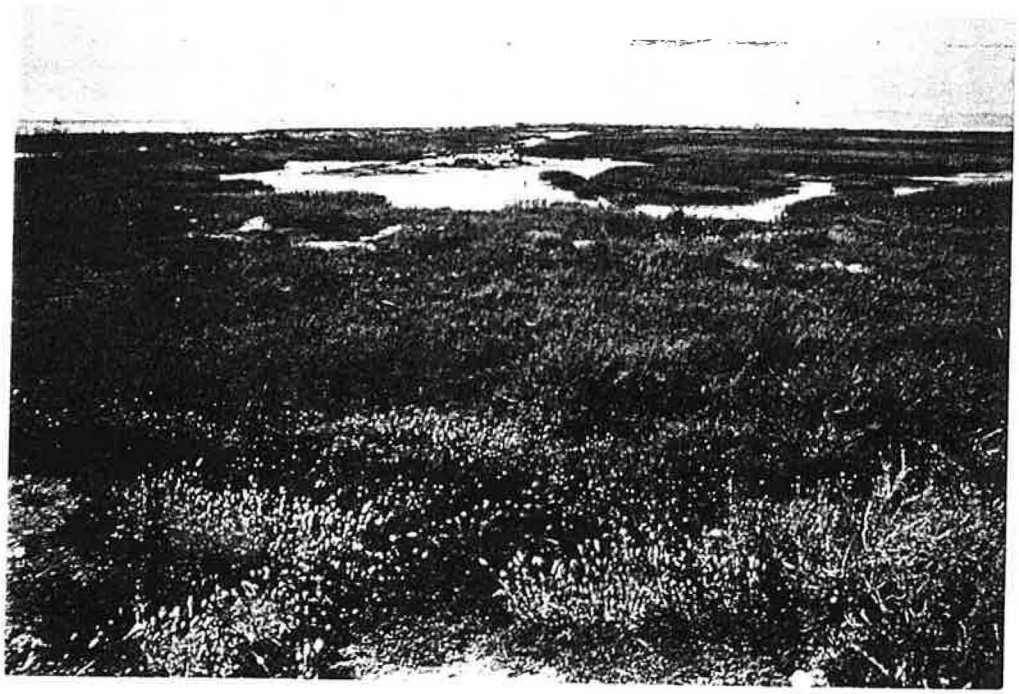


E2SS3U wetlands are dominated by the ebb and flow of tidal waters. Scrub-shrub often includes species such as red mangrove (Rhizophora mangle).

E2EMP = Estuarine, intertidal, emergent, irregularly flooded

An E2EMP wetland is an intertidal marsh dominated by emergent vegetation and subject to tidal innundation less often than daily. These wetlands are strongly influenced by adjacent land.





E2EMP wetlands are often called high marshes and are flooded by the higher of the high tides. Common plants are Salicornia spp., Deschampsia caespitosa, Spartina spp., and Distichlis spicata.

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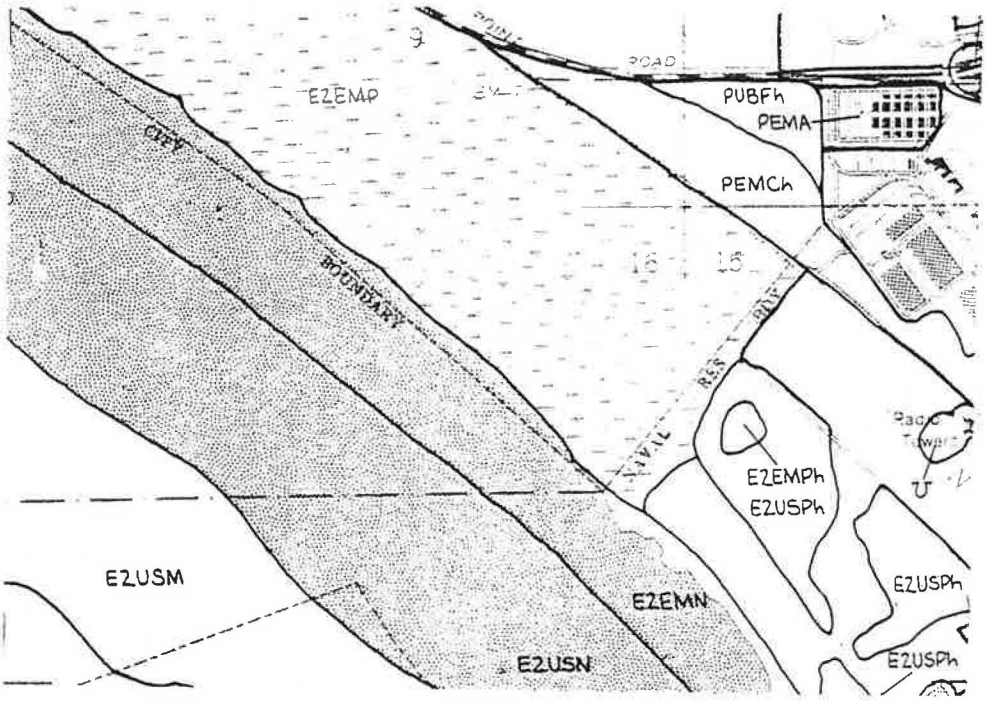

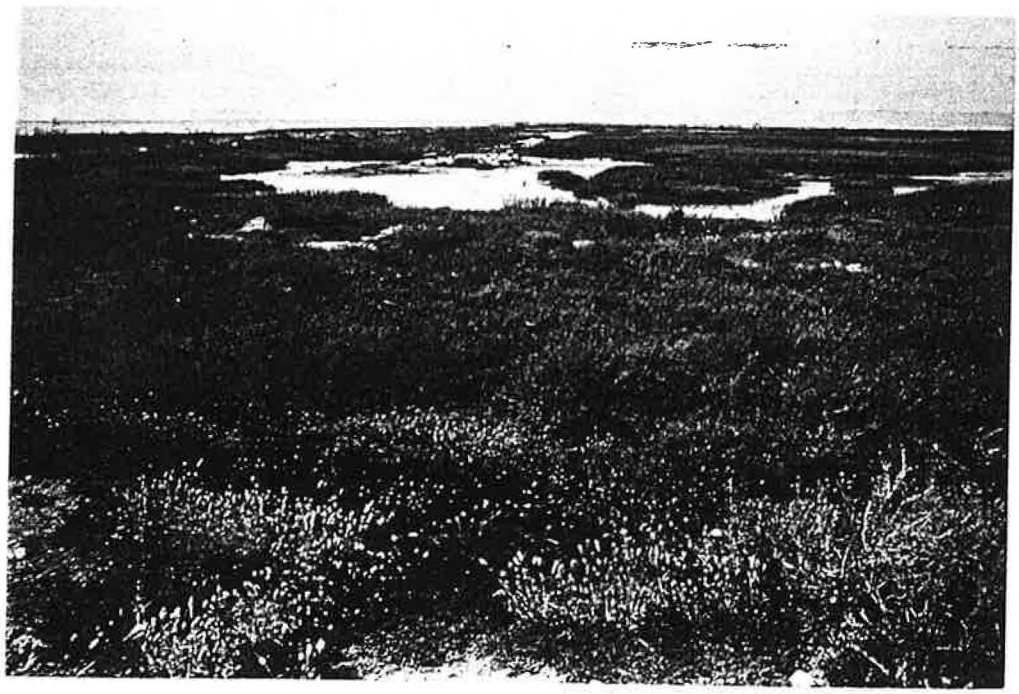

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APPENDIX

National Wetlands Inventory Offices and Telephone Numbers

Washington, DC	(703) 358-2161
NWI Center, St. Petersburg, FL	(727) 570-5400
Portland Regional Office	(503) 231-6154
Albuquerque Regional Office	(505) 248-6668
Atlanta Regional Office	(404) 679-7129
Boston (Hadley) Regional Office	(413) 253-8620
Denver Regional Office	(303) 236-7400
Alaska Regional Office	(907) 786-3471