



**A User's Guide to Interpret the National Wetland Inventory  
Maps of the Caribbean Area  
Natural Resources Conservation Service**



## Introduction

This guide intends to explain how to read and interpret National Wetland Inventory Maps (NWI Maps). These maps are excellent source of general wetland area locations, boundaries and characteristics. However, they are not a substitute for onsite specific investigations. The onsite specific investigation is necessary because:

- Certain wetland types can be difficult to identify on aerial photographs (those found under forest canopy).
- Land use changes
  - Drainage
  - Restoration
  - Development
- Shallow or temporarily flooded wetlands may be difficult to identify if the photograph is acquired during dry season.

The maps were prepared by stereoscopic analysis of high altitude aerial photographs. The aerial photographs reflect conditions during specific year when they were taken.

Wetlands on these maps are classified by a series of letters and numbers, which define the physical characteristics of each wetland. These maps show boundaries and wetland classification on U.S. Geological Survey topographic base maps (1:20,000 scale). See Figure 1. Wetlands were identified on photographs based on vegetation, visible hydrology, and geography in accordance with *Classification of Wetlands and Deepwater Habitats of the United States* (FWS/OBS-79/31 December 1979). The Cowardin, et al. (1979) wetland classification system provides consistency of wetlands concepts, terminology and classification for the National Wetlands Inventory. The classification system takes a hierarchical approach to classifying different wetlands types. This system of hierarchical (Figure 2) proceeds from general definitions to specific terminology. The level of detail or degree of information increases for each wetland as one proceeds down the classification system.

Figure 1. A portion of the NWI Map for the Arecibo Quadrangle, PR

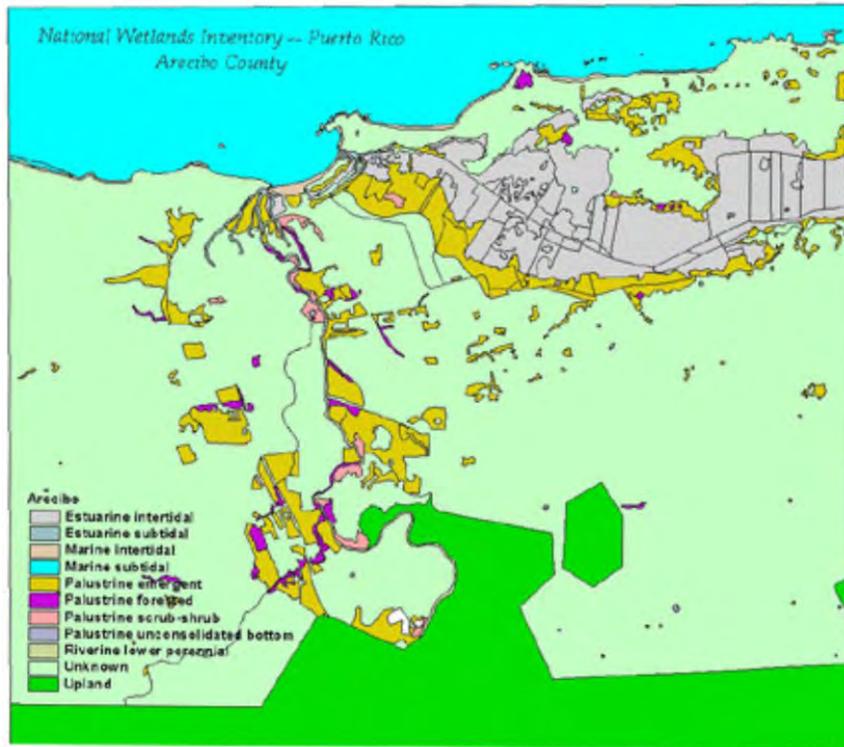
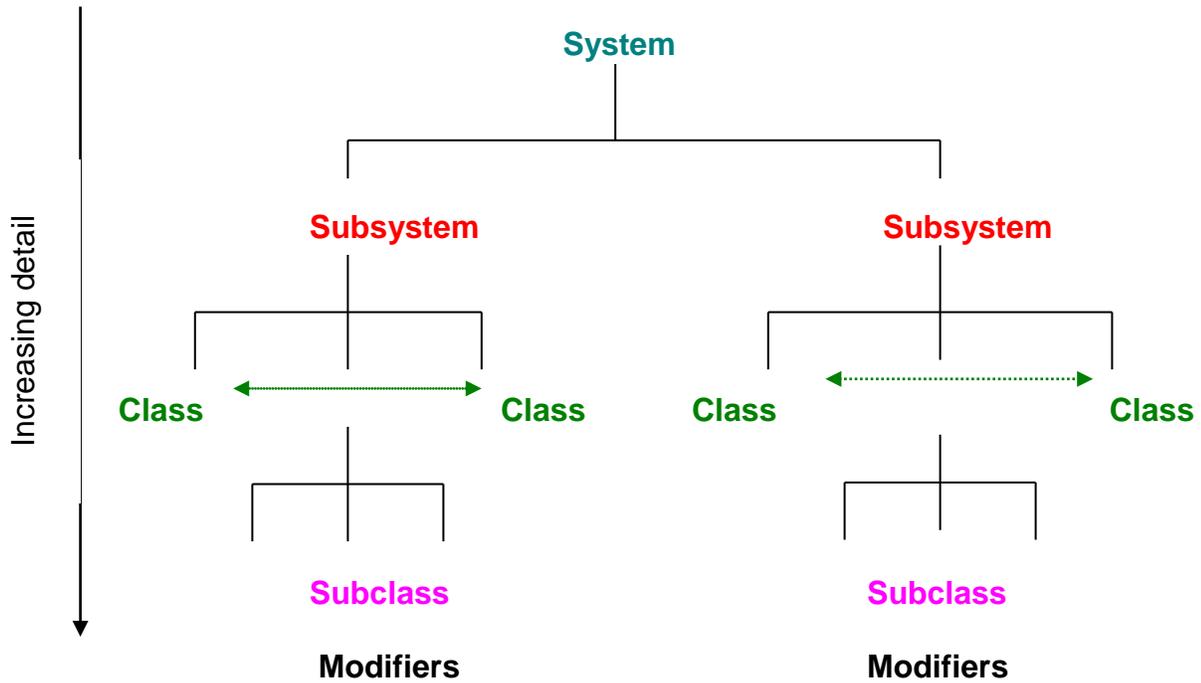


Figure 2. Hierarchical Arrangement of Cowardin, et. Al. (1979) Wetland Classification System.



## How to interpret the NWI map code

This section shows how to translate any map code into meaningful description of a particular wetland type. Also on the web page <http://www.nwi.fws.gov/atx/atx.html> the code description can be found. Each map code consists of an ordered series of letters and numbers that reflect certain characteristics of wetlands and deepwater habitats. The number of characters in each map code varies depending upon the wetland type.

➔ The first character is an upper case letter representing which **System** the wetland belongs; five are defined:

System	Map Code	Description
Marine	M	Exposed to waves and currents of the open ocean and to water having salinity greater than 30 part per thousand (ppt).
Estuarine	E	Tidal wetlands in low wave energy environments where the salinity of the water is greater than 0.5 part per thousand (ppt) and is variable due to evaporation and the mixing of seawater and freshwater. Ex. mouth of the river.
Riverine	R	Water within a channel flowing either permanently or intermittently.
Lacustrine	L	Non tidal and tidal freshwater wetlands within an Intermittently to permanently flooded lake or reservoir larger than 20 acres (lakes) and/or deeper than 2 meters (6.6 feet).
Palustrine	P	Non tidal and tidal freshwater wetlands within an intermittently to permanently flooded open water bodies of less than 20 acres and less than 2 meters deep (6.6 feet) Ex. <i>Pterocarpus</i> forest

➔ The second character is a number which represents **Subsystem**

### Marine and Estuarine

Both Marine and Estuarine systems are divided into two Subsystems: the Subtidal and Intertidal.

Map code	Subsystem	Description
1	Subtidal	The substrate is continuously submerged.
2	Intertidal	The substrate is exposed and flooded by tides; includes the associated splash zone.

### Riverine

The Riverine (R) system is divided into four Subsystems: Tidal, the Lower perennial, the Upper perennial and Intermittent. In Puerto Rico and the U.S. Virgin Islands, the Tidal Subsystem does not exist. Each is defined in terms of water permanence, gradient, water velocity, substrate, and extent of floodplain development.

Map code	Subsystem	Description
2	Lower perennial	Low gradient, slow velocity, well developed floodplain, sand and mud substrate, oxygen deficits at times.
3	Upper perennial	High gradient, fast velocity, poorly developed floodplain, stone and rock substrate, high oxygen levels.
4	Intermittent	Periodic flows, isolated pools possible, surface water may be absent.

### Lacustrine

The Lacustrine (L) system is divided into two Subsystems: the Limnetic and Littoral.

Map code	Subsystem	Description
1	Limnetic	Deep lake, water deeper than 2 meters at low water.
2	Littoral	Shallow lakes and shorelines of deeper lakes, depth less than 2 meters (6.6 feet) at low water.

### Palustrine

The Palustrine system has no subsystem.

→ The third character is a set of two upper case letters representing the **Class**.

It describes the general appearance of the habitat in terms of either the dominant life form of the vegetation or physiography and composition of the substrate. The Moss Lichen does not apply to Puerto Rico.

Map code	Class	Description
RB	Rock Bottom	Stones, boulders, bedrock, at least semipermanently flooded; less than 30% vegetated (Bedrock and Rubble).
UB	Unconsolidated Bottom	Cobbles, sand, gravel, mud; at least semipermanently flooded; less than 30% vegetated (Cobbles-Gravel, Sand, Mud, or Organic).
RS	Rocky Shore	Stone, boulders, bedrock; seasonally flooded or less, less than 30% vegetated (Bedrock and Rubble).
US	Unconsolidated Shore	Cobbles, sand, gravel, mud; seasonally flooded or less than 30% vegetated {Cobble-Gravel, Sand, Mud, organic and Vegetated (pioneer plants)}.
SB	Streambed	All wetlands in Intermittent Subsystem of the Riverine System; seasonally flooded or less (Bedrock, Rubble, Cobble-Gravel, Sand, Mud, Organic and Vegetated Streambeds).
RF	Reef	Structures formed by colonization and growth of sedentary invertebrates, (Corals, Mollusk), subtidal, irregularly exposed, regularly flooded, irregularly flooded water regimes.
AB	Aquatic Bed	Plants growing on or below the surface water; at least seasonally flooded (Algal, Aquatic Moss, Rooted Vascular, and Floating Vascular).
ML	Moss Lichen	Mosses or lichens, only the saturated water regime.
EM	Emergent	Erected, rooted, herbaceous hydrophytes; all water regimes {Persistent and Nonpersistent}.
SS	Scrub-shrub	Woody vegetation less than 20 feet tall; all water regimes {Broad-leaved Deciduous, Needle-leaved Deciduous, Broad-leaved Evergreen, Needle-leaved Evergreen, and Dead}.
FO	Forested	Woody vegetation greater than 20 feet tall; all water regimes {Broad-leaved Deciduous, Needle-leaved Deciduous, Broad-leaved Evergreen, Needle-leaved Evergreen, and Dead}.

➔ The fourth character is an upper case letter representing the **Modifier**.

The modifiers described below were adapted from existing classifications or were developed specifically for this system.

**Water Regime Modifiers** are grouped under two major headings Tidal and Nontidal.

Nontidal

- **A** - Temporarily flooded, surface water is present for brief period during the growing season.
- **B** - Saturated, the substrate is saturated to the surface for extended periods, but surface water is seldom present.
- **C** - Seasonally flooded, surface water is present for extended periods in growing season, but is absent by the end of the season in most years.
- **D** - Seasonally flooded well drained
- **E** - Seasonally flooded saturated
- **F** - Semipermanently flooded, surface water persists throughout the growing season in most years.
- **G** - Intermittently exposed, surface water persists in most years except during extreme drought.
- **H** - Permanently flooded, surface water is present throughout the year in all years.
- **J** - Intermittently flooded, substrate usually exposed, but surface water is present for variable periods without seasonal periodicity.
- **K** - Artificially flooded, amount and duration flooding is controlled by pumps or siphons in combination with dikes or dams.
- **W** - Intermittently flooded temporary
- **Y** - Saturated semipermanent seasonal
- **Z** - Intermittently exposed/permanent

Tidal (water regimes are largely determined by oceanic tides).

- **K** – Artificially flooded, amount and duration flooding is controlled by pumps or siphons in combination with dikes or dams.
- **L** - Subtidal, substrate is permanently flooded with tidal water.
- **M** - Irregularly exposed, land surface is exposed by tides less often than daily.
- **N** - Regularly flooded, tidal water alternately floods and exposes the land surface at least once daily.
- **P**- Irregularly flooded, tidal water floods the land surface less often than daily
- **S** - Temporary tidal \*
- **R** - Seasonal tidal \*
- **T** - Semipermanent tidal \*
- **V** - Permanent tidal \*
- **U** - Unknown

\* These water regimes are only used in tidally influenced fresh water systems.

### **Water Chemistry Modifiers**

- Coastal Halinity – the term haline is used to indicate the dominance of ocean salt:
  - Hyperhaline (1)
  - Euhaline (2)
  - Mixohaline (3)
  - Poyhaline (4)
  - Mesohaline (5)
  - Olighaline (6)
  - Fresh (0)
- (5) • Inland Salinity – salinity is governed by interactions between precipitation, surface runoff, groundwater flow, evaporation and sometimes evapotranspiration by plants.
  - Hypersaline (7)
  - Eusaline (8)
  - Mixosaline (9)
  - Fresh (0)
- pH Modifiers for all fresh water – is used to indicate the difference between mineral-rich and mineral-poor sites.
  - a - Acid

### **Soil Modifiers**

- **g** - Organic } Differentiated on specific criteria that
- **n** – Mineral } are enumerated in soil taxonomy.

### **Special Modifiers**

- **b** - Beaver
- **d** - Partly drained – Water level is artificially lowered but soil moisture is sufficient to support hydrophytes.
- **f** - Farmed-soil surface has been mechanically or physically altered for production of crops, but hydrophytes will become reestablished if farming is discontinued.
- **h** - Impounded/diked – Created by barrier obstructing the outflow or inflow of water.
- **r** - Artificial – refers to substrates that were emplaced by man, using either natural materials such as dredge spoil or synthetic materials such as discarded automobiles, tires, or concrete.
- **s** -Spoil
- **x** - Excavated - lies within a basin or channel excavated by man.

Approximate acreage of wetlands in Puerto Rico and U.S. Virgin Islands

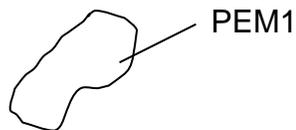
Puerto Rico					U.S. Virgin Islands		
System	Puerto Rico	Culebra	Vieques	Total	St.Croix	VI	Total
Marine	943,942.59	44,428.73	65,531.07	1,053,902.39	81,844.09	166,573.05	248,417.14
Estuarine	74,450.49	1,538.29	2,954.09	78,942.87	1,101.53	1,034.94	2,136.47
Riverine	660.85		4.72	665.57			
Palustrine	77,486.61	28.00	500.58	78,015.19	201.88	190.34	392.22
Lacustrine	415.41			415.41	165.36		165.36
<b>Total</b>	<b>1,096,955.95</b>	<b>45,995.02</b>	<b>68,990.46</b>	<b>1,211,941.43</b>	<b>83,312.86</b>	<b>167,798.33</b>	<b>251,111.19</b>

Source: FWS

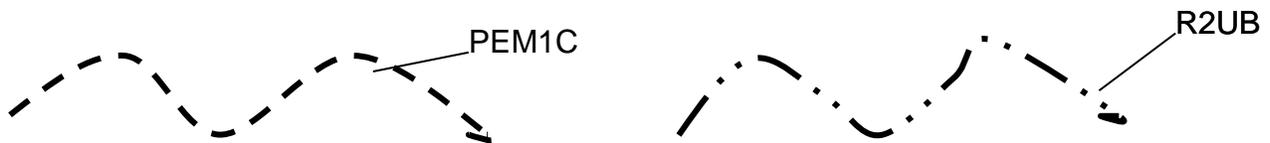
## ADDITIONAL TIPS FOR INTERPRETING NWI MAPS

- The inverted omega symbol  represents upland.
- All wetlands are delineated by either a polygon  , a linear  ; or a single point  .
- Wetlands are labeled with leader line running from the wetland to the map code.

Polygons identified wetlands large enough for the photo-interpreter to delineate an actual boundary.



- Lines identified wetlands that are too narrow to be delineated with polygons. Each linear wetland consists of either a dashes line (Palustrine linear) or series of dots and dashes (Riverine linear) and is labeled with leader line running from map code.



- Points identify wetlands that are too small to be delineated with polygons.
- Some map codes indicate a mixture of “classes” within a single polygon. Mixed “classes” indicate that each class occupies at least 30% of the delineation.

**WETLANDS AND DEEPWATER HABITATS CLASSIFICATION**

<b>SYSTEM</b>	<b>SUBSYSTEM</b>	<b>CLASS</b>	<b>SUBCLASS</b>
<b>M=MARINE</b>	1=SUBTIDAL	- RB=Rock Bottom	1=Bedrock 2=Rubble
		- UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		- AB=Aquatic Bed	1=Algal 3=Rooted Vascular 5=Unknown Submergent
		- RF=Reef	1=Coral 3=Worm
		- OW=Open Water/Unknown Bottom (used on older maps)	
	2=INTERTIDAL	- AB=Aquatic Bed	1=Algal 3=Rooted Vascular 5=Unknown Submergent
		- RF=Reef	1=Coral 3=Worm
		- RS=Rocky Shore	1=Bedrock 2=Rubble
		- US=Unconsolidated Shore	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic

SYSTEM	SUBSYSTEM	CLASS	SUBCLASS
E=ESTUARINE-	-- 1=SUBTIDAL----	- RB=Rock Bottom	1=Bedrock 2=Rubble
		- UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		- AB=Aquatic Bed	1=Algal 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
		- RF=Reef	2=Mollusc 3=Worm
		- OW=Open Water/Unknown Bottom (used on older maps)	
		- AB=Aquatic Bed	1=Algal 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
		- RF=Reef	2=Mollusc 3=Worm
		- SB=Streambed	3=Cobble-Gravel 4=Sand 5=Mud 6=Organic
		- RS=Rocky Shore	1=Bedrock 2=Rubble
		- US=Unconsolidated Shore	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
	-- 2=INTERTIDAL--	- EM=Emergent	1=Persistent 2=Nonpersistent
		- SS=Scrub-Shrub	1=Broad-Leaved Deciduous 2=Needle-Leaved Deciduous 3=Broad-Leaved Evergreen 4=Needle-Leaved Evergreen 5=Dead 6=Indeterminate Deciduous 7=Indeterminate Evergreen
		- FO=Forested	1=Broad-Leaved Deciduous 2=Needle-Leaved Deciduous 3=Broad-Leaved Evergreen 4=Needle-Leaved Evergreen 5=Dead 6=Indeterminate Deciduous 7=Indeterminate Evergreen

SYSTEM	SUBSYSTEM	CLASS	SUBCLASS
		- RB=Rock Bottom	1=Bedrock 2=Rubble
		- UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
	--1=TIDAL-----		
		-*SB=Streambed	1=Bedrock 2=Rubble 3=Cobble-Gravel 4=Sand 5=Mud 6=Organic 7=Vegetated
	--2=LOWER PERENNIAL----		
R=RIVERINE-----	--3=UPPER PERENNIAL----	- AB=Aquatic Bed	1=Algal 2=Aquatic Moss 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
	--4=INTERMITTENT-		
		- RS=Rocky Shore	1=Bedrock 2=Rubble
	--5=UNKNOWN PERENNIAL---- (used on older maps)	- US=Unconsolidated Shore	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic 5=Vegetated
		-**EM=Emergent	2=Nonpersistent
		- OW=Open Water/Unknown Bottom (used on older maps)	
		-*STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.	
		-**EMERGENT is limited to TIDAL and LOWER PERENNIAL SUBSYSTEMS.	

SYSTEM	SUBSYSTEM	CLASS	SUBCLASS
L=LACUSTRINE---	-- 1=LIMNETIC----	- RB=Rock Bottom	1=Bedrock 2=Rubble
		- UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		- AB=Aquatic Bed	1=Algal 2=Aquatic Moss 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
		- OW=Open Water/Unknown Bottom (used on older maps)	
		- RB=Rock Bottom	1=Bedrock 2=Rubble
		- UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		- AB=Aquatic Bed	1=Algal 2=Aquatic Moss 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
	-- 2=LITTORAL----	- RS=Rocky Shore	1=Bedrock 2=Rubble
		- US=Unconsolidated Shore	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic 5=Vegetated
		- EM=Emergent	2=Nonpersistent
		- OW=Open Water/Unknown Bottom (used on older maps)	

SYSTEM	SUBSYSTEM	CLASS	SUBCLASS
		- RB=Rock Bottom	1=Bedrock 2=Rubble
		- UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		- AB=Aquatic Bed	1=Algal 2=Aquatic Moss 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
		- US=Unconsolidated Shore	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic 5=Vegetated
		- ML=Moss-Lichen	1=Moss 2=Lichen
<b>P=PALUSTRINE</b>		- EM=Emergent	1=Persistent 2=Nonpersistent
		- SS=Scrub-Shrub	1=Broad-Leaved Deciduous 2=Needle-Leaved Deciduous 3=Broad-Leaved Evergreen 4=Needle-Leaved Evergreen 5=Dead 6=Indeterminate Deciduous 7=Indeterminate Evergreen
		- FO=Forested	1=Broad-Leaved Deciduous 2=Needle-Leaved Deciduous 3=Broad-Leaved Evergreen 4=Needle-Leaved Evergreen 5=Dead 6=Indeterminate Deciduous 7=Indeterminate Evergreen
		- OW=Open Water/Unknown Bottom (used on older maps)	

MODIFIERS

- WATER REGIME**-----
- Non-Tidal-----
    - A=Temporarily Flooded
    - B=Saturated
    - C=Seasonally Flooded
    - D=Seasonally Flooded/Well Drained
    - E=Seasonally Flooded/Saturated
    - F=Semipermanently Flooded
    - G=Intermittently Exposed
    - H=Permanently Flooded
    - J=Intermittently Flooded
    - K=Artificially Flooded
    - W=Intermittently Flooded/Temporary (used on older maps)
    - Y=Saturated/Semipermanent/Seasonal (used on older maps)
    - Z=Intermittently Exposed/Permanent (used on older maps)
    - U=Unknown
  
  - Tidal-----
    - K=Artificially Flooded
    - L=Subtidal
    - M=Irregularly Exposed
    - N=Regularly Flooded
    - P=Irregularly Flooded
    - \*S=Temporary-Tidal
    - \*R=Seasonal-Tidal
    - \*T=Semipermanent-Tidal
    - \*V=Permanent-Tidal
    - U=Unknown
- \*These water regimes are only used in tidally influenced, freshwater systems.

		- 1=Hyperhaline
		- 2=Euhaline
	--Coastal	- 3=Mixohaline (Brackish)
	Halinity-----	- 4-Polyhaline
		- 5=Mesohaline
		- 6=Oligohaline
		- 0=Fresh
<b>WATER CHEMISTRY-</b>		
	--Inland	- 7=Hypersaline
	Salinity-----	- 8=Eusaline
		- 9=Mixosaline
		- 0=Fresh
	--pH Modifiers	- a=Acid
	for all	- t=Circumneutral
	Fresh Water----	- i=Alkaline

<b>SOIL-----</b>	- g=Organic
	- n=Mineral

<b>SPECIAL MODIFIERS-----</b>	- b=Beaver
	- d=Partially Drained/Ditched
	- f=Farmed
	- h=Diked/Impounded
	- r=Artificial Substrate
	- s=Spoil
	- x=Excavated

U = Uplands

## References

1. Classification of Wetlands and Deepwater Habitats of the United States, U.S. Department of the Interior, Fish and Wildlife Service, December 1979, Reprinted 1992.
2. NWI Maps Easy, U.S. Fish and Wildlife Service, Mountain Prairie Region, February 1993, Denver, Colorado.
3. Puerto Rico Wetland Resources, U.S. Geological Survey Water-Supply Paper 2425.
4. U.S. Virgin Islands Wetland Resources, U.S. Geological Survey Water-Supply Paper 2425.
5. "Inventario de Uso de Terrenos Anegadizos y Hábitats de Aguas profundas de Puerto Rico, Manuel del Llano, octubre 1984."

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