

Lindheimer Chapter 2025 TEXAS WATER SPECIALIST CERTIFICATION



Marilyn J McFarland, RN, MS
Communications Director, LMN
Certified Texas Waters Specialist

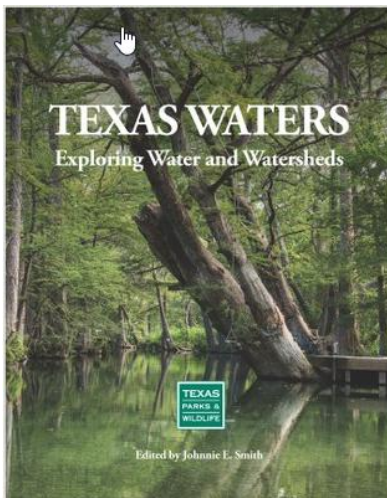


Texas Waters Specialist Certification Class

The purpose of the Texas Waters Specialist Certification is to "develop a corps of well-informed volunteer specialists who provide education, outreach, service & field research dedicated to the beneficial management of aquatic resources & aquatic habitats within their communities for the state of Texas. These classes utilize the Texas Waters Curriculum which will certify you as a Texas Waters Specialist. You will receive 8 hours of Advanced Training for these classes. You don't have to obtain any other AT but 10 hours of your annual 40 hours must be water related.



<https://tpwd.texas.gov/education/water-education/texaswatersprogram>



2025 Texas Waters Specialist Certification Classes Presented by Lindheimer Chapter

WHEN: October 4 2025 1pm - 3 pm
October 18 2025 2pm - 4pm
October 25 2025 2pm - 4pm
November 1 2025 2pm - 4pm

WHERE: Tye Preston Memorial Library
16311 S Access Rd, Canyon Lake, TX 78133

WHO: Marilyn J McFarland

WHAT: To preview curriculum, go online:
<https://tpwd.texas.gov/education/water-education/texaswatersprogram>

INTRODUCTION

“Throughout the history of literature,
the guy who poisons the well has been
the worst of all villains...”

— Author unknown —

Class Schedule

Date	Chap	Topic	Pages	Lesson Focus	Discussion Guide
10/4/25	Intro	Introduction to Texas Waters Curriculum		Sessions Plan	Review curriculum; how to document your hours in VMS; what LMN projects qualify as waters projects
	1	Texas Aquatic Habitats and the Species They Support	2 - 26	Freshwater habitats: Rivers & Streams, Aquifers & Springs, Lakes & Ponds Saltwater & Estuarine Habitats: Wetlands, Bays & Estuaries, Gulf Coast	Texas freshwater ecosystem characteristics; diversity of animal & plant life; supported species by habitat; endangered freshwater species; Texas saltwater & estuarine ecosystem functions; species by habitat; endangered marine & estuarine species
	6	Role & Function of Wetlands & Estuarine Systems	86 - 90	Biodiversity of a wetlands; most important functions	Very short chapter combined with Chapter 1 (wetlands, bays, estuaries).
10/18/25	2	Characteristics, Components, and Value of Healthy Watershed Ecosystems	28 - 40	Abiotic & Biotic Components; Species Biodiversity; structure	Explanation of biotic, abiotic components; exploration of biodiversity & place in eco-culture
	3	The Watershed's Role as a Natural System	41 - 48	Watershed functions; plant strategies	Trace the ecosystem of the major river in our area: Guadalupe
	9	Texas Water Law & Planning	120-139	Water rights; planning; Texas Water Development Board, TCEQ-water	Current issues re: water resources in the Hill Country; how water law affects us by reviewing an actual Texas lawsuit on a surface water dispute between neighbors
10/25/25	4	Ecosystem Services	49 - 63	Types of services: Supporting, provisioning, regulating & cultural	Identify aquatic ecosystem services in the Hill Country; discuss which type of service is most prevalent
11/1/25	5	Ecological Significance of Natural Flow Regimes	66 - 83	Review natural flow regimes concepts	How disruption/impedance of natural flow affects the Hill Country (Flash Flood Alley); the impact of dams on the watershed; recent dam failure Lake Dunlap
	7	Natural Instruments of Watershed Change with	92 - 96	Floods, drought, wildfire, fire suppression, wind, erosion, sinkholes & sediment deposition	Discuss natural events in the Hill Country & how they changed the watershed area; flood of 2002 & creation of Canyon Gorge
	8	Human Caused Instruments of Watershed Change	98 - 116	Manmade alterations; invasive plants & animals; Pollution, land development, including dams, climate change	Tracing the introduction of plant and animal invasives; Effect of land development, population increase & Canyon Dam on ecosystems in Hill Country

- Classes are based on the Texas Waters Specialist Curriculum found at <https://tpwd.texas.gov/education/water-education/texaswatersprogram>. You will need to print it out if you want a hard copy.
- Please read designated chapters before class.
- For any questions, please email LindheimerMNContact@gmail.com

To report your waters specialist AT hours: Go to AT: TX Waters Certification Training: TMN AT Report Hours (see blue arrow)



Note: Make certain to request approval from Projects Committee prior to attending the AT activity if it is an activity put on outside our chapter.

Select an opportunity to report hours/service

AT: Bat Conservation International, TMN AT Report Hours:TMN AT Report Hours
AT: Canyon Lake Gorge Preservation Society, Advanced Training, TMN Report Hours:TMN AT Report Hours
AT: Chapter Approved; TMN Report Hours:TMN AT Report Hours
AT: Cibolo Nature Center, Advanced Training, TMN Report Hours:TMN AT Report Hours
AT: NativePlantSocietyOfTexas chapter meetings; classes; TMN Report Hours:TMN AT Report Hours
AT: New Class field trips and new class training; TMN Report Hours:TMN AT Report Hours
AT: Online training; Report TMN hours:TMN AT Report Hours
AT: TX Waters Certification Training:TMN AT Report Hours
CB: Administrative Work, all chapter business, service project, TMN Report Hours:TMN Admin Report Hours
FR: Birds; TMN Report Field Research Hours:TMN Field Research Hours
FR: Chapter Approved, TMN Report Field Research Hours:TMN Field Research Hours
FR: CoCoRaHS, Colorado State Univ., TMN Report Field Research hours:TMN Field Research Hours
FR: Guadalupe River State Park; Volunteer Corps; TMN Report Hours:TMN Field Research Hours
FR: Insects; TMN Report Hours:TMN Field Research Hours
FR: Karst Survey, Texas Nature Conservancy; TMN Report Field Research Hours:TMN Field Research Hours
FR: Water-Report TMN Hours:TMN Field Research Hours
NPA: Chapter Approved; TMN Report Hours:TMN Report Hours
NPA: Guadalupe River State Park; Volunteer Corps; TMN Report Hours:TMN Report Hours
OT: Other ANIMAL RESCUE:TMN Report Hours
OT: Other LMN PARTNER ACTIVITY:TMN Report Hours
PO: Chapter Approved; TMN Report Hours:TMN Report Hours
PO: Festivals; Chapter Approved; TMN Report Hours:TMN Report Hours
PO: Guadalupe River State Park; TMN Approved Hours:TMN Report Hours
PO: Plant Identification Database:TMN Report Hours
PO: Traveling Trunks, LMN trunks for sharing; LMN Report Hours:TMN Report Hours
RM: Chapter Approved; TMN Report Hours:TMN Report Hours
RM: Guadalupe River State Park; Resource Management;TMN Report Hours:TMN Report Hours
TG: Chapter Approved; TMN Report Hours:TMN Report Hours
TR: Guides, Leaders, Docents for tours with any partner; TMN report hours:TMN Report Hours
TR: Chapter Approved; TMN Report Hours:TMN Report Hours
TR: Guadalupe River State Park;Texas Parks and Wildlife:TMN Report Hours

To report your waters specialist volunteer hours (VH), you select the activity in which you participated. For example, you have CoCoRaHS hours. Click on the CoCoRaHS line. When the page appears, you will see a check box for Texas Waters Specialist (**green arrow**). Click on it and it will record your waters specialist activity.

Note 1: For approval as a TWS activity at the local level, the project must be on the chapter's approved list.

Note 2: Certification or recertification is determined at the state level by searching the database for TWS designated ATH & VH.

Report Service

Please select from the following survey(s):

FR: CoCoRaHS, Colorado State Univ., TMN Report Field ▾

Field Research Volunteer Hours

Start Date for volunteer service: 02/05/2018

End Date for volunteer service: 02/05/2018

How many hours did you volunteer?

(To the nearest quarter hour, including travel time)

You must put in service hours

Describe your research:

This activity qualifies for the following specialization:

☐ Texas Waters Specialist

For your personal records....

What was the total number of miles you drove round trip?

Frightening Factoid

If all of the Earth's water (estimated 375 trillion gallons) were squeezed into a gallon jug and you poured out what wasn't drinkable (salty, frozen, polluted), you'd only be left with ONE DROP, and even that might not pass U.S. water quality standards.



INTERESTING FACTOIDS

- ▶ 17% of world's irrigated cropland produces 30 - 40% of world's crops
- ▶ 20% of world (1.2 billion people) do NOT have safe drinking water
- ▶ 40% of world population (2.4 billion people) do NOT have access to adequate sanitation
- ▶ People spend \$366 BILLION a year on water purification & consumption
- ▶ More than 90% of Earth's fresh water is in Antarctica
- ▶ Total amount of water on our planet has remained the same for 2 BILLION years

Finding Water: Water Witching

- ▶ https://youtu.be/-qhyyjTy_wM
- ▶ <https://youtu.be/T7R8ul7vABM>

TEXAS AQUATIC ENVIRONMENTS

Freshwater

- ▶ Surface Water
 - ▶ Rivers
 - ▶ Streams
- ▶ Groundwater
 - ▶ Aquifers
 - ▶ Springs

Saltwater

- ▶ Wetlands (Fresh & Salt)
- ▶ Bays & Estuaries
- ▶ Gulf Coast

FRESHWATER ENVIRONMENTS

SURFACE WATER

Rivers & Streams

- ▶ Most visible water supply
- ▶ Streams - Precipitation run-off or from groundwater springs/seeps
- ▶ Rivers - Convergence of many small streams into a large stream
- ▶ 3,700 named streams & 15 major rivers winding through 191,000 miles of Texas

GROUNDWATER

Aquifers & Springs

- ▶ Groundwater is a huge portion of Texas' water supplies
- ▶ Aquifer - Underground layer of permeable rock or sand; collects, holds & conducts water ("reservoir")
- ▶ Springs - Holes/cracks where aquifer water flows to the surface forming pools and often streams

FRESHWATER

SURFACE WATER: Rivers & Streams

- ▶ Freshwater systems provide the following ecosystem services
 - ▶ Nourishment of watersheds with water & nutrients
 - ▶ Waste assimilation
 - ▶ Fish & wildlife habitat
 - ▶ Recreational activities
 - ▶ Drinking water
 - ▶ Agricultural irrigation

Tracing a Texas River - the Guadalupe https://youtu.be/GBG_VeMlPds (5:59)

Water Data

- ▶ <https://waterdata.usgs.gov/nwis/rt>
- ▶ https://waterwatch.usgs.gov/index.php?mt=real&st=tx&usst=&ushuc=&id=wwlmap_viewer
- ▶ https://waterdata.usgs.gov/tx/nwis/current/?type=flow&group_key=county_cd
- ▶ <http://www.nbtexas.org/1106/River-Status>

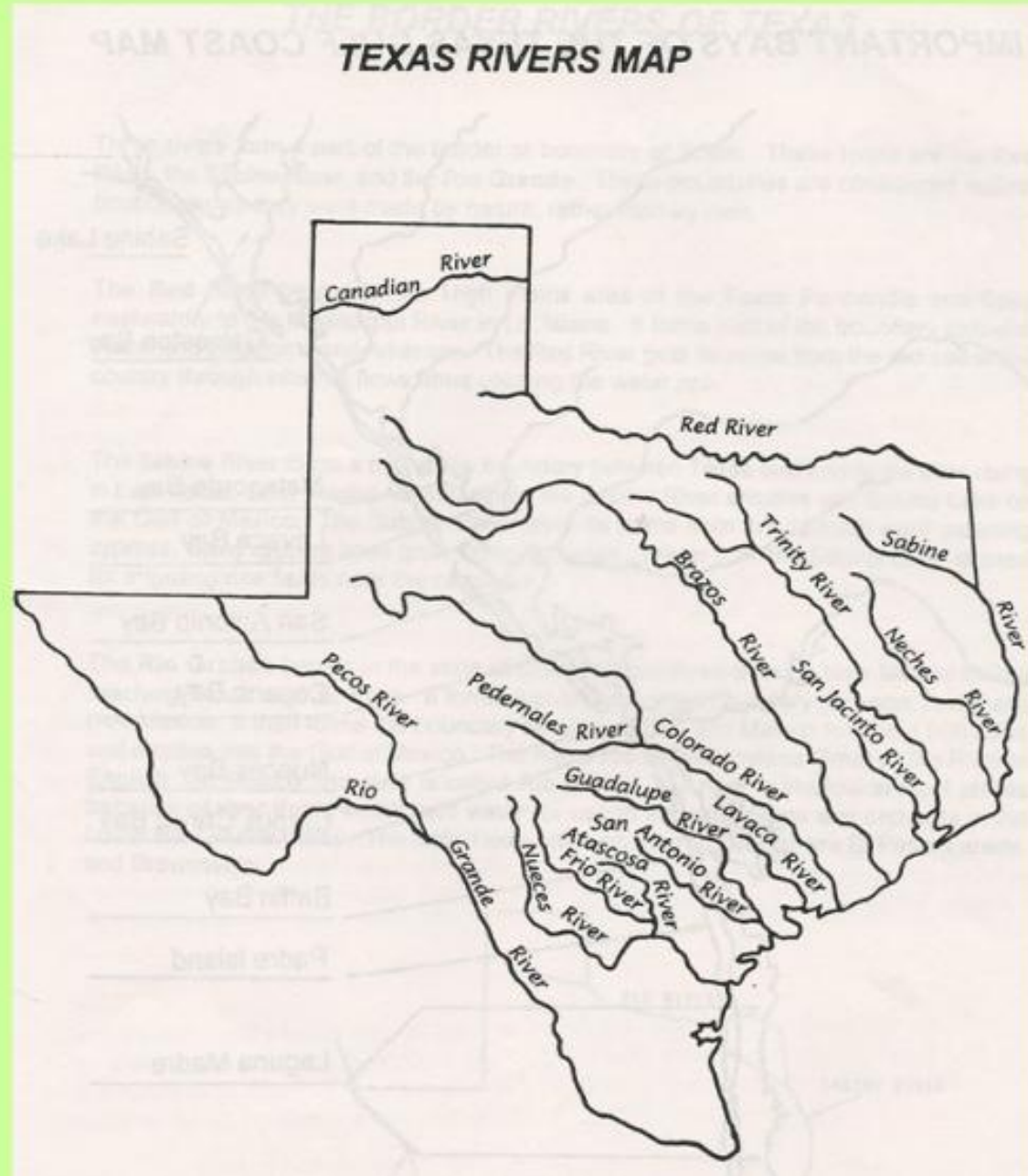
Comal River Recreation Threshold

Flow	River Status
100 - 500 cfs	Recreational flow - all recreation activities are available
500 - 600 cfs	Use extreme caution - all activities questionable - flows of this magnitude are usually caused by rainfall and involve turbid water and floating debris - contact river outfitters for more information
600+ cfs	The Comal River is usually closed at this flow rate

Guadalupe River Recreation Threshold

Flow	River Status
100 - 500 cfs	Recreational flow - all activities are available
500 - 750 cfs	All activities are available - caution to swimmers; Life Jacket required for all persons under 8.
750 - 1000 cfs	Tubing questionable - use extreme caution; Life Jackets required for all people.
1000 - 3000 cfs	No tubing - raft and kayak trips only
3000 cfs +	Guided trips only - check with local river outfitters for their policies

Map of Texas Rivers



Yes, Bubba, there is a country song that names all the Texas Rivers

Texas River Song

- ▶ We crossed the wild Pecos
We forded the Nueces
We swum the Guadalupe
And we followed the Brazos
Red River runs rusty
The Wichita clear
But down by the Brazos
I courted my dear

Singing li, li, li, le, le, le
Lend me your hand
Li, li, li, le, le, le
Lend me your hand
Li, li, li, le, le, le
Lend me your hand
There's many a river
That waters the land

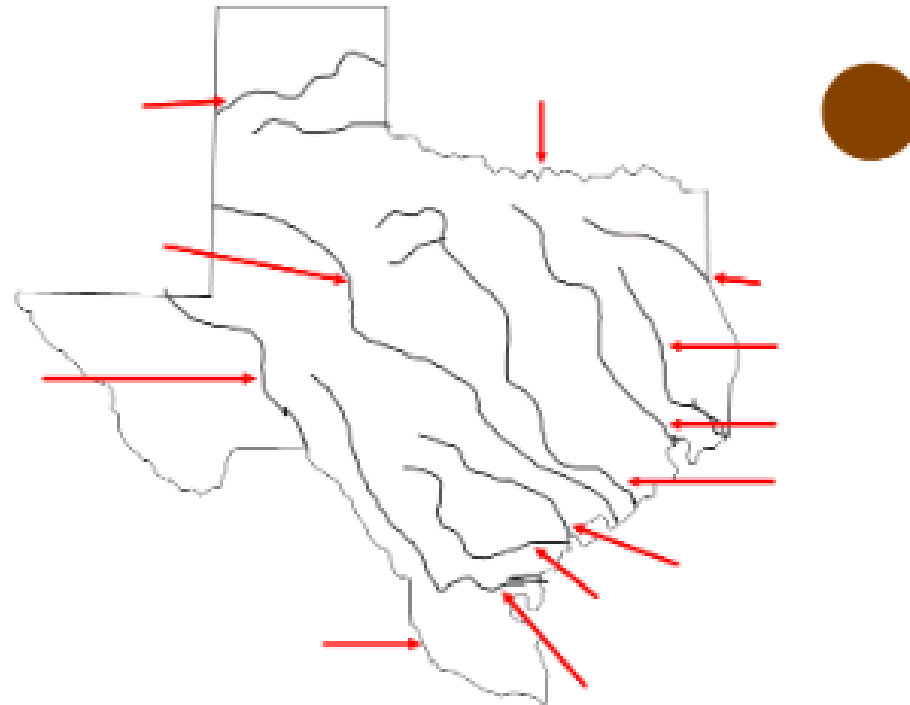
Now the fair Angelina
Runs glossy and gliding
the crooked Colorado
Runs weaving and winding
The slow San Antonio
Courses and plains
But I never will walk
By the Brazos again

- ▶ She kissed me and she hugged me
And she called me her dandy
The Trinity's muddy
But the Brazos quick sandy
She kissed me and she hugged me
And she called me her own
But down by the Brazos
She left me alone

Now the girls of Little River
They're plump and they're pretty
The Sabine and the Sulphur
Hold beauties a'many
The banks of the Neches
There are girls by the score
But down by the Brazos
I'll wander no more

And yes, Bobby Sue, there is a test for Texas rivers.

Name the Texas Rivers



10 Most Endangered Rivers in US

► Guadalupe: Endangered or Well Protected?

In April 2002, a non-profit group that monitors the nation's waterways, [American Rivers](#), ranked the Guadalupe River as the 10th most endangered in the nation. The group said the main threat to the Guadalupe was the State's new water plan, which it says does not place enough importance on conservation and fails to ensure sufficient flow for fish and wildlife, especially in the estuaries along the coast. It also said that GBRA's plans to expand diversions from the Guadalupe posed an immediate threat to the River and its estuaries. The GBRA disputed American Rivers' opinion, saying the Guadalupe is not endangered and is being managed well. GBRA Manager Bill West said the entire regional water plan "is geared around protecting the springs and the River. It is just the complete opposite of what they claim."

UPDATE: In 2023, the Guadalupe is no longer in the Top 10 endangered rivers. No Texas river is in the Top 10. Unable to find any rankings.

► <https://endangeredrivers.americanrivers.org/>

The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern and dynamic visual effect.

TAKE A BREAK!
BE BACK IN 10 MINUTES

Species as an Indicator of Stream Health

Uniquely adapted to their environment

- ▶ Some of the Endangered Species
 - ▶ Texas Wild Rice
 - ▶ Salamanders: Austin Blind, Barton Springs, Cascade Cavern, Georgetown, Jollyville, Texas Blind
 - ▶ Fish: Fountain Darter
- ▶ https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/nongame/listed-species/

GROUND WATER

Aquifers & Springs

- ▶ Most of Texas land surface lies above aquifers
 - ▶ 9 major & 21 minor aquifers

A Drop In the Edwards Aquifer (7:20 minutes)

<https://youtu.be/NzYWOM2TmJk> (7:20 minutes)

Major Aquifers of Texas

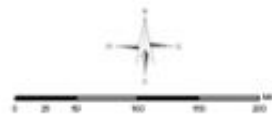


Legend

- Pecos Valley
- Seymour
- Gulf Coast
- Carrizo - Wilcox (outcrop)
- Carrizo - Wilcox (subcrop)
- Hueco - Mesilla Bolson
- Ogallala
- Edwards - Trinity Plateau (outcrop)
- Edwards - Trinity Plateau (subcrop)
- Edwards BFZ (outcrop)
- Edwards BFZ (subcrop)
- Trinity (outcrop)
- Trinity (subcrop)

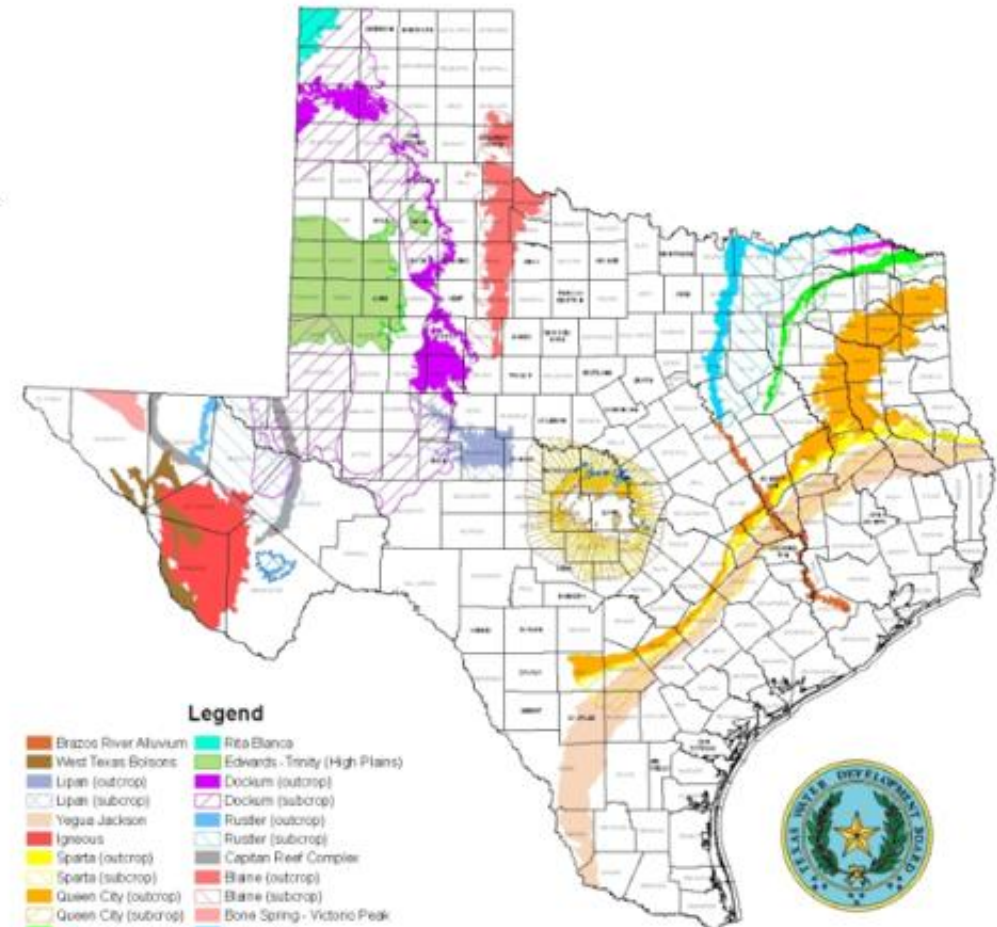
NOTE: Check for Geologic age

OUTCROP (portion of a water-bearing rock unit exposed at the land surface)
SUBCROP (portion of a water-bearing rock unit existing below other rock units)



DISCLAIMER
This map was generated by the Texas Water Development Board using GIS (Geographic Information System) software. No warranty is made by the Board as to the accuracy or completeness of the information shown herein nor to its suitability for particular use. The water distribution of all mapped areas is approximate.
Map updated December 2008 by Mark Hays, PhD

Minor Aquifers of Texas



Legend

- Brazos River Alluvium
- West Texas Bolson
- Upan (outcrop)
- Upan (subcrop)
- Yegua Jackson
- Igneous
- Sparta (outcrop)
- Sparta (subcrop)
- Queen City (outcrop)
- Queen City (subcrop)
- Nacatoch (outcrop)
- Nacatoch (subcrop)
- Blossom (outcrop)
- Blossom (subcrop)
- Woodbine (outcrop)
- Woodbine (subcrop)
- Rio Blanco
- Edwards - Trinity (High Plains)
- Dockum (outcrop)
- Dockum (subcrop)
- Rustler (outcrop)
- Rustler (subcrop)
- Captain Reef Complex
- Blaine (outcrop)
- Blaine (subcrop)
- Bone Spring - Victoria Peak
- Marble Falls
- Marathon
- Blinnburg - San Saba (outcrop)
- Blinnburg - San Saba (subcrop)
- Hickory (outcrop)
- Hickory (subcrop)

NOTE: Check for Geologic age

OUTCROP (portion of a water-bearing rock unit exposed at the land surface)
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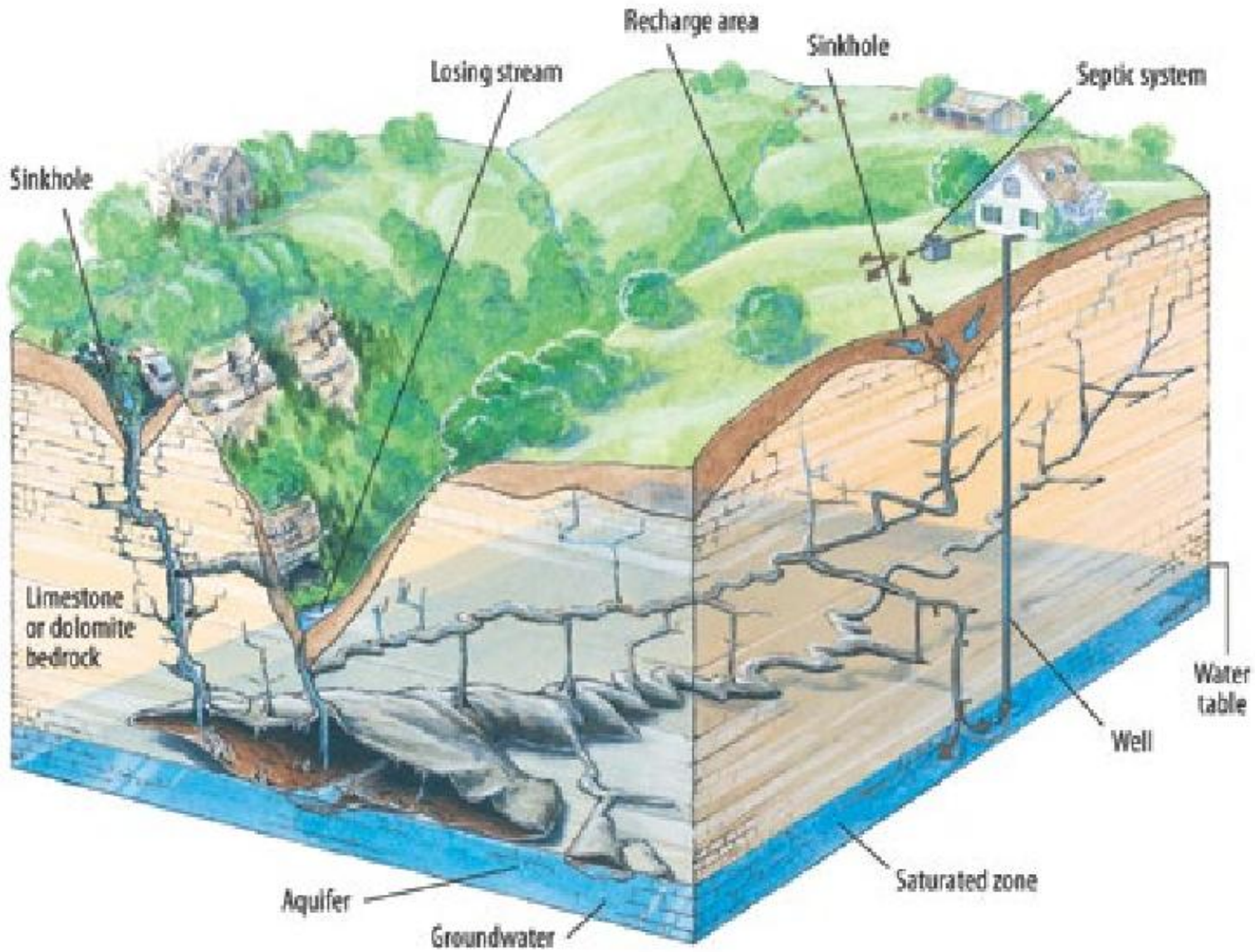


Figure 1.9 - Aquifer cross-section.. Image used with permission from the Missouri Department of Conservation.

A Drop in the Edwards Aquifer

<https://youtu.be/NzYWOM2TmJk> (7:20 minutes)

SINK HOLES

<https://youtu.be/pcgvWUTiEMI> Daisetta, Texas



Wetlands - Fresh & Salt

Area routinely inundated or saturated by surface or ground water

- ▶ Water: Present for part/all of year, at or above the surface, or within the root zone.
- ▶ Soils: Differ from surrounding uplands
- ▶ Vegetation: Adapted to the presence of water
- ▶ Types of wetlands
 - ▶ Deepwater swamp
 - ▶ Freshwater marsh
 - ▶ Playa lake
 - ▶ Riparian
 - ▶ Salty & brackish marsh

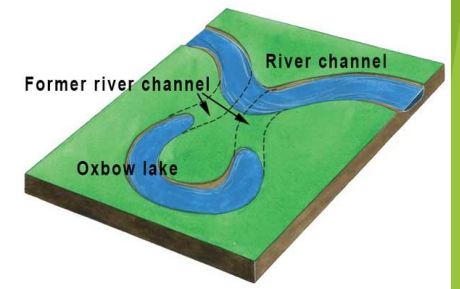


Deepwater Swamps: Forested ecosystems that contain standing water year round; typically have bald cypress & are mostly in East Texas

- ▶ Example: Caddo Lake State Park
- ▶ Interesting factoid: Caddo Lake WAS the only natural lake in Texas

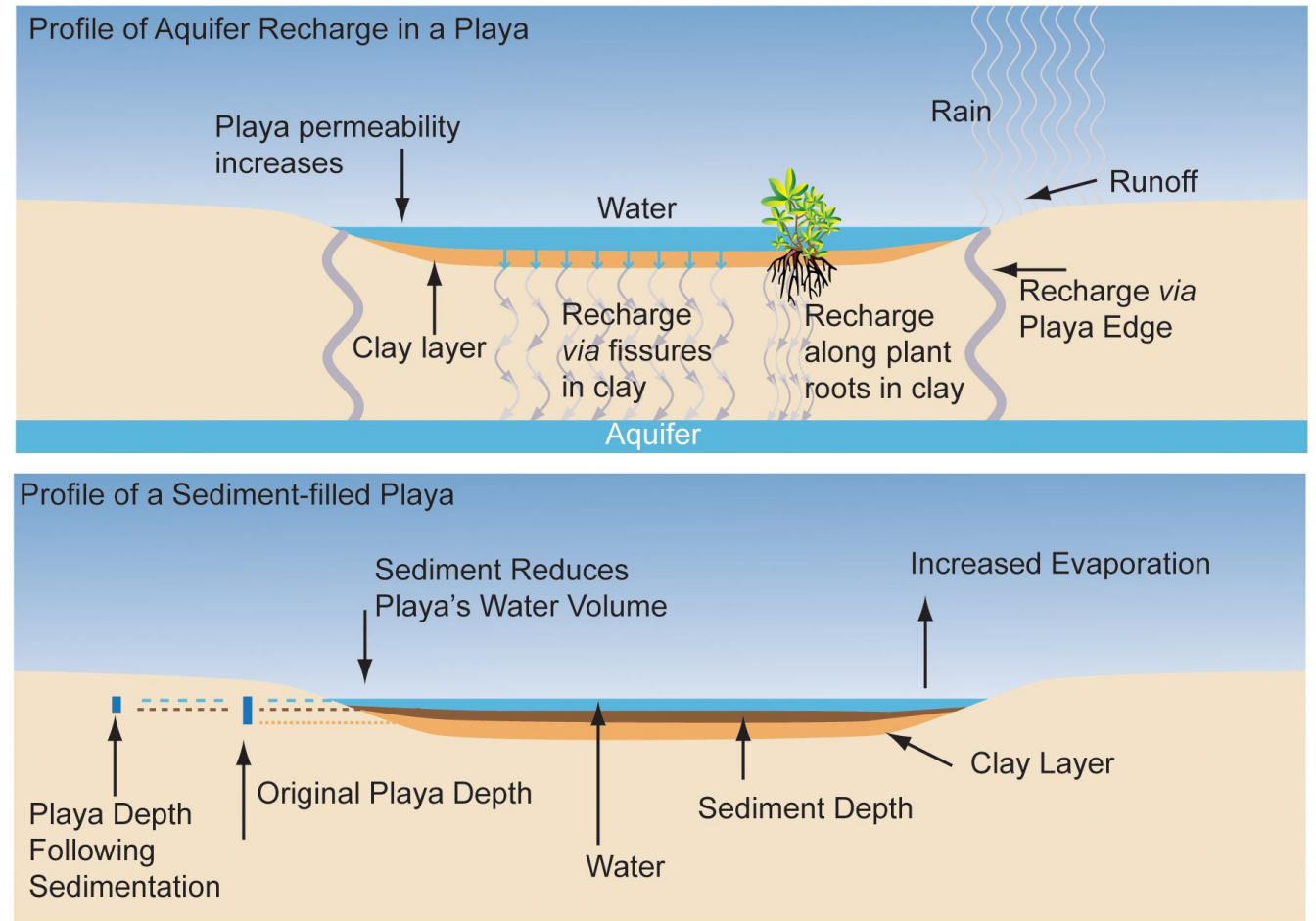


Freshwater Marsh: Non-forested, non-tidal with grasses, sedges & other freshwater plants; shallow water along lakes, rivers, streams, abandoned oxbows, depressions



Playa Lakes: Ephemeral wetland characterized by Randall or Ness clay soils

<https://youtu.be/Bs3CuApELRY> (3:20 minutes)



Adapted from PLJV⁴⁴⁵

Riparian wetlands: Bottomland hardwood forests; **periodic over bank flooding**



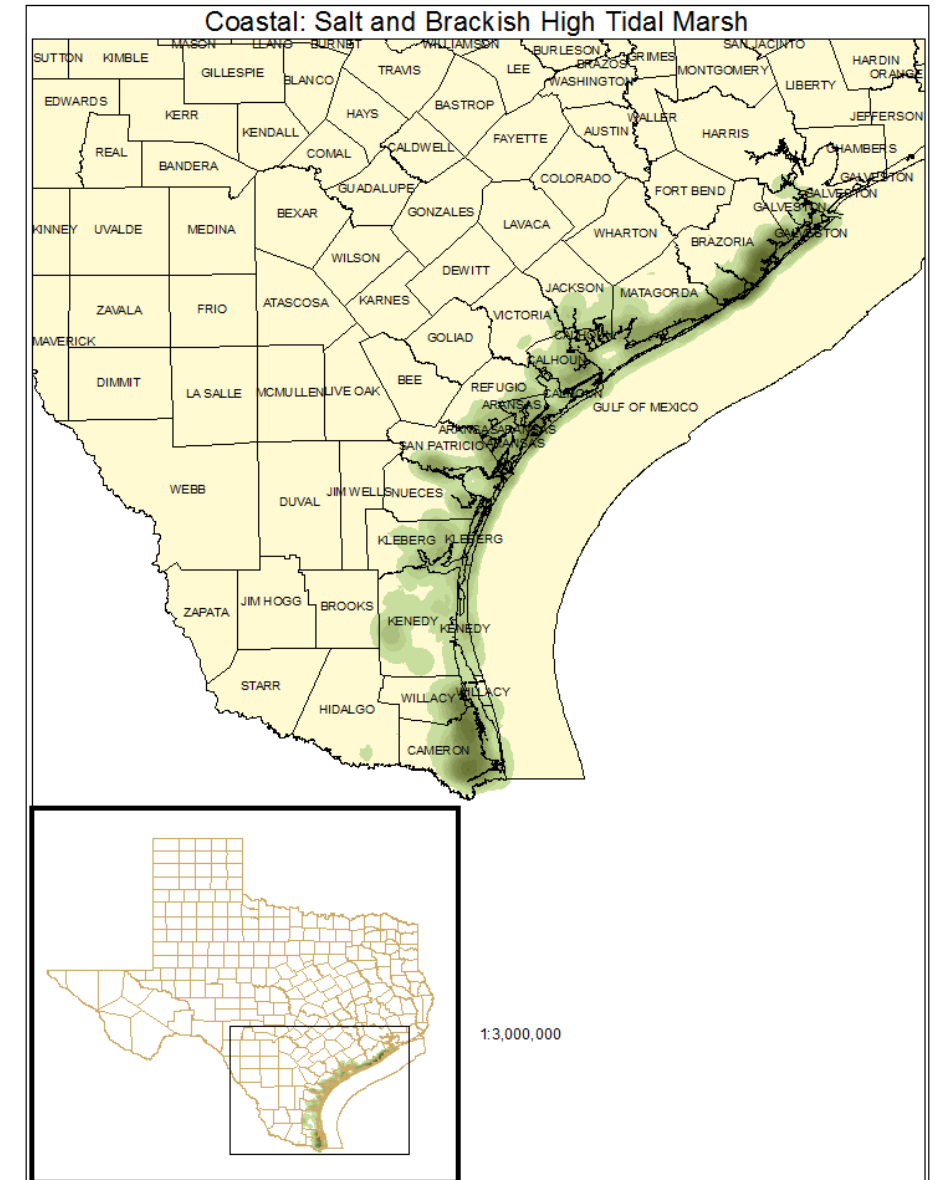
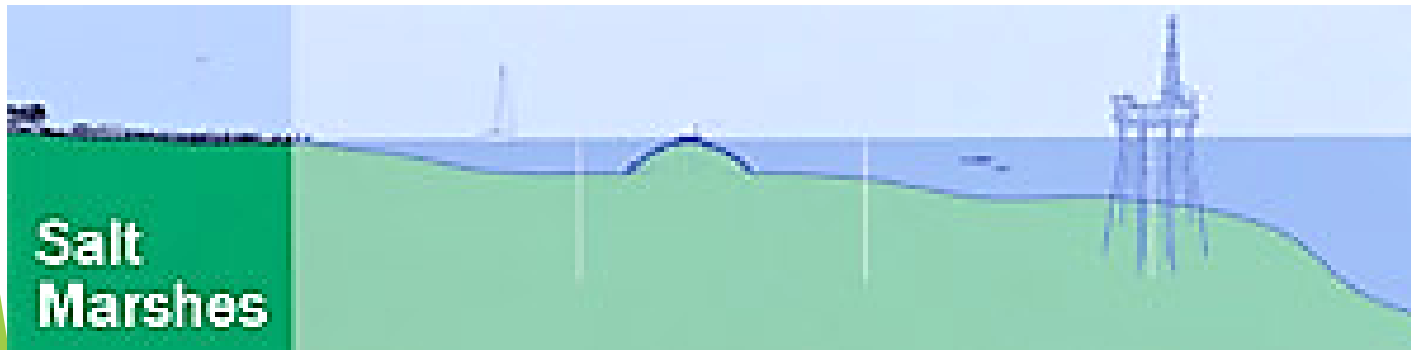
Rio Bosque Wetlands Park



Riparian area on ephemeral creek

Salty & Brackish Marshes: Rich ecosystems; protect life in the bay by filtering sediment & pollutants (**Gulf Coast**)

- ▶ Salt marshes act as biological filters where pollutants from freshwater runoff can settle out before reaching the Gulf.
- ▶ Decaying vegetation from the marsh provides adjoining bays with food from many small marine animals. These, in turn, are food for fish, mammals and birds.
- ▶ Marshes also serve as spawning grounds and nursery for marine animals including blue crabs and red drum.



FACTS ABOUT TEXAS WATER

https://texaslivingwaters.org/wp-content/uploads/2016/06/FATW_Final_English_May-2016_web-optimized.pdf

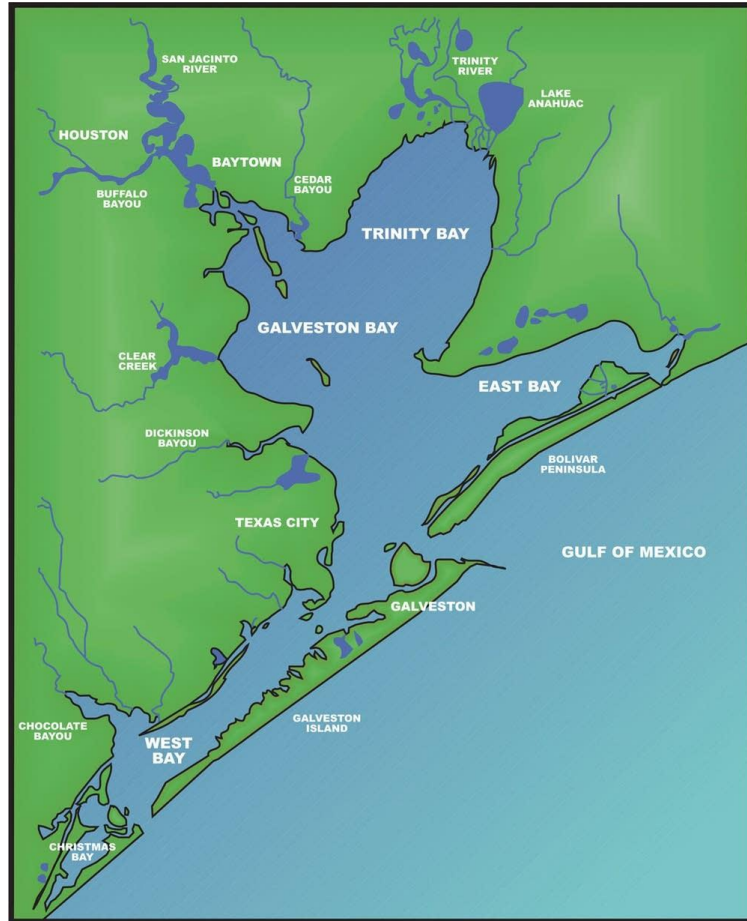
Video 1: Texas Wetlands (2:15) <https://youtu.be/DXZqP-PYOrc>

Video 2: Texas Wetlands (7:03) https://youtu.be/uAfgv_rlKWw



Bays & Estuaries

Bay - Indentation in shoreline, larger than a cove, smaller than a gulf



Estuary - Water passage where the tide meets a river current



http://www.twdb.texas.gov/surfacewater/bays/major_estuaries/index.asp

Major Estuaries



- Minor Estuaries



Video 1: Texas Bays & Estuaries (4:41)

Video 2: Estuary (NOAA) (2:00)



The Wonder of the Tides

The **bore tide** is a natural phenomenon that occurs in narrow channels when the leading edge of an incoming tide clashes with the flow of an outgoing tide, colliding and causing a wave. **Bore** tides exist in about 30 places in the world. One of the best is **Turnagain Arm**, just south of Anchorage, Alaska. Others: Qiantang River, China; Bay of Fundy, Nova Scotia; and the Pororoca, Amazon.

- ▶ <https://youtu.be/Ny3KXmJuqbE> Turnagain Arm (2:00)
- ▶ [Surfers of the Bore Tide! #drone #travel #alaska #surfing](#)
- ▶ [The Silver Dragon: The World's Largest Tidal Bore Wave Part 1](#)
- ▶ <https://youtu.be/s3SLigRpgKw> Pororoca (2:32)
- ▶ <https://www.youtube.com/watch?v=wC6m2KNpcto> Bay of Fundy (8:13)
- ▶ <https://youtu.be/LuxTviktIN8> Bay of Fundy (0:55)
- ▶ https://youtu.be/qfhNjpu_IU4 Bay of Fundy (1:51)
- ▶ <https://youtu.be/OP0cpXpw8yk> Bay of Fundy Tides time lapse (1:25)

Gulf Coast

- ▶ Description: Where 11,250 named rivers, streams, creeks and bayous drain to the Gulf of Mexico providing 367 miles of gulf shoreline and 3,300 miles of bay beaches
- ▶ Texas Gulf Ecological Management Sites (GEMS) - Multiple Gulf states in a cooperative to provide a regional framework for focusing attention on geographic areas that have special ecological significance
 - ▶ Focuses on fish, wildlife and other natural resources
 - ▶ Furthers conservation through inter-agency coordination
 - ▶ 24 sites in Texas (see page 24)

October 18, 2025: Chapters 2,3 & 9

<https://tpwd.texas.gov/education/water-education/Watershed%20Viewer>