

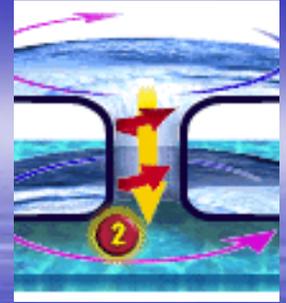
Hurricanes



Katrina approaching New Orleans



What is a hurricane?

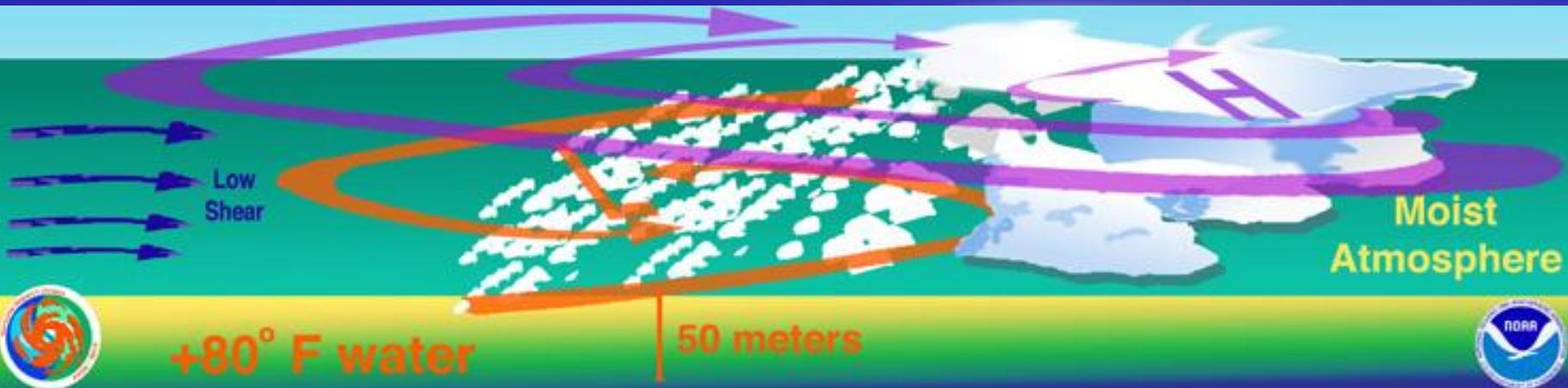


- A large rotating storm
 - centered around an area of very low pressure
 - strong winds blowing at an average speed over 74 miles per hour
- The whole storm system may be up to 10 miles high and on average 500 miles wide
- It moves forward like an immense spinning top, at speeds up to 20 mph

How do hurricanes form?

For a hurricane to form, you need two things:

1. Warm, moist air
2. Just the right wind conditions

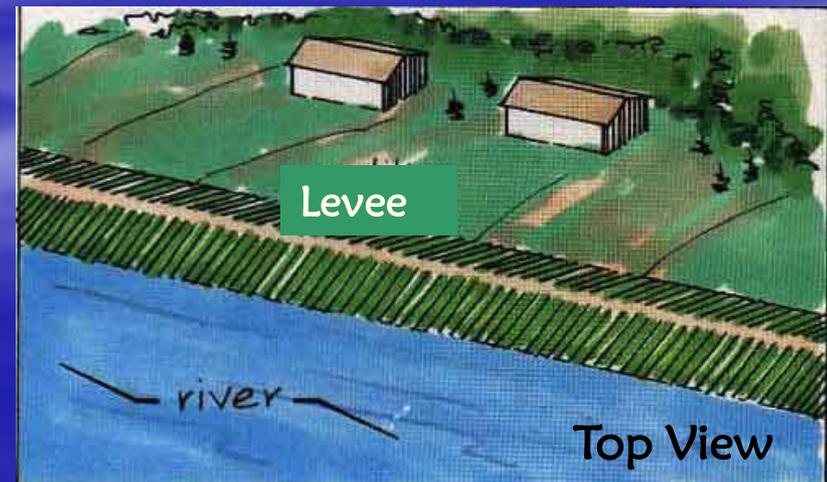
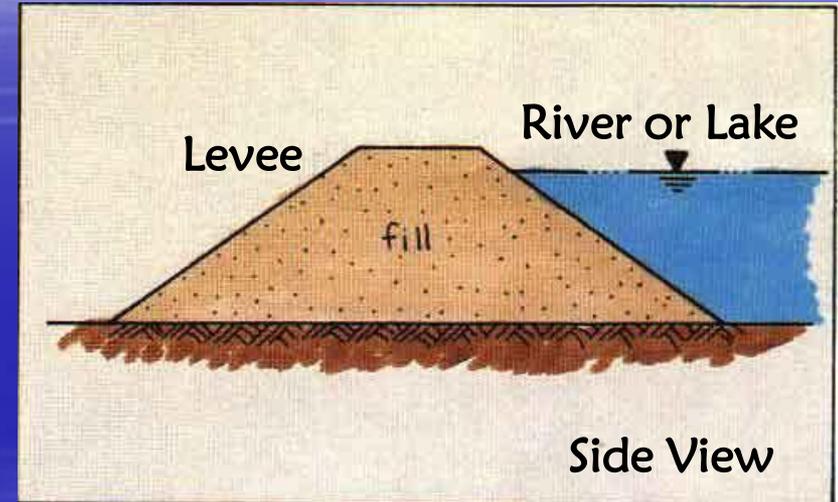


Engineers protecting people

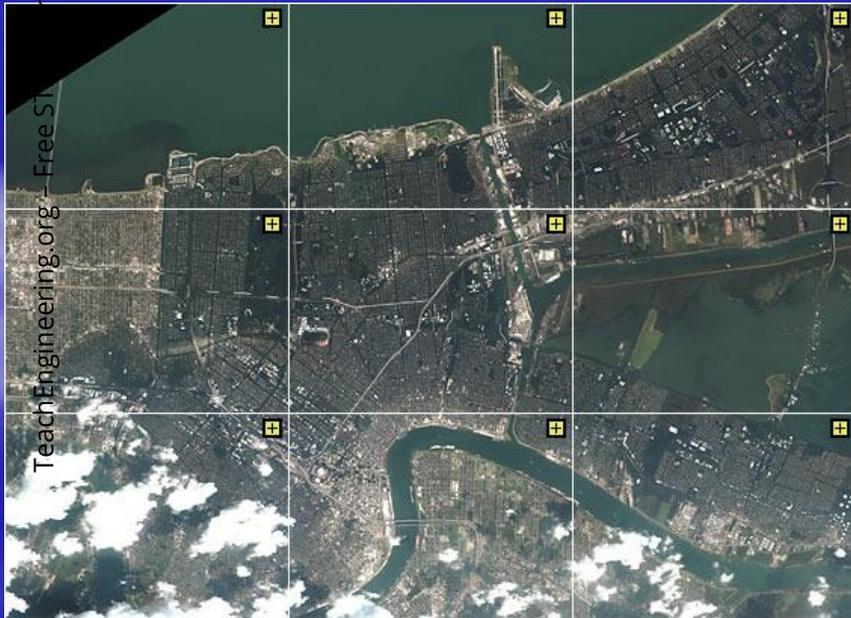
- Ways that engineers can protect people from hurricanes:
 - Early warning systems
 - Strong buildings, bridges and roads
 - Flood prevention
 - Levees
 - Pumps
 - Floodwalls

All About Levees

- Protect people from the flooding of a river or lake.
- Made from piled dirt that is wide at the bottom and level at the top. Sometimes extra sandbags are used at the top for reinforcement.
- Some areas that see a lot of flooding may have not just one, but several levees.

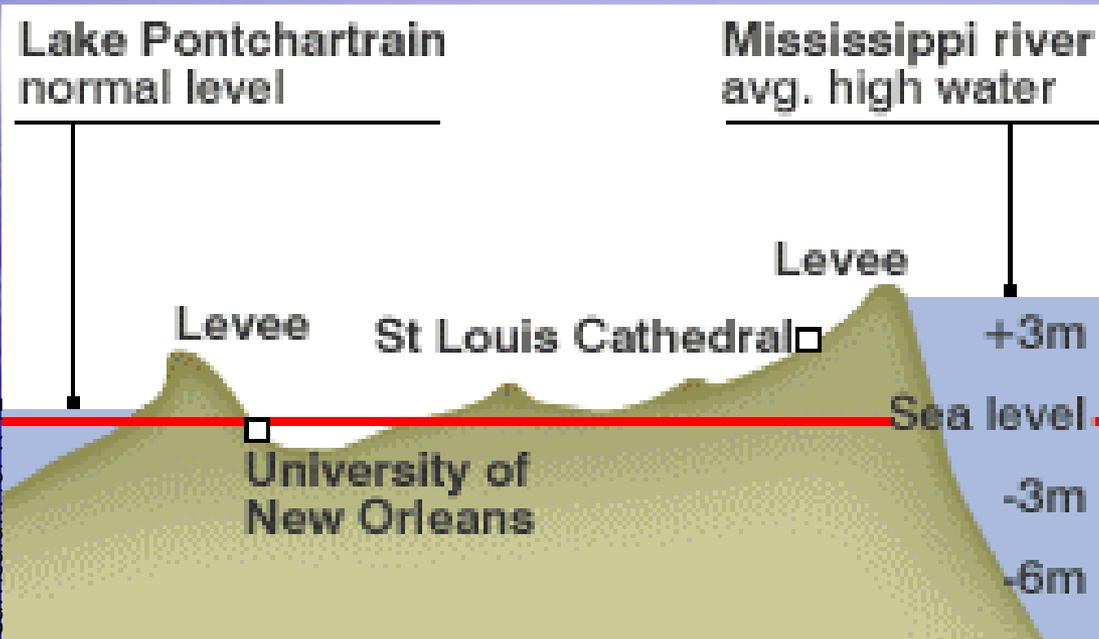


What happened in New Orleans?



Brief New Orleans history

- Founded in the 19th century
- Mississippi River seasonal flooding was always an issue, with additional occasional floods from the lake during severe storms.
- Levee construction began along the Mississippi soon after the city was founded.
- Small lake levees were built and then expanded in the 1920s as the land near the lake was developed.
- A pump and canal system was built to keep water out.



- New Orleans sits between Lake Pontchartrain and the Mississippi, below sea level.

As hurricane Katrina moved over land, the water it brought poured into the lake.

The levees could not hold back the water. They broke in three places, letting water pour into the city.

The lake is usually 1 foot above sea level, and it peaked at 8.6 feet above sea level.

Katrina's impact..

- At first, it seemed that N.O. had missed the brunt of the storm.
- Industrial Canal levee breach, major breaches at 17th and London Street levees.

In a portion of the city's 9th Ward, reported 3 pump failures.

A 200 ft. breach in the 17th Street Canal levee flooded the area under 25 ft. of water.

Smaller breaches and “overtoppings” throughout the city.



Researching what happened..

- Several groups of engineers and scientists have been researching exactly what happened in New Orleans — and why.
- Hurricane Katrina storm surges resulted in numerous breaches that flooded approximately 75% of the New Orleans metropolitan area.
- Evidence indicates that most of the levee and floodwall failures were caused by overtopping, however other factors were the reason for failure in the 17th Street Canal and London Avenue Canal breaches.

What happened, cont'd...

- Data suggests that structural failure due to seepage and piping and even weak soil layers within or under the earthen levees combined to contribute to the levees and walls to giving way against the shear force.
- Additionally, investigators have not ruled out other contributing factors, such as trees growing near the levees that may have undermined fills or weak soil layers.
- The wider debate still continues on with evidence that the sheet piles were not driven to sufficient depth, perhaps allowing entire sections of earthen levees with wall to shift.