Strategic Response to Catastrophic Flooding:

A Geologist's Recommendations for New Orleans Post-Hurricane Katrina

Geology 111

Jai Vang

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As a geologist and the Science Advisor to the President of the United States, I will provide a brief history of New Orleans's surrounding area and science-based recommendations for the long-term response the U.S. government should implement concerning the catastrophic flooding caused by Hurricane Katrina on August 30, 2005.

More than fifty percent of New Orleans is below sea level. Since the city was built over swamp land that was drained by pumps starting in the early 1900s, it has gradually sunk due to soil compaction in areas that were once filled with water (Campanella, The Atlantic, 2018). The removal of unwanted swamp water created air pockets in the soil, oxidizing the organic matter and causing further compaction as fine-textured particles settled into these cavities (Campanella, 2015). The soil beneath the city has subsided significantly below sea level, making it vulnerable to flooding from all three surrounding bodies of water. Most of the land surface is subsiding as the soft sediments beneath are compressed by overlying sediment (Mathewson, 2005).

New Orleans is situated between three large bodies of water: the Mississippi River, Lake Pontchartrain, and Lake Borgne. Its topography resembles a bowl, making it prone to water accumulation. Liquid flows easily into the inhabited areas, but removal requires pumps and other methods. The Mississippi River once replenished this region with sediments annually. However, once levees were constructed along the river to prevent flooding, these sediments were carried straight into the sea, starving the coastal area of fresh sediment necessary for reinforcing wetlands (Restore The Mississippi River Delta, n.d.). Replenishing these lost sediments will require a collaborative effort, which could be both time-consuming and expensive, whether on land or along the coast.

The first issue to address is the water contamination and pollution caused by the floodwaters. An estimated seven million gallons of oil spilled into the Gulf Coast waterways must be addressed immediately to prevent endangering marine life and posing hazards to humans (Sturgis, 2015). The streets and urban areas of New Orleans are filled with wastewater, considered extremely hazardous due to landfill and sewage flooding, as well as chemicals such as cleaning agents, paint, and bleach. The United States Environmental Protection Agency performed chemical sampling and discovered over one hundred pollutants (Singers, 2005). Removing the contaminated water will be challenging but necessary to ensure proper drainage and prevent long-term environmental impacts.

A permanent resolution to the flooding issue is complex. It is impractical to relocate the entire city or restore it to its original state. Journalist Campanella noted, “there is no true solution for soil subsidence; it is not feasible to ‘reinflate’ soils with water while urban life continues above” (Campanella, 2015). However, affordable and feasible solutions include rain gardens, bioswales, and permeable materials, which can reduce water flow into the streets and replenish groundwater lost due to ongoing pumping. Planting trees and vegetation that absorb large amounts of water, such as Red Maple, Weeping Willow, Ash, and Bald Cypress, can also help. These solutions can prevent rainwater runoff into roads or storm drains, reverting back to natural hydrological processes and using soil and plants to turn rainfall into a resource rather than waste (Denchak, 2019). The government should support these projects to increase ground stability and reduce subsidence.

During Hurricane Katrina, the barrier islands along the Louisiana coast changed drastically (Asbury Sallenger, n.d.). These islands serve as the first line of defense against hurricanes, protecting the mainland from powerful forces of wind, waves, tides, currents, and storms (Olsen, n.d.). Restoring these barrier islands is crucial as they help protect the coastline.

Restoring wetlands is equally important. Ongoing oil drilling and industrial activity had already damaged coastal wetlands before the storm, allowing Gulf saltwater intrusion, which killed soil-anchoring plants and trees, leading to land loss (Sturgis, 2015). Hurricane Katrina exacerbated this with its powerful winds and surge waves, causing significant damage to southern Louisiana's wetlands (Palaseanu-Lovejoy, 2013). Wetlands buffer against waves, slow them down before they reach property, and help drain floodwaters after a storm (Martin, 2020). Restoring these wetlands is vital for protecting the land.

Levees constructed to prevent surge waves from entering the city failed during the storm, causing flooding in eighty percent of New Orleans. Over fifty levees and flood walls collapsed (Wikipedia, n.d.). The Army Corps of Engineers stated that these levees were designed to withstand a Category 3 hurricane, but Hurricane Katrina was a Category 4 storm (Press, 2005). Poorly constructed levees contributed to the catastrophic flooding. Stronger, taller steel levees are needed to keep water from the Mississippi River, Lake Pontchartrain, and Lake Borgne out of the city. These levees will be the last defense against powerful storm surge waves.

Flooding in New Orleans is inevitable. Another storm like Hurricane Katrina could strike the city again, repeating similar catastrophic events. As most of the city is below sea level, residents should consider relocating to higher ground to avoid future fatalities. For those determined to remain, buildings should be elevated like coastal beach homes to reduce casualties in future storms. If mandated by the government, this could save many lives.

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