

Houston (United States) and Harvey - Boomtown, Flood Town (Full Text)

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HOUSTON — For the third time in eight years, water gushed into Virginia Hammond’s northwest Houston.

It was 2 a.m. on April 18. Over the next several hours, her two granddaughters — ages 12 and 15 — perched on tables, scared to put their feet in the dark gray floodwater rising below them. It nearly topped 3 feet.

“They couldn’t get in the beds because the beds were wet. They couldn’t go to the bathroom because the water was over the toilet bowl,” Hammond recalled.

“We were in there, well, trapped.”

The storm that pummeled Hammond’s modest brick home — nicknamed the “Tax Day” flood because it fell on the deadline to file federal income taxes — came just 11 months after another, on Memorial Day 2015, that also crippled the city. Together, the floods killed 16 people, inflicted well over \$1 billion in damage and provoked an unprecedented uproar from Houstonians, some of whom are now suing the city over chronic flooding problems. A month after the Tax Day flood, another mega-storm hit the city, dumping well over a foot of rain on parts of Harris County, home to Houston, in 24 hours.

The area’s history is punctuated by such major back-to-back storms, but many residents say they are becoming more frequent and severe, and scientists agree [\[1\]](#).

“More people die here than anywhere else from floods,” said Sam Brody, a Texas A&M University at Galveston researcher who specializes in natural hazards mitigation. “More property per capita is lost here. And the problem’s getting worse.”

Why?

Scientists, other experts and federal officials say Houston’s explosive growth is largely to blame. As millions have flocked to the metropolitan area in recent decades, local officials have largely snubbed stricter building regulations, allowing developers to pave over crucial acres of prairie land that once absorbed huge amounts of rainwater. That has led to an excess of floodwater during storms that chokes the city’s vast bayou network, drainage systems and two huge federally owned reservoirs, endangering many nearby homes — including Virginia Hammond’s.

On top of that, scientists say climate change is causing torrential rainfall to happen more often, meaning storms that used to be considered “once-in-a-lifetime” events are happening with greater frequency. Rare storms that have only a minuscule chance of occurring in any given year have repeatedly battered the city in the past 15 years. And a significant portion of buildings that flooded in the same time frame were not located in the “100-year” floodplain — the area considered to have a 1 percent chance of flooding in any given year — catching residents who are not required to carry flood insurance off guard.

Scientists say the Harris County Flood Control District, which manages thousands of miles of floodwater-evacuating bayous and helps enforce development rules, should focus more on preserving green space and managing growth. The City of Houston, too. And they say everyone should plan for more torrential rainfall because of the changing climate. (A host of cities in the U.S. and around the world are doing so.)

But county and city officials responsible for addressing flooding largely reject these arguments. Houston's two top flood control officials say their biggest challenge is not managing rapid growth but retrofitting outdated infrastructure. Current standards that govern how and where developers and residents can build are mostly sufficient, they say. And all the recent monster storms are freak occurrences — not harbingers of global warming or a sign of things to come.

The longtime head of the flood control district flat-out disagrees with scientific evidence that shows development is making flooding worse. Engineering projects can reverse the effects of land development and are doing so, Mike Talbott said in an interview with The Texas Tribune and ProPublica in late August before his retirement after 18 years heading the powerful agency. (His successor shares his views.)

The claim that “these magic sponges out in the prairie would have absorbed all that water is absurd,” Talbott said.

He also said the flood control district has no plans to study climate change or its impacts on Harris County, the third-most-populous county in the United States.

Of the astonishing frequency of huge floods the city has been getting, he said, “I don't think it's the new normal.” He also criticized scientists and conservationists for being “anti-development.”

“They have an agenda ... their agenda to protect the environment overrides common sense,” he said.

But Talbott acknowledged that projects in the works wouldn't come close to protecting against something like a Tax Day flood. Those include retrofitting old drainage, widening bayous and building more ponds to temporarily store floodwater.

Meanwhile, the city of Houston's “flood czar,” appointed after the Tax Day storm to assess the city's flooding problems, appears more receptive to alternative solutions, like more green space. But Stephen Costello, an engineer and former city councilman and mayoral candidate, has had no budget, staff or firm timeline. (He expects to hire one paid staffer in the coming weeks.)

He also acknowledges his role as more political than action-oriented. He spends much of his time consoling angry residents at community meetings and “making house calls.” And he is pursuing smaller, cheaper, quick-hit projects.

“I think what people are keenly interested in is making sure that there is a point person that they can direct their comments to,” said Houston's Mayor, Sylvester Turner, noting the city “has never had a chief resilience officer. That indicates in and of itself a major commitment.”

But residents who have flooded say they're looking for more than that.

Eight months after the Tax Day flood, Hammond's home is still in shambles, with almost no furniture, kitchen cabinets or place to cook. She wants someone to buy her out, but she's not optimistic.

“I'm too old to go through this again,” Hammond said. “It's very traumatizing.”

The New Normal

For Louise Hansen, the story has been the same every time she's flooded: The water starts to creep into her house in the middle of the night.

In 2009 — the first time her home flooded after she moved into it about a decade earlier — she figured it was an anomaly. Then it happened again in 2015. And again in 2016.

Three times in less than 10 years — for a home that's not in any floodplain identified by the Federal Emergency Management Agency.

"It's actually paralyzed me," said Hansen, who grew up in the area and is now selling her house just for the lot value. "I just don't think I can go through another flood."

Many of Hansen's neighbors, who live in an area of Houston known as Memorial City, have had the same experience. They've flooded in 2009, 2015 and 2016, and none of them live in any known floodplain. So they have formed a group called "Residents Against Flooding," and recently, the group sued the City of Houston and a local tax reinvestment zone this year, demanding better drainage.

What's happened in Memorial City is called "urban flooding." The phenomenon refers to flooding outside of any known floodplain — in this case, outside the 100-year floodplain, which triggers insurance requirements, or the 500-year floodplain, which has a 1 in 500 chance of flooding in any given year. Homeowners don't need insurance to get a mortgage in the 500-year floodplain, but many buy it anyway.

And it turns out that Houston has seen the most urban flooding of any other area in the country in the past four decades, according to recent analysis by Brody, the Texas A&M scientist.

Scientists say there are a number of likely culprits. Maps showing where the floodplains are may be outdated, for one thing, and the drainage in this older part of town was likely built before engineers understood the true risk of flooding in the area.

Then there are the reasons scientists fear local officials are ignoring.

For one, flood planning is still done by looking at what's happened in the past. But climate change means that might not work anymore.

"How do we determine where the 100-year flood zone lies? By looking backwards at rain events in the past," said Katharine Hayhoe, a climate scientist at Texas Tech University. "Looking backwards does not work so well if climate is changing."

In general, Hayhoe said, climate change takes the risks that people already face and makes them worse. That's particularly true for Houston because it sits so close to the Gulf of Mexico, where waters have been warming as the planet gets hotter.

Warm water means more evaporation and more water vapor in the air. So when a storm comes along, there's more water to pick up and dump on nearby land.

"The exact same storm that comes along today has more rain associated with it than it would have 50 or 100 years ago," Hayhoe said. "And that's a big part of what happened in Houston" on Tax Day.

There are many ways to measure the frequency of rare storms in an area. The Harris County Flood

Control District does so by tracking rainfall totals for the entire county within a 24-hour period. Based on that data, which dates back to 1989, the county has been hit with eight rare storms.

Five of those storms are considered to have a 1 in 100 chance of occurring each year, including the rains that hit in May of this year. Another three are considered to be even rarer, including the Tax Day storm in April of this year.

The flood control district could not provide data in time for this story on rainfall that occurred over a 12-hour period, rather than a 24-hour period. But it nevertheless confirmed that the number of rare storms would be higher. (Enough rain fell during the Memorial Day 2015 storm over 12 hours to classify it as a 100-year event.)

But Talbott doesn't think Houston's most recent back-to-back torrential floods are indicative of climate change, or that studying its potential impacts should be a priority for the Harris County Flood Control District.

"We've had heavy back-to-back rainfalls before," he said.

Of the low probability that two 100-year storms hit within weeks of each other, he said, "You can flip a coin and come up heads 10 times in a row." (The flood control district is partially funding a study that will help decide whether rainfall totals should change for what are considered to be rare storms.)

He also downplayed the human impact of the Tax Day storm, pointing out that no one drowned in their home — only in flooded underpasses they drove into — and that the resulting flood impacted a relatively small portion of the population.

"As bad as the April, the Tax Day flood, was this year, if you look at the number of people affected in Harris County, it's less than 1 percent of the population. Is the other 99 percent willing to pay for a much more robust system?" he said.

Scientists also worry that local officials are ignoring another crucial reason Houston is flooding more: what Hayhoe calls "the paving of Houston."

The region was once home to acres of prairie grass whose roots extended far underground, with a capacity to absorb water for days on end or even permanently. Most of that land has now been paved over. The Katy Prairie northwest of Houston was once about 600,000 acres of flood-absorbing land; recent development has reduced it to a quarter of that capacity, according to estimates from the Katy Prairie Conservancy, an advocacy group.

That means the rain is now falling on what are called impervious or impermeable surfaces, like concrete, preventing the ground underneath from absorbing it. So the rainfall becomes "runoff," traveling to wherever is easiest for it to flow. The water might flow to a nearby stream, but on its way the water could flood homes, cars and businesses, or the stream might be overwhelmed by that water, causing more flooding nearby.

In Harris County alone, research by Texas A&M scientist John Jacob shows, almost 30 percent of freshwater wetlands were lost between 1992 and 2010, a figure he calls "unconscionable."

As wetlands have been lost, the amount of impervious surface in Harris County increased by 25 percent from 1996 to 2011

<https://urbanedge.blogs.rice.edu/2016/11/30/in-houston-constant-flooding-will-be-the-new-normal-expert-says/#.WaXoXa3pNBw>, Brody said. And there's no way that engineering projects or flood

control regulations have made up for that change, he said.

Between 2001 and 2005, his research found, the loss of flood-absorbing land along the Gulf of Mexico increased property damage from floods by about \$6 million — much of that outside floodplains.

“There’s no doubt that the development ... that we’re putting in these flood-prone areas is exacerbating flooding over time,” Brody said. “There’s a huge body of research out there beyond Houston, across the world” supporting that argument.

Research [2] by Talbott’s own Harris County Flood Control District points to the effectiveness of prairie grass to absorb floodwater. “The restoration of one acre of prairie,” a 2015 report by the district wrote, would offset the extra volume of runoff created by two acres of single-family homes or one acre of commercial property. (The district says that data is preliminary.)

But Talbott and his successor, Russ Poppe, don’t buy the research.

Developers have to follow regulations that should reverse the effects of paving over wetlands, they both argued. That includes building what are called detention ponds, which can temporarily store rainwater when it falls on pavement and isn’t absorbed into the ground.

These regulations first went into effect in the mid-1980s. Talbott and Poppe claim that all development since then has not contributed to any additional flooding.

Both insisted the rules are so effective that an acre of commercial strip mall would discharge stormwater at the same rate as an acre covered in prairie grass — though not for events rarer than a 100-year storm. They pointed to a 2011 study commissioned by the flood control district as evidence.

But scientists vehemently disagree with those claims. They say the restrictions are inadequate — and loosely enforced — and could worsen the situation for people like Louise Hansen and her neighbors.

When developments in floodplains are elevated, they can end up redirecting floodwaters to a nearby neighborhood, causing flooding where it otherwise might not have happened, in areas far outside floodplains. The phenomenon has been acknowledged by FEMA, but it’s never been fully studied.

Brody said he couldn’t be sure that’s what’s happening to Hansen, but a graduate student of his, Kayode Atoba, is researching that very question right now. And Hansen’s story is a familiar one.

“I can’t tell you how many times I’ve gotten people calling me saying: ‘I’ve never flooded before, I’ve been here for 30 years, I’m not in a floodplain,’” Brody said. “And every single time, there’s a development nearby that’s changed drainage ... that story is told every day tens of thousands of times across the country.”

Talbott disagreed that elevating buildings could be causing others to flood, and in general, he dismissed what Brody and other scientists had to say about what is causing Houston’s flooding problems.

“You need to find some better experts,” he said. When asked for names, he would only say, “starting here, with me.”

Not a single scientist or expert of a dozen interviewed by The Texas Tribune and ProPublica shared his view on such matters.

"I don't agree with Mr. Talbott at all," said Phil Bedient, a Rice University scientist. "That is an astounding statement. I don't agree with it, and there are a lot of other people that don't either."

Hansen, the Memorial City resident, rejects the idea that local officials can't do anything to help her situation.

"I have learned that it's government, and things take a very, very long time to get anything done. But you have to keep fighting," she said.

Rapid growth, "sitting ducks"

Stacey Summers and her husband sat on their bed with their two small dogs, gazing out the window in shock at snakes swimming by in the rising floodwaters. During the Tax Day flood, the water rushed into their one-story brick house in the northwest Houston suburb of Cypress, in a matter of hours, topping out at nearly a foot.

"It's unimaginable still," said Summers, who evacuated her neighborhood in a canoe, as did many of her neighbors. The creek near her upscale subdivision known as Stable Gate overflowed, flooding almost all of the 250 homes in the neighborhood.

It was the first time the 15-year-old development had flooded. But scientists point to the area as one where development has run amok in recent years, putting more people and property in harm's way.

"Those people up there are sitting ducks," said Bedient, the Rice University scientist.

Because all the water in the area drains into Cypress Creek, it's called the Cypress Creek watershed. In the 1990s, as the population in the watershed grew by 35 percent, two major floods hit the area — both considered "500-year" events, which should have just a 1 in 500 chance of occurring in any given year.

The back-to-back floods spurred a rowdy, beer-fueled gathering at a local Veterans of Foreign Wars hall in 1998 and, soon after, the formation of the Cypress Creek Flood Control Coalition. The hope was to curb further development, or encourage more responsible development, to help prevent flooding.

But little changed, even after another major storm crippled Cypress and the Houston region just three years later — one that scientists say should have served as a wake-up call.

In June 2001, Tropical Storm Allison dumped almost 40 inches of rain on the city in five days, flooding 73,000 residences and 95,000 vehicles. Twenty-two people died, and damage from the storm was more than \$5 billion in Harris County. It likely is the worst rainstorm to ever befall an American city in modern history, according to the flood control district.

Allison was a shock not just because of the extent of flooding but also where it occurred — almost half of the buildings that flooded were outside floodplains designated by FEMA.

The tragedy prompted FEMA and the flood control district to redraw floodplain maps, which expanded as much as 20 percent in some areas. And in conjunction with the city, the district spent hundreds of millions of dollars to improve drainage, widen bayous and build detention ponds to temporarily hold floodwater.

But when local politicians tried to change policies over development, they were met with stiff resistance from developers and residents.

The city did pursue a law banning new development or major renovations of existing buildings in areas called floodways — the most vulnerable parts of the 100-year floodplain that are closest to the bayous. That prompted multiple lawsuits, and the law was ultimately severely weakened by the city council two years later.

Still, said Bill White, who was mayor at the time, “It was the most aggressive action that had ever been taken” against such development.

When White’s successor, Annise Parker, tried to impose a fee on city residents to pay for drainage improvements, lawsuits followed, too. The proposed fee remains in limbo.

The county’s development regulations are superior to the city’s and have been strengthened over time, said Steve Radack, a longtime Harris County Commissioner who represents the Cypress area.

But they have to be economically reasonable, he said. If the rules are too strict, developers will say “fine, to heck with Harris County. We’ll go build in Fort Bend,” the county directly west of Harris County, or wherever else, he said.

In fact, Fort Bend County has stricter regulations for developing in the floodplain — and it’s growing faster than Harris County.

Developers there must incorporate more green space or detention ponds than in Harris County. That’s because Fort Bend requires them to hold excess floodwater on their properties for longer and discharge it at one-tenth of the rate in Harris County.

“They still have lots of development, it’s just that they know how to do it,” said Phil Bedient of Rice University, who helped develop Fort Bend County’s rules.

Harris County has never prioritized green space, he said, and is now paying the price.

“Mother Nature is wreaking her fury on the county and sending some fairly strong signals that some things need to change.”

Bedient and other experts also say they wish Harris County had been able to buy out more homes that have been badly damaged by floods or that are known to flood repeatedly. Since Allison, the flood control district has purchased about 2,400 such properties, mostly with federal money, and after the Tax Day flood, the district allocated \$15 million of local money for more buyouts. A recent study by the agency has identified 3,300 homes that are still at high risk of flooding and should be bought.

The properties that were acquired “will never flood again – the only properties for which we can make such a guarantee,” according to the flood control district website. “Unfortunately, there still remain over 140,000 single-home residential parcels identified within the regulated floodplains.”

Scientists and experts say communities need to move away from developing in the 100-year floodplain, or at least make the rules for doing so far more stringent. But after Allison, the pace of development in and near floodplains in the Houston area only seemed to accelerate — especially in the Cypress Creek area, where there was still plenty of cheap pastureland.

The same year Allison occurred, Stacey Summers’ neighborhood was built. And over the next decade, the Cypress Creek area grew even faster than it had in the previous one.

Between 2000 and 2010, it grew by nearly 70 percent to a population of 587,142 — equivalent to

that of Milwaukee. In that same time period, according to a Tribune/ProPublica analysis, the percentage of developed land there jumped from 23 percent to 33 percent.

Stable Gate was one of many neighborhoods built in the area after Allison. It wasn't in a floodplain when it was built in 2001, but new flood maps that took effect six years later placed a large swath of the subdivision in the 100-year floodplain, triggering flood insurance requirements for many residents. Parts of the neighborhood were also placed in a newly expanded 500-year floodplain — an area with a smaller but still notable chance of flooding each year.

Summers' home ended up in a 500-year floodplain after the new maps took effect. She doesn't need to buy flood insurance, but she still carries it for about \$400 a year.

Greg Bowen, president of the Stable Gate Homeowners Association, said the neighborhood "was built on the best data they had at the time."

But even with the new flood maps, development has continued in the 100-year floodplains. Since 2010, more than 7,000 residential buildings have been built in these risky areas in Harris County, according to a Tribune/ProPublica analysis of local appraisal data, along with more than 1,600 nonresidential buildings.

Bowen said the county and developers are not installing enough flood control measures or ensuring developers follow the rules for building in a floodplain.

"The bottom line is there needs to be more done to keep up with the growth out in Cypress," he said.

Frank Espinoza recently built 12 homes in the 100-year floodplain along Little Cypress Creek, just a few miles from Stable Gate. Three of them flooded on Tax Day, costing him tens of thousands of dollars to repair.

The longtime Houston-area homebuilder finished them anyway, and even though he doesn't have to tell buyers, he said he will to avoid lawsuits. But he doesn't think the homes will flood again.

"I just think it was a freak of nature," Espinoza said, noting the elevations of many of the homes that didn't flood are actually lower than the ones that did.

Growth in Cypress and other Houston-area suburbs has been so substantial that the state plans to build a third highway loop around the city. When it's completed in 2021, the Grand Parkway will be large enough to fit the state of Rhode Island inside of it.

The highway will cut down on commute times, but critics — including the environmental group Sierra Club, which sued to try to stop its construction — say it will encourage even more suburban sprawl and wetland loss and worsen flooding problems.

That new development will not only make Cypress more vulnerable, but it also will impact flooding problems downstream, scientists say. That's because there is less green space to absorb rainfall, causing more — and faster — runoff into Cypress Creek, which spills into several streams that flow southeast toward downtown Houston and the coast.

Dick Smith, co-founder and longtime president of the Cypress Creek Flood Control Coalition, said his group has worked for more than a decade to encourage the county to plan for the impact of new growth. He said he'd like to see it act more like Fort Bend County.

But the flood control district has "stiff-armed" them multiple times, he said.

They'll never be able to totally prevent flooding, Smith said, but "they could do a hell of a lot better job than they're doing."

Smith's home first flooded in 1994, and has since flooded four more times. Tax Day was the worst, he said, when 35 inches of water accumulated on his ground floor.

At the raucous 1998 VFW meeting that inspired Smith and his neighbors to form the coalition, he recalled someone demanding they put the local county commissioner's "ass in a boat" to tour the extensive damage.

Nearly 20 years later, that county commissioner — Radack — is still fielding angry feedback from residents.

At an August town hall, Radack told more than 300 seething attendees packed into a church auditorium that they were part of the problem. He said it all came down to paying for flood control projects and said he would vote for a tax increase to do so.

"This is what this is all about," he said, repeatedly. "Government — it takes money."

But residents urged Radack to support stricter development criteria and enforce the existing rules. They also repeatedly said the county should somehow curb growth outright.

"Just stop building," one woman yelled, inciting cheers.

"A whole lot of you people live in subdivisions that in many people's opinion should have never been built," Radack responded. "But people have a right to development. They own the land, if they follow the rules."

"But they're not," several people in the crowd shouted in unison.

Asked about such sentiments, Talbott said resident expectations are too high.

"I've heard the members of the public say they never want their streets to flood, and they don't want their houses to flood," he said. "That's just unrealistic."

The reservoir predicament

If development in the Cypress Creek area grew after Tropical Storm Allison, it grew even more quickly in the area around Addicks Reservoir — one of two massive World War II-era detention basins meant to protect central Houston from catastrophic flooding.

In 2001, 28 percent of the land in the Addicks watershed was developed. By 2010, it was 41 percent. And Virginia Hammond's home is perched on the northern edge of the reservoir.

The U.S. Army Corps of Engineers built Addicks and its counterpart, Barker Reservoir, in the 1940s after back-to-back mega storms put downtown Houston underwater.

At the time, the Army Corps had a singular mission: to protect Houston, which was then some 15 miles away from the reservoirs. But 70 years later, achieving that goal has become more difficult as Houston's suburban sprawl has encroached on them.

During heavy rainfall, the Corps shutters conduits on the reservoir's tall, earthen dams to keep a torrent of water from rushing down down Buffalo Bayou — a narrow, winding waterway that passes through downtown on its way to the coast.

The reservoirs are dry most of the time, covered in woods and parkland. But Army Corps officials say the amount of water that accumulates in the reservoirs during big storms has increased substantially in recent decades, and takes longer to drain out. That's because much of the open space around them has been covered with non-absorbent concrete.

When those pools get too large, the Army Corps is forced into a precarious balancing act where it has to keep just enough water inside the reservoirs to protect areas downstream while also releasing enough water so that surrounding neighborhoods, including Hammond's subdivision, aren't flooded.

"We're between a rock and a hard place," said Richard K. Long, who helps oversee the day-to-day operation of Addicks and Barker for the Corps.

In an ideal world, neighborhoods like Hammond's wouldn't exist, he acknowledged.

Hammond's neighbor, retired engineer Ali Aumir, whose home also has flooded three times, agrees: "This whole area should never have been built."

Long said there was no way the Corps — or anyone — could've predicted 70 years ago the kind of growth the Houston area has seen. If it had, he says the Corps probably would've done things differently — bought up more land around the reservoirs, for example, or at least acquired easements allowing the agency to flood it when necessary. (The Corps has such legal agreements for most of its reservoirs.)

The agency has little to no control over development, though. Long says its hands were tied by local politicians and other factors, including the whims of various presidents and congresses with differing views on how much land the government should own and who controls the Army Corps budget.

"Today if we were starting over again knowing what has happened, would our battle lines be a little different? Yeah, our battle lines would definitely be different. But we don't have that pleasure of doing that," Long said.

After the Tax Day storm, the amount of water that accumulated in Addicks and Barker reached record highs, forcing the Army Corps to release more water from the reservoirs than normal. That resulted in flooding of areas both downstream and upstream of the reservoirs, including a subdivision called Bear Creek Village just south of Hammond's.

That area flooded twice. The first time, it flooded because rainwater overwhelmed drainage systems and streams. The second time, the Corps had closed the dams in Addicks reservoir, causing the stored water to back up into neighborhood streets.

It's lucky homes didn't flood the second time around, Long said. If the rain had fallen closer to the reservoirs, the situation would have been much worse.

Of the 10 largest pools that have accumulated in the reservoirs, nine have occurred since 1990 and six of those were since 2000. Long says that's directly correlated with all the new growth and development.

On top of the balancing act triggered by major storms, the extra water that's accumulated in the reservoirs has strained their earthen dams, which have been considered in critical condition for seven years in large part because of what would happen if they failed. The Army Corps says they are nowhere close to failure but estimates damage of about \$60 billion if a breach were to occur. More than 1 million residents downstream from them would be impacted.

The more immediate risk, though, is to nearby residents like Hammond who may be flooded during the next big storm. Such neighborhoods are not just at increased risk; Long said they also are adding to the problem because their drainage systems are sending more water into the reservoirs.

Development in the Cypress area upstream from the reservoirs is also making things worse.

It has led to increased runoff into Cypress Creek during major storms, causing it to escape its banks and spill into four other streams on the south side of State Highway 290, in a completely different watershed. The phenomenon has been called “the overflow problem.”

Original plans for the Addicks and Barker reservoirs included a levee that would’ve prevented the overflow problem and a canal that would have evacuated more water out of the reservoirs. Those components were dropped due to some combination of time and money, Long said — decisions that would come back to haunt the Army Corps decades later.

The flood control district has said it will split the \$3 million cost to study the impact of development on the reservoirs with the Corps, but Congress hasn’t yet authorized the funding. Any study will only mark the beginning of what could be a long and expensive process; more studies are likely to be needed, Long said.

In the meantime, the flood control district is taking steps to protect Addicks and Barker from the effects of future growth. This year, it strengthened rules for new developments around the two reservoirs and in parts of the Cypress Creek watershed. Developers in those areas must now account for not only the rate at which water leaves their lots but also the volume that ends up draining into the reservoirs.

It’s a step in the right direction, Rice University’s Bedient said, but also “a day late and a dollar short” with the area around the reservoirs already so densely developed.

The flood control district also is looking at building another large reservoir to ease the stress on Addicks and Barker. But the agency hasn’t officially proposed the project and has no timeline for doing so, district engineer Dena Green said. That’s in part because of how expensive it will be [3], she said.

Bedient said the additional reservoir “is absolutely a critical necessity” if the county wants to avoid another scenario like the Tax Day flood.

“They have no choice,” he said. “If they don’t do that, we’re going to get another one of these, you know, maybe not in five years but ... within the next decade. It’s just absurd.”

Longtime problem, little progress

Houston has been trying to solve its flooding woes since at least 1937, when a letter penned by local officials to state lawmakers pleaded for help and declared Texas’ largest city “at the mercy of the relentless water [4].”

Two horrible storms had struck the city in the previous eight years. Flooding, officials wrote, was a “constant menace” — endangering thousands of human lives and “millions of dollars in private, municipal and other governmental capital investments” and potentially causing “the distress of all of the peoples of Texas.”

After nearly eight decades of massive engineering projects, incredible technological advances and a flurry of regulations for flood control, that letter still rings true. But now millions of lives and billions

of dollars are at stake.

Why has so little changed after so long?

It's true that Houston is naturally prone to flooding. The "Bayou City" is incredibly flat and near a coast along a warming ocean. And much of it was built before people knew what they know now about drainage and floodplain regulation.

But scientists say the fundamental problem is that Houstonians have assumed they can simply engineer their way out of flooding.

Indeed, Talbott insists that the only solution to Houston's flooding woes is to continue widening thousands of miles of bayous across the region so they can carry more rainwater into the Gulf of Mexico. At a cost of \$25 billion, with a current spending rate of \$80 million a year, that will take 400 years, he said — and Congress has been unwilling to provide any extra funds to speed up the process.

Even then, the widening projects would only ensure that the area's bayous can handle 100-year events — nothing like a Tax Day flood, which Talbott said it is impossible to plan for or prevent.

Experts say that is a sorely misguided view.

"I reject that somebody with the sophisticated resources like Houston couldn't do something," said Chad Berginnis, executive director of the Association of State Floodplain Managers.

Berginnis and other experts say Houston-area officials could work to preserve green space; strengthen regulation on development; plan for a changing climate; and work harder to remove the 140,000 homes that remain in the 100-year floodplain.

Other cities are trying those approaches. The Milwaukee Metropolitan Sewerage District, Berginnis pointed out, plans to eventually get rid of all habitable buildings in the 100-year floodplain. And many cities are also realizing they must prepare for more severe rainfall.

In Florida, the City of Fort Lauderdale's recent vision plan includes an entire chapter on climate change preparedness and resiliency. And Broward County, where Fort Lauderdale is located, strictly regulates development in areas that are pegged to be at or below sea level in the future, said Nancy Gassman, the city's assistant public works director for sustainability.

After Boulder, Colorado experienced horrible flooding in 2013, the city is working to redesign infrastructure with "permeable surfaces" — surfaces that can absorb some floodwater, as opposed to concrete — and leaving more open space. The idea is to do so not just with a "100-year flood" in mind, but a more rare flood, such as what happened three years ago.

"We don't see an event around Boulder in the last thousand years that was as crazy as that one. So yes, freak event," said Hayhoe, the Texas Tech climate scientist. "Is Boulder preparing? They're still preparing because they know in a warmer world, the chance of heavier rainfall is greater."

Costello, Houston's flood czar, said he is aiming to secure about \$10 million in the next city budget to create a "response team" that would carry out smaller, quick-hit flooding projects. The city also secured a \$250,000 state grant in August to improve its early warning system.

But the region has many other competing priorities.

"Are we doing everything we can?" said Radack, the Harris County commissioner. "No, we're not doing everything we can because we still have to pay hundreds of millions of dollars for the hospital district. We still have to build roads. We certainly want to have parks."

He also indicated there was little chance that the city or county would be able to implement stricter regulations on development in floodplains, even though the neighboring county, Fort Bend, has been able to do so.

Not only are the rules lax, critics say, but also local officials don't always enforce them. Costello, Houston's flood czar, agrees.

"Some of the residents are saying that we don't have the resources to go out and police what has been done," he said of irresponsible development. "If you drive around parts of the city, you'll get confirmation of that. ... This is a very big city, and we have limited resources."

(The flood control district said it has plenty of resources to police development in Harris County, though experts and residents strongly disagree.)

And the Army Corps of Engineers, which regulates development in coastal wetlands, only has about 10 people in charge of making sure the rules are followed for all of Texas and Louisiana.

"Our budget is fixed by Congress, and it's been flatlined for three or five years," said Kimberly Baggette, chief of the regulatory division at the Army Corps' Galveston District. (Whether that will change under the new president remains to be seen.)

Texas Congressman John Culberson insisted that the agencies in charge of dealing with flooding in his district have always gotten the money they asked for. The Houston Republican also said the planned third reservoir would help the city prepare for a bigger flood event.

But he believes the Texas Legislature will have to fund such a project, which the flood control district estimated last year would cost hundreds of millions of dollars. Meanwhile, the district has said there is not even a timeline to recommend where exactly to build the additional reservoir or how to fund it.

Aside from the distant reservoir plans, it remains unclear whether many Houstonians realize that nothing is being done to address floods like the one that happened on Tax Day. Democratic Congressman Al Green said he was counting on his colleagues in the U.S. House of Representatives to fund some key bayou-widening projects in the coming months — though he understands they only aim to protect against much smaller events.

"I'm going to maintain a level of optimism," he said. "We should not have another catastrophic event and then bemoan the fact that we didn't do what we could have and should have done, so that's an argument that I make."

At a community clubhouse meeting in Houston this summer, Costello assured the people in attendance that the city was doing everything it could to address recent flooding issues. The meeting was organized by Residents Against Flooding, the group suing the city in hopes of getting certain flood protection projects built.

Asked in an interview the next day if the city could feasibly protect against recent floods, Costello said, "No."

"I don't think they were following me as well as I hoped," he said, adding that once the group gets

the project they're pushing for in the lawsuit, "There's still going to be areas that are flood prone and it's still going to exist there."

"I don't think they realize that."

This story was written and reported by **Neena Satija** of **The Texas Tribune** and **Reveal and Kiah Collier** of *The Texas Tribune*. Data reporting, maps and design by Al Shaw of ProPublica.

P.S.

* THE TEXAS TRIBUNE AND PROPUBLICA DEC. 6, 2016 9 PM:

<https://www.texastribune.org/2016/12/06/houston-flooding-boomtown-flood-town-plain-text/>

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Footnotes

[1] <https://weather.com/storms/severe/news/houston-flood-history-april2016>

[2] https://www.hcfcd.org/media/1805/cypresscreekeoverflowreport_fin.pdf

[3] https://www.hcfcd.org/media/1805/cypresscreekeoverflowreport_fin.pdf

[4] https://www.hcfcd.org/media/1345/wildriver1937_hcfcd_created.pdf