Upstream Watersheds' Relative Contributions to Lake Houston Area Flooding

What are upstream watersheds' relative contributions to Lake Houston Area flooding? During a flood, where does all the water come from? Of course, it depends on how much rain falls where and when, and how long it takes to concentrate downstream. Rainfall is rarely uniform across an entire region.

But still, when considering hundreds of events over time, variations tend to average out. So, considering a hypothetical scenario that assumes a uniform distribution of rain can yield useful insights for planning flood-mitigation and conservation efforts.

Revisiting the January Flood

During late January 2024, the north and west Houston areas experienced widespread flooding. Even though most of the rain didn't fall around Lake Houston, excess stormwater worked its way downstream over several days and wound up flooding the area. This caused widespread confusion.

During the event, many people put all the blame for downstream flooding on the 19,500 cubic-foot-per-second release from Lake Conroe. However, river gages showed upstream flooding in other watersheds as well. They included Lake Creek, Cypress Creek, Spring Creek and the West Fork below Lake Conroe.

Rainfall is rarely uniformly distributed across a region as large as Houston. But it's not just how much falls where. The size of a watershed and how it converges with others also affect downstream flooding.

Hypothetical Uniformly Distributed 100-Year Rainfall

That prompted an interesting question that I asked Jeff Lindner, Harris County's meteorologist.

Given uniform rainfall throughout the region, how much would each upstream watershed contribute to Lake Houston Area flooding during a 100-year rain?

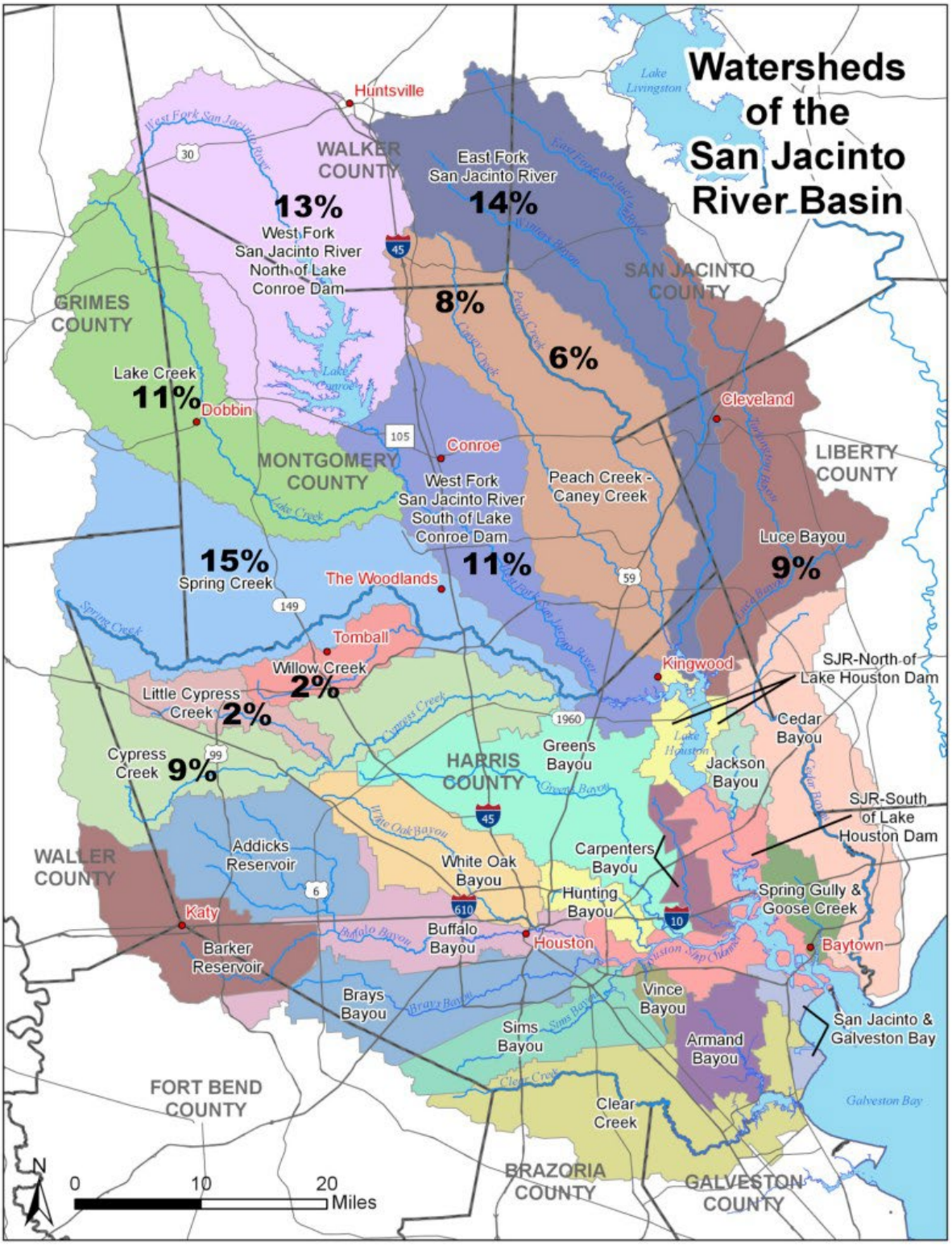
Lindner worked with engineers at the San Jacinto River Authority (SJRA) to calculate the volumes below. Eleven different watersheds from seven counties feed into Lake Houston.

The table below summarizes their size in square miles, calculates the acre-feet of runoff in a 100-year event, and then determines each watershed's percentage of the total passing through Lake Houston.

100-year Total Runoff Volume			
	Area	Volume	
Watershed	sq. mi.	acre-feet	Percentage
Lake Conroe	**445**	**252,000**	**13%**
Lake Creek	331	214,000	11%
Caney	**218**	**156,000**	**8%**
Peach Creek	159	118,000	6%
East Fork	**413**	**269,000**	**14%**
West Fork	293	221,000	11%
Spring Creek	**366**	**289,000**	**15%**
Cypress	267	183,000	9%
Luce Bayou	**220**	**184,000**	**9%**
Willow Creek	56	43,000	2%
Little Cypress	**52**	**33,000**	**2%**
Total Volume		**1,962,000**	

Upstream.watersheds".relative.contributions. to.Lake.Houston.Area.flooding¡ Assumes.uniform.distribution.of.rainfall.throughout.region¡

The map below shows the location of each of the eleven contributing watersheds with the percentages above superimposed.



Map.courtesy.of.SJRA¡.Percentages.courtesy.of.Jeff.Lindner.and.SJRA¡.Only.watersheds.draining.through.Lake.Houston.were.considered.for.this.exercise¡

Observations

What can we conclude from these numbers? If rainfall is evenly distributed across the region:

- Lake Conroe releases aren't the only thing contributing to Lake Houston Area floods. SJRA controls only 13% of the runoff. That's because the Lake Conroe Dam is the only dam in the eleven watersheds draining into Lake Houston.
- Watersheds vary radically in their size – 7.5X. So we need to be careful when generalizing about the contribution of different areas to flooding.
- 37% of the runoff coming into Lake Houston comes via the East Fork San Jacinto and its sub-watersheds.
- 63% comes under the I-69 bridge into the West Fork between Humble and Kingwood.
- 35% of the region's drainage comes down the West Fork and passes through an area between I-45 and I-69 with 20 square miles of sand mines.
- In total, almost 2 million acre feet will drain into Lake Houston during a 100-year rain.

The implications of that last fact for flood mitigation are enormous.

The total volume of water during a 1% (100-year) storm reaching Lake Houston would fill Lake Conroe 4.75 times.

One hydrologist I consulted for this post said, "I don't know the exact amount of detention storage needed to significantly reduce flooding risks in Kingwood, but it will probably be at least another Lake Conroe's worth of storage. That may help drive home the challenge facing HCFCD, SJRA, COH, and Montgomery County."

And the money to accomplish that will likely take State and Federal backing.

Reviewing watersheds' relative contributions to Lake Houston Area flooding may also be helpful in:

- Visualizing where water comes from in a flood.
- Determining the optimal locations for potential, regional, stormwater-detention basins/dams, such as those proposed along tributaries of Spring Creek.
- Focusing conservation efforts, such as the Bayou Land Conservancy's recent dedication of a preserve along Lake Creek.
- Controlling sedimentation, i.e., planning for the retirement of West Fork sand mines, which have become leaky sieves.
- Sand-trap placement.

As always, nothing clears brain fog faster than clean data, well summarized and presented. My thanks to Jeff Lindner and the SJRA for their help with this post.

Posted.by.Bob.Rehak.on.9~~-76-8~~❸

89❹❶.Days.since.Hurricane.Harvey