Update on Rainfall and River Flow

By: Jace A. Houston, General Manager

Working in the water business often feels like a roller coaster ride between too much and too little. May has been one of those months of "too much," although after the drought years our area has suffered through, I'm not complaining. The purpose of this article is to share with readers a few facts and figures about our recent rainfall events. The data below is compiled from a number of published sources, including SJRA's own weather gauges and our good friend and talented meteorologist with the Harris County Flood Control District, Jeffery Lindner.

May was an extraordinarily wet month across our region. Rainfall for the first half of the month at various gauges has ranged from 90 percent to nearly 600 percent of normal. The following list shows the rainfall total for May 1 through May 16 at each location (along with the amount above normal for that location):

- BUSH IAH: 3.16 inches (+.52 inches)
- College Station: 4.48 (+2.29)
- Hobby: 5.98 (+3.71)
- Conroe: 7.43 (+4.93)
- Sugar Land: 5.33 (+2.86)
- Corpus Christi: 8.12 (+6.62)
- Victoria: 3.60 (+.60)
- Austin: 4.96 (+3.59)

The rainfall totals for our area since January 1 show that we have been running slightly above normal through April 30, and then well above normal for May. In fact, this spring is the first time since 2012 in which our rainfall for the first four months of the year has been above average. The list below shows how much rainfall totals have varied from average at each of the following locations:

- Huntsville: +13.88 inches
- League City: +13.31
- Hobby: +10.46
- Angleton: +10.39
- College Station: +8.36
- Conroe: +4.11
- Tomball: +4.77
- Sugar Land: +8.71
- BUSH IAH: +3.61
- Corpus Christi: +15.42
- Victoria:+9.64

Lake Conroe Data

Turning to our own backyard, the following figures show some of the key data points that are measured and tracked by our operators here at the dam. The graphs show rainfall, lake level, and storm water releases for each day since January 1.

Figure 1. Daily rainfall totals from January 1 to May 18 measured at Lake Conroe dam.

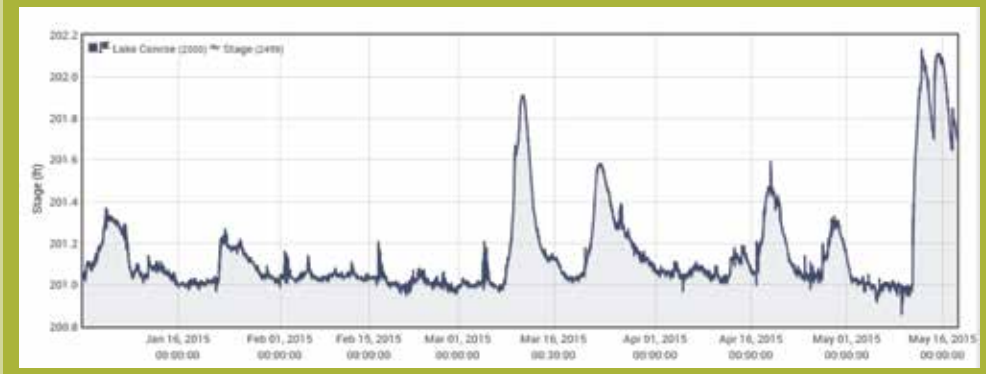

Figure 2. Daily lake level reading from January 1 to May 18. The lake's normal "full pool" level is 201' above mean sea level (MSL).

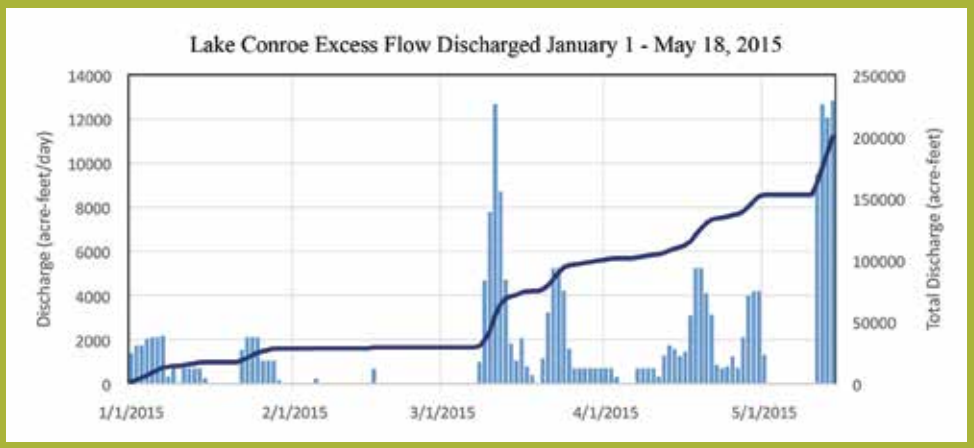

Figure 3. Daily release totals from Lake Conroe dam from January 1 to May 18. The instantaneous release rate is reported on SJRA's website in cubic feet per second, but the daily total is reported in acre-feet, which is one acre of water one foot deep or 325,851 gallons. The total amount of storm water released year-to-date is 238,432 acre-feet, which is approximately 10 times the amount that will be used each year in Phase 1 for drinking water purposes.

Of course, lake levels have responded positively to the widespread rains in our area, but when you look statewide, not all areas have received above-average rainfall. Statewide reservoir storage is at its highest level since 2012, but as the following list shows, many reservoirs still have a long way to go:

- Buchanan: -29.05 feet (39% capacity)
- Conroe: +.68 (100%)
- Houston: +1.75 (100%)
- EV Spence: -70.58 (2.9%)
- Georgetown: -10.50 (67%)
- Sam Rayburn: +3.94 (100%)
- Somerville: +8.80 (100%)
- Livingston: +1.51 (100%)
- Texanna: 0.00 (100%)
- Travis: -49.26 (39%)
- Canyon: -7.81 (84%)

Lake Travis reached a low of -58.95 feet (31% capacity) around the middle of November 2014 and has since risen 9.70 feet. But even with the recent rainfall in large areas of the state, the amount of inflow into the Highland Lakes on the middle Colorado basin continues to be staggeringly low. From January 1 to April 30, the inflow to Lake Travis has been 70,974 acre-feet (339,651 acre-feet is average for this period), which is why Lake Travis remains so low. The inflows for April were only 22 percent of normal. The hydrologic drought in this portion of the state has been the worst since the 1930's, and recent heavy rains have largely missed this area resulting in little drought recovery.

Gate Operations and River Flow Data

During large storm events like we experienced in May, we receive numerous questions about the policies and procedures that govern how high the lake is allowed to rise and how much water is released down the river.

The operating protocols for major reservoirs are created based on balancing a number of factors, and because no computer program or simulation is perfect, operator judgment is still a part of the decision matrix. Numerous factors are considered in the protocol, including rate and amount of precipitation, rate and amount of inflows from surrounding streams, upstream and

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Figure 4. This photo shows the top of one of the main spillway gates at the Lake Conroe dam. At normal pool level of 201' MSL, there is approximately 18 inches of "freeboard" above the water line.

Figure 5. Back side of the main spillway gates showing storm water being released. Photo courtesy of Firefly UAV Services, LLC – www.fireflyuav.com.

downstream weather forecasts, upstream lake level, downstream river levels, projected stream flows in surrounding basins, and the safe operating range of the spillway gates. Safety is always the first concern – both the safety of the structure and the safety of residents upstream and downstream of the dam.

There are a few key points to remember when it comes to operation of the spillway gates at the Lake Conroe dam:

• Reservoir operators must always be prepared to deal with extreme rainfall events. A "flowage easement" was purchased before construction of the dam for all property around Lake Conroe, which allows floodwaters to be stored up to elevation 207' above mean sea level (MSL). The temporary storage capacity created by this easement is necessary to reduce the flow at the dam in a "probable maximum flood" or PMF event to a rate that can be safely passed through the dam's spillway structure. All large dams in Texas must be designed to safely pass the PMF; therefore, gate operation protocols strike a balance between utilizing storage in the reservoir to the extent possible while ensuring the ability to pass a sudden, heavy rainfall that causes a rapid increase in lake level. However, Lake Conroe is NOT a flood control reservoir, meaning no permanent storage capacity is reserved to absorb flood events, and all such events must basically be passed downstream at a rate equal to or below the rate that would occur if the dam did not exist.

• Lake Conroe has a small amount of operating storage capacity or "freeboard" with which to temporarily absorb increases in lake level. However, as shown in Figure 4, there is only about 18 inches of spillway floodgate that extends above the water line when the lake is full and these gates are not designed to support the weight of water flowing over the top of the gates; therefore, as the lake level rises, the gates must be raised to allow the water to flow beneath the gates and over the spillway to the river below (See Figure 5).

• Even though Lake Conroe has very little freeboard, it does "buffer" downstream river flow to some extent by temporarily holding water behind the dam and releasing it more slowly over time. For example, during the rainfall event that occurred the week of May 11th, the peak estimated rate of excess stormwater

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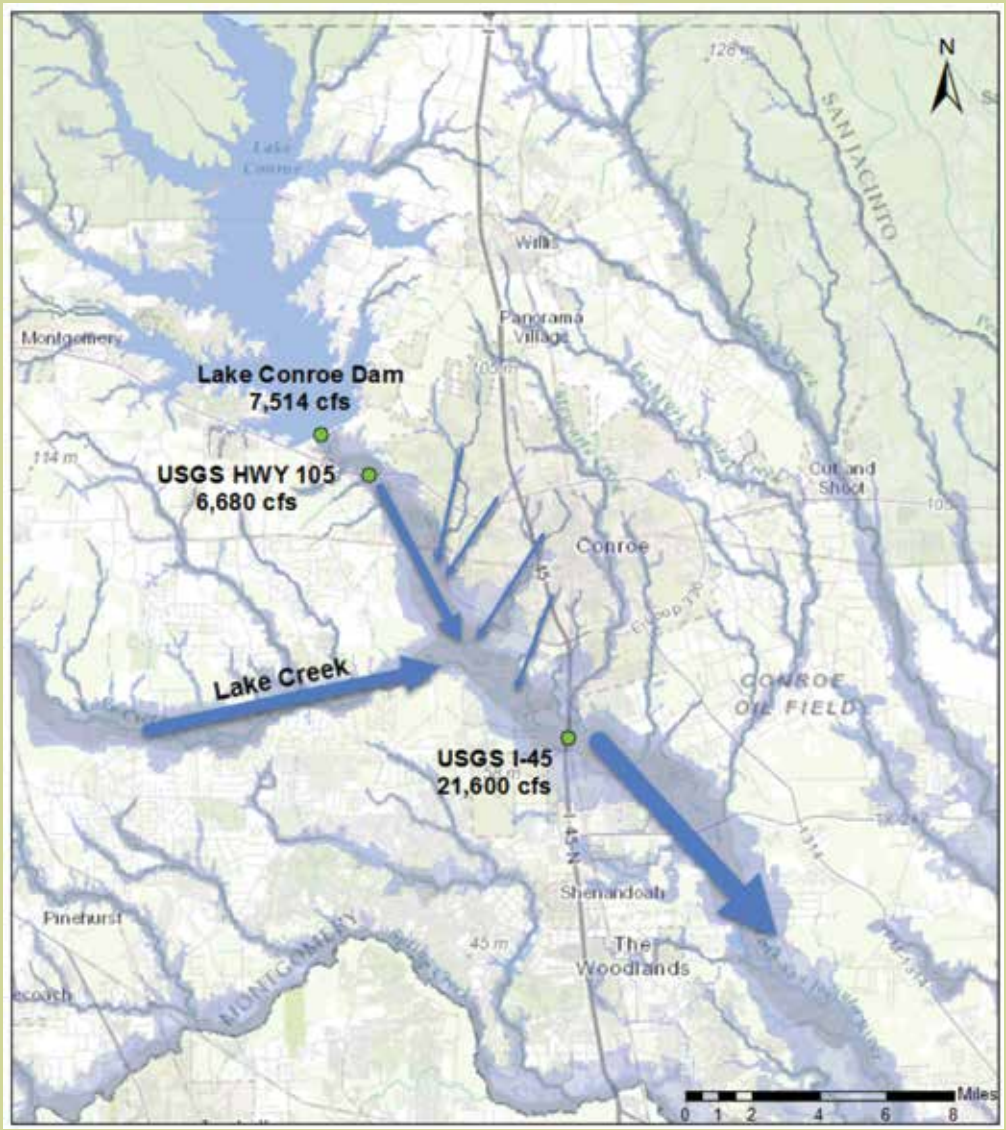

Figure 6. Map showing peak flow measurements at key gauges along the San Jacinto River along with other contributing streams.

flowing into Lake Conroe was 17,000 cubic feet per second while the maximum release rate from the dam was only 7,400 cubic feet per second. The lake rose approximately one foot during the first 24-hours of that event, which absorbed approximately 22,000 acre-feet of the initial runoff. If the dam did not exist, the peak flow in the river downstream from the dam would have been much greater resulting in increased impacts to downstream residents.

• Another important point when it comes to understanding the impact of the Lake Conroe dam is realizing how many different watersheds, or drainage basins, contribute to the overall flow in the river downstream from the lake. The Lake Conroe dam is situated directly on the West Fork of the San Jacinto River, but there are numerous other creeks and streams, such as Lake Creek, Stewart Creek, and others, that all contribute significant amounts of flow into the river as you move downstream. As mentioned above, the Lake Conroe dam provides some amount of buffer to flows coming down the West Fork, but the other major tributaries have no such buffer. Figure 6 shows the peak flows in the river that occurred during the week of May 11th. Lake Conroe contributed only about 7,000 cubic feet per second of the almost 22,000 cubic feet per second that was measured by the river gauge at IH-45. The remaining flows originated primarily from the Lake Creek watershed.

How to Access Information

For anyone interested in monitoring the current conditions of the reservoir or the San Jacinto River, SJRA provides continuous data regarding lake level and release rate on its homepage along with numerous other data points. In addition, historic data can be accessed by clicking the link labeled "Additional Data" (look for the map labeled San Jacinto Contrail Web). There are excellent resources on the Additional Data page that provide up-to-date information on rainfall, stream flows, lake level, and other important weather information.

The "Additional Data" page contains links to numerous outside sources of information, and it may take some exploring to find the type of data that suits your needs. I also recommend the National Weather Service's Advanced Hydrologic Prediction Service that is linked at the very top of the page. During major flood events, this site uses NWS models to predict peak river levels. ◆