



## U.S. Drought Monitor Workshop: Forecasting, Monitoring, and Responding to Droughts in the Southeast

### **Duke Energy Hydroelectric Projects Low Inflow Protocols**




*February 4-5, 2020*

PRESENTED BY:  
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The Federal Energy Regulatory Commission (FERC) license regulates hydro operations and shapes the river uses for the Catawba-Wataree and Keowee-Toxaway River Basins including:

## License Requirements

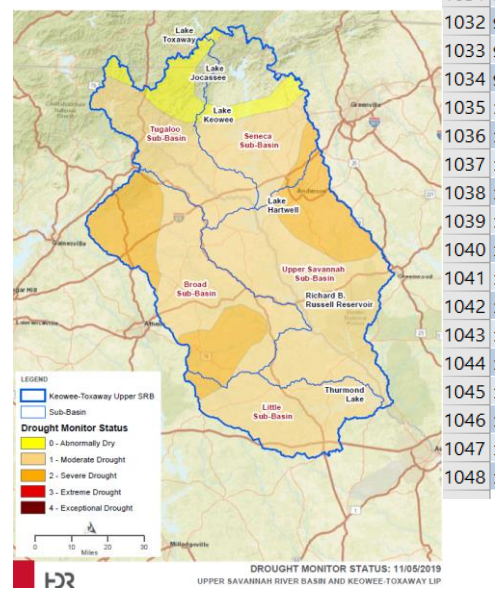
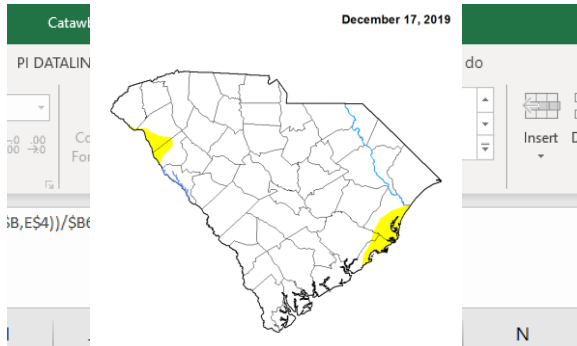
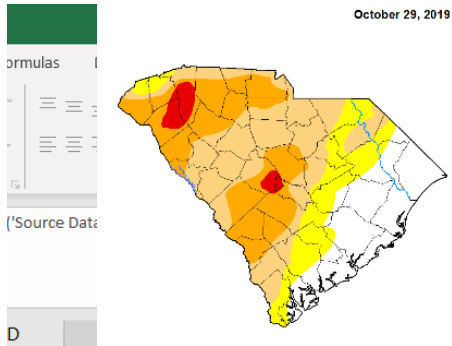
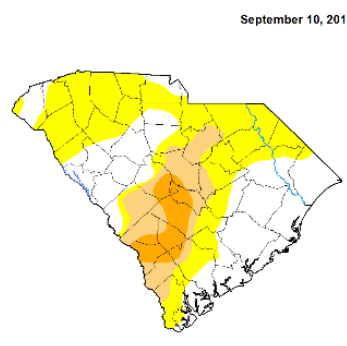
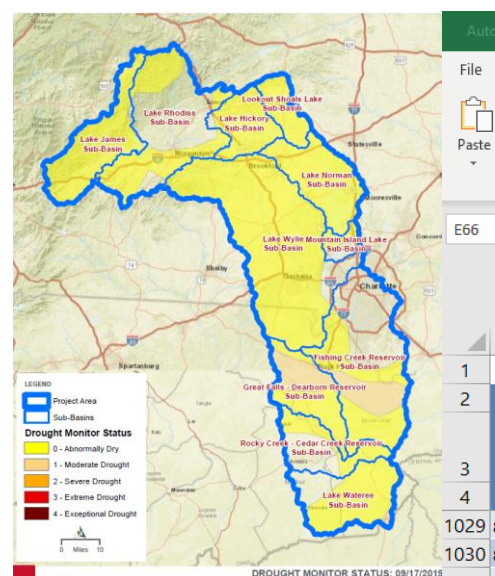
Normal Conditions	Drought Conditions	Emergency Conditions
<ul style="list-style-type: none"><li>▪ Lake levels</li><li>▪ Aquatic flows</li><li>▪ Recreation flows</li><li>▪ Recreation facilities</li></ul>	<ul style="list-style-type: none"><li>▪ <b>Low Inflow Protocols (LIPs) determine when drought conditions exist</b></li></ul> 	<ul style="list-style-type: none"><li>▪ Emergency River Access</li><li>▪ High Water Events</li><li>▪ Grid Emergencies</li><li>▪ Unexpected Hydro Outages</li><li>▪ Planned Hydro Outages</li></ul>

The LIPs designates 5 stages of drought in the Catawba-Wataree and Keowee-Toxaway River Basins as determined by the following indicators, which are evaluated and reported at least monthly:

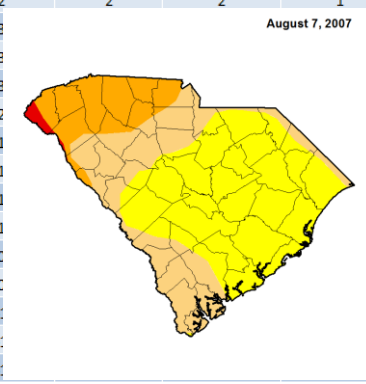
- **How much total remaining usable water is in the reservoirs**
  - Volume of water between current reservoir elevations and each reservoir's Critical Reservoir Elevation
- **How much water is flowing into the reservoirs**
  - As measured by 4 tributary US Geological Survey (USGS) streamflow gages
- **U.S. Drought Monitor**, a government map indicating areas experiencing drought and the severity, **specific to the River Basin**

Duke Energy coordinates with the Catawba-Wataree Drought Management Advisory Group and Keowee-Toxaway Drought Management Advisory Group to manage the shared water supplies

# Catawba-Wateree River Basin - Drought Indicators



Date	Catawba-Wateree Basin (Acres)	Percent by DM Value						LIP Analysis					
		Normal	Abnormally Dry	Moderate Drought	Severe Drought	Extreme Drought	Exceptional Drought	Area-Weighted Average	Highest Level	Area of Highest Levels > 1%	Area of Highest Levels > 5%	Area of Highest Levels > 10%	Area of Highest Levels > 25%
8/20/2019	3,036,768	71.0%	29.0%	--	--	--	--	-0.71	0	0	0	0	0
8/27/2019	3,036,768	91.0%	9.0%	--	--	--	--	-0.91	0	0	0	-1	-1
9/3/2019	3,036,768	91.0%	9.0%	--	--	--	--	-0.91	0	0	0	-1	-1
9/10/2019	3,036,768	62.5%	37.3%	0.2%	--	--	--	-0.62	1	0	0	0	0
9/17/2019	3,036,768	21.2%	73.4%	5.4%	--	--	--	-0.16	1	1	1	0	0
9/24/2019	3,036,768	0.0%	38.6%	61.4%	--	--	--	0.61	1	1	1	1	1
10/1/2019	3,036,768	0.0%	10.8%	76.3%	12.9%	--	--	1.02	2	2	2	2	1
10/8/2019	3,036,768	0.0%	1.3%	42.0%	49.3%	7.4%	--	1.63	3	3	3	3	3
10/15/2019	3,036,768	0.0%	1.3%	42.6%	48.7%	7.4%	--	1.62	3	3	3	3	3
10/22/2019	3,036,768	0.0%	1.3%	46.5%	44.9%	7.4%	--	1.58	3	3	3	3	3
10/29/2019	3,036,768	0.0%	25.1%	67.2%	7.7%	--	--	0.83	2	2	2	2	2
11/5/2019	3,036,768	25.0%	21.6%	53.4%	--	--	--	0.28	1	1	1	1	1
11/12/2019	3,036,768	35.5%	11.1%	53.4%	--	--	--	0.18	1	1	1	1	1
11/19/2019	3,036,768	34.9%	55.6%	9.5%	--	--	--	-0.25	1	1	1	1	1
11/26/2019	3,036,768	65.4%	33.0%	1.5%	--	--	--	-0.64	1	1	1	1	1
12/3/2019	3,036,768	88.8%	11.2%	--	--	--	--	-0.89	0	0	0	0	0
12/10/2019	3,036,768	88.8%	11.2%	--	--	--	--	-0.89	0	0	0	0	0
12/17/2019	3,036,768	100.0%	--	--	--	--	--	-1.00	-1	-1	-1	-1	-1
12/24/2019	3,036,768	100.0%	--	--	--	--	--	-1.00	-1	-1	-1	-1	-1
12/31/2019	3,036,768	100.0%	--	--	--	--	--	-1.00	-1	-1	-1	-1	-1



The overall USDM designation is an average of the last 3 end of month readings for the Catawba-Wateree River Basin and the average of the last 12 week readings for the Keowee-Toxaway River Basin.

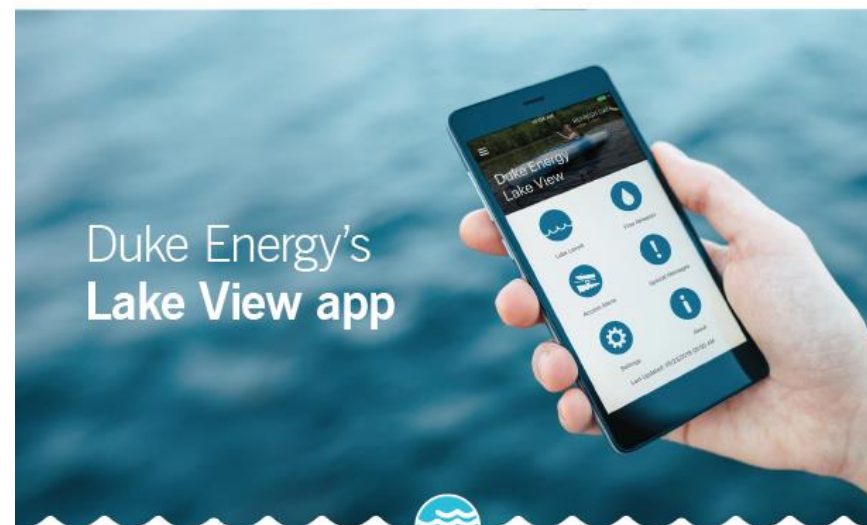
Stage	Triggers	Action Summary
0	Storage Index (SI) below Target Storage Index (TSI), but greater than 90% of TSI; <b>or</b> US Drought Monitor $\geq 0$ ; <b>or</b> USGS Stream Gauges $\leq 85\%$ of long term average (must have two)	<b>Licensee</b> - Activate Catawba-Wateree Drought Management Advisory Group (CW-DMAG).
1	SI at or below 90%TSI, but greater than 75% of TSI... <b>and</b> <b>US Drought Monitor <math>\geq 1</math></b> ; <b>or</b> USGS Stream Gauges $\leq 78\%$ of long term average	<b>Licensee</b> - <b>Reduce</b> downstream, bypass, recreation flows and Normal Minimum Elevations. <b>Public Water Suppliers (PWS)</b> – Voluntary water use restrictions, 2 day/wk irrigation, reduce vehicle washing; <b>water reduction goal of 3-5%</b> . <b>Other Large Water Intake (LWI) Owners</b> – Notify employees and customers and request voluntary cutbacks.
2	SI at or below 75%TSI, but greater than 57% of TSI... <b>and</b> <b>US Drought Monitor <math>\geq 2</math></b> ; <b>or</b> USGS Stream Gauges $\leq 65\%$ of long term average	<b>Licensee</b> – <b>Further reduce</b> flows and Normal Minimum Elevations. Eliminate recreation flows. <b>PWS</b> – Mandatory water use restrictions, <b>2 day/wk irrigation</b> , eliminate vehicle washing; <b>water reduction goal of 5-10%</b> . <b>Other LWI Owners</b> – Notify employees and customers and request voluntary cutbacks.
3	SI at or below 57%TSI, but greater than 42% of TSI... <b>and</b> <b>US Drought Monitor <math>\geq 3</math></b> ; <b>or</b> USGS Stream Gauges $\leq 55\%$ of long term average	<b>Licensee</b> - <b>Reduce</b> downstream and bypass flows to critical flows, and further reduce Normal Minimum Elevations. <b>PWS</b> – Mandatory water use restrictions, <b>1 day/wk irrigation</b> , limit other outdoor water uses; <b>water reduction goal of 10-20%</b> . <b>Other LWI Owners</b> – Notify employees and customers and request voluntary cutbacks.
4	SI at or below 42%TSI... <b>and</b> <b>US Drought Monitor = 4</b> ; <b>or</b> USGS Stream Gauges $\leq 40\%$ of long term average	<b>Licensee</b> – Maintain downstream and bypass flows to critical flows, and <b>reduce</b> Normal Minimum Elevations to critical elevations. <b>PWS</b> – Restrict all outdoor water use, implement emergency restrictions; <b>water reduction goal of 20-30%</b> . <b>Other LWI Owners</b> – Notify employees and customers and request voluntary cutbacks.

# QUESTIONS?

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<https://www.duke-energy.com/lakes>



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