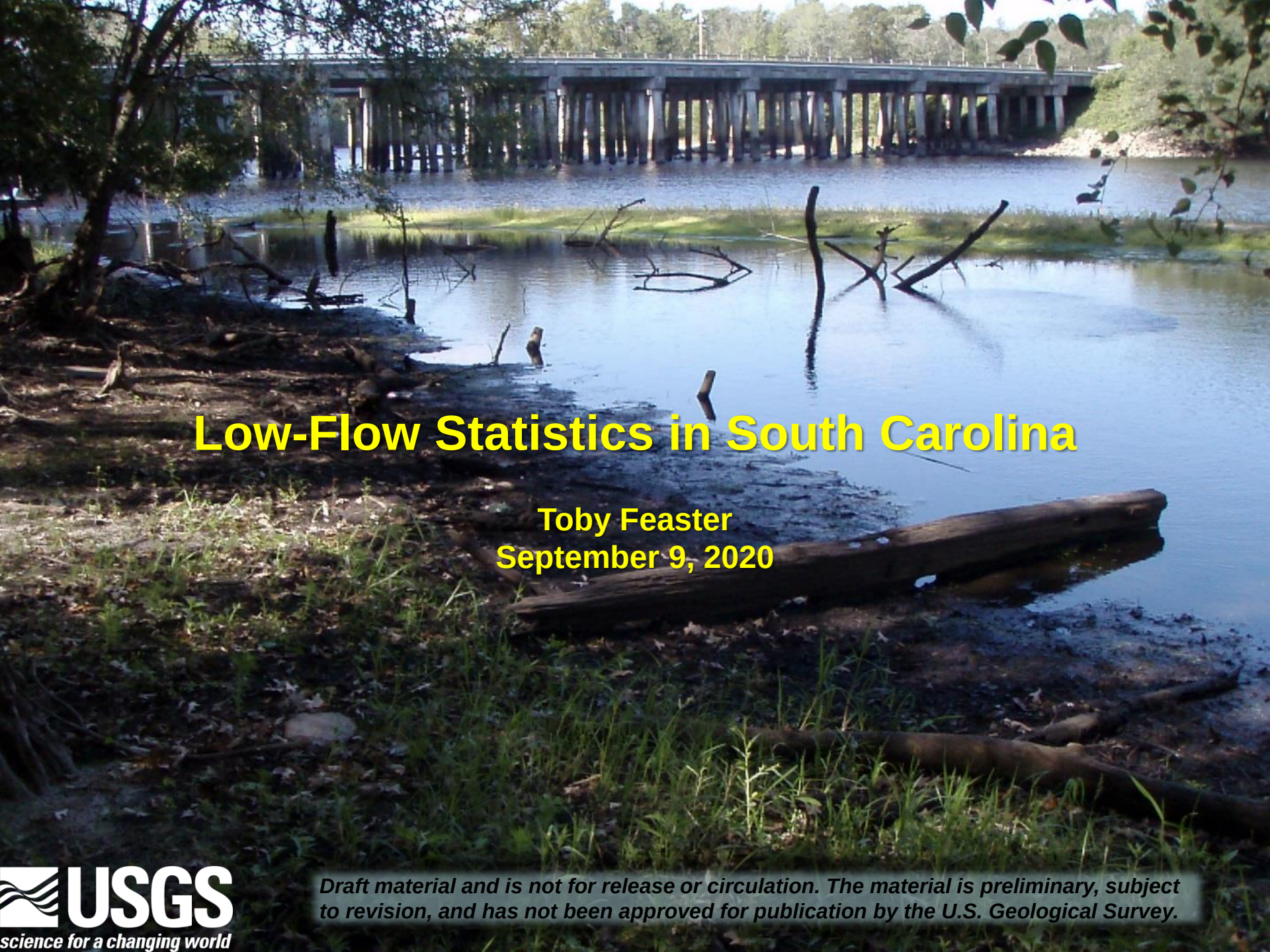


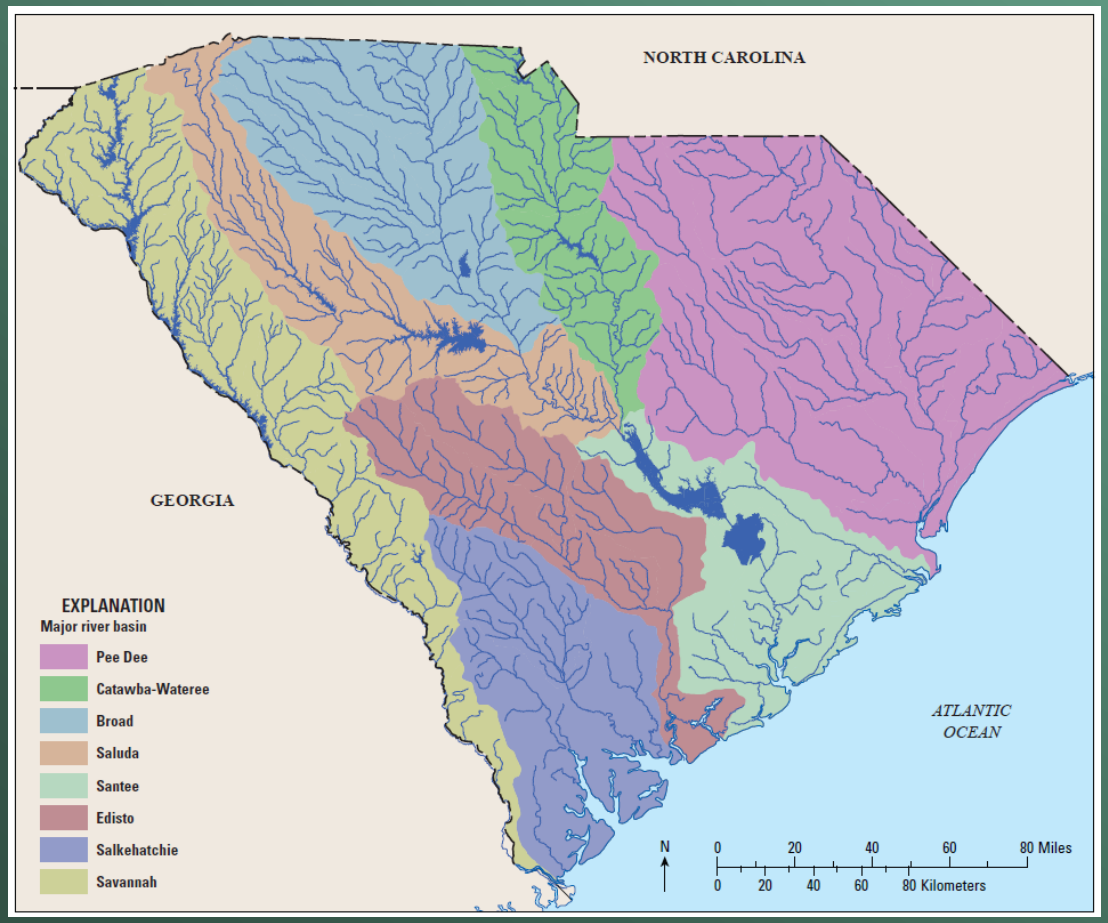
Low-Flow Statistics in South Carolina

Toby Feaster

September 9, 2020

USGS
science for a changing world

Low-Flow Characterization of South Carolina Streams



South Carolina Low-Flow Updates

In 2008, the U.S. Geological Survey, in cooperation with the South Carolina Department of Health and Environmental Control, initiated a study to update low-flow statistics at continuous-record streamgaging stations.

Prior to that, low-flow statistics had not been updated on a state-wide basis since 1987.

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Low-Flow Characterization of South Carolina Streams

- Pee Dee River (March 2007)
- Broad River (March 2008)
- Saluda, Congaree, and Edisto Rivers (March 2009)
- Catawba-Wateree and Santee Rivers (March 2012)
- Savannah and Salkehatchie Rivers (March 2014)
- Summary report published in 2017

https://pubs.er.usgs.gov/

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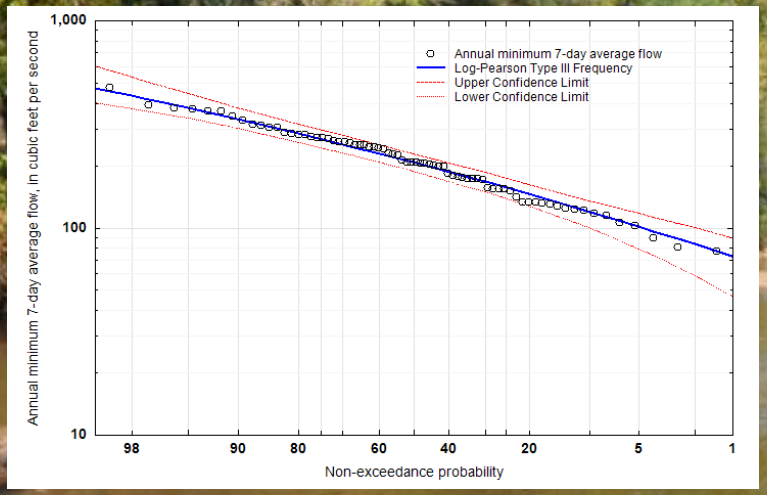
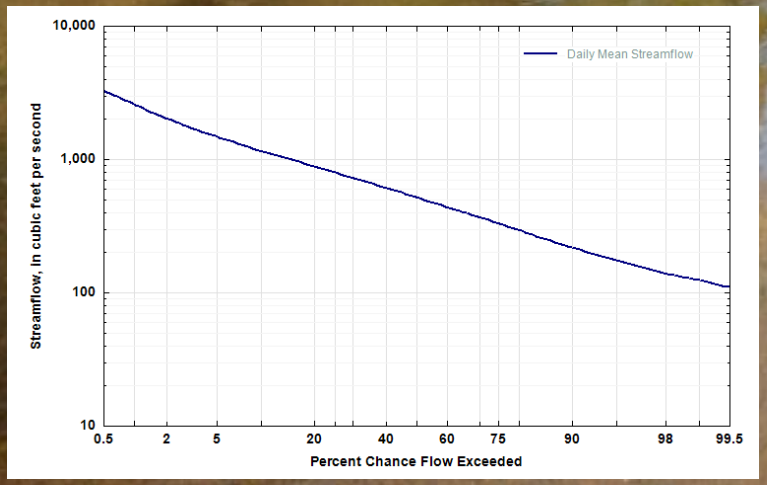
Low-Flow Characterization of South Carolina Streams





Low-Flow Statistics Published

- Annual minimum 1-, 3-, 7-, 14-, 30-, 60-, and 90-day average flows with a 2-, 5-, 10-, 20-, 30-, and 50-year recurrence interval (depending on the available length of record)
- Daily flow durations for the 5, 10, 25, 50, 75, 90, and 95 percentiles

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Low-Flow Characterization of South Carolina Streams

7Q10

One of the most common low-flow statistics is the 7Q10, which is the annual minimum 7-day average flow with a 10-year recurrence interval.

In terms of probability of occurrence, there is a 1 in 10 (1/10) or 10-percent probability that the annual minimum 7-day average flow at a site will be less than or equal to the estimated 7Q10.

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Low-Flow Characterization of South Carolina Streams

7Q10 in SC State Regulation

7Q10 was adopted as the minimum flow for applying water quality criteria as early as the S.C. Rules and Regulations of 1967.

It is used for such things as:

- **Water Quality Standards (Reg. 61-68)**
- **Source Water Protection (Reg. 61-68)**
- **Interbasin Transfers (Reg. 121-12)**

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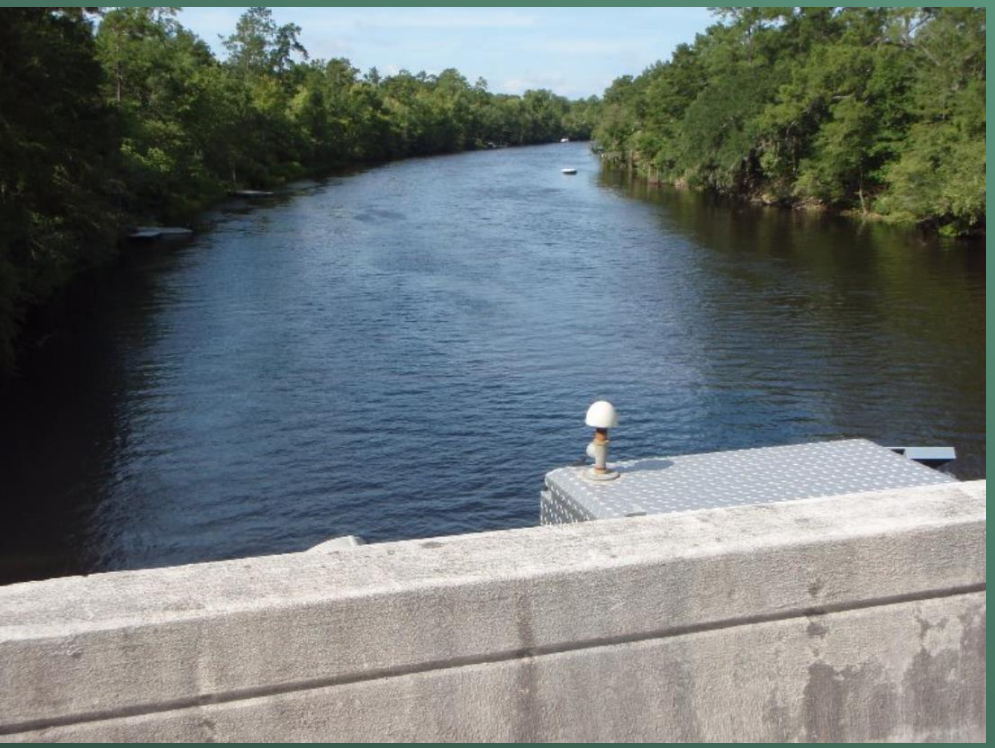
Low-Flow Characterization of South Carolina Streams



How is the 7Q10 computed?

Let's look at an example using climate years 1939-48 (first 10-years of record) at USGS station 02175000, Edisto River near Givhans, SC.

Note: A climate year begins on April 1 and ends on March 31 and is designated by the beginning year.

Why do we use the climate year as opposed to the water year, which begins on October 1 and ends on September 30 and is designated by the ending year?

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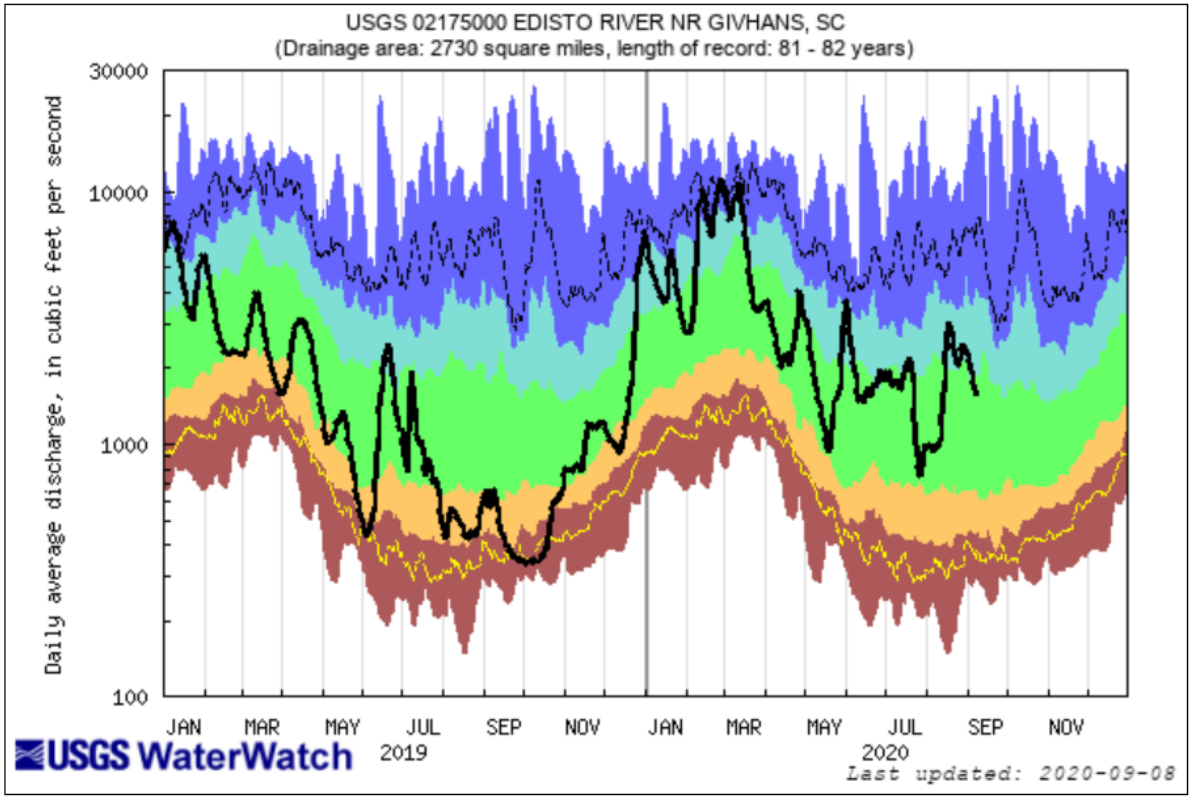
Low-Flow Characterization of South Carolina Streams



Climate year (Apr 1 to Mar 31)

Water year (Oct 1 to Sep 30)

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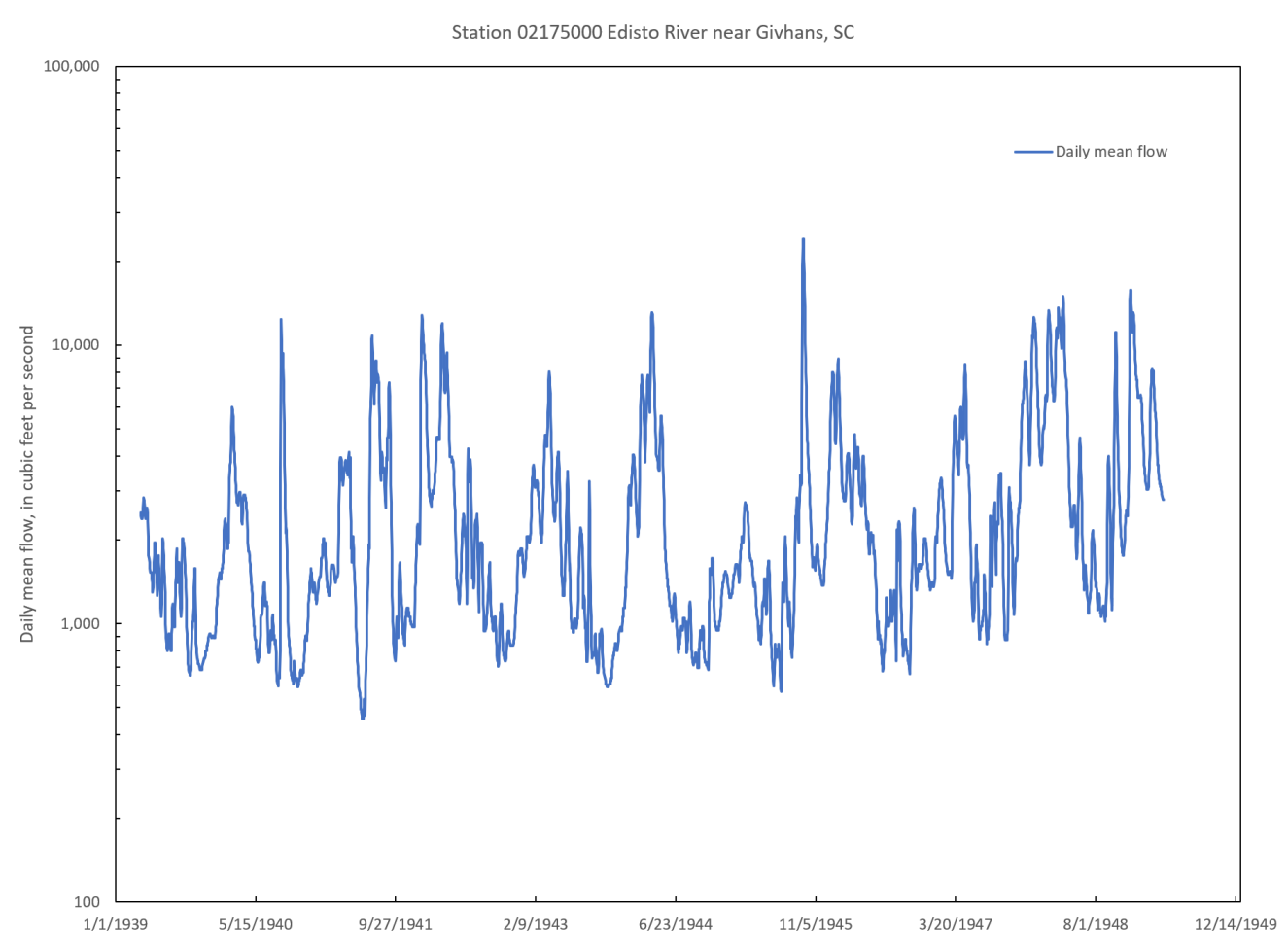
Low-Flow Characterization of South Carolina Streams



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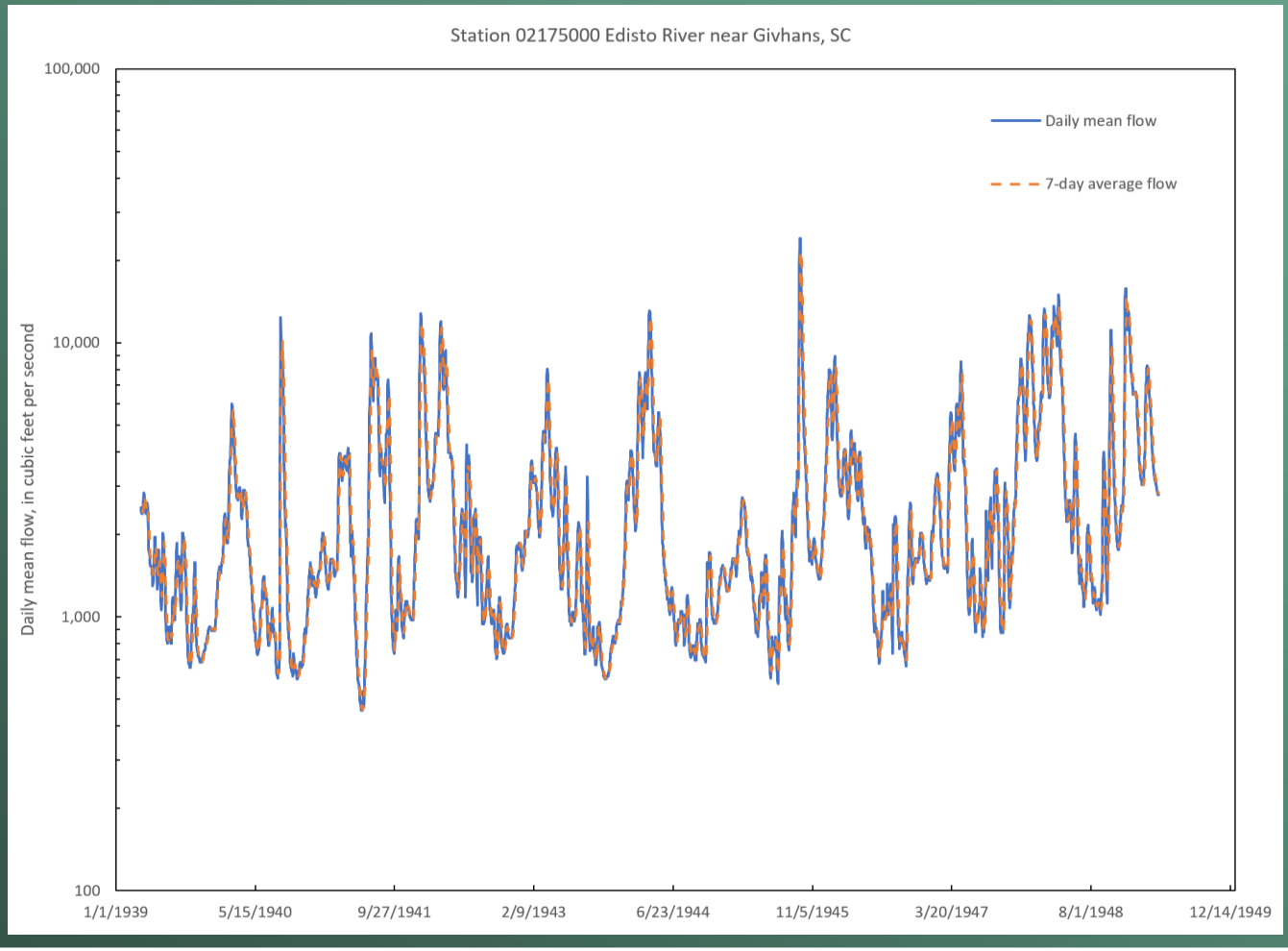
Low-Flow Characterization of South Carolina Streams



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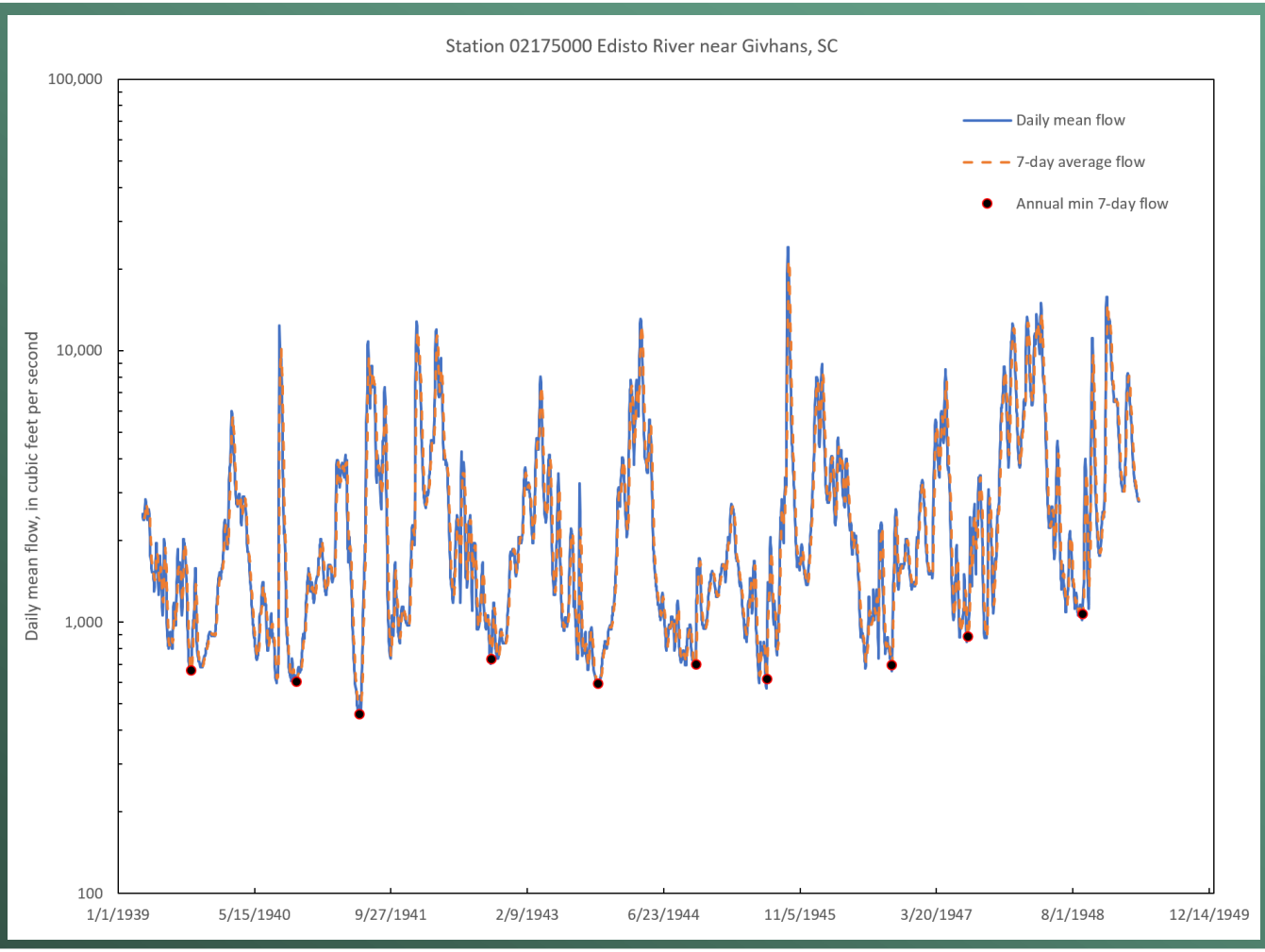
Low-Flow Characterization of South Carolina Streams



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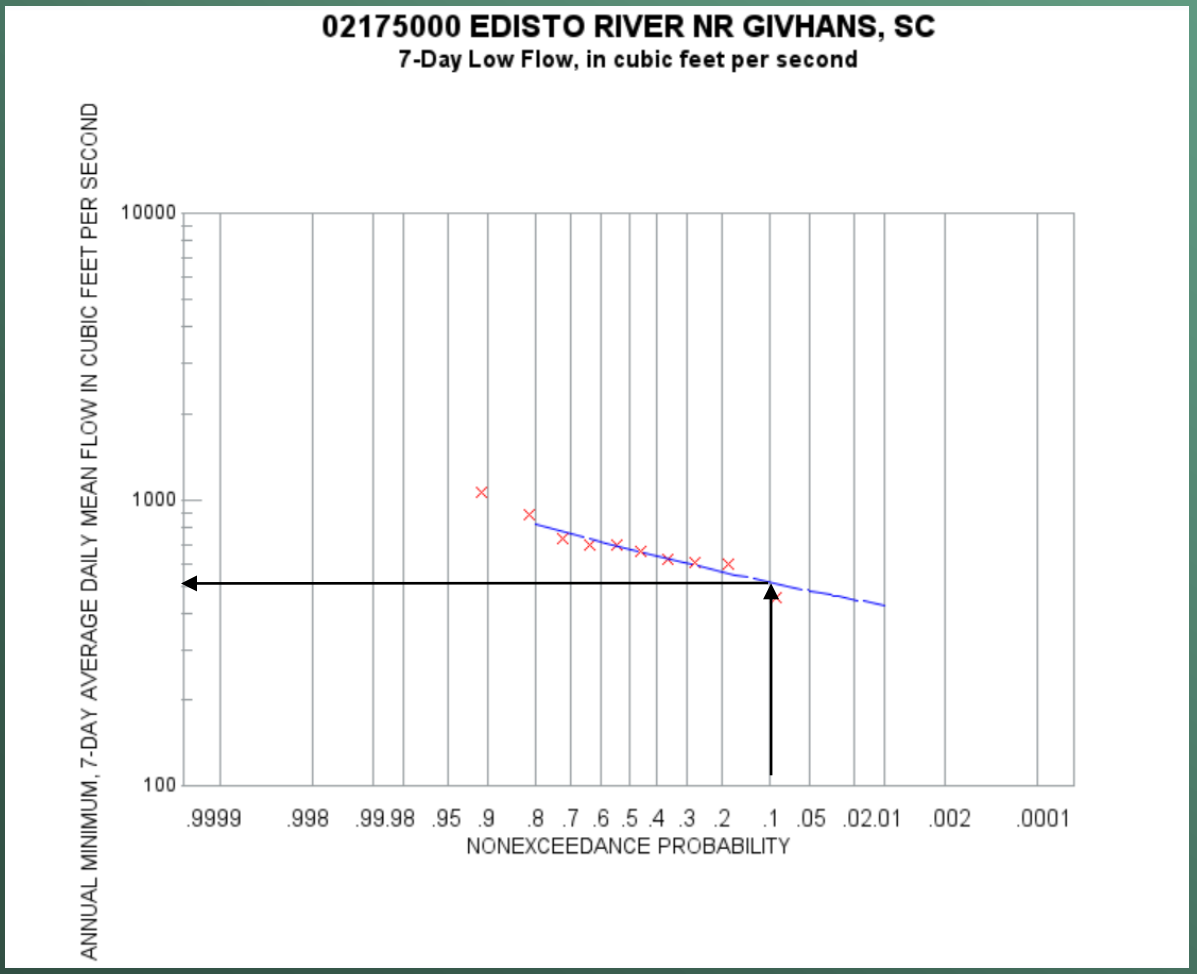
Low-Flow Characterization of South Carolina Streams



From the log Pearson Type III statistical distribution, the 7Q10 for this period of record is 516 cubic feet per second (ft^3/s).

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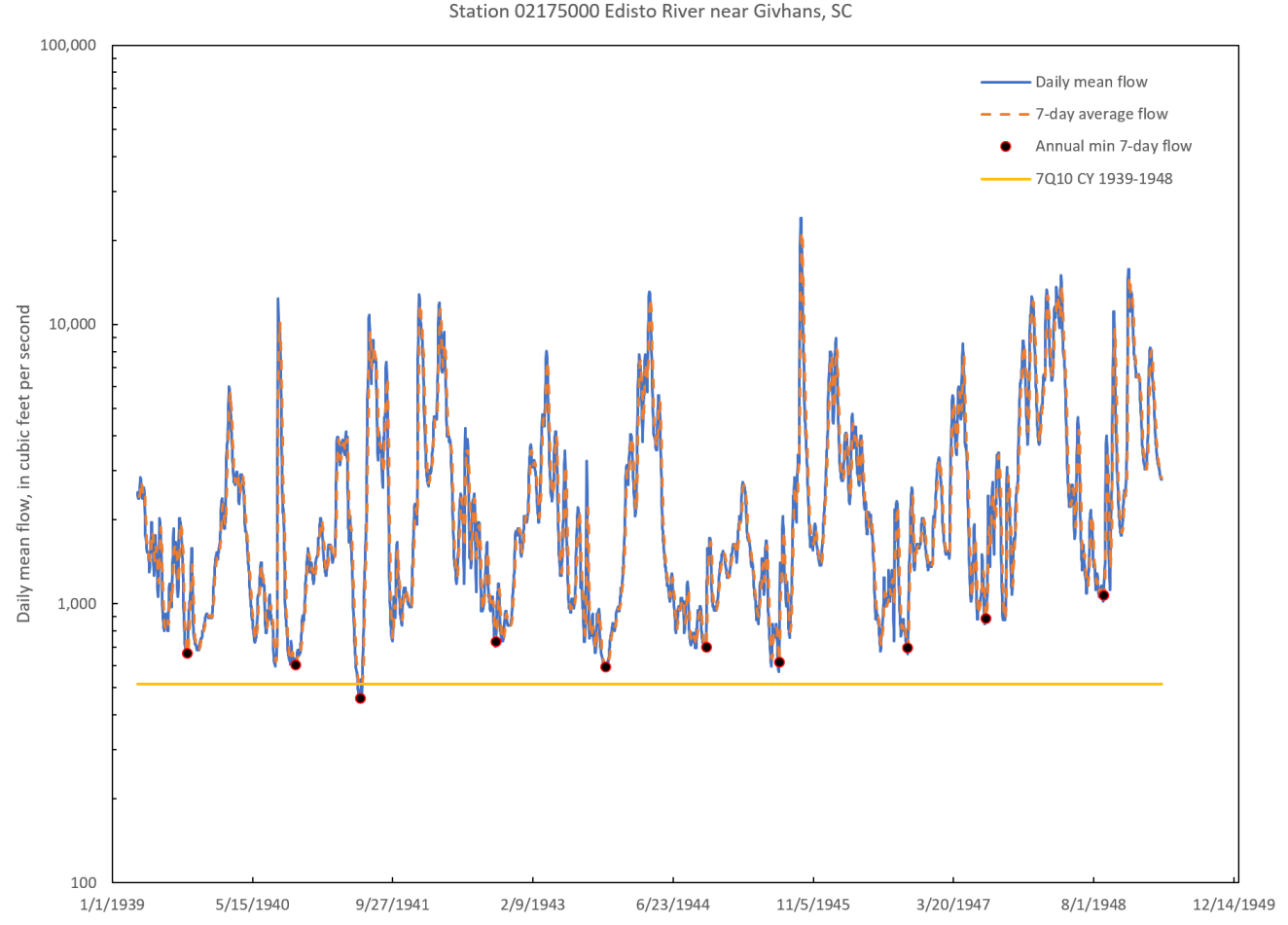
Low-Flow Characterization of South Carolina Streams

7Q10 = 516 ft³/s



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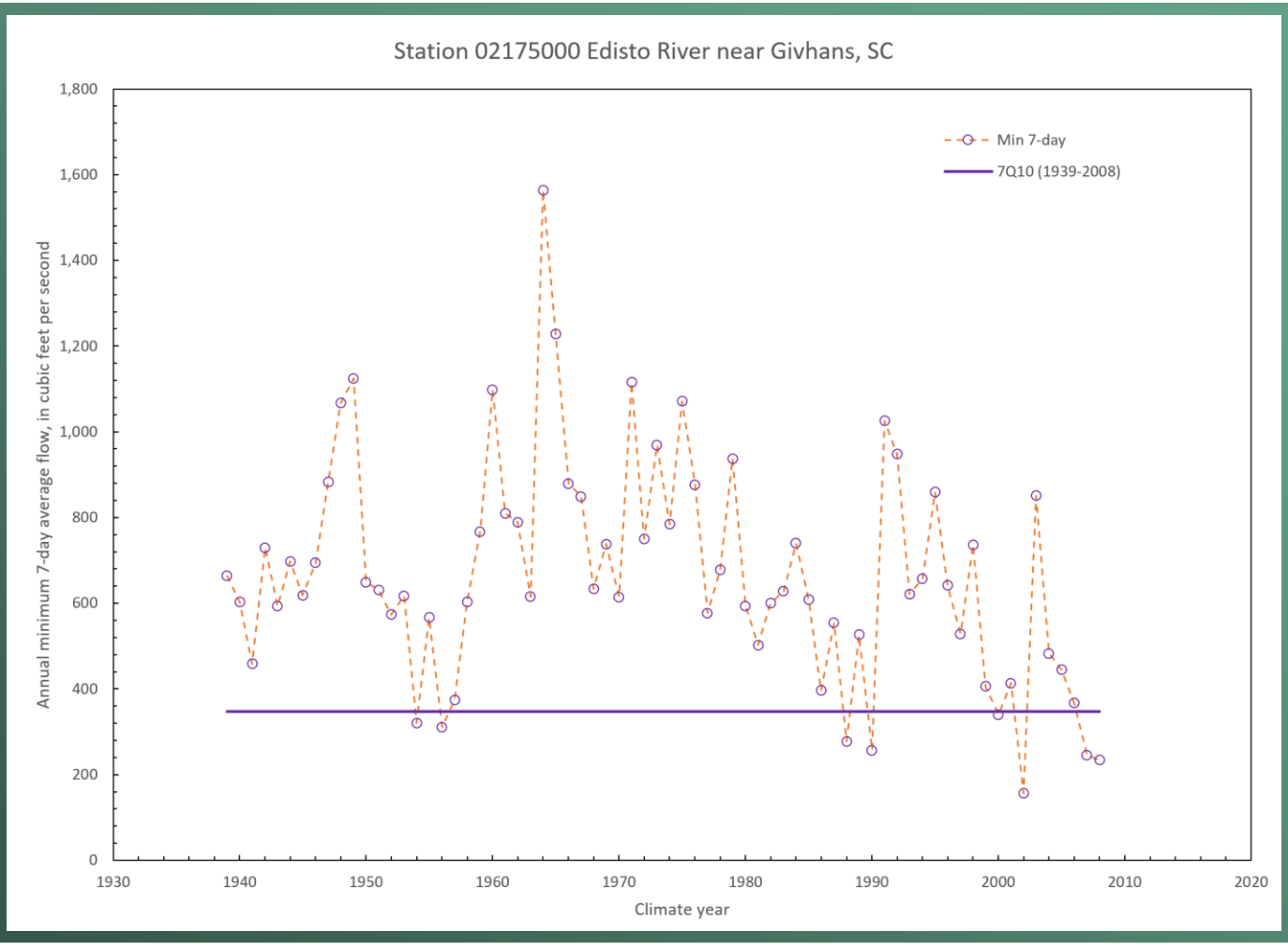
Low-Flow Characterization of South Carolina Streams



For the period from 1939 to 2008, the 7Q10 = 347 ft^3/s

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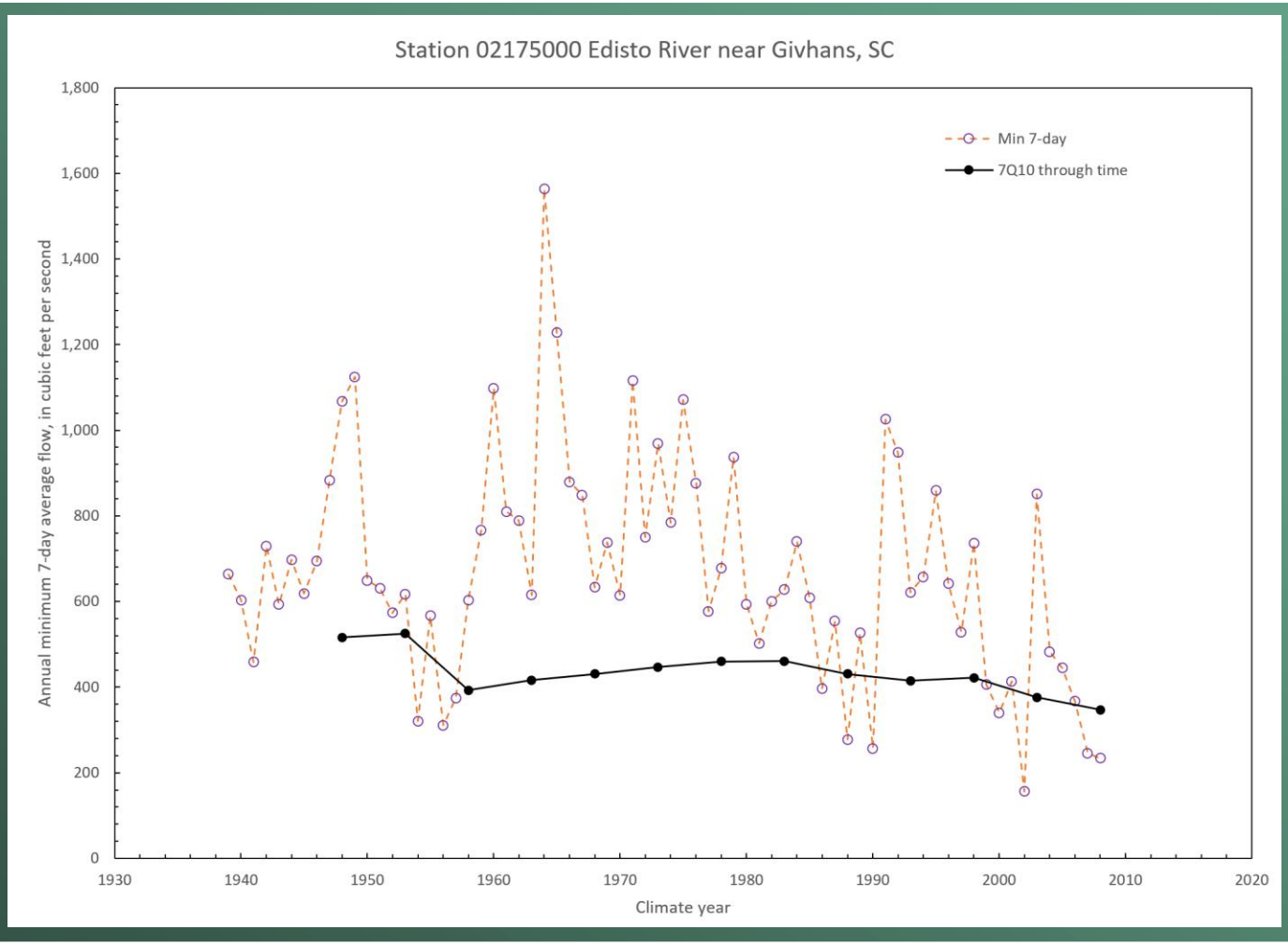
Low-Flow Characterization of South Carolina Streams



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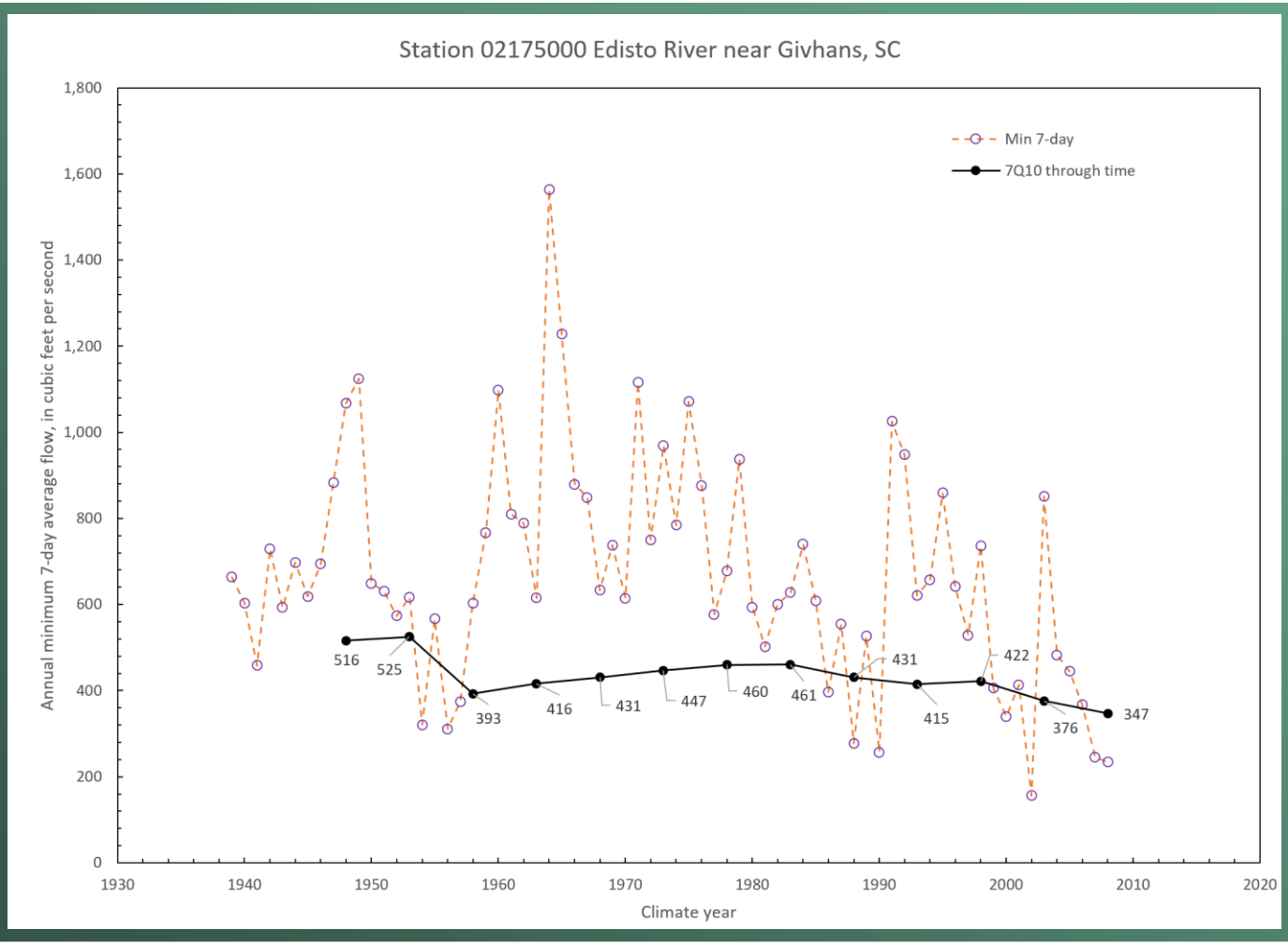

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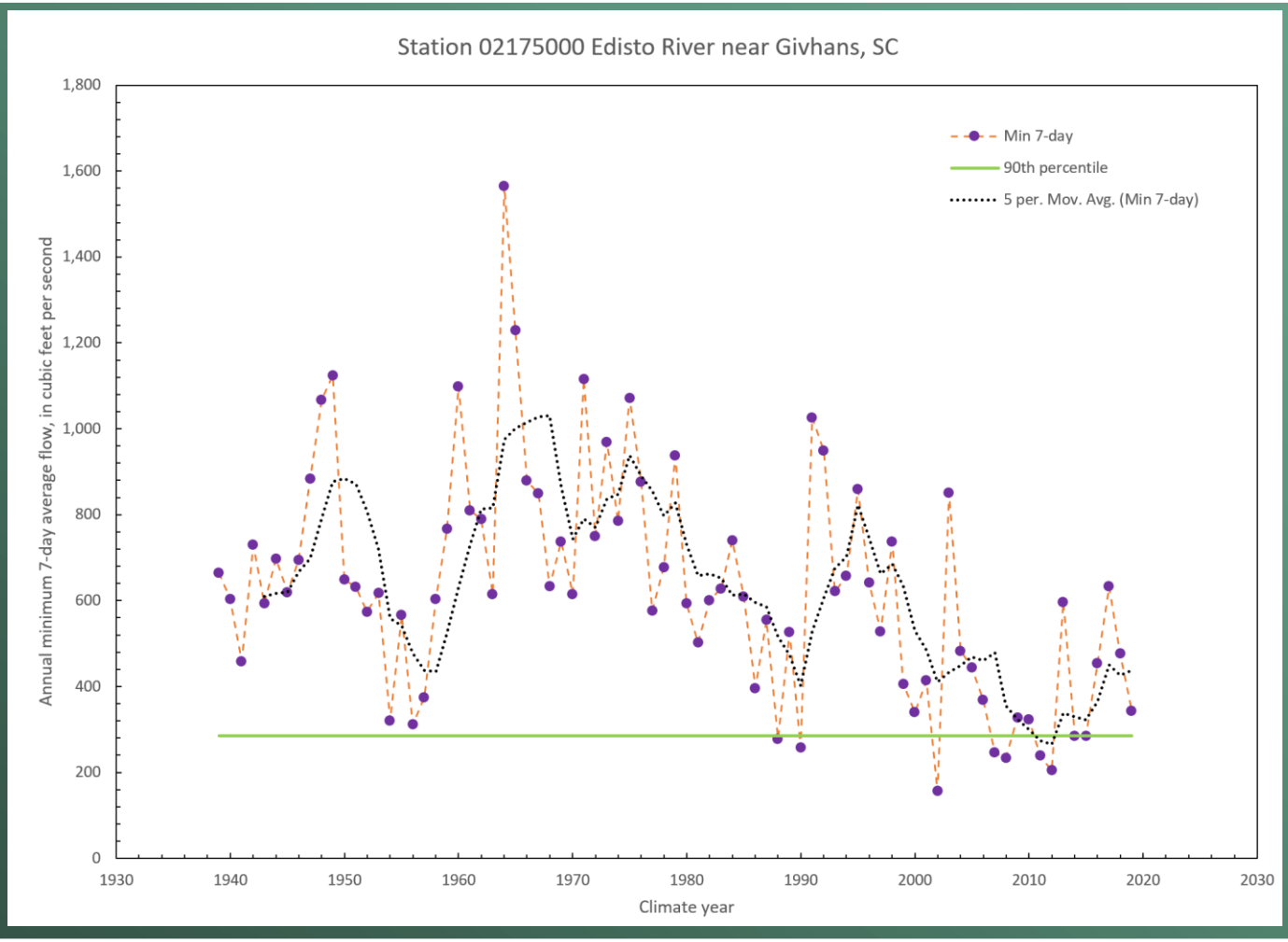
Low-Flow Characterization of South Carolina Streams

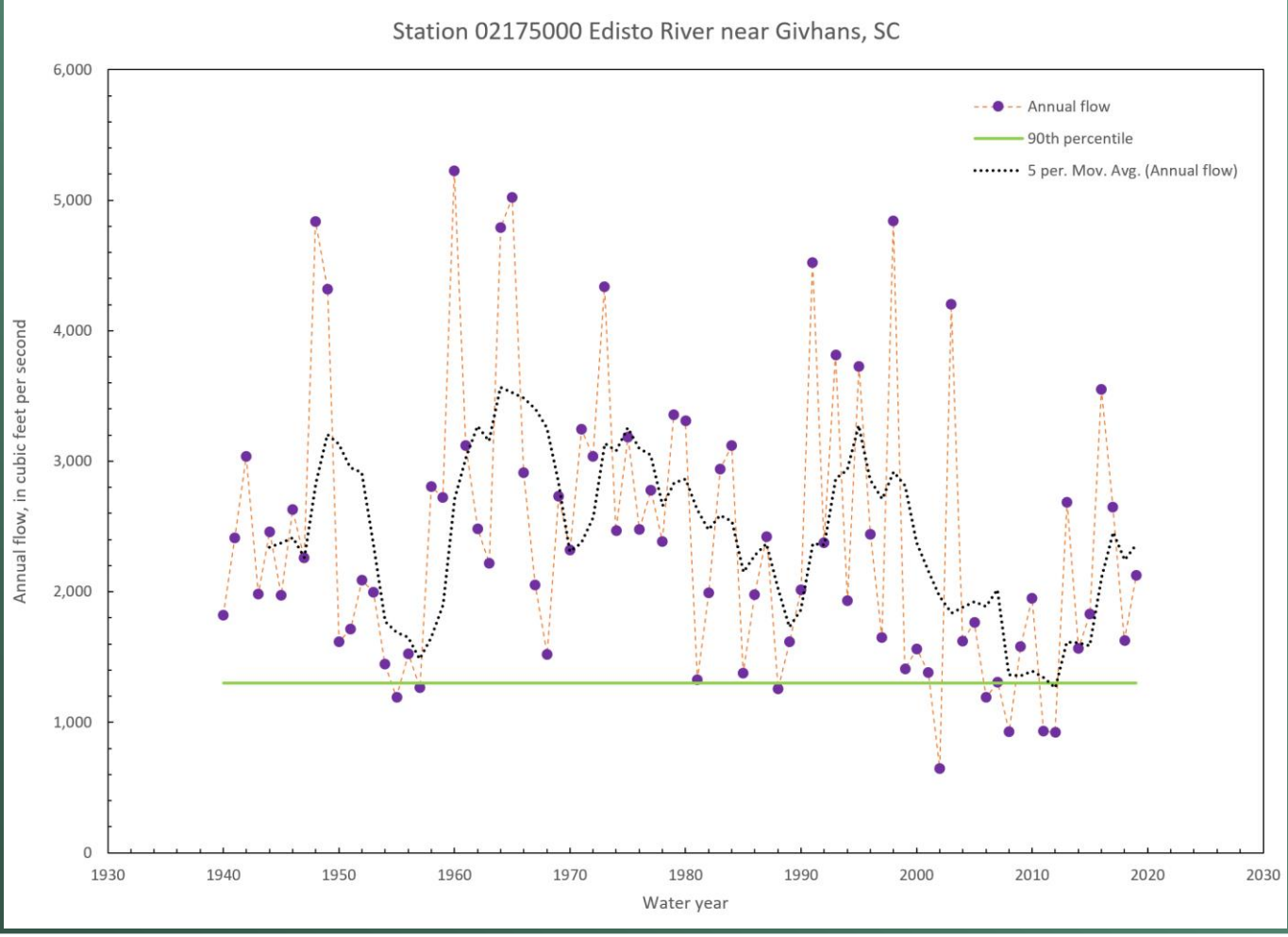


Annual minimum 7-day average flow for 1939 to 2019.

USGS

Low-Flow Characterization of South Carolina Streams

Annual flow

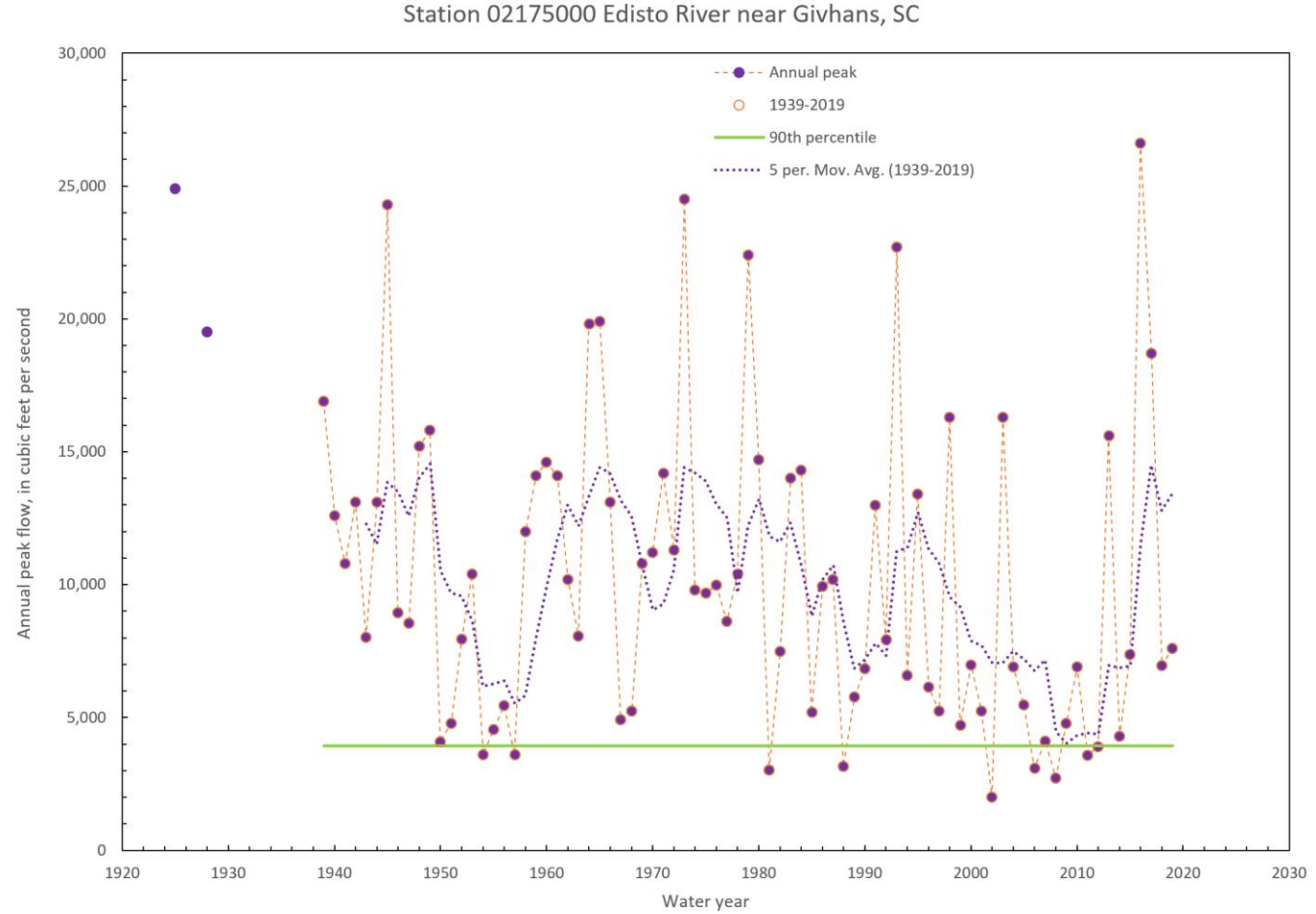


Annual flow is the mean of the daily flows for the water year.

USGS

Low-Flow Characterization of South Carolina Streams

Annual peak flow



Annual peak flow is the largest instantaneous flow for the water year.

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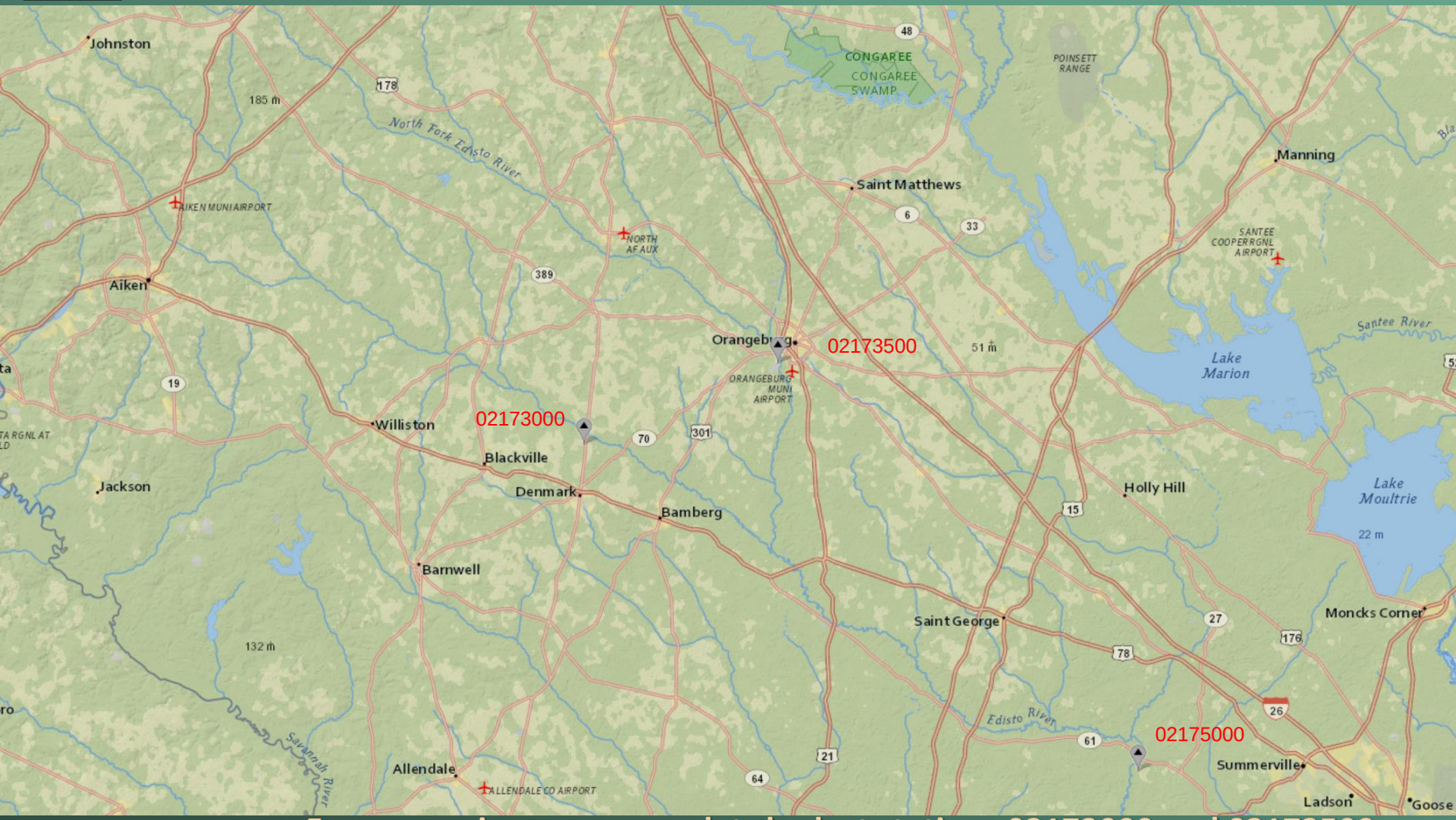
Low-Flow Characterization of South Carolina Streams



For comparison purposes, lets look at stations 02173000 and 02173500.

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Low-Flow Characterization of South Carolina Streams

02173000 South Fork Edisto River near Denmark, SC

DA = 720 mi²

72% from Sand Hills

28% from Coastal Plain

02173500 North Fork Edisto River at Orangeburg, SC

DA = 683 mi²

47% from Sand Hills

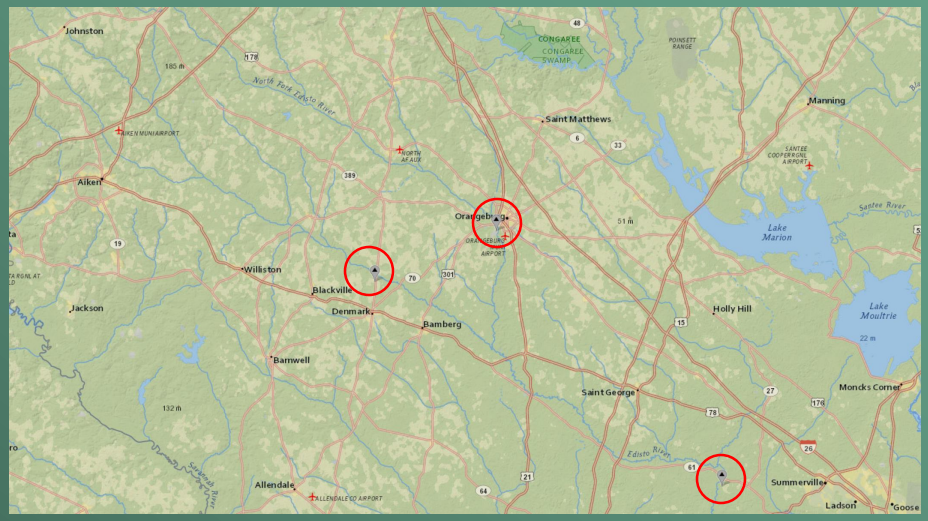
53% from Coastal Plain

02175000 Edisto River near Givhans, SC

DA = 2,730 mi²

31% from Sand Hills

69% from Coastal Plain



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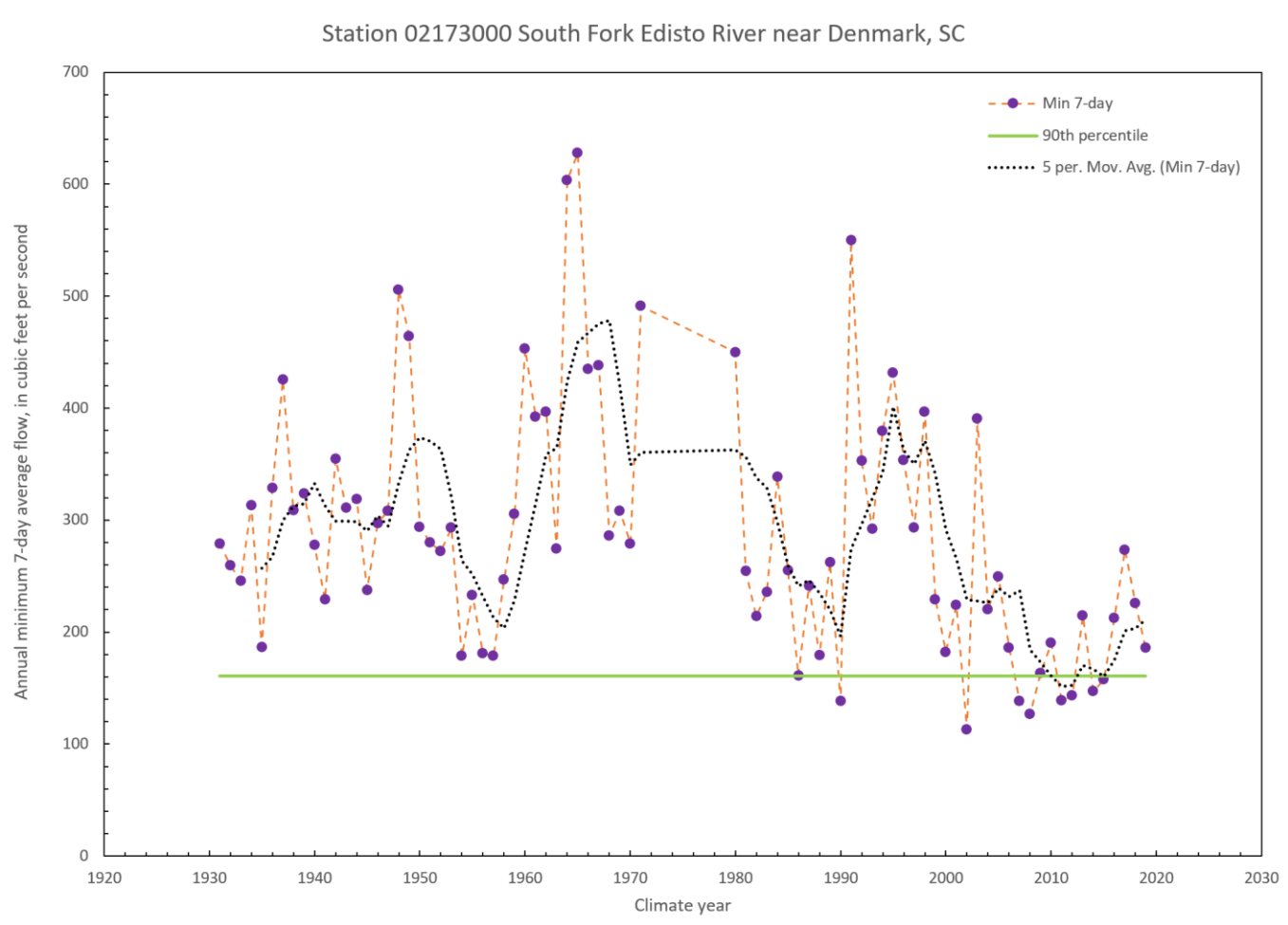
Low-Flow Characterization of South Carolina Streams

Annual min 7-day average flow



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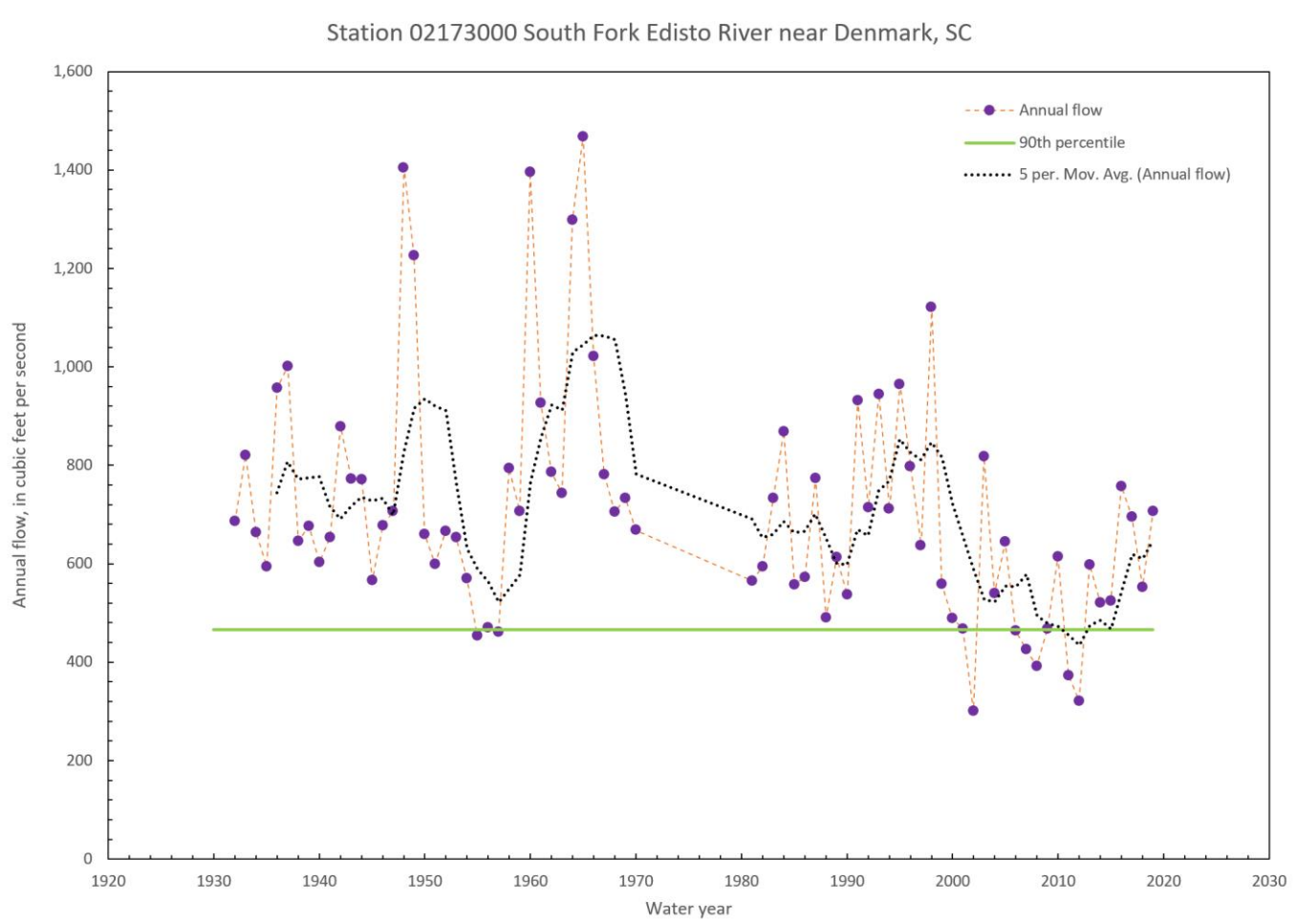
Low-Flow Characterization of South Carolina Streams

Annual flow



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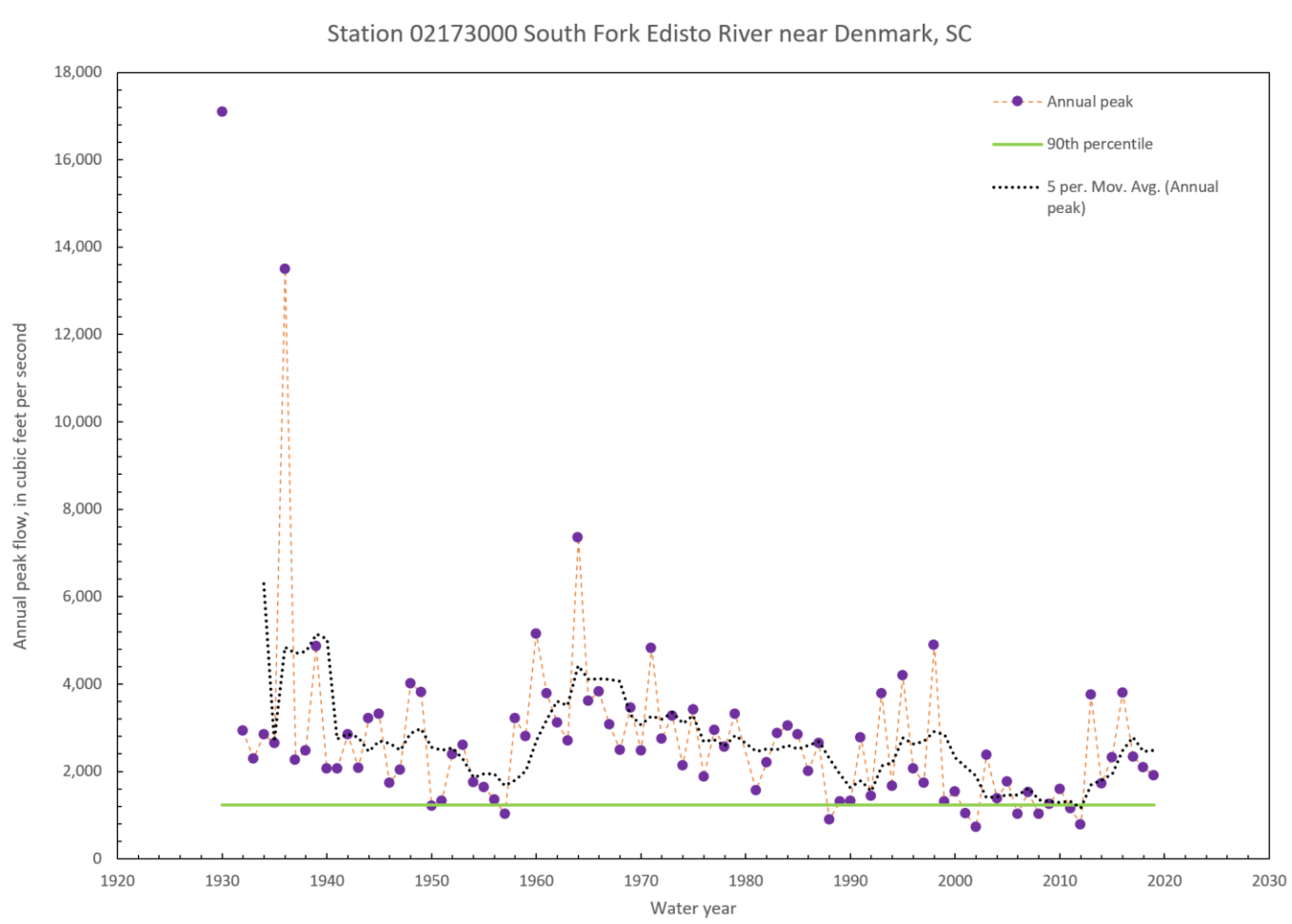
Low-Flow Characterization of South Carolina Streams

Annual peak flow



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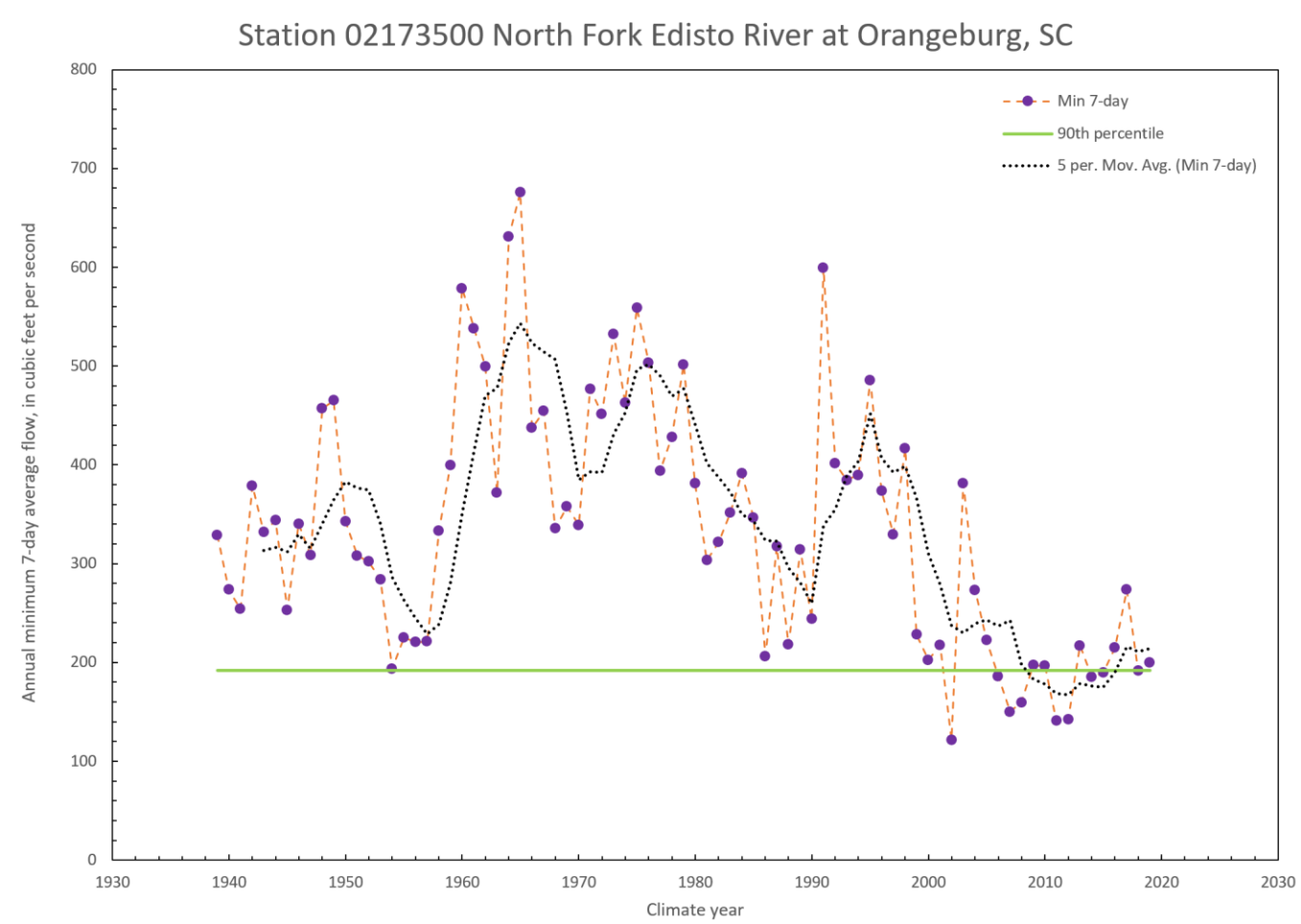
Low-Flow Characterization of South Carolina Streams

Annual min 7-day average flow



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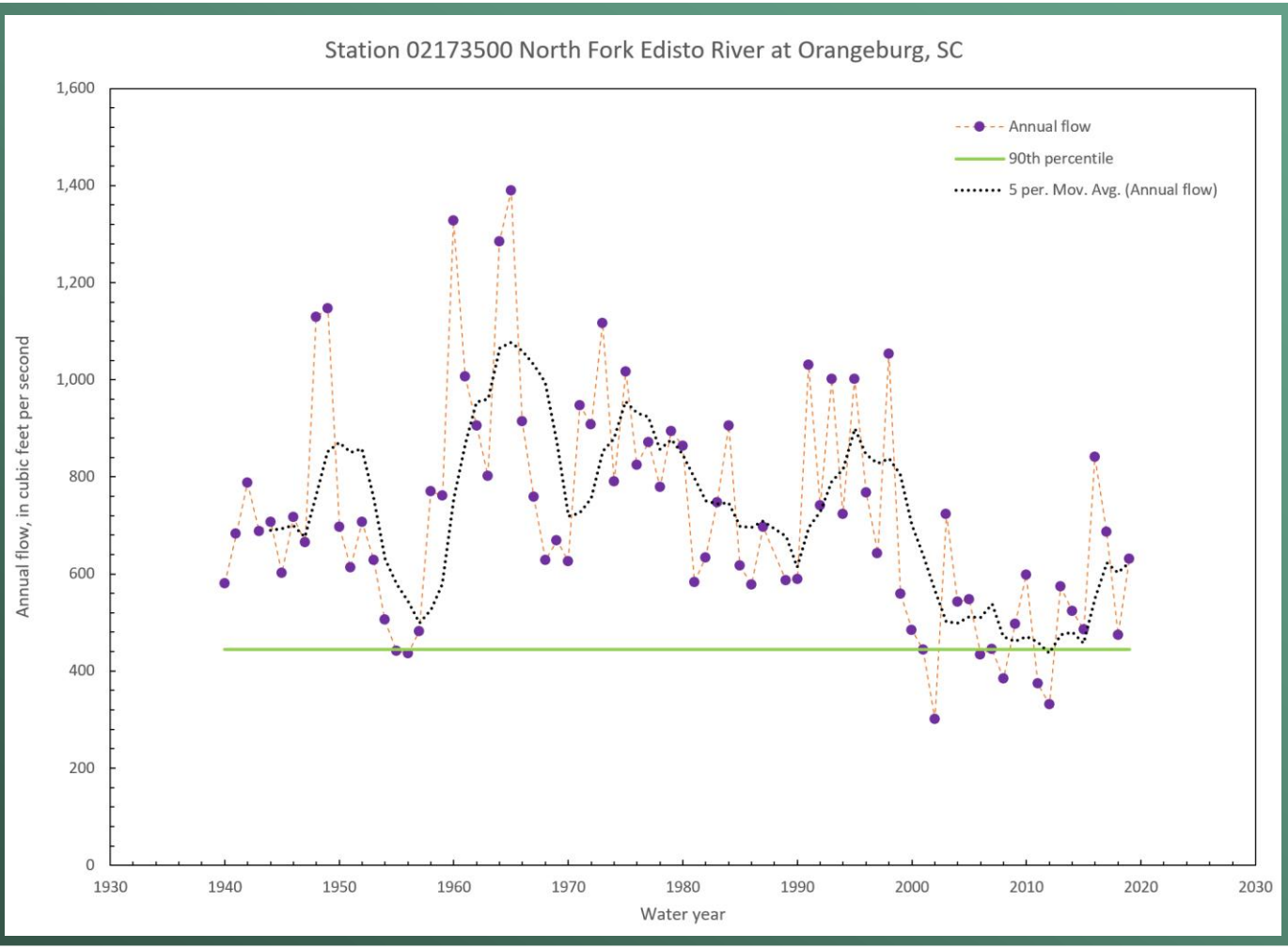
Low-Flow Characterization of South Carolina Streams

Annual flow



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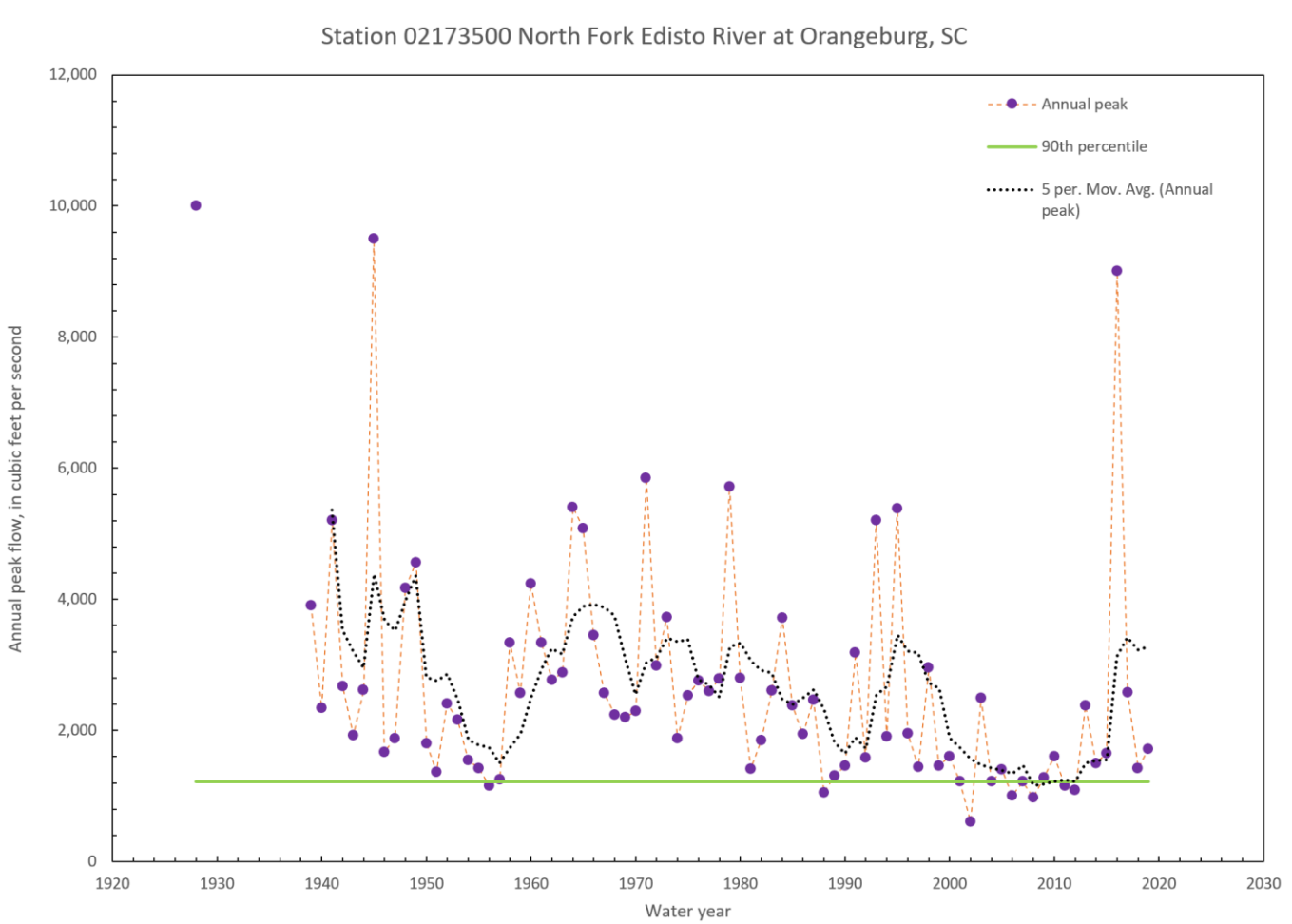
Low-Flow Characterization of South Carolina Streams

Annual peak flow



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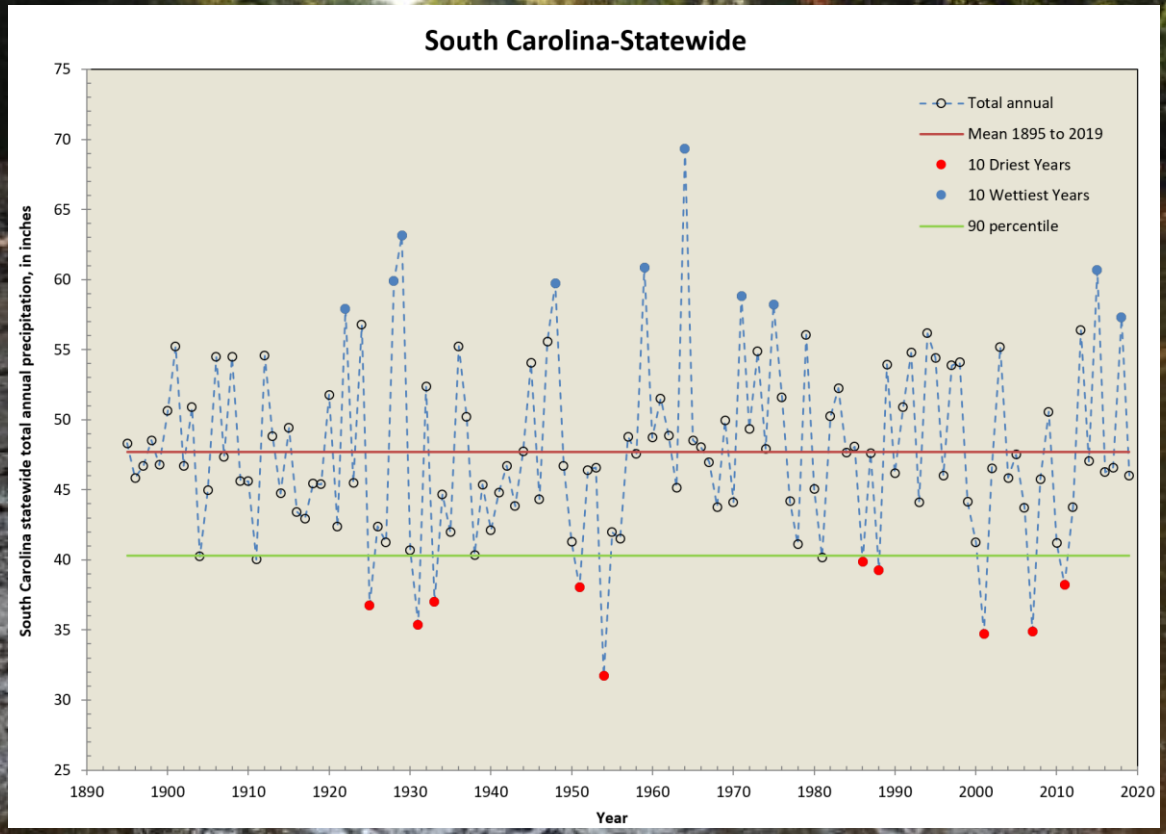
Low-Flow Characterization of South Carolina Streams

With respect to long-term statewide annual precipitation from 1895 to 2019



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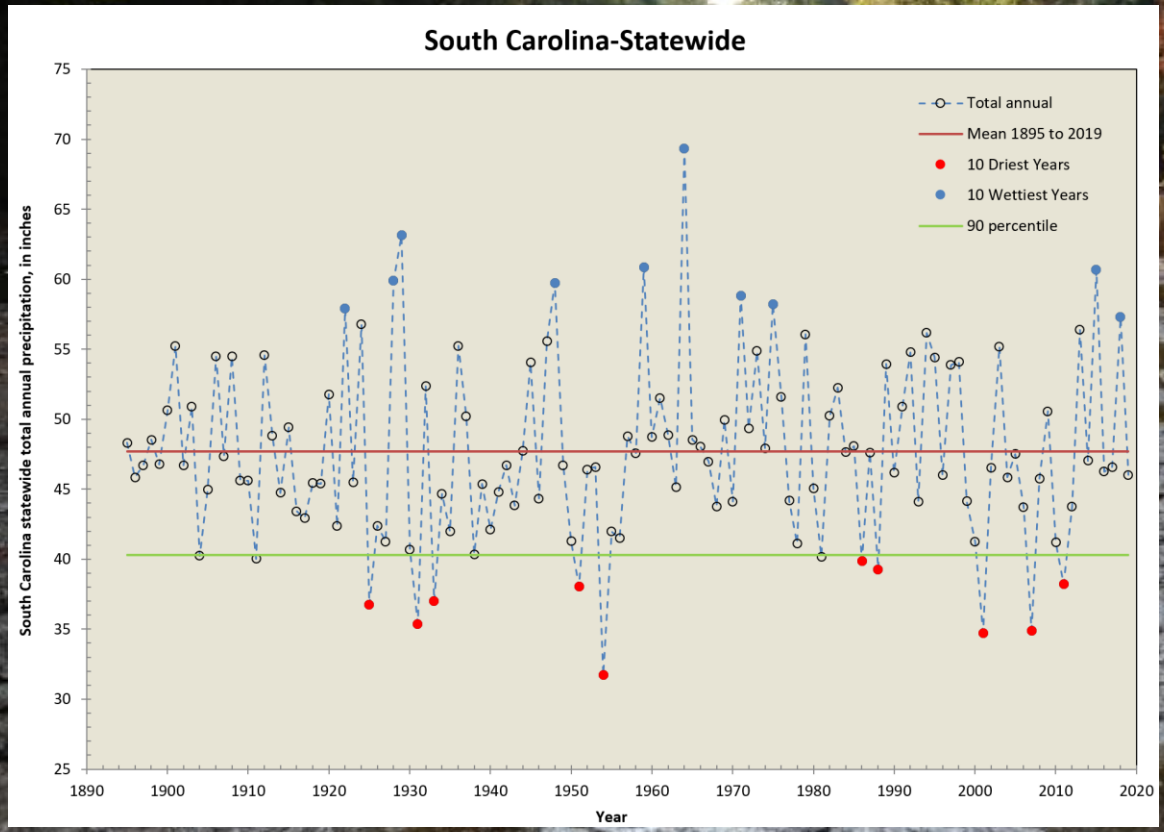
Low-Flow Characterization of South Carolina Streams

With respect to long-term statewide annual precipitation from 1895 to 2019



Wettest		Driest	
Year	Total annual precipitation (inches)	Year	Total annual precipitation (inches)
1964	69.32	1954	31.72
1929	63.14	2001	34.72
1959	60.86	2007	34.90
2015	60.66	1931	35.37
1928	59.89	1925	36.73
1948	59.74	1933	36.99
1971	58.82	1951	38.04
1975	58.23	2011	38.21
1922	57.90	1988	39.26
2018	57.30	1986	39.88

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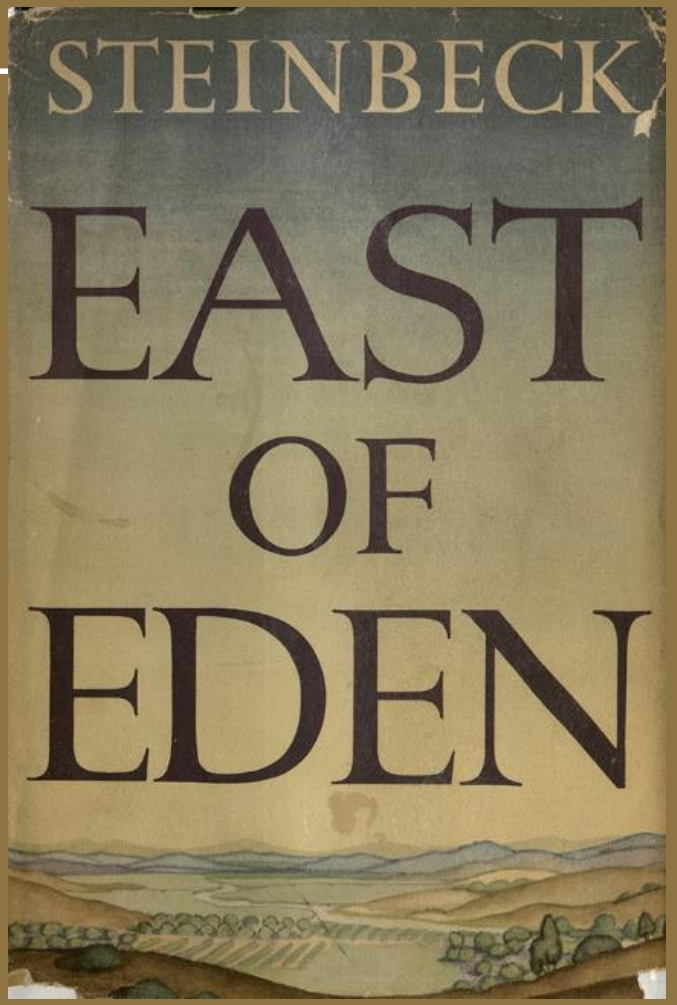
"And it never failed that during the dry years the people forgot about the rich years, and during the wet years, they lost all memory of the dry years. It was always that way."
–John Steinbeck *East of Eden*

"The reason we need long-term records is because we have short-term memories."--TDF



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