Pee Dee River Basin Surface Water Availability Modeling Results

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Agenda Item 4

Surface Water Scenarios

Today, we are only focusing on demand projections for **year 2070** (the end of our planning horizon)

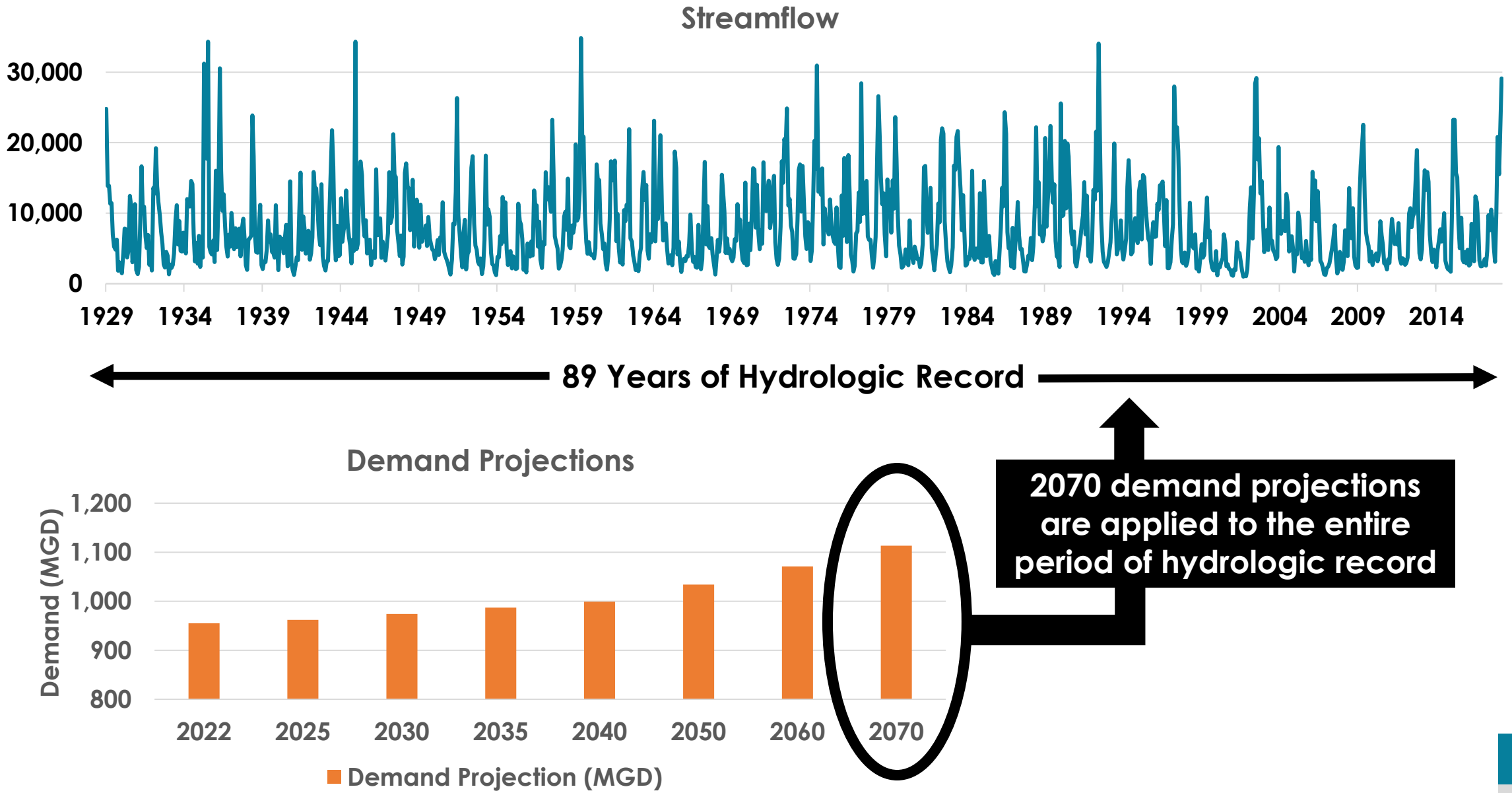
Base Scenarios

- Current Surface Water Use Scenario
  - *Uses most recent 10-yr average withdrawals (as reported by month)*
- Permitted and Registered (P&R) Surface Water Use Scenario
  - *Uses current fully-permitted and registered amounts*
- **Moderate Water Demand Projection Scenario**
  - *Future water demand projection based on moderate growth and normal climate*
- **High Water Demand Projection Scenario**
  - *Future water demand projection based on high growth and hot/dry climate*

Additional Scenarios

- Unimpaired Flow (UIF) Scenario
  - *Naturalized conditions (no surface water withdrawals, discharges, or reservoirs)*

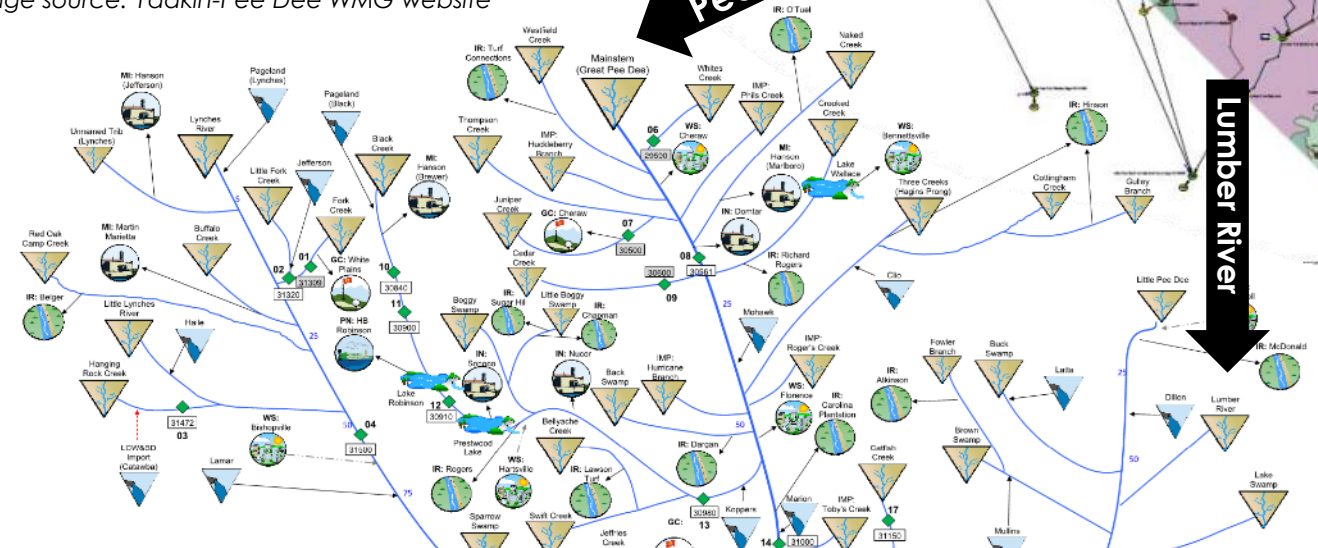
Evaluating Projected Demands (Example)



North Carolina Inflows From the NC Yadkin-Pee Dee and Lumber Hydrologic Model (OASIS)

Image source: Yadkin-Pee Dee WMG website

Model schematic from Hazen's "Model Overview – Yakin-Pee Dee/Lumber River Basin Hydrologic model presentation, December 11, 2020



- Daily and monthly inflows provided by HDR for the **UIF, Current Use, Moderate** and **High Demand Scenarios** for the **Pee Dee River**.
- Daily and monthly inflows provided by HDR for the **UIF,** and **Current Use Scenarios** for the **Lumber River**.
- For the **Lumber River**, **Current Use Scenario** inflows were used for the **Moderate** and **High Demand Scenarios** (for now)

Summary of Average Annual Surface Water Demands for Current Use and P&R Scenario (in MGD)

- Not including tidal-area surface water users that are not in the SWAM model

Surface Water Use Sector	Current Use	Permitted and Registered (P&R)	Current Use as a Percent of P&R
Mining	0.2	15.3	1%
Agriculture	2.1	197.5[2]	1%
Golf Courses	0.2	4.8	5%
Industrial/Manufacturing	79.5	184.3	43%
Public Water Supply	18.8	58.2	32%
Thermoelectric[1]	475.3	864.1	55%
Total all Sectors*	576	1,324	44%
Percent Increase Compared to Current Use:		99%	
Total without Thermoelectric*	101	460	22%
Percent Increase Compared to Current Use:		356%	

* *Rounded to nearest MGD*

[1] *Greater than 99% of the thermoelectric withdrawals are returned*

[2] *Now includes IR: Oaklyn Plantation (a new registration)*

Summary of Average Annual Surface Water Demands for Current Use and 2070 Moderate Demand Scenario (in MGD)

- Not including tidal-area surface water users that are not in the SWAM model

Surface Water Use Sector	Current Use	2070 Moderate Demand	Percent Increase from Current to 2070 Moderate Demand
Mining	0.2	1.3	501%
Agriculture	2.1	2.7	31%
Golf Courses	0.24	0.20	-18%
Industrial/Manufacturing	79.5	103.3	30%
Public Water Supply	18.8	16.3	-13%
Thermoelectric[1]	475.3	722.5	52%
Total all Sectors*	576	846	47%
Total without Thermoelectric*	101	124	23%

** Rounded to nearest MGD*

[1] Greater than 99% of the thermoelectric withdrawals are returned

Summary of Average Annual Surface Water Demands for Current Use and 2070 High Demand Scenario (in MGD)

- Not including tidal-area surface water users that are not in the SWAM model

Surface Water Use Sector	Current Use	2070 High Demand	Percent Increase from Current to 2070 High Demand
Mining	0.2	2.0	831%
Agriculture	2.1	3.7	77%
Golf Courses	0.24	0.41	69%
Industrial/Manufacturing	79.5	227.3	186%
Public Water Supply	18.8	33.1	76%
Thermoelectric[1]	475.3	825.4	74%
Total all Sectors*	576	1,092	90%
Total without Thermoelectric*	101	266	164%

** Rounded to nearest MGD*

[1] Greater than 99% of the thermoelectric withdrawals are returned

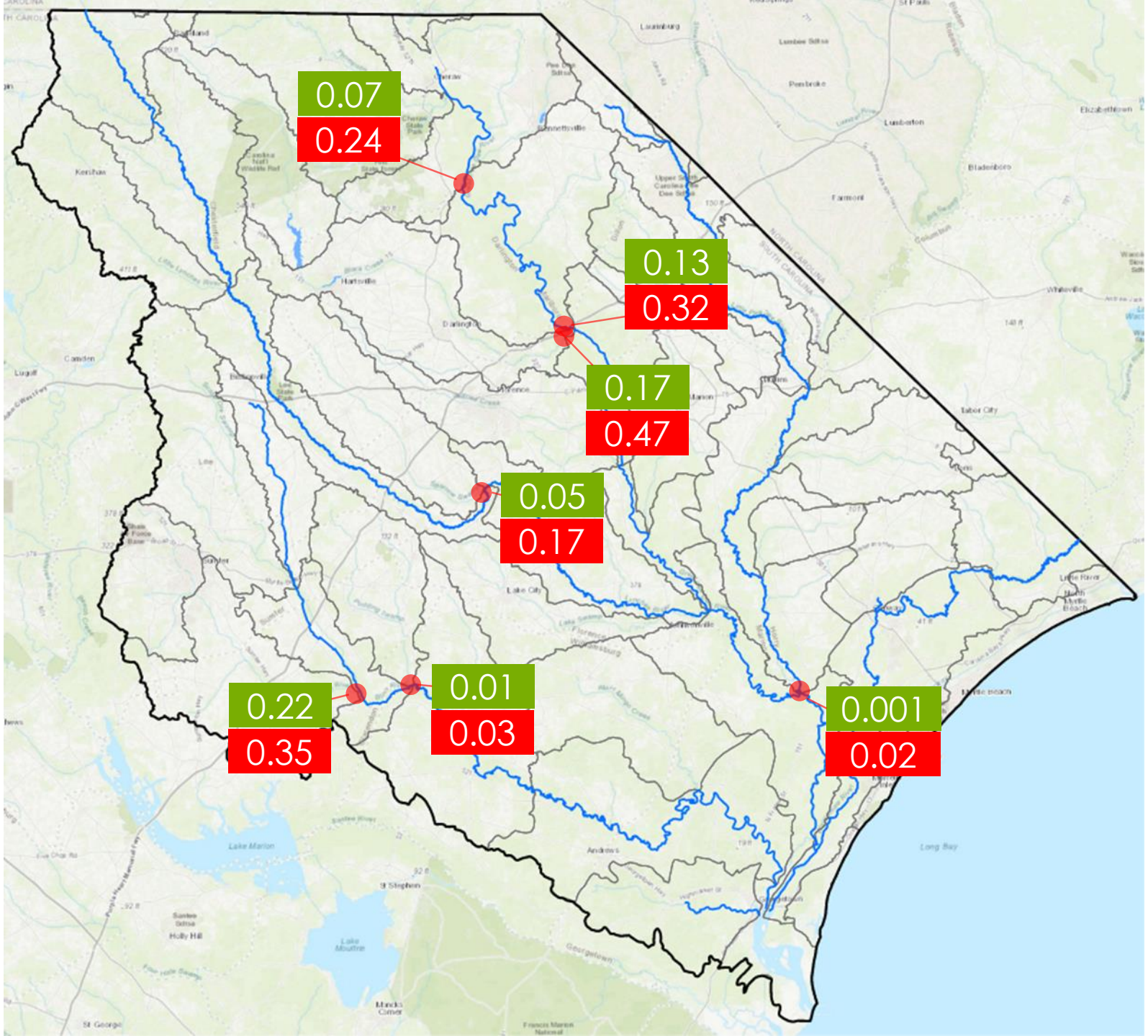
Projected Agricultural Demands

2070 Average Annual Demands, by Scenario

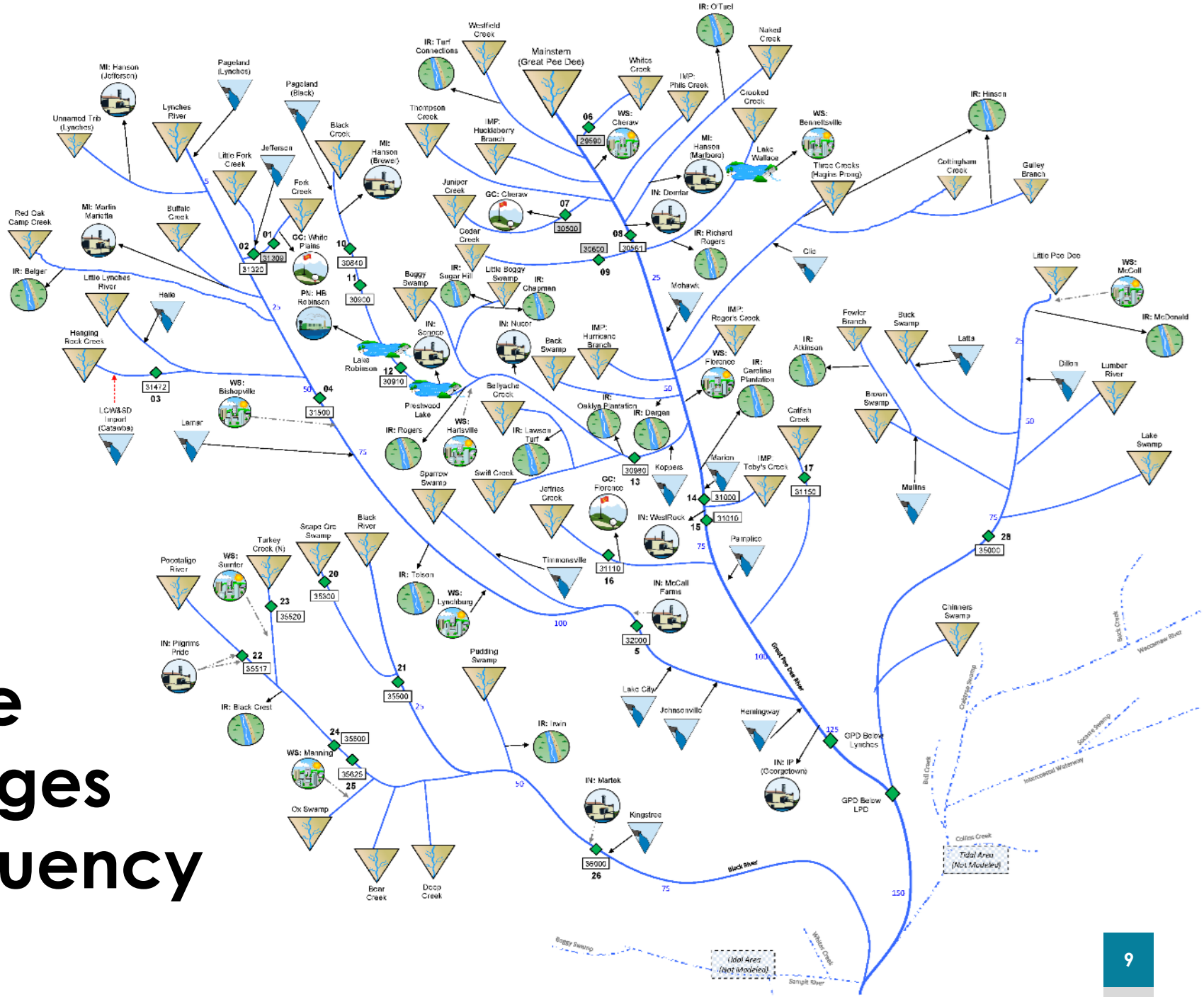
Scenario	Added Agriculture Demand (mgd)
Moderate	0.22
High Demand	0.35

HUC 10 Outlet

HUC 10s without values are assumed to have no additional Ag demand



Planning Scenario Model Results
(monthly timestep)



Where do we see simulated shortages and at what frequency and magnitude?

Current Use Scenario

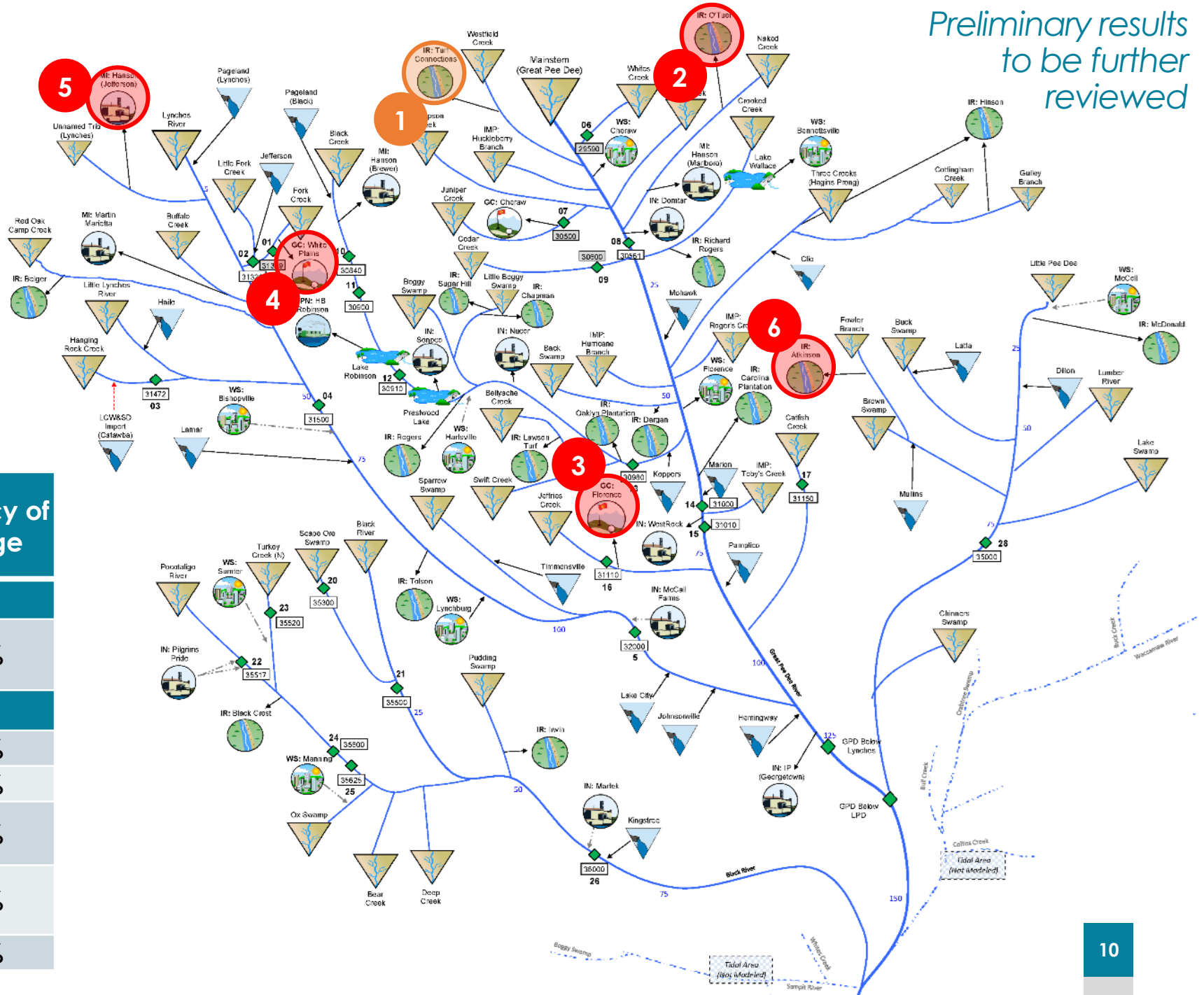
Preliminary results to be further reviewed

1 **Regulatory Shortage**

2 **Physical Shortage**

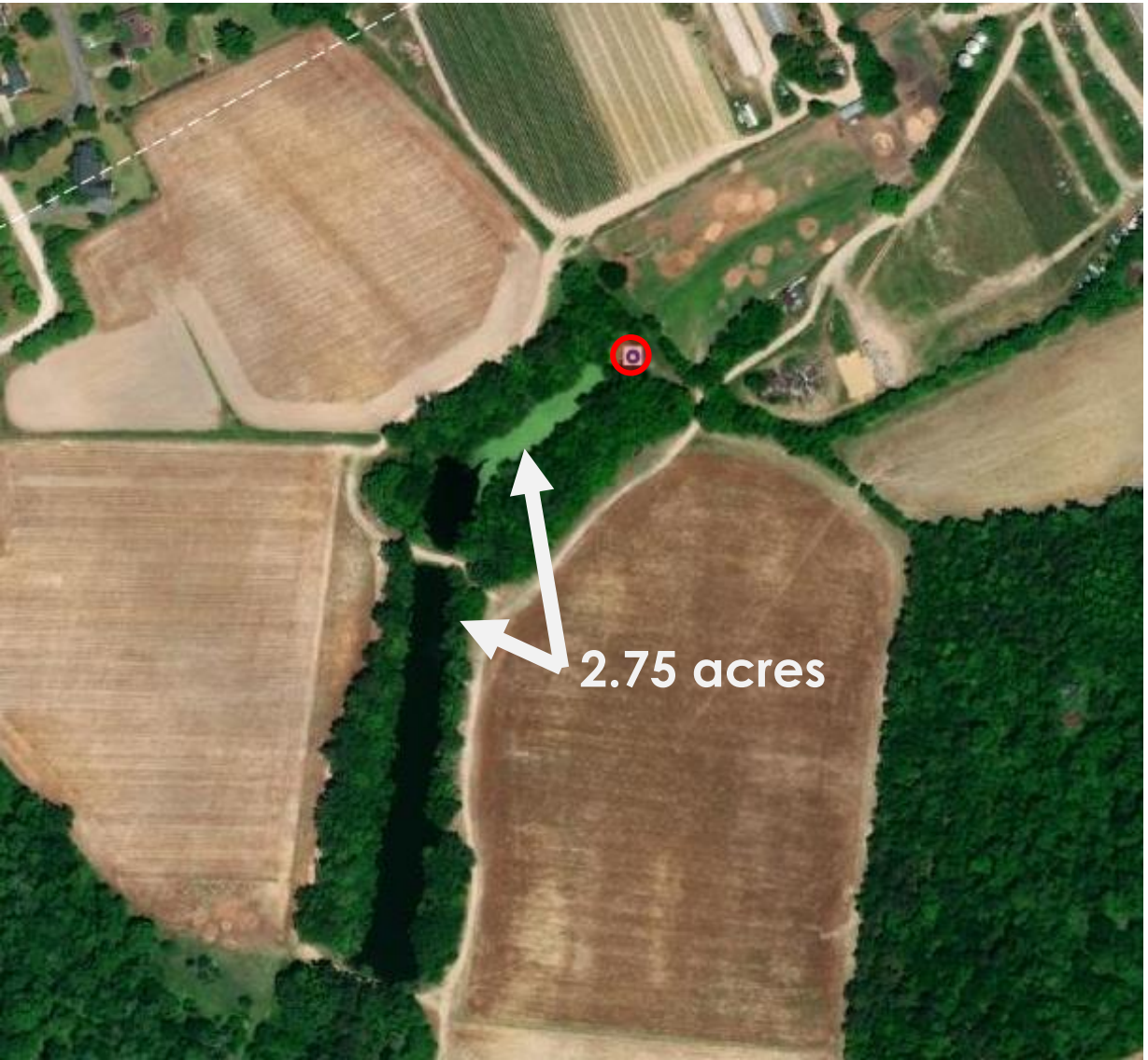
Surface Water Shortage Table

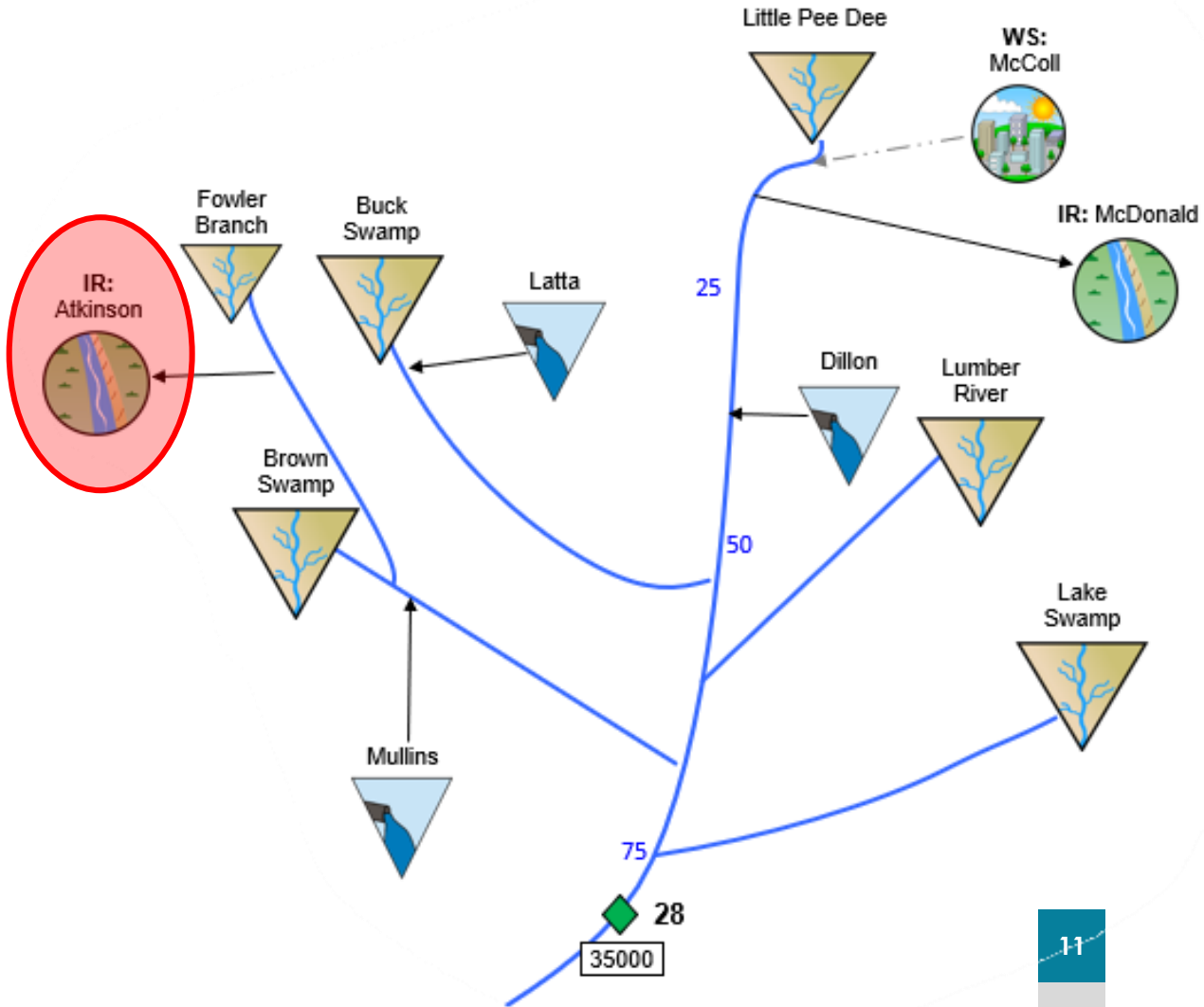
Map ID	Water User	Max Shortage (MGD)	Frequency of Shortage
Regulatory Shortage			
1	IR: Turf Connections	0.1	33.3%
Physical Shortages			
2	IR: O'Tuel	0.3	0.4%
3	GC: Florence	0.1	0.3%
4	GC: White Plains	0.1	7.0%
5	MI: Hanson (Jefferson)	0.05	6.1%
6	IR: Atkinson	0.05	1.2%



IR: Atkinson
2.75-acre impoundment

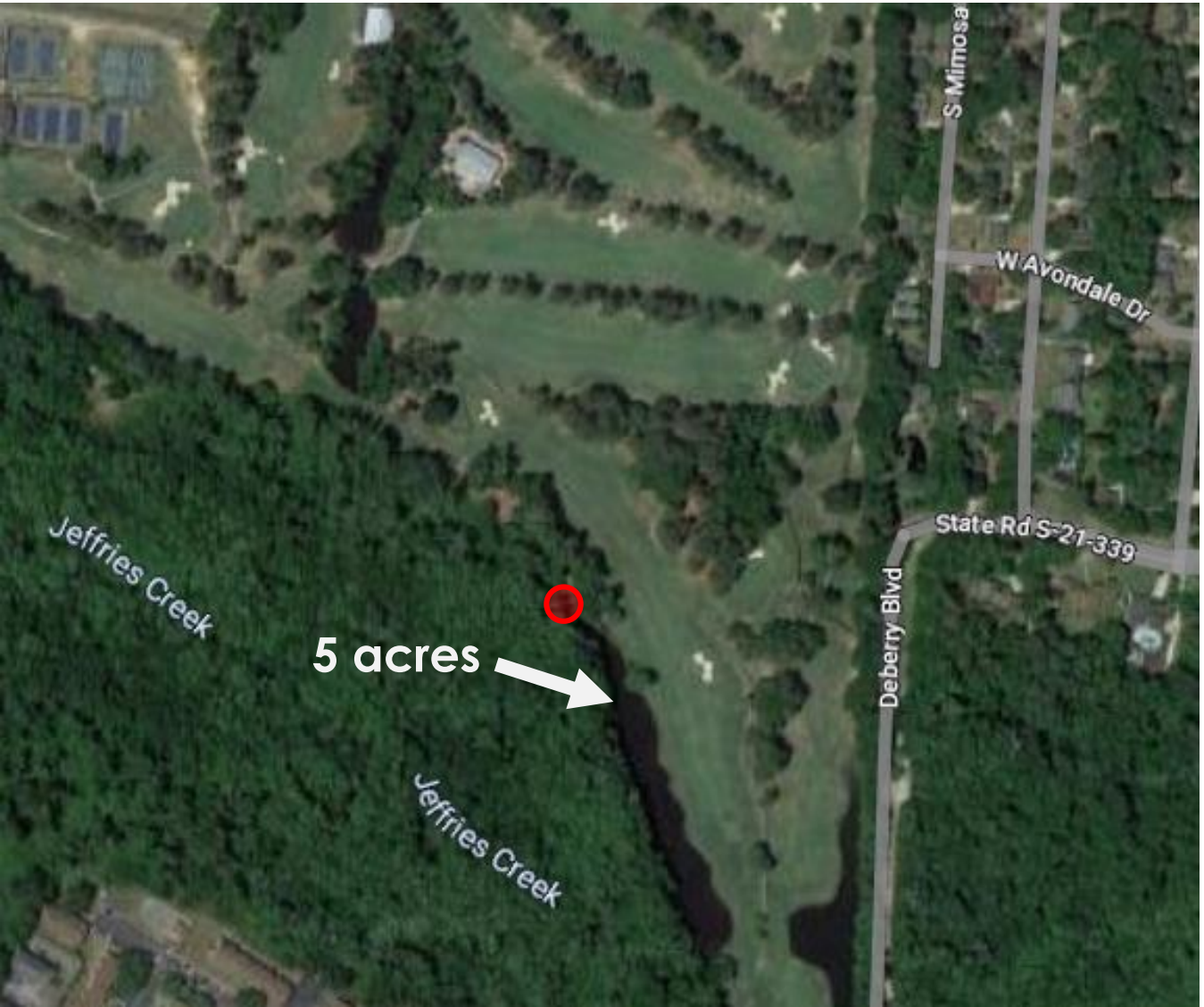
Surface water user with storage not included in the model

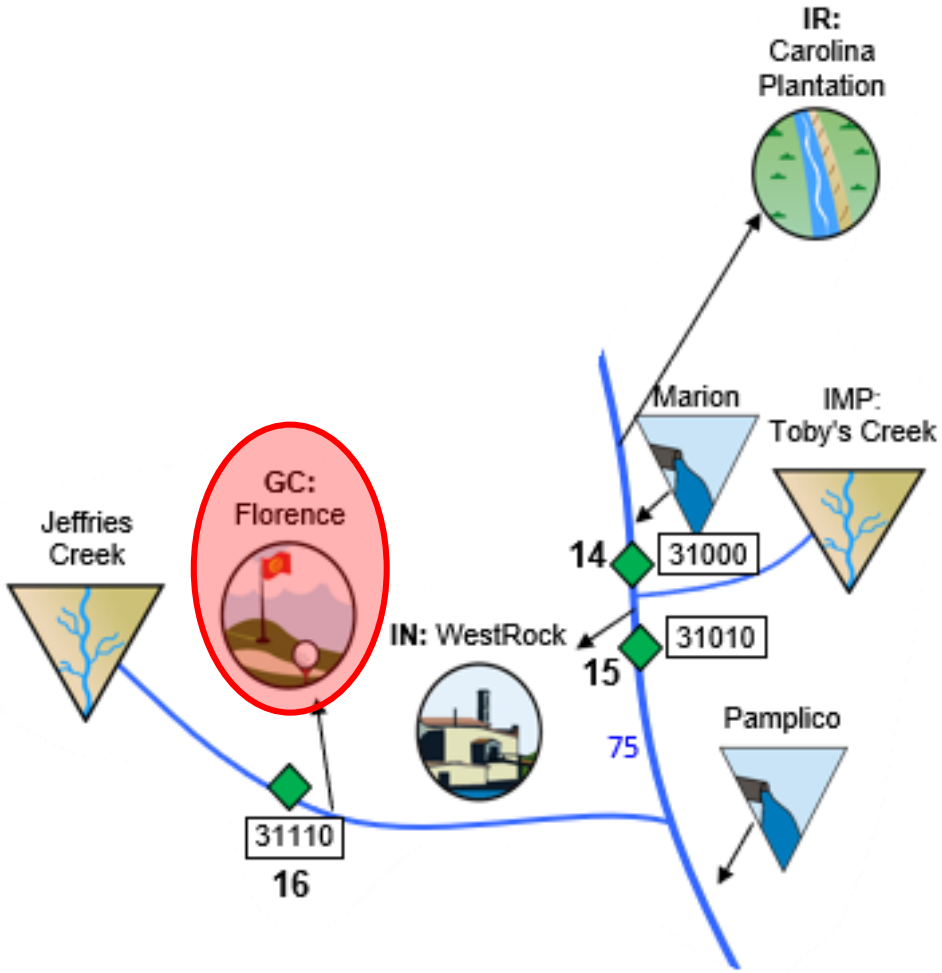




GC: Florence
5-acre impoundment

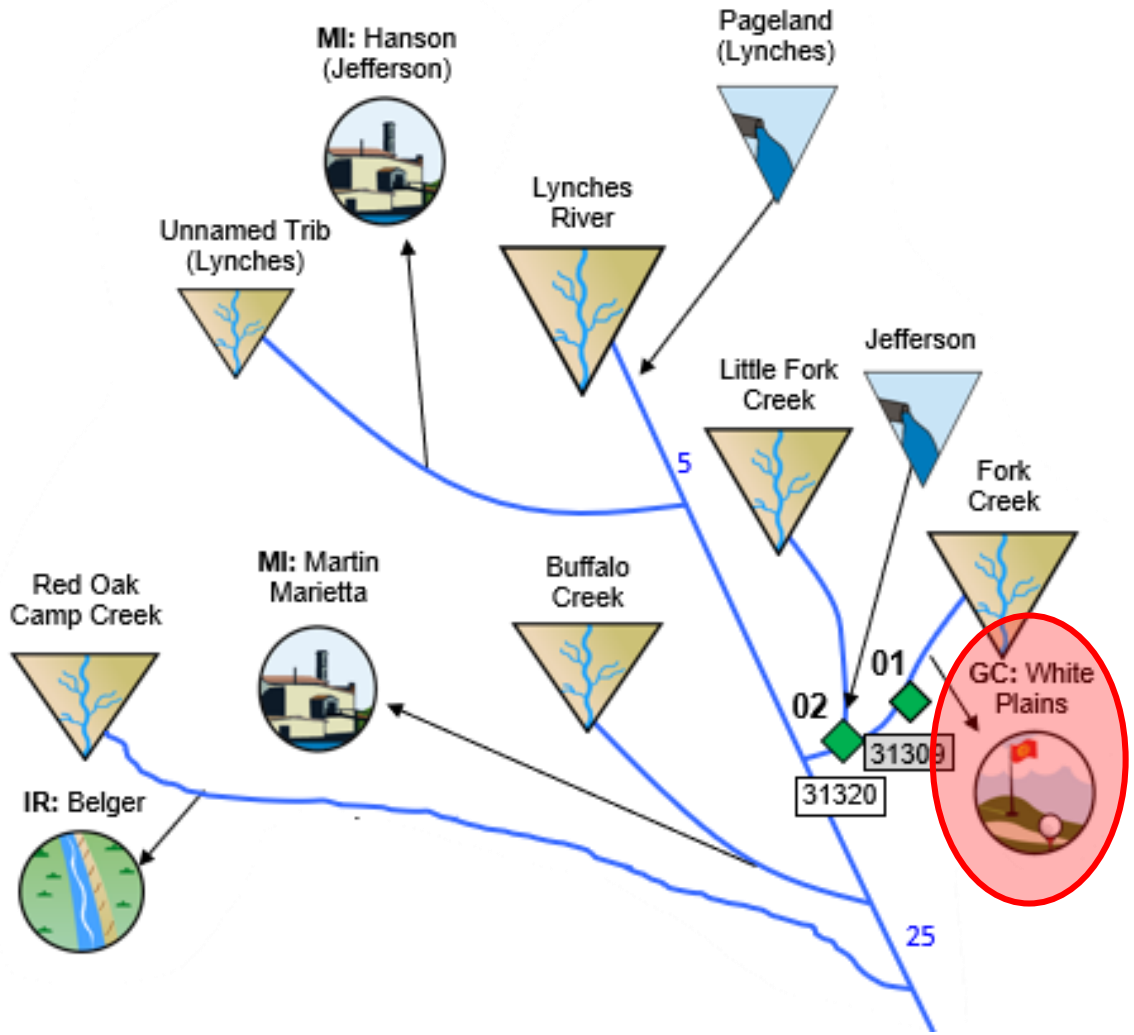
Surface water user with storage not included in the model





GC: White Plains
2-acre impoundment

Surface water user with storage not included in the model



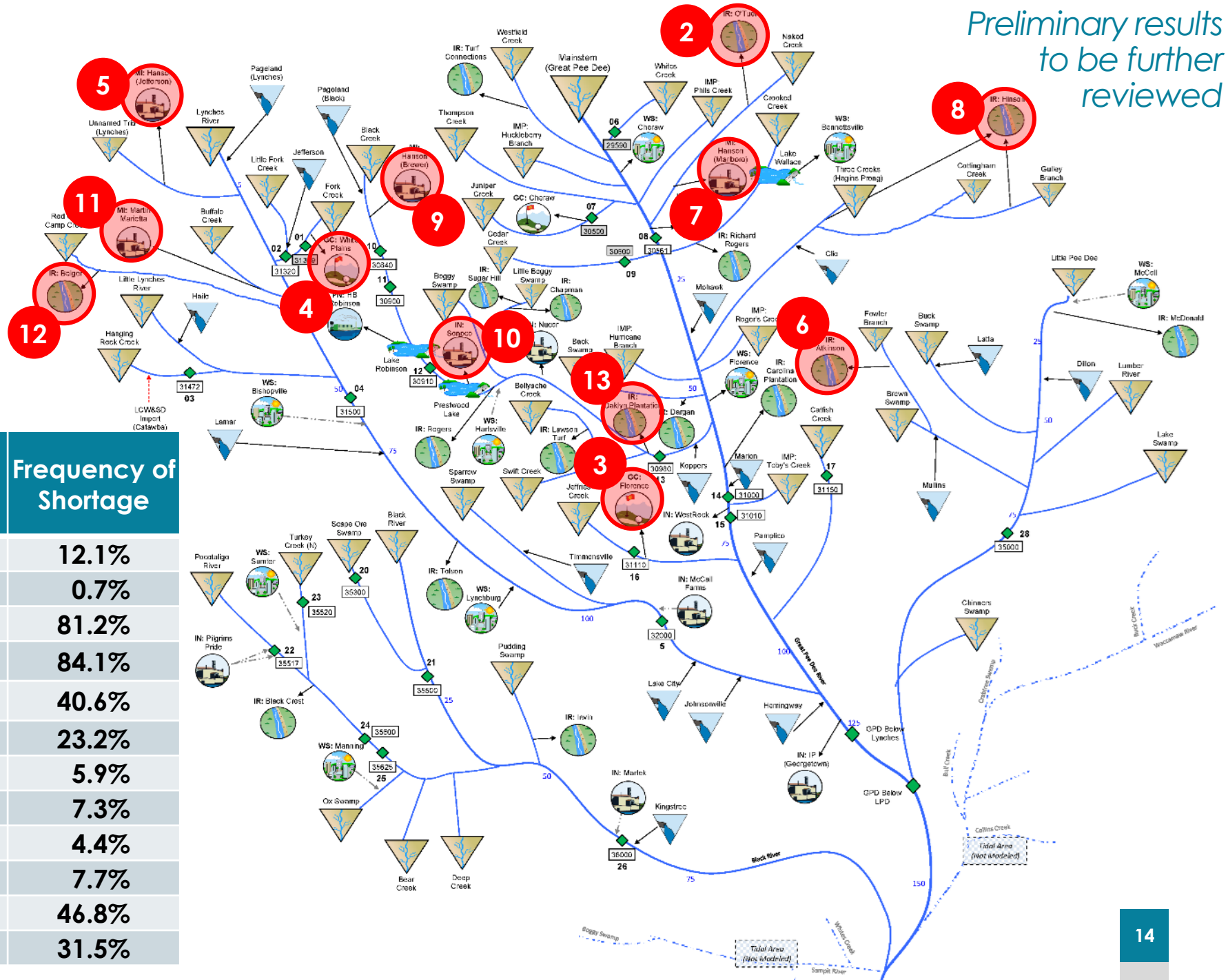
Permitted and Registered (P&R) Scenario

1 **Physical Shortage**

Preliminary results to be further reviewed

Surface Water Shortage Table

Map ID	Water User	Max Shortage (MGD)	Frequency of Shortage
2	IR: O'Tuel	1.8	12.1%
3	GC: Florence	1.6	0.7%
4	GC: White Plains	1.6	81.2%
5	MI: Hanson (Jefferson)	0.9	84.1%
6	IR: Atkinson	0.3	40.6%
7	MI: Hanson (Marlboro)	3.9	23.2%
8	IR: Hinson	0.3	5.9%
9	MI: Hanson (Brewer)	4.5	7.3%
10	IN: Sonoco	35.5	4.4%
11	MI: Martin Marietta	2.8	7.7%
12	IR: Belger	2.9	46.8%
13	IR: Oaklyn Plantation	146.3	31.5%



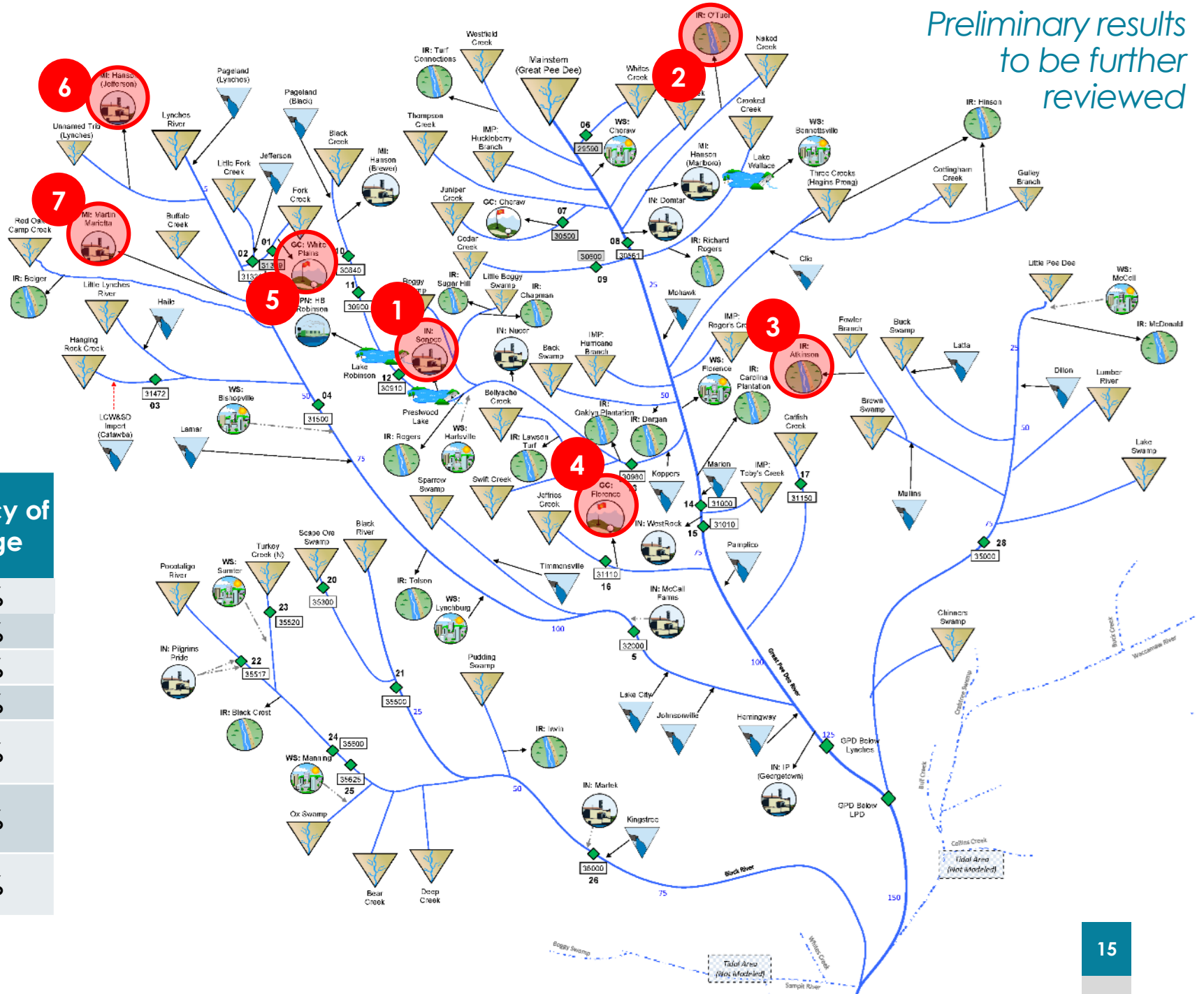
2070 Moderate Demand Scenario

Preliminary results to be further reviewed

Physical Shortage

Surface Water Shortage Table

Map ID	Water User	Max Shortage (MGD)	Frequency of Shortage
1	IN: Sonoco	9.2	0.3%
2	IR: O'Tuel	0.3	0.4%
3	IR: Atkinson	0.05	1.2%
4	GC: Florence	0.03	0.3%
5	GC: White Plains	0.1	6.3%
6	MI: Hanson (Jefferson)	0.04	5.0%
7	MI: Martin Marrietta	1.1	1.0%



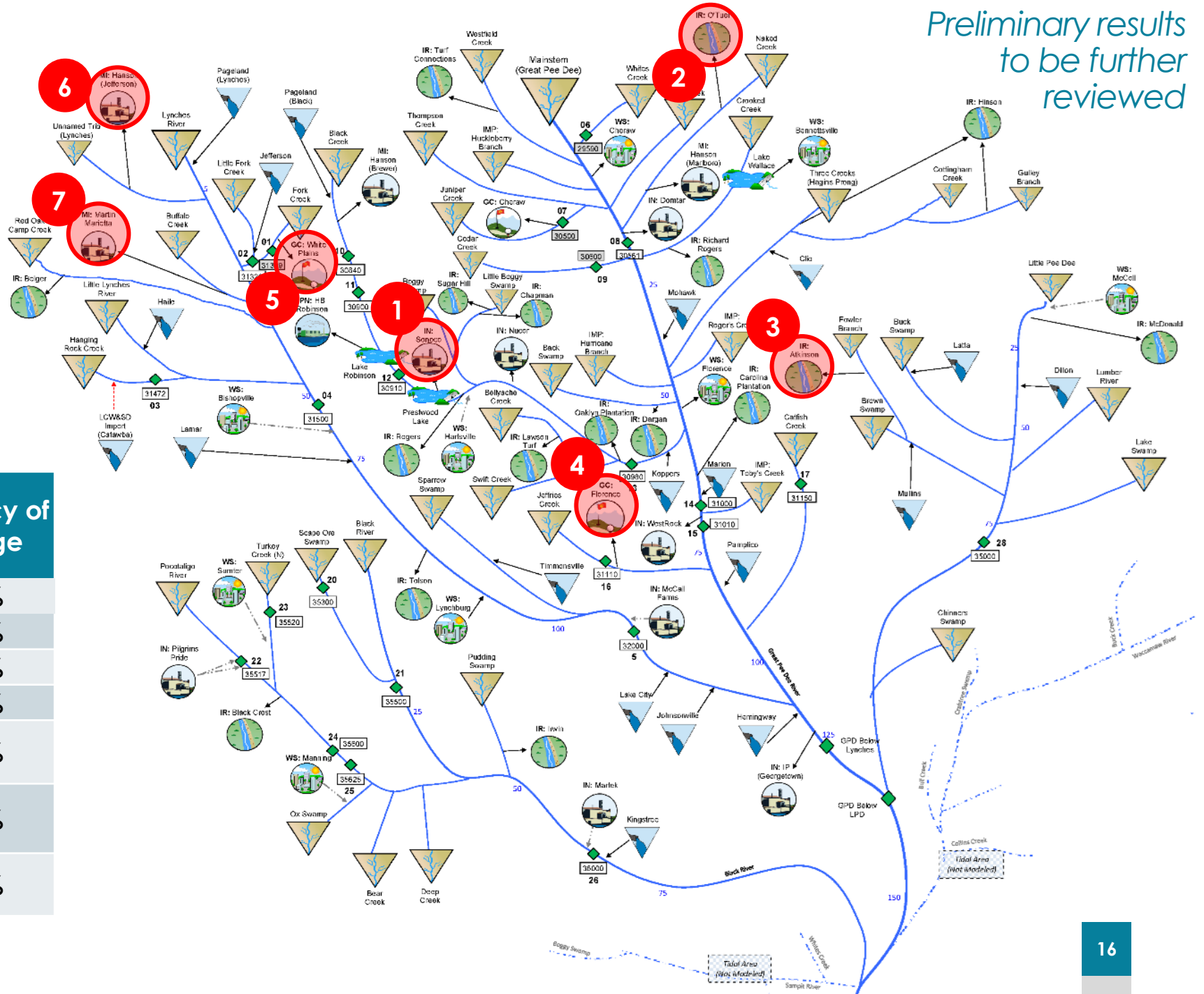
2070 High Demand Scenario

Preliminary results to be further reviewed

1 Physical Shortage

Surface Water Shortage Table

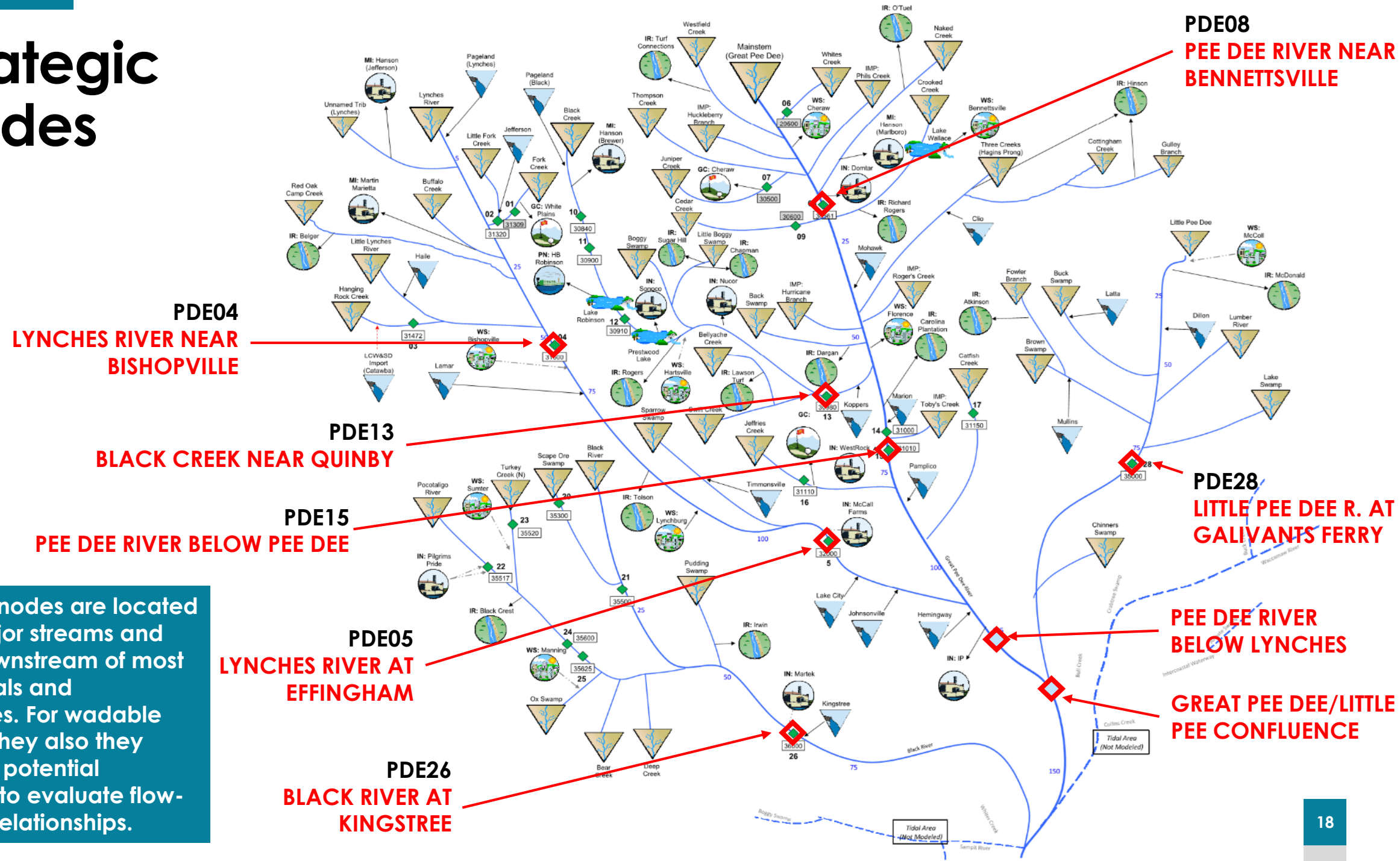
Map ID	Water User	Max Shortage (MGD)	Frequency of Shortage
1	IN: Sonoco	21.0	1.3%
2	IR: O'Tuel	0.3	0.4%
3	IR: Atkinson	0.05	1.2%
4	GC: Florence	0.1	0.3%
5	GC: White Plains	0.1	8.2%
6	MI: Hanson (Jefferson)	0.1	7.1%
7	MI: Martin Marrietta	1.1	1.3%



Summary of Surface Water Supply Shortages

Supply Shortage Metric	Current Use	Permitted & Registered	2070 Moderate Demand	2070 High Demand
Total basin annual mean shortage (MGD)	0.03	21.5	0.03	0.14
Maximum water user shortage (MGD)	0.3	146.3	9.2	21.0
Total basin annual mean shortage as a percentage of total water demand	0.03%	4.6%	0.02%	0.05%
Percentage of water users experiencing a shortage	18.8%	36.4%	17.5%	17.5%
Average frequency of shortage (%)	1.5%	10.5%	0.4%	0.5%

Strategic Nodes



Strategic nodes are located on all major streams and rivers, downstream of most withdrawals and discharges. For wadable streams, they also they represent potential locations to evaluate flow-ecology relationships.

Simulated Flows (Performance Measures) at Strategic Nodes

Performance Measure	PDE08 Pee Dee River near Bennettsville	PDE15 Pee Dee River below Pee Dee	Pee Dee River Below Lynches River Confluence	Great Pee Dee River below Little Pee Dee Confluence	PDE13 Black Creek near Quinby	PDE04 Lynches River near Bishopville	PDE05 Lynches River at Effingham	PDE28 Little Pee River at Galivants Ferry	PDE26 Black River at Kingstree
	All values in CFS								
UIF Scenario									
mean flow	8,046	9,673	11,732	14,892	540	751	1,001	2,883	984
median flow	6,129	7,457	9,070	11,561	463	524	712	2,162	647
25th percentile flow	3,703	4,638	5,641	7,065	294	279	384	1,197	299
10th percentile flow	2,699	3,263	3,836	4,787	207	177	247	721	166
5th percentile flow	2,229	2,796	3,277	4,051	165	138	193	577	115
minimum flow	689	939	1,126	1,359	70	45	67	202	26
Current Use Scenario									
mean flow	7,935	9,463	11,568	14,795	527	752	1,006	2,917	999
median flow	6,154	7,384	8,913	11,521	452	525	716	2,190	662
25th percentile flow	3,707	4,510	5,500	7,093	279	280	388	1,223	314
10th percentile flow	2,548	3,058	3,632	4,637	191	177	251	745	180
5th percentile flow	2,020	2,437	2,968	3,778	151	139	197	599	129
minimum flow	991	1,105	1,362	1,670	56	46	71	190	38
P&R Scenario									
mean flow	7,921	9,029	11,182	14,446	249	743	996	2,917	994
median flow	6,141	6,935	8,520	11,157	141	514	708	2,189	657
25th percentile flow	3,692	4,078	5,110	6,750	12	272	381	1,222	309
10th percentile flow	2,533	2,687	3,329	4,359	9	172	245	744	177
5th percentile flow	2,009	2,107	2,729	3,520	7	135	192	598	125
minimum flow	984	901	1,210	1,549	2	46	70	190	36

This is the top half of Table 6 of the memo

Simulated Flows (Performance Measures) at Strategic Nodes

Performance Measure	PDE08 Pee Dee River near Bennettsville	PDE15 Pee Dee River below Pee Dee	Pee Dee River Below Lynches River Confluence	Great Pee Dee River below Little Pee Dee Confluence	PDE13 Black Creek near Quinby	PDE04 Lynches River near Bishopville	PDE05 Lynches River at Effingham	PDE28 Little Pee River at Galivants Ferry	PDE26 Black River at Kingstree
	All values in CFS								
2070 Moderate Demand Scenario									
mean flow	7,792	9,285	11,391	14,628	523	751	1,004	2,917	997
median flow	6,018	7,203	8,717	11,389	448	524	714	2,190	661
25th percentile flow	3,583	4,343	5,325	6,913	275	278	386	1,223	312
10th percentile flow	2,416	2,879	3,435	4,472	186	176	248	745	177
5th percentile flow	1,880	2,292	2,785	3,618	147	137	196	599	128
minimum flow	989	1,093	1,351	1,658	56	46	70	190	36
2070 High Demand Scenario									
mean flow	7,639	8,964	11,122	14,418	521	750	1,005	2,918	1,011
median flow	5,842	6,858	8,447	11,191	443	523	715	2,190	674
25th percentile flow	3,430	4,007	5,067	6,694	274	278	387	1,223	325
10th percentile flow	2,231	2,547	3,139	4,244	184	176	249	745	189
5th percentile flow	1,709	1,974	2,500	3,443	144	137	196	599	141
minimum flow	974	928	1,236	1,538	53	46	71	190	47

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Difference in Simulated Flows for Current Use and 2070 Moderate Demand Scenario at Strategic Nodes

Performance Measure	PDE08 Pee Dee River near Bennettsville	PDE15 Pee Dee River below Pee Dee	Pee Dee River Below Lynches River Confluence	Great Pee Dee River below Little Pee Dee Confluence	PDE13 Black Creek near Quinby	PDE04 Lynches River near Bishopville	PDE05 Lynches River at Effingham	PDE28 Little Pee River at Galivants Ferry	PDE26 Black River at Kingstree
Current Use Scenario (cfs)									
mean flow	7,935	9,463	11,568	14,795	527	752	1,006	2,917	999
median flow	6,154	7,384	8,913	11,521	452	525	716	2,190	662
25th percentile flow	3,707	4,510	5,500	7,093	279	280	388	1,223	314
10th percentile flow	2,548	3,058	3,632	4,637	191	177	251	745	180
5th percentile flow	2,020	2,437	2,968	3,778	151	139	197	599	129
minimum flow	991	1,105	1,362	1,670	56	46	71	190	38
2070 Moderate Demand flow minus Current Use Scenario flow (cfs)									
mean flow	-143	-177	-177	-167	-4	-1	-2	0	-2
median flow	-136	-181	-196	-132	-4	-1	-2	0	-1
25th percentile flow	-124	-167	-175	-180	-4	-2	-2	0	-2
10th percentile flow	-132	-180	-197	-165	-5	-1	-3	0	-3
5th percentile flow	-140	-145	-183	-160	-5	-2	-1	0	-1
minimum flow	-2	-12	-11	-12	0	0	-1	0	-2
Percent Difference between 2070 Moderate Demand Scenario flow and Current Use Scenario flow									
mean flow	-1.8%	-1.9%	-1.6%	-1.1%	-0.8%	-0.2%	-0.2%	0.0%	-0.2%
median flow	-2.3%	-2.5%	-2.3%	-1.2%	-0.9%	-0.1%	-0.2%	0.0%	-0.2%
25th percentile flow	-3.5%	-3.8%	-3.3%	-2.6%	-1.5%	-0.6%	-0.6%	0.0%	-0.6%
10th percentile flow	-5.5%	-6.2%	-5.7%	-3.7%	-2.6%	-0.8%	-1.2%	0.0%	-1.5%
5th percentile flow	-7.5%	-6.3%	-6.6%	-4.4%	-3.3%	-1.2%	-0.7%	0.1%	-0.9%
minimum flow	-0.2%	-1.1%	-0.8%	-0.7%	0.0%	0.0%	-1.4%	0.0%	-5.6%

This is from Table 8 of the memo

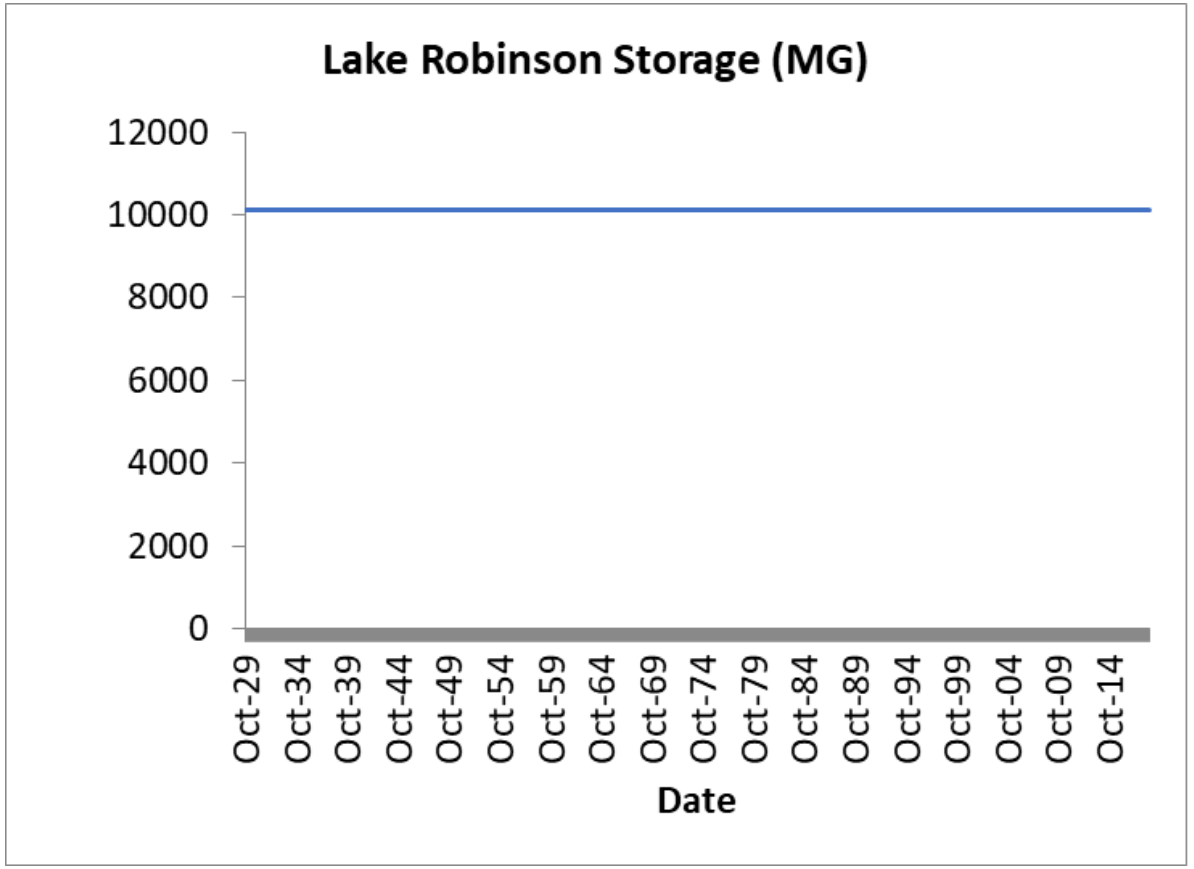
Difference in Simulated Flows for Current Use and 2070 High Demand Scenario at Strategic Nodes

Performance Measure	PDE08 Pee Dee River near Bennettsville	PDE15 Pee Dee River below Pee Dee	Pee Dee River Below Lynches River Confluence	Great Pee Dee River below Little Pee Dee Confluence	PDE13 Black Creek near Quinby	PDE04 Lynches River near Bishopville	PDE05 Lynches River at Effingham	PDE28 Little Pee River at Galivants Ferry	PDE26 Black River at Kingstree
Current Use Scenario (cfs)									
mean flow	7,935	9,463	11,568	14,795	527	752	1,006	2,917	999
median flow	6,154	7,384	8,913	11,521	452	525	716	2,190	662
25th percentile flow	3,707	4,510	5,500	7,093	279	280	388	1,223	314
10th percentile flow	2,548	3,058	3,632	4,637	191	177	251	745	180
5th percentile flow	2,020	2,437	2,968	3,778	151	139	197	599	129
minimum flow	991	1,105	1,362	1,670	56	46	71	190	38
2070 High Demand flow minus Current Use Scenario flow (cfs)									
mean flow	-296	-499	-446	-377	-6	-2	-1	1	12
median flow	-312	-526	-466	-330	-8	-2	-1	0	12
25th percentile flow	-277	-503	-433	-399	-6	-2	-1	0	11
10th percentile flow	-317	-511	-492	-392	-8	-1	-2	0	9
5th percentile flow	-311	-463	-468	-335	-7	-2	-1	0	12
minimum flow	-17	-177	-126	-132	-3	0	0	0	9
Percent Difference between 2070 High Demand Scenario flow and Current Use Scenario flow									
mean flow	-3.9%	-5.6%	-4.0%	-2.6%	-1.2%	-0.3%	-0.1%	0.0%	1.2%
median flow	-5.3%	-7.7%	-5.5%	-2.9%	-1.8%	-0.3%	-0.1%	0.0%	1.8%
25th percentile flow	-8.1%	-12.5%	-8.5%	-6.0%	-2.1%	-0.6%	-0.3%	0.0%	3.5%
10th percentile flow	-14.2%	-20.1%	-15.7%	-9.2%	-4.1%	-0.8%	-0.8%	0.0%	5.0%
5th percentile flow	-18.2%	-23.4%	-18.7%	-9.7%	-4.9%	-1.2%	-0.7%	0.1%	8.4%
minimum flow	-1.7%	-19.1%	-10.2%	-8.6%	-5.7%	0.0%	0.0%	0.0%	19.1%

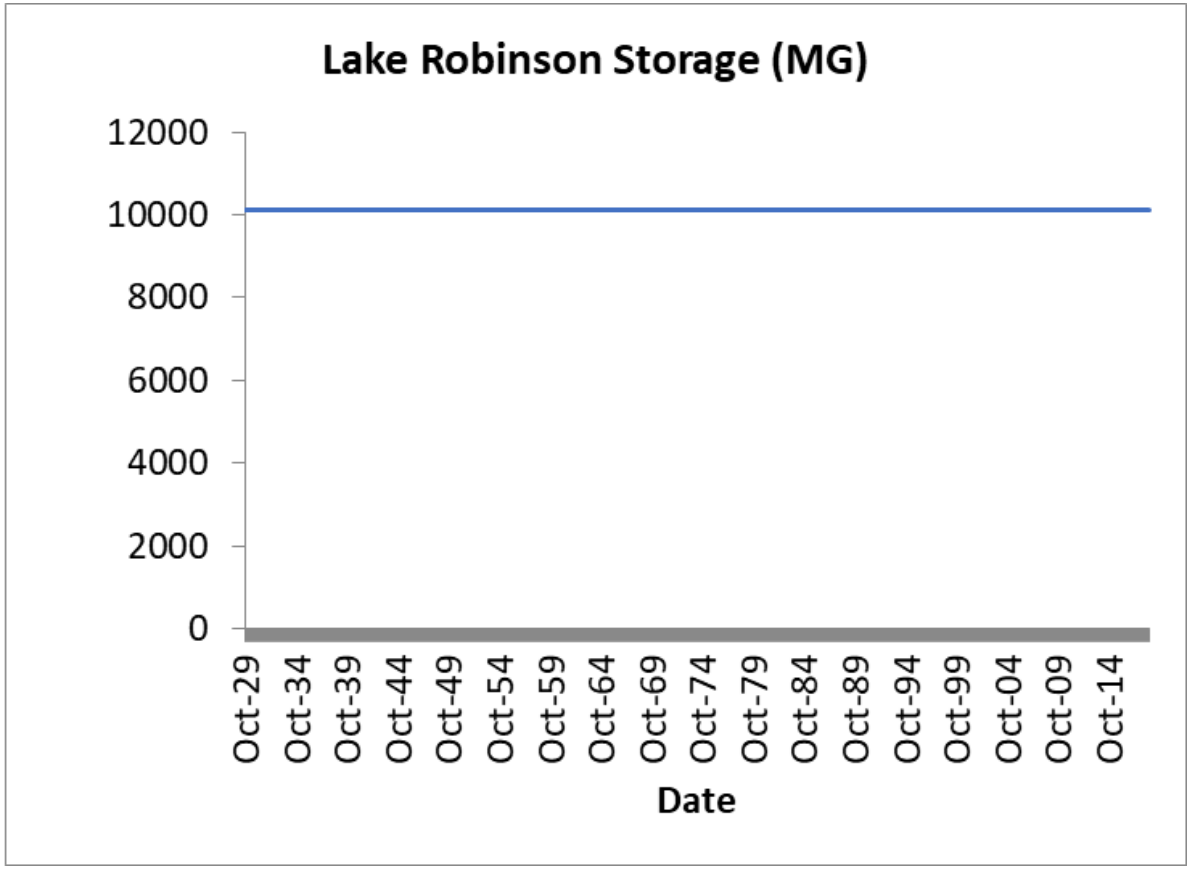
This is from Table 8 of the memo

Reservoir Storage – Lake Robinson

Current Use Scenario
(2.0 MGD Consumptive Demand for PN: HB Robinson)

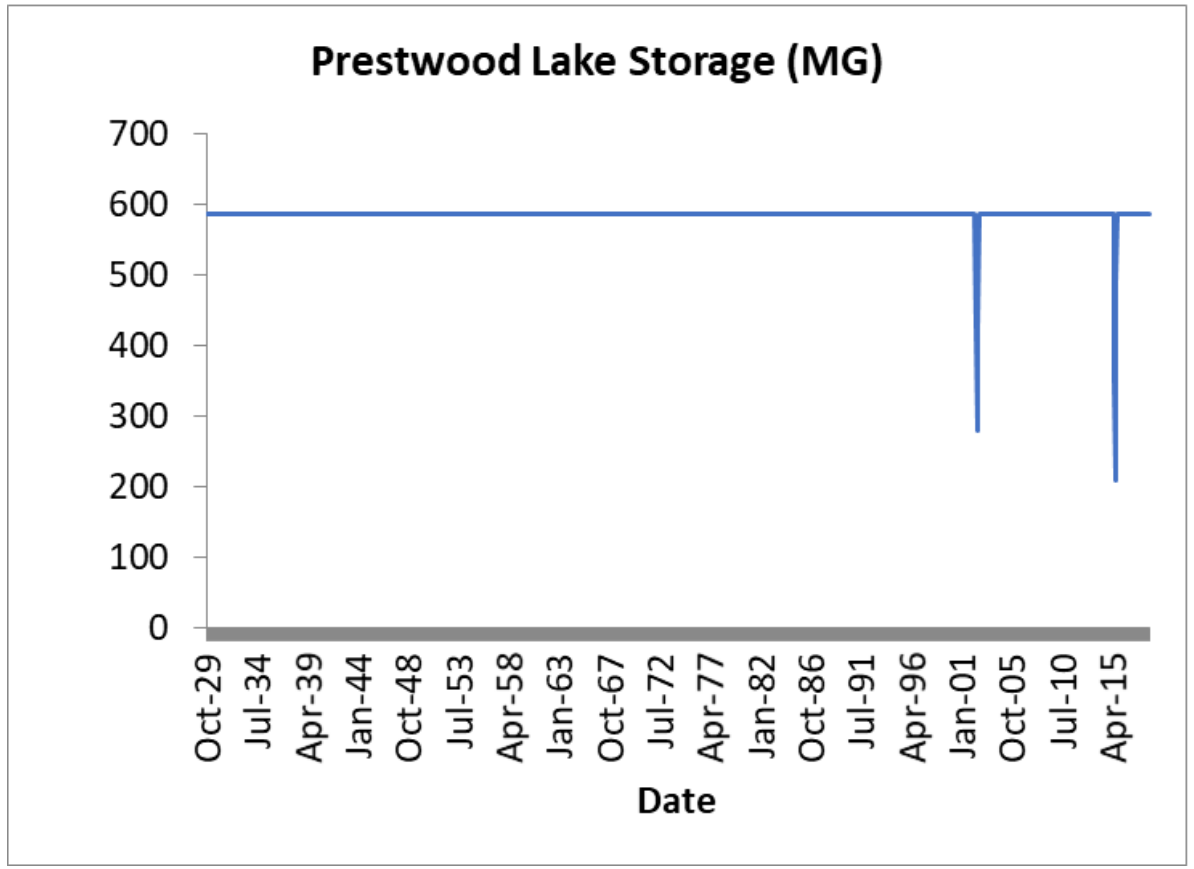


2070 High Demand Scenario
(2.2 MGD Consumptive Demand for PN: HB Robinson)

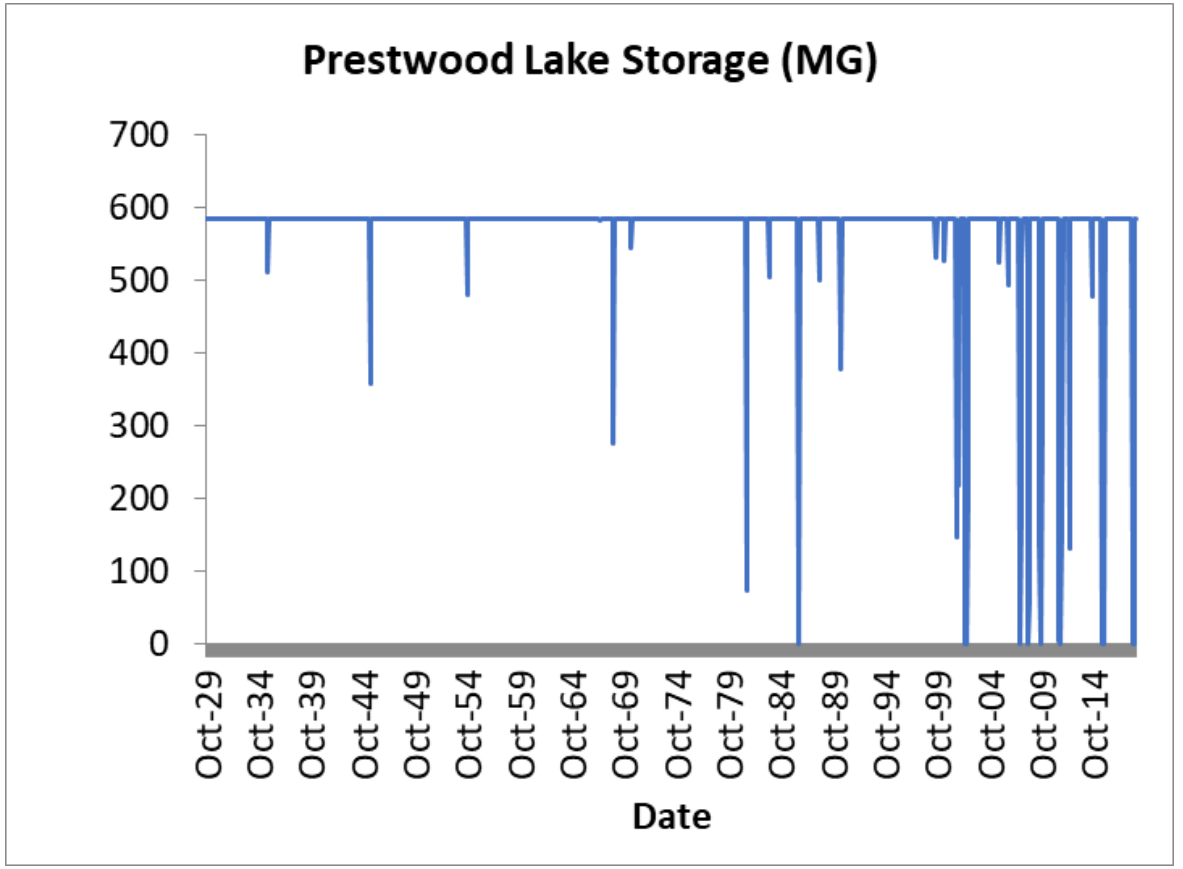


Reservoir Storage – Prestwood Lake

Current Use Scenario
(12.6 MGD Demand for IN: Sonoco)

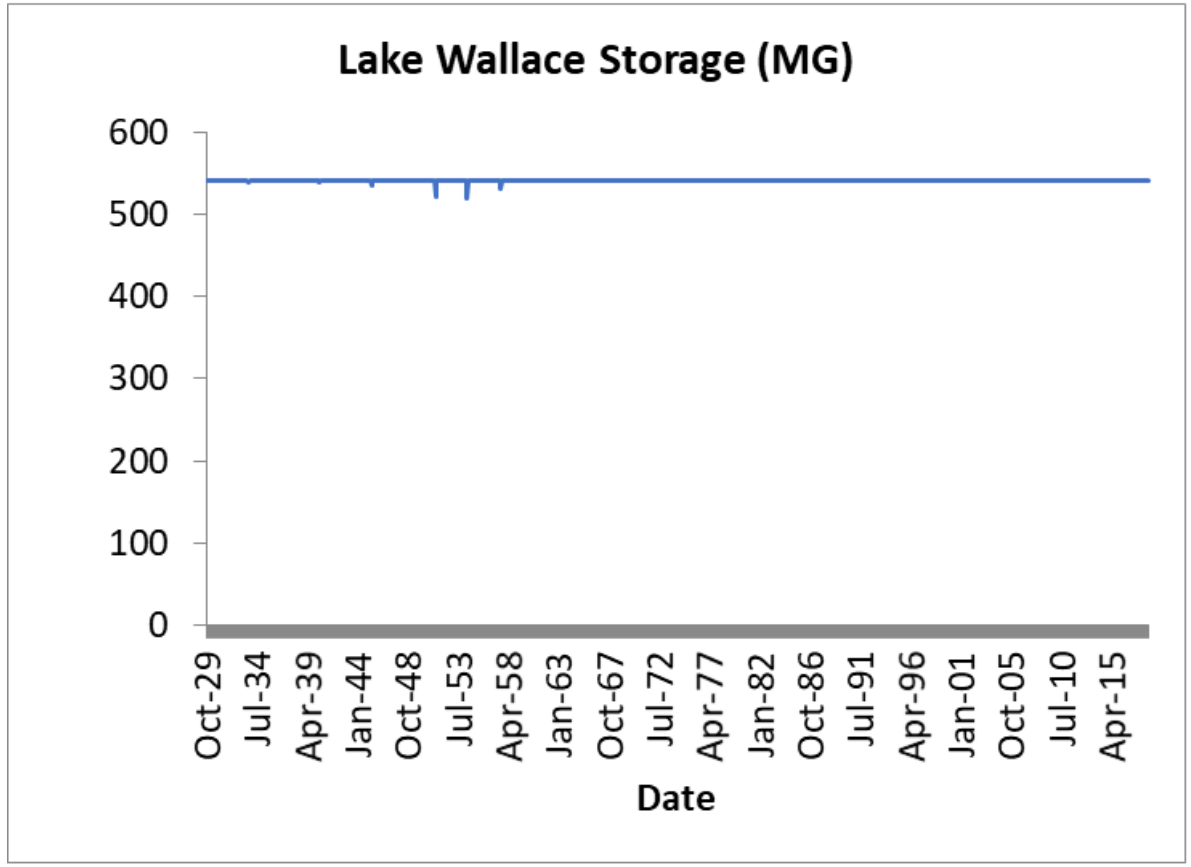


2070 High Demand Scenario
(29.8 MGD Demand for IN: Sonoco)

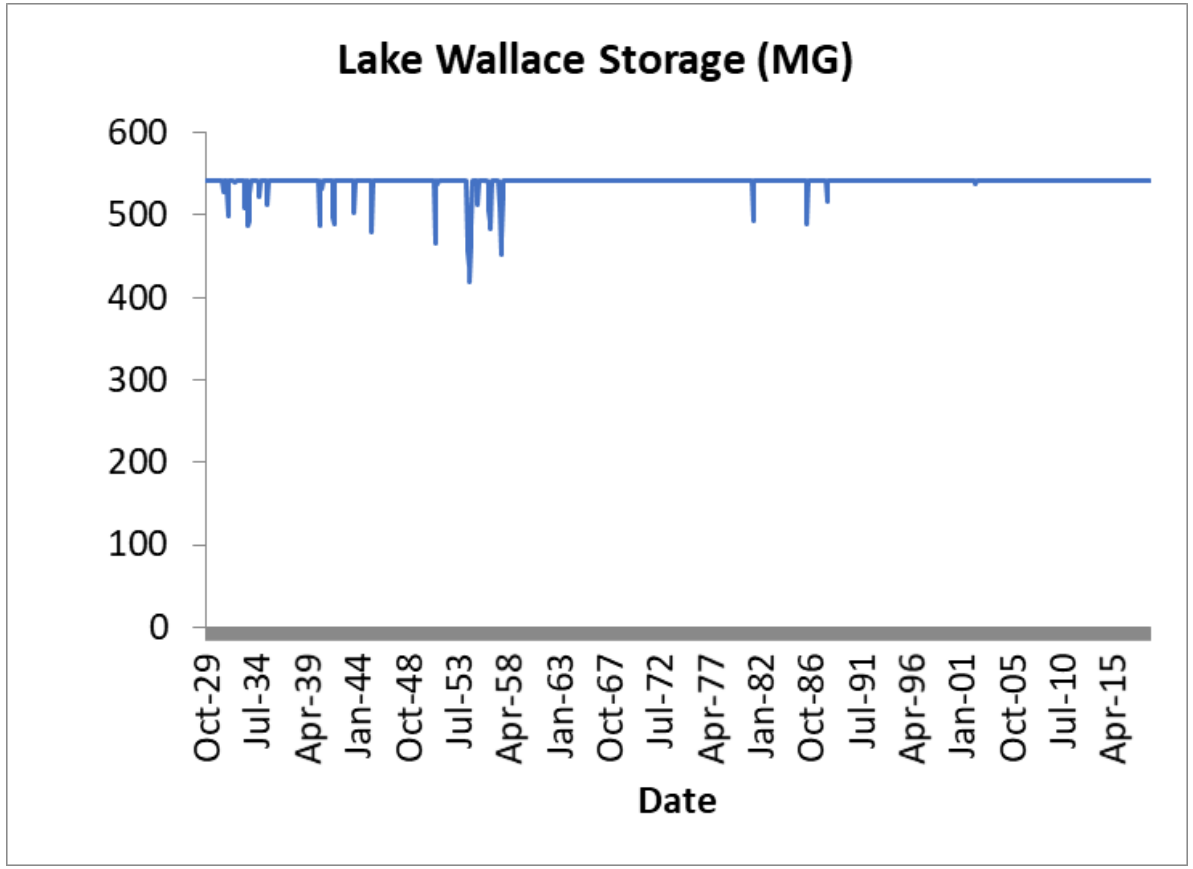


Reservoir Storage – Lake Wallace

Current Use Scenario
(2.2 MGD Demand for WS: Bennettsville)



2070 High Demand Scenario
(3.95 MGD Demand for WS: Bennettsville)



What Did We Learn?

- Based on historical hydrology (1929-2018) and applying 2070 projected demands, which assume high population and economic growth (**High Demand Scenario**), we found that:
  - There are two **agriculture operations** that could have infrequent shortages (0.4% to 1.2% of the time). At least one of these users has a storage pond (not included in the model), which may prevent the shortages.
  - **Sonoco** may have infrequent (<1.3% of the time) but significant shortages; however, additional releases from Lake Robinson may eliminate these.
  - There are two **golf courses** that could have infrequent shortages (0.3% to 8.2% of the time). Both golf courses have storage ponds (not included in the model), which may prevent the shortages.
  - Two **mining operations** have infrequent shortages (1.3% to 7.1% of the time), ranging from 0.1 to 1.1 MGD.

What Did We Learn?

- Based on historical hydrology (1929-2018) and applying 2070 projected demands which assume high population and economic growth (**High Demand Scenario**), we found that:
  - The six **agriculture**, **mining** and **golf course** surface water users with projected shortages are:
    - on first and second order tributaries to larger streams
    - the most upstream (registered or permitted) surface water users on the reach where they withdraw water

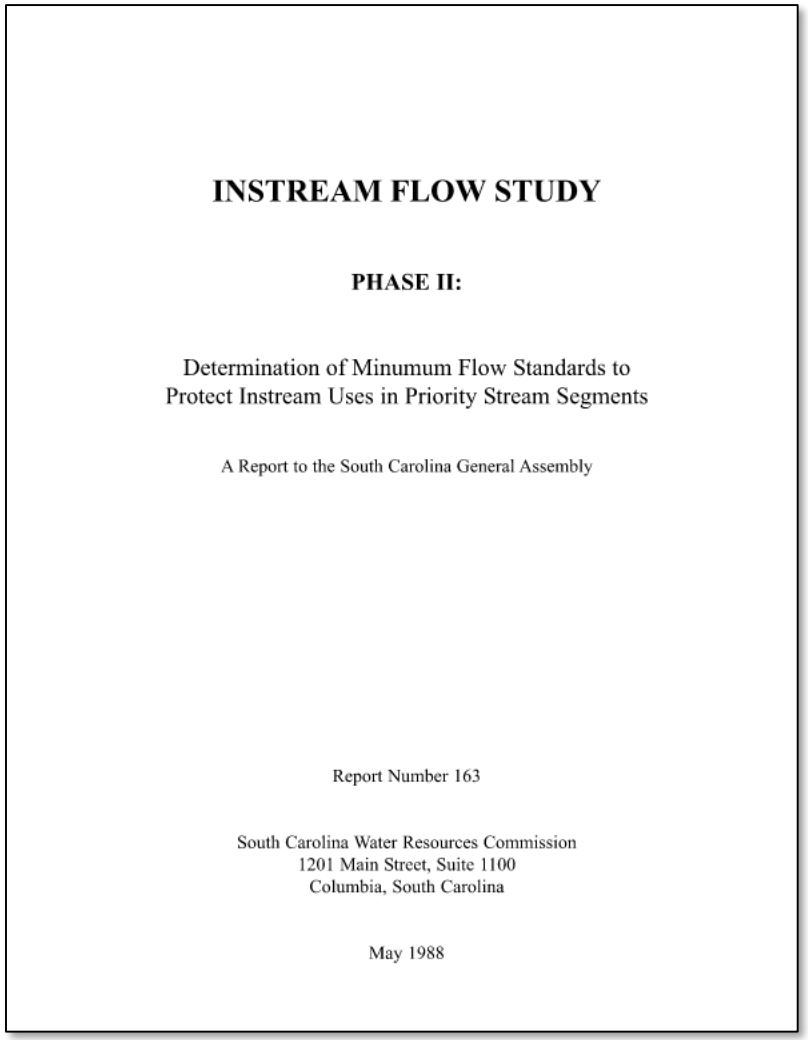
Considerations and Next Steps

RBC Considerations Moving Forward

- Would the RBC like to revise or add to the list of **Strategic Nodes**… i.e. evaluate flows at different points in the basin?
- Would the RBC like to see how often simulated flows under each scenario drop below the **Minimum Recommended Instream Flows** (**MIFs**) (even though most water users in the basin are not subject to them)?

1988 Instream Flow Study

- In 1983 the Water Resource Commission was directed to
  - **Phase 1:** Identify streams in need of low flow protection (1985)
  - **Phase II:** Make recommendations of MIF requirements to protect instream uses (1988)
- Determined MIF for 33 study sites based on 6 instream uses with different instream flow approaches
- MIF to protect fisheries resources determined by
  - Tennant Method
  - Wetted Perimeter
  - Usable Width
- Instream flows should be determined for 3 periods to maintain natural seasonal variability (higher flows in spring, lower in summer).
- SC Wildlife and Marine Resources Dept. used study to develop MIF for fisheries as 20-30-40



INSTREAM FLOW STUDY

PHASE II:

Determination of Minumum Flow Standards to
Protect Instream Uses in Priority Stream Segments

A Report to the South Carolina General Assembly

Report Number 163

South Carolina Water Resources Commission
1201 Main Street, Suite 1100
Columbia, South Carolina

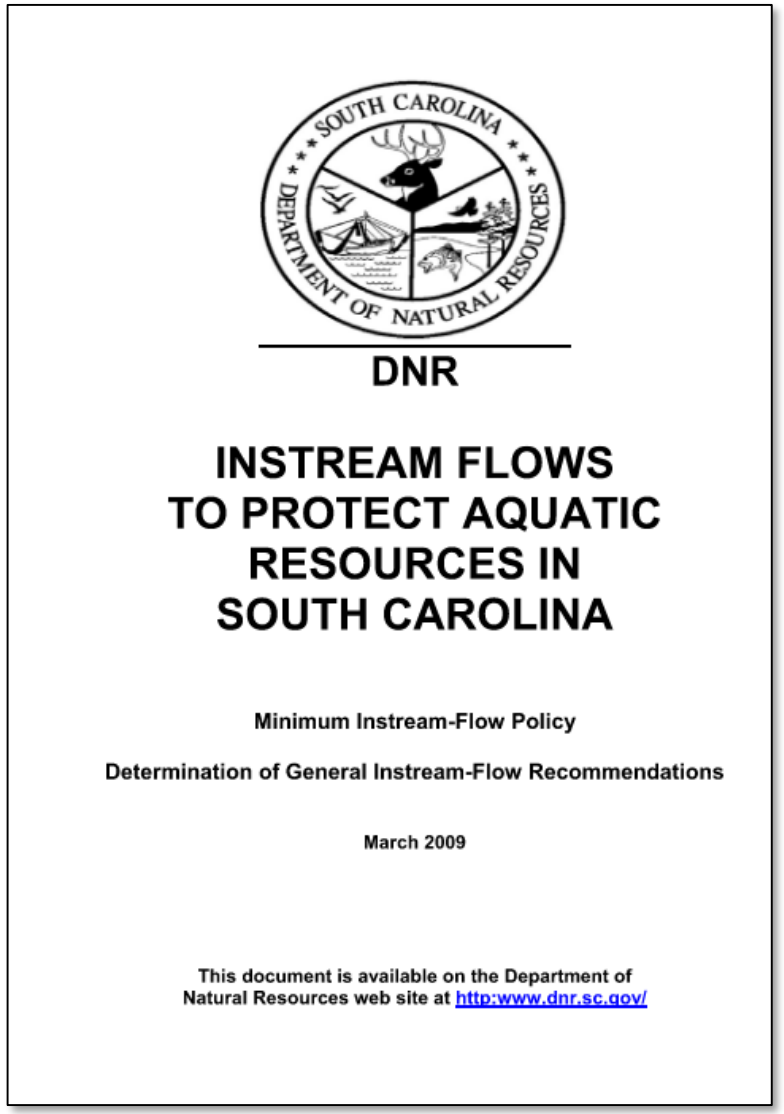
May 1988

2009 SCDNR Instream Flow Policy

- Adopted results of 1988 study
  - Seasonal variability in flows
  - Fisheries requirements as limiting
- Based on variation in fish habitat needs in the Piedmont vs the Coastal Plain, DNR recommended MIFs vary
- DNR will request MIFs below proposed or existing dams be maintained at minimum levels noted in the table

Table VI. DNR recommended minimum acceptable instream flows.

Region	Period	Minimum Recommended Instream-Flow
Coastal Plain	July – November	20% of mean annual daily flow
	January – April	60% of mean annual daily flow
	May, June & December	40%' of mean annual daily flow
Piedmont	July – November	20% of mean annual daily flow
	January – April	40% of mean annual daily flow
	May, June & December	30% of mean annual daily flow



Minimum Instream Flows in the SW Regulations

The South Carolina Surface Water Withdrawal, Permitting, Use, and Reporting Act defines the Minimum Instream Flow as:

"… the flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation and that flow is set at forty percent of the mean annual daily flow for the months of January, February, March, and April; thirty percent of the mean annual daily flow for the months of May, June, and December; and twenty percent of the mean annual daily flow for the months of July through November for surface water withdrawers as described in Section 49 4 150(A)(1).

For surface water withdrawal points located on a surface water segment downstream of and influenced by a licensed or otherwise flow controlled impoundment, "minimum instream flow" means the flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation and that flow is set in Section 49 4 150(A)(3)." (*which says that MIF shall be the flow specified in the license by the appropriate governmental agency*)

Example: Comparison to Minimum Instream Flows in the Broad River Basin

N. Tyger River below Wellford (15 yrs)	
UIF	0.5
Current	5.5
2070 Mod	3.4
2070 HD	12.9
P&R	70.2

N. Pacolet River near Fingerville (92 yrs)	
UIF	0
Current	0.3
2070 Mod	1.6
2070 HD	3.3
P&R	1.9

S. Tyger River below Duncan (21 yrs)	
UIF	0.5
Current	4.9
2070 Mod	8.4
2070 HD	8.4
P&R	10.7

Middle Tyger River near Lyman (22 yrs)	
UIF	1.5
Current	6.3
2070 Mod	19.8
2070 HD	40.3
P&R	47.8

Years of gage data used to calculate the MIF

Pacolet River near Saratt (10 yrs)	
UIF	4.4
Current	9.9
2070 Mod	9.2
2070 HD	9.9
P&R	17.9

Percent of days below MIF for the location

Enoree River near Whitmire (49 yrs)	
UIF	6.6
Current	4.5
2070 Mod	3.5
2070 HD	3.4
P&R	7.0

Tyger River near Delta (49 yrs)	
UIF	5.7
Current	8.6
2070 Mod	10.5
2070 HD	12.7
P&R	17.6

Broad below Ninety-Nine Islands (22 yrs)	
UIF	1.5
Current	0.7
2070 Mod	0.8
2070 HD	1.0
P&R	0.9

Broad near Carlise (84 yrs)	
UIF	4.0
Current	6.1
2070 Mod	6.6
2070 HD	7.2
P&R	7.9

Broad near Alston (42 yrs)	
UIF	3.7
Current	6.7
2070 Mod	7.1
2070 HD	7.7
P&R	9.3

Broad Outlet (11 yrs)	
UIF	2.9
Current	5.8
2070 Mod	6.4
2070 HD	7.6
P&R	10.5

RBC Considerations Moving Forward (continued…)

- Are there additional scenarios the RBC would like to see modeled?
- As additional information is presented, the RBC should continue to consider if there is reason to establish a **Surface Water Condition** at any location.
- As additional information is presented, the RBC should continue to consider if there is reason to establish one or more **Reaches of Interest**.

Potential Next Steps

- Continue to review the preliminary modeling scenario results (CDM Smith, RBC, and SCDNR)
- Incorporate estimated Lumber River inflows for **Moderate** and **High Demand Projections**.
- Add operating rules to Lake Robinson to see if the Sonoco shortage in Prestwood Lake can be eliminated.
- Select locations to apply **flow-ecology metrics** then evaluate them using SWAM model daily timestep results for each planning scenario (RBC, CDM Smith, TNC, Clemson)
- Other actions, as identified by RBC (e.g. comparison to MIFs?)

Definitions

- **Physically Available Surface Water Supply** – maximum amount of water occurring 100% of the time at a location on a surface water body, with no defined conditions applied on the surface water body.
- **Surface Water Condition** – a physical limitation on the amount of water that can be withdrawn from a surface water source and is independent of water demand.
- **Surface Water Supply** – maximum amount of water available for withdrawal 100% of the time at a location on a surface water body without violating any applied *Surface Water Conditions* on the surface water source and considering upstream demands.
- **Surface Water Shortage** – occurs when the water demand exceeds the *Surface Water Supply* for any water user in the basin.
- **Regulatory Shortage** – occurs when the water demand exceeds the permitted or registered amount for a water user.
- **Reaches of Interest** – specific stream reaches that may have no identified Surface Water Shortage but experience undesired impacts, environmental or otherwise, determined from current or future water-demand scenarios or proposed water management strategies.