Discussion of

2014 draft applications for Jordan Lake water supply allocations and preliminary modeling results

NC Division of Water Resources

August 28, 2014

DWR
Division of Water Resources

Agenda

- Jordan Lake Yield Analysis
- Interpretation of Draft Applications
- Modeling of 2035, 2045 and 2060 demand scenarios
- Schedule
- Final Applications
- Questions and concerns

Agenda

- Jordan Lake Yield Analysis
  - Jordan Lake Yield
  - City of Fayetteville Allowable Withdraw
- Interpretation of Draft Applications
- Modeling of 2035, 2045 and 2060 demand scenarios
- Schedule
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Background

- Why review yield for this round of Jordan allocations?
  - 50-50 Rule – Limits no more than 50% to be allocated to users outside of the Jordan watershed. Included in the rule to protect the yield because of limited operational data. Limits allocation flexibility.
  - Previous Work
    - Corps' contract with the State based on a 50-year safe yield estimated to be 100 mgd.
    - 2002 MikeBasin study – 120 mgd.
    - 2012 DWR's HEC DSSvue plugin – 109 mgd.
- ***Yield*.** The maximum quantity of water which can be reliably available throughout the most severe drought of record. The critical period is the lowest Jordan inflow in the Cape Fear – Neuse Hydrologic Model.

This analysis is based on:

- **DWR's interpretation of information in the draft allocation applications**
- **Cape Fear – Neuse River Basin Hydrologic Model**
  - (based on Simbase_Jan_2010 revised as DWR_JLP2_Yr2010)
- **Modeling assumptions:**
  - **Jordan Lake Western WTP**
  - **Withdrawal – Return flow relationships**
  - **Water purchase arrangements**
  - **Volume of return flows not limited**

Model Setup

- Turned off all allocations and used node 475 for all Jordan withdrawals.
- Varied the % returned upstream, downstream, and not returned to the basin.
- With and without Jordan drought protocol.
  - Without was a constant 600 cfs Lillington target.
- Used 3 base scenarios 2010, 2045, and 2060.

Yield Analysis Results

Model Set Up for Water Supply Yield Analysis						
		JL Drought	Return Flow Assumption			WS Yield
	Scenario	Plan	US RF, %	DS RF, %	NO RF, %	MGD
1	2010	Off	0	0	100	104
2	2010	Off	100	0	0	157
3	2010	Off	0	100	0	105
4	2010	Off	50	50	0	125
5	2010	Off	50	0	50	124
6	2010	Off	0	50	50	104
7	2010	Off	25	75	0	115
8	2010	Off	25	0	75	113
9	2010	Off	75	25	0	140
10	2010	Off	0	25	75	104
11	2010	Off	75	0	25	138
12	2010	Off	0	75	25	104
13	2060	Off	0	0	100	113
14	2060	Off	100	0	0	170
15	2060	Off	0	100	0	114
16	2060	Off	50	50	0	137
17	2060	Off	50	0	50	135
18	2060	Off	0	50	50	113
19	2060	Off	25	75	0	125
20	2060	Off	25	0	75	123
21	2060	Off	75	25	0	151
22	2060	Off	0	25	75	113
23	2060	Off	75	0	25	150
24	2060	Off	0	75	25	113
25	2010	On	0	0	100	104
26	2010	On	50	20	30	125
27	2045	On	0	0	100	112
28	2045	On	50	20	30	125
29	2045	On	20	20	60	112
30	2060	On	0	0	100	113
31	2060	On	20	25	55	121

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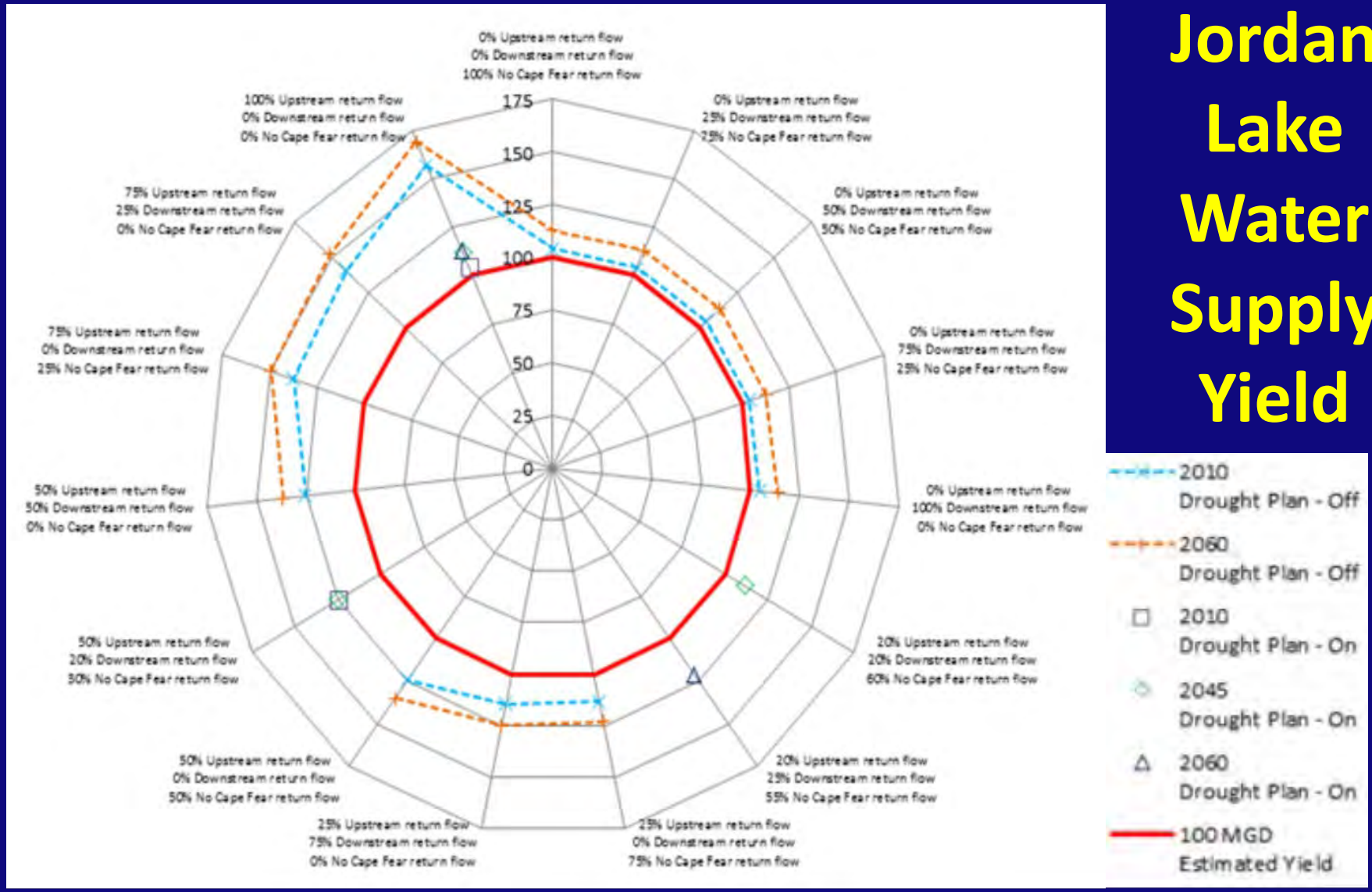
Jordan Lake Water Supply Yield



All evaluations > 100 mgd

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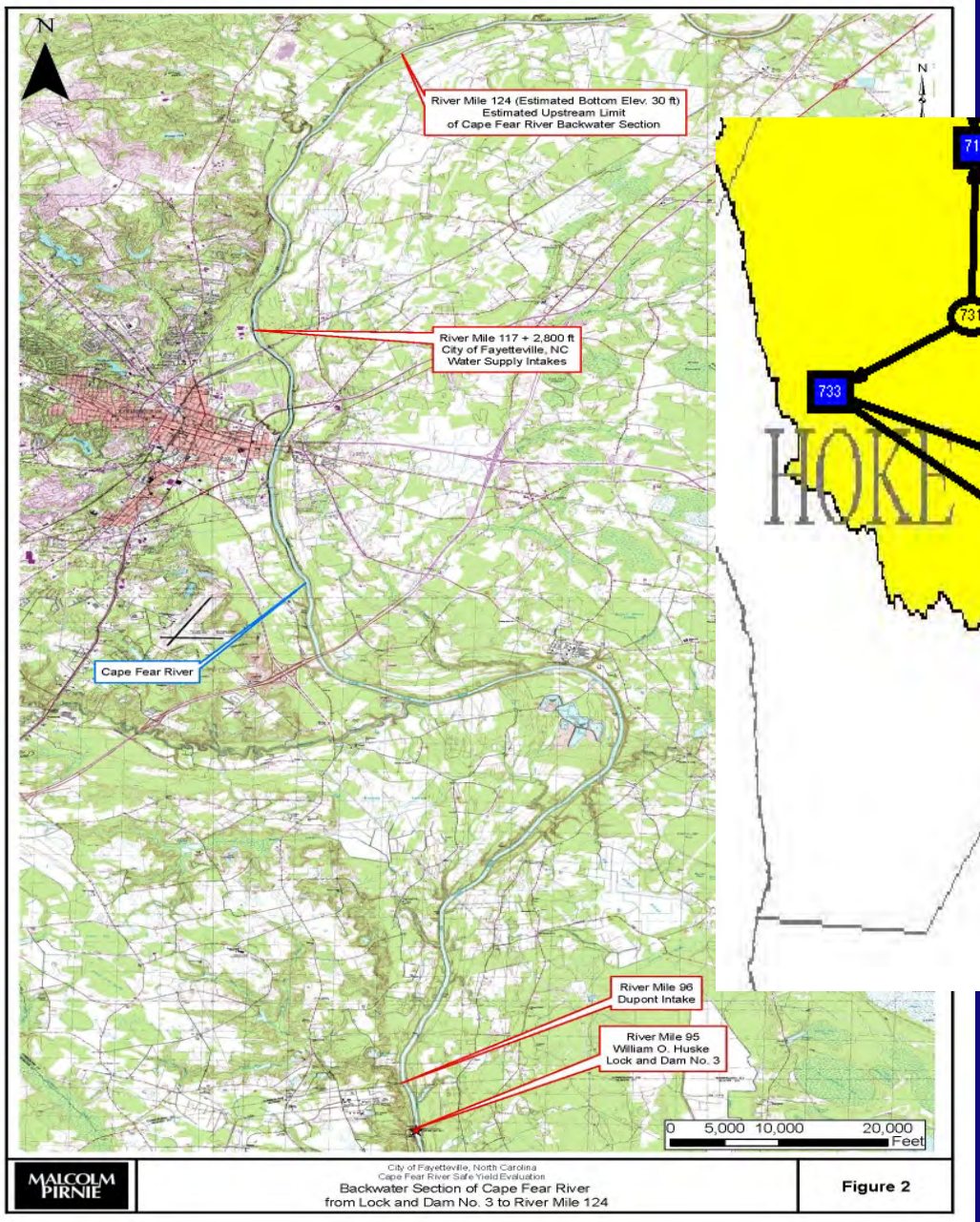
Other Results

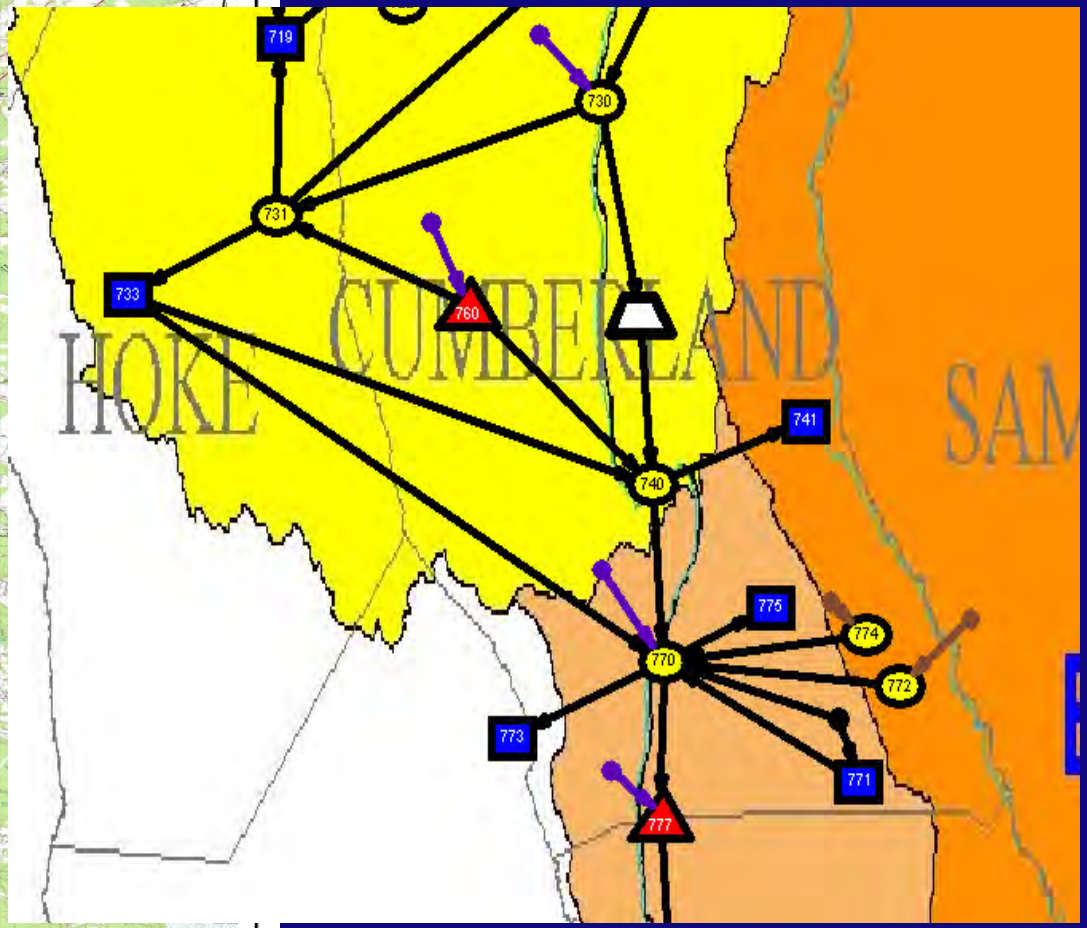
- Without Jordan Drought Plan
  - Lowest lake level – 2/24/1934 (202.65 – 204.07)
  - WS critical period – 5/1933 – 3/1934 (315 days)
  - WQ min storage – 1934, 1953, 2002, 2007 (0% - 14% remaining)
- With Jordan Drought Plan
  - Lowest lake level – 1953, 2002 (206.16 – 209.94)
  - WS critical period – 5/1933 – 3/1934 (290 – 310 days)
  - WQ min storage – 2002, 2007 (21% - 43% remaining)

Yield Conclusions

- Keep the estimated yield at 100 mgd and estimate a new return period.

- Recommend to either drop 50% watershed requirement or reduce it to 20%.


N
River Mile 124 (Estimated Bottom Elev. 30 ft)
Estimated Upstream Limit
of Cape Fear River Backwater Section
River Mile 117 + 2,800 ft
City of Fayetteville, NC
Water Supply Intakes
Cape Fear River
River Mile 96
Dupont Intake
River Mile 95
William O. Huske
Lock and Dam No. 3
0 5,000 10,000 20,000
Feet
MALCOLM PIRNIE
City of Fayetteville, North Carolina
Cape Fear River Safe Yield Evaluation
Backwater Section of Cape Fear River
from Lock and Dam No. 3 to River Mile 124
Figure 2


719
730
731
733
760
HOKE
CUMBERLAND
741
740
775
774
770
772
773
771
777

DWR Approach

- Due to the unique situation of withdrawals and discharges in the same backwater, DWR will evaluate the flow impacts at Lock and Dam Number 3 (Node 777), not the individual river nodes 730, 740 and 770.
- Because of the unique situation of withdrawals and discharges in the same backwater DWR will use the combined (Fayetteville and DuPont) consumptive loss instead of combined withdrawal for this evaluation. In this situation consumptive loss is a better indicator of flow impacts than withdrawal.

Questions

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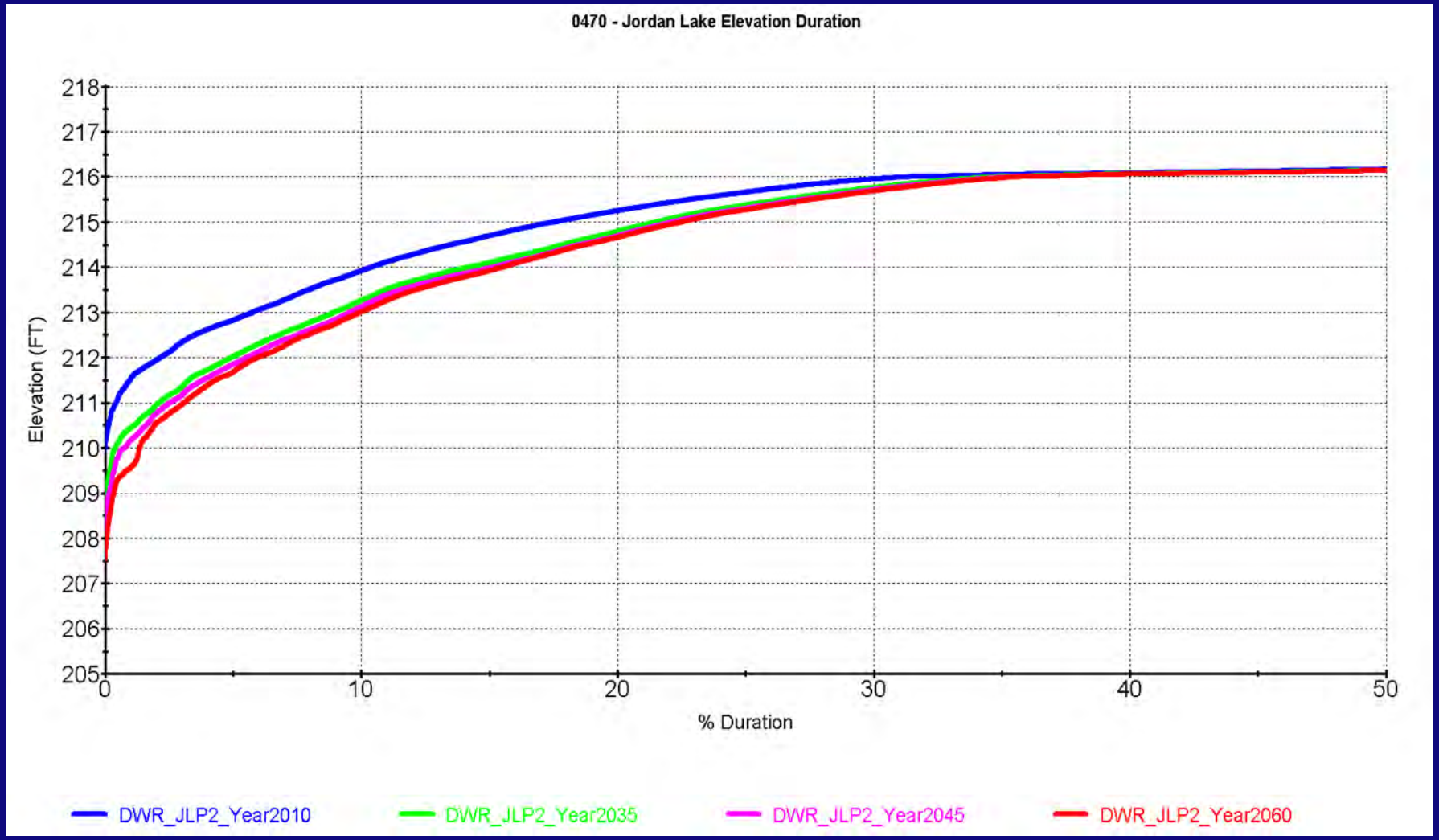
Draft Application Allocation Requests

Summary of JLA-4 Draft Application Requests (% of 100 MGD)				
	Current	Round 4		Future?
	2010	2035	2045	2060
Cary,Apex,Morrisville,RTP	39	46.2	46.2	48.5
Chatham Co.-North	6	13.1	13.1	18.2
Durham	10	16.5	16.5	16.5
Orange WASA	5	5	5	5
Holly Springs	2	2	2	2.2
Orange County	1	2	2	2
Hillsborough	0	1	1	1
Pittsboro	0	6	6	6
Total Allocation	63	91.8	91.8	99.4

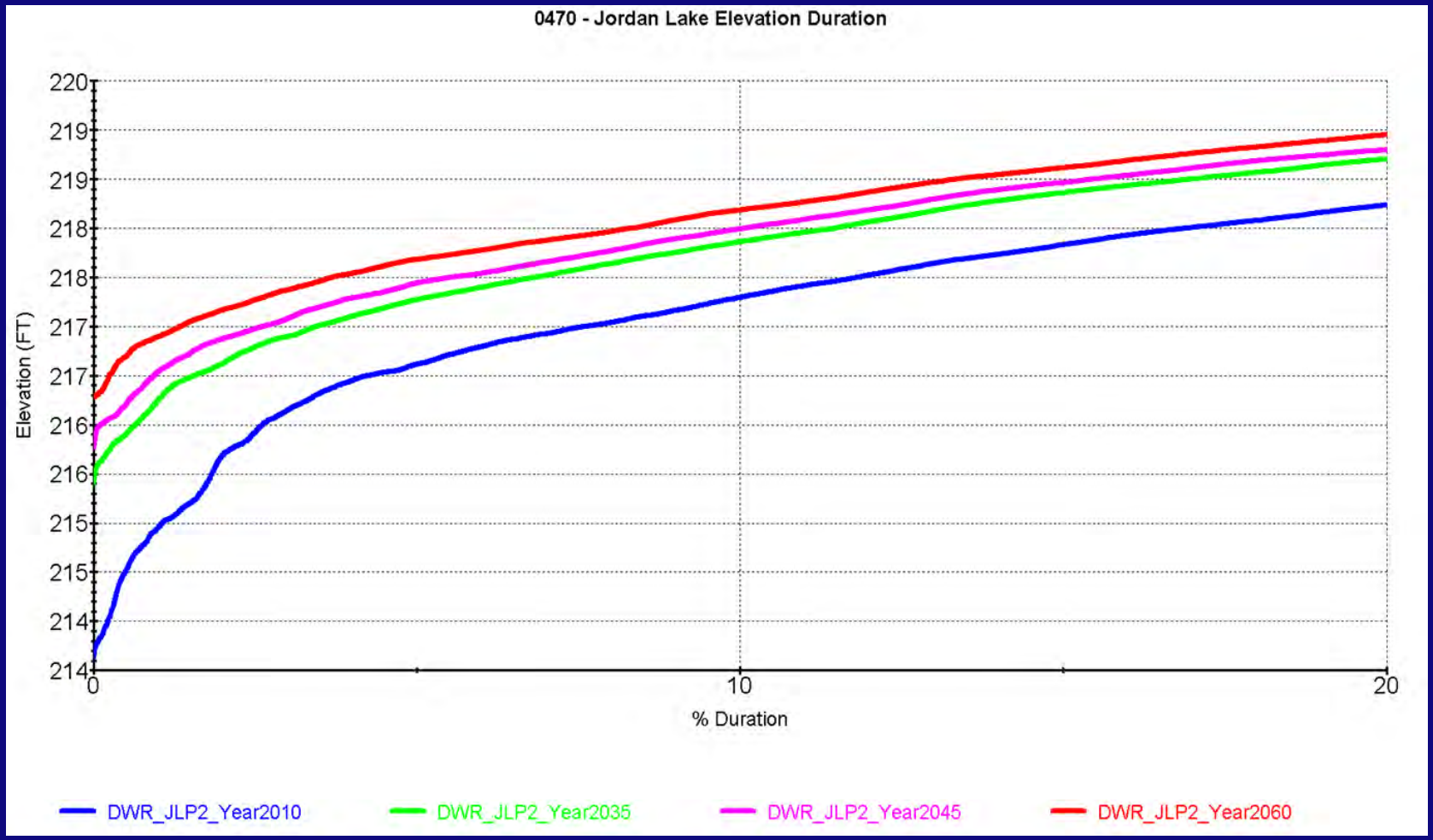
Withdrawals and Return Flows in area of interest

Modeled Withdrawals and Return Flows Cape Fear - Neuse River Basin Hydrologic Model August 2014			
Withdrawer or Discharger	2035 MGD	2045 MGD	2060 MGD
Cary Apex Combined Withdrawal	**40.820**	**45.820**	**48.330**
Cary Apex Combined Return Flow	*26.378*	*29.609*	*31.231*
Chatham County North Water System Withdrawal	**10.130**	**13.300**	**18.120**
Dunn Withdrawal	**3.013**	**3.072**	**3.328**
Dunn Return Flow	*1.078*	*1.090*	*1.109*
DuPont Withdrawal	**11.170**	**11.170**	**11.170**
DuPont Return Flow	*11.170*	*11.170*	*11.170*
Durham Withdrawal	**36.100**	**40.000**	**44.400**
Durham Return Flow	*30.113*	*33.367*	*37.037*
Fayetteville PWC Withdrawal	**54.777**	**65.045**	**78.300**
Fayetteville PWC Return Flow	*50.183*	*60.019*	*72.766*
Harnett County RWS Withdrawal	**29.573**	**34.963**	**43.171**
Harnett County RWS Return Flow	*11.071*	*13.473*	*17.128*
Harris Nuclear Station Withdrawal	**20.000**	**20.000**	**20.000**
Harris Nuclear Station Return Flow	*12.317*	*12.317*	*12.317*
Hillsborough Withdrawal	**2.870**	**3.220**	**3.700**
Hillsborough Return Flow	*1.849*	*2.074*	*2.383*
HollySprings Return Flow	*5.033*	*5.850*	*7.089*
Orange Water and Sewer Authority Withdrawal	**10.235**	**11.325**	**12.910**
OWASA Return Flow	*9.774*	*10.815*	*12.329*
Orange-Alamance Eno River Withdrawal	**0.220**	**0.226**	**0.235**
Orange-Alamance Return Flow	*0.020*	*0.021*	*0.022*
Performance Fibers/Allied Signal	**0.201**	**0.201**	**0.201**
Pittsboro Withdrawal	**8.900**	**10.400**	**11.800**
Pittsboro Return Flow	*2.839*	*3.318*	*3.764*
Raleigh Withdrawal	**84.800**	**97.000**	**115.000**
Raleigh Return Flow	*75.620*	*86.500*	*102.551*
Sanford Withdrawal	**13.029**	**17.428**	**24.175**
Sanford Return Flow	*9.408*	*12.600*	*17.496*

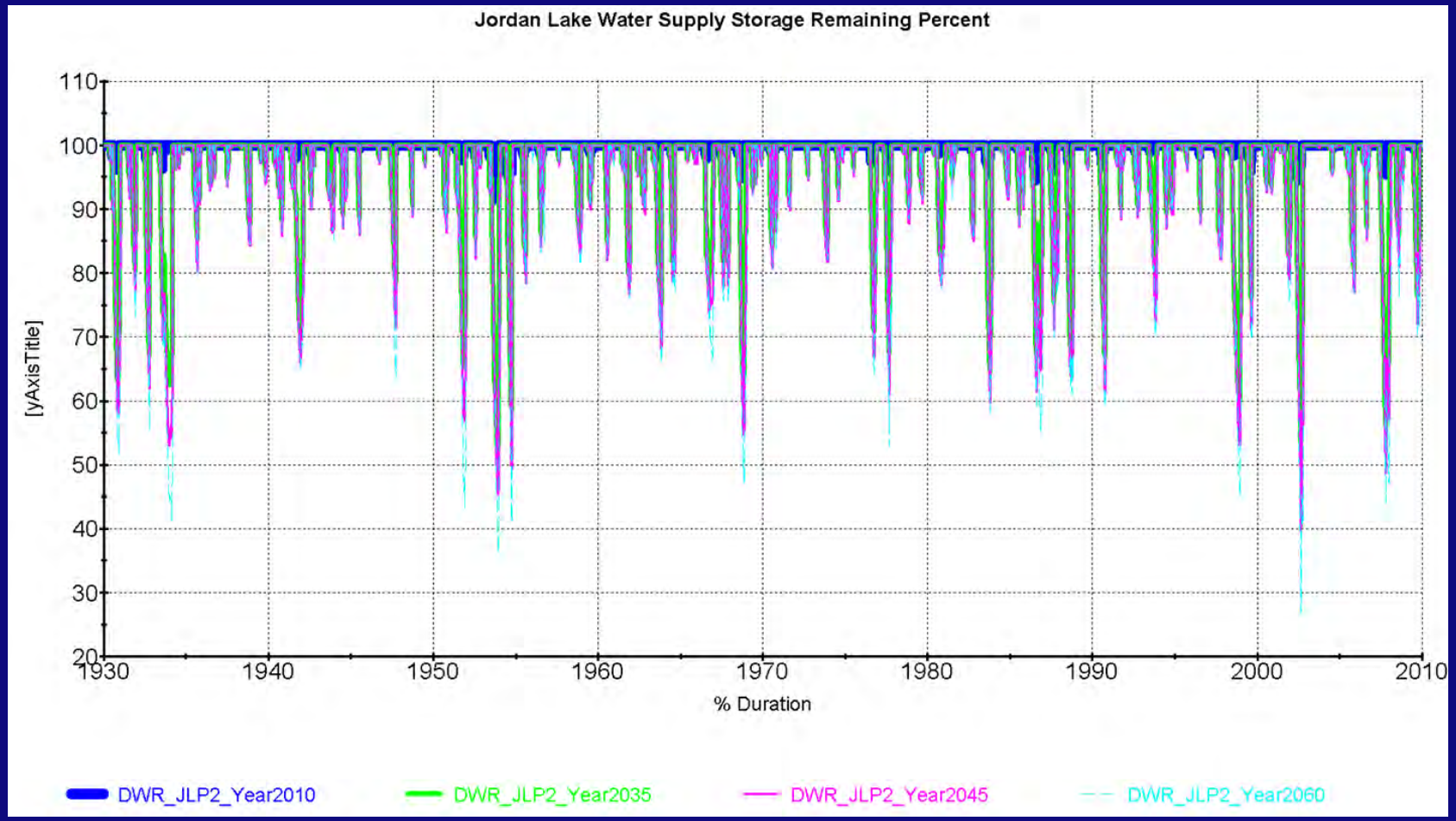
Jordan Lake Elevation



Lowest 20% Jordan Lake Elevation



Jordan Lake Water Supply Storage % remaining



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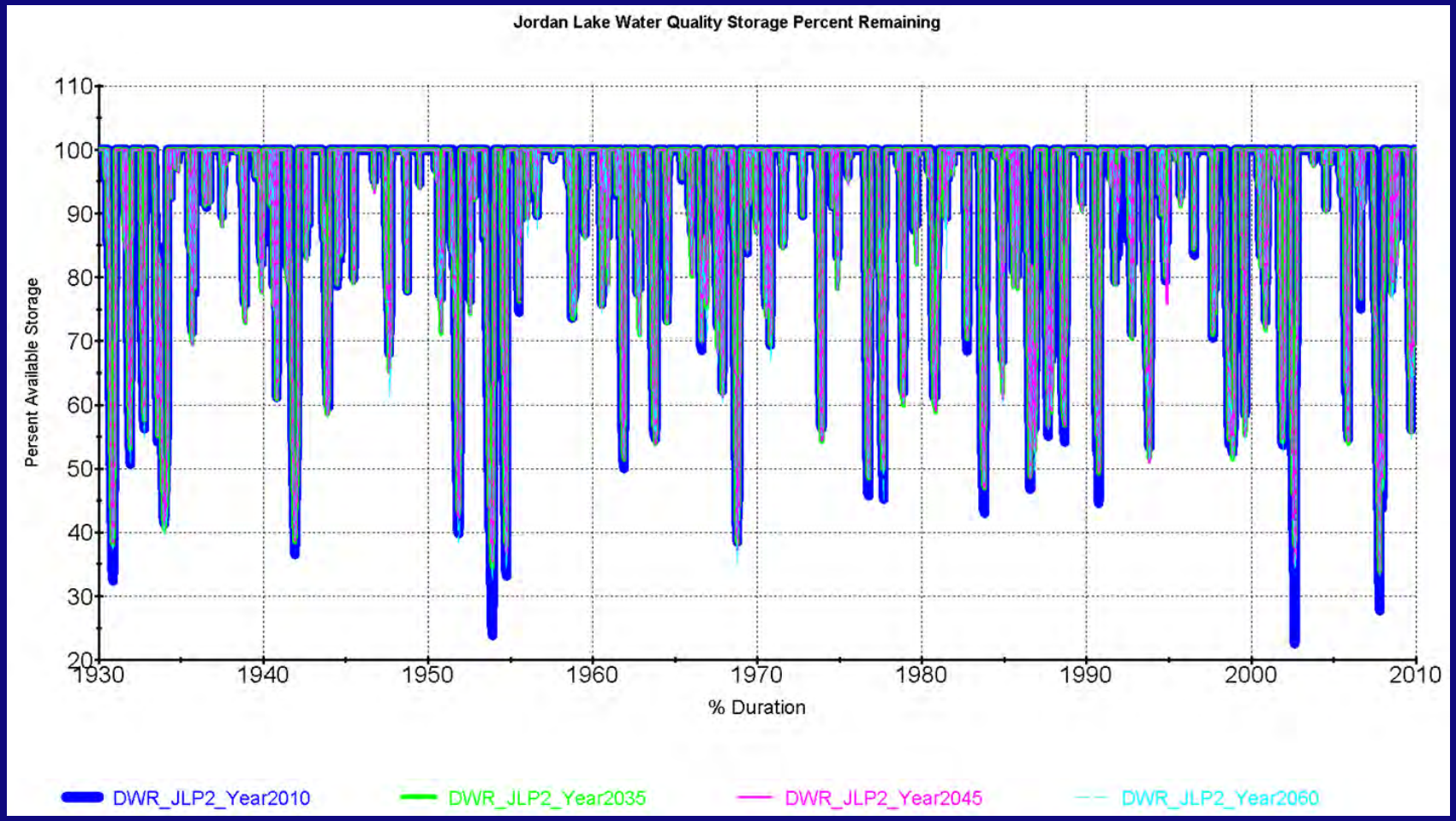
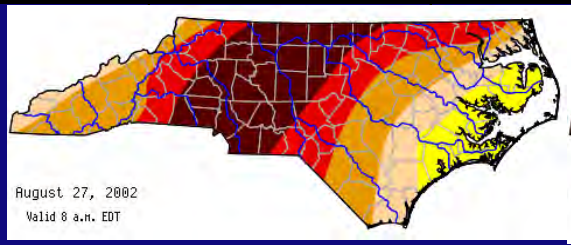
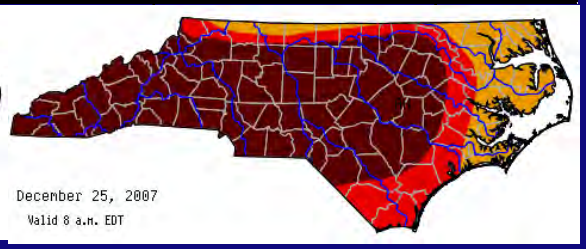
Jordan Lake Flow Augmentation Storage % remaining



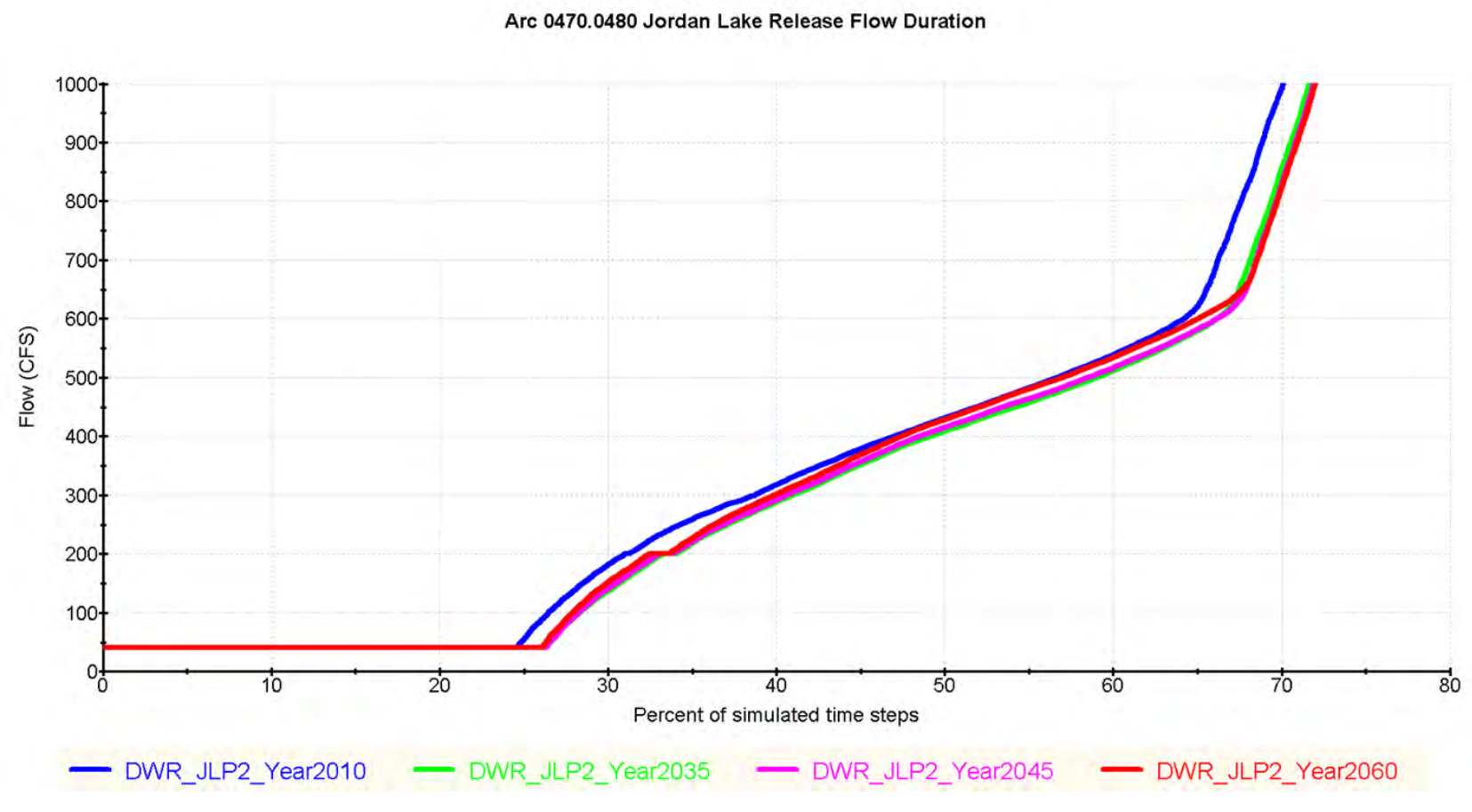
Minimum Percent Remaining
Jordan Lake – Falls Lake Storage Pools

Reservoir Storage Pool Minimum Percentages		Jordan Lake				Falls Lake			
		Water Supply Pool		Water Quality Pool		Water Supply Pool		Water Quality Pool	
Scenarios	Drought Plan On/OFF	Min WS Storage, %	Critical Date	Min WQ Storage, %	Critical Date	Min WS Storage, %	Critical Date	Min WQ Storage, %	Critical Date
DWR_JLP2_year2010	OFF	91.46	9/26/1953	22.58	8/30/2002	31.44	12/25/2007	15.31	12/25/2007
DWR_JLP2_year2035	OFF	52.12	12/3/1953	33.86	10/23/2007	21.26	12/25/2007	21.11	12/25/2007
DWR_JLP2_year2045	OFF	39.84	8/30/2002	34.09	10/23/2007	9.31	12/25/2007	27.05	12/25/2007
DWR_JLP2_year2060	OFF	26.78	8/30/2002	32.45	12/1/1953	17.43	12/25/2007	28.42	12/25/2007

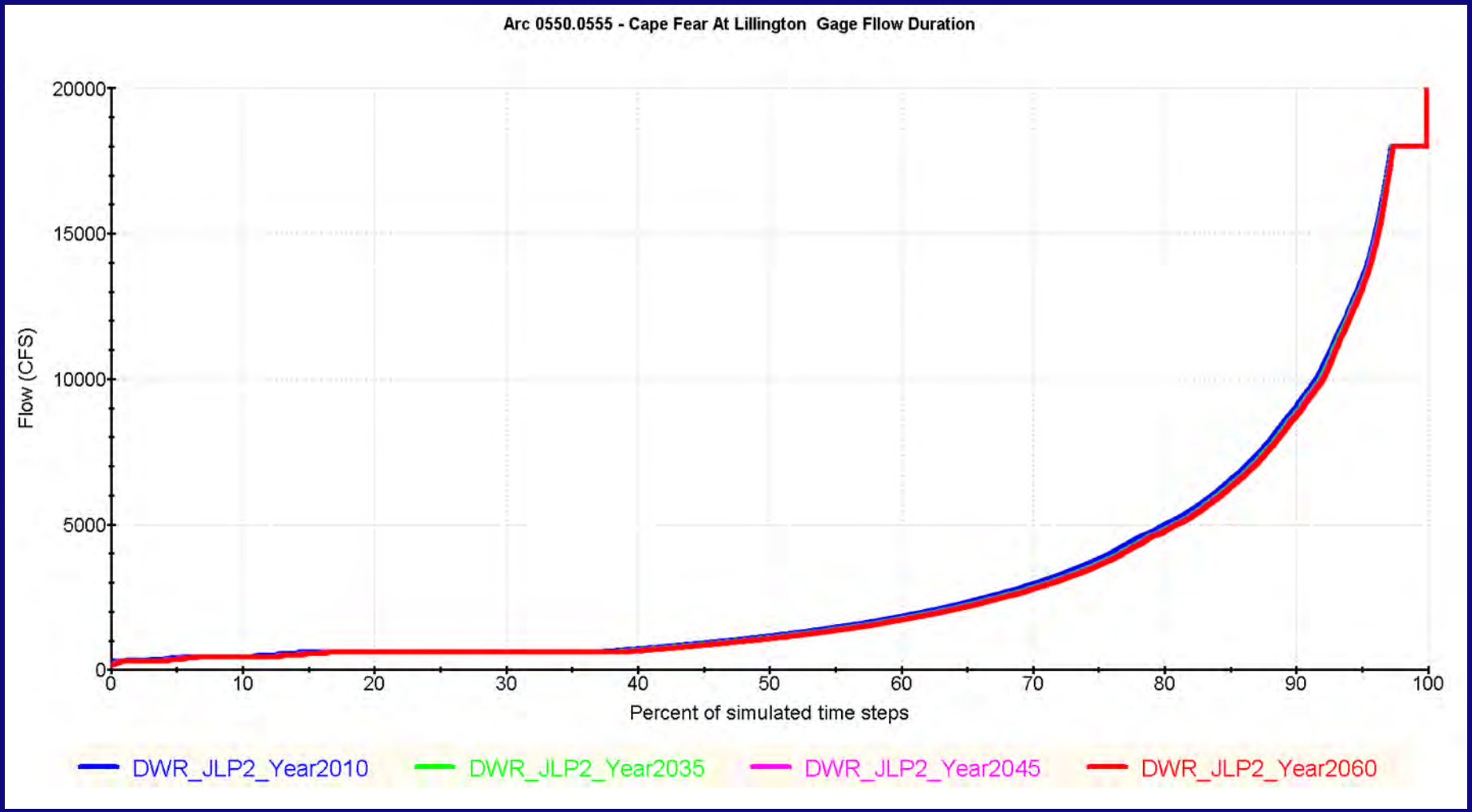




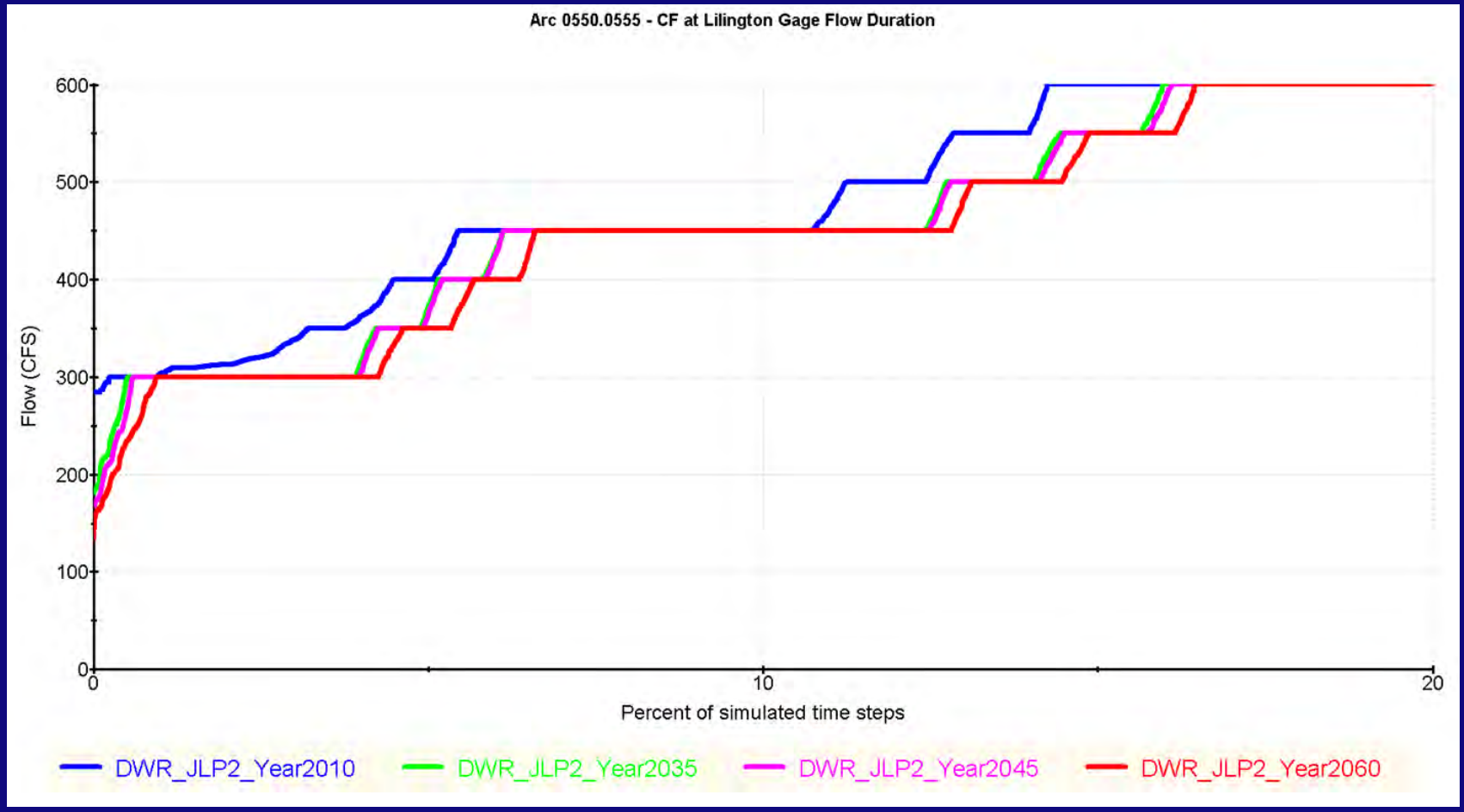
Jordan Lake Release Flow



Cape Fear River @ Lillington



Cape Fear @ Lillington Flow



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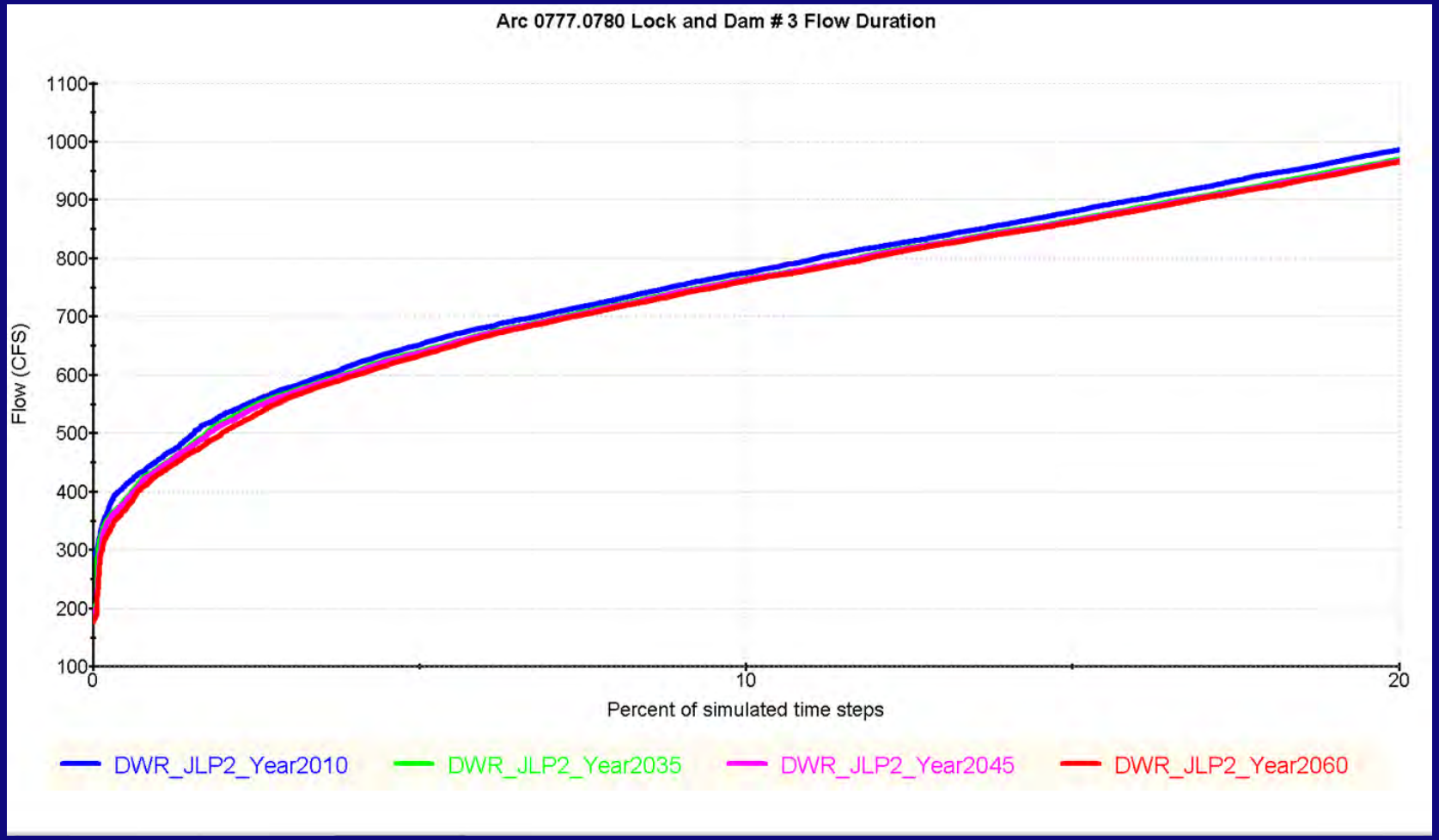
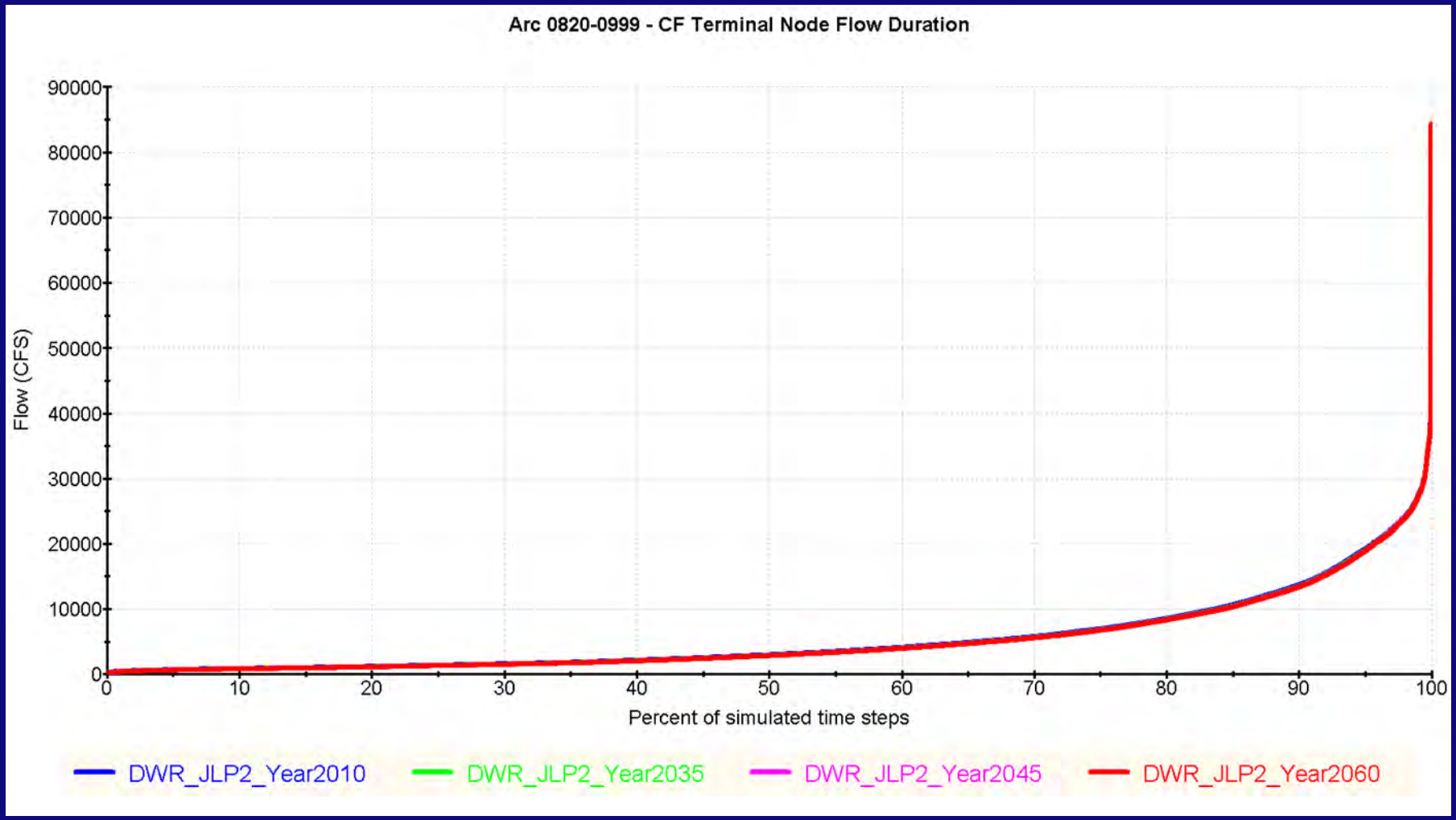
L&D #3 Outflow

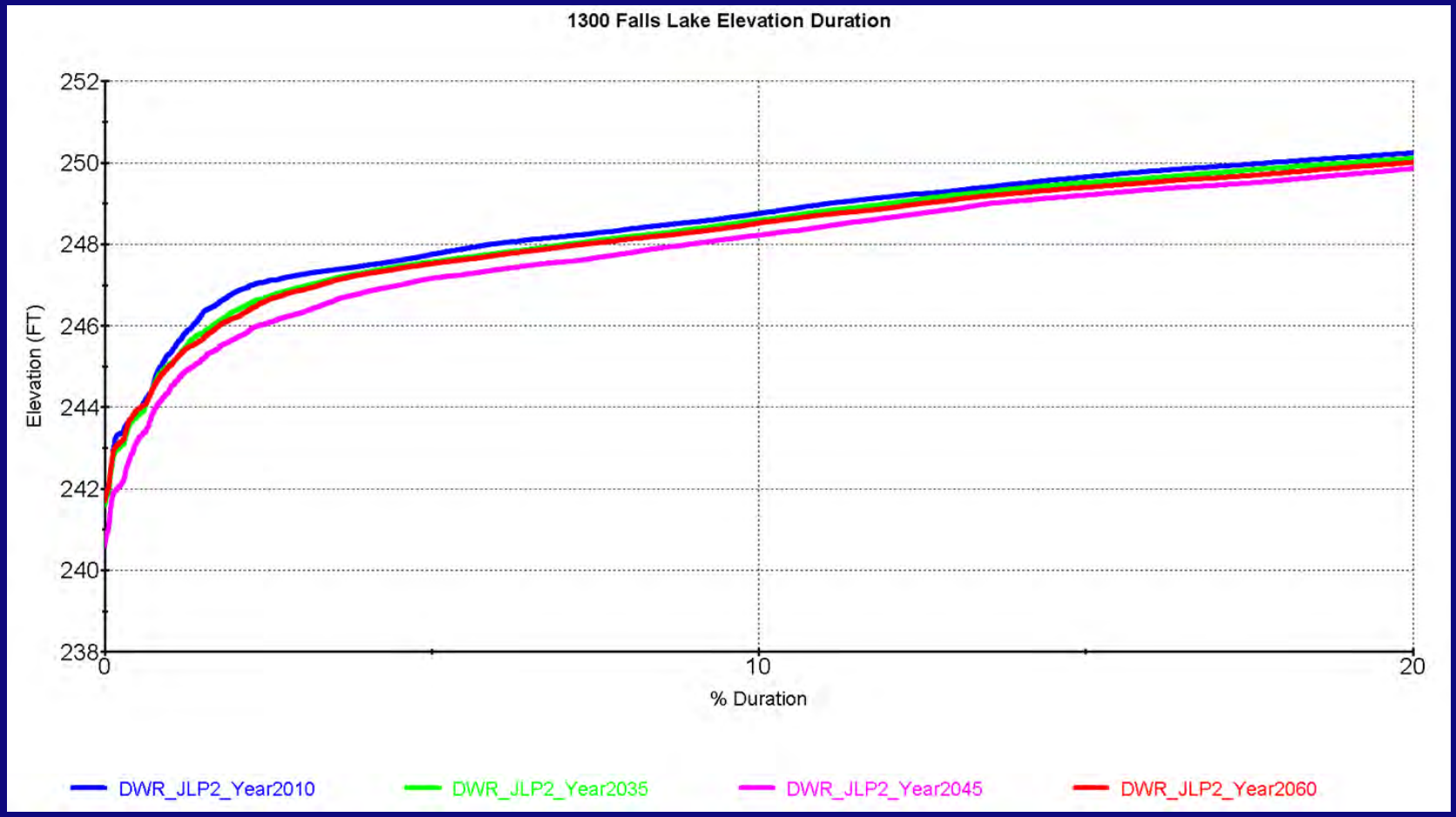

Arc 0777.0780 Lock and Dam # 3 Flow Duration
Flow (CFS)
1100
1000
900
800
700
600
500
400
300
200
100
0
10
20
Percent of simulated time steps
DWR_JLP2_Year2010
DWR_JLP2_Year2035
DWR_JLP2_Year2045
DWR_JLP2_Year2060

Cape Fear River @ Terminal Node



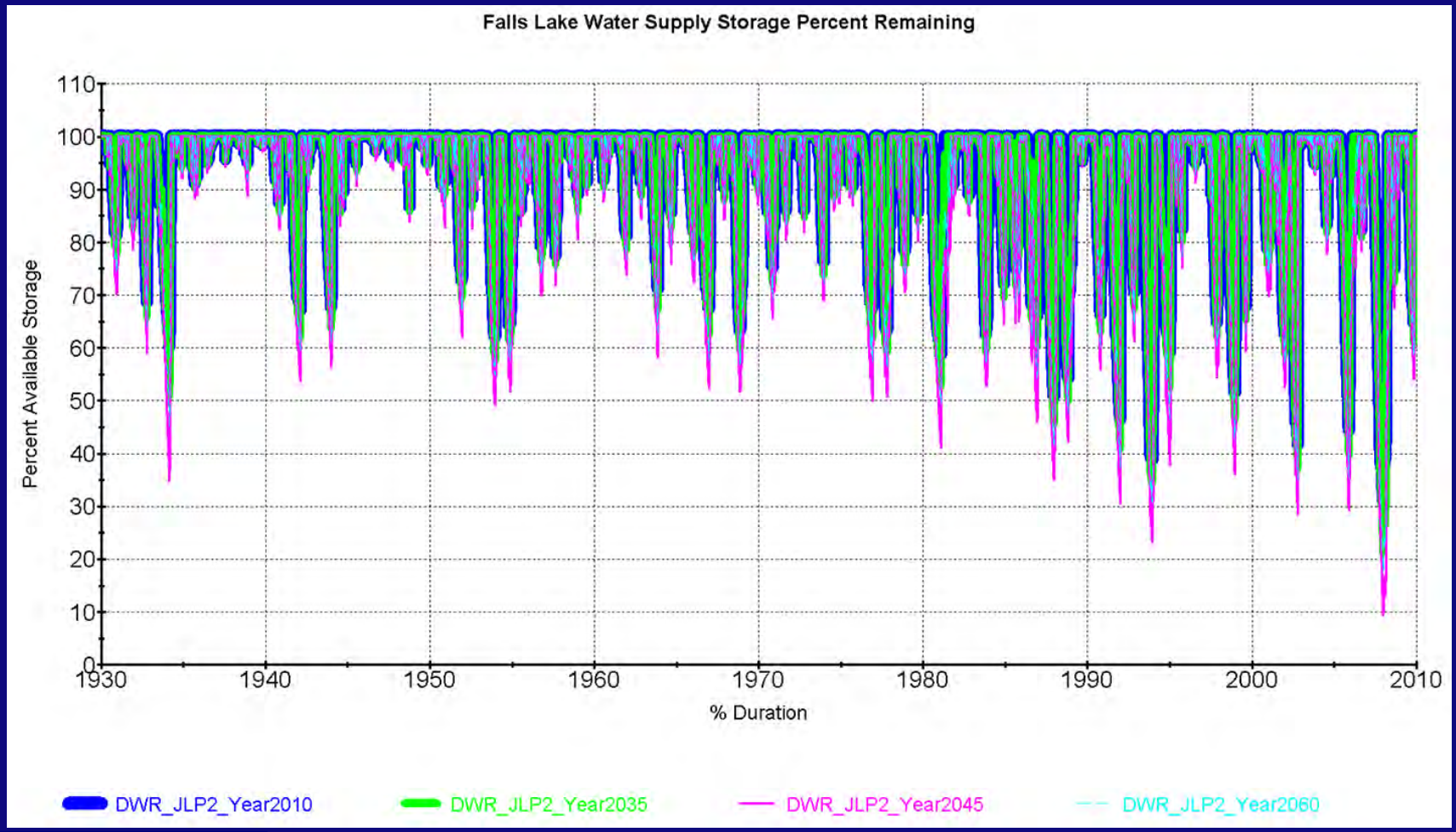
Division of Water Resources

Lowest 20% Falls Lake Elevation

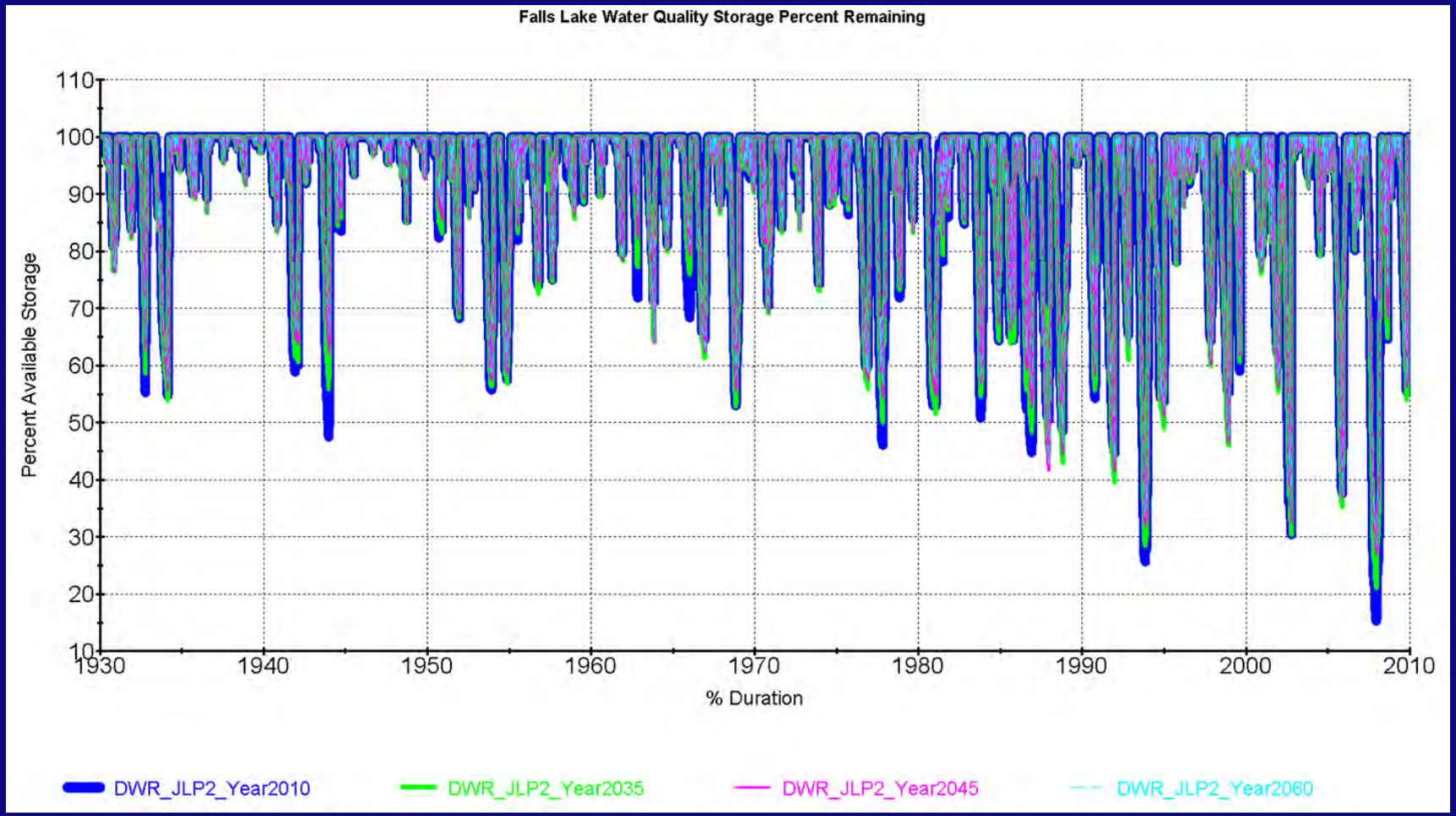


Division of Water Resources

Falls Lake Water Supply Storage % remaining

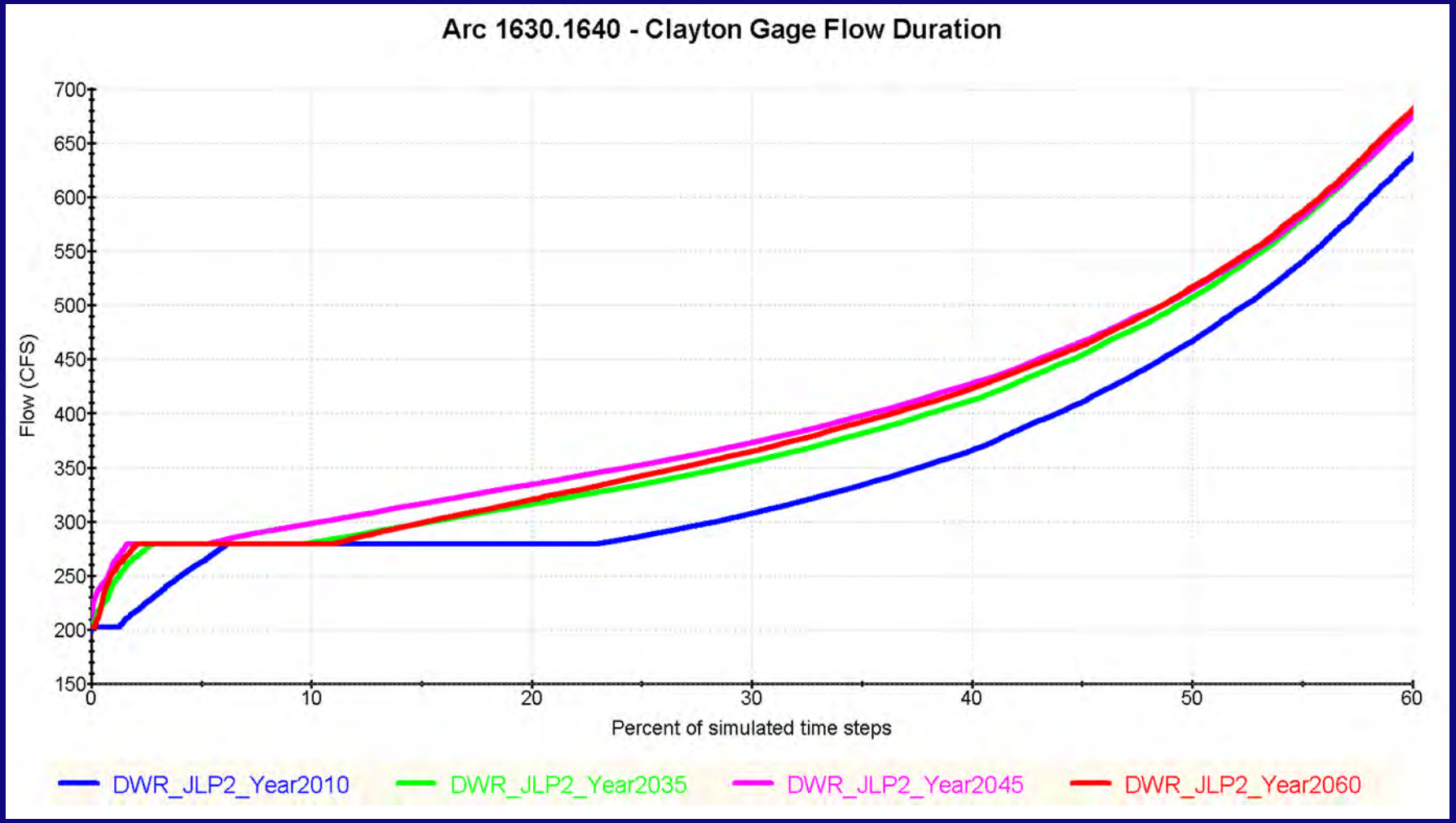


Falls Lake Flow Augmentation Storage % remaining

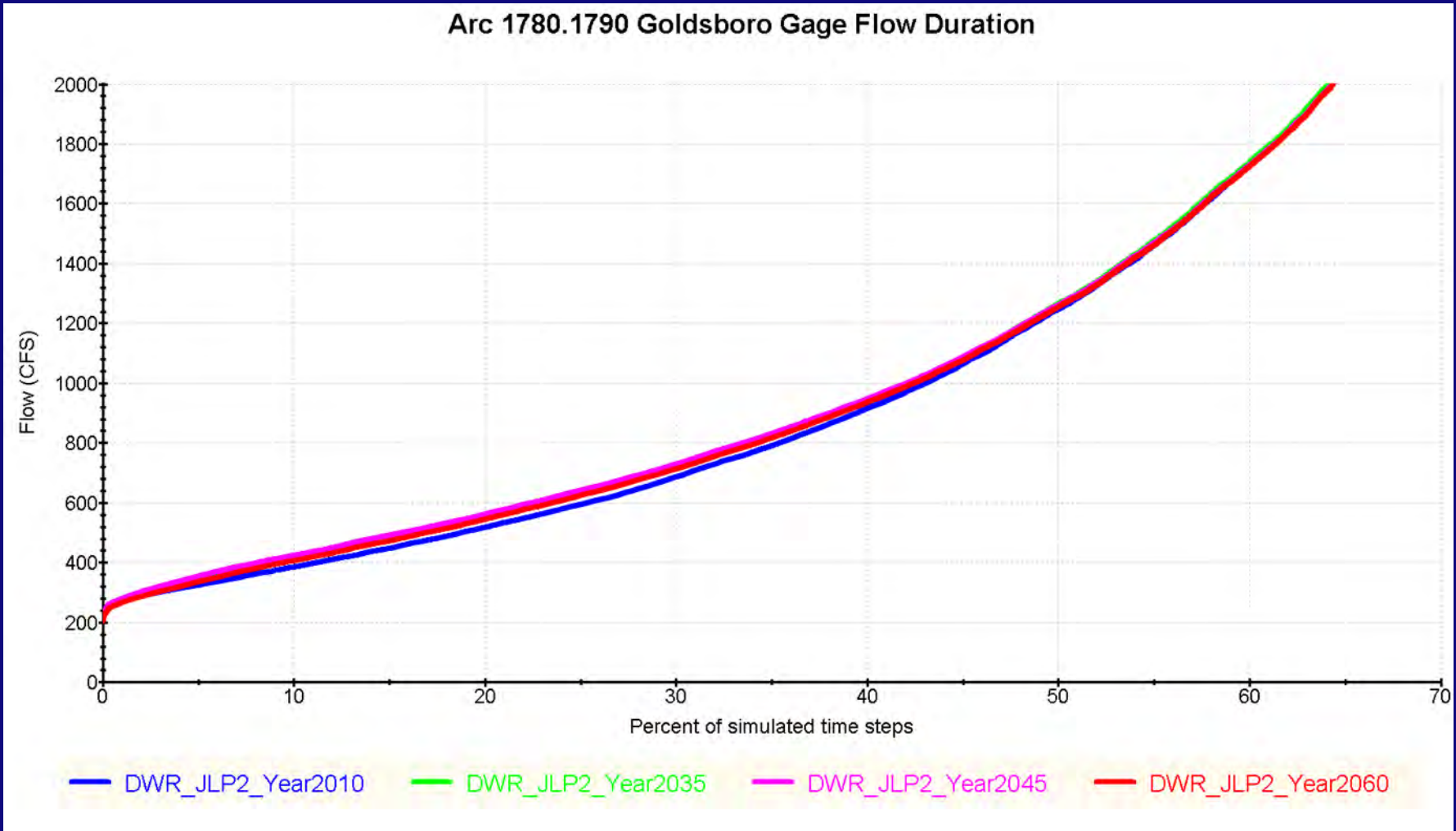


Division of Water Resources

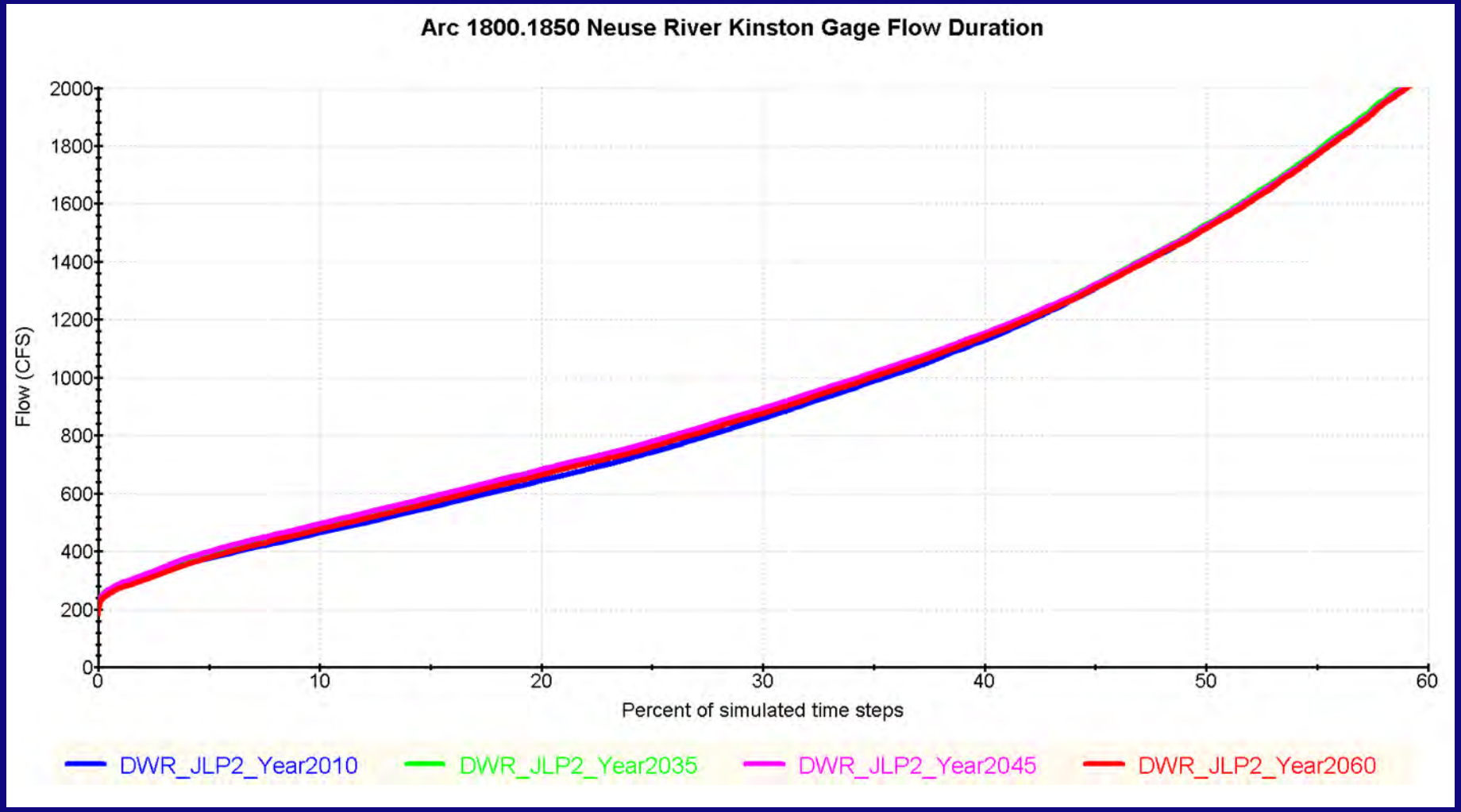
Neuse River @ Clayton



Neuse River @ Goldsboro

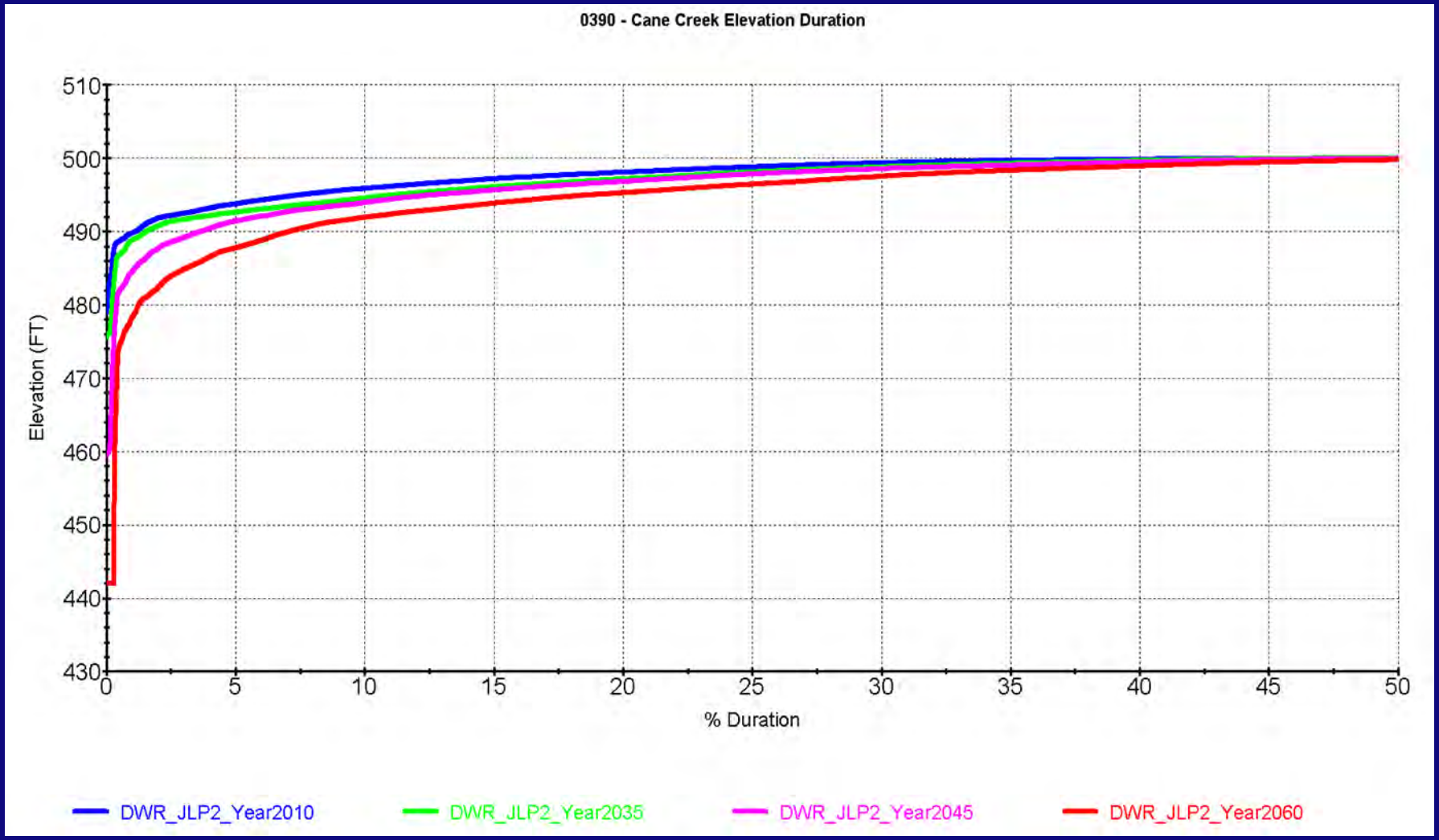


Neuse River @ Kinston

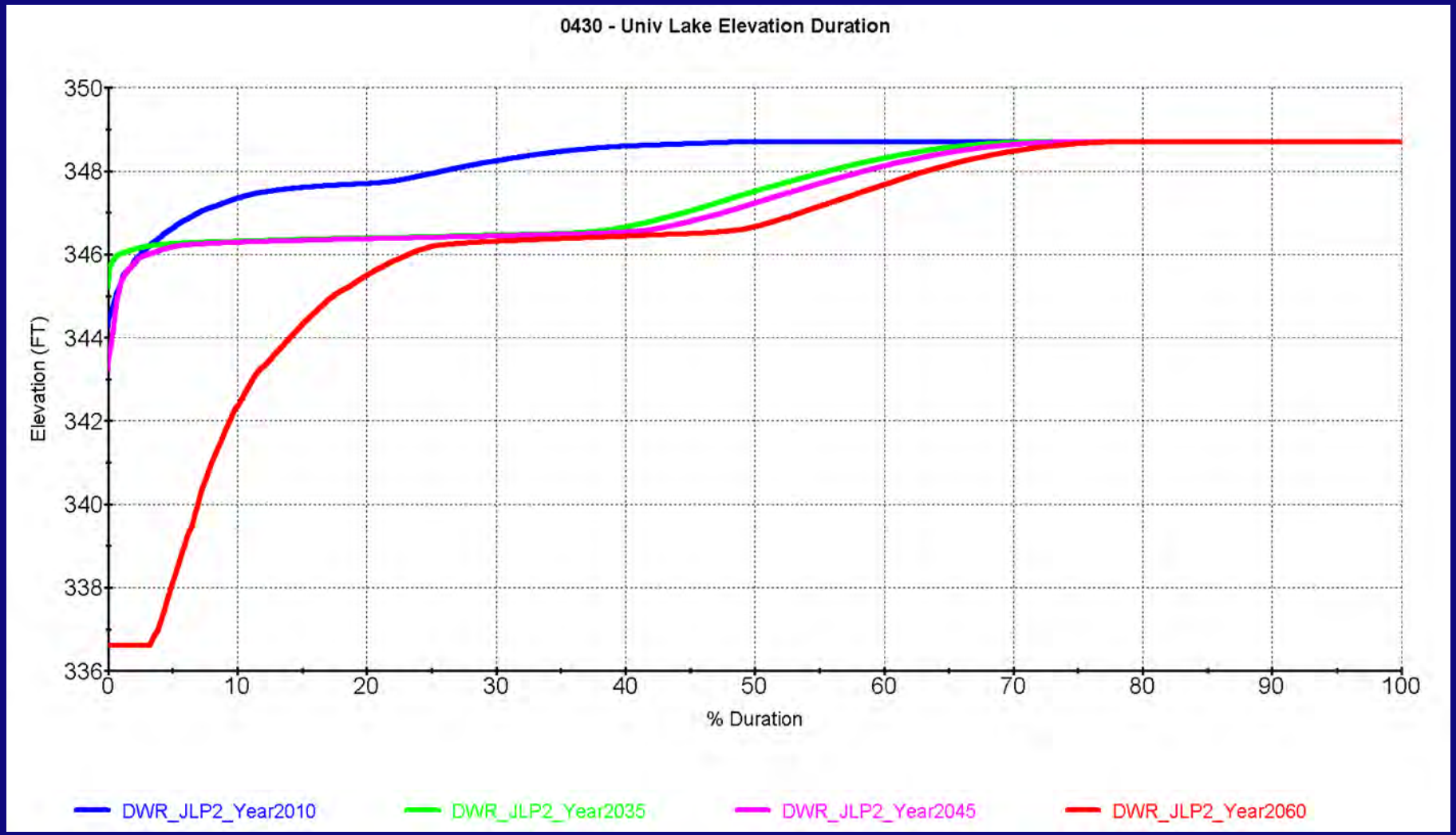


Modeling Results
Other Reservoirs and Stream Gages

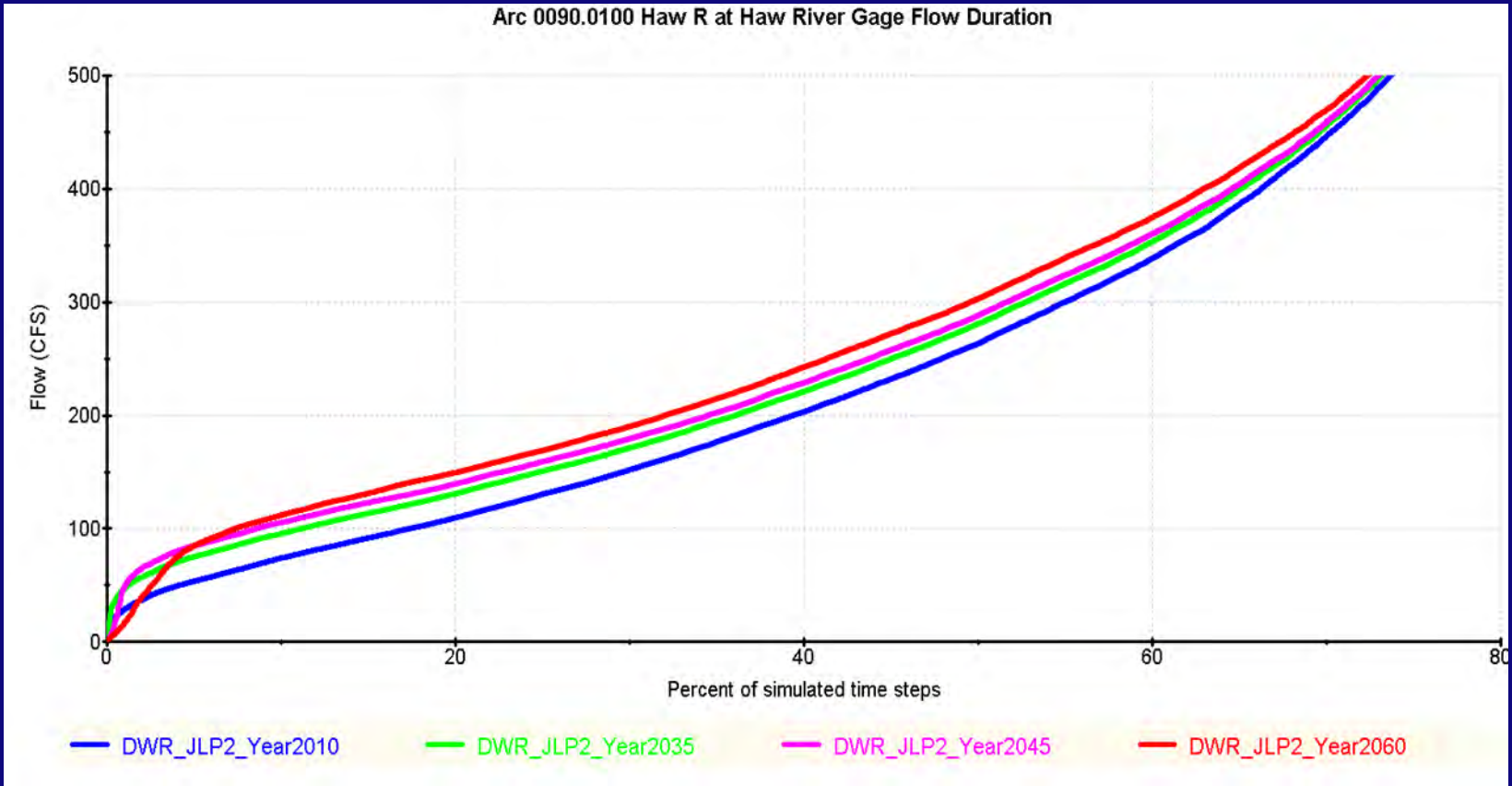
Cane Creek Elevation



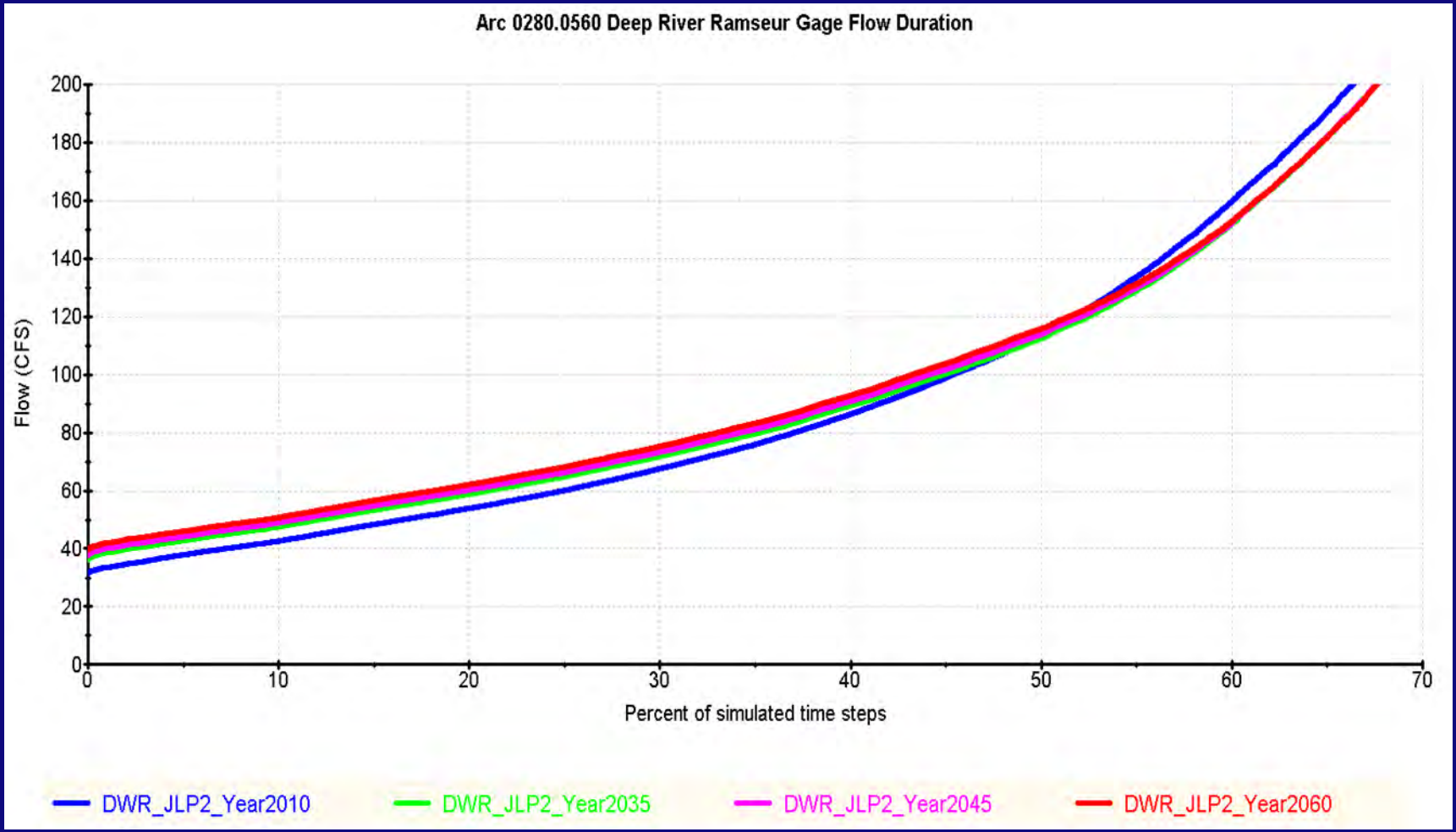
University Lake Elevation



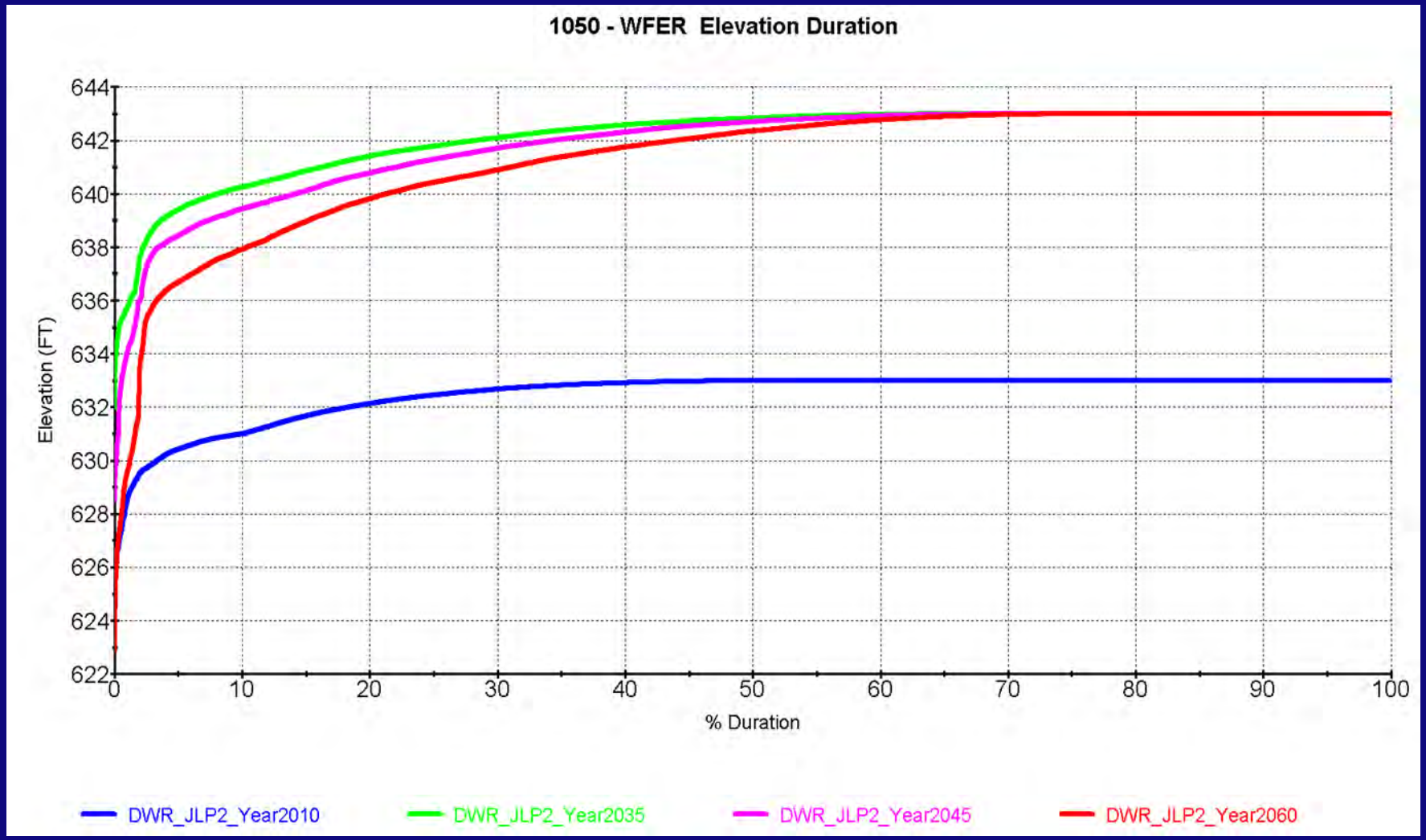
Haw River @ Haw River



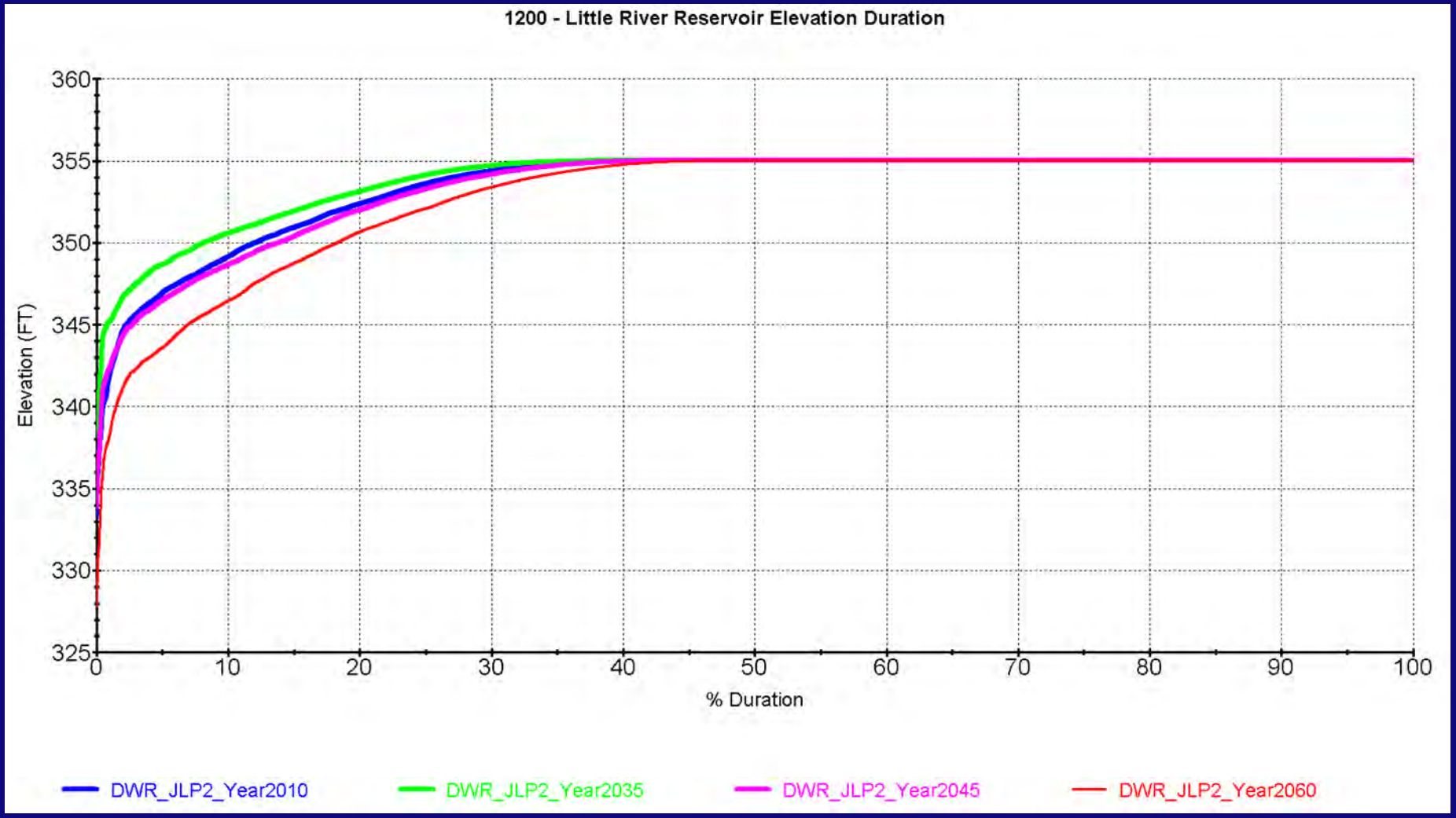
Deep River @ Ramseur



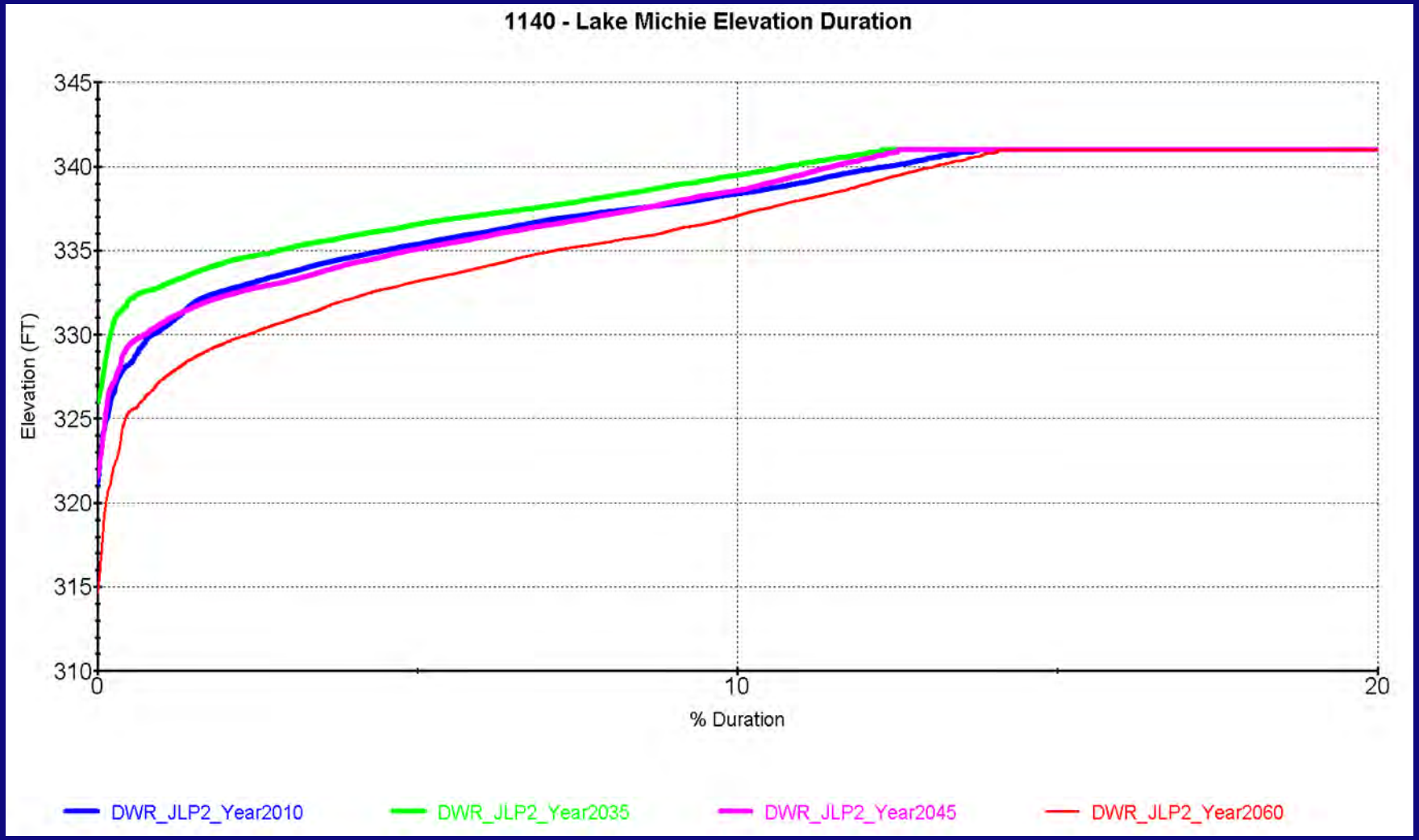
W. Fork Eno Reservoir Elevation



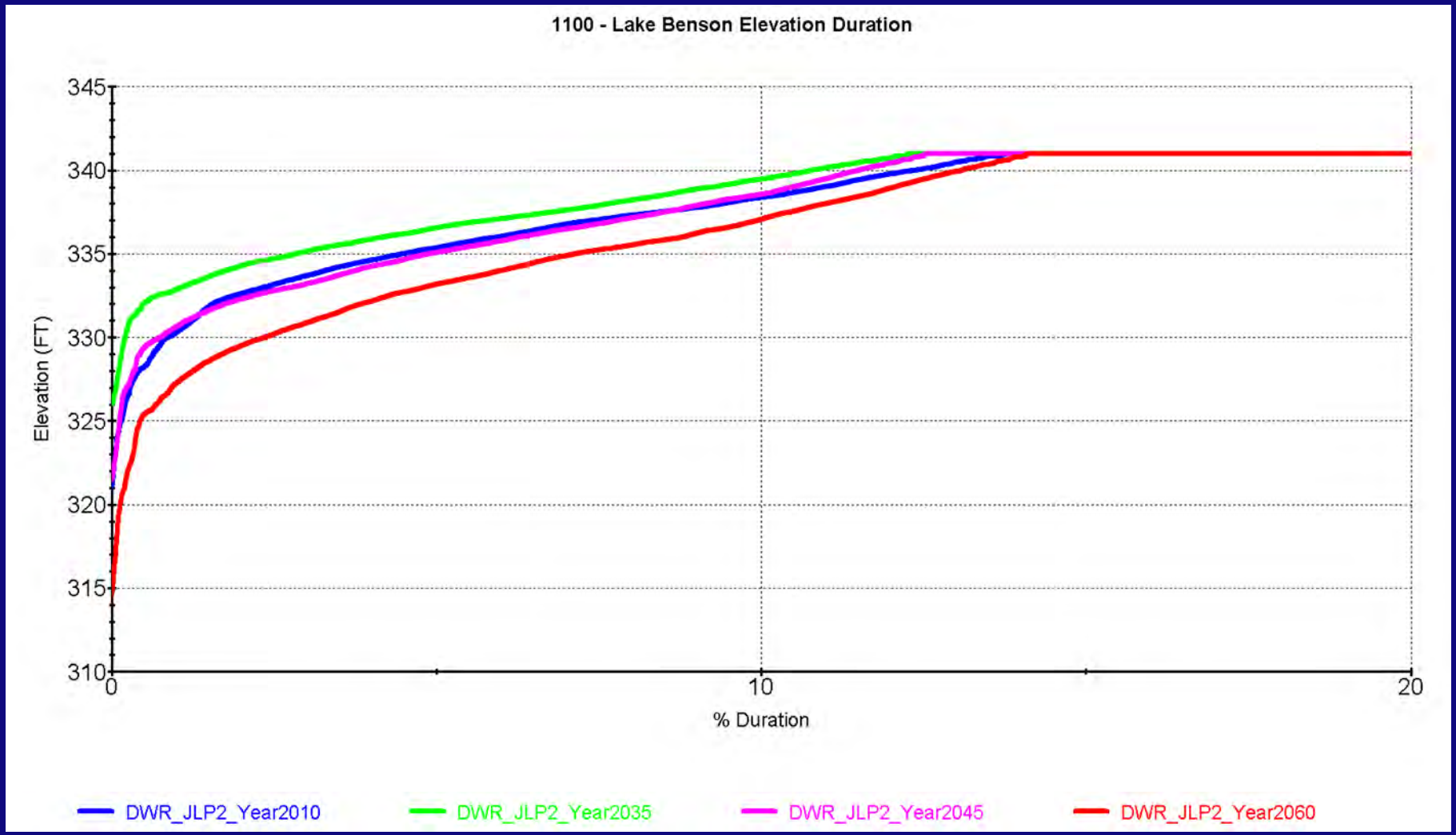
Durham Little River Reservoir Elevation



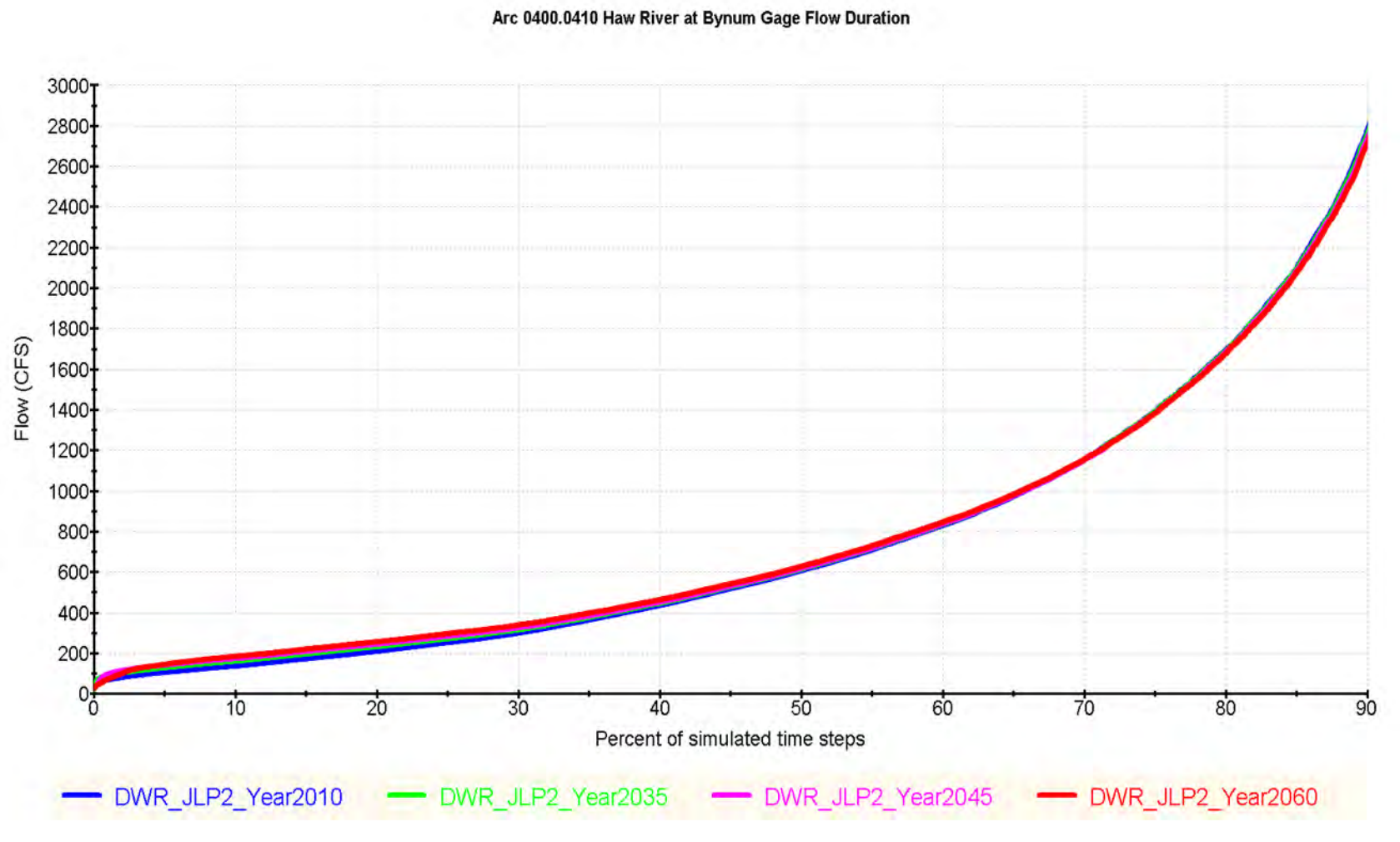
Lake Michie Elevation



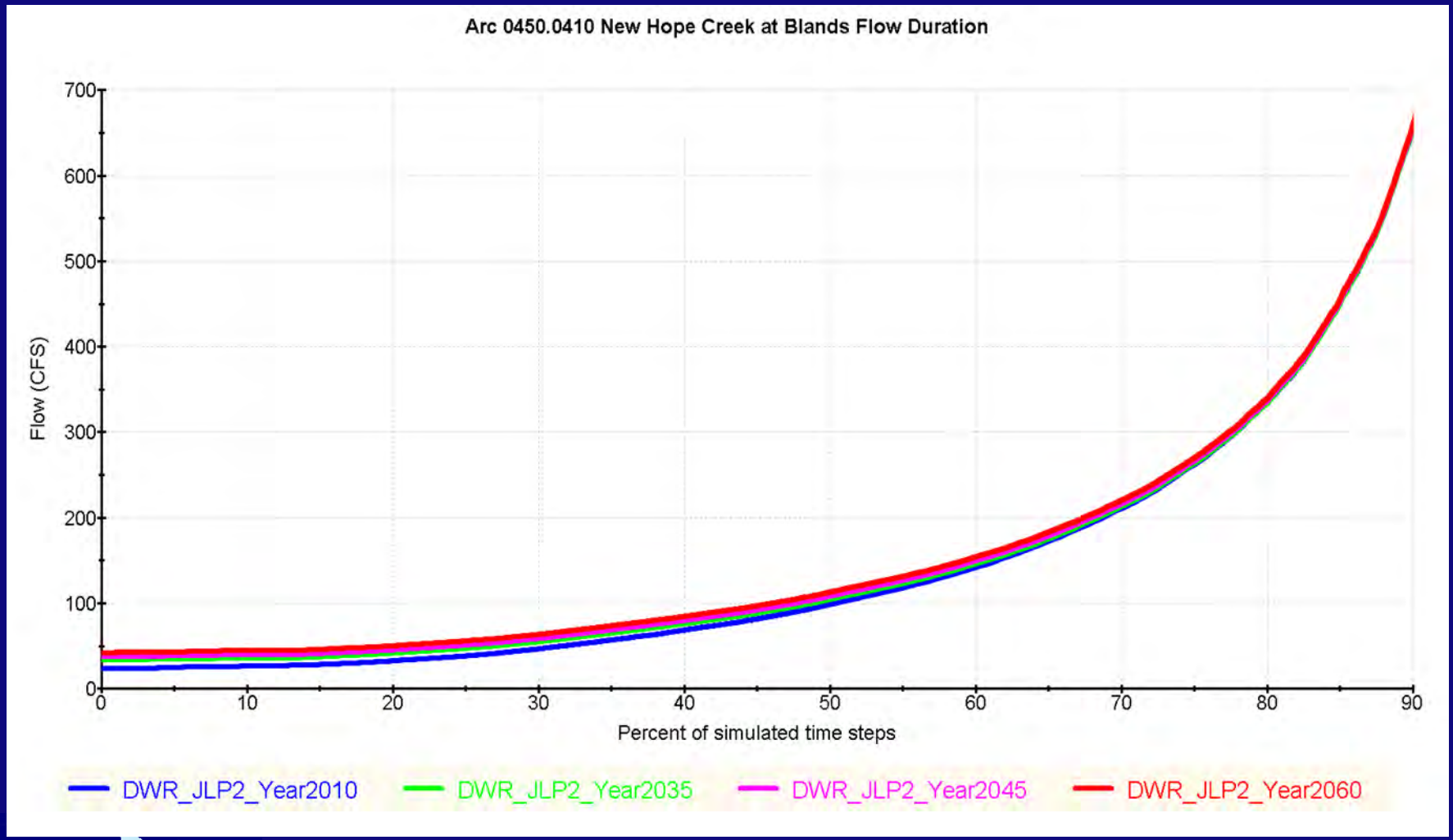
Lake Benson Elevation



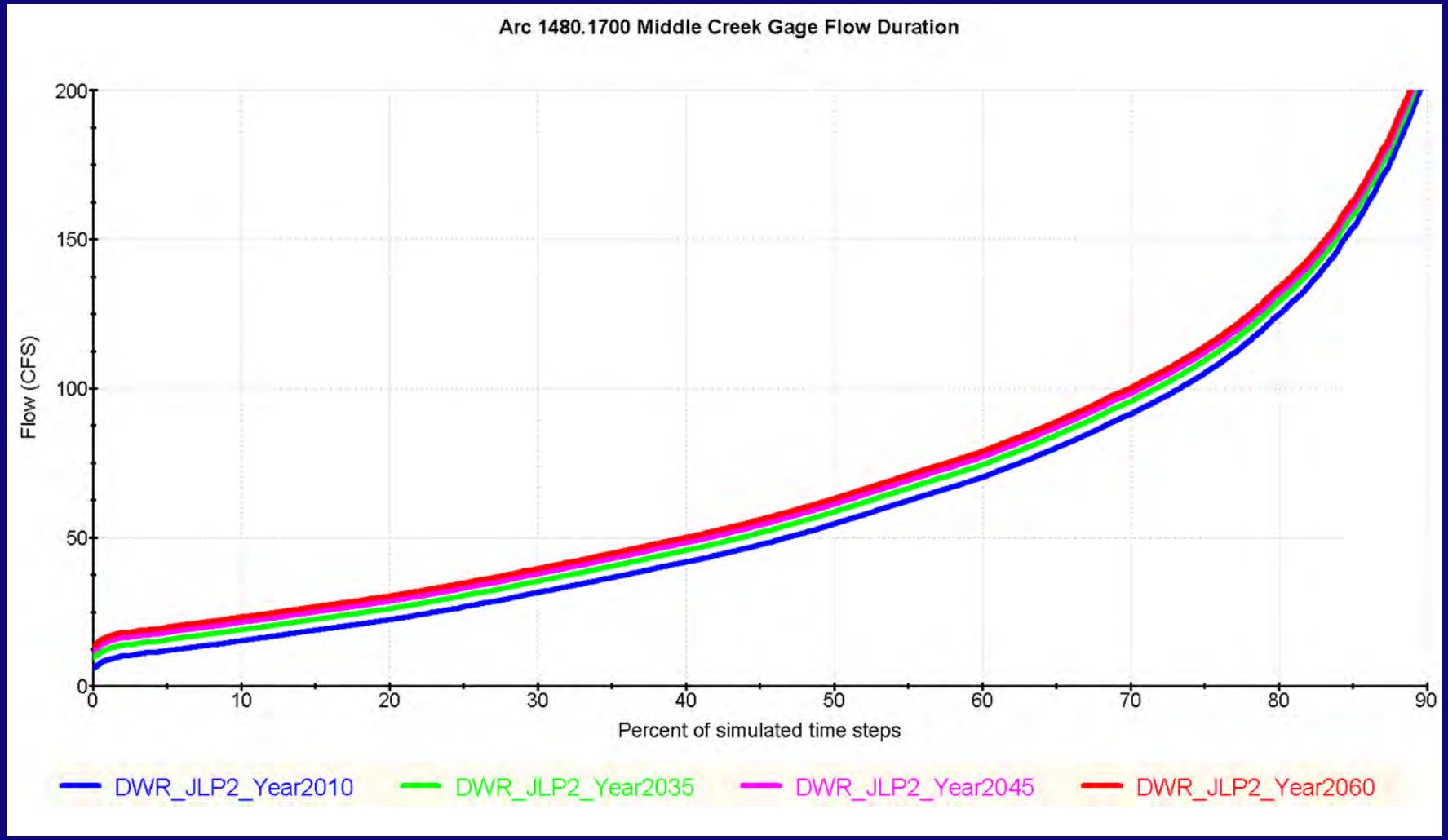
Haw River @ Bynum



New Hope Creek @ Blands



Middle Creek Gage



Schedule
Final Applications

Date	Jordan Lake Water Supply Allocations	Cape Fear River Basin Water Supply Plan	Cape Fear - Neuse River Basin Hydrologic Model
6/1/2013	Round 4 Application Instructions Finalized.		
9/3/2013			Updated model completed
10/24/2013			Review of updated model
11/12/2013			Model Training
2/28/2014		Review Safe Yield Methodology (Includes how to evaluate the 50-50 allocation rule.)	EMC Model Approval
5/1/2014	Applicants submit draft applications.		
8/1/2014		Draft Water Supply Plan available for review.	
10/1/2014	Applicants submit final applications.	Comments on Draft Water Supply Plan due.	
11/13/2014	DWR will provide update to the EMC.		
3/11/2015	Water Supply Plan and DWR's Allocation Recommendations Presentation to the EMC's Water Allocation Committee.		
	Public review of Water Supply Plan and Allocation Recommendations		
9/9/2015	Respond to comments and revisions if necessary Present recommendations to EMC's Water Allocation Committee		
11/12/2015	EMC decision at the November 2015 meeting. **(EMC has not determined their final procedures for making allocation determinations, if there are IBT's.)**		