

Appendix F

Minimum Flows and Levels (MFLs) Assessment

Introduction

Minimum Flows and Levels (MFLs) were evaluated during the North Florida Regional Water Supply Plan (NFRWSP) process in order to determine whether adopted river or spring flows and/or lake levels would be achieved under current or projected groundwater withdrawals at the planning horizon (2045). If analyses determine that a waterbody is not currently meeting its MFLs or is projected to fall below its MFLs during the planning horizon, that waterbody is said to be in recovery or prevention, respectively, with regards to its MFL. In both cases, the districts are required to “expeditiously adopt a recovery or prevention strategy” and either achieve recovery to the established MFL “as soon as practicable” or prevent the flow or level from falling below the established MFL (subsection 373.0421(2), F.S.). This document includes a review of the basic methodology used to assess MFLs status for the different types of waterbodies evaluated within the NFRWSP area, followed by a summary of the results.

Methodology

The methodology used to assess the rivers, springs, and lakes in the NFRWSP area is reviewed in this section. The North Florida-Southeast Georgia groundwater flow model (NFSEG) was used to simulate changes in aquifer potentiometric surfaces based on differences between 2009 pumps off (PO), and 2014 to 2018 average groundwater withdrawals which is referred to as current pumping (CP), and 2045 projected withdrawal scenarios. River flow, spring flow, and UFA levels were extracted and analyzed. Lakes Brooklyn and Geneva are the exception in that the Keystone Heights Transient Groundwater Flow Model v2.0 (KHTM), a semi-integrated groundwater-surface water model, was also used to assess changes in lake levels from CP to 2045 withdrawal conditions (Meridith et al. 2020).

SRWMD Methodology

River and Spring MFLs

The minimum flows for the Lower Santa Fe and Ichetucknee Rivers and associated priority springs (LSFI) were evaluated in 2014 and ratified by the legislature in 2015. Based on that evaluation, the LSFI are in Recovery (rule 62-42.300, Florida Administrative Code (F.A.C.)). For planning purposes, the status as of 2015 for these MFL waterbodies is incorporated from the adopted Lower Santa Fe River Basin Recovery Strategy (LSFRB Recovery Strategy (Appendix L)). If projected future demands indicate a greater need for projects than what was documented in the initial strategy, that additional demand will be incorporated into this planning process. The minimum flows for the LSFI are in the process of being re-evaluated. The re-evaluation may result in new or revised MFLs for the LFSI waterbodies which upon status assessment may be in prevention or recovery. In such a case, the plan will be amended concurrently with the relevant portions of the recovery or prevention strategy to include any WSD project or WRD project identified in that strategy.

For the remaining MFL waterbodies in the SRWMD, the impact of demand projections within the NFRWSP area through the planning horizon were evaluated by comparing the PO condition to CP and PO to the 2045 projection. These percentages were then compared to the reference criteria, specific to the waterbody of interest, to determine the current and future status. This planning evaluation is separate from the re-evaluation of the established MFLs (subsection 62-42.300(1)(e), F.A.C.).

Lake MFLs

The NFSEG model was used to derive predicted UFA drawdowns beneath each MFL lake from PO to CP and CP to 2045. The change in aquifer level between these scenarios was used to evaluate MFL lakes based on lake specific criteria.

SJRWMD Methodology

For all types of MFL waterbodies, freeboard is commonly used to describe the quantity of additional water available for consumptive uses of water, which would not cause a violation of a waterbody's adopted MFLs. Freeboard can be expressed in terms of Upper Floridan aquifer (UFA) drawdown or lake level drawdown (for MFL lakes) or flow (for MFL rivers and springs). A positive value, or freeboard, indicates the availability of additional groundwater or surface water for future withdrawals, while a negative value, or deficit, indicates that an MFL is not met under the current pumping condition. Each MFL assessment includes a current freeboard or deficit calculation and a projected freeboard or deficit calculation at 2045 pumping conditions. A deficit at current conditions indicates a waterbody is in recovery with regard to its MFLs. Freeboard at current conditions with a deficit at 2045 projected conditions indicates a waterbody is in prevention with regard to its MFLs. Freeboard at current conditions and at the 2045 projected conditions indicates the MFLs are met throughout the planning horizon.

River and Spring MFLs

The SJRWMD does not have any river and spring MFLs in the NFRWSP area.

Lake MFLs

Current Pumping Status

For the majority of assessed SJRWMD MFL lakes, a previously estimated freeboard value corresponding to a withdrawal condition year associated with the lake's surface water model, ranging from 1995 to 2009, was brought forward to one of the three existing NFSEG groundwater flow model simulations (2001, 2009 or CP) as described below.

If the MFL lake had a surface water model year of 2004, 2008 or 2009 (Banana, Como, Gore, Little Como, Tarhoe, and Trone), the previously estimated freeboard associated with the surface water model was brought forward to the NFSEG 2009 withdrawal

condition. The assessment of the MFLs for Cowpen Lake adopted in 2016 was based on a 2009 pumping condition, so the NFSEG 2009 withdrawal condition was used for this lake as well. If the MFL lake had a surface water model year of 2000, 2001 or 2002 (Broward, Georges, and Grandin), the surface water model year freeboard was brought forward to the NFSEG 2001 withdrawal condition. For MFL lakes with surface water model years before 2000 (Bell, Dream Pond, Orio, Silver, Stella, Swan or Tuscawilla), the freeboards from their latest assessments (2012 for Tuscawilla and 2008 for the others) were used due to lack of modeling tool to simulate pre-2000 pumping impact conditions. The assumption was then made that freeboard values would not have changed significantly between 2008 and 2009 or between 2012 and CP, so freeboard values for these lakes were brought forward to these NFSEG withdrawal conditions accordingly. The freeboards for these MFL lakes were then updated to the CP condition by calculating the change in the UFA potentiometric surface from either 2001 or 2009 withdrawal conditions to the CP withdrawal condition, accordingly.

The assessment of MFLs for Lake Lochloosa, adopted in 2019, was based on 2011-2015 average pumping condition, so the freeboard value was brought forward to the CP withdrawal condition. The assessment of MFLs for Lakes Brooklyn and Geneva, adopted in 2021, was based on 2014-2018 average pumping condition which is the same withdrawal condition as the planning assessment.

2045 Status Methodology

The NFSEG model was then used to derive predicted UFA drawdown beneath each MFL lake from CP to 2045. Lakes Brooklyn and Geneva were the exception, where the KHTM was used to calculate the lake level drawdown from CP to 2045. The differences in drawdown were applied to the CP condition MFL status (freeboard or deficit values) to determine 2045 MFL status.

Results

This section discusses the results of the river, spring, and lake MFLs assessment. A summary of the results of the MFLs assessment under the CP and 2045 withdrawal conditions can be found in Tables F1-F3. Figure F1, below shows a map of the locations and names of the waterbodies assessed. Figure F2 shows a map of the results for each waterbody.

River and Spring MFLs

In the SRWMD, there were five springs, 15 Outstanding Florida Springs (OFS), and four river reaches assessed. The water resource evaluation determined that four waterbodies are currently achieving their MFLs and were projected to achieve their MFLs at 2045, two waterbodies were determined to be in prevention, and 18 were in recovery. The waterbodies that are meeting their MFL and predicted to meet their MFLs are the Santa Fe River at Worthington Springs, the Santa Fe River Near Graham, Peacock Springs, and Troy Spring (Table F1).

There are four Outstanding Florida Springs (OFS) on the Suwannee River that are currently under an emergency rule (rule 40BER 17-01, F.A.C.) which went into effect in 2017. The springs covered under this emergency rule are Falmouth Spring, Lafayette Blue Spring, Peacock Springs, and Troy Spring. The existing emergency rule shows that these four MFLs are being met. The analysis conducted for the 2023 NFRWSP, identified that Lafayette Blue Spring and Falmouth Spring as being in prevention. However, these four OFS are on the SRWMD 2022 MFL Priority List, and technical work is underway to establish the updated MFLs (SRWMD, 2022). Upon finalization of the updated MFLs, the status of these OFS on the Suwannee River will be re-assessed.

The Lower Santa Fe and Ichetucknee rivers and associated priority springs (LSFI) are in recovery based on the current adopted Lower Santa Fe River Basin (LSFRB) Recovery Strategy. The analyses to support this determination can be found within the MFL document for these waterbodies (Appendix L).

Lake MFLs

In the NFRWSP, there are 23 lakes with adopted MFLs that were assessed as part of this planning effort. Three of them are located in the SRWMD and 20 are located in the SJRWMD. Additionally, 24 SJRWMD MFLs lakes were not assessed as part of this planning effort due to there being no significant Floridan aquifer connection or insufficient data (Appendix E).

The three lakes assessed in the SRWMD are all meeting their MFL and are projected to meet their MFL in 2045. These lakes are Lake Butler, Lake Hampton, and Lake Santa Fe (Table F2).

The analysis indicated that in the SJRWMD, 17 of the lakes are currently meeting and are projected to meet their MFLs in 2045. Lakes Brooklyn and Geneva were determined to be in recovery in 2020 resulting in adoption of the Recovery Strategy for the Implementation of Lakes Brooklyn and Geneva Minimum Levels (B-G Recovery Strategy), in 2021 (Appendix M). The assessment of lakes with MFLs also shows that Lakes Brooklyn and Geneva will continue to be in Recovery because they are currently not meeting their respective MFLs and are projected to not meet their MFLs in 2045. Lake Cowpen is in Prevention because although it is currently meeting its MFLs under the CP withdrawal condition, it is projected to not meet its MFLs by 2045. However, the impacts for Lakes Brooklyn, Geneva and Cowpen will be addressed by the Black Creek Water Resource Development Project, which is under construction. (Table F3).

Table F1: SRWMD Rivers & Springs Assessment Summary

Waterbody Type	Waterbody Name	Basin	Reference Criteria (%)	NFSEG Pumps off Flow Estimate (cfs)	Modeled Change from PO to CP (%)	Status at CP	Modeled Change from PO to 2045 (%)	Status at 2045
River	Ichetucknee River at U.S. Highway 27 ²	Ichetucknee River	3.1%	285.2	-5.7%	Recovery	-8.2%	Recovery
River	Santa Fe River at Worthington Springs	Upper Santa Fe River	15.0%	45.4	-4.3%	Met	-6.2%	Met
River	Santa Fe River near Ft. White ²	Lower Santa Fe River	8.0%	792.3	-9.3%	Recovery	-12.5%	Recovery
River	Santa Fe River near Graham	Upper Santa Fe River	15.0%	3.1	6.9%	Met	3.0%	Met
Spring	Blue Hole Spring (OFS) ²	Ichetucknee River	3.0%	81.5	-5.1%	Recovery	-7.2%	Recovery
Spring	COL101974 – Unnamed Spring ²	Lower Santa Fe River	8.0%	13.6	-3.4%	Recovery	-4.7%	Recovery
Spring	Devil's Ear Spring (OFS) ²	Lower Santa Fe River	8.0%	118.0	-3.3%	Recovery	-4.8%	Recovery
Spring	Devil's Eye Spring (OFS) ²	Ichetucknee River	3.0%	36.4	-4.4%	Recovery	-6.3%	Recovery
Spring	Falmouth Spring (OFS) ¹	Middle Suwannee River	9.9%	25.8	-9.4%	Met	-11.5%	Prevention
Spring	Grassy Hole Spring (OFS) ²	Ichetucknee River	3.0%	2.0	-3.2%	Recovery	-4.6%	Recovery
Spring	Hornsby Spring (OFS) ²	Lower Santa Fe River	8.0%	19.1	-12.7%	Recovery	-16.8%	Recovery
Spring	Ichetucknee Headspring (OFS) ²	Ichetucknee River	3.0%	56.9	-11.5%	Recovery	-16.3%	Recovery
Spring	July Spring ²	Lower Santa Fe River	8.0%	63.7	-3.3%	Recovery	-4.7%	Recovery
Spring	Lafayette Blue Spring (OFS)	Middle Suwannee River	9.9%	59.1	-6.6%	Met	-10.5%	Prevention

Waterbody Type	Waterbody Name	Basin	Reference Criteria (%)	NFSEG Pumps off Flow Estimate (cfs)	Modeled Change from PO to CP (%)	Status at CP	Modeled Change from PO to 2045 (%)	Status at 2045
Spring	Mill Pond Spring (OFS) ²	Ichetucknee River	3.0%	15.4	-3.2%	Recovery	-4.6%	Recovery
Spring	Mission Spring (OFS) ²	Ichetucknee River	3.0%	76.3	-4.2%	Recovery	-6.0%	Recovery
Spring	Peacock Springs (OFS)	Middle Suwannee River	9.9%	14.7	-2.8%	Met	-4.3%	Met
Spring	Poe Spring (OFS) ²	Lower Santa Fe River	8.0%	44.0	-3.9%	Met	-5.4%	Met
Spring	Rum Island Spring ²	Lower Santa Fe River	8.0%	26.0	-3.4%	Recovery	-4.7%	Recovery
Spring	Santa Fe River Rise ²	Lower Santa Fe River	8.0%	0.5	-2.1%	Recovery	-2.8%	Recovery
Spring	Treehouse Spring (OFS) ²	Lower Santa Fe River	8.0%	4.2	-29.7%	Recovery	-40.1%	Recovery
Spring	Troy Spring (OFS)	Middle Suwannee River	9.9%	95.7	-3.6%	Met	-5.9%	Met

¹Assessed based on average flows from Lime Spring, Lime Sink Rise, and Suwanacoochee Spring

²Assessed based on the current LSFRB Recovery Strategy

Table F2: SRWMD Lake Assessment Summary

Waterbody Type	Waterbody Name	County	Reference Criteria (ft)	NFSEG Pumps off Aquifer Level Estimate (ft)	Modeled Change from PO to CP (ft)	Status at CP	Modeled Change from PO to 2045 (ft)	Status at 2045
Lake	Butler	Union	13.6	61.77	-7.1	Met	-8.8	Met
Lake	Hampton	Bradford	23.5	72.53	-5.9	Met	-7.2	Met
Lake	Santa Fe	Alachua	22.0	84.52	-5.2	Met	-6.3	Met

Table F3: SJRWMD Lake Assessment Summary

Waterbody Type	Waterbody Name	County	CP Freeboard (ft)	Status at CP	2045 Freeboard or Deficit (ft)	2045 Freeboard or Deficit (ft)	Status at 2045
Lake	Banana	Putnam	1.8	Met	1.4	0.4	Met
Lake	Bell	Putnam	2.5	Met	1.9	0.6	Met
Lake	Brooklyn ¹	Clay	-1.6	Recovery	1.5	-3.1	Recovery
Lake	Broward	Putnam	3.8	Met	1.1	2.7	Met
Lake	Como	Putnam	2.0	Met	1.4	0.6	Met
Lake	Cowpen ¹	Putnam	0.7	Met	0.8	-0.1	Prevention
Lake	Dream Pond	Putnam	2.4	Met	2.0	0.4	Met
Lake	Geneva ¹	Clay	-0.3	Recovery	0.7	-1.0	Recovery
Lake	Georges	Putnam	4.6	Met	1.7	2.9	Met
Lake	Gore	Flagler	3.7	Met	1.2	2.5	Met
Lake	Grandin	Putnam	3.0	Met	0.9	2.1	Met
Lake	Little Como	Putnam	2.9	Met	1.4	1.5	Met
Lake	Lochloosa	Alachua	1.9	Met	0.1	1.8	Met
Lake	Orio	Putnam	1.8	Met	1.6	0.2	Met
Lake	Silver	Putnam	1.8	Met	1.5	0.3	Met
Lake	Stella	Putnam	2.4	Met	2.0	0.4	Met
Lake	Swan	Putnam	2.4	Met	1.0	1.4	Met
Lake	Tarhoe	Putnam	1.7	Met	1.5	0.2	Met
Lake	Trone	Putnam	2.9	Met	1.4	1.5	Met
Lake	Tuscawilla	Alachua	1.0	Met	0.3	0.7	Met

¹Impacts to Lakes Brooklyn, Geneva and Cowpen will be addressed by the Black Creek Project, which is under construction. When this project is fully implemented these lakes will no longer be in recovery or prevention, respectively.

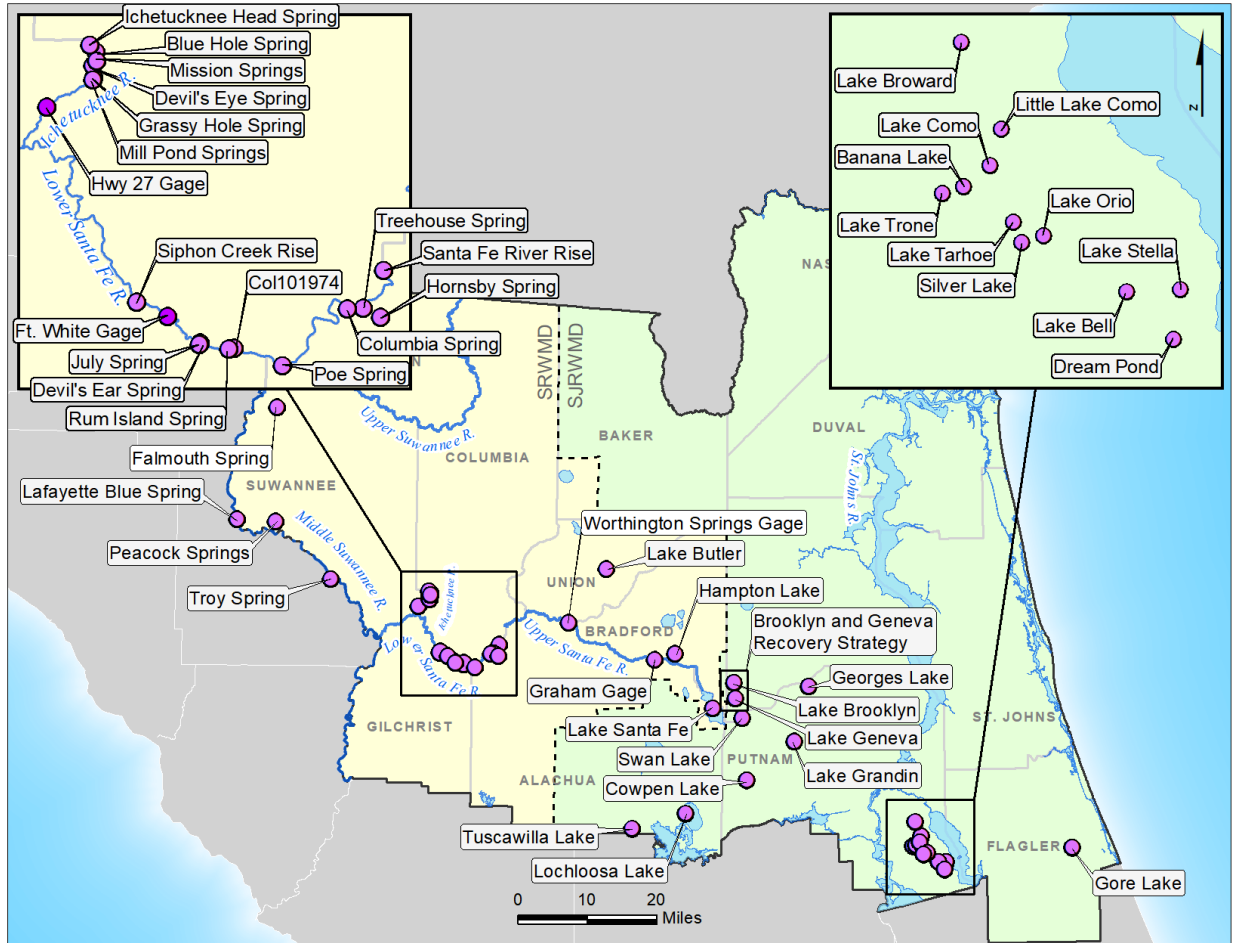


Figure F1. Names and locations of MFL rivers, springs, and lakes in the NFRWSP area

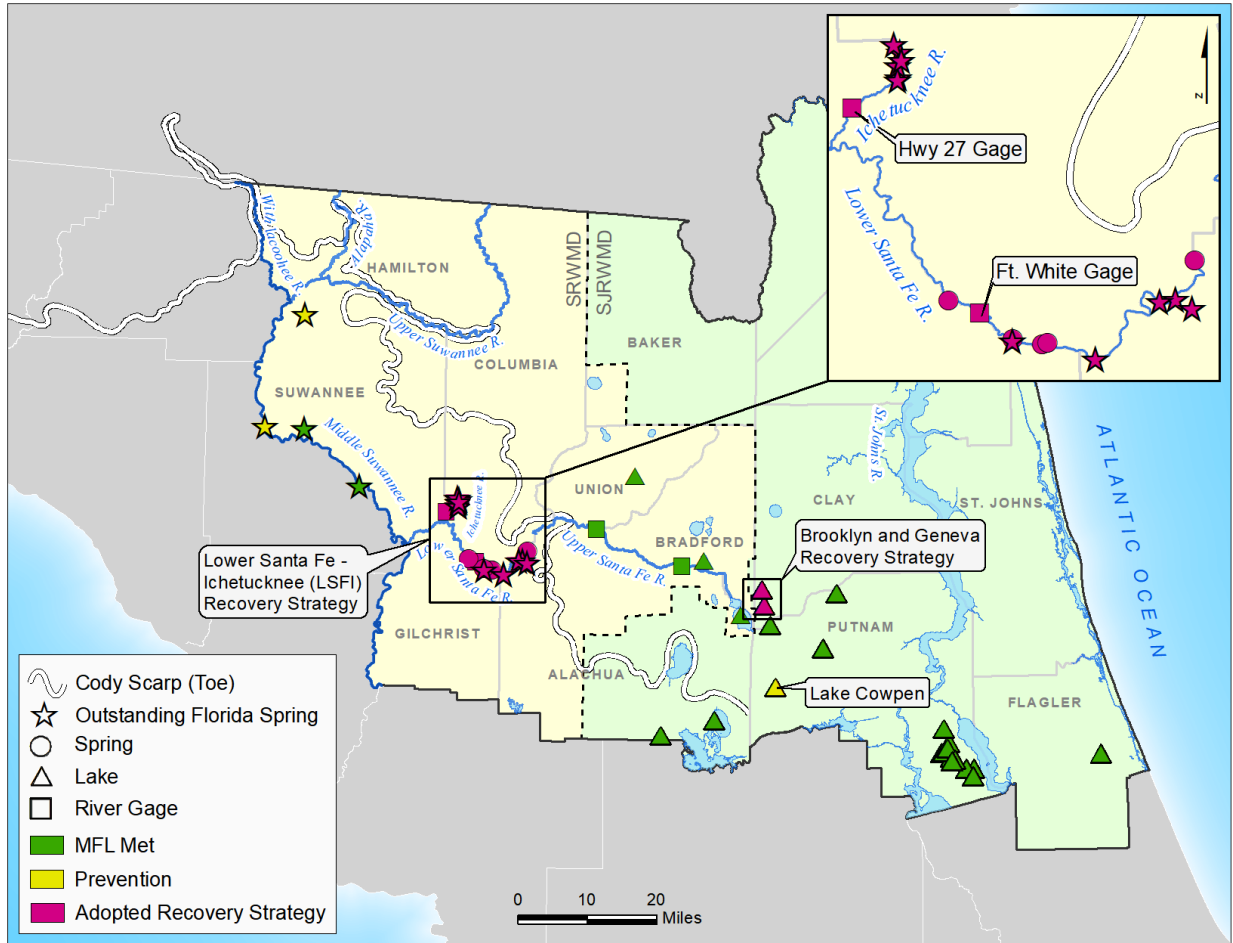


Figure F2. River, spring, and lake MFLs assessment

References

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