

APPENDIX D — MFLS STATUS ASSESSMENT

CURRENT STATUS ASSESSMENT

Current MFLs status for Lake Prevatt was based on the 2016–2020 current-pumping condition and was assessed for each of the environmental criteria used in the MFLs determination. The MFLs threshold for each of the final criteria was compared to the current-pumping condition to determine a lake level freeboard for each criterion. Upper Floridan aquifer (UFA) freeboards were then estimated for each criterion. UFA freeboard is defined as the aquifer reduction allowable before an MFL is no longer achieved. The most constraining environmental metric (i.e., with smallest freeboard) was used as the basis for the Lake Prevatt MFLs. The following briefly summarizes the assessment of each environmental metric.

Event-based metrics

Current status for event-based metrics (i.e., FH, MA, and FL) was assessed using frequency analysis. The current-pumping condition frequency of each event was compared to the recommended minimum frequency to determine if the level was met under current conditions. The difference between the current-pumping condition water level and MFLs magnitude represents the freeboard or deficit in the lake.

Frequent High (FH)

Calculating the probability of exceedance of the FH involved the following three steps:

1. Determine the annual maximum elevation continuously exceeded for the specified duration for each water year. The water year for flooding events is from June 1 to May 31.
2. Rank annual maximums from step 1 in descending order.
3. Use Weibull plotting position formula to calculate the probability of exceedance.

$$P(S \geq \hat{S}_m) = \frac{m}{n+1}$$

where $P(S \geq \hat{S}_m)$ = probability of S equaling or exceeding $\hat{S}_m$
 m = rank of event
 n = number of water years

Under the current-pumping condition, the FH flooding event (53.8 feet (ft), duration of 30 days) has a probability of 84.5% (1.2-year return interval) compared to a probability of 76.9% (1.3-year return interval) under the MFLs condition. The MFLs condition allows for fewer flooding events per 100 years than what occurs under the current-pumping condition.

At the MFLs return interval (1.3 years), the current-pumping elevation is approximately 54.6 ft NAVD88. Based on the current-pumping elevation and return interval, the FH is

considered met under current conditions (Figure D-1) with a lake freeboard of 0.8 ft (Table D-1); see below for UFA freeboard calculation (Table D-3).

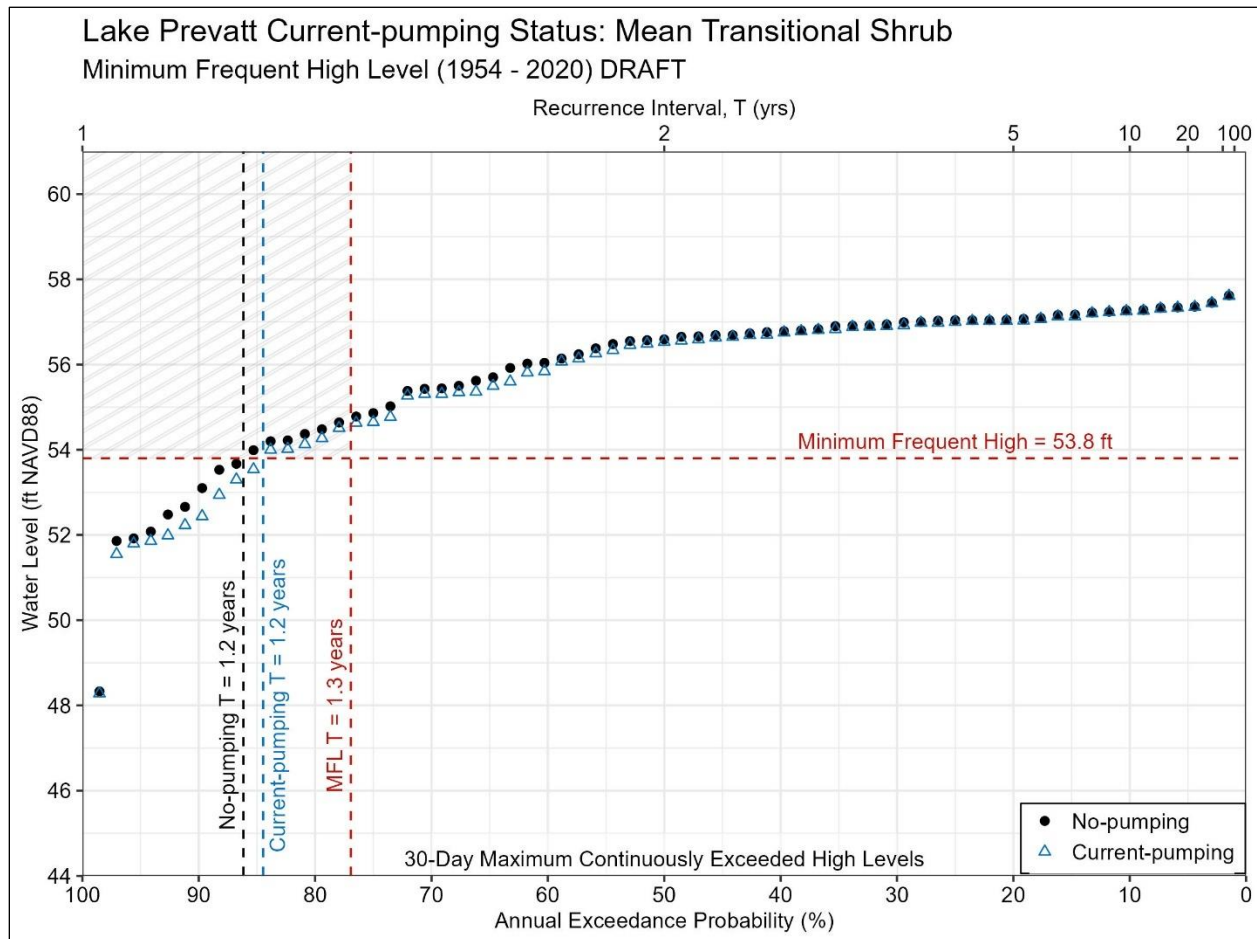


Figure D-1. Frequency analysis plot (i.e., Weibull plot) for the Lake Prevatt FH. Shown are the annual exceedance probability (bottom axis) and return interval (top axis) of the FH for the current-pumping condition (blue triangles) and no-pumping condition (black dots) versus the MFLs condition (red vertical and horizontal lines). The horizontal and vertical red lines represent the minimum magnitude (lake level) and return interval, respectively. The blue vertical line represents the current-pumping condition frequency and return interval. The black vertical line represents the no-pumping condition frequency and return interval.

Minimum Average (MA)

Calculating the probability of non-exceedance of the MA involved the following three steps:

1. Determine the annual minimum average elevation not exceeded for the specified duration for each water year. The water year for a non-exceedance event is October 1 to September 30.

2. Rank annual minimum averages from step 1 in descending order.
3. Use Weibull plotting position formula to calculate the probability of non-exceedance.

$$P(S < \hat{S}_m) = 1 - \left(\frac{m}{n+1} \right)$$

where $P(S < \hat{S}_m)$ = probability of S not exceeding $\hat{S}_m$
 m = rank of event
 n = number of water years

Under the current-pumping condition, the MA drying event (49.7 ft, duration of 180 days) has a probability of 21.1% (4.7-year return interval) compared to a probability of 28.6% (3.5-year return interval) under the MFLs condition. The MFLs condition allows for 7 more drying events per 100 years than what occurs under the current-pumping condition.

The current-pumping condition elevation is 52.4 ft (NAVD88). When compared to the MFLs elevation of 49.7 ft, this results in a lake level freeboard of 2.7 ft (Table D-1). Based on the current-pumping elevation and return interval, the MA is considered met under current conditions (Figure D-2); see below for UFA freeboard calculation (Table D-3).

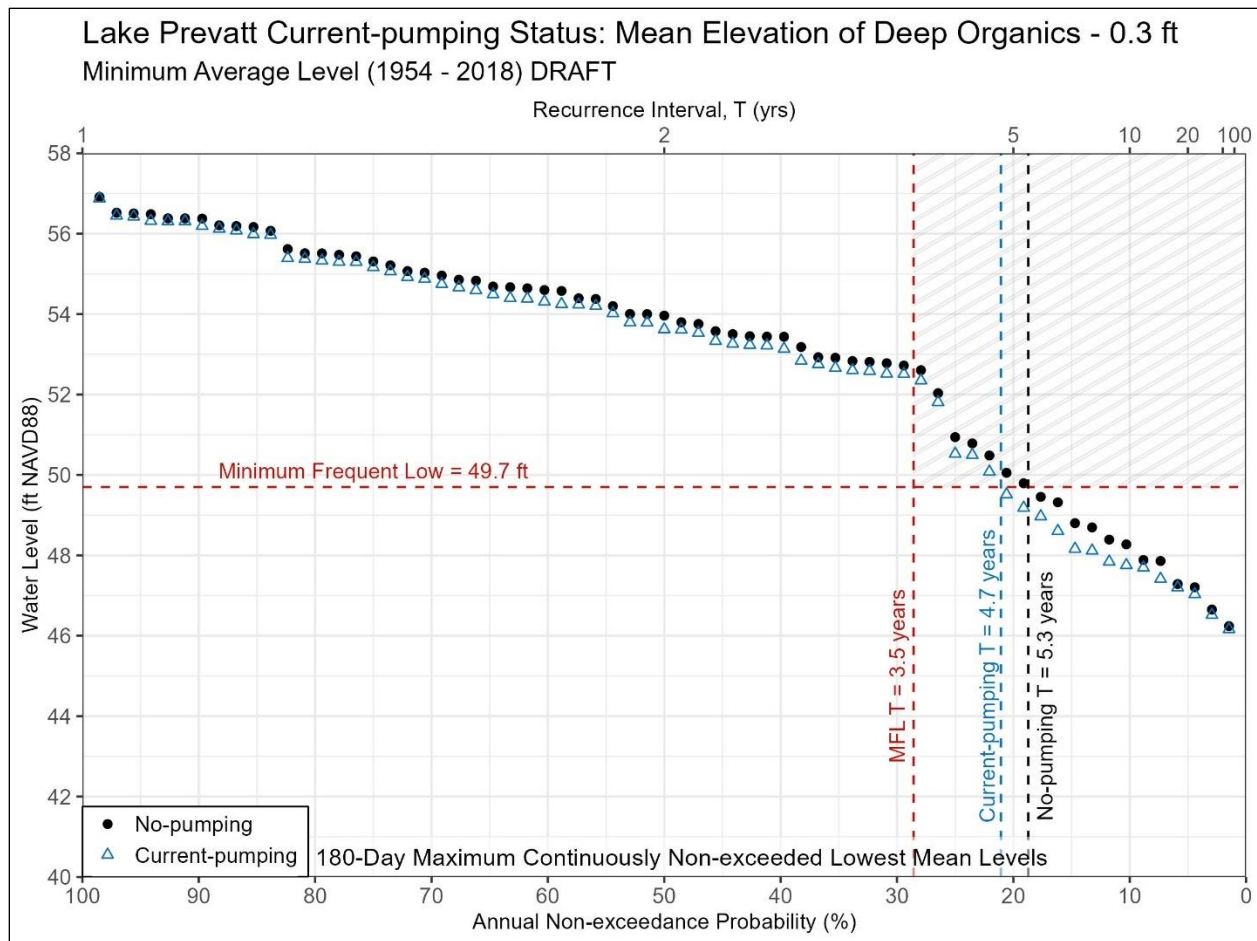


Figure D-2. Frequency analysis plot (i.e., Weibull plot) for the Lake Prevatt MA. Shown are the annual non-exceedance probability (bottom axis) and return interval (top axis) of the MA for current-pumping condition (blue triangles) and no-pumping condition (black dots) versus MFLs condition (red vertical and horizontal lines). The horizontal and vertical red lines represent the minimum magnitude (lake level) and return interval, respectively. The blue vertical line represents the current-pumping condition frequency and return interval. The black vertical line represents the no-pumping condition frequency and return interval.

Frequent Low (FL)

Calculating the probability of non-exceedance of the FL involved the following three steps:

1. Determine the annual minimum elevation continuously not exceeded for the specified duration (120 days) for each water year. The water year for a non-exceedance event is October 1 to September 30.
2. Rank annual minimums from step 1 in descending order.
3. Use Weibull plotting position formula to calculate the probability of non-exceedance.

$$P(S < \hat{S}_m) = 1 - \left(\frac{m}{n+1} \right)$$

where $P(S < \hat{S}_m)$ = probability of S not exceeding $\hat{S}_m$
m = rank of event
n = number of water years

Under the current-pumping condition, the FL drying event (51.1 feet, duration of 120 days) has a probability of 21.4% (4.7-year return interval) compared to a probability of 27.8% (3.6-year return interval) under the MFLs condition. The MFLs condition allows for 6 more drying events per 100 years than what occurs under the current-pumping condition.

The current-pumping condition elevation is 52.5 ft (NAVD88). When compared to the MFLs elevation of 51.1 ft, this results in a lake level freeboard of 1.4 ft (Table D-1). Based on the current-pumping elevation and return interval, the FL is considered met under current conditions (Figure D-3); see below for UFA freeboard calculation (Table D-3).

Table D-1. Frequency of MFLs events under MFLs condition and current-pumping condition for Lake Prevatt, Orange County, Florida.

MFLs	Environmental Criteria	Frequency of the MFLs event (years per 100 years)		Difference in number of events between current-pumping and MFLs conditions	Lake Freeboard (ft)
		MFLs Condition	Current-pumping Condition		
Frequent High (FH)	Transitional shrub communities; fish and wildlife habitat	76.9	84.5	7.6	0.8
Minimum Average (MA)	Organic soils; seasonally flooded wetland habitat	28.6	21.1	7.5	2.7
Frequent Low (FL)	Shallow and deep marsh habitat	27.8	21.4	6.4	1.4

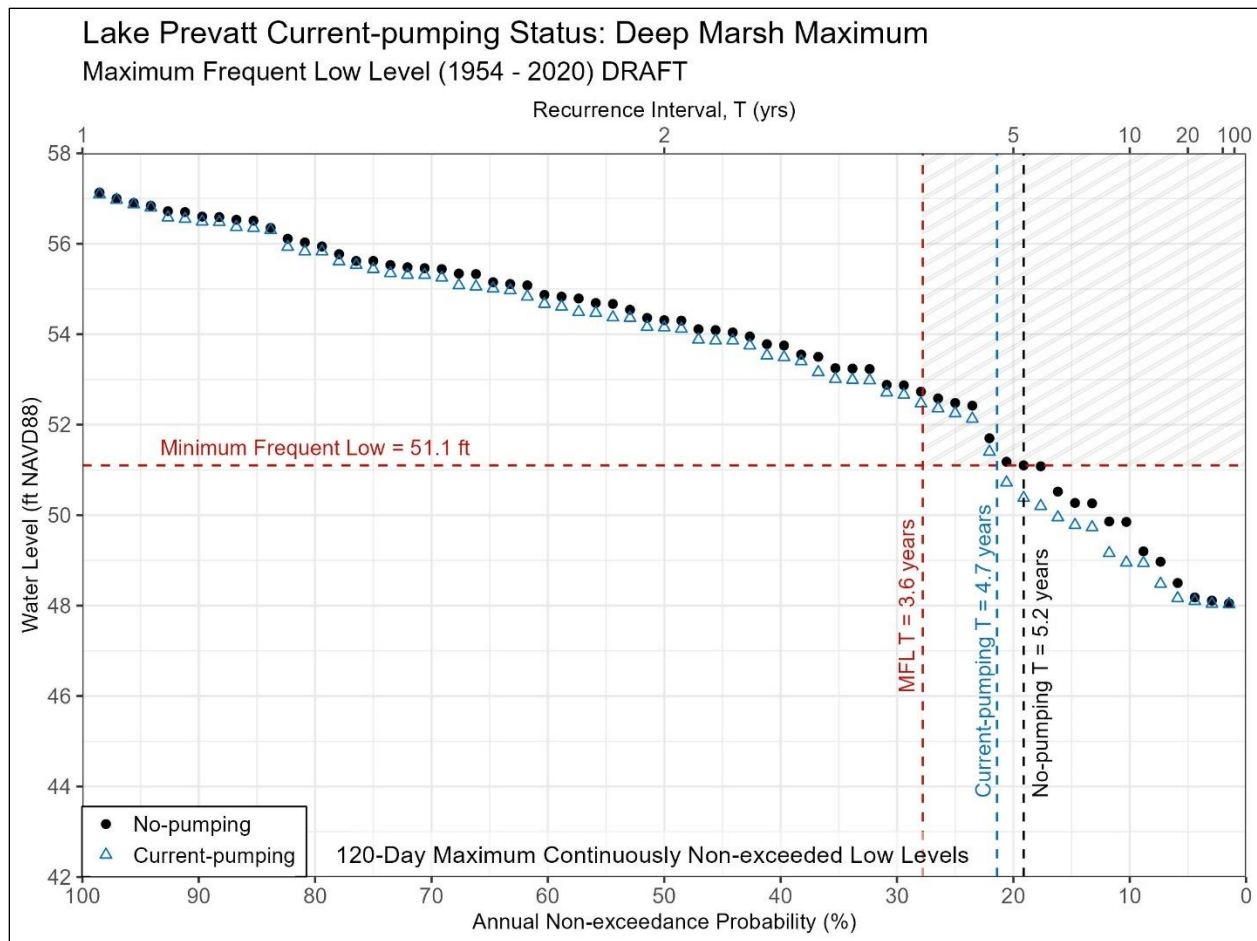


Figure D-3. Frequency analysis plot (i.e., Weibull plot) for the Lake Prevatt FL. Non-exceedance probability (bottom axis) and return interval (top axis) of the FL for current-pumping condition (blue triangles) and no-pumping condition (black dots) versus MFLs condition (red vertical and horizontal lines). The horizontal and vertical red lines represent the minimum magnitude (lake level) and return interval, respectively. The blue vertical line represents the current-pumping condition frequency and return interval. The black vertical line represents the no-pumping condition frequency and return interval.

Fish and Wildlife Metrics – Hydroperiod Tool

The SJRWMD’s GIS-based hydroperiod tool was used to evaluate the effect of water level decline on the following eight fish and wildlife criteria:

- Small wading bird forage habitat;
- Large wading bird forage habitat;
- Game fish spawning habitat;
- Emergent marsh habitat;
- Canoe paddling area;
- Open water (5 ft) area; and
- Lake area

For each metric, habitat area was calculated at 0.1 ft intervals for the no-pumping lake level timeseries using stage/habitat area output from the hydroperiod tool. Status was assessed by comparing the percent reduction of average habitat area (i.e., averaged across the entire POR) under the current-pumping condition to the average habitat area under the no-pumping condition. The allowable reduction in average area is defined as 15% from a no-pumping condition to the MFL condition. Metrics are considered “met” if they exhibit less than or equal to a 15% reduction in average area relative to the no-pumping condition.

Each of the seven hydroperiod tool metrics was met under the current-pumping condition (i.e., the average area was greater than or equal to the MFLs condition area (Table D – 2). The largest percent area reduction from no-pumping to current-pumping condition was for the open water – 5 ft habitat (6.2 % reduction; Table D – 2).

Table D-2. MFLs condition for Lake Prevatt environmental criteria; NP = no-pumping condition; CP = current-pumping condition.

Environmental Criterion	NP Condition area (acres)	CP Condition area (acres)	MFLs Condition area (acres)	NP to CP area reduction (%)
Small wading bird forage habitat	4.6	4.6	4.6	0.0
Large wading bird forage habitat	10.7	10.6	10.5	0.5
Game fish spawning habitat	36.0	35.5	35.1	1.4
Emergent marsh habitat	70.0	68.4	66.6	2.3
Canoe paddling area	66.9	64.5	61.5	3.7
Open water (5 ft) area	27.2	25.5	23.3	6.2
Lake area	85.7	83.1	80.0	3.0

UFA Freeboard/Deficit Calculation

Event-based Metrics

For event-based metrics, frequency analysis is also used to determine whether there is water available for withdrawal (freeboard) from the UFA or whether water is needed to recover the UFA (deficit). UFA freeboard is defined as the aquifer reduction (ft) allowable before an MFL is no longer achieved. Deficit is defined as the amount of water needed to recover an MFL that is not being achieved. For a lake MFL, aquifer deficit is expressed as the amount of recovery needed (in feet) in the UFA.

Freeboard or deficit calculation involves the following steps:

1. UFA elevations (i.e., water levels in a UFA well record) used in the surface water model are increased or decreased by small increments (depending on frequency analysis results);
2. The surface water model is then run iteratively after each change to UFA levels to simulate a new surface-water level timeseries representing an increase or decrease in withdrawal relative to the current-pumping condition;
3. Frequency analysis and Weibull plotting are repeated using the new timeseries data;
4. Steps 1 through 3 are repeated until the given minimum level is just met (i.e., within 0.1 ft);
5. The amount of water added (or subtracted) to the UFA elevation represents the amount of water available for consumptive use (i.e., freeboard) or amount of water needed to be recovered (i.e., deficit).

Each of the three Lake Prevatt MFLs have lake freeboards greater than zero, and therefore, UFA freeboard analyses were performed for each level. The FH, MA, and FL have lake freeboards of 0.8, 2.7, and 1.4 ft respectively. For each of the three MFLs, the current-pumping UFA and lake level timeseries were iteratively decreased using the surface water model until the event frequency just met the recommended minimum frequency following the steps above. This iterative modeling and frequency analysis process resulted in UFA freeboards for the FH, MA, and FL of 2.5, 2.1, and 2.4 ft respectively (Table D-3). Therefore, the MA is the most constraining of the event-based MFL metrics with a UFA freeboard of 2.1 ft.

Table D-3. MFLs criteria including MFL and current-pumping condition return intervals and UFA freeboard for Lake Prevatt, Orange County, Florida.

MFLs	Environmental Criteria	Minimum Level Components				Lake Freeboard (ft)	UFA Freeboard (ft)
		Level (ft NAVD88)	Duration (days)	MFL Condition Return Interval (years)	Current-pumping Condition Return Interval (years)		
Frequent High (FH)	Transitional shrub communities; Fish and wildlife habitat	53.8	30	1.3	1.2	0.8	2.5
Minimum Average (MA)	Organic soils	49.7	180	3.5	4.7	2.7	2.1
Frequent Low (FL)*	Shallow and deep marsh communities/ associated wildlife values	51.1	120	3.6	4.7	1.4	2.4
*Not considered as final metric.							

Fish and Wildlife Metrics – Hydroperiod Tool

Freeboard and deficit are also derived from the analysis of hydroperiod tool metrics, comparing the average area reductions under the MFL condition as compared to the no-pumping condition. Freeboard is assessed in a similar manner to the event-based metrics above, and includes the following steps:

1. UFA elevations (i.e., water levels in a UFA well record) used in the surface water model are increased or decreased by small increments (depending on initial no-pumping and current-pumping analysis results);
2. The surface water model is then run iteratively after each change to UFA levels to simulate a new surface-water level timeseries representing an increase or decrease in withdrawal relative to the current-pumping condition;
3. Average habitat areas are calculated based on the new lake stage timeseries;
4. Steps 1 through 3 are repeated until the MFL is just met (i.e., average habitat area equals a 15% reduction from the no-pumping condition habitat area);
5. The amount of water added (or subtracted) to the UFA elevation represents the amount of water available for consumptive use (i.e., freeboard) or amount of water needed to be recovered (i.e., deficit).

UFA freeboard was calculated for the seven fish and wildlife metrics (Table D-4). Small waders, large waders, and game fish spawning all had >3.5 ft of UFA freeboard. Emergent marsh and lake area freeboard values were consistent with those calculated from the event-based metrics. The most constraining of the hydroperiod tool metrics, and all metrics overall, was the open water 5 ft metric with 0.9 ft UFA freeboard. Therefore, the MFL condition for Lake Prevatt is based on a UFA drawdown of 0.9 ft that would support the open water 5 ft criterion and all subsequent less constraining metrics.

Table D-4. UFA freeboard for Lake Prevatt hydroperiod tool environmental criteria.

Environmental Criterion	Environmental Value(s) Protected	Freeboard (ft)
Small Waders	Fish and wildlife habitat	> 3.5
Large Waders	Fish and wildlife habitat	> 3.5
Game Fish Spawning	Fish and wildlife habitat	> 3.5
Emergent Marsh	Fish and wildlife habitat	2.5
Canoe	Recreation/Aesthetics/Water Quality/Fish Habitat	1.7
Open Water 5ft	Recreation/Aesthetics/Water Quality/Fish Habitat	0.9
Lake Area	Recreation/Aesthetics/Water Quality/Fish Habitat	2.2

Future/Projected Status

The status assessment for Lake Prevatt indicates that all evaluated environmental criteria are met under the 2016 – 2020 current-pumping condition. All metrics have freeboard in the UFA (i.e., do not have a deficit), and therefore the waterbody is not in recovery. If the MFLs are currently being achieved but are projected to not be achieved within the 20-year planning horizon, then a waterbody is in “prevention” requiring a prevention strategy developed concurrently with the MFLs. Whether MFLs are being achieved within the planning horizon is determined by comparing the UFA freeboard of the most constraining environmental criterion to the amount of projected UFA drawdown at the planning horizon.

Water withdrawal information used to assess future status was based on water supply planning projections for the planning horizon (i.e., not current CUP allocations). The projected UFA drawdown at the 20-year planning horizon (2045) was estimated for Lake Prevatt using the East Central Florida Transient Expanded (ECFTX) groundwater model (ECFTX v2.0).

Assuming all future pumping is equal to projected 2045 water demand, the predicted UFA drawdown is 0.16 ft.

Under current-pumping conditions, all Lake Prevatt MFLs are met, and the most constraining (open water 5 ft) has a UFA freeboard of 0.9 ft. The additional 0.16 ft of drawdown at the planning horizon results in a remaining UFA freeboard of 0.74 ft at 2045. Therefore, Lake Prevatt is not in prevention or recovery.