Appendix D— MFLs Status Assessment

CURRENT STATUS ASSESSMENT

Current MFLs status for Johns Lake was based on the 2016–2020 current-pumping condition and was assessed for each of the environmental criteria selected as part of the MFLs determination process (see Table 12 and Table 13 in main report). 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 Johns Lake MFLs. The following briefly summarizes the assessment of each environmental metric.

Event Based Metrics

Current status for event-based metrics (i.e., two FH metrics; see *MFLs Determination* section for more details) 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. The following describes how frequency analysis was used to calculate the exceedance probability of each FH under the current-pumping condition:

For FH#1

1. Determine the annual maximum elevation continuously exceeded for the specified duration (30 days) for each water year. The water year used for flooding events is June 1 to May 31.
2. Rank annual maximums from step 1 in descending order.
3. Use the Weibull plotting position formula to calculate the probability of exceedance.

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

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

For FH#2

1. Determine the annual maximum elevation continuously exceeded for the specified duration (60 continuous days between January 1st and May 31st) for each year.
2. Rank annual maximums from step 1 in descending order.
3. Use the Weibull plotting position formula to calculate the probability of exceedance.

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

where: $P(S \geq \hat{S}_m)$ = probability of S equaling or exceeding $\hat{S}_m$

m = rank of event

n = number of years

Frequent High #1

Under the current-pumping condition, the FH1 exceedance event (94.1 feet, duration of 30 days) has a probability of 76% (1.3-year return interval) compared to a probability of 63% (1.6-year return interval) under the MFLs condition. Therefore, FH#1 is achieved under current-pumping conditions (Figure D-1).

Frequent High #2

Under the current-pumping condition, the FH2 exceedance event (90.4 feet, duration of 60 continuous days between January 1st and May 31st) has a probability of 94% (1.1-year return interval) compared to a probability of 33% (3-year return interval) under the MFLs condition. Therefore, FH#2 is achieved under current-pumping conditions (Figure D-2).

UFA Freeboard Calculation

Since both FHs are met under current conditions, these metrics do not result in a deficit of water (i.e., these metrics do not put the water body in Recovery). To determine if Johns Lake is in Prevention, based on these metrics, frequency analysis was used to determine the amount of UFA reduction (ft) that is allowable before it is no longer achieved. This UFA freeboard was then compared to the amount of withdrawal projected in the 20-year planning horizon (2045 projection) to determine if there would be a deficit in this time period (i.e., that withdrawals would cause the lake to be in Prevention). UFA freeboard was calculated as follows:

1. UFA elevations (i.e., UFA well levels) in Johns Lake surface water model were decreased by a small increment (amount of decrease is result dependent);

2. The surface water model is run after this iterative change to UFA elevations, to simulate a new lake stage time series;

3. Frequency analysis is performed, and a Weibull plot (Figure D-1; Figure D-2 is created and reviewed;

4. Steps 1 through 3 are repeated until MFL is just met

5. The amount of water added (or subtracted) to UFA elevations represents the amount of water available for consumptive use (i.e., freeboard), or amount of water needed to be recovered (i.e, deficit).

Under the current-pumping condition FH#1 and FH#2 are met and, based on the analysis described above, they have a UFA freeboard of 1.5 ft and > 3.0 ft, respectively (Table D-1).

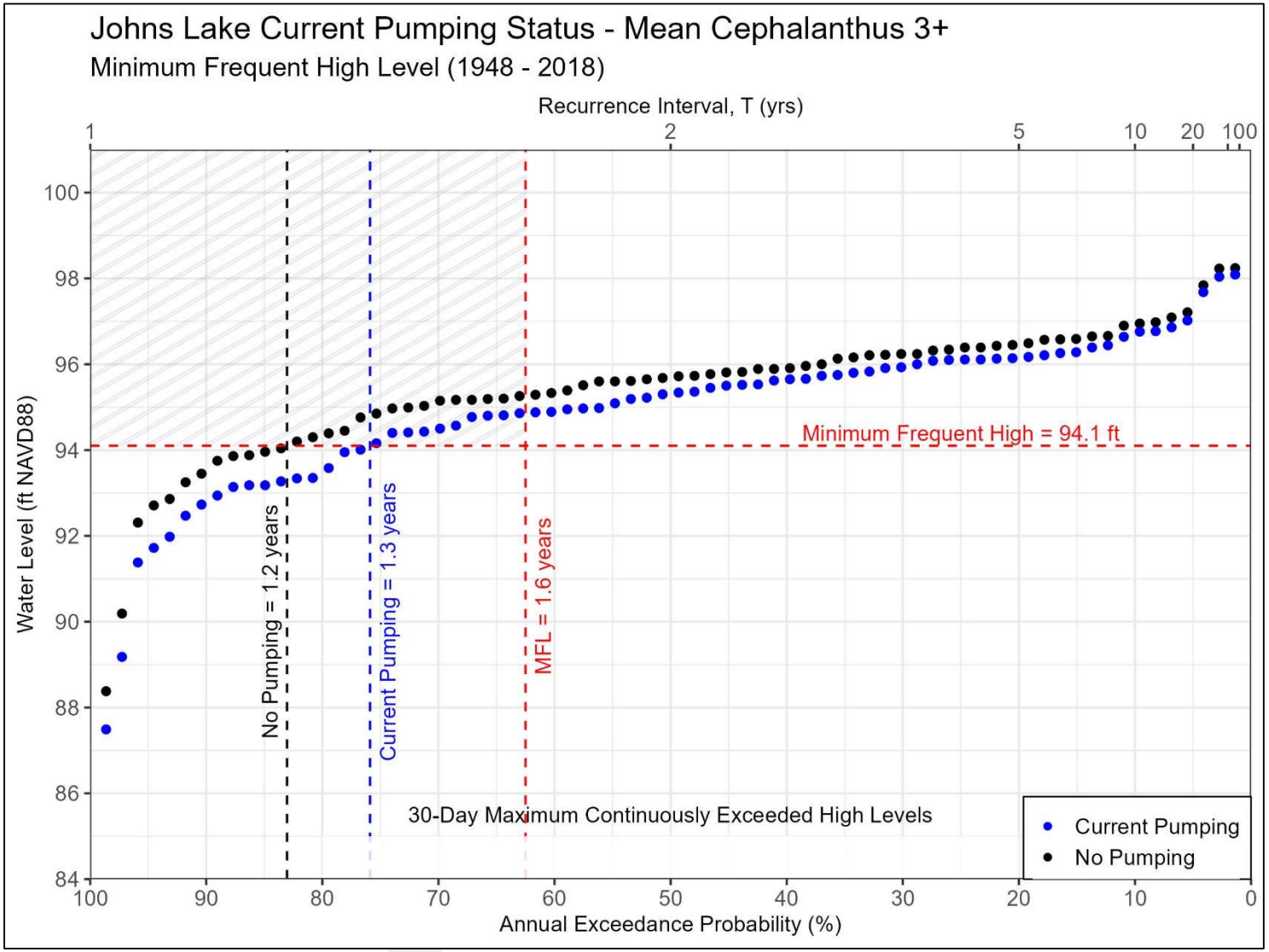

Figure D-1: Weibull plot illustrating the *Cephalanthus* inundation event occurring more frequently than the MFLs condition.

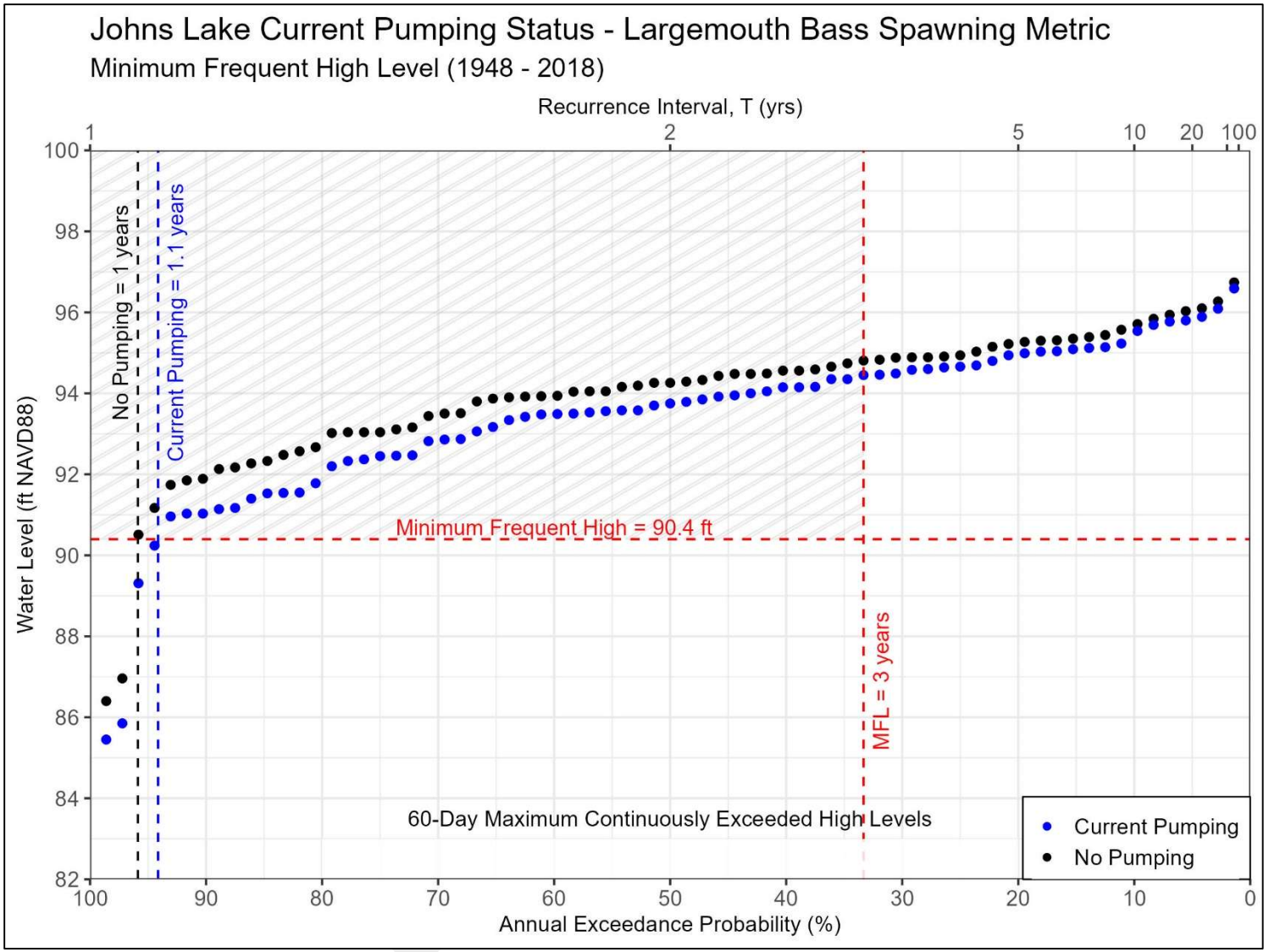

Figure D-2: Weibull plot illustrating the largemouth bass spawning habitat inundation event occurring more frequently than the MFLs condition.

Table D-1: UFA freeboard for Johns Lake Event-based metrics.

Event-based Metric	Environmental Value Protected	UFA freeboard (ft)
Frequent High #1	Seasonally Flooded Wetland Communities	1.5
Frequent High #2	Largemouth Bass Spawning Habitat	> 3

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 seven fish and wildlife criteria:

- Small wading bird forage habitat;
- Large wading bird forage habitat;
- Sandhill crane nesting habitat;
- Emergent marsh habitat;
- Lake area;
- Canoeable area; and
- Open-water 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. Current status was assessed by comparing the percent reduction of average habitat area (i.e., averaged across the entire POR) under the current-pumping condition, relative to the MFLs condition, which is defined as a 15% reduction in average area relative to the no-pumping 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 area (7.1% reduction). This is the most sensitive metric and the basis of the MFLs condition. For the open-water area metric, a UFA drawdown of 1.3 feet results in a 14.7% reduction in average area, relative to the no-pumping condition. However, a drawdown of 1.4 feet results in a 15.4% reduction. Since the latter results in open-water area reduction greater than the 15% threshold, 1.3 feet is considered the UFA freeboard for this metric

Table D-2: MFLs condition for Johns Lake environmental criteria; NP = no-pumping condition; CP = current-pumping condition; MFLs Condition = CP – 1.3 feet UFA Drawdown.

Environmental Criterion	NP Condition average area (acres)	CP Condition area (acres)	MFLs Condition (CP-1.3 ft) area (acres)	15% Reduction Threshold area (acres)
Small wading bird forage habitat	46.0	48.7	51.1	39.1
Large wading bird forage habitat	105.5	111.7	116.6	89.7
Sandhill crane nesting habitat	59.5	62.9	65.5	50.6
Emergent marsh habitat (≤7 ft)	993.3	1,034.1	1,079.5	844.3
Lake area	2,488.5	2,422.7	2,355.0	2,115.2
Canoe area (≥ 20 in)	2,299.1	2,222.9	2,146.1	1,954.2
Open-water area (≥7 ft)	1,495.2	1,388.6	1,275.5	1,270.9

UFA freeboard was assessed in a similar manner to the FH assessment described above, and included the following steps:

1. UFA levels (i.e., UFA well levels) 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 run 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. Using the new surface-water level timeseries data, average habitat areas are calculated;

4. Steps 1 through 3 are repeated until the given minimum level 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 level represents the amount of water available for consumptive uses (i.e., freeboard), or the amount of water needed to be recovered (i.e., deficit).

UFA freeboard was calculated for seven fish, wildlife, and recreation metrics. Based on this analysis, the open-water area metric had the smallest amount of freeboard (i.e., is most constraining); UFA freeboard for this metric equals 1.3 ft (Table D-3).

The current-pumping condition minus 1.4 feet resulted in a reduction of open water area of 15.4%. Because reductions in the UFA are modeled in 0.1-foot increments, the nearest value that does not violate the 15% reduction threshold was chosen, which was a UFA reduction of 1.3 feet.

Table D-3: UFA freeboard for Johns Lake Hydroperiod Tool (HT) metrics.

Environmental Criterion	Environmental Value Protected	UFA Freeboard (ft)
Small wading bird forage habitat	Fish and wildlife habitat	> 3.0
Large wading bird forage habitat	Fish and wildlife habitat	> 3.0
Sandhill crane nesting habitat	Fish and wildlife habitat	> 3.0
Emergent marsh habitat (7ft and less)	Fish and wildlife habitat	> 3.0
Lake Area	Recreation/Aesthetics/Water Quality/Fish Habitat	> 3.0
Canoe area	Recreation/Aesthetics/Water Quality/Fish Habitat	> 3.0
Open-water area (7ft or deeper)	Recreation/Aesthetics/Water Quality/Fish Habitat	1.3

FUTURE/PROJECTED STATUS

The current status assessment indicates that all environmental criteria evaluated are met under the 2016-2020 average current-pumping condition. The most constraining criterion (open-water area metric) has a UFA freeboard of 1.3 feet. 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" and requires a prevention strategy to be 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 Johns Lake using the ECFTX v2.0 groundwater model. Assuming all future pumping equals projected 2045 water demand, the predicted UFA drawdown is 0.8 ft. Relative to the current-pumping condition, this leaves a freeboard of 0.5 feet at 2045. Therefore, Johns Lake MFLs are met at the planning horizon and this water body is not in prevention or recovery.