# APPENDIX F— MFLS ASSESSMENT

## MFLs Assessment

MFLs are not meant to represent optimal conditions, but rather set the limit to withdrawals, beyond which significant harm would occur. A fundamental assumption of the SJRWMD's approach is that alternative hydrologic regimes exist that are lower than a priority water body's historical regime but that still protect important environmental functions and values from significant harm caused by water withdrawals. The MFLs determination component involves defining a minimum hydrologic regime (which defines the MFLs condition) necessary to protect relevant water resource values (see main report for MFLS determination).

The no-pumping condition and current-pumping condition lake level datasets developed for Apshawa Lake South were used to calculate freeboard or deficit and determine whether the lake is in recovery, prevention or neither (see *Hydrological Analyses* in the main report and Appendix B for more details regarding development of the no-pumping and current-pumping conditions). The MFLs assessment compares the MFLs condition for each metric with the current hydrologic regime (current-pumping condition) to assess whether the MFLs are being achieved under the current-pumping condition, and to determine if there is water available for withdrawal (freeboard), or if water is needed for recovery (deficit). If any of the MFLs criteria are not being protected under the current-pumping condition, indicating a deficit of water, a recovery plan is required. If an MFLs criterion is currently being met, but a deficit is projected within the 20-year planning horizon, a prevention plan is required.

## Current Status

Current status was assessed for the final suite of environmental criteria selected as part of the MFLs determination process (Table 11 in main report). The MFLs-condition and current-pumping condition were compared for each environmental metric, resulting in a freeboard or deficit. The most constraining environmental metric was used as the basis for the Apshawa Lake South MFLs. The following briefly summarizes the assessment of each environmental metric.

### Event Based Metric

Only one event-based metric was determined for Apshawa Lake South, a minimum average (MA; see *MFLs Determination* section for more details). The MA was assessed by using frequency analysis to compare the recommended return interval of the event to the return interval under the current-pumping condition. The following describes how frequency analysis was used to calculate the non-exceedance probability of the MA under the current-pumping condition:

1. Using the current-pumping condition lake level dataset, the annual minimum average elevation not exceeded (i.e., dry) for the specified duration (180 days) was determined for each water year. The water year used for a non-exceedance event is October 1 to September 30 (water years used for flooding events are different);
2. Annual minimum averages from step 1 were then ranked in descending order; and

3. Using the following Weibull plotting position formula, the probability of non-exceedance was then calculated.

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

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 non-exceedance event (80.6 feet, duration of 180 days) has a probability of 15.6% (6.4-year return interval) compared to a probability of 41.7% (2.4-year return interval) under the MFLs condition. Therefore, the MA is achieved under current-pumping conditions (Figure 1).

**UFA Freeboard Calculation**

Since the MA is met under current conditions, this metric does not result in a deficit of water (i.e., this metric does not put the water body in Recovery). To determine if Apshawa Lake South is in Prevention, based on this metric, 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 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 the Apshawa Lake South 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 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 elevation represents the amount of water available for consumptive use (i.e., freeboard), or amount of water needed to be recovered (i.e, deficit).

Under current-pumping conditions the MA is met and, based on the analysis described above, has a UFA freeboard of 1.4 ft (i.e., this metric allows for a UFA reduction of 1.4 ft below the lake; Figure 2).

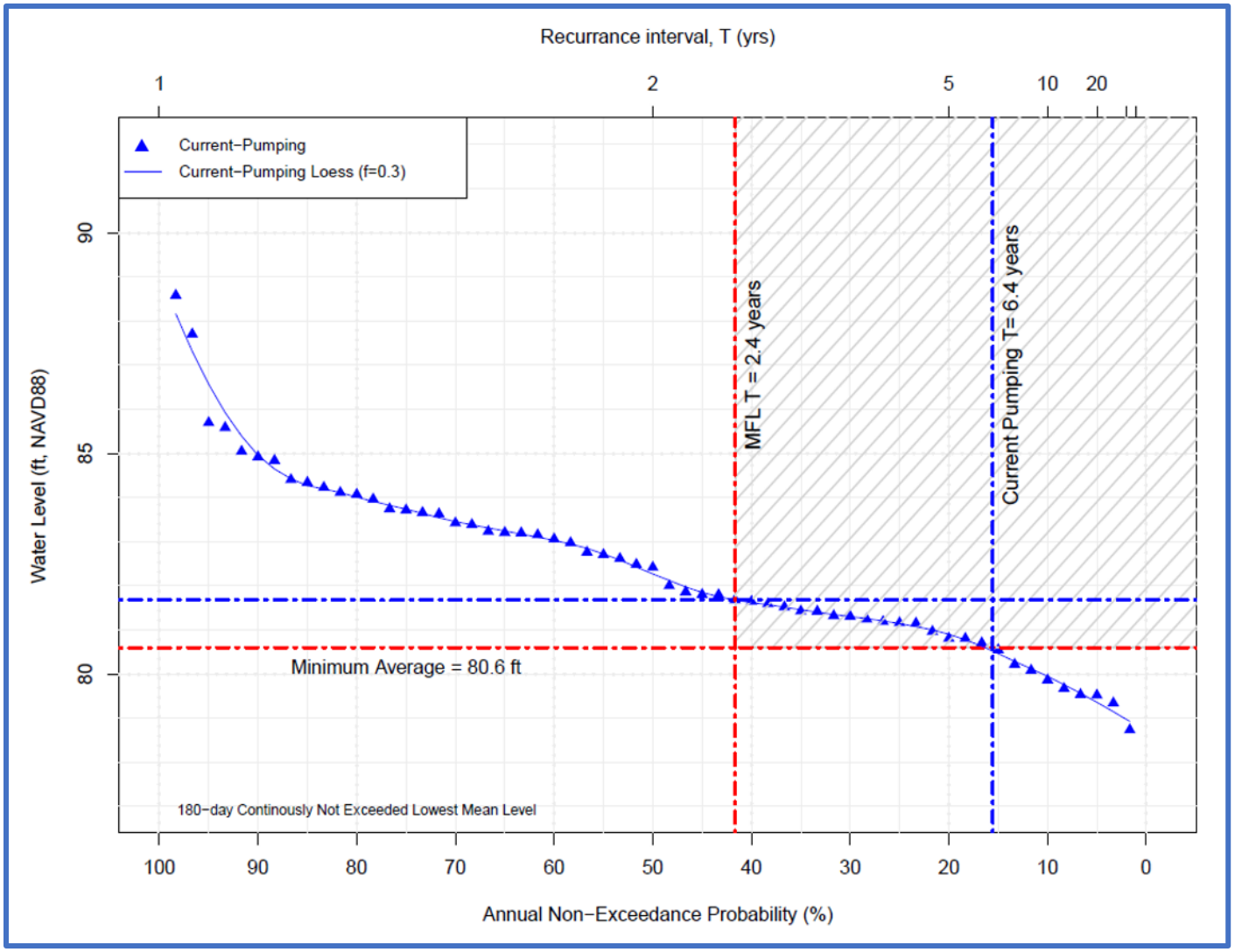


Figure 1. Hydroperiod non-exceedance probability (bottom axis) and return interval (top axis) of the MA for current-pumping condition (blue triangles) versus MFLs condition (red vertical and horizontal lines). The data plotted in blue triangles represent the maximum value for a mean lake level for a duration of 180-days, for each year in the period of record under current-pumping conditions. 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 blue horizontal line represents the current-pumping condition water level that occurs at the MFLs return interval.

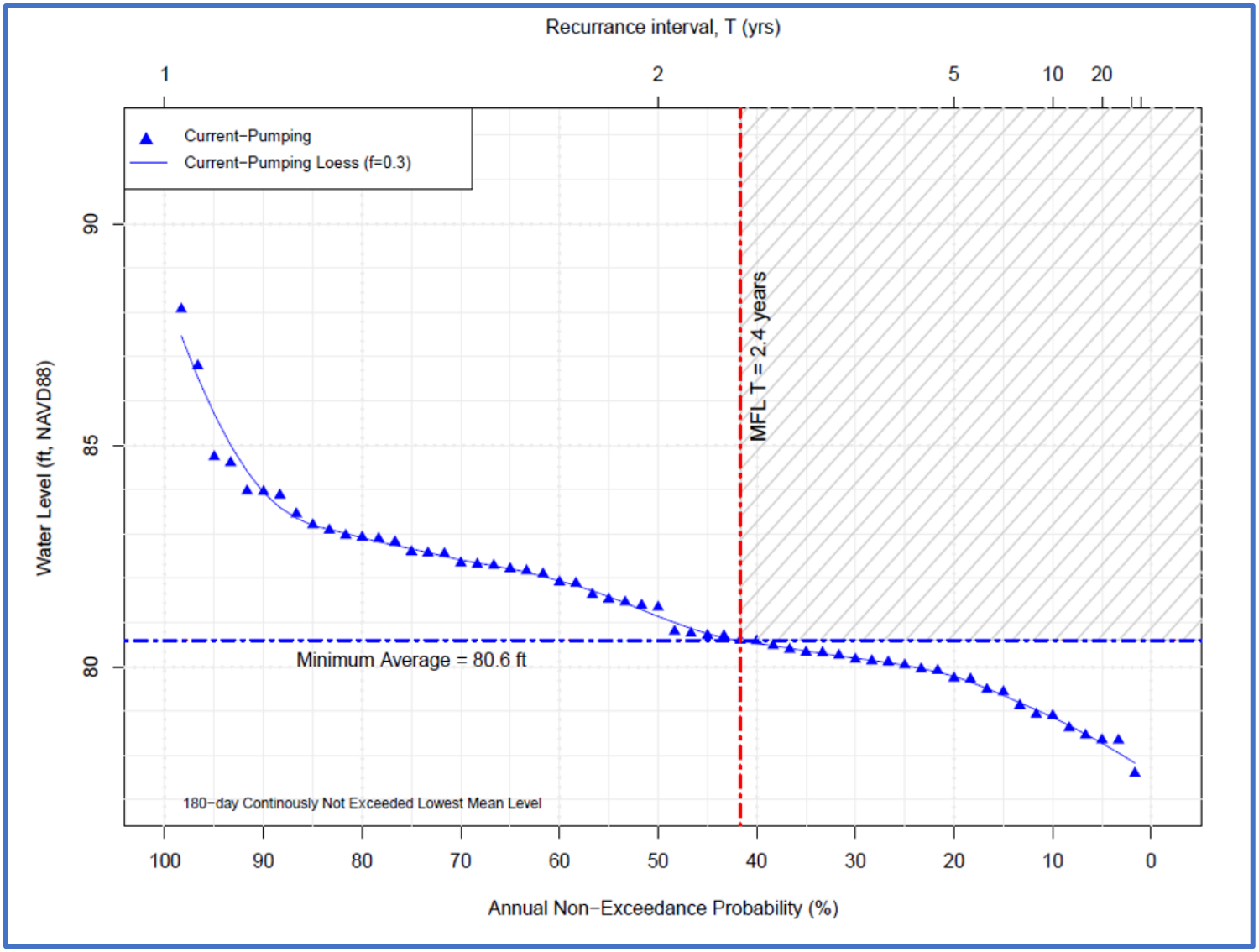


Figure 2. Frequency analysis (Weibull) plot showing MA just met, based on reducing UFA levels in Apshawa Lake South surface water model by 1.4 ft (i.e., this equals the UFA freeboard for this metric); see Figure 1 for description of data and axes.

### 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 six fish and wildlife criteria:

- Small wading bird forage habitat;
- Large wading bird forage habitat;
- Sandhill crane nesting habitat
- Emergent marsh habitat;
- Game fish spawning habitat; 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 six 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 1). The largest percent area reduction from no-pumping to current-pumping condition was for the sandhill crane nesting habitat (8.7% reduction) and open-water area (9.7% reduction).

Table 1. MFLs condition for Apshawa Lake South environmental criteria; NP = no-pumping condition; CP = current-pumping condition.

| Environmental Criterion | NP Condition area (acres) | CP Condition area (acres) | MFLs Condition area (acres) |
|---|---|---|---|
| Small wading bird forage habitat | 1.8 | 1.7 | 1.5 |
| Large wading bird forage habitat | 4.1 | 3.8 | 3.5 |
| Sandhill crane nesting habitat | 2.3 | 2.1 | 2.0 |
| Emergent marsh habitat | 25.1 | 24.9 | 21.3 |
| Game fish spawning habitat | 12.6 | 12.5 | 10.7 |
| Open-water area | 49.4 | 44.6 | 42.0 |

Freeboard was assessed in a similar manner to the MA assessment described above, and included the following steps:

1. UFA elevations (i.e., UFA well levels) in the Apshawa Lake South 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. Average habitat areas were calculated based on the new lake stage time series;

4. Steps 1 through 3 are repeated until 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 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 three fish and wildlife metrics with the highest amount of habitat acreage under the no-pumping condition (i.e., UFA freeboard was not calculated for the three metrics with less than 5 acres of habitat; Table 2). The freeboards for both the emergent marsh habitat and game fish spawning habitat metrics equal > 1.4 ft. Both exhibited minimal reduction in habitat area under this withdrawal scenario, and so further modeling and assessment was not done for these 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 0.8 ft.

Table 2. UFA freeboard for Apshawa Lake South environmental criteria.

| Environmental Criterion | UFA freeboard (ft) |
|---|---|
| Minimum average | 1.4 |
| Emergent marsh habitat | > 1.4 ft |
| Game fish spawning habitat | > 1.4 ft |
| Open-water area | 0.8 |

This status assessment indicates that all environmental criteria evaluated are met under the 2014-2018 average current-pumping condition. The most constraining criterion (open-water area metric) has a UFA freeboard of 0.8 feet under this impacted condition. A UFA drawdown of 0.7 feet is projected at 2045, relative to the current-pumping condition, leaving a freeboard of 0.1 feet at 2045. Therefore, Apshawa Lake South MFLs are met at the planning horizon and this water body is not in prevention or recovery.