# Appendix 4-2: Water Year 2008 Supplemental Evaluations for Regulatory Source Control Programs in Lake Okeechobee Watershed

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## INTRODUCTION

Source controls began in the Lake Okeechobee Watershed in 1989 when Chapter 40E-61, Florida Administrative Code (F.A.C.), the Lake Okeechobee Works of the District Rule, was adopted. The rule was a component of the Surface Water Improvement and Management Plan for Lake Okeechobee. The nutrient of concern associated with the rule currently in effect is phosphorus.

In 2000 and 2007, the legislative mandate that provides the authority for Chapter 40E-61, F.A.C., was revised. The legislation is currently known as the Northern Everglades and Estuaries Protection Program (NEEPP). The revised legislation establishes the relationship of the coordinating agencies – the Florida Department of Environmental Protection (FDEP), the Florida Department of Agriculture and Consumer Services (FDACS), and the South Florida Water Management District (SFWMD or District). It also expands the boundary of the Lake Okeechobee Watershed to include the Upper Kissimmee sub-watershed and the Lake Istokpoga sub-watershed. It requires that the District implement the Lake Okeechobee Protection Plan, which calls for phosphorus source controls. It also requires that the District modify and update the Lake Okeechobee Operating Permit, which is regulated by the FDEP. The District is also mandated to meet the Lake Okeechobee Total Maximum Daily Load (TMDL) for total phosphorus by January 1, 2015.

Currently Chapter 40E-61, F.A.C., (Rule 40E-61) is being revised to align the source control program in the Lake Okeechobee Watershed to meet the updated requirements of the NEEPP legislation. The District is required under the Lake Okeechobee Operating Permit to report the status of the source control program in the watershed annually. This appendix serves as a summary of data collected within the watershed related to total phosphorus (TP) and unit area load (UAL).

The data presented in this appendix for TP loads and UALs were observed for the Lake Okeechobee Watershed for the period of record (POR) from Water Years 1992–2005 (WY1992–WY2005) (May 1, 1991–April 30, 2005). The date range for this POR was selected to parallel with the time range that the FDEP used to determine the total maximum daily load (TMDL) for the Lake Okeechobee Watershed established in accordance with section 403.067, F.S. The TMDL for this watershed was determined to be 140 metric tons, of which 35 metric tons are due to atmospheric deposition. This TMDL must be met by January 1, 2015.

Source controls are only one component of the restoration effort necessary to achieve the TMDL. Therefore, with the revisions being proposed to Rule 40E-61, F.A.C., sub-watershed-based performance measures will be adopted to determine if the collective source control programs are achieving the reductions expected from that component of the restoration effort. The collective source control programs include the District's Lake Okeechobee Source Control Program (Chapter 40E-61, F.A.C.) for agricultural and non-agricultural uses, the FDACS Agricultural Best Management Practices (BMP) Program, and the FDEP Dairy Rule and Non-Agricultural programs. If the source control performance measures are not met, the coordinating agencies (District, FDACS, and FDEP) will institute a reevaluation of the source control BMPs and make appropriate changes to the programs.

To date, these sub-watershed-based performance measures have not been adopted. Once the performance measures are incorporated into the amended rule, the nine individual sub-watersheds will be evaluated based on water quality and flow data collected from an optimized monitoring network. The data will be used to calculate the observed load for each sub-watershed, which will be compared against the calculated performance measure goal. If a sub-watershed's observed load is equal to or below the calculated performance measure, then the sub-watershed will be determined to be meeting the appropriate reductions and no further actions will be necessary. However, if a sub-watershed's observed load is higher than the calculated performance measure, then the sub-watershed is considered to not be meeting the appropriate reductions and further actions will be necessary by the coordinating agencies.

Since the performance measures are not adopted at this time, the observed annual UALs for WY2008 will be presented with a comparison to the average UALs for each sub-watershed for the POR (see **Tables 1-9** and **Figures 1-9)**. It should be noted that the average unit area loads calculated for the nine sub-watersheds do not include any reduction factors to meet the TMDL; these values are strictly averages for the 14-year period. These average UALs are for comparison purposes only.

**Tables 1-9** and **Figures 1-9** use the following terms and designations:

- *Observed UAL* is the ratio of the amount of TP load recorded for a sub-watershed during a water year over the land area within the sub-watershed. This value is presented in a unit of pounds per acre (lbs/acre).

- *Observed Water Year TP* is the amount of TP recorded for a sub-watershed during a water year. This value is presented in a unit of metric tons (mt).

- *Period of Record UAL* is the ratio of the average TP load for a sub-watershed from WY1992–WY2005 over the total land area within the sub-watershed. This value is presented in a unit of pounds per acre (lbs/acre).

**Table 1.** Upper Kissimmee total phosphorus (TP) load and unit area load (UAL) for Water Years 1992–2005 (WY1992–WY2005).

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 41.10 | 0.09 |
| 1993 | 6.27 | 0.01 |
| 1994 | 81.65 | 0.18 |
| 1995 | 138.18 | 0.30 |
| 1996 | 39.46 | 0.08 |
| 1997 | 269.70 | 0.58 |
| 1998 | 12.78 | 0.03 |
| 1999 | 53.30 | 0.11 |
| 2000 | 6.86 | 0.01 |
| 2001 | 34.02 | 0.07 |
| 2002 | 110.18 | 0.24 |
| 2003 | 104.21 | 0.22 |
| 2004 | 238.67 | 0.51 |
| 2005 | 211.92 | 0.46 |

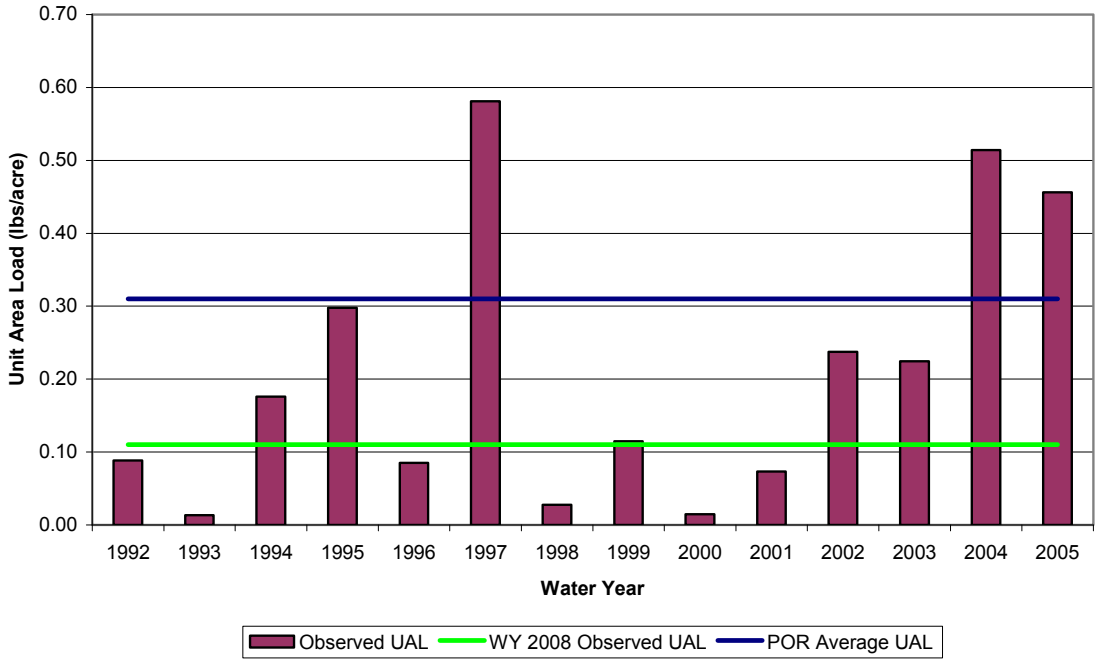


**Figure 1.** Upper Kissimmee observed UAL versus WY2008 observed UAL and the average UAL for the period of record (POR).

**Table 2.** Lower Kissimmee TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 34.79 | 0.18 |
| 1993 | 126.42 | 0.65 |
| 1994 | 20.94 | 0.11 |
| 1995 | 218.41 | 1.12 |
| 1996 | 204.67 | 1.05 |
| 1997 | 39.77 | 0.20 |
| 1998 | 436.95 | 2.24 |
| 1999 | 53.14 | 0.27 |
| 2000 | 193.77 | 0.99 |
| 2001 | 20.09 | 0.10 |
| 2002 | 102.19 | 0.52 |
| 2003 | 225.11 | 1.15 |
| 2004 | 206.58 | 1.06 |
| 2005 | 282.11 | 1.45 |

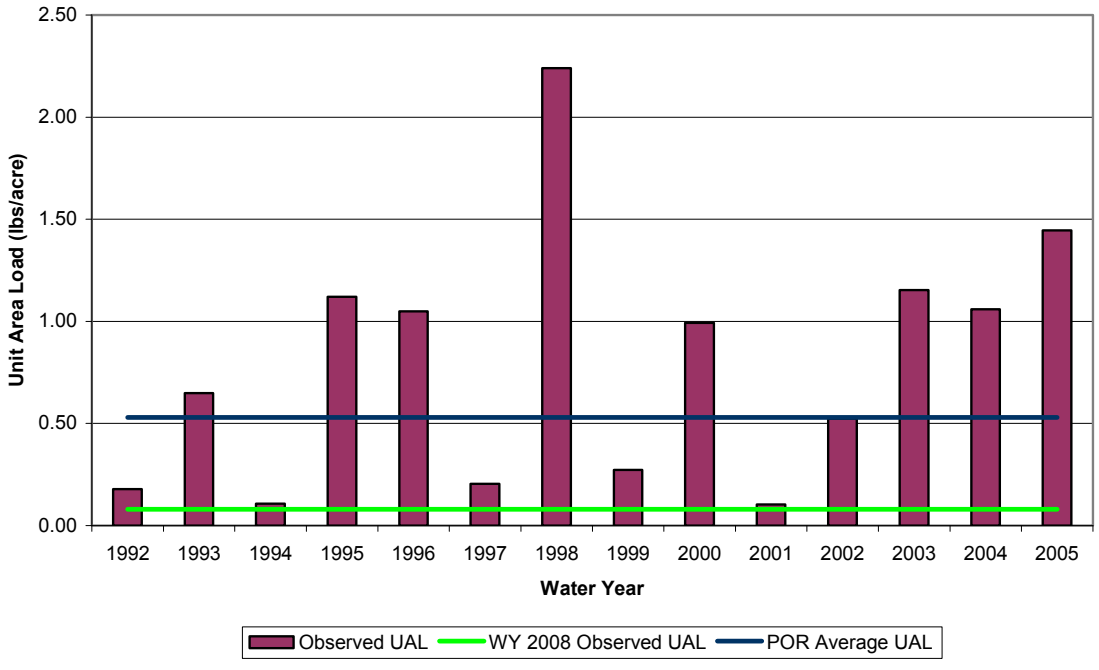


**Figure 2.** Lower Kissimmee observed UAL versus WY2008 observed UAL and the average UAL for the POR

**Table 3.** Taylor Creek Nubbin Slough TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 15.41 | 0.17 |
| 1993 | 178.29 | 1.98 |
| 1994 | 27.04 | 0.30 |
| 1995 | 158.49 | 1.76 |
| 1996 | 191.49 | 2.12 |
| 1997 | 23.69 | 0.26 |
| 1998 | 138.33 | 1.53 |
| 1999 | 60.05 | 0.67 |
| 2000 | 238.00 | 2.64 |
| 2001 | 11.96 | 0.13 |
| 2002 | 109.24 | 1.21 |
| 2003 | 90.62 | 1.01 |
| 2004 | 97.15 | 1.08 |
| 2005 | 245.31 | 2.72 |

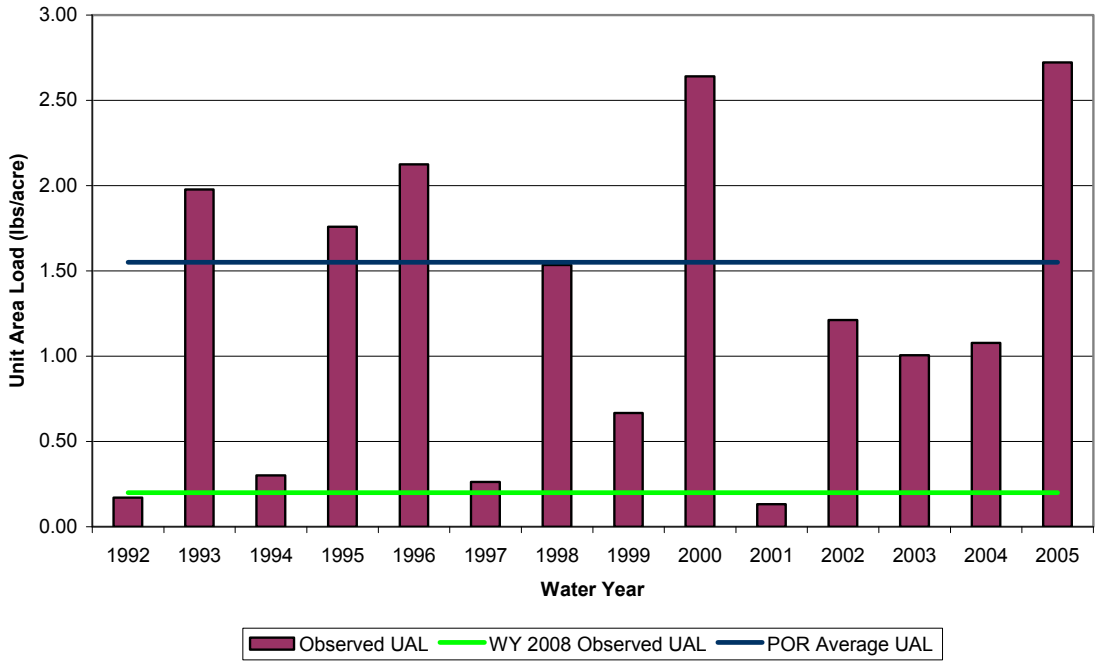


**Figure 3.** Taylor Creek Nubbin Slough observed UAL versus WY2008 observed UAL and the average UAL for the POR.

**Table 4.** Lake Istokpoga TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 1.22 | 0.01 |
| 1993 | 7.15 | 0.04 |
| 1994 | 2.90 | 0.02 |
| 1995 | 6.36 | 0.04 |
| 1996 | 11.21 | 0.06 |
| 1997 | 2.64 | 0.01 |
| 1998 | 67.92 | 0.38 |
| 1999 | 12.91 | 0.07 |
| 2000 | 29.39 | 0.16 |
| 2001 | 2.40 | 0.01 |
| 2002 | 25.24 | 0.14 |
| 2003 | 32.54 | 0.18 |
| 2004 | 41.36 | 0.23 |
| 2005 | 46.63 | 0.26 |

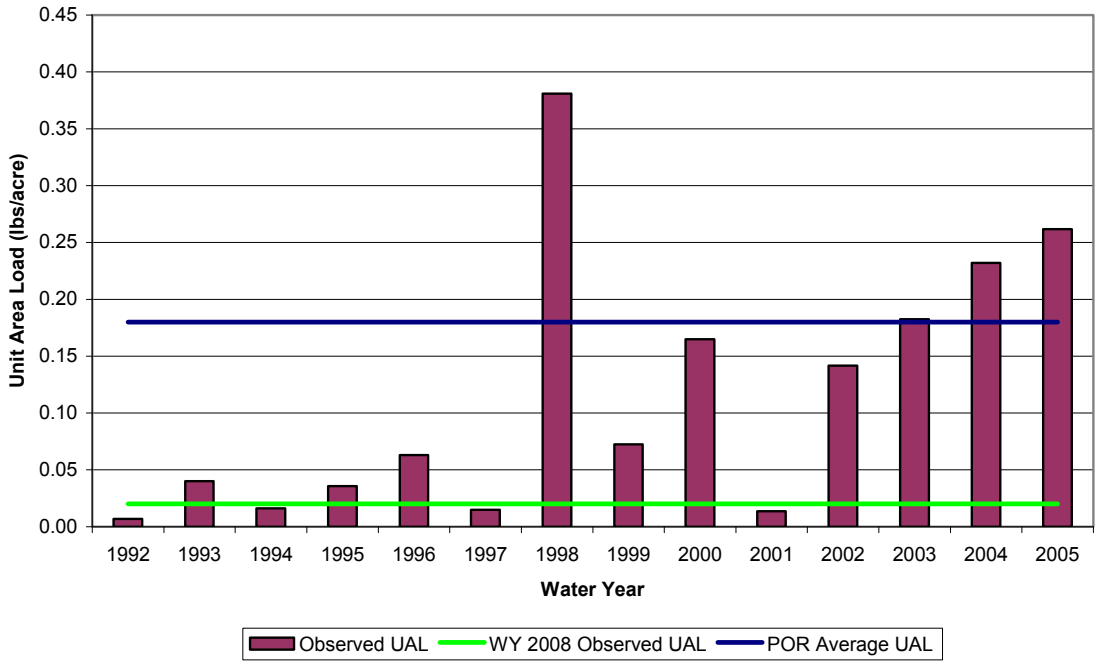


**Figure 4.** Lake Istokpoga observed UAL versus WY2008 observed UAL and the average UAL for the POR.

**Table 5.** Indian Prairie TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 8.83 | 0.07 |
| 1993 | 90.93 | 0.68 |
| 1994 | 24.00 | 0.18 |
| 1995 | 71.53 | 0.53 |
| 1996 | 112.49 | 0.84 |
| 1997 | 27.19 | 0.20 |
| 1998 | 133.19 | 1.00 |
| 1999 | 66.16 | 0.49 |
| 2000 | 83.73 | 0.63 |
| 2001 | 13.07 | 0.10 |
| 2002 | 128.85 | 0.96 |
| 2003 | 182.15 | 1.36 |
| 2004 | 153.03 | 1.14 |
| 2005 | 245.20 | 1.83 |

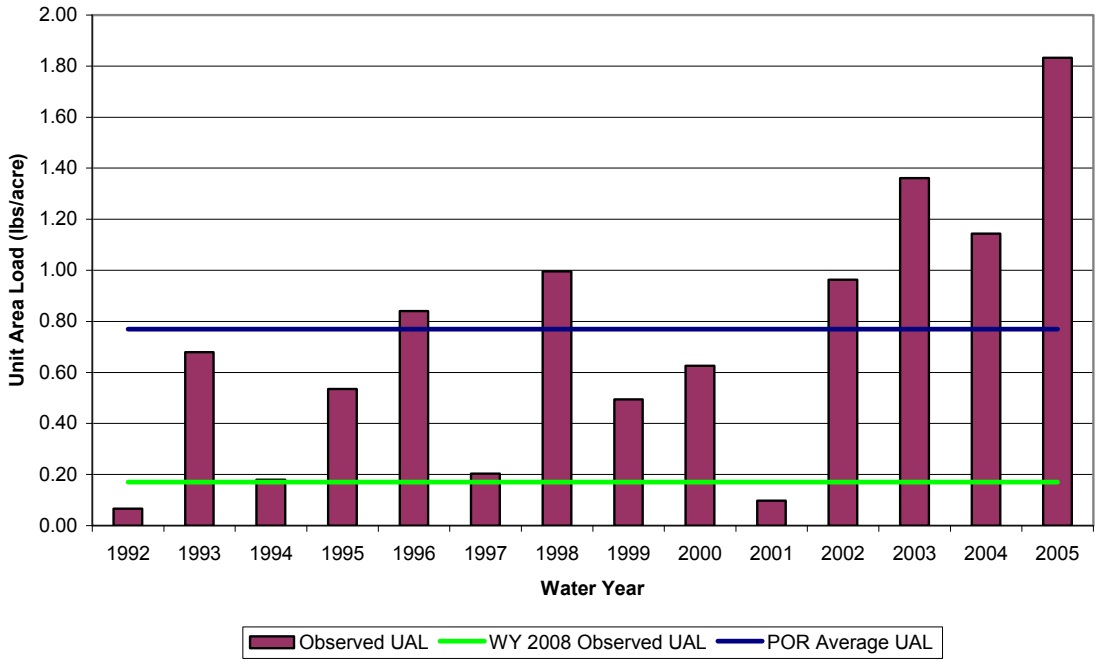


**Figure 5.** Indian Prairie observed UAL versus WY2008 observed UAL and the average UAL for the POR.

**Table 6.** Fisheating Creek and Nicodemus Slough TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 3.15 | 0.02 |
| 1993 | 41.48 | 0.29 |
| 1994 | 24.91 | 0.17 |
| 1995 | 46.66 | 0.33 |
| 1996 | 46.46 | 0.32 |
| 1997 | 20.96 | 0.15 |
| 1998 | 129.86 | 0.91 |
| 1999 | 30.76 | 0.21 |
| 2000 | 38.89 | 0.27 |
| 2001 | 6.59 | 0.05 |
| 2002 | 115.08 | 0.80 |
| 2003 | 68.14 | 0.48 |
| 2004 | 49.67 | 0.35 |
| 2005 | 113.81 | 0.79 |

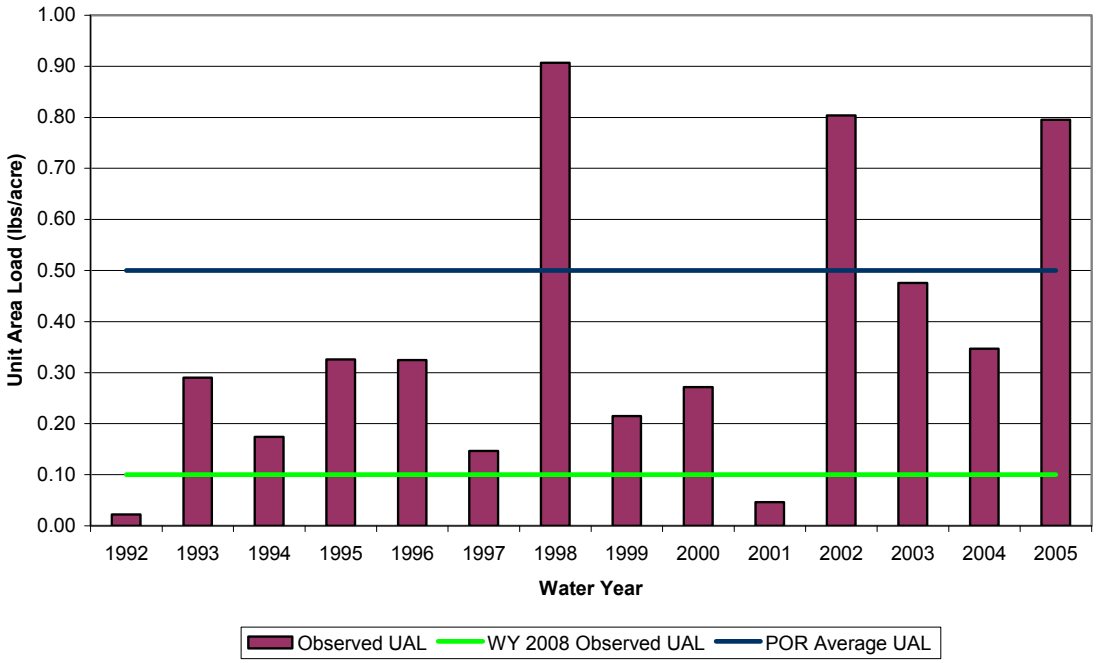


**Figure 6.** Fisheating Creek and Nicodemus Slough observed UAL versus WY2008 observed UAL and the average UAL for the POR.

**Table 7.** West Lake Okeechobee TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 0.00 | 0.00 |
| 1993 | 0.00 | 0.00 |
| 1994 | 0.00 | 0.00 |
| 1995 | 0.00 | 0.00 |
| 1996 | 0.00 | 0.00 |
| 1997 | 0.00 | 0.00 |
| 1998 | 0.00 | 0.00 |
| 1999 | 0.00 | 0.00 |
| 2000 | 0.00 | 0.00 |
| 2001 | 0.61 | 0.01 |
| 2002 | 14.39 | 0.16 |
| 2003 | 0.00 | 0.00 |
| 2004 | 0.00 | 0.00 |
| 2005 | 0.00 | 0.00 |

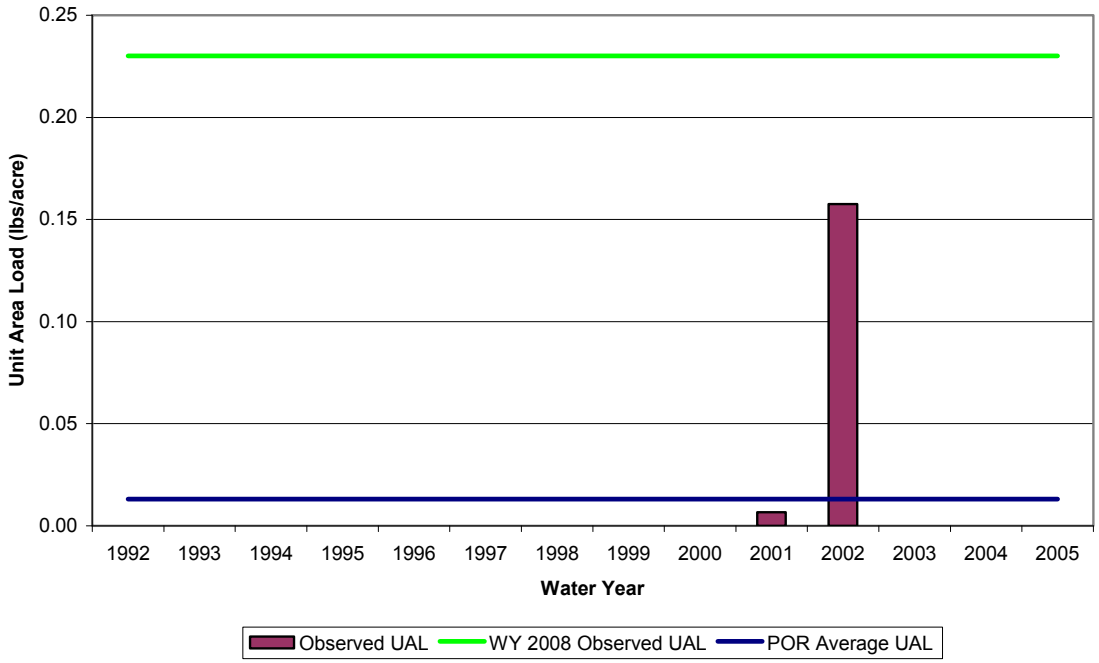


**Figure 7.** West Lake Okeechobee observed UAL versus WY2008 observed UAL and the average UAL for the POR.

**Table 8.** Everglades Agricultural Area TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 5.58 | 0.03 |
| 1993 | 36.48 | 0.22 |
| 1994 | 16.90 | 0.10 |
| 1995 | 50.07 | 0.30 |
| 1996 | 48.91 | 0.30 |
| 1997 | 13.22 | 0.08 |
| 1998 | 28.75 | 0.17 |
| 1999 | 58.22 | 0.35 |
| 2000 | 58.53 | 0.36 |
| 2001 | 29.48 | 0.18 |
| 2002 | 58.56 | 0.36 |
| 2003 | 12.38 | 0.08 |
| 2004 | 10.96 | 0.07 |
| 2005 | 24.98 | 0.15 |

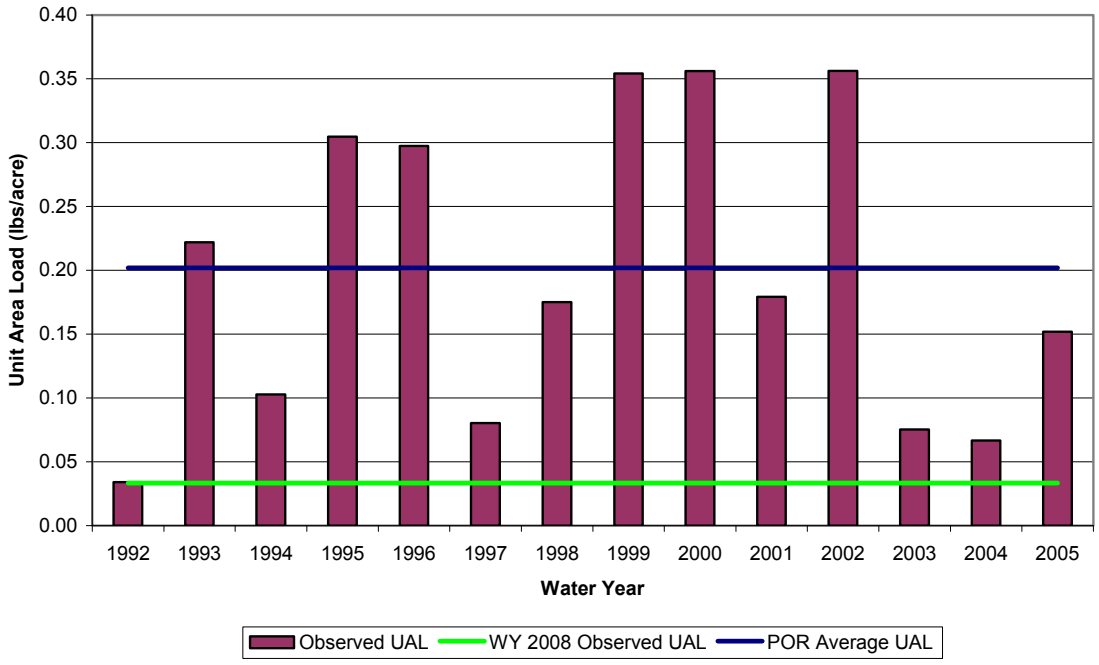


**Figure 8.** Everglades Agricultural Area observed UAL versus WY2008 observed UAL and the average UAL for the POR.

**Table 9.** East Lake Okeechobee TP load and UAL for WY1992–WY2005.

| Water Year | Observed Water Year TP (mt) | Observed Water Year UAL (lbs/acre) |
|---|---|---|
| 1992 | 0.33 | 0.00 |
| 1993 | 10.76 | 0.10 |
| 1994 | 32.12 | 0.30 |
| 1995 | 36.69 | 0.34 |
| 1996 | 4.83 | 0.04 |
| 1997 | 7.35 | 0.07 |
| 1998 | 10.90 | 0.10 |
| 1999 | 8.30 | 0.08 |
| 2000 | 20.24 | 0.19 |
| 2001 | 34.24 | 0.32 |
| 2002 | 60.58 | 0.56 |
| 2003 | 26.33 | 0.24 |
| 2004 | 2.14 | 0.02 |
| 2005 | 20.19 | 0.19 |

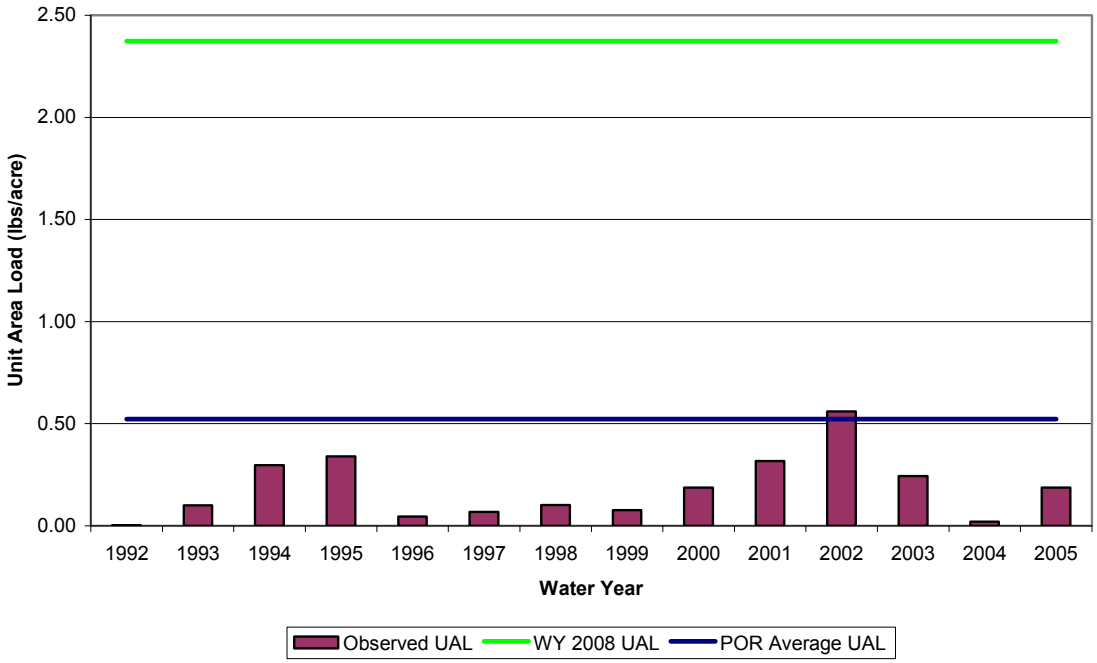


**Figure 9.** East Lake Okeechobee observed UAL versus WY2008 observed UAL and the average UAL for the POR.

From **Tables 1-9** and **Figures 1-9**, it can be seen that only the WY2008 UAL observed values for East Lake Okeechobee and West Lake Okeechobee sub-watersheds exceeded the average UAL for the POR. Typically, discharge from the East Lake Okeechobee and West Lake Okeechobee sub-watersheds is sent to the St. Lucie and Caloosahatchee estuaries and not toward Lake Okeechobee. Due to the low water levels in Lake Okeechobee during WY2008, these two sub-watersheds contributed higher loads to the lake through gravity drainage than normally observed. In **Figure 10**, a pie chart shows the breakdown of the land area within the watershed. **Figures 11** and **12** depict the average TP load percentages for each sub-watershed for the POR, with the WY2008 TP load percentages are for each sub-watershed.

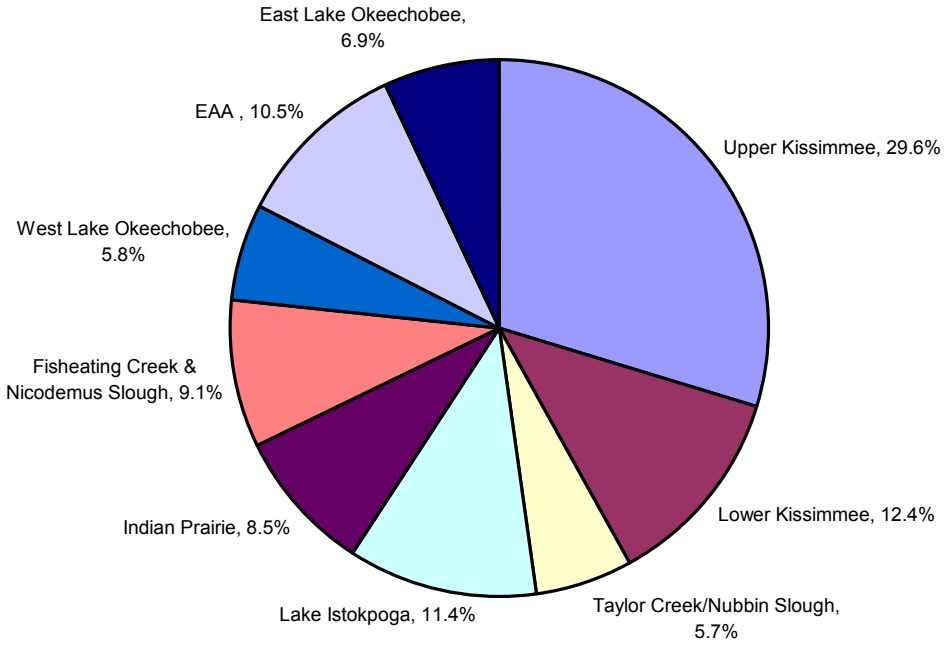


**Figure 10.** Lake Okeechobee Watershed land area breakdown by sub-watershed.

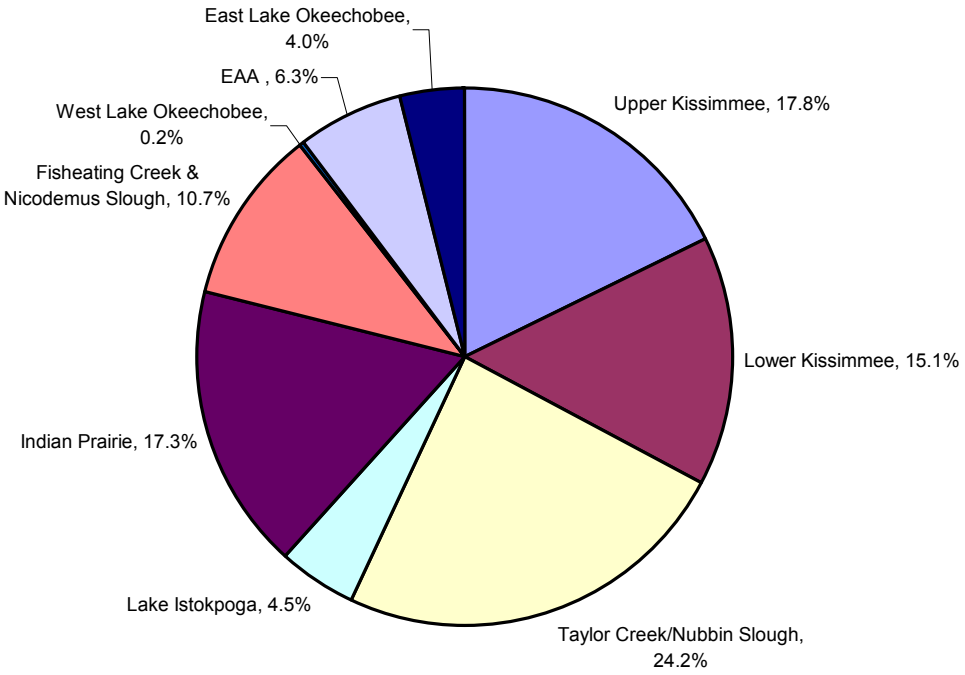


**Figure 11.** Average percent of TP load in the Lake Okeechobee Watershed by sub-watershed for the POR (WY1992–WY2005).

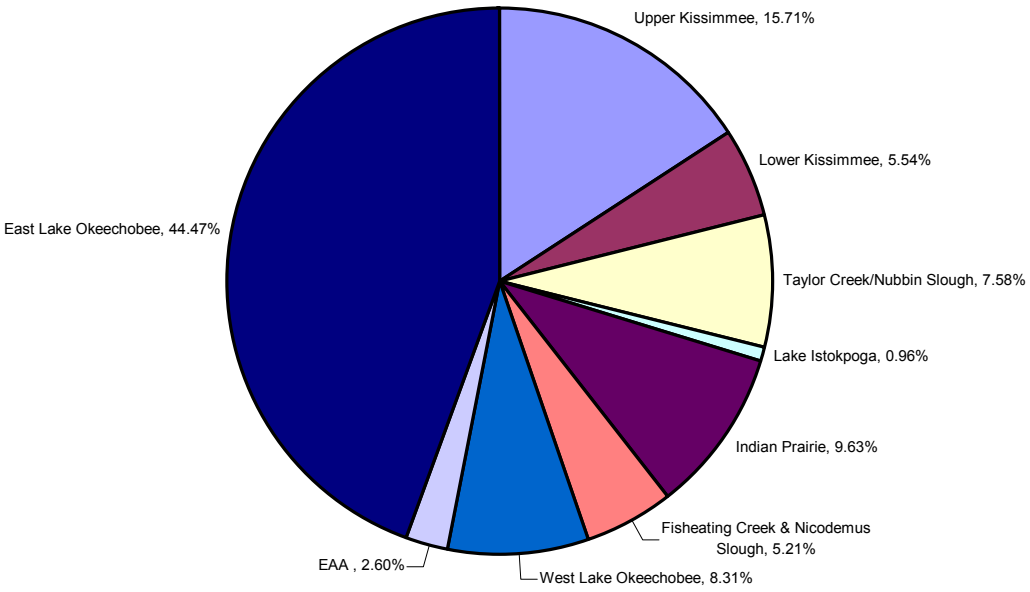


**Figure 12.** Average percent of TP load in the Lake Okeechobee Watershed by sub-watershed for WY2008.