

Water Supply Augmentation - Water Quantity and Quality Considerations

Governing Board Workshop

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Objective

- **To present water quantity and water quality aspects of water supply augmentation**
 - **S-2 and S-3 historical contributions to the Lake's water/nutrient budgets**
 - **How much pumping is required to raise the Lake by a foot?**
 - **Recent nutrient concentrations at S-2/S-3**
 - **Range of nutrient loads associated with pumping**
 - **... relative to permit load target**



Lake Okeechobee

St. Lucie Canal

S308

CV10A

S308

CV10A

S77

S77

C-43

S235

S4

S169

S3

S2

L-25

L-20

L-8

S352

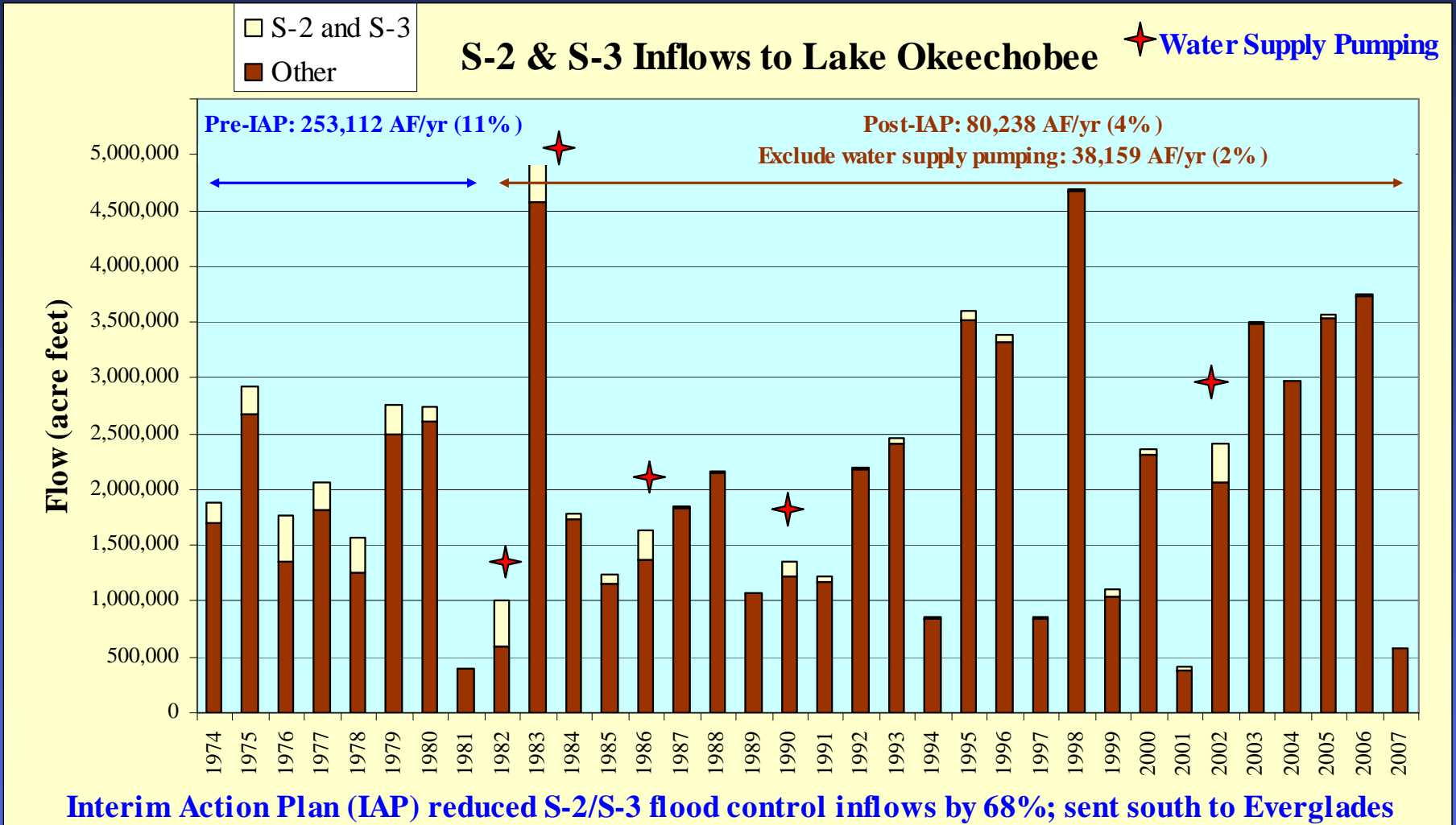
S319

G311

S155A



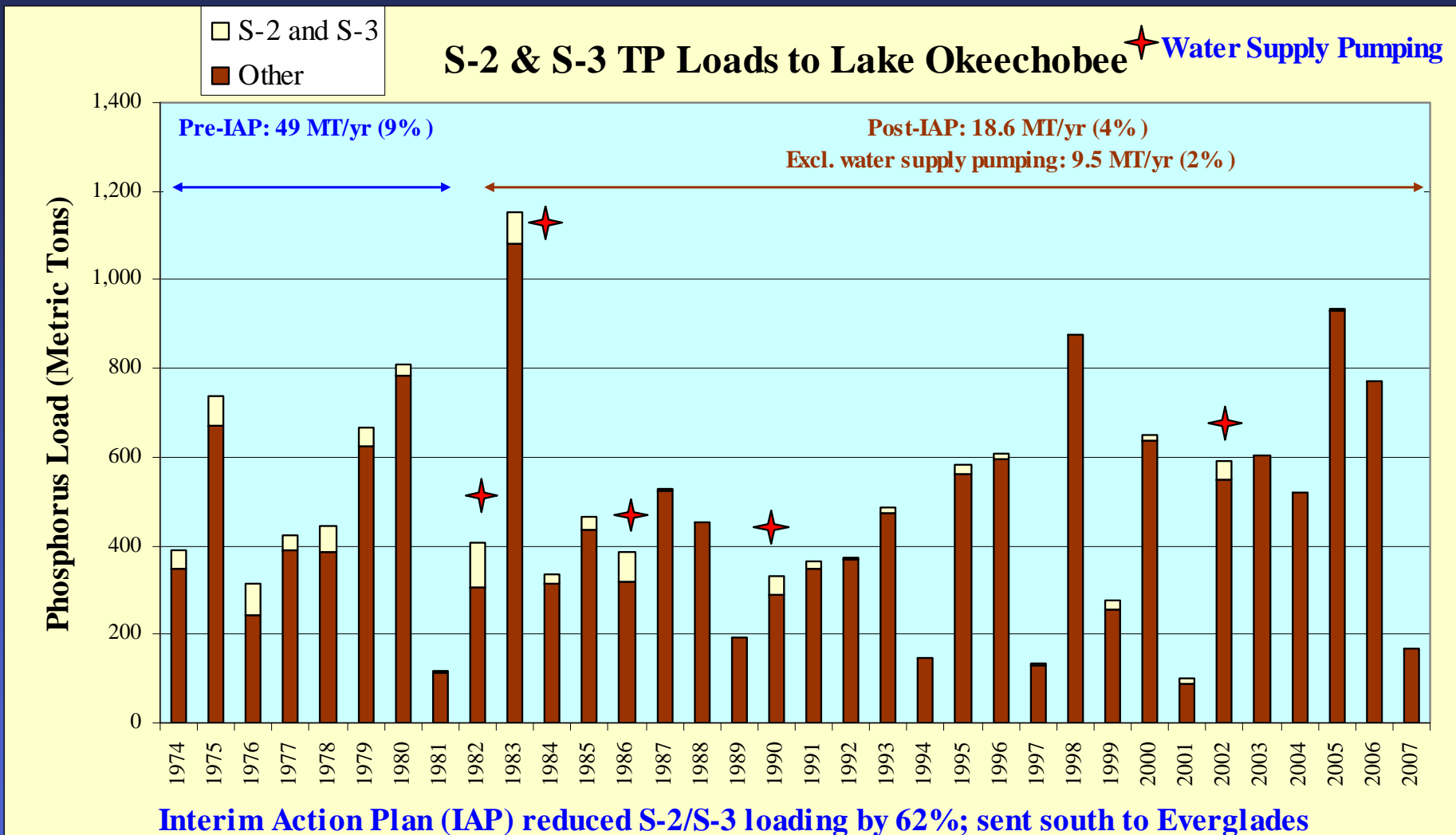
Surface Inflows to Lake Okeechobee



Interim Action Plan (IAP) reduced S-2/S-3 flood control inflows by 68%; sent south to Everglades

**Water Year 2007 saw the 3rd lowest inflow volumes in 34 years
 5-year average of 8,382 AF/yr – 0.3% of total surface inflows**

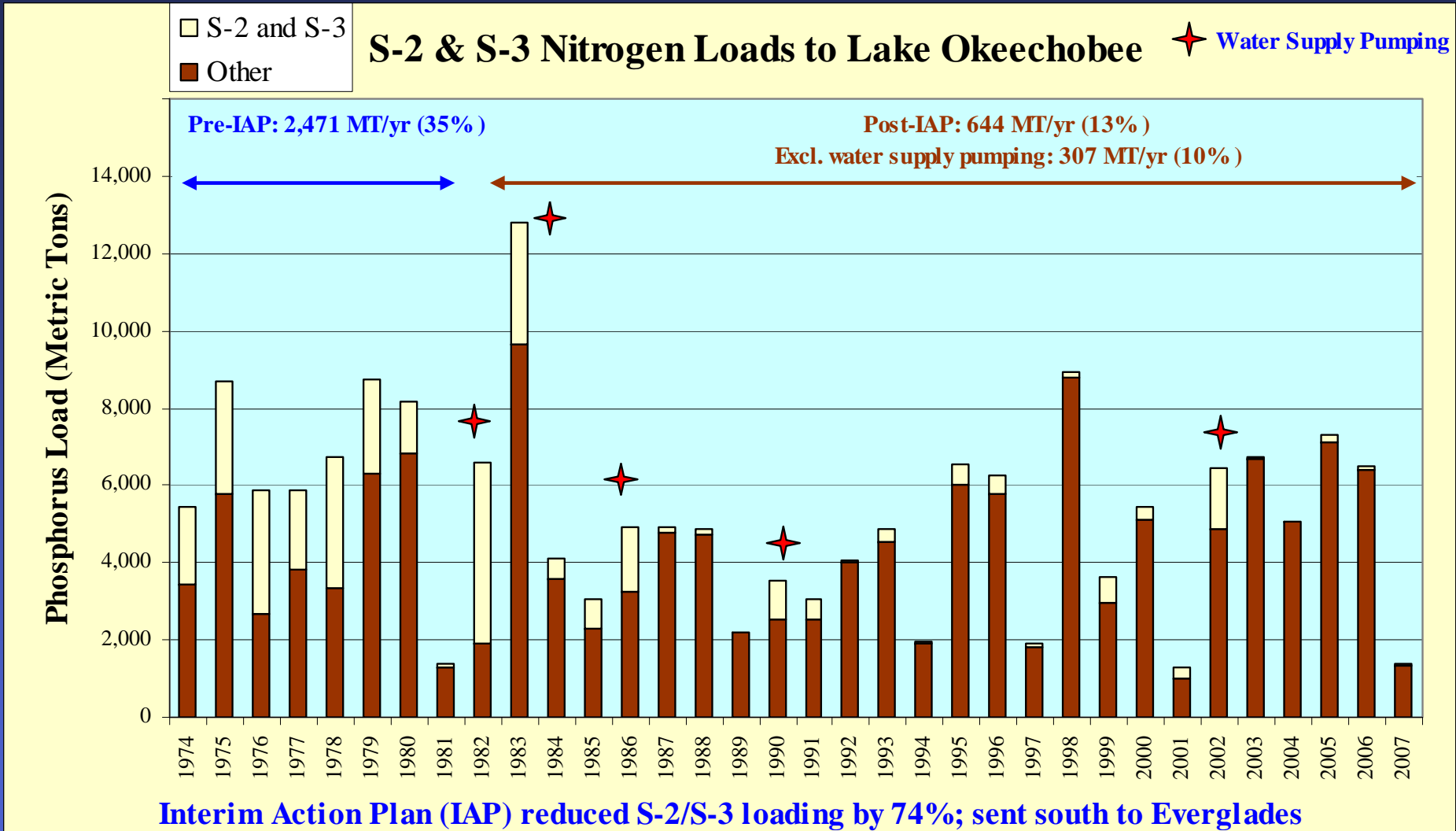
Surface Phosphorus Loads to Lake



Water Year 2007 saw the 5th lowest inflow loads in 34 years

5-year average of 1.6 tons/yr – 0.3% of total surface loads

Surface Nitrogen Loads to Lake



**Water Year 2007 saw the 3rd lowest inflow loads in 34 years;
5-year average of 59 tons/yr – 1% of total surface loads**

Historical Water Supply Pumping

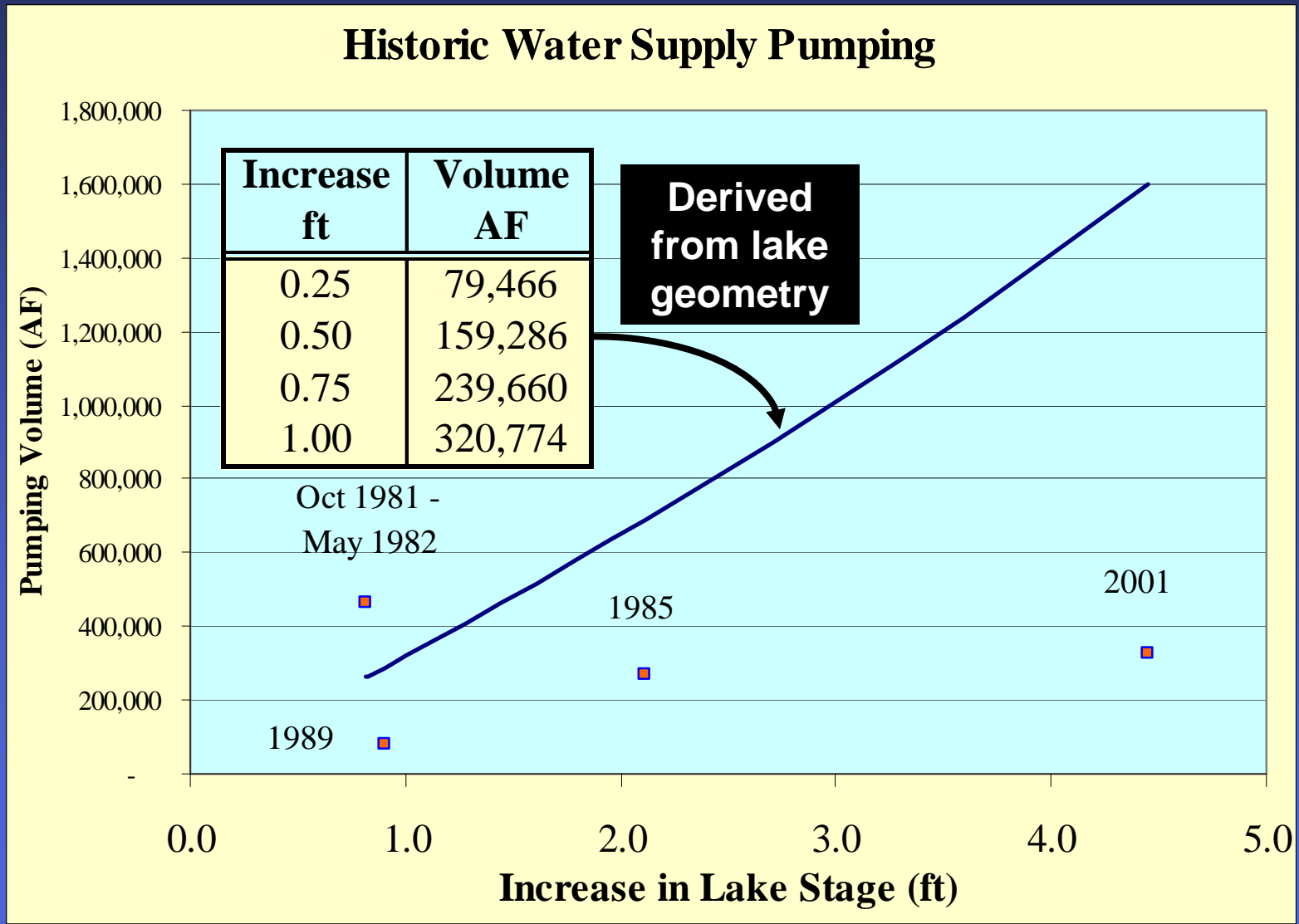
- Pumping at S-2 and S-3 for water supply has occurred during four prior droughts:

Dates	Volume Pumped AF	Beginning Lake stage ft	Ending Lake stage ft	Increase in stage ft
June 1981 - May 1982	461,615	10.5	11.4	0.8
July - September 1985	267,265	12.0	14.1	2.1
July - September 1989	81,564	11.3	12.2	0.9
June - September 2001	325,698	9.0	13.5	4.5

Dates	P Load MT	P Conc ppb	N Load MT	N conc ppb
June 1981 - May 1982	110.5	194	5,212.8	9,155
July - September 1985	65.3	198	1,665.4	5,052
July - September 1989	33.2	330	775.3	7,706
June - September 2001	37.9	94	1,453.0	3,617

How Much Pumping to Raise Lake?

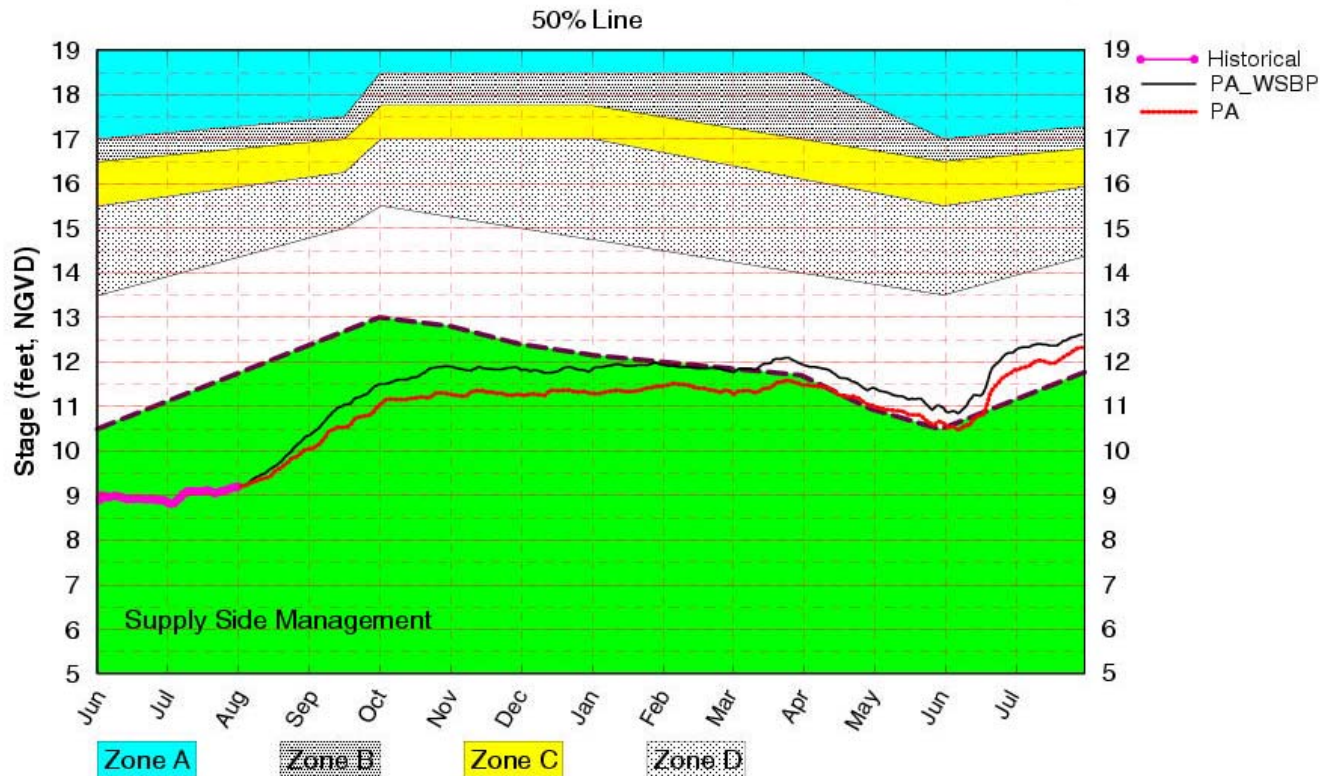
- Many factors contribute to Lake stage, including starting stage, rainfall, other inflow sources, evapotranspiration and other outflows



Simulation Estimates

- Pumping volume and Lake stages estimated by 2x2 model
- Can evaluate various operation scenarios

Lake Okeechobee SFWMM August 2007 Position Analysis



(See assumptions @ http://www.sfwmd.gov/org/pld/hsm/sfwmm_pa.html)

Simulation Estimates

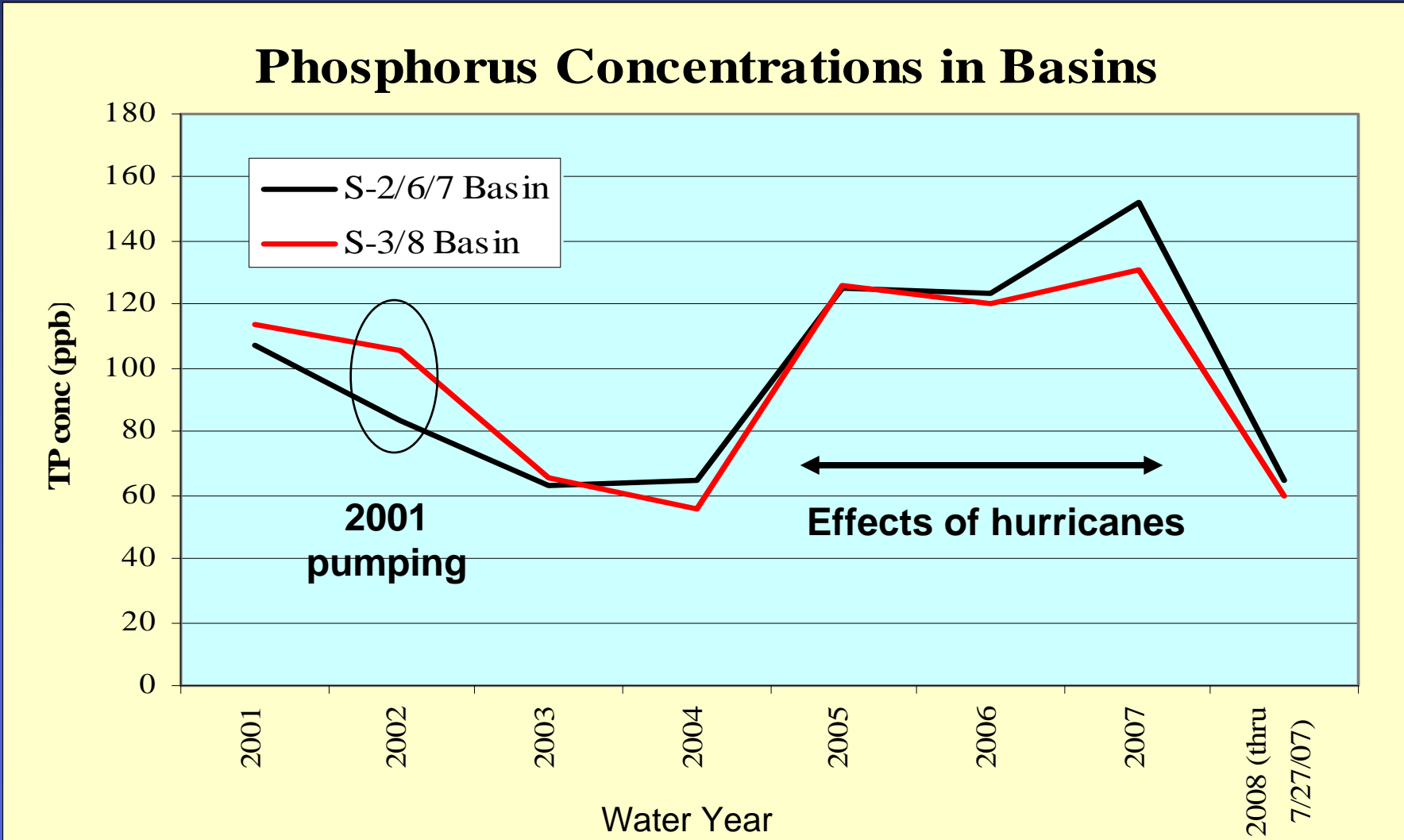
- Pumping volume and Lake stages estimated by 2x2 model
 - 40 years of rainfall (8/1/1965-5/31/2005)
 - Pump volumes Aug – May (+/- 65%)

Parameter	Units	Without WSA	Range of WSA Options
S-2+S-3			
Average Volume	AF	32,619	242,971 - 370,184
Median Lake Stage at June 1	ft NGVD	10.6	10.9 - 11.2
Increase in Stage on June 1	ft	0.0	0.3 - 0.6

- Commensurate reduction in flows and nutrient loads to STAs / Everglades

Nutrient Concentrations are Highly Variable

- WY2006 - July 2007 Phosphorus concentration = 129 ppb
- WY2006/07 Nitrogen concentration = 3.14 mg/L



Estimate of Nutrient Loading

- Difficult to predict in light of the variability and uncertainty of flows and concentrations
- Pumping volume and Lake stages estimated by 2x2 model:

Parameter	Units	Without WSA	Range of WSA Options
S-2+S-3			
Average Volume	AF	32,619	242,971 - 370,184
129 ppb TP Load	Metric Tons	5.2	38.7 - 58.9
3,140 ppb TN Load	Metric Tons	126	941 - 1,434
Median Lake Stage at June 1	ft NGVD	10.6	10.9 - 11.2
Increase in Stage on June 1	ft	0.0	0.3 - 0.6

- Loads could be greater if pumped volume and/or concentration is greater
- Commensurate reduction in flows and nutrient loads to STAs / Everglades

Load Targets in Permit

- Existing Lake Okeechobee permit has a 5-yr phosphorus load target for Southern Region
 - S-2, S-3, S-4, S-351, S-352, S-354, Industrial Canal, S-236, and 4 lake culverts
 - Target = 9.56 tons/yr, 47.8 tons in 5 years
 - Last 4 years (including hurricanes) = 80 tons

Water Year	Total P Load (tons)	5-yr ave (tons/yr)
2003	18.41	
2004	13.10	
2005	30.23	
2006	28.43	
2007	8.18	19.67

How Much Increase in Water Supply Releases?

- Magnitude of water supply releases virtually impossible to predict - depends on many factors
 - Lake stage
 - Basins runoff – highly variable
 - Evaporation and transpiration
 - Water supply pumping – highly variable
 - Basins' rainfall and water supply demand
 - Water shortage policy in place
- Minimal empirical data
- Simulation results show extreme variability

Summary

- **High level of variability**
- **Model estimates:**
 - **Average of 4 operational scenarios**
 - **243,000-370,000 AF of additional water (+/-65%)**
 - **Increased Lake stage on June 1 by 0.3-0.6 ft**
 - **40-60 tons of TP; 940-1,400 tons of TN (+/-65%)**
 - **Loads could be greater if pumped volume and/or concentration is greater**
- **Commensurate reduction in flows and nutrient loads to STAs / Everglades**

Estimate of Nutrient Loading at S-3

- Pumping volume and Lake stages estimated by 2x2 model
 - 40 years of rainfall (8/1/1965-5/31/2005)
 - Pump volumes Aug - May

Parameter		Units	Without WSA	Range of WSA Options
S-3				
Average	Volume	AF	5,122	89,464 - 139,554
120 ppb	TP Load	Metric Tons	0.8	13.2 - 20.7
2,562 ppb	TN Load	Metric Tons	16	283 - 441
Median Lake Stage at June 1		ft NGVD	10.6	10.7 - 10.8
Increase in Stage on June 1		ft	0.0	0.1 - 0.2

- Loads could be greater if pumped volume and/or concentration is greater
- Commensurate reduction in flows and nutrient loads to STAs / Everglades