Summary of Operations Affecting the Refuge

Technical Oversight Committee
June 16, 2006

Gary Goforth, P.E., Ph.D.

Objective

- At May meeting, TOC members requested analysis of operations affecting Refuge
  - Did WY2006 operations influence interior marsh water quality?
- Follows May/June 2005 TOC discussions on same topic that produced 4 action items:
  - Additional outflow sampling (District lead: analysis & recommendation presented to TOC in summer 2005)
  - Improved coordination of inflow/outflow operations (Refuge and Corps lead)
  - Delay stage rise until after wet season (Refuge and Corps lead)
  - Re-distribution of flow through S-10s (Refuge and Corps lead)

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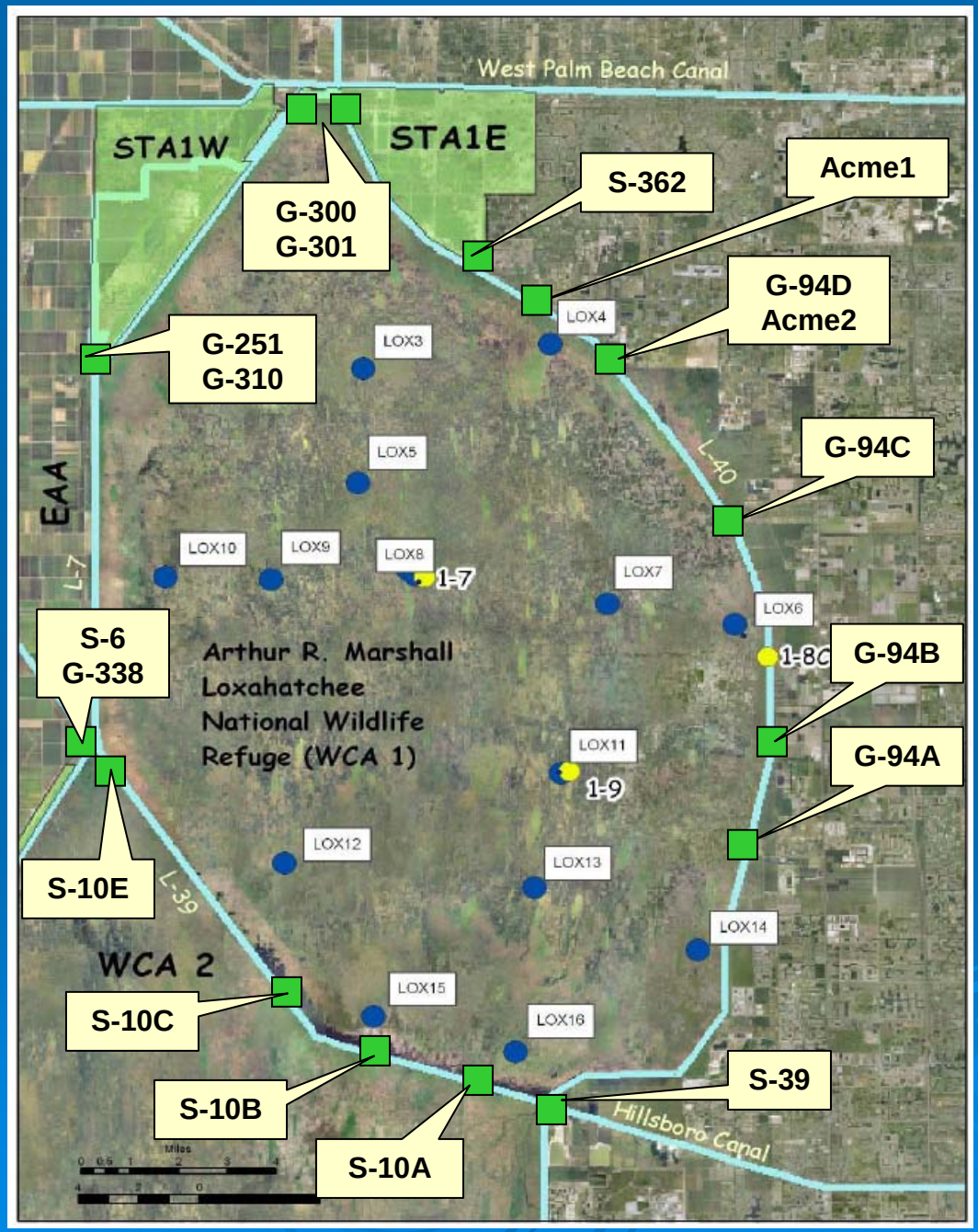
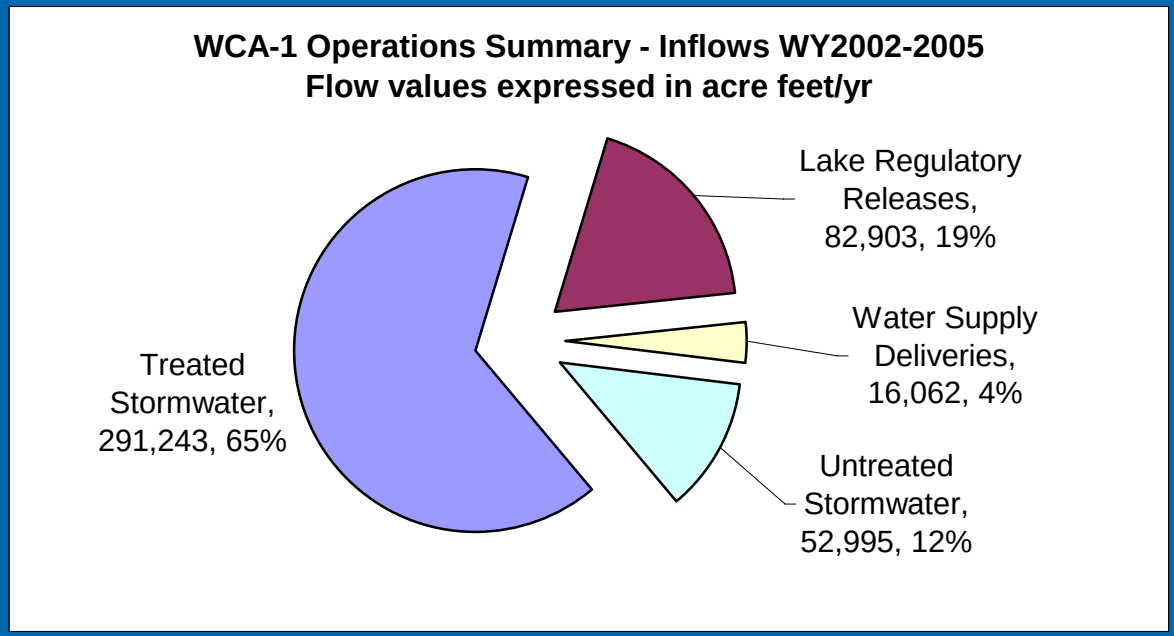


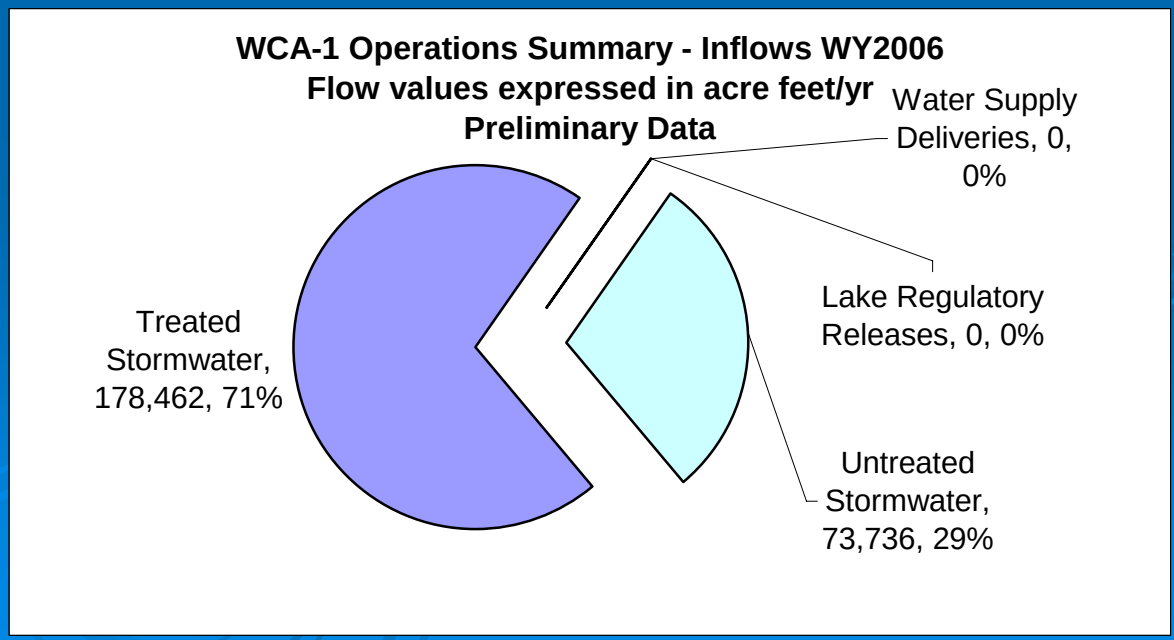
Principle Operations

- Inflow
  - Treated stormwater
  - Untreated stormwater
    - Exceeded capacity of STA-1W / STA-1E
    - Village of Wellington
  - Treated water supply inflows preceding withdrawals
  - Treated Lake Okeechobee regulatory releases
- Outflow
  - WCA-1 regulatory releases
  - Water supply withdrawals
  - Other releases
    - Lake regulatory pass-through (WY2003)
    - Anticipation of tropical storm inflows (WY2006)

WCA-1 Inflow Operations

- WY2006 inflows were less than half of long-term (1978-2005) average
- New divide structure in place to reduce flows to STA-1W; hard to quantify effect, as STA-2 inflows <10% above average
- Although a temporary deviation to regulation schedule was in place, conditions were not triggered – no impact
- Minimal (?) Lake Okeechobee inflows (2007 report will document)





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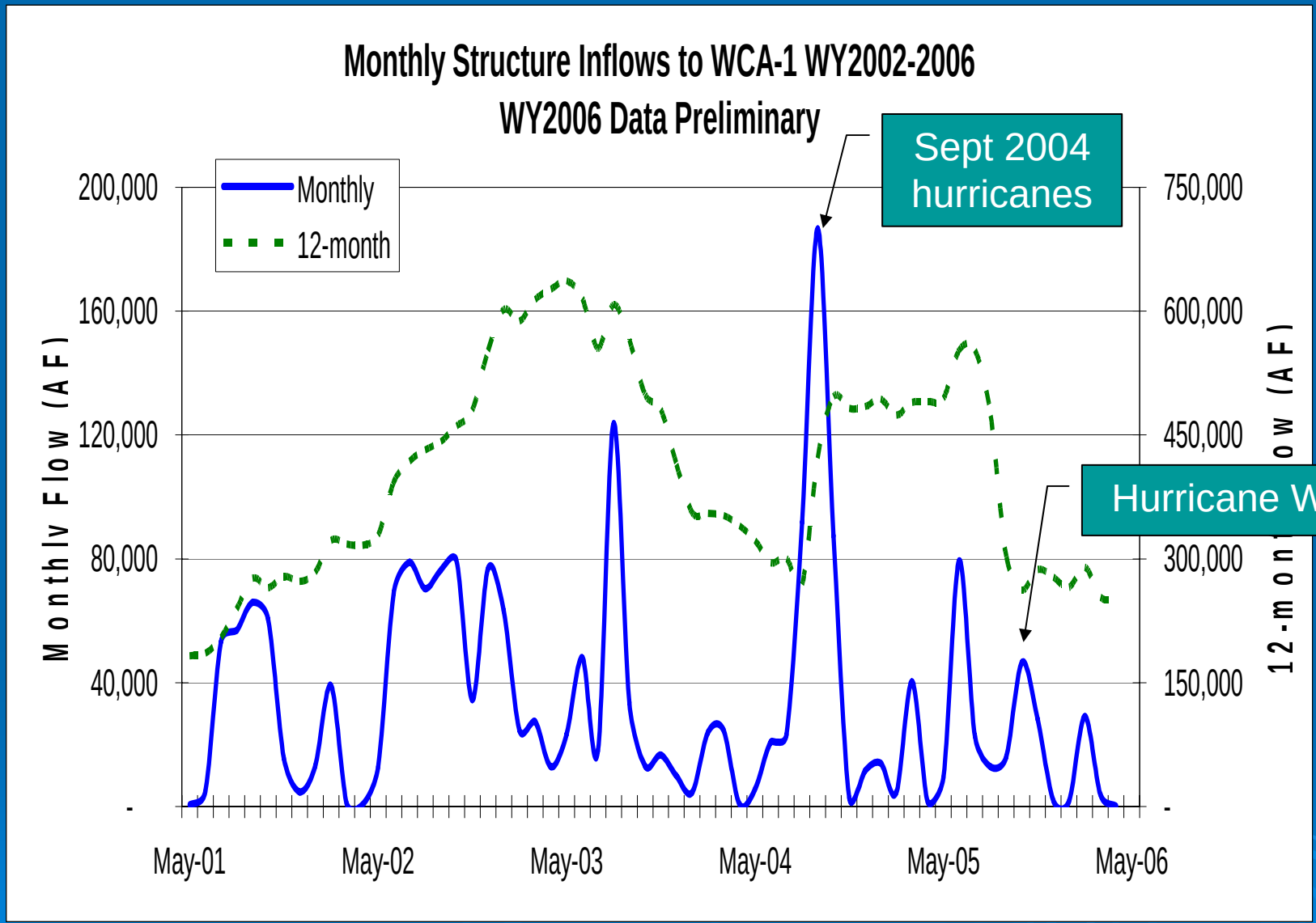
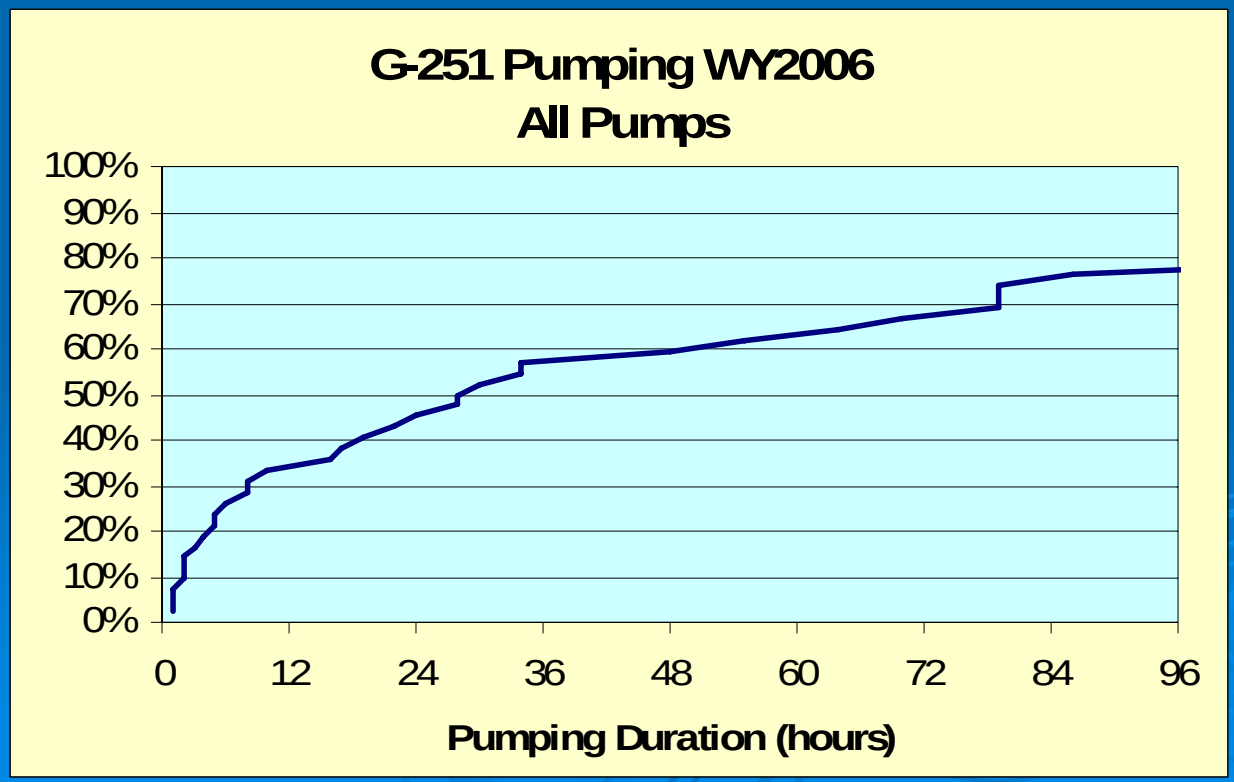


S-6 was diverted in June 2001; STA-1E emergency discharges in Sept/Oct 2004, with normal discharges beginning in October 2005

STA Outflow Pump Durations

- Operations staff utilizes remote-operated electric pumps in concert with large diesel units to reduce pulsed loads to Refuge
- Limited by STA flow-through volume (flow-ways off-line and reduced inflows) and rate at which water moves through treatment vegetation
- Practical limit may be <24 hours for large diesel units for most storms



STA Outflow Pump Durations

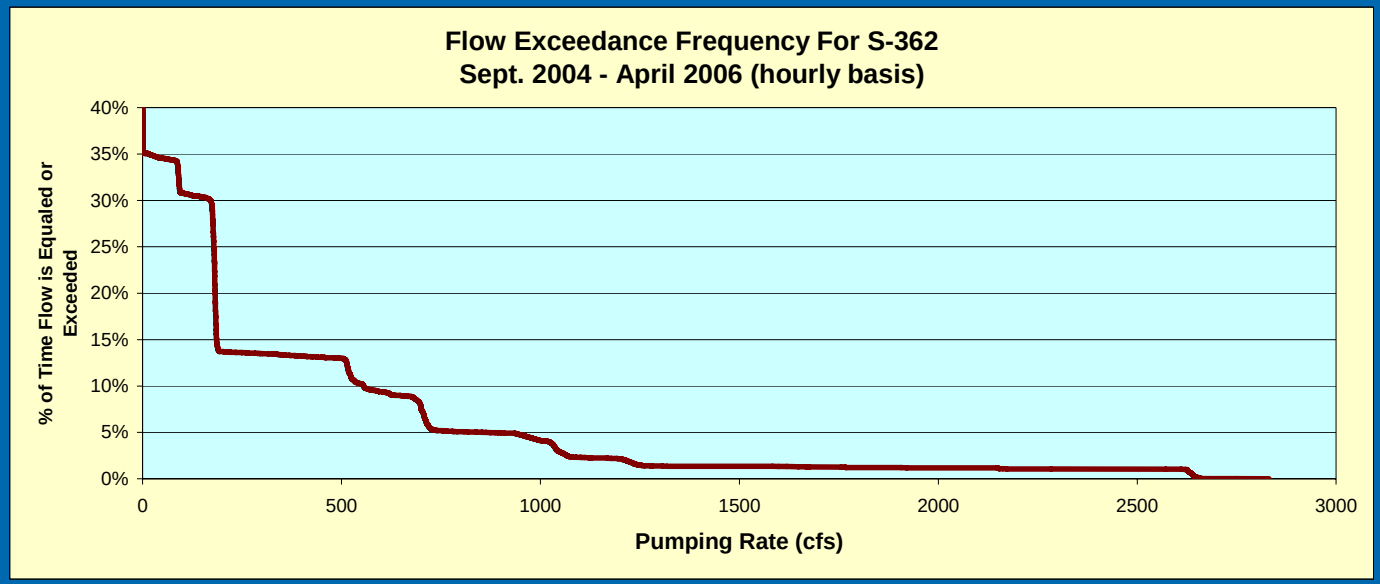
- Estimated durations are sensitive to inter-event period used in analysis
- Initially used 1 hour of zero flow to separate events in report
- Further review and discussion with Operations staff - minimum of 8 hours more reasonable; will revise report

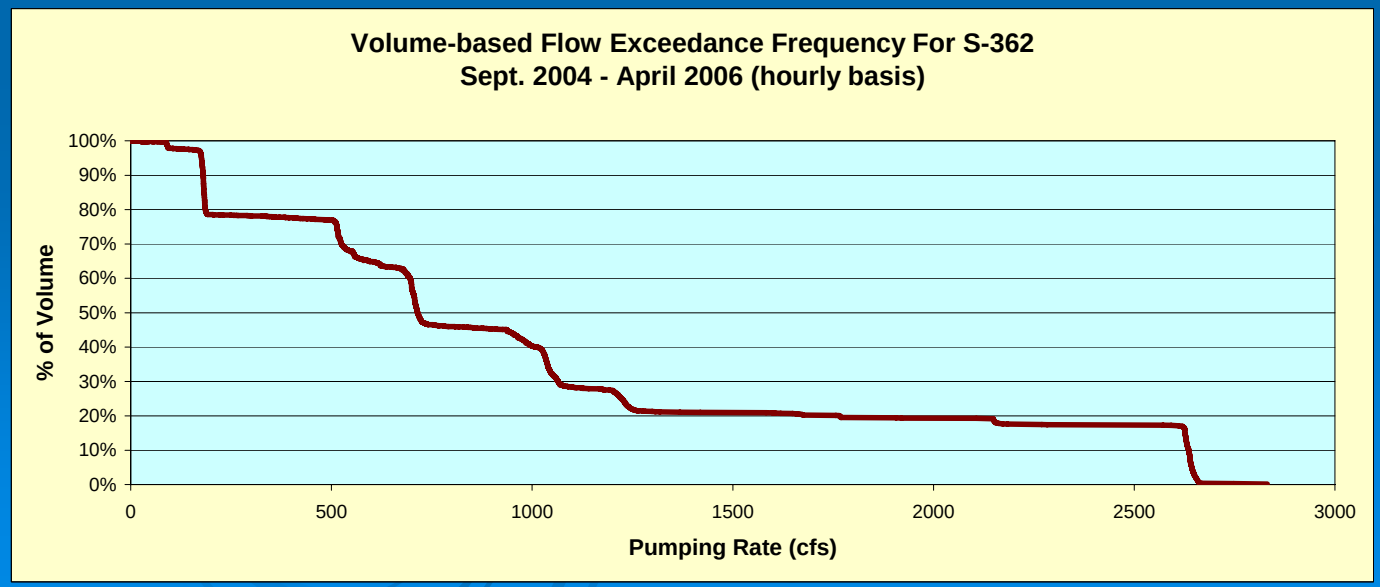
G-310 All pumps - 8 hour inter-event period

Water Year	# of Events	Average Duration	25th %-ile Duration	Median Duration	75th %-ile Duration	Maximum Duration
2002	58	56.8	5.3	7.0	11.0	1142
2003	70	83.5	7.0	9.5	55.8	962
2004	77	48.2	7.0	9.0	18.0	990
2005	33	134.9	2.0	32.0	65.0	2217
2006	54	58.3	4.3	7.0	49.8	705
Average	58.4	76.3	5.1	12.9	39.9	1203.2

STA-1E Outflow Pump Rates

- STA-1E discharged ~35% of time
- ~90% of time <550 cfs
- ~32% of volume discharged at rate of <550 cfs (correction to report page 4)





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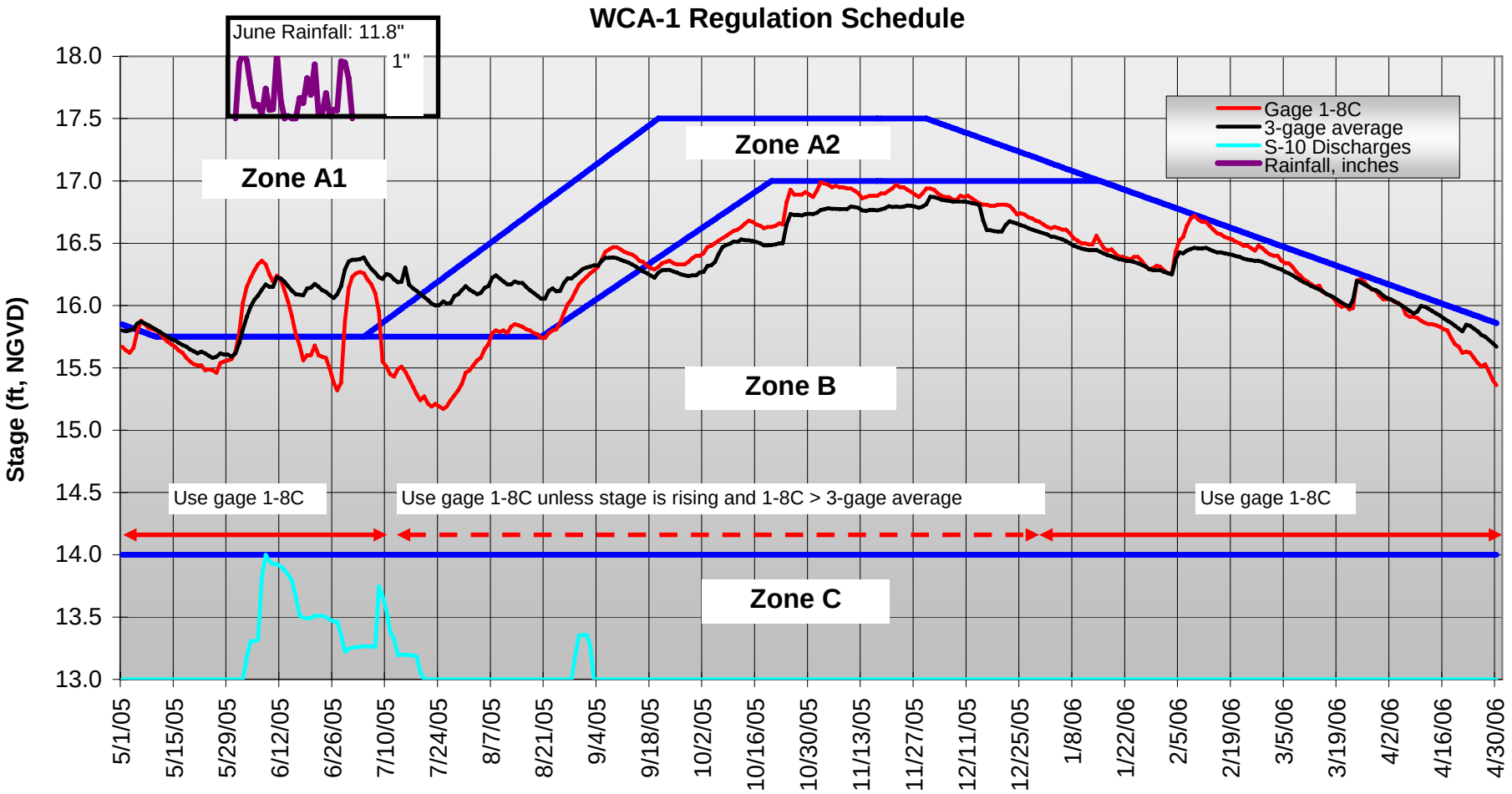


ZONE	RELEASES
A1	UP TO MAXIMUM AT S-10 (AND S-39 WHEN AGREED BETWEEN CORPS AND SFWMD). WATER SUPPLY RELEASES AS NEEDED.
A2	S-10 RELEASES BASED ON CORPS FORECASTS. WATER SUPPLY RELEASES AS NEEDED. IF LAKE OKEECHOBEE STAGE IS ABOVE WCA-1 STAGE OR NO MORE THAN ONE FOOT BELOW WCA-1 STAGE, THEN WATER SUPPLY RELEASES FROM WCA-1 MUST BE PRECEEDED BY AN EQUIVALENT VOLUME OF INFLOW.
B	WATER SUPPLY AS NEEDED. IF LAKE OKEECHOBEE STAGE IS ABOVE WCA-1 STAGE OR NO MORE THAN ONE FOOT BELOW WCA-1 STAGE, THEN WATER SUPPLY RELEASES FROM WCA-1 MUST BE PRECEEDED BY AN EQUIVALENT VOLUME OF INFLOW.
C	NO NET RELEASES FROM WCA-1. ANY WATER SUPPLY RELEASES MUST BE PRECEEDED BY AN EQUIVALENT VOLUME OF INFLOW.

DATES	USE GAGE	CONDITIONS
1 JAN - 30 JUN	1-8 CANAL	ALL
1 JUL - 31 DEC	1-8 CANAL	EXCEPT AS NOTED BELOW
	AVG. 1-7, 1-8T, 1-9	DURING RISING STAGES WHEN CANAL STAGE EXCEEDS AVERAGE.

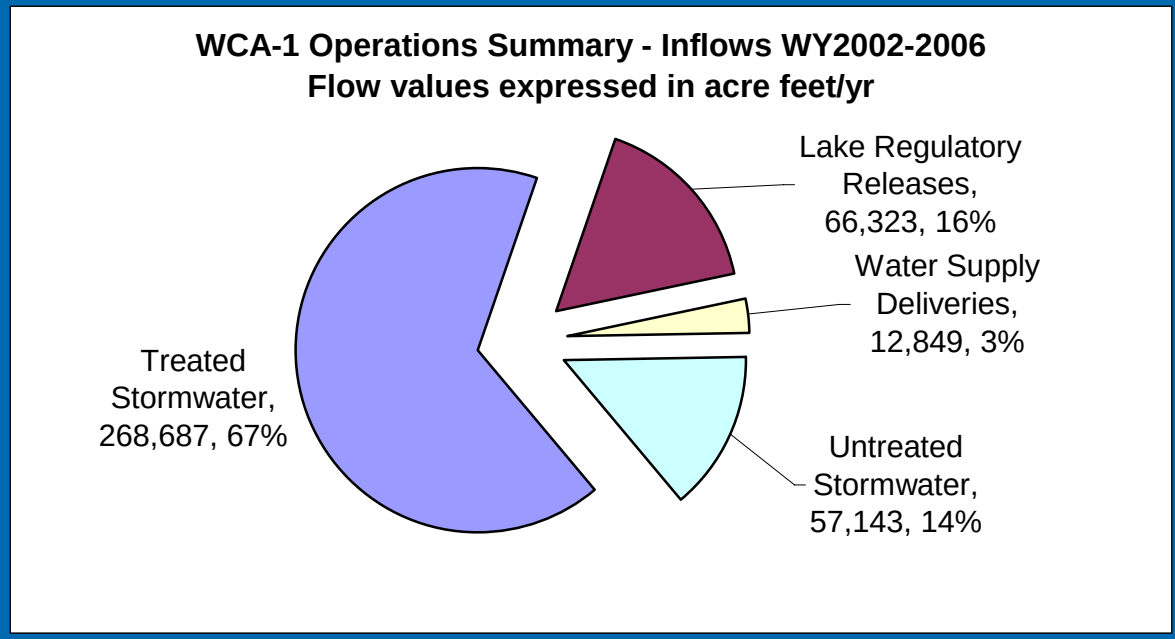
CENTRAL AND SOUTHERN FLORIDA
INTERIM REGULATION SCHEDULE

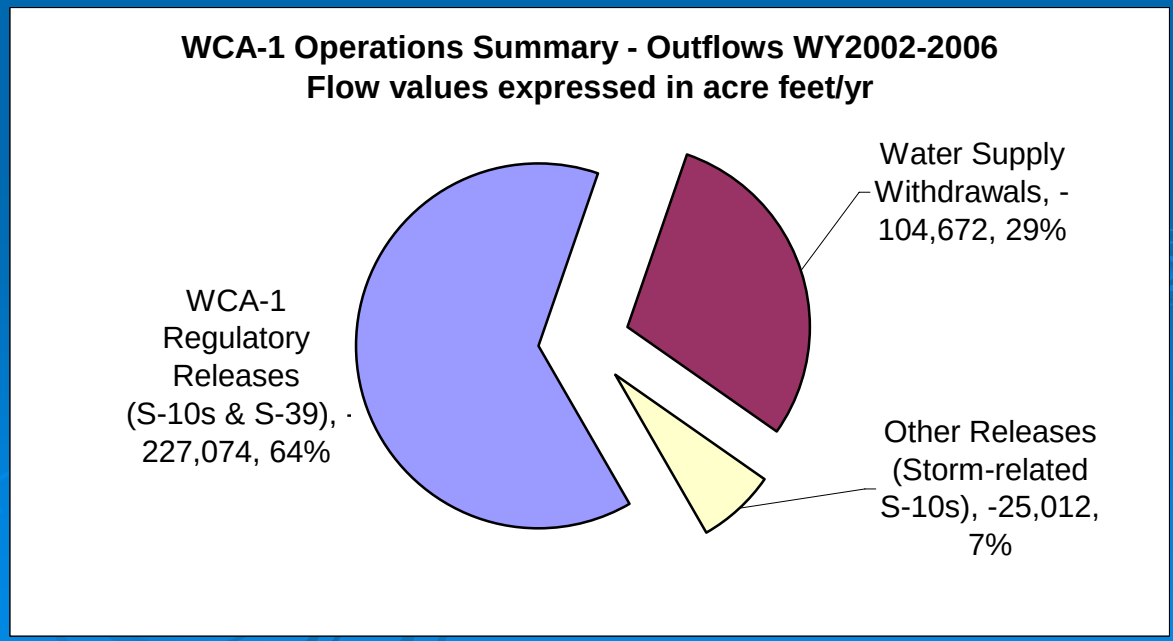
WATER CONSERVATION AREA NO. 1

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
DATED: 03 MAY 1995

WCA-1 Outflow Operations

- WY2006 outflows were less than half of long-term average
- Significantly less regulatory releases
- Higher releases when stage was below schedule
  - In anticipation of storm inflows
  - These may inadvertently cause higher loads to Refuge during subsequent dry season; TOC should acknowledge this
- District installing supplemental water supply pumps on C-51 to reduce water supply withdrawals – WY2007





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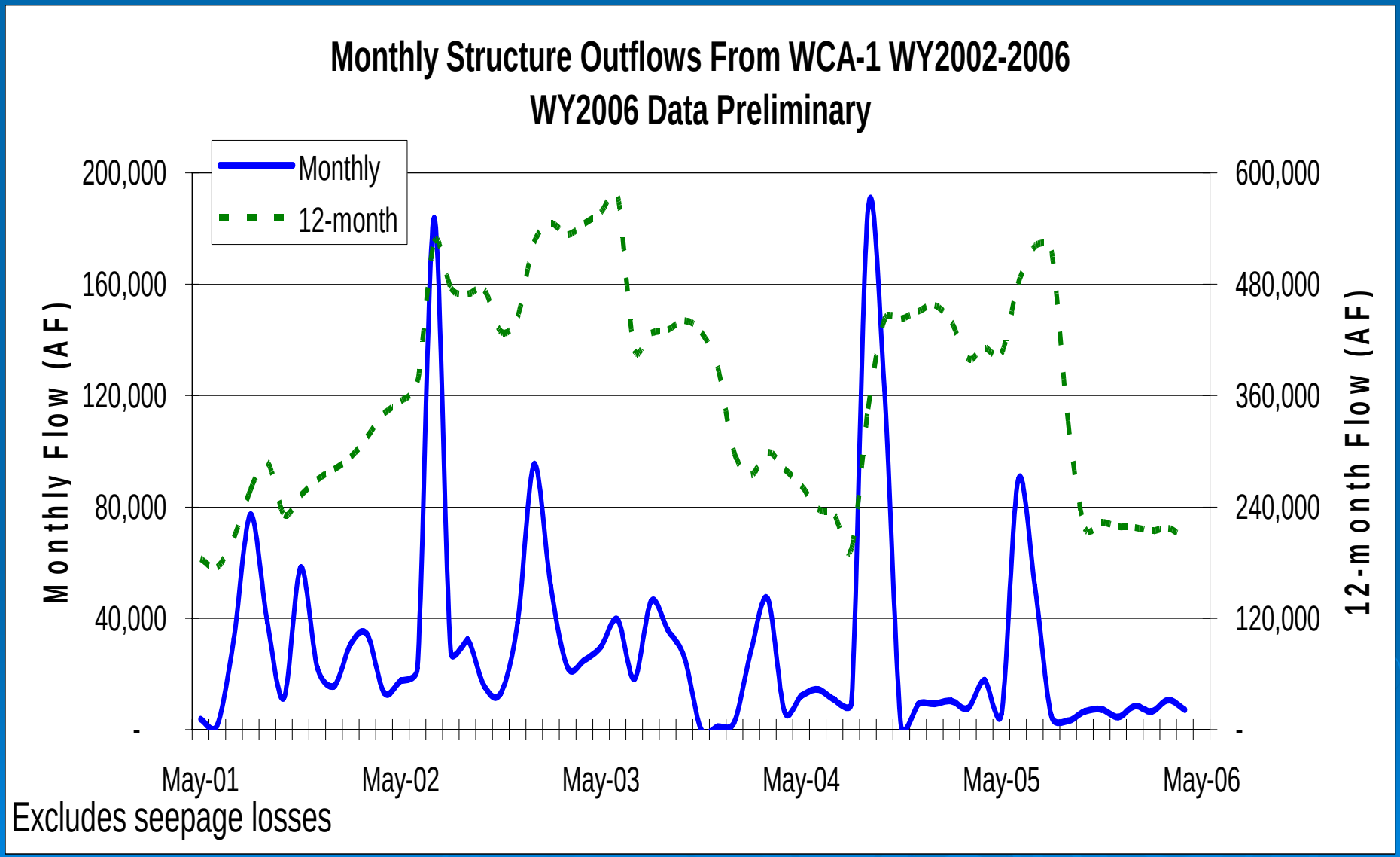

Excludes seepage losses

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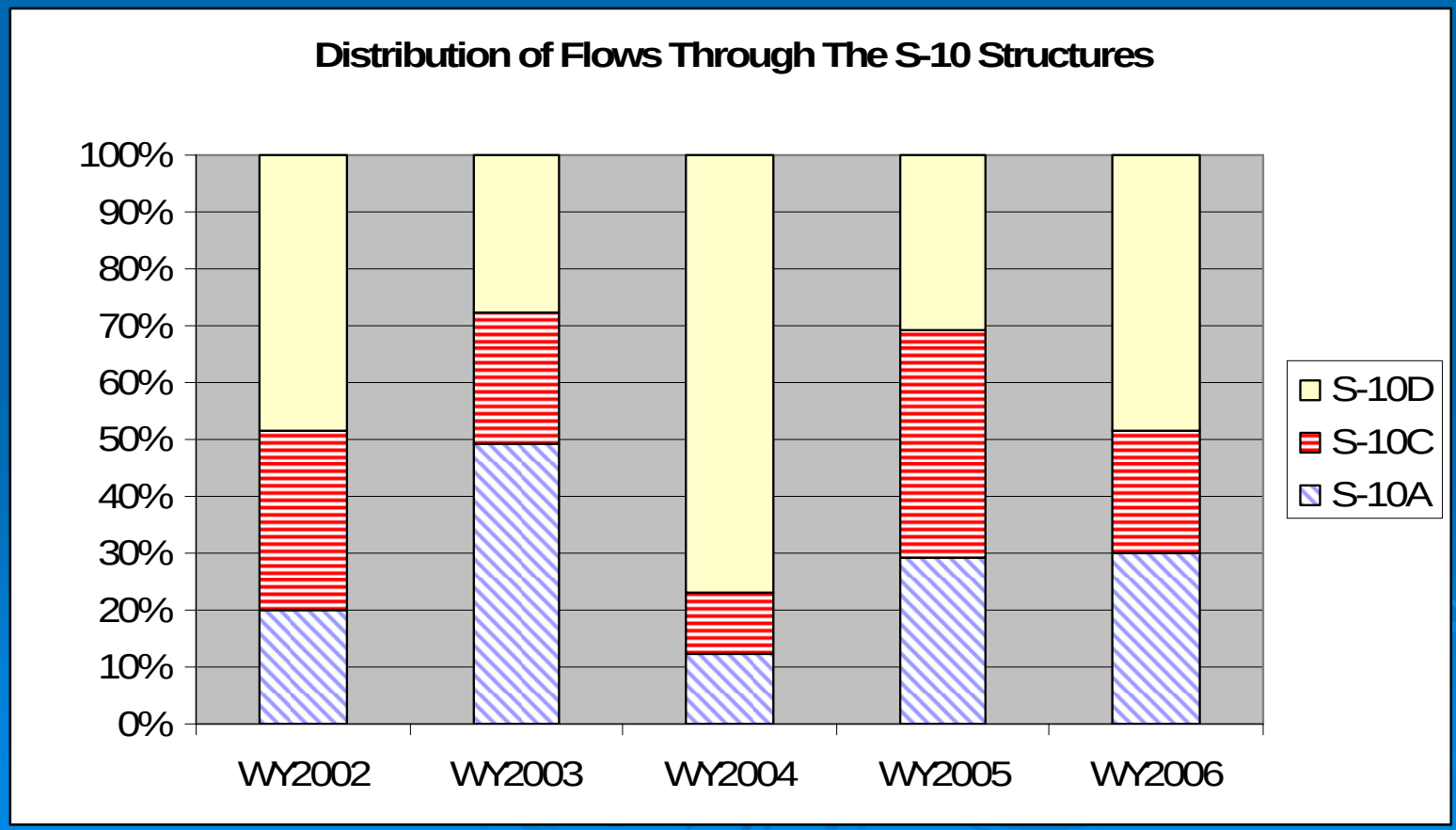
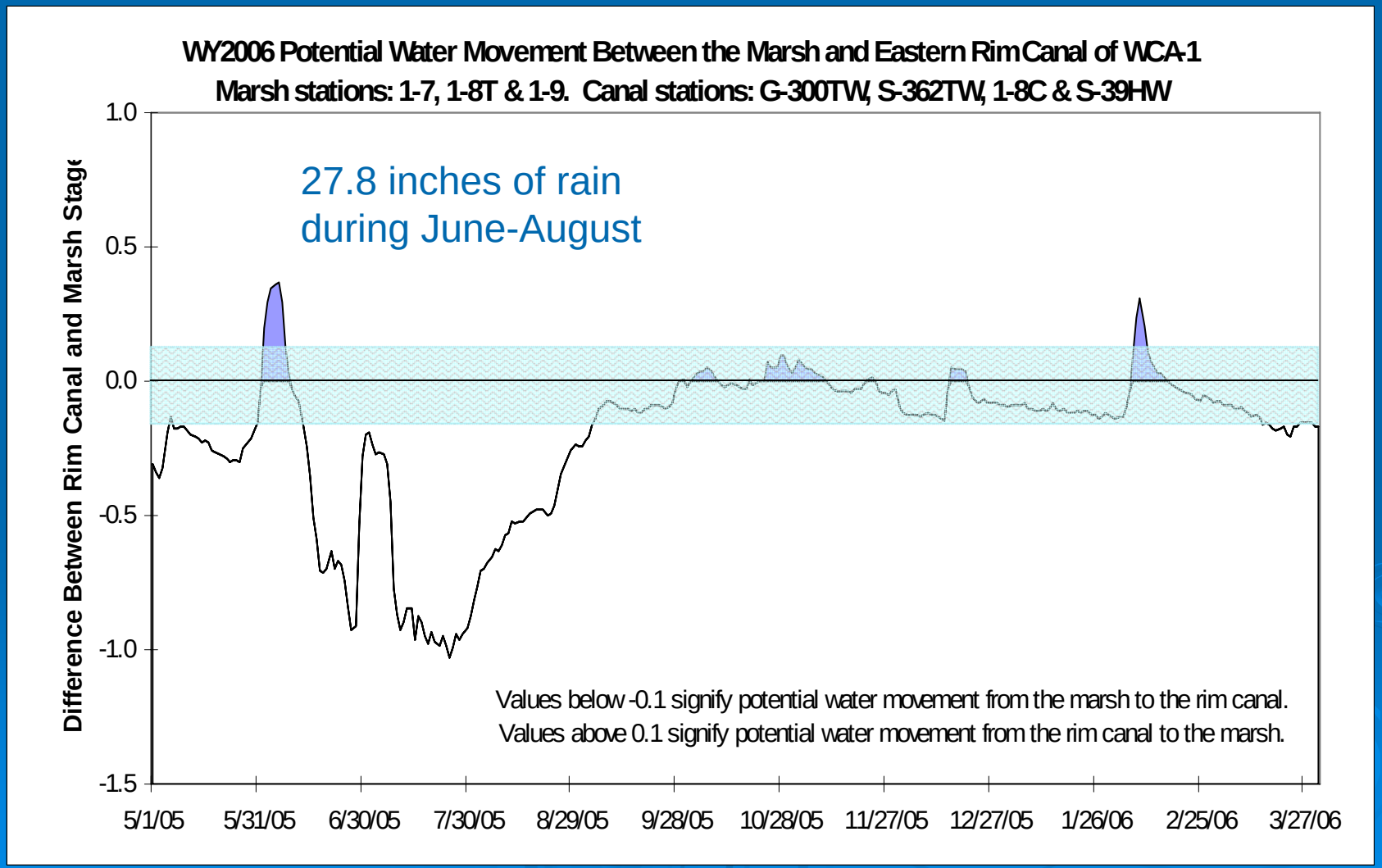
- Re-distribution of flows through S-10s suggested by Refuge staff as way to reduce net retention of phosphorus and impact on pristine areas of Refuge
- WY2006 distribution through S-10D (49%) about equal to prior 4 years (46%)
- Flexibility exists in regulation schedule to re-distribute flows



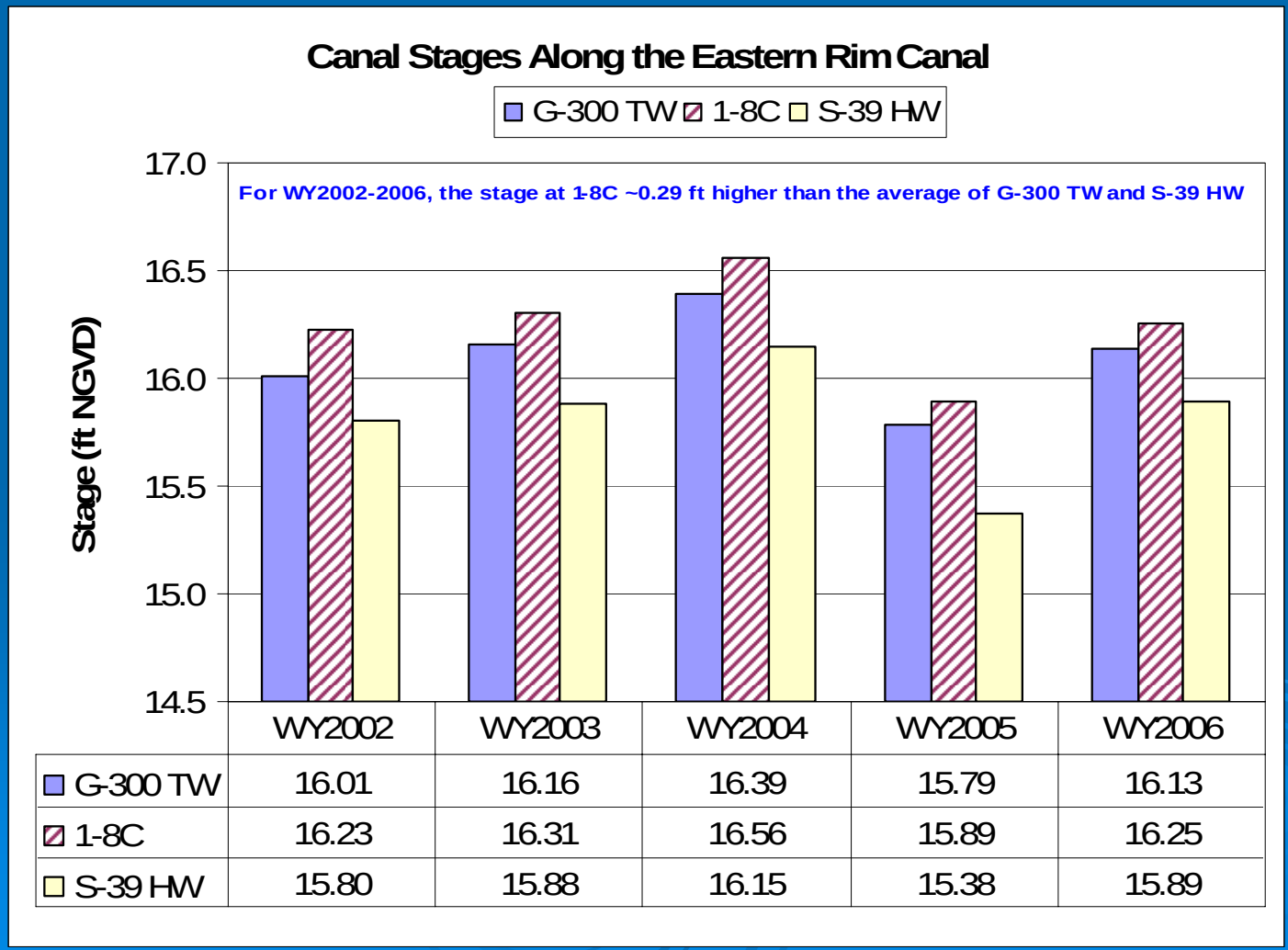
Perimeter canals respond separately to inflow points

- Can expect 1-8C to increase now that STA-1E is in operation



Likely reference elevation error at 1-8C of ~0.3 ft

- Would bias compliance levels, i.e., establish lower TP levels
- Gages should be re-surveyed



	WY2002	WY2003	WY2004	WY2005	WY2006
G-300 TW	16.01	16.16	16.39	15.79	16.13
1-8C	16.23	16.31	16.56	15.89	16.25
S-39 HW	15.80	15.88	16.15	15.38	15.89

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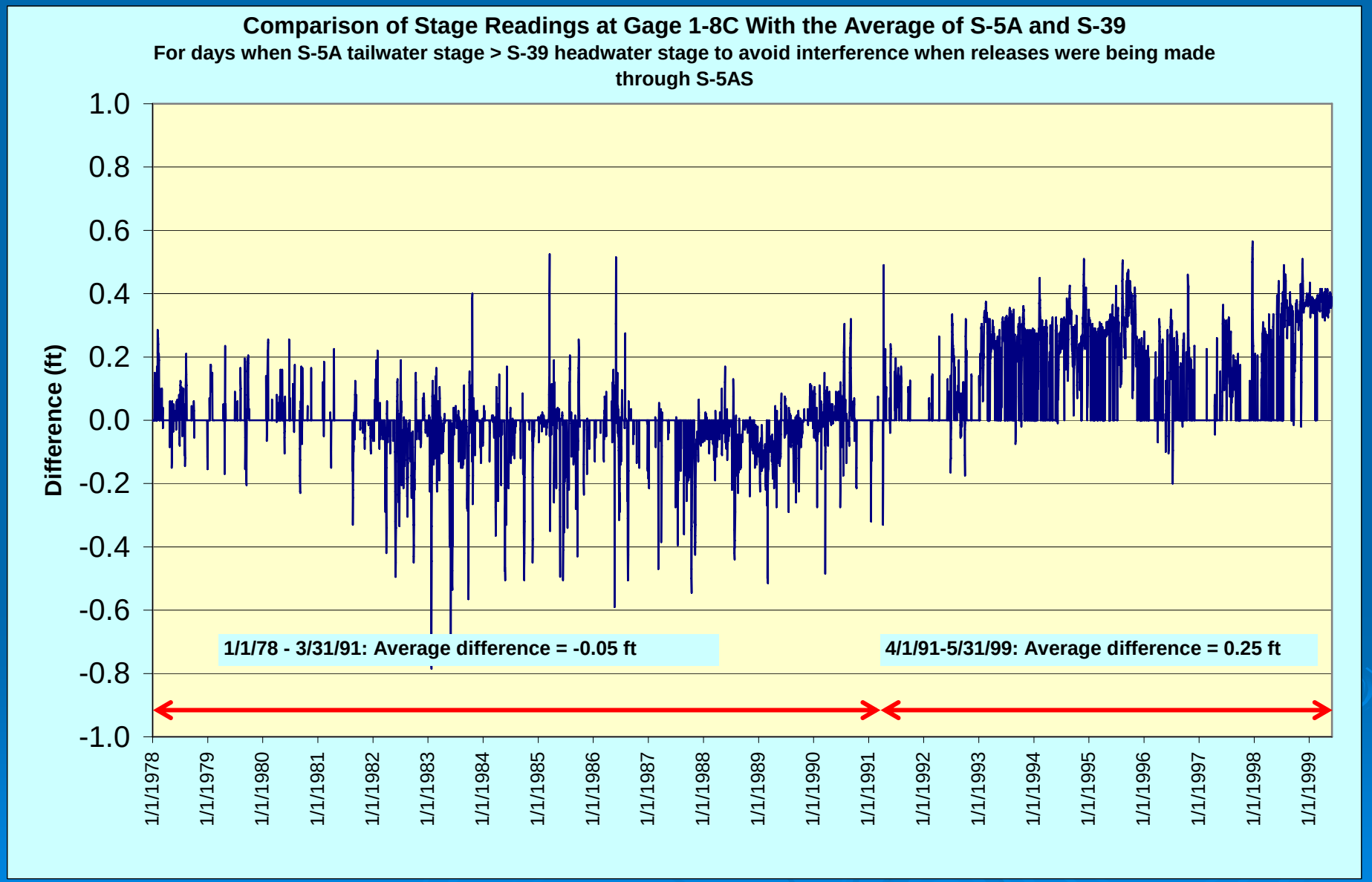

Sent inquiry to USGS regarding possible datum shift

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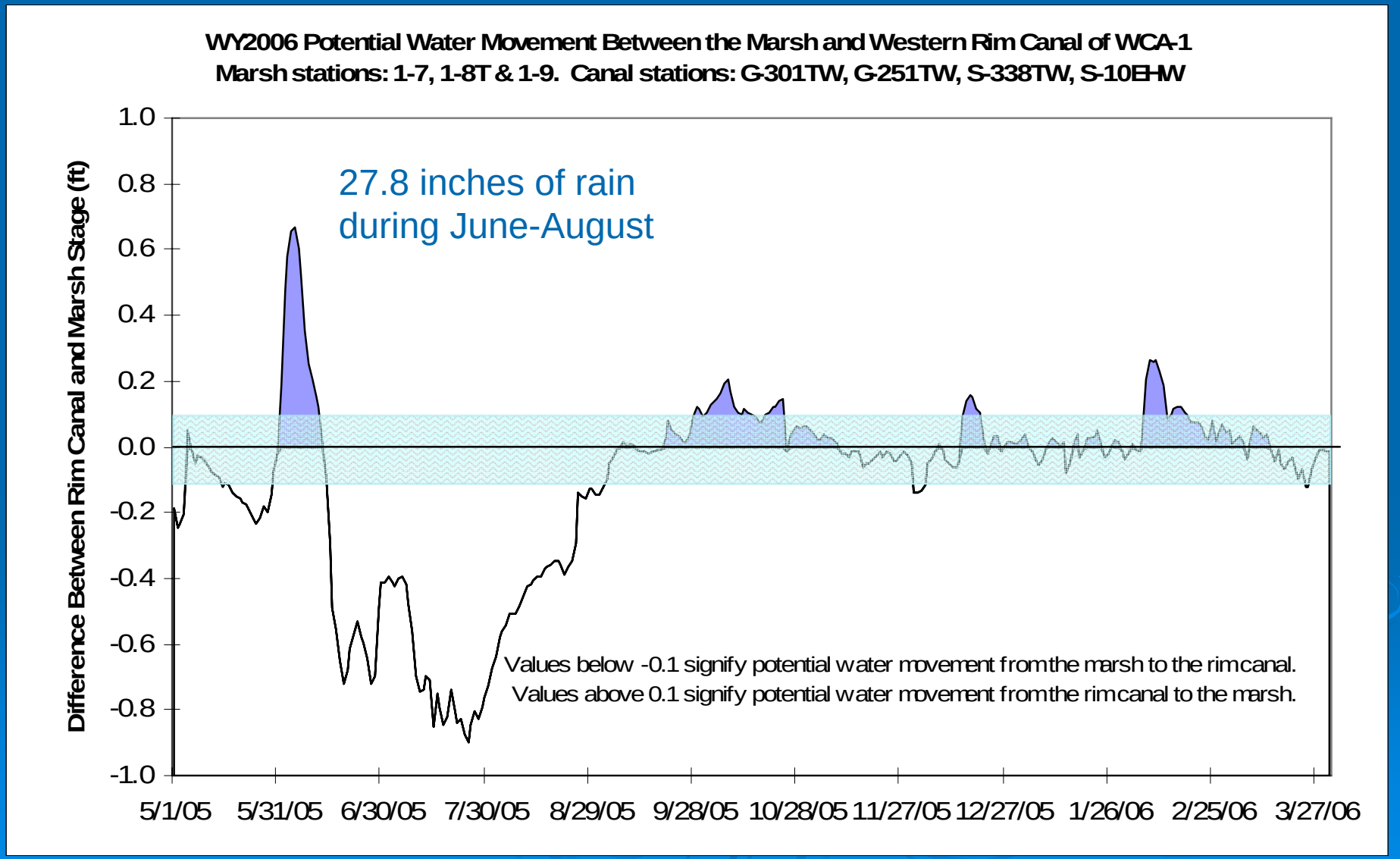
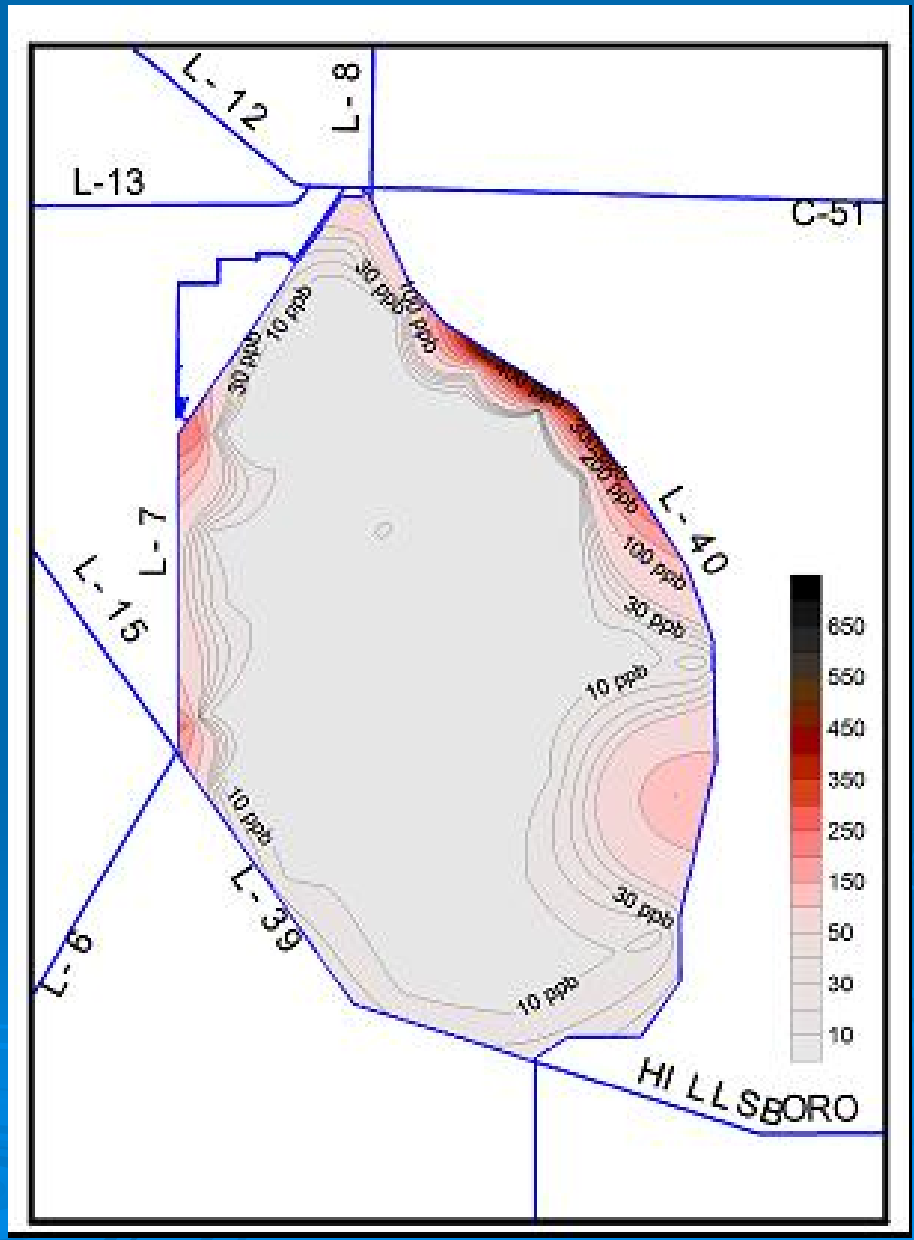
Charts show influence of both inflows and rainfall on interior marsh, both of which are a factor in penetration potential



TP Contour plots

- Useful to better understand penetration dynamics
- Prepared by District staff based on available data

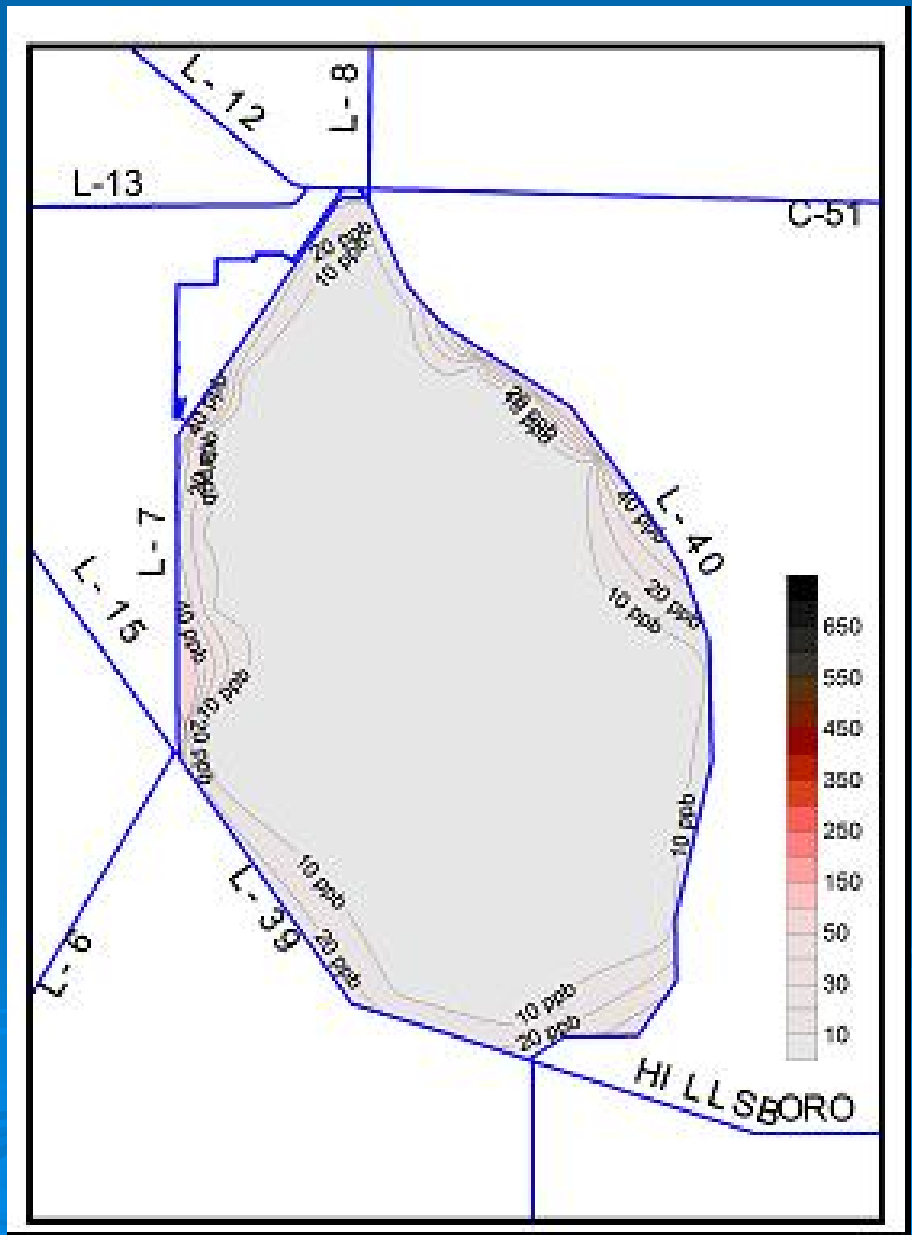
October 2004



February 2006

- Dry season conditions
- Visual indication of limited influence of external operations

February 2006



Summary

- WY2006 operations driven by lower than normal inflows and outflows
  - Interior marsh dominated by rainfall-driven dynamics and local phenomena as opposed to external dynamics
- Some change in operations over previous years
  - STA-1E inflows will continue to increase along eastern boundary, as will stage at 1-8C
  - S-10 discharges increased when stage was below zones A1 and A2 in anticipation of tropical storm inflows
  - May not have influenced marsh phosphorus levels due to reduced potential for penetration
  - Temporary deviation had no impact
- Reference elevations of stage gages should be re-surveyed to remove potential bias and evaluate influence on previous excursions/exceedances