

Pesticides in Nursery Runoff and Mitigation

(A 319h grant)

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Outline

- **Dry weather runoff**
- **Stormwater runoff**
- **Mitigation practices**



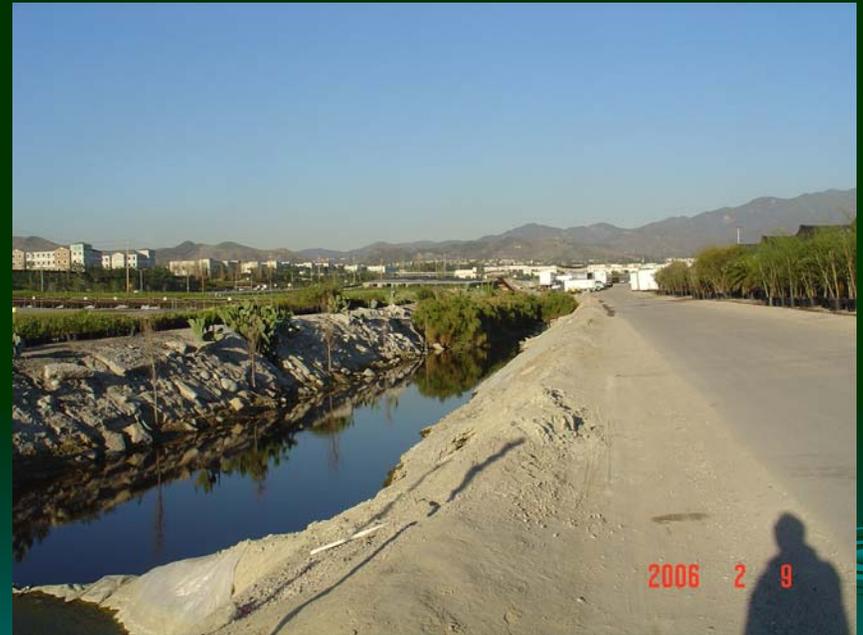
A Multi-billion Industry

United States Top 5 Nursery, Flower and Foliage Producing States

Top 5 States	2002 Grower Cash Receipts	2002 % of U.S.	2003 Grower Cash Receipts	2003 % of U.S.
California	\$3,319,761,000	22.03	\$3,312,977,000	21.81
Florida	1,586,371,000	10.53	1,601,040,000	10.54
Texas	1,341,270,000	8.90	1,324,780,000	8.72
North Carolina	937,445,000	6.22	944,554,000	6.22
Oregon	887,190,000	5.89	923,759,000	6.08
TOTAL U.S.	\$15,070,673,000		\$15,193,378,000	

*SOURCE: <http://www.ers.usda.gov/Data/FarmIncome/finfidmu.htm>

A Large Commercial Nursery



Dry Weather Runoff



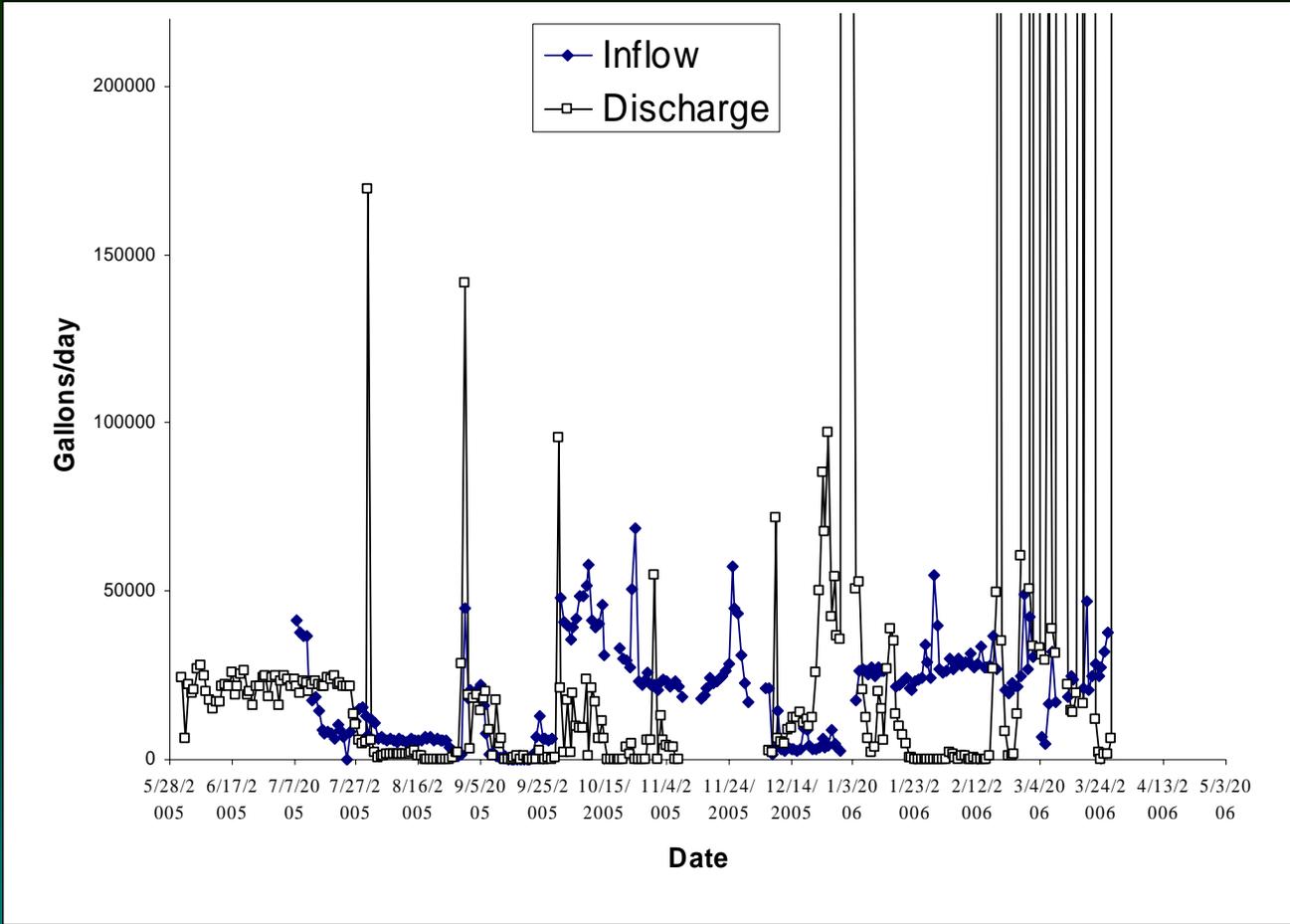
Inflow Rate Measurement



Outflow Rate Measurement



Daily Inflow and Outflow Rates (Gallons/day)

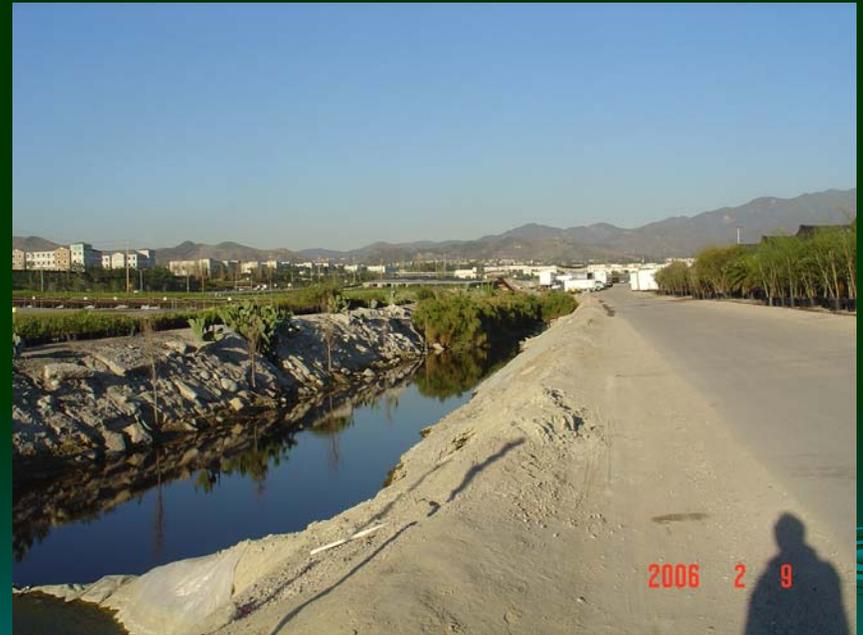


Flow Rate Observations

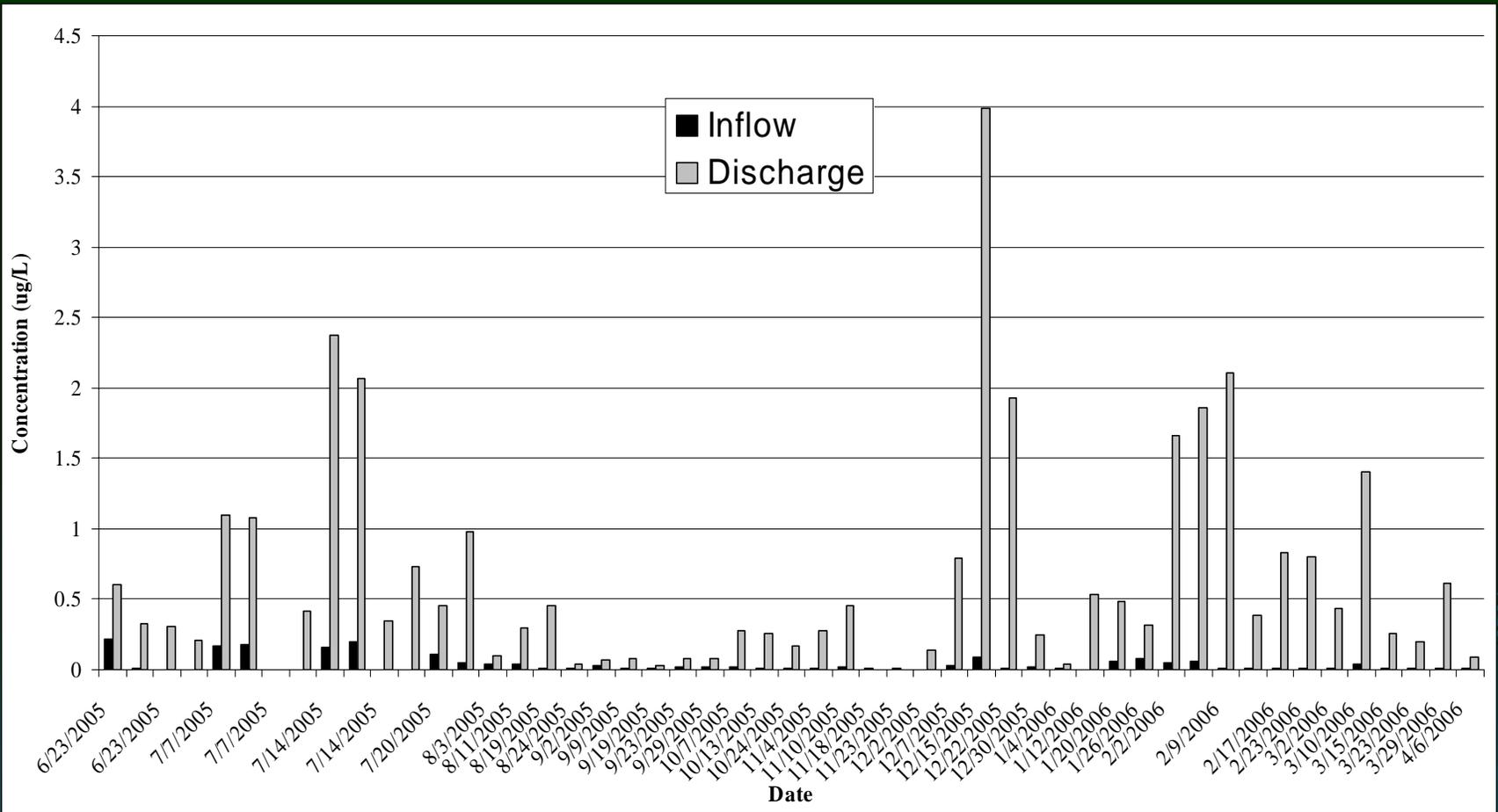
- Flumes + sensors ideal for dry weather runoff monitoring
- Daily inflow rate > outflow rate
- July 8, 2005 - Mar. 28, 2006
 - 2.93 million gallons outflow volume
 - 4.47 million gallons inflow volume
 - Output = 65% input
 - The nursery served as a sink under dry weather conditions
- Reduced runoff
 - Improved irrigation practices
 - On-site retention
 - Reuse of retained water
 - Percolation
 - Evaporation



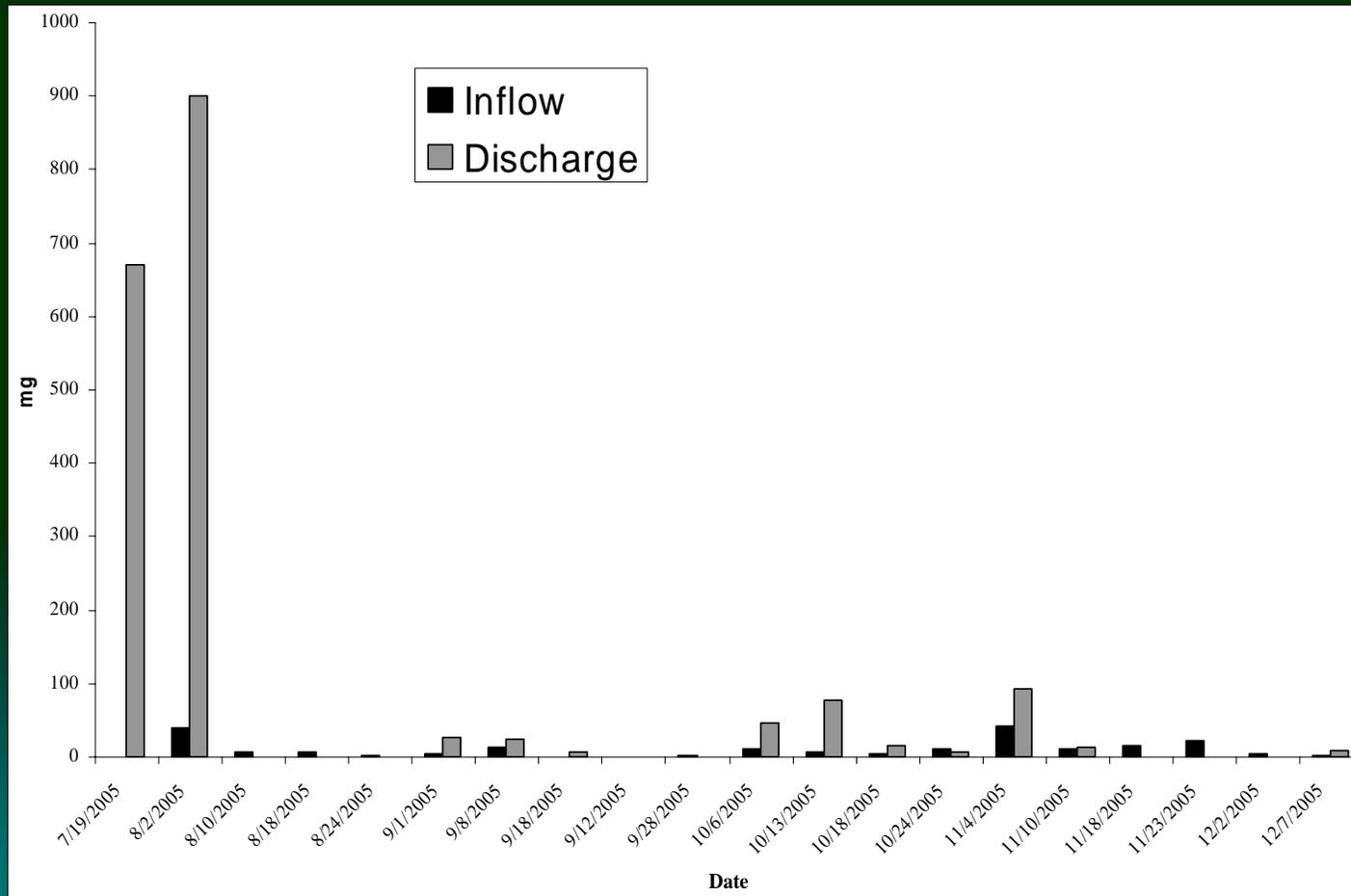
Water Retention and Reuse



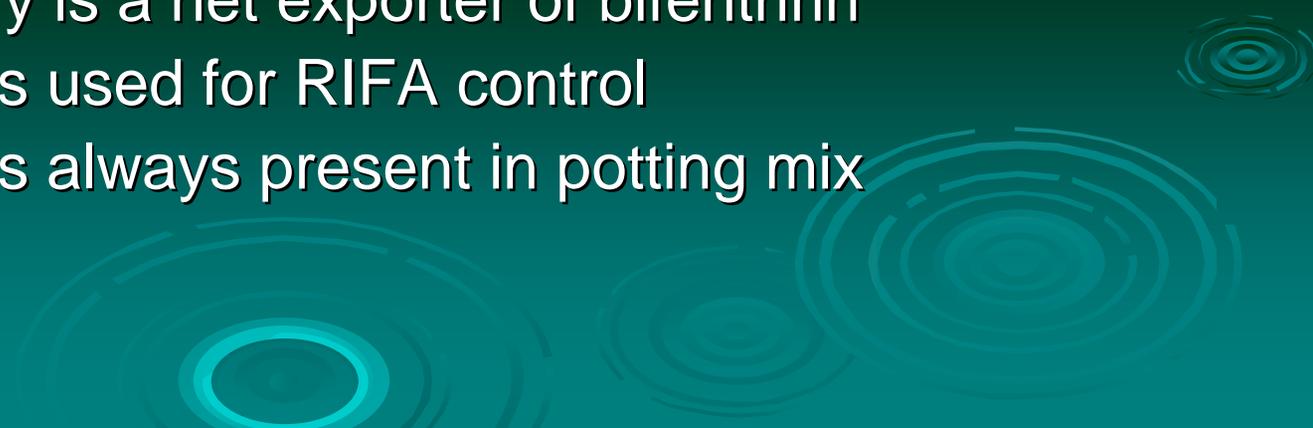
Bifenthrin Concentrations in Runoff (ppb, $\mu\text{g/L}$)



Weekly Dry Weather Bifenthrin Runoff (mg)

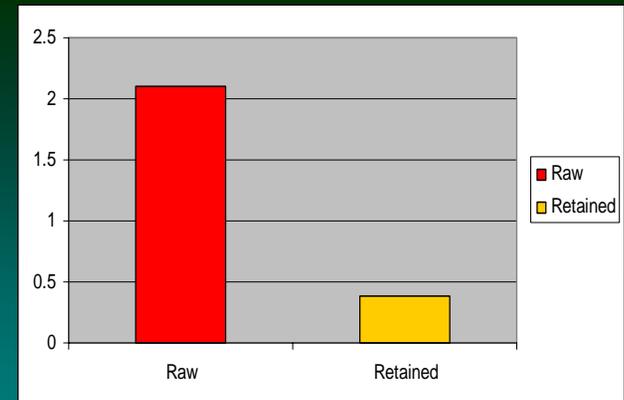


Pesticide Loads Observation

- No OP was detected
 - Pyrethroids were frequently detected
 - Bifenthrin always detected
 - Fenpropathrin, cyhalothrin, cyfluthrin, and deltamethrin sometimes detected
 - Bifenthrin concentrations higher in outflow than in inflow
 - The nursery is a net exporter of bifenthrin
 - Bifenthrin is used for RIFA control
 - Bifenthrin is always present in potting mix
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Pesticide Loads Observation

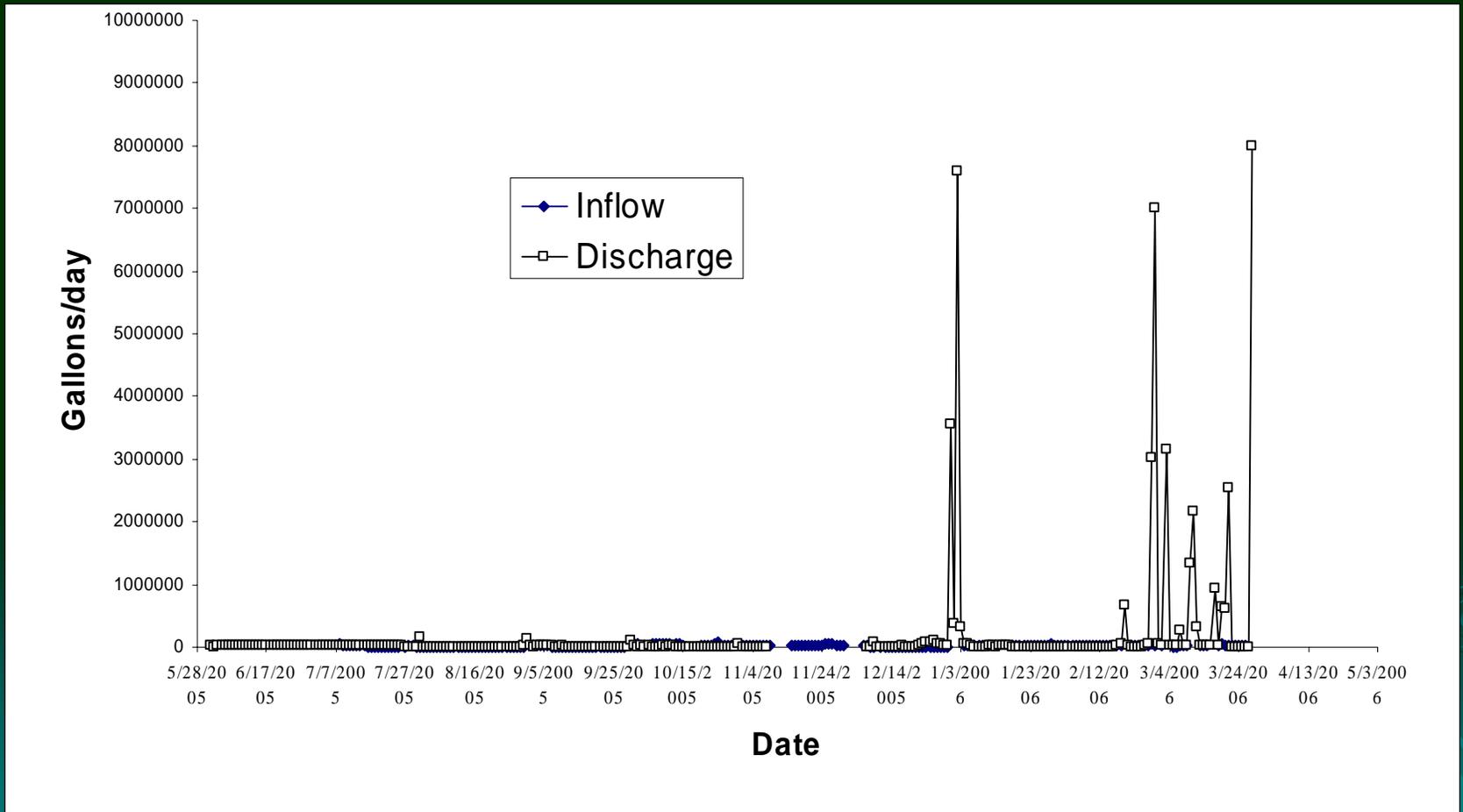
- Bifenthrin concentrations decreased substantially during the project
- Daily bifenthrin load reduction: 98.7%
 - Daily bifenthrin load with mitigation = 2.06 mg/day
 - Daily bifenthrin load without mitigation = 163.4 mg/day
- Causes for reduction:
 - Reduction in outflow rate
 - Reduction in pesticide concentration
 - On-site retention
 - Settling of loose particles
 - Adsorption to sediment
 - In-situ degradation



Stormwater Runoff



Stormwater Runoff Outflow



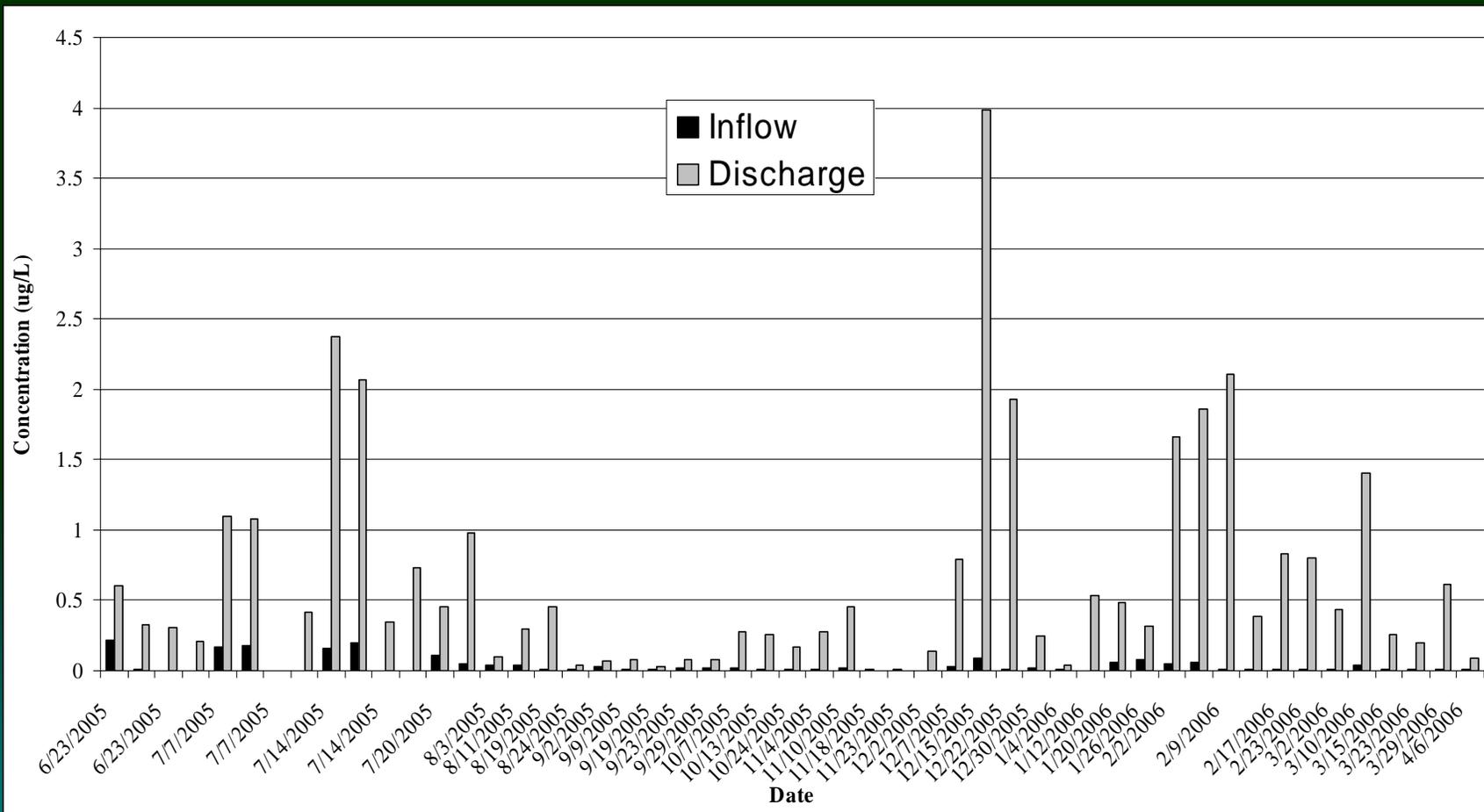
Flow Rate Observations

- Large flumes needed for storm flow monitoring
- Storm runoff overwhelms dry weather runoff
- July 8-March 31:
 - Dry weather total output: 4.1 million gallons
 - Storm total output: 41.4 million gallons
 - Storm runoff: 90.9% of total output
 - Dry weather runoff: 9.1% of total output

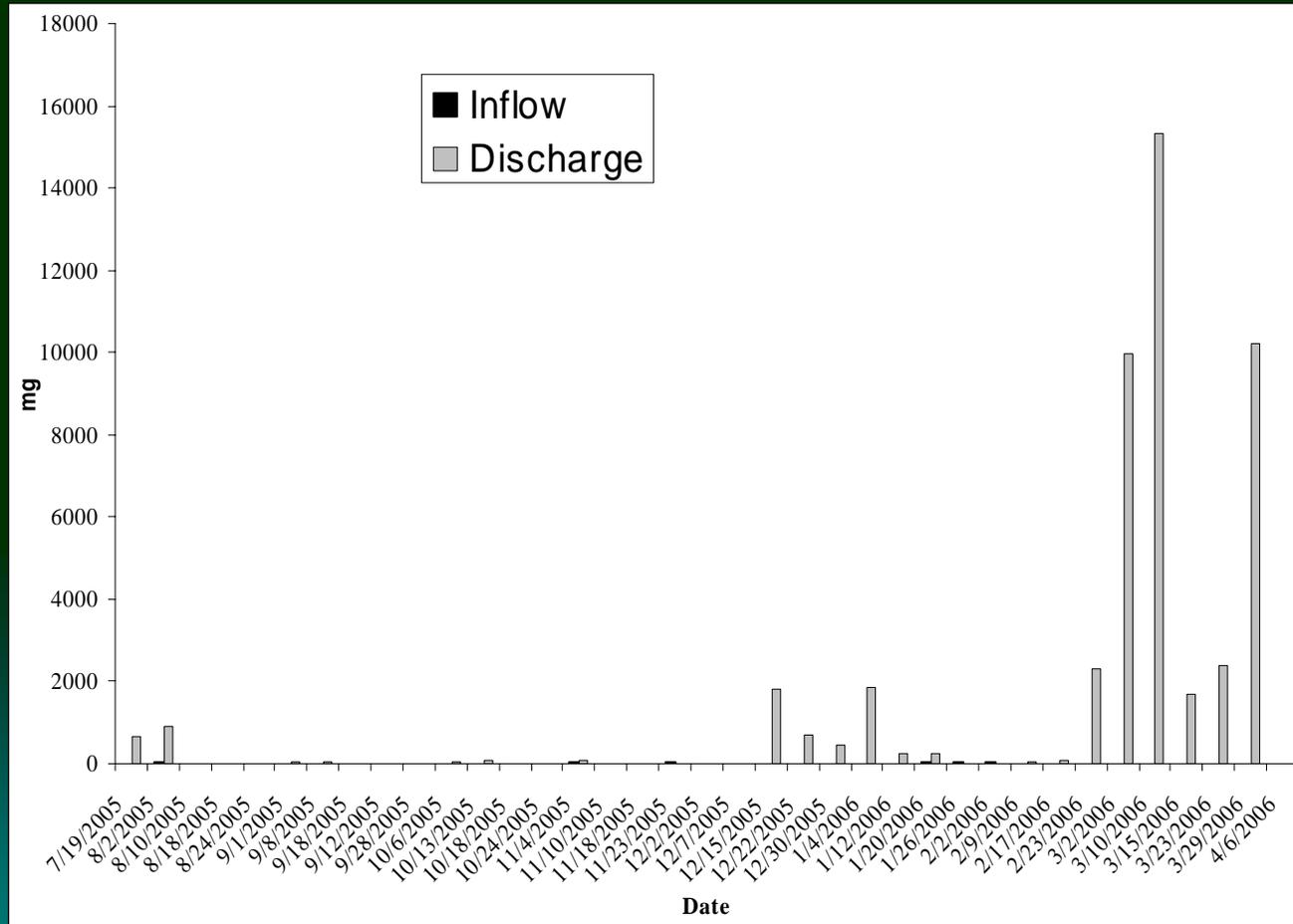


Bifenthrin in Runoff

(ppb, $\mu\text{g/L}$)

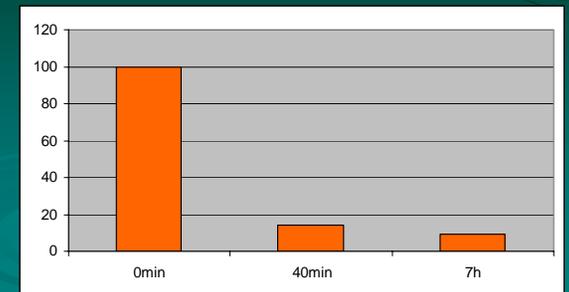


Weakly Bifenthrin Runoff at Outlet 2 (mg)



Pesticide Loads Observation

- Bifenthrin concentrations in storm runoff were higher than in dry weather runoff
- Bifenthrin loads in storm runoff overwhelms dry weather runoff
- July 8-March 31:
 - Total dry weather export: 2,104 mg
 - Total storm export: 67,029 mg
 - Storm runoff loads: 97% of total export
- Storm runoff features:
 - High initial concentrations



Mitigation Practices

Irrigation Runoff

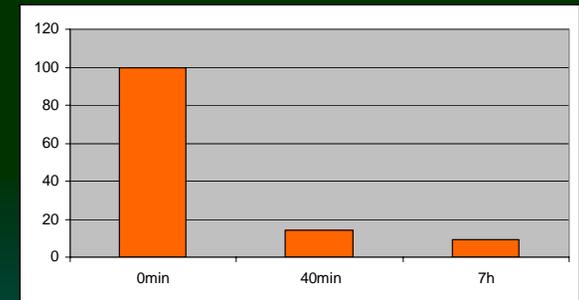
- Easy to manage
- Efficient irrigation practices
- Retention
 - Retention of particles and organic matter
 - Percolation
 - Evaporation
 - Natural degradation
 - Reuse of retained water
- Loose potting mix management
- Vegetative filters in ditches
- Coir filters?



Mitigation Practices

Storm Runoff

- (Extremely) difficult to manage
- Catch and retain runoff from small storms
 - “First flush”
- Pre-storm preparation:
 - Loose potting mix management
 - Containers away from ditches?
 - Clean up ditches
 - Minimize pesticide use in winter months
 - Alternative pesticides in winter months



Acknowledgement

- The no-name nursery
- EPA 319(h) program
- Santa Ana RWQCB
(Doug Shibberu)
- CA Department of Pesticide Regulation
(PUR databases)