P Reduction Demonstration Project Background Info

Egan WRP

- Located in Schaumburg, IL
- Design capacity of 30 MGD
- Discharges into Salt Creek

Salt Creek

- General Use waterway in Northeast Illinois
- Drainage area of about 150 mi^2
- Effluent dominated

Objectives

Determine effects of P reduction at Egan WRP on downstream water quality

Explore possible effects in the paradigm:

Phosphorus → Algae → DO

Observe any subsequent effects of this paradigm shift on stream biota

Study effects on plant operation and solids production

Study effects on biosolids characteristics

P Reduction Demonstration Project Phosphorus Results

Upstream of Egan at Busse Dam

	2005	2006	2007	2008
Mean P (mg/L)	0.25	0.18	0.11	0.10
Range P (mg/L)	<0.05-3.15	<0.05-0.87	0.06-0.36	0.04-0.35

Egan Effluent daily 24-hour composite samples

	2005	2006	2007	2008
Mean P (mg/L)	3.26	3.72	0.35	0.43
Range P (mg/L)	0.98-5.87	0.92-8.22	0.06-1.77	0.14-1.38

P Reduction Demonstration Project Phosphorus Results (continued)

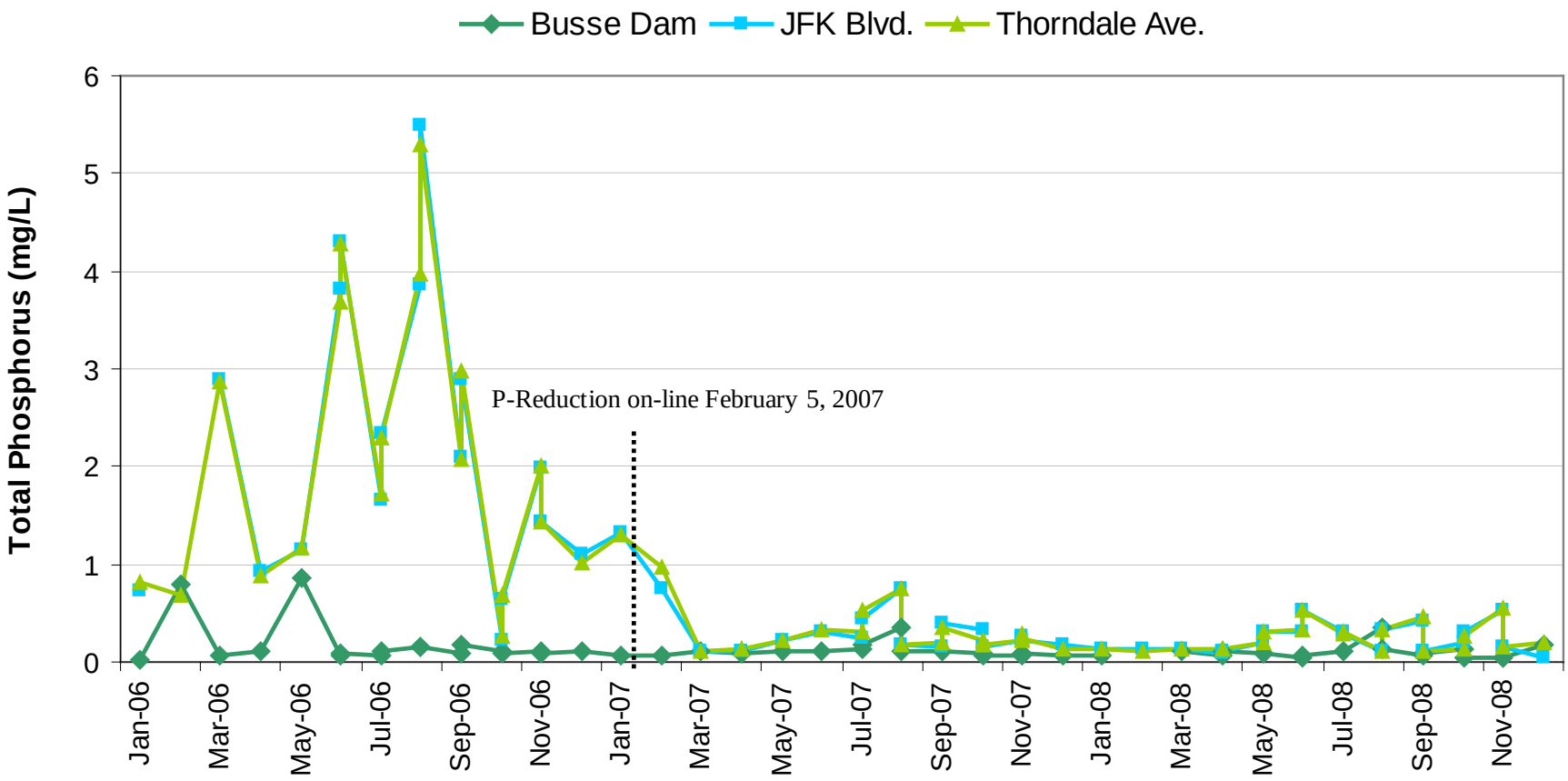
Downstream of Egan at JFK Blvd.

	2005	2006	2007	2008
Mean P (mg/L)	2.76	2.20	0.29	0.24
Range P (mg/L)	0.88-4.64	0.22-5.49	0.10-0.76	0.05-0.54

Downstream of Egan at Thorndale Ave.

	2005	2006	2007	2008
Mean P (mg/L)	2.51	2.12	0.30	0.24
Range P (mg/L)	<0.05-4.45	0.27-5.30	0.10-0.97	0.11-0.56

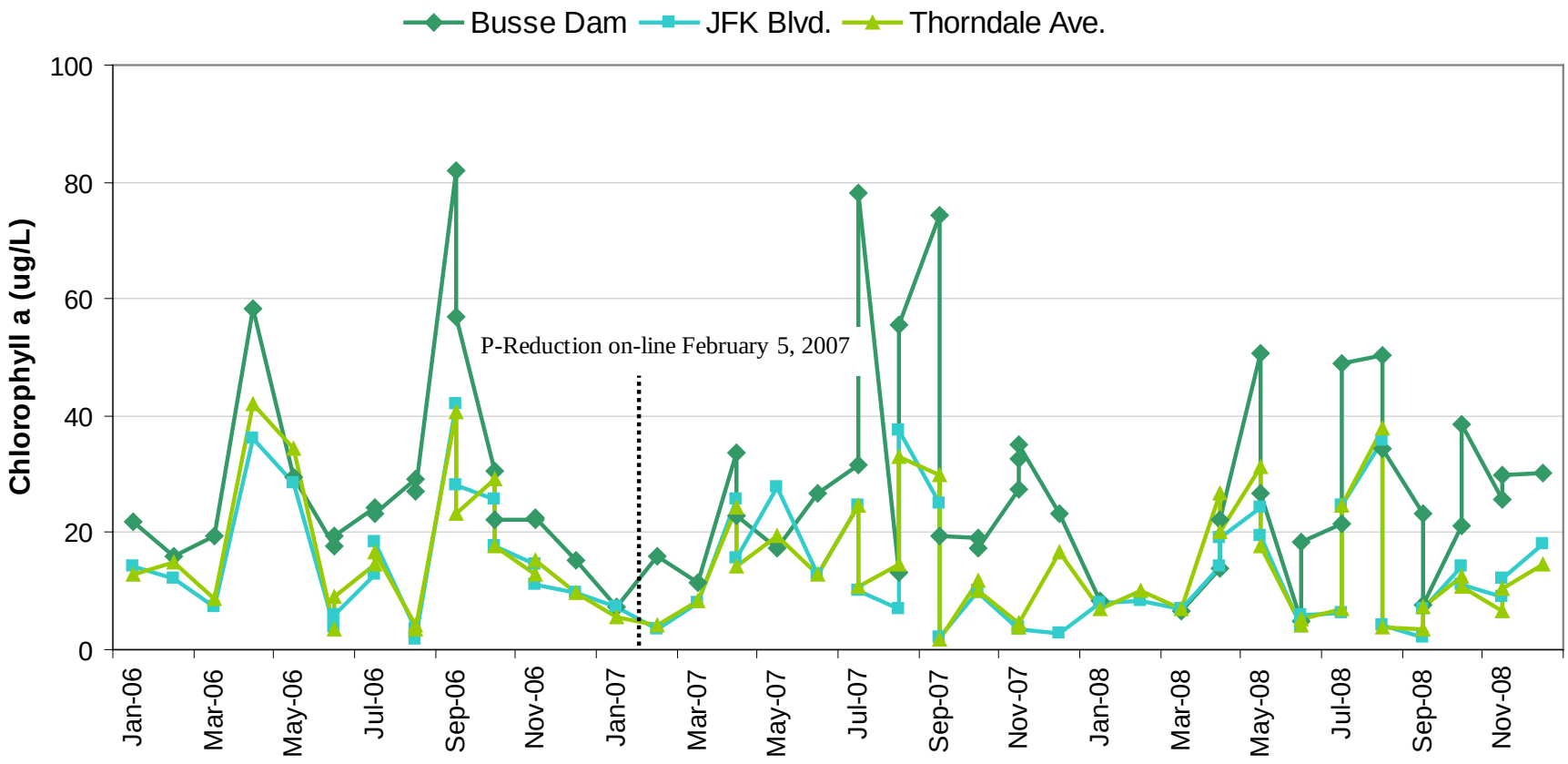
P Reduction Demonstration Project Phosphorus Results (continued)



P Reduction Demonstration Project
Chlorophyll *a* Results

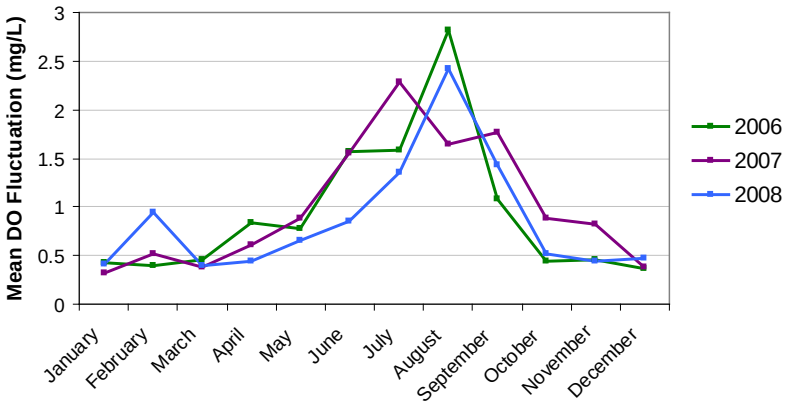
Location		Chlorophyll *a* (µg/L)			
		2005 (pre)	2006 (pre)	2007 (post)	2008 (post)
Busse Dam	Mean	29	30	31	25
	Range	7-63	15-82	11-78	5-51
JFK Blvd.	Mean	10	16	13	13
	Range	3-29	2-42	2-38	2-36
Thorndale	Mean	11	17	14	13
	Range	3-34	3-42	2-33	4-38

P Reduction Demonstration Project
Chlorophyll *a* Results (continued)

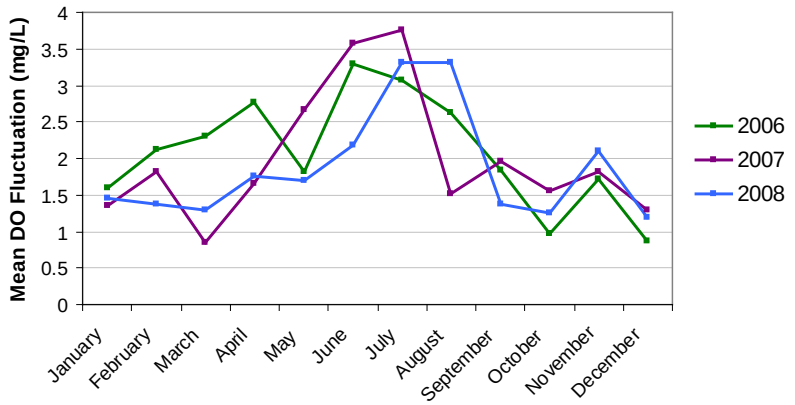


Mean Monthly DO Fluctuation Before (2006) and After (2007, 2008) P Reduction

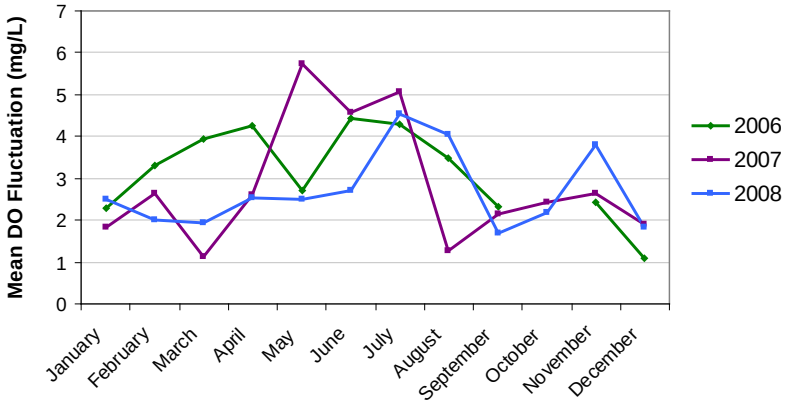
Busse Dam



JFK

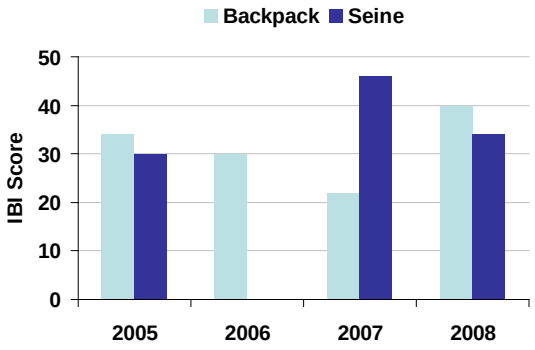


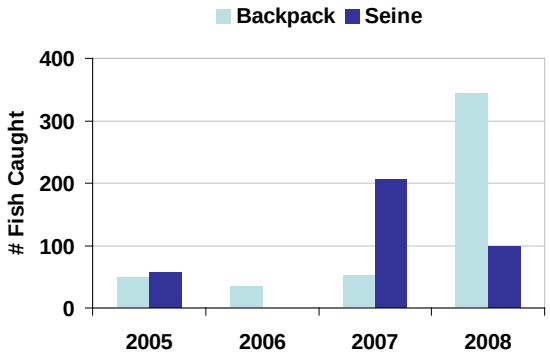
Thorndale



P Reduction Demonstration Project
Fish Results

Busse Dam





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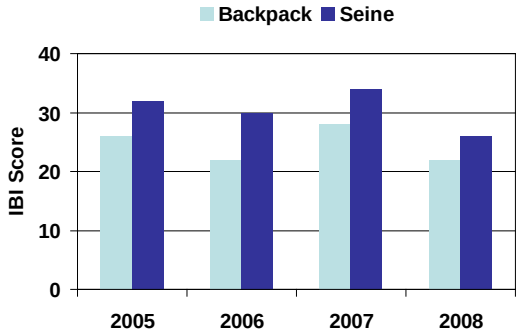

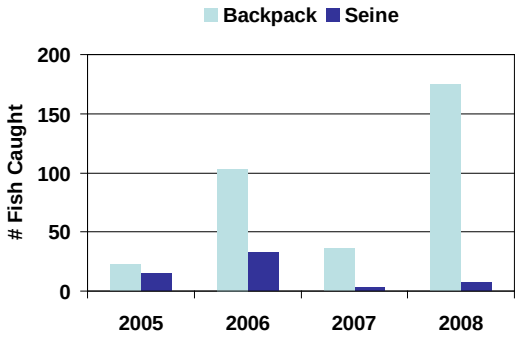

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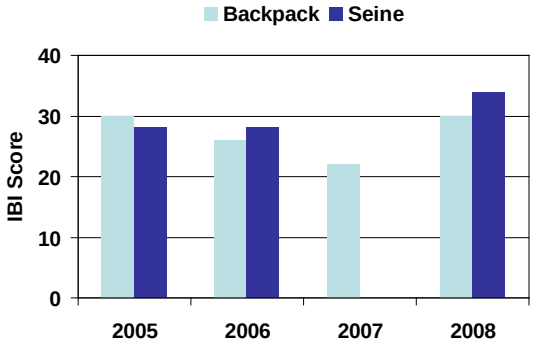

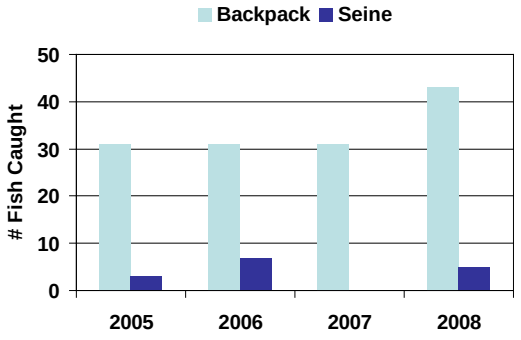

P Reduction Demonstration Project
Benthic Invertebrate Results – MBI Values

Busse Dam

	Ponar Grab	Hester Dendy
2005	6.2	ND
2006	6.7	6.3
2007	7	6.5
2008	6.9	6.1

JFK

	Ponar Grab	Hester Dendy
2005	7.9	6.7
2006	9.3	8.7
2007	5.4	6.7
2008	8.3	6.2

Thorndale

	Ponar Grab	Hester Dendy
2005	7.5	6.0
2006	9.8	6.1
2007	7.2	6.2
2008	7.6	6.1

Lower MBI values are indicative of better water quality

Cost

Major Costs

- Design and Construction: $800,000 - $1M
- Chemical Cost: $450,000/yr
- Extra Sludge Disposal: $132,000/yr

These figures do not account for cost of extra sludge processing

Another drawback of chemical P reduction is truck traffic for delivery:

- Egan required 1,700 g/d ferric chloride. Chemical Delivery every 3 days for relatively small WRP (24MGD capacity)

Conclusions

Following P Reduction at Egan, there was:

- Significant reduction in stream P concentrations at stations downstream of Egan
- P reduction process increases total P in biosolids but greatly decreases the agronomical P availability.
- No significant effect on sestonic algae in Salt Creek
- Diurnal fluctuations of similar magnitude recorded
- Sediment P variable year to year and does not appear to be linked to P-reduction at Egan
- Similar fish and benthic invertebrate data as before P reduction

Case Study: Salt Fork Vermilion River and Copper Slough Branch of the Kaskaskia River

Study by UIUC: Linda Jacobson, Mark David, and Corey Mitchell
Partially funded by Illinois through C-FAR

Periphyton, sestonic algae, canopy cover, turbidity, water depth, temperature, TP, DRP, nitrate, DOC, and silica measured at 10 sites, 10 km apart downstream of WRPs

Two Illinois Rivers in Agricultural Watersheds Receiving Sewage Effluent from Champaign-Urbana WRPs:

- Salt Fork
  - Mean TP= 1.9 mg/L - downstream near WRP
  - Mean TP=0.66 mg/L – 90 km downstream of WRP
- Copper Slough Branch
  - Mean TP= 0.19 mg/L - downstream near WRP
  - Mean TP=0.16 mg/L – 90 km downstream of WRP

Conclusions

Phosphorus not related to sestonic or periphytic chlorophyll *a* in either river

Light limitation due to canopy cover, turbidity, and unstable sediments

Agricultural runoff alone adds sufficient P to both rivers to prevent P limitation of algae

Algae would not likely be P-limited even if point sources completely eliminated P in discharge