Developing a Strategy for Reducing Nutrient Losses in Illinois

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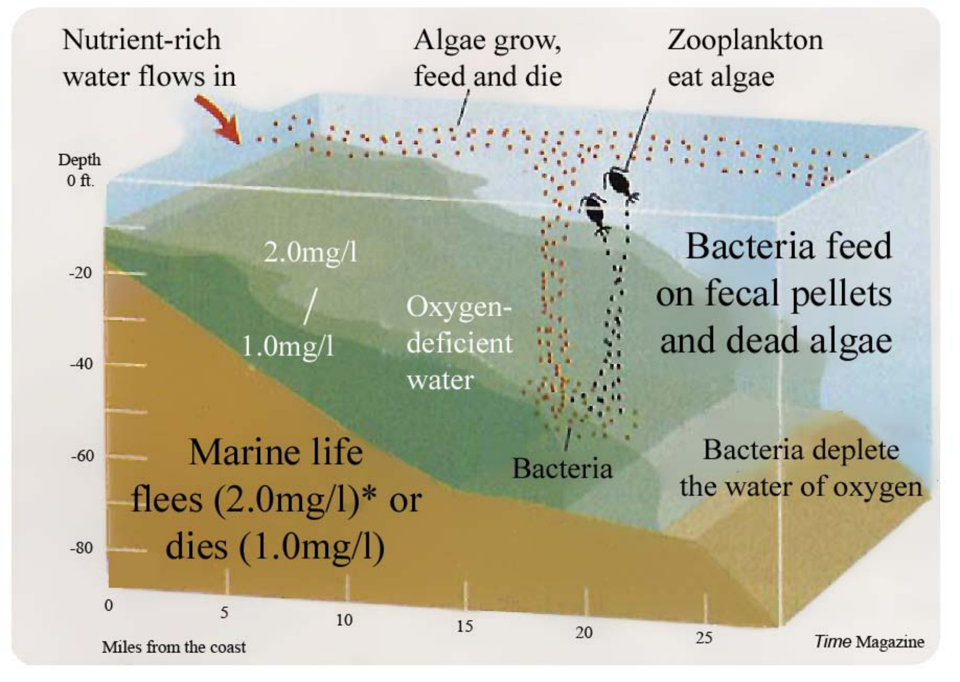
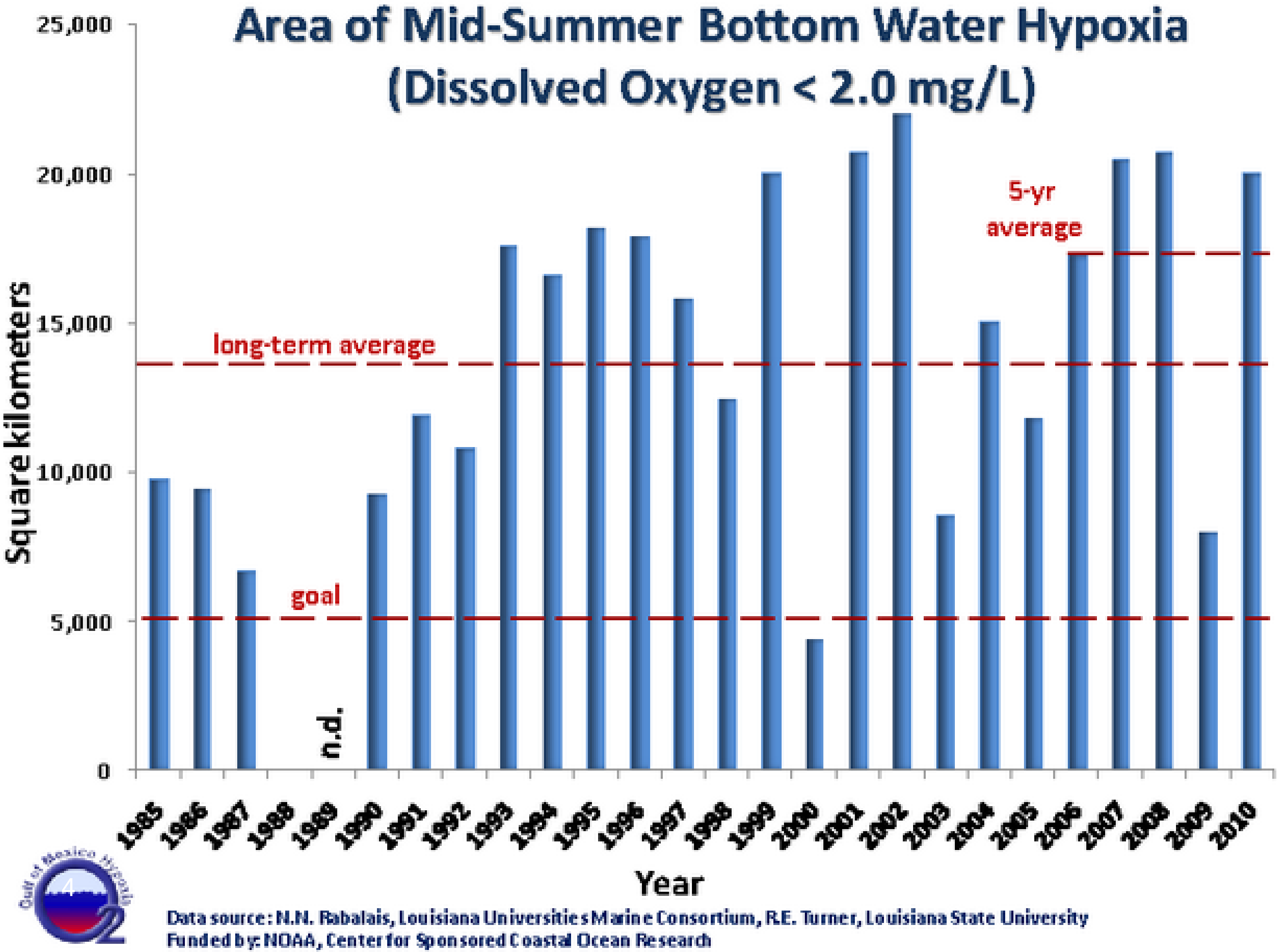
Why?

- **Local impairments**
- **Hypoxia in the Northern Gulf of Mexico**

Hypoxia

- Dissolved oxygen levels below 2 ppm
- Caused by stratification of water column and decomposition of organic materials (algae)
- Excess algal growth caused by excess nutrients





Area of Mid-Summer Bottom Water Hypoxia
(Dissolved Oxygen < 2.0 mg/L)
25,000
20,000
15,000
10,000
5,000
0
Square kilometers
5-yr average
long-term average
goal
n.d.
1985
1986
1987
1988
1989
1990
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1992
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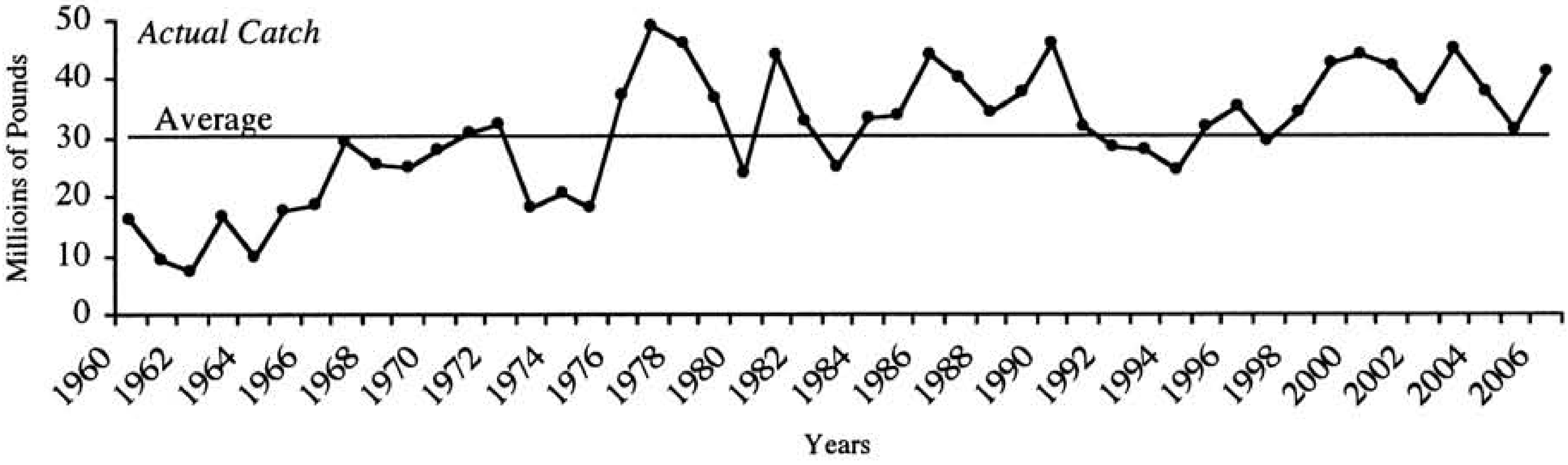
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

The size of the hypoxic zone varies due to:

- Timing and extent of water-column stratification
- Weather conditions in the Gulf
- Temperature
- Amount of precipitation in the Mississippi River Basin

USEPA SAB Hypoxia Advisory Panel warns of "regime shift " in the Gulf

No economic impacts have been demonstrated



Louisiana Shrimp Harvest:
1960-2007

Mississippi River Gulf of Mexico Watershed Nutrient Task Force

Comprised of:

- Federal Agencies (EPA, NOAA, USDA, USACE, DOI)
- States represented by Agriculture or Environment Departments (AR, IL, IA, LA, MN, MS, MO, OH, TN, WI)

Addresses:

- Complex science and policy issues surrounding Gulf Hypoxia
- Collaborative actions to improve water quality

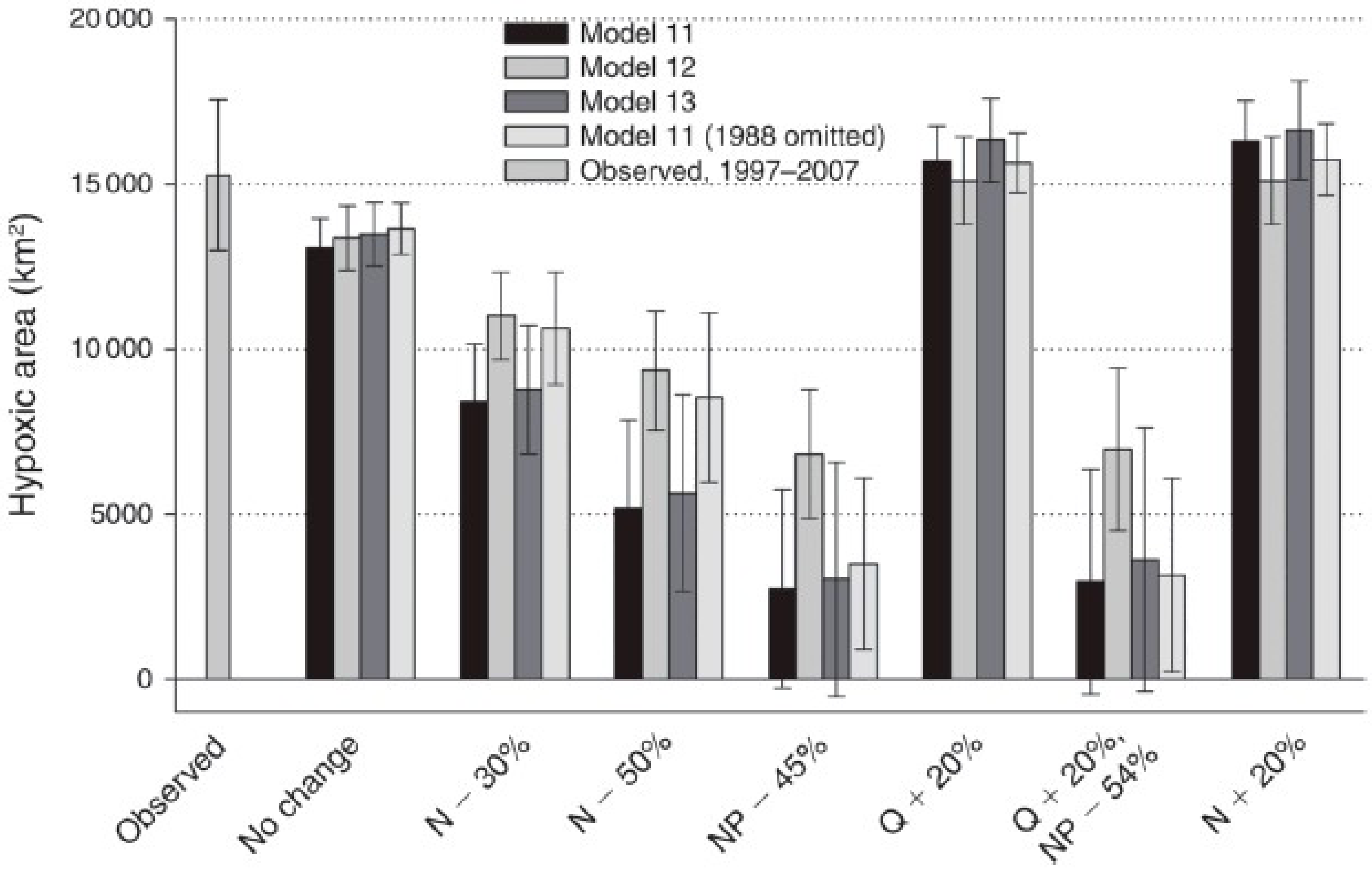

Mississippi River
Gulf of Mexico
Watershed Nutrient
Task Force
2008 Gulf Hypoxia Action Plan

2008 Action Plan Goals

1. Coastal Goal: **Subject to the availability of additional resources, strive to reduce or make significant progress** towards reducing the five-year running average areal extent of the hypoxic zone to less than 5,000 square kilometers by the year 2015
2. Within Basin Goal: To restore and protect the waters of the 31 States and Tribal lands within the Basin through implementation of nutrient and sediment reduction actions
3. Quality of Life Goal: To improve the communities of the MARB, in particular the agriculture, fisheries, and recreation sectors, through a cooperative, incentive-based approach

Hypoxia Advisory Panel says 45 percent reduction in both N and P is needed to reduce size of hypoxic zone to 5,000 square kilometers (about 1900 square miles)

Effects of nutrient reductions and increased stream flow on hypoxia



Actions 1-3

- **Focus on State-level nutrient strategies**
- **Introduce complementary Federal strategies**
- **Utilize existing programs to enhance protection of Gulf and local water quality**

Nutrient Reduction Strategy for Illinois???

- The NRCS Tech Guide is not a strategy!
- No till is not a strategy!
- Phosphorus removal at POTWs is not a strategy!

Definitions of strategy

- **The science and art of military command as applied to the overall planning and conduct of warfare;**
- **A company's overall plan of development… a comprehensive plan or action orientation that identifies the critical direction and guides the allocation of resources of an entire organization.**

- **A strategy is a long term plan of action designed to achieve a particular goal, most often "winning". Strategy is differentiated from tactics or immediate actions with resources at hand by its nature of being extensively premeditated....**

Nutrient Reduction Strategy for Illinois???

- Potential approach
  - Establish Task Force of key decision makers (Agency Directors, organization leaders), and
  - a technical committee of agency staff, researchers and other technical individuals, e.g. wastewater engineer

Potential Participants

- State agencies (IEPA, IDA, DNR)
- Federal agencies (USEPA, USDA-NRCS, USDA-FSA, USDA-NASS, USACE, USFWS)
- Researchers (U of I, State Surveys, USGS,)
- Stakeholders (Farm Bureau, commodity groups, environmental organizations, wastewater agencies, municipalities, IFCA, SWCDs, industrial sources, ….)

Potential Technical Tasks

- Identify critical watersheds
  - watersheds with nutrient-impaired water bodies (303d list/305b report)
  - watersheds with the highest nutrient loads delivered to the Gulf of Mexico

- Identify sources of nutrients, e.g. POTWs, cropland) within critical watersheds

A possible scheme for prioritizing watersheds

- 1) watersheds with a nutrient impairment and high nutrient loads delivered to the Gulf,
- 2) watersheds with a nutrient impairment, but not high delivery to the Gulf and
- 3) watersheds with high nutrient delivery to the Gulf, but not impaired.

Assess current conditions

- Determine current management practices within critical watersheds, e.g. wastewater treatment, erosion rates, cropping and nutrient management practices

Lake Bloomington Watershed

Mark David, Gregory McIsaac and Corey Mitchell

University of Illinois-NRES

Baseline conditions
High nitrate and low phosphorus losses

44,764 acres
93% cropland
Low erosion rates
More than 50% tile-drained
Well-buffered

Nutrient Management Practices

- 77% fall apply N, nearly all use a nitrification inhibitor
- N rates at University recommendations
- P surface -applied, recent 21% reductions in rates to U of I recommendations

Estimate potential reductions

- Estimate the effectiveness and costs of various management practice changes
- Estimate the potential for management practice changes and nutrient reductions through existing programs
- Scale-up estimates to a watershed scale to, for example, meet TMDL reduction targets

Nitrate reduction practices (tile drainage)

Practice	% reduction
nitrification inhibitors	10
spring vs. fall fertilization	20
recommended rate vs. above	0
no-till vs. conventional	0
cover crops	25
water table management	40
shallow or wide tiles	25
conversion to CRP	95
conversion to perennial crops	80
constructed wetlands (20:1)	50
bioreactors	No data

Phosphorus reduction practices

Practice	% reduction	
	Tiled	Runoff
recommended rate vs. above		5
inject phosphorus fertilizer		20
cover crops	5	25
shallow or wide tiles	+	-
conversion to CRP	50	75
conversion to perennial crops	50	95
WASCOBs		75
sedimentation basin		95
riparian buffers		50
constructed wetlands (20:1)		20

Practice	Cost
Fall to spring fertilizer N	$25/ac
Recommended P rate vs. above	$12/ac/4 yrs
Inject P fertilizer	$14/ac/2yrs
Wetlands	$6,000/ac + $300/ac rent
Drainage mgt	$250/ac
Sediment basin (250 ac)	$3.3 million
Cover Crops	$50/ac
CRP/perennials	$300/ac/yr

To achieve a 30% reduction in nitrate

Practice	Plan 1 (acres)	Plan 2 (acres)	Plan 3 (acres)
Fall to spring fertilizer	32,134	32,134	32,134
Wetlands		4,003	
Drainage mgt		4,171	
Sediment basin	40,718		
Cover crops		7,304	29,213
Total Cost/lb/yr	$1.97	$3.73	$7.86

50% reduction Nitrate

	Non-targeted		Targeted	
Practice	Area	Annual cost/lb	Area	Annual cost/lb
CRP	6,919	$15.60		
Fall to spring fertilizer	26,805	$3.59	32,134	$2.85
Cover Crops	19,027	$15.79	23,228	$13.06
Wetlands	4,003	$4.03	4,003	$2.16
Drainage mgt	4,171	$3.17	4,171	$1.80
Sediment basin	40,718	$1.42	40,718	$1.26
Total		$8.59		$4.67

To achieve a 45% reduction in TP

Practice	Area (ac)	Reduction lbs/yr	Total cost 30 years	Annual cost/lb
No P fertilizer > 70	17,945	282	$1,663,950	$193.01
Inject P	21,409	1,323	$4,548,600	$114.62
Sediment basin	40,718	5,344	$4,523,500	$28.22
Grand Total		6,949	$10,706,050	$51.36

To meet TMDL for phosphorus

	Acres	Total P reduction	%TP	30-year cost	Annual cost/lb
Perennial crops	41,731	12,491	88.5	$379,980,000	$1,013.99
Sediment basin	40,718 served	692	4.9	$4,523,500	$217.82
Grand total		13,183	93.4	$384,503,500	$972.18

Also achieves 79.8% reduction in TN

Dual nutrient scenarios

	Percent reductions		Total cost (30 years)	Annual cost per acre
	TN	TP		
Targeted N	50%	52%	$70,509,163	$56.32
Non-targeted	50%	52%	$117,671,310	$93.99
TMDL	79%	93%	$384,503,500	$307.13

- Inventory existing programs with the potential to reduce nutrient losses
- Determine the gap between existing capabilities and efforts needed to reach watershed goals
- Identify obstacles to achieving additional nutrient reductions
- Identify opportunities for innovative and non-traditional approaches

Illinois is better prepared than most states:

- Monitoring by IEPA, ISWS, USGS, Universities and others
- CFAR Research
- IAWA analyses
- Understanding of nutrient source, fate and transport, esp. nitrate
- Involved stakeholders

Lots yet to do

- ?? Streambank erosion and phosphorus
- Economic analyses
- Whole system analyses
  - Avoiding unintended consequences

Desired Outcomes

- **Shared understanding among agencies and stakeholders of nutrient issues and potential solutions**
- **Consensus on priority watersheds**
- **Consensus on most cost-effective and acceptable solutions**
- **Estimates of total costs/resources to achieve desired nutrient reductions**
- **Identification of potential ways to acquire needed resources**

WHY??

- **If you are going to spend billions of dollars, you should have a plan**