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Des Plaines River Watershed Workgroup NARP Workplan

February 20, 2020

DES PLAINES RIVER WATERSHED WORKGROUP

Agenda

- Introduction
- DRWW NARP Objectives
- Existing Data Review
- Modeling Tools for NARP Development
- Recommended NARP approach

Introduction

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What is NARP ?

- Nutrient Assessment Reduction Plan – Dec 31, 2023
- 2018 Agreement between Illinois Association of Wastewater Agencies (IAWA), Illinois Environmental Protection Agency (IEPA) and Environmental Groups
- Special conditions in NPDES permits to address the P-related impairments
  - Dissolved Oxygen
  - Nuisance Algae
- Tangentially also a requirement in MS4 permit to meet TMDL (or alternative) requirements
- Flexibility to develop watershed-specific targets

Lower Des Plaines River.
Photo by Cynthia Skrukrud.

Permit Requirements

- If NARP exists
  - Effluent limits based on the NARP and any applicable data
- If no NARP
  - Effluent requirements based on Nutrient Science Advisory Nutrient Science Advisory Committee
  - Discharge cannot “cause or contribute to” violations of dissolved oxygen or narrative water quality standards

When is a NARP Required?

Based on Instream Sampling Collected by IEPA

PHOSPHORUS RELATED IMPAIRMENT

Listed on 303(d) list for:

- Dissolved oxygen
- Offensive condition (algae and/or aquatic plant growth)

RISK OF EUTROPHICATION

Information that plant, algal, or cyanobacterial growth is causing or will cause violations of water quality standards

- pH
- Dissolved oxygen
- Chlorophyll-a

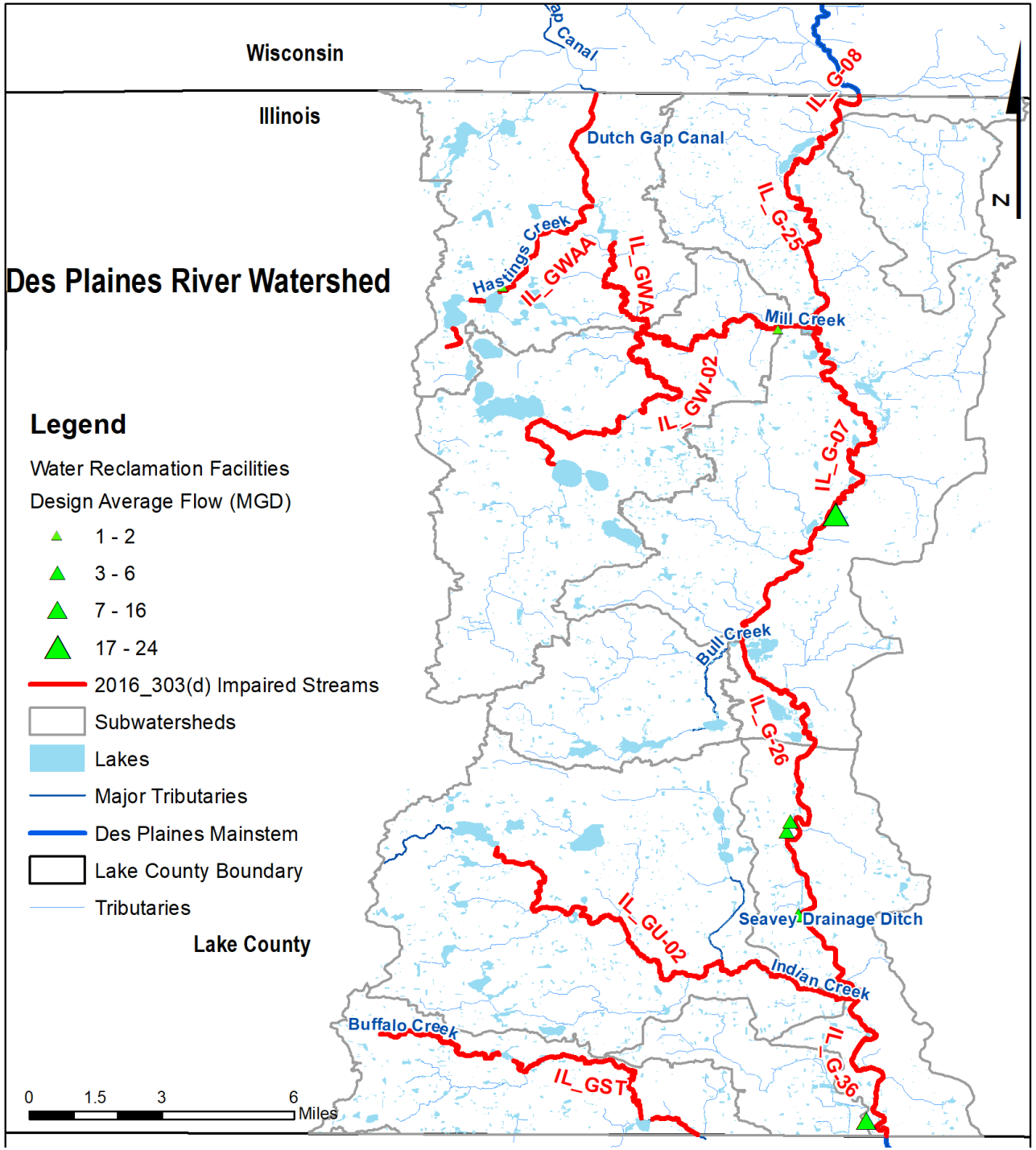
Impaired Reaches

- Impaired Reaches

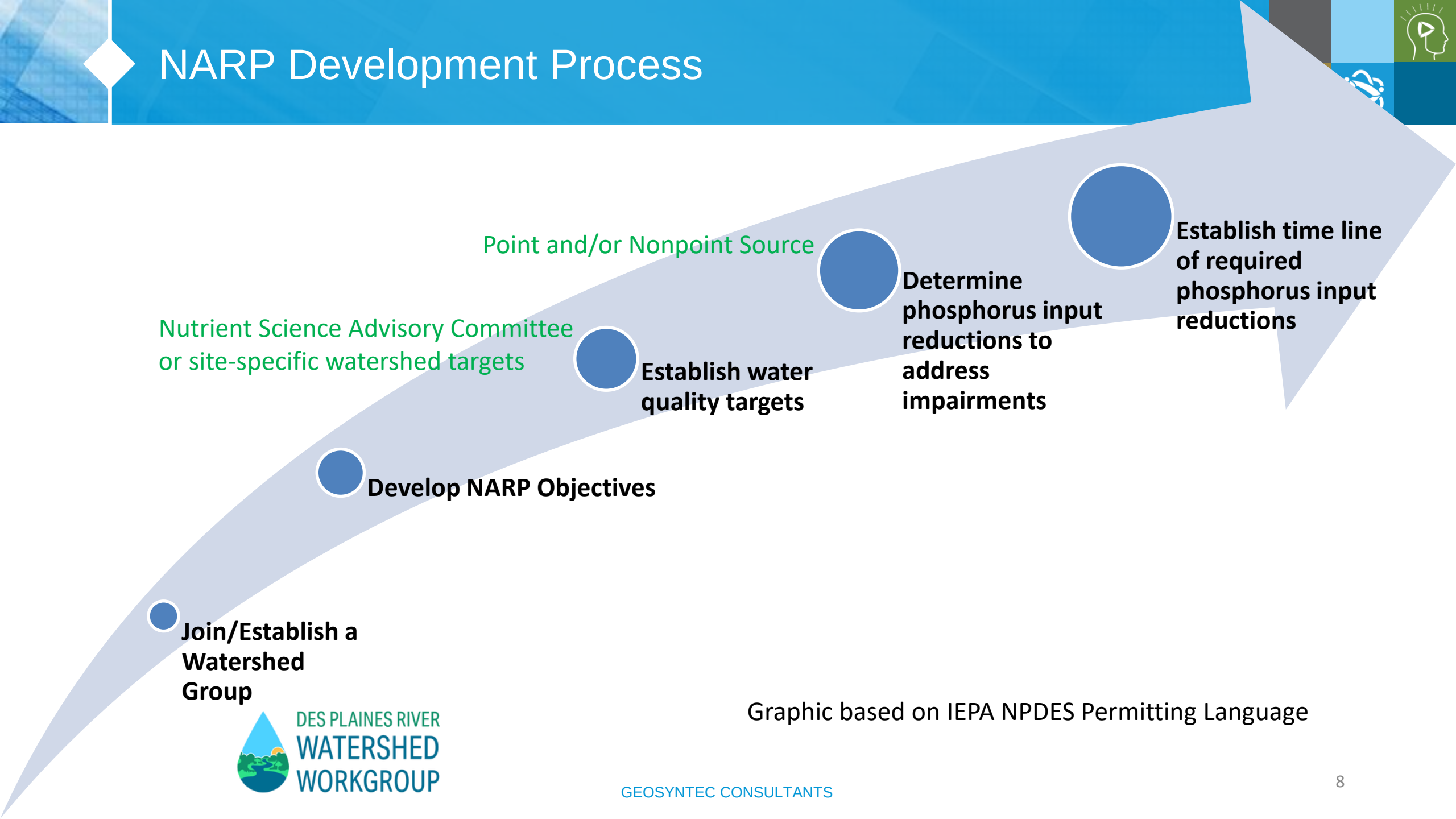
Segment	Miles	Impairment
IL_G-25	6.9	Arsenic, Mercury, Oxygen, Dissolved, Sedimentation/Siltation, Total Suspended Solids (TSS)
IL_G-35	5.0	Cause Unknown, Mercury, Phosphorus (Total), Polychlorinated biphenyls
IL_G-36	7.2	Fecal Coliform, Mercury, Phosphorus (Total), Polychlorinated biphenyls
IL_G-07	10.8	Arsenic, Chloride, Fecal Coliform, Mercury, Phosphorus (Total), Polychlorinated biphenyls
IL_G-08	1.0	Fecal Coliform, Mercury, Oxygen, Dissolved, Total Suspended Solids (TSS)
IL_G-26	6.0	Cause Unknown, Mercury, Polychlorinated biphenyls
IL_GWA	5.5	Arsenic, Manganese, Phosphorus (Total), Sedimentation/Siltation
IL_GST	10.7	Total Suspended Solids (TSS)
IL_GW-02	13.0	Oxygen, Dissolved, pH
IL_GU-02	11.3	Oxygen, Dissolved
IL_GWAA	4.0	Arsenic, Phosphorus (Total), Sedimentation/Siltation

NARP related impairment

Based on IEPA data only*



NARP Development Process



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Graphic based on IEPA NPDES Permitting Language

DRWW NARP Objectives

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DRWW Objectives

Based on DRWW NARP Subcommittee Direction

NARP Objective
IPS Tool Objective

1) Establish watershed-specific water quality targets
2) Determine phosphorus reductions needed to achieve site-specific water quality targets or if targets are infeasible
3) Identify mechanisms to facilitate cost-effective implementation of the NARP, including assessing feasibility of BMP implementation, prioritization, and costs; trading; and funding
4) *Assess the other measures needed to address aquatic life impairments*
5) *Identify specific achievable projects to address water quality and aquatic life impairments and establish timeline for implementation*

Potential DRWW NARP Objective 1

Establish watershed-specific targets for water quality

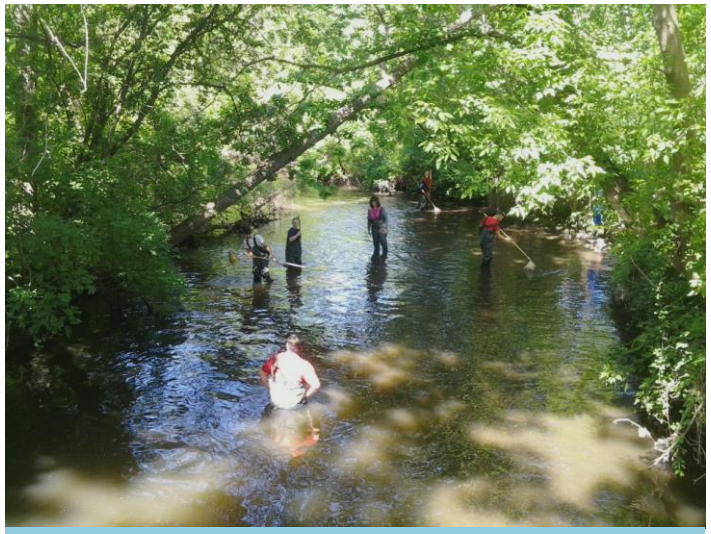
- Dissolved oxygen
- Chlorophyll-a (Algae)
- Total phosphorus (dissolved reactive phosphorus)
- Possibly nitrogen

Non Wadeable Streams

Sestonic chlorophyll-a*

*Some streams might require both sestonic and benthic chlorophyll

Wadeable Streams

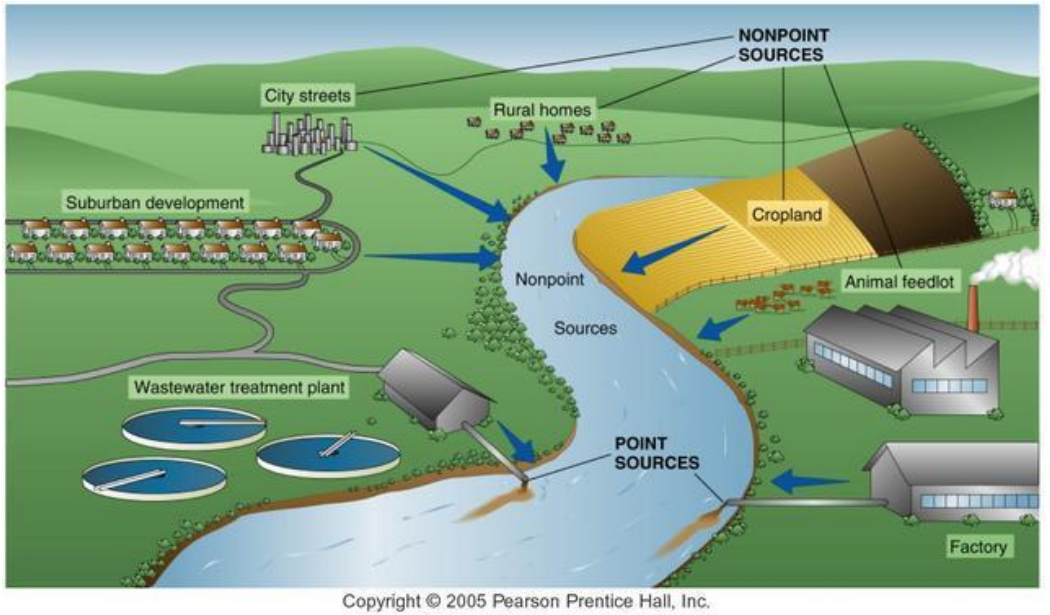


Benthic chlorophyll-a

Potential DRWW NARP Objective 2

Determine phosphorus reductions needed to achieve site-specific water quality targets or if targets are infeasible

- Point sources
  - Wastewater treatment plants
  - Pesticide application
  - Industrial

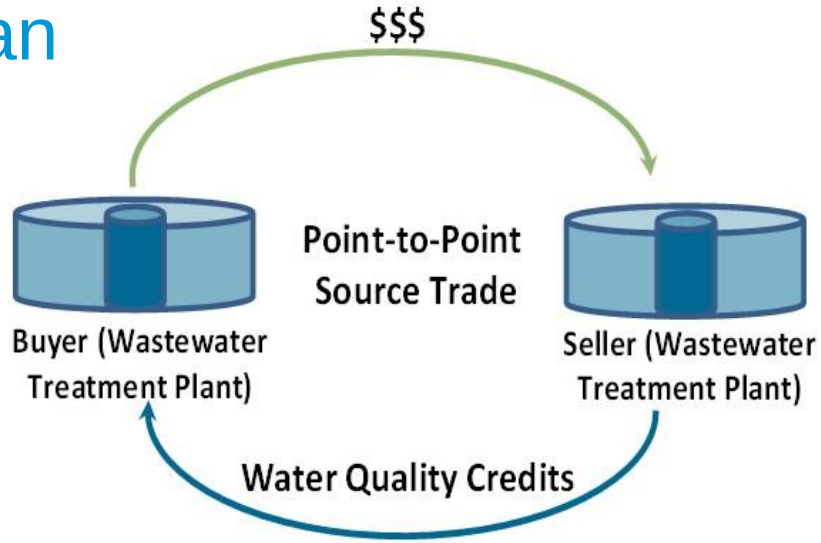


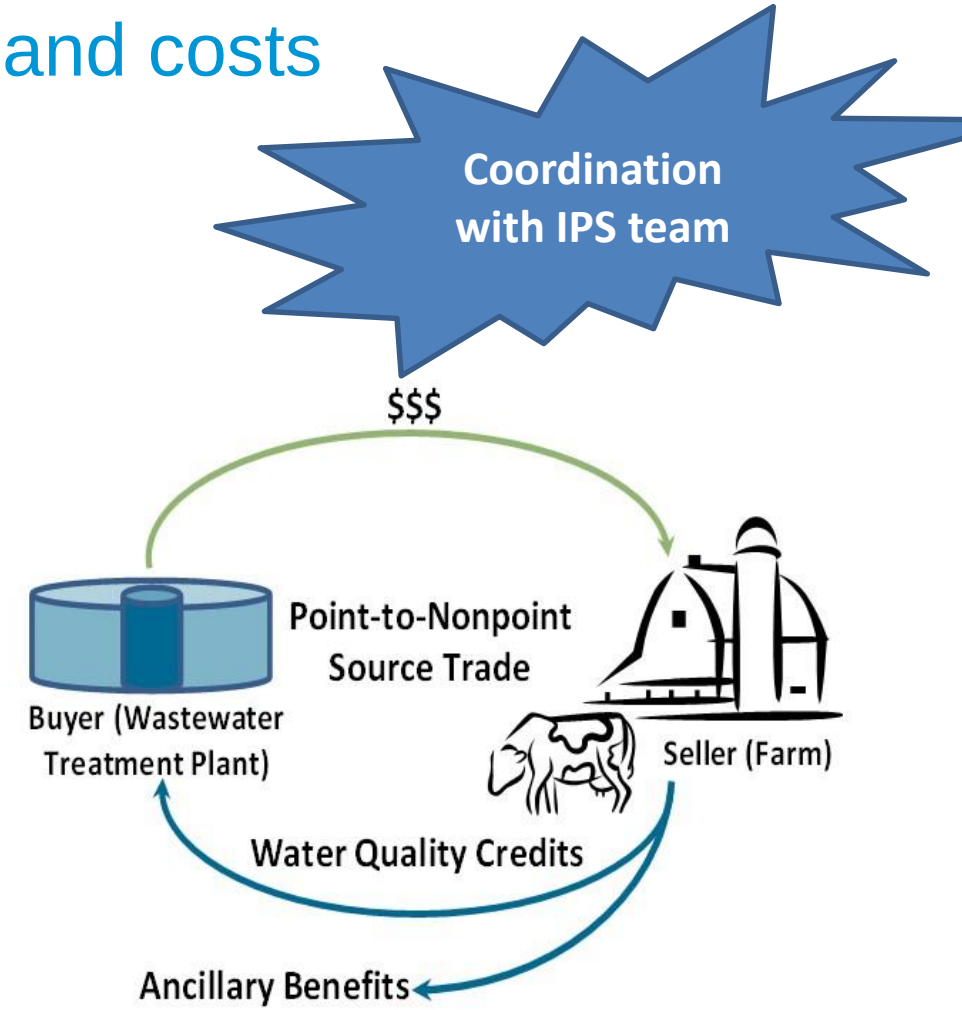
- Nonpoint sources
  - Small Municipal Separate Storm Sewer Systems (MS4s)
  - Agriculture

Potential DRWW NARP Objective 3

Identify mechanisms to facilitate cost-effective NARP implementation:

- Assess feasibility of BMPs, prioritization, and costs
- Point-to-point trading program
- Point-to-nonpoint trading program
- Funding plan





Existing Data Review

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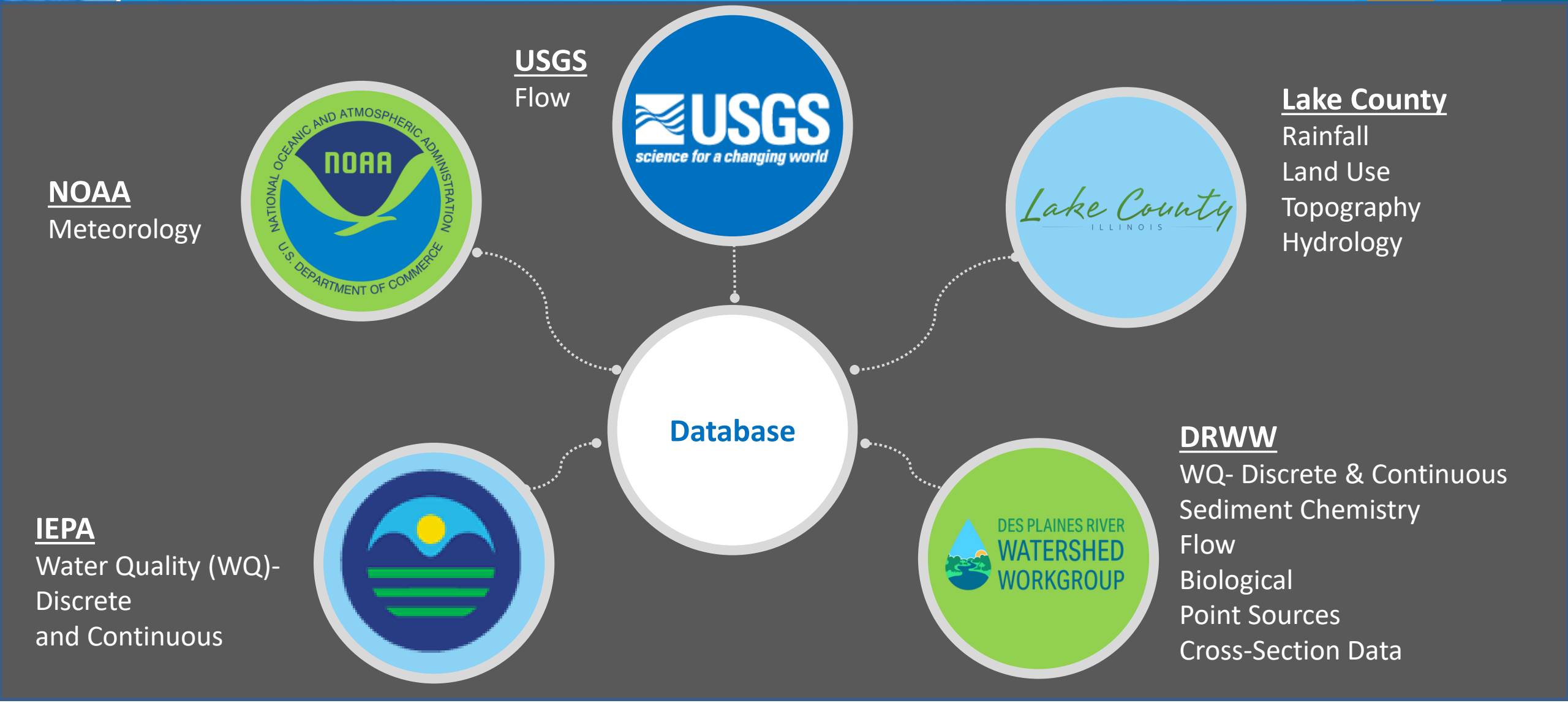
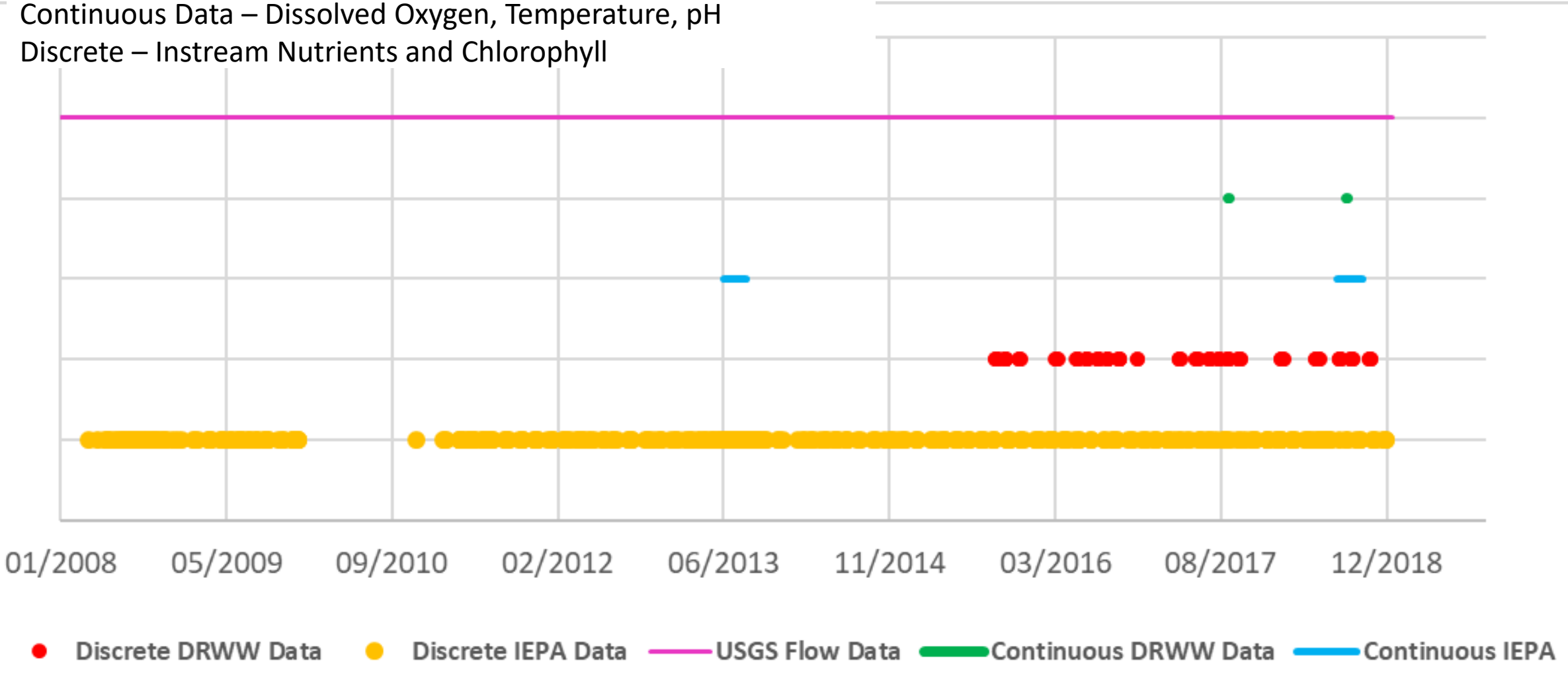
Data Sources for NARP Development

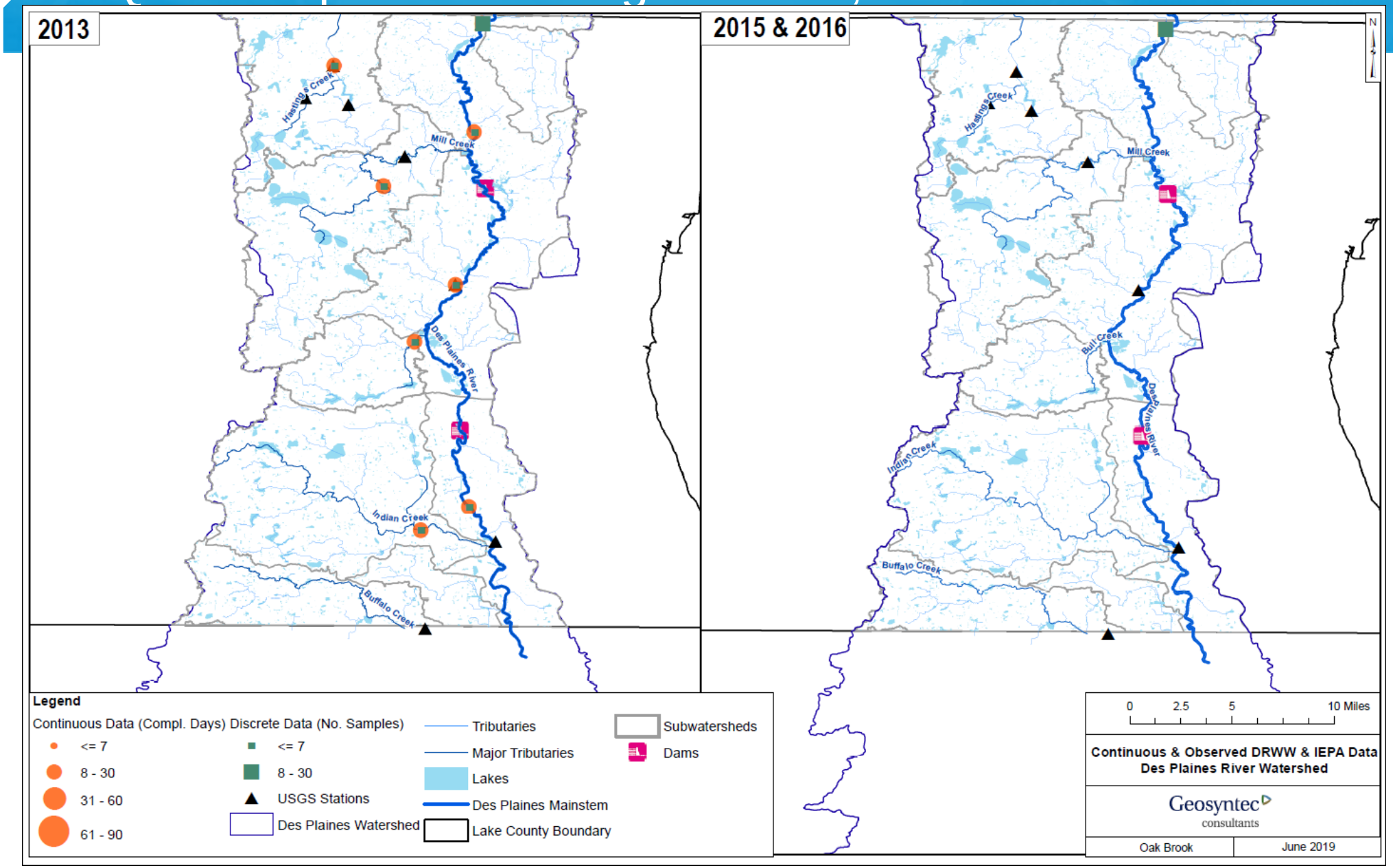


Temporal Coverage

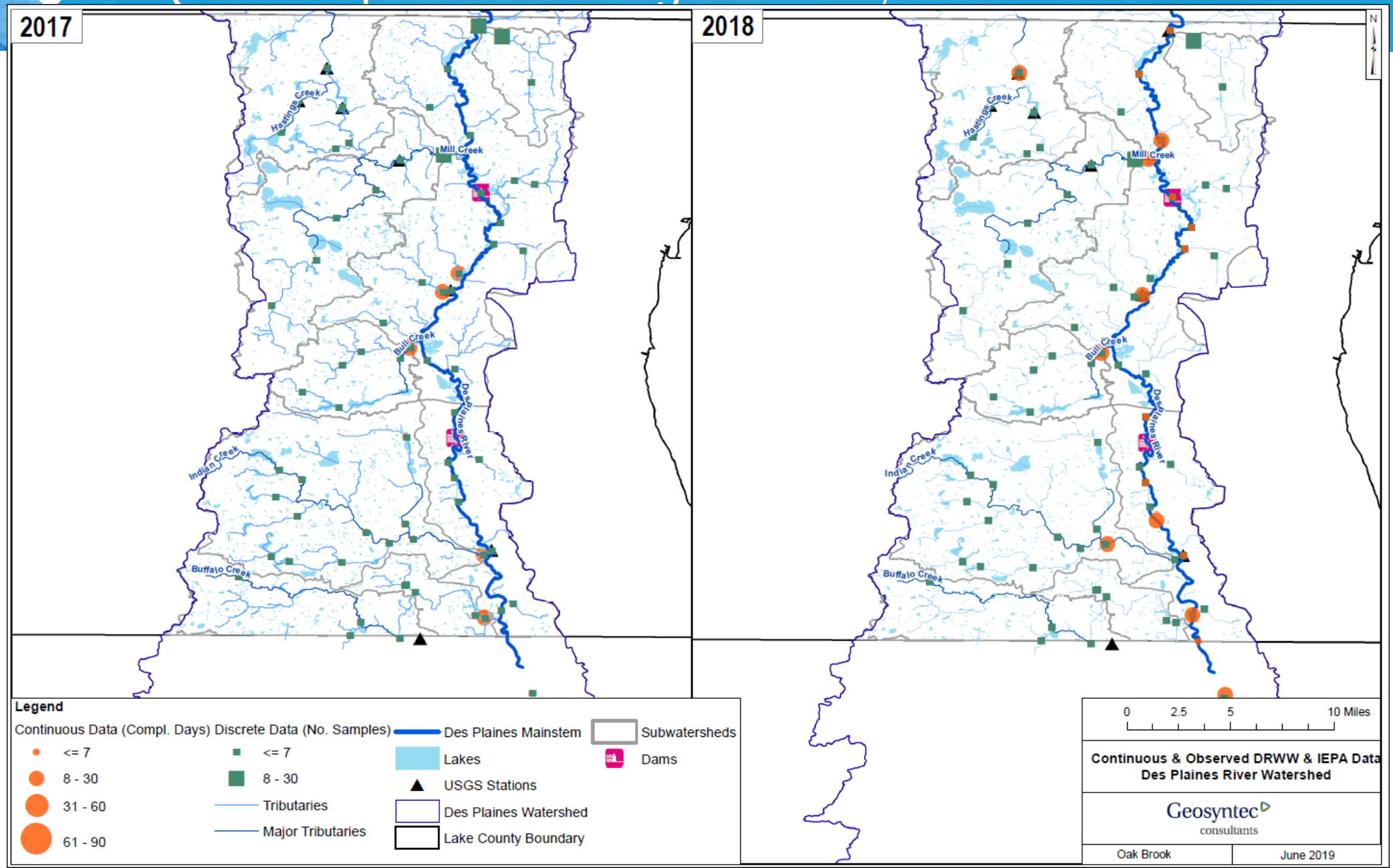
Continuous Data – Dissolved Oxygen, Temperature, pH
Discrete – Instream Nutrients and Chlorophyll



WQ Data Spatial Coverage – 2013, 2015 & 2016



WQ Data Spatial Coverage – 2017, 2018



Data Review Summary and Recommendations

- Good spatial coverage of instream water quality discrete and continuous stations for model calibration and understanding of the receiving water system

- Continue to collect additional data for 2019 and 2020
  - Cross-section data for mainstem Des Plaines River
  - Strategic data collection in 2020 for NARP models
  - Sites in Bull Creek watershed can be removed from additional monitoring since it is not listed as impaired

- Recommend installing a continuous monitoring water quality gauge at the upstream boundary
  - Tie in with the existing USGS Gauge 05527800 Des Plaines River at Russell, IL

Modeling Tools for NARP Development

Cannot collect data everywhere, all the time – modeling is therefore needed to fill in spatial and temporal gaps

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What is a Model?

- Mathematical approximation of reality

$$\frac{dC}{dt} = r(C_m - C) - K \cdot BOD(t)$$ Dissolved Oxygen Model

- Based on laboratory or field data and best professional judgement
- Wide range in levels of complexity
  - Simple spreadsheet
  - Computer programs

Why do we need models for NARP ?

- Fill in spatial and temporal data gaps
- Simulate and better understand the linkage between phosphorus and dissolved oxygen/nuisance algae
- Evaluate watershed management scenarios' effectiveness in reducing impairments
  - Nutrient load reductions
- Help with policy or management decisions
  - Priority projects
  - Ordinances
- Support NPDES permitting and water quality trading
- If needed, explain why (or why not) something unexpected occurred

Image: Chicago Tribune

Types of Model

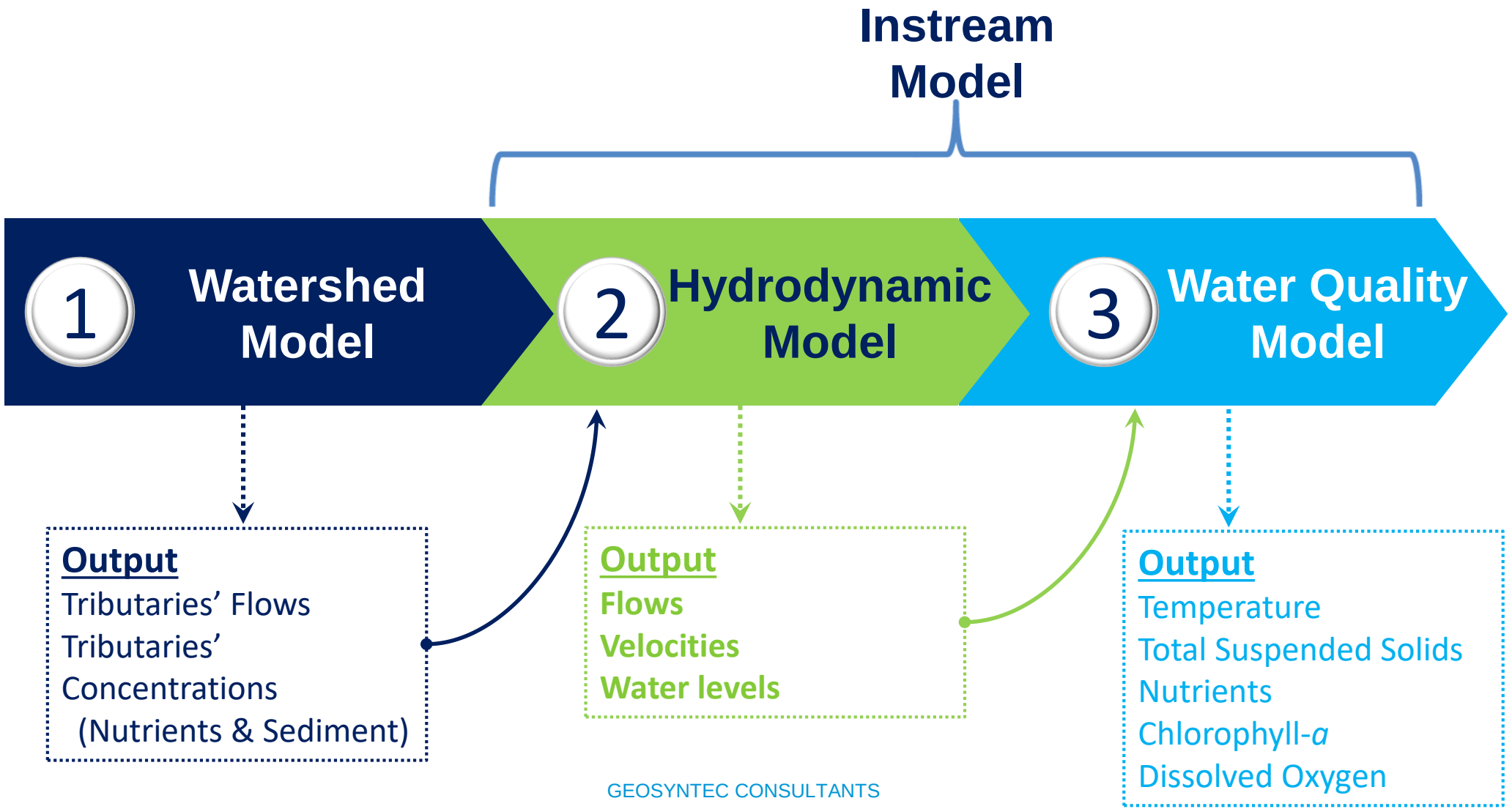
- Watershed Model
  - Calculate flows and loads to the mainstream of river and key tributaries
  - Provide a tool for testing and prioritizing management scenarios (nutrient load reductions)

- Instream Model
  - Simulates instream hydraulics and water quality
  - Relative influences of loadings, hydrology, and other inputs parameters on the algal and dissolved oxygen levels

Image Courtesy : Lake County

Model Linkage

Complexity of DRWW Model Requires a linked modeling framework



Model Evaluation Process

- Reviewed model selection guidance from
  - US Environmental Protection Agency
  - Water Environmental Research Foundation (WERF)

- Experience and lessons learned from previous projects models
  - DuPage River Salt Creek Workgroup
  - Fox River Watershed Group
  - Mill Creek Watershed Support
  - Peer review of Illinois River (OK/AR) watershed TMDL models

Watershed Model Options

- Developed model selection criteria to meet NARP objectives
- Refined evaluation
- Preliminary Recommendation – HSPF
- Added SWAT based on Lake County SMC recommendation

Model	SWAT	HSPF	WARMF	AGWA
Spatial Component	●	●	◒	◒
Sub Daily Timestep	●	●	◒	◒
Instream Water Quality	◒	●	◒	◒
Sediments	◒	●	◒	◒
Nutrient Output by Land Use	●	●	◒	◒
Auto-calibration	●	●	○	○
User Support/Training	●	◒	●	●
GIS Interface	●	●	●	●
Software Updates	●	◒	○	○
Model Score	25	25	18	18

Instream Water Quality Models Options

- Model choices for criteria specified
  - CE-QUAL-ICM
  - CE-QUAL-W2
  - ECOMSED
  - EFDC
  - WASP7
  - QUAL2kw
- Used WERF's Nutrient Modeling Toolbox (NMT) to select instream model
- Preliminary recommendation: QUAL2kw
  - Dynamic version of QUAL2K which is typically applied for similar applications
  - QUAL2kw is being used the FRSG* and DRSCW**
  - Level of effort required to setup is less as compared to other models

* Transitioned from steady-state to time variable

**Uses a steady state version of QUAL2kw

Recommended NARP Approach

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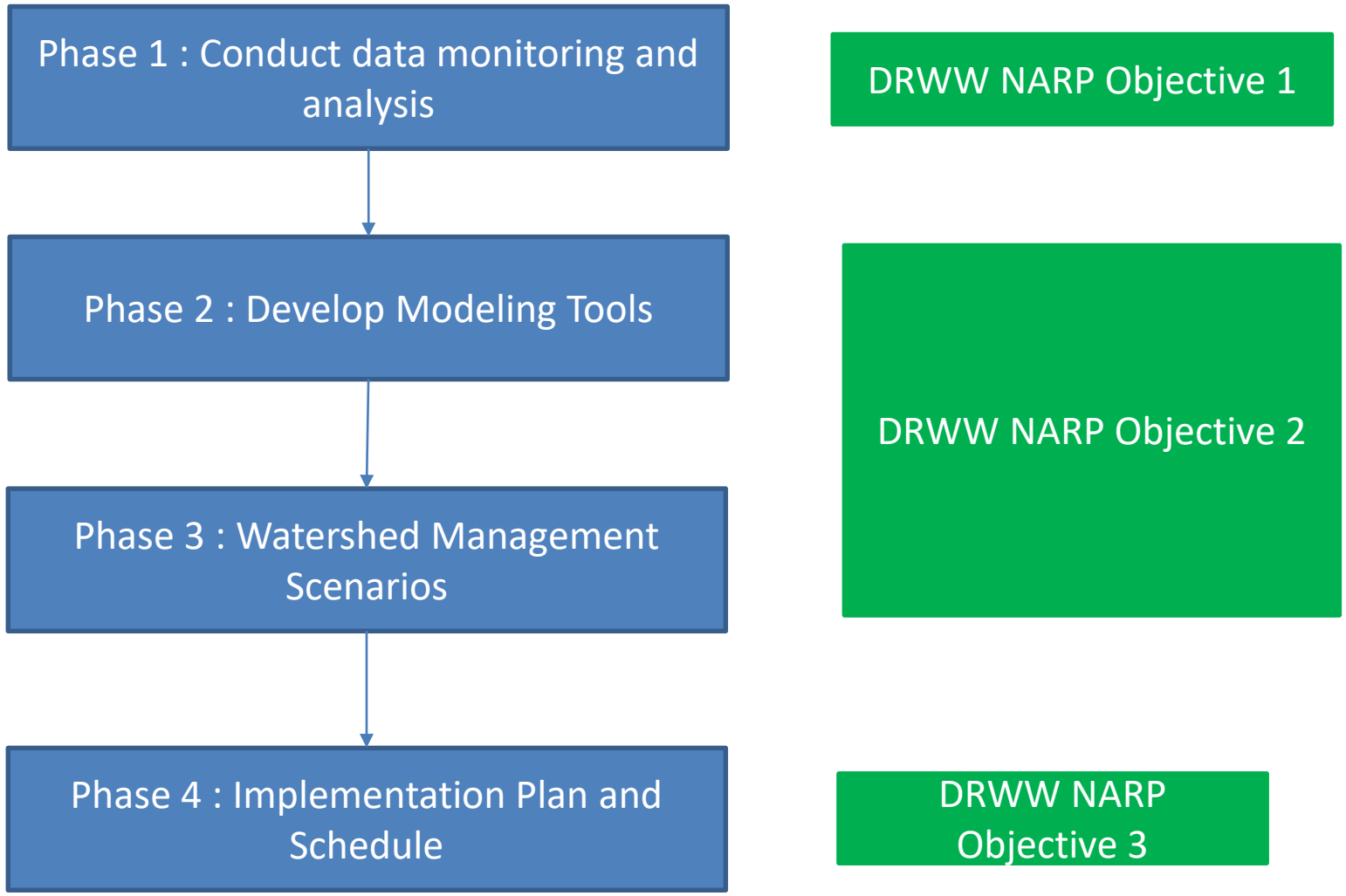
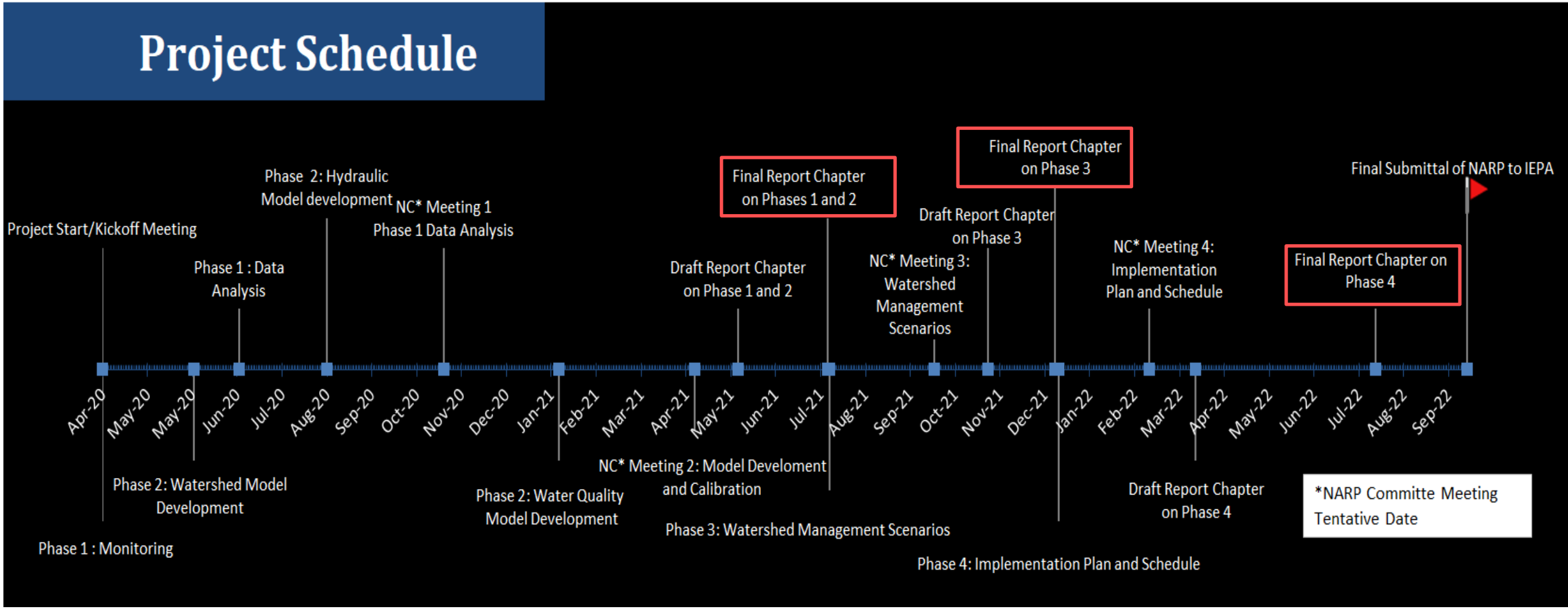
Recommended Steps for DRWW NARP



Estimated Cost – $559,900

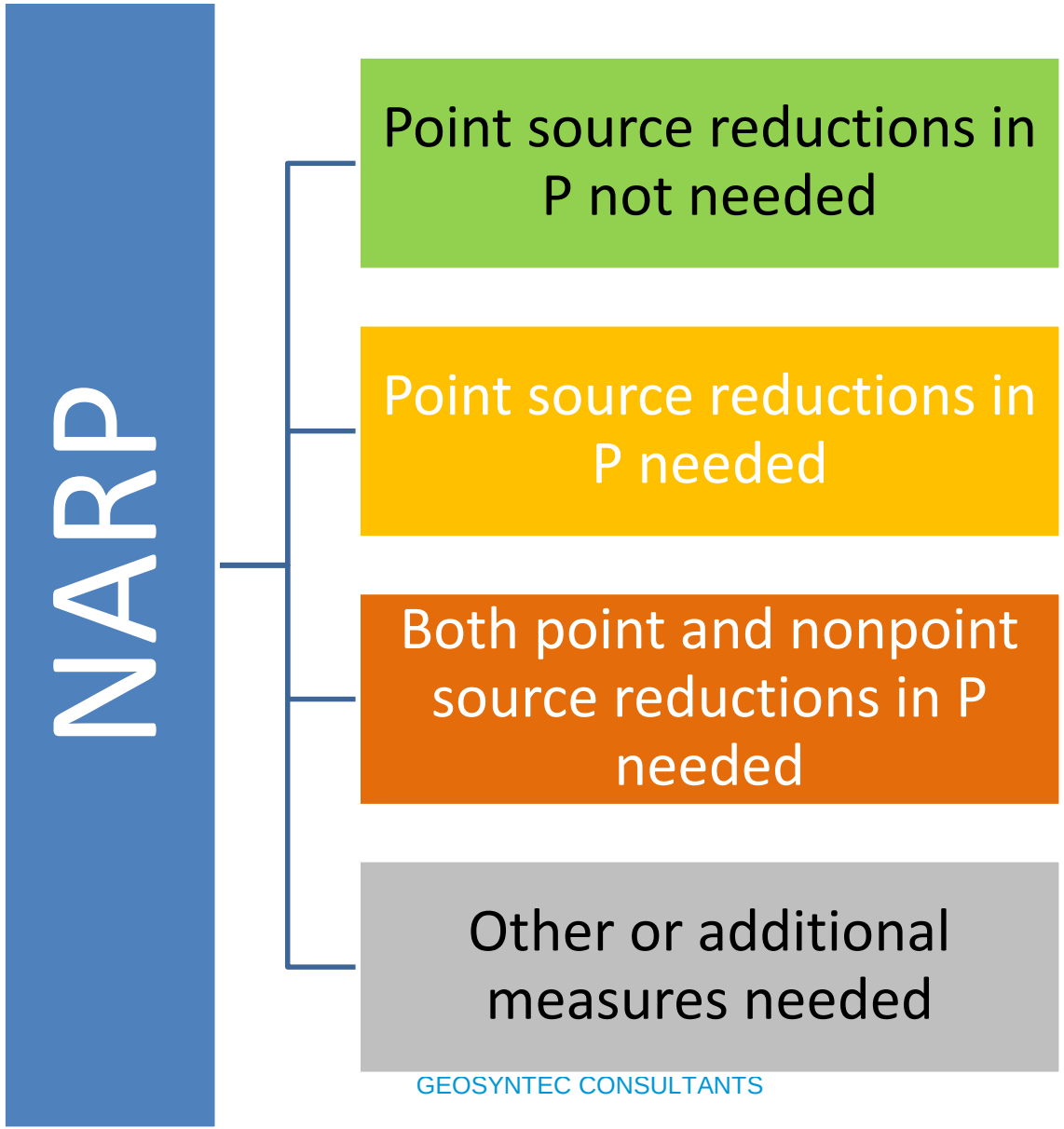
Phase	Description	2020	2021	2022
1	Conduct data monitoring and analysis	$265,800		
2	Develop Modeling Tools	$100,800	$75,400	
3	Watershed Management Scenarios		$39,700	
4	Implementation Plan and Schedule			$77,800
Total Budget Estimate for Year*		$366,600	$115,100	$77,800
Planned Budget		$160,000		
Additional Budget required for NARP		$206,600	$115,100	$77,800

Schedule



NARP Workplan Report

Possible NARP Outcomes



Questions

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