

# Balancing Priorities: Developing a Monitoring Network to Meet Multiple Needs

Chattanooga 2004 National Water Quality  
Monitoring Workshop  
Monday, May 17

- Session Organizers

- Chuck Spooner, Jim Harrison, David Wangsness, Al Korndoerfer

# AGENDA

Time		Presenter(s)/ Facilitator(s)
12:30-1:15	Introduction to session <ul style="list-style-type: none"> <li>• Introduction of workshop participants—why are you here?</li> <li>• Defining the terms we will use</li> </ul>	Spooner
1:15-1:30	<ul style="list-style-type: none"> <li>• Multi-Objective Planning - The Science and Practice</li> </ul>	Spooner
1:30 -2:00	<ul style="list-style-type: none"> <li>• Examples of State Monitoring Decisions</li> <li>• <b>Sampling Strategies for Estimating Acute and Chronic Exposures of Pesticides in Streams</b></li> </ul>	State Reps. Wangness
2:00 -2:45	<ul style="list-style-type: none"> <li>• Applying Theory to Practice</li> </ul>	General Discussion
2:45-3:15	<ul style="list-style-type: none"> <li>• Integrating Monitoring Tools to Meet Multiple Needs: Roles for Predictive Tools</li> </ul>	Harrison
3:15	<ul style="list-style-type: none"> <li>• What to look for during the conference</li> </ul>	Spooner

# Defining Today's Terms

- **A Network**
  - The stations our organization owns or uses
    - Specialized subcategories
    - Sites with common analytic goals (e.g. trends, compliance, etc.)
  - Stations that are used together in some way
    - Paired sites ( e.g. Upstream / Downstream, Before & After)
    - Sites that are a part of a probabilistic sample set

# Defining Today's Terms

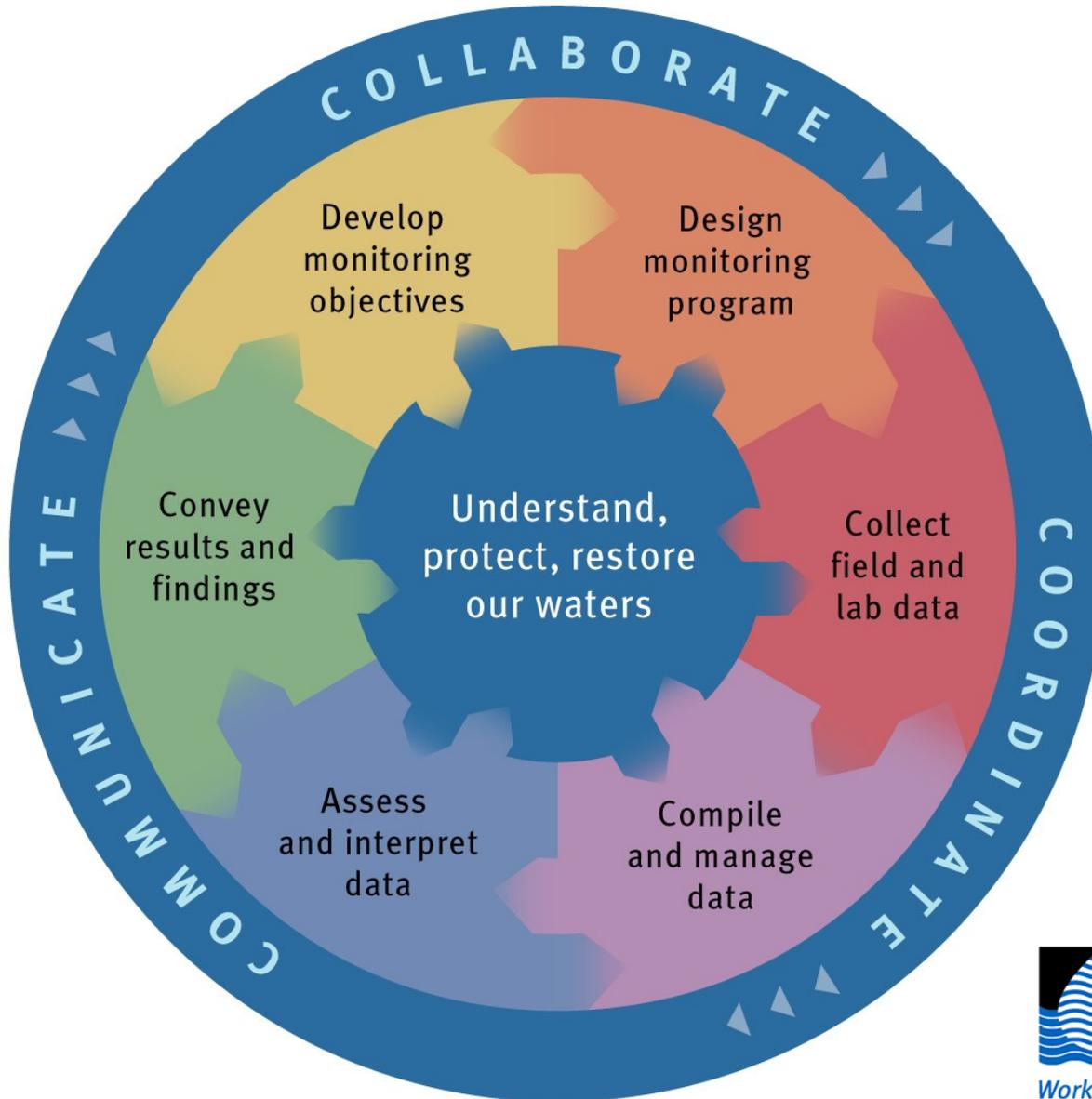
- **Comparability**
  - Parameters monitored
  - Timing (frequency, duration of record)
  - Precision
  - Detection levels
  - Methods
    - Filed
    - Laboratory
  - Etc.
- **Metadata**
  - Data describing the results obtained

# Multi-Objective Planning

## The Science and Practice

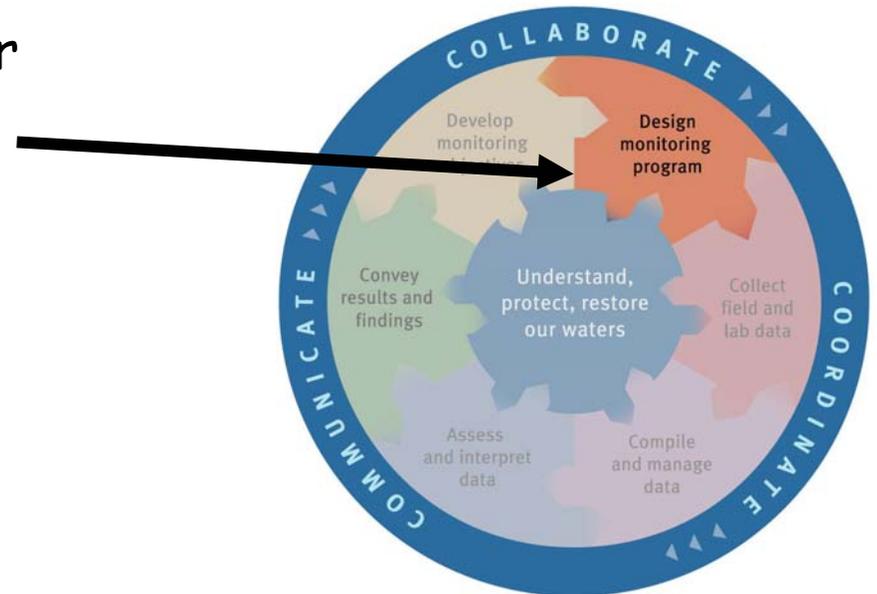
- Pareto-Optimal Solutions
  - Multi-Objective optimization
  - Used in robotics
  - Satellite coverage
  - Pharmacology
  
- Principals and Guidelines for Water and Related Land Resources Implementation Studies
  - Water supply studies
  - Flood control studies
  - Habitat impacts

# The Framework for Monitoring



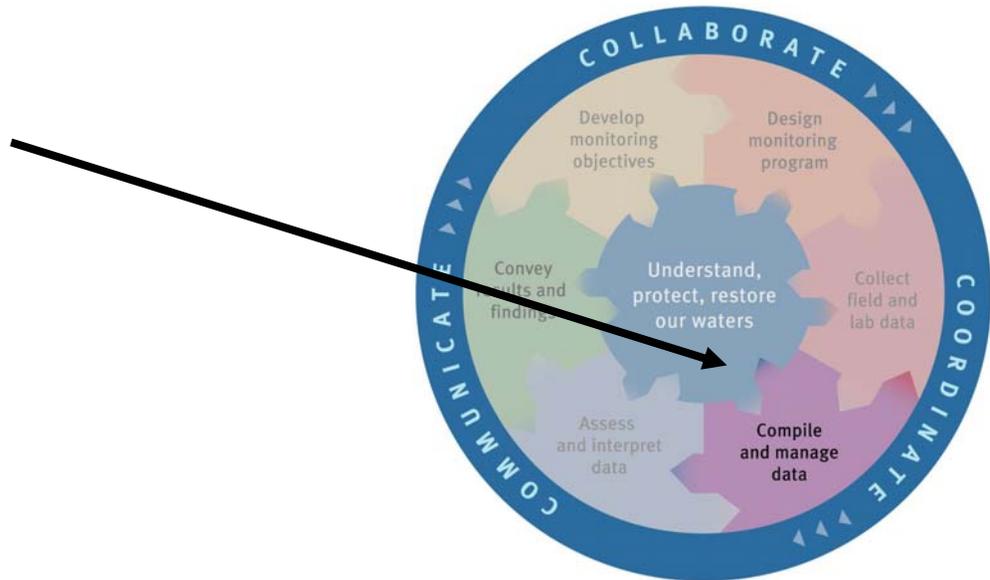
# Design Monitoring Program

- Sampling network design
  - Site selection, what to monitor
  - How often, for how long



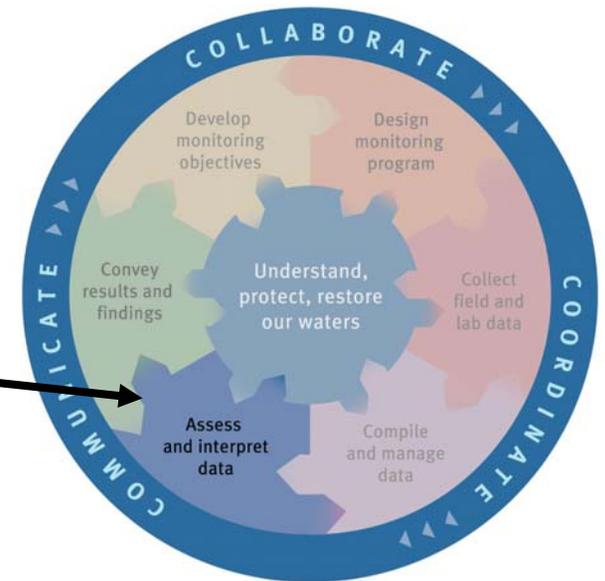
# Compile and Manage Data

- Access to data
- Data assembly
- Data Verification



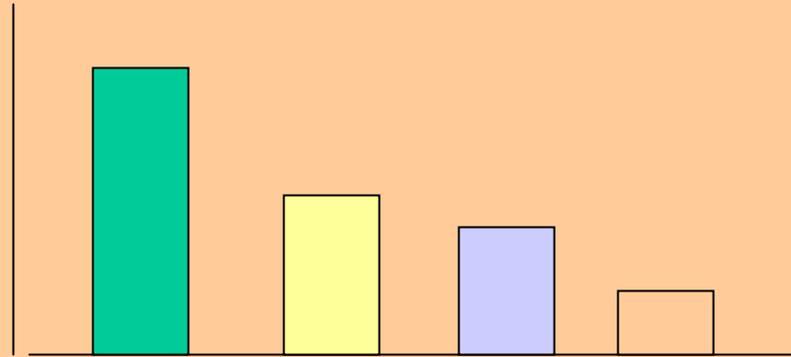
# Assess and Interpret Data

- Summary statistics
  - Max, min, mean, range
  - Parametric/non-parametric
- Meets State Standards?
- Threshold (action) levels
- Time series plots
- Indicators/indices



# The Science and Practice Pareto-Optimal Solutions

- **Pareto Charts**
- Rank critical issues
  - Parameter coverage
  - Precision
  - Timing
- Prioritize
- Display groupings of data
- Display frequencies of responses
- Common assumptions on basic elements are needed

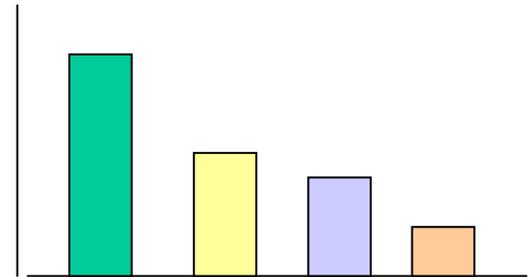


# The Science and Practice Pareto-Optimal Solutions

- **Simultaneous optimization of multiple objectives**
  - No single solution (unlike a single objective decision from linear programming)
  - There is a set of pareto-optimal solutions
- A pareto-optimal solution is one in which one where no objective can be improved without degrading the success of another
- A pareto analyses are used to inform the other decision processes that are needed to choose among the mix of options

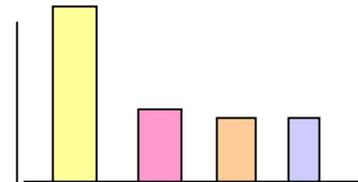
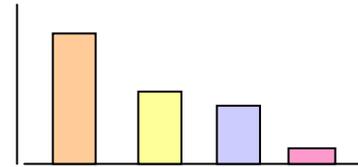
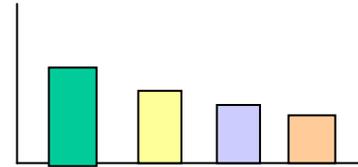
# The Science and Practice Principles & Guidelines

- **Principals and Guidelines proposes that “Accounts” be established to track the merits of plans.**
  - **National economic development account**
    - **Displays changes in the economic value the national output of goods and services**
  - **Environmental quality account**
    - **Displays non monetary effects on significant natural and cultural resources.**
  - **Regional economic development account**
  - **Other social effects account registers**



# A Possible Applications

- Economic account - Comparative cost of different networks changes
- Parameter coverage - number and type
- Benefits of a common practice (e.g. a common method)



# Multi-Objective Planning

## The Science and Practice

- **The take-home message:**
- **There are methods for making multi-objective decisions**
- **Pareto-Optimal Solutions have been used in water related planning as outlined in the Principals and Guidelines**
- **Pareto charts are useful and intuitive tools to use in displaying and ranking issues of comparability**

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