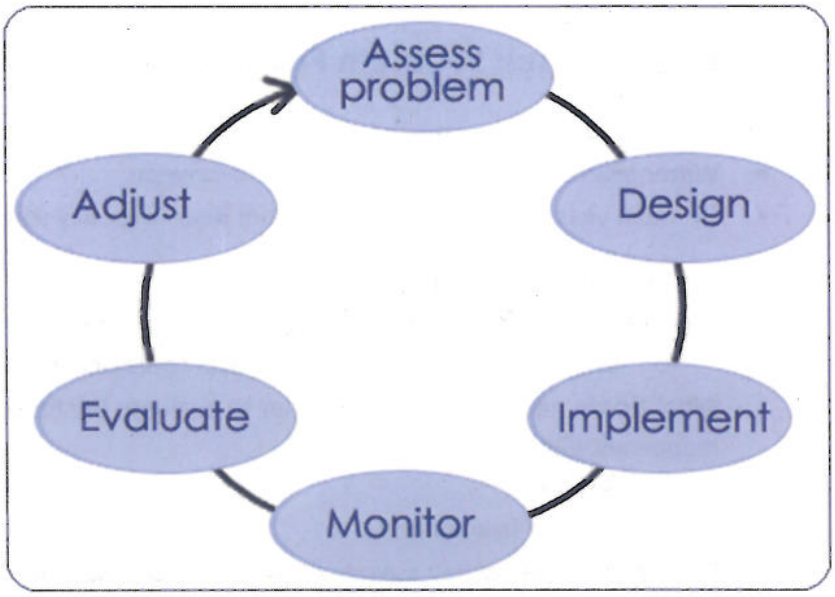
Willard Spur Science Panel

Potential recommendations to the steering committee:

- Immediate Actions
  - Changes to Water Quality Standards? Other rules?
  - WWTP BMPs
    - Changes to permit conditions?
  - Refuge management options
- Ongoing Actions
  - Ongoing monitoring and assessment
  - What ecological attributes? Where? How?Future research, particularly if there is a direct connection to other management recommendations
    - i.e., what would need to be addressed to recommend site-specific N and P numeric criteria?



- How to make sure that relevant data are captured to address future issues and concerns?

Framing Questions

1. How do we ensure the long-term protection of the Willard Spur ecosystem?
2. What is the potential for the Perry-Willard WWTP to cause deleterious effects to the ecosystem?

Neither question is possible without context!

Where did we start?

Many concerns, with essentially no data to confirm or reject the information!

- Background conditions were determined from a single sampling event in 2010

- This collection happened to occur in low pool conditions without context
- Nothing was known about underlying conditions, particularly nutrient retention, storage and transport
- Little was known about important attributes of the food web, which prohibits reliable estimates of the potential impacts of the Spur

Preliminary Data

- Calculate potential loads under various accumulation scenarios
  - No data to reliably estimate year-to-year variation
- Projected stressor-response relationships from studies of about 15 wetlands around GSL

Our conclusion, based on admittedly shaky assumptions, was that we saw no immediate threats, but could not discount the potential for deleterious effects over the long term.

The Science Panel: Problem Formulation

Expanding on preliminary understanding of the Spur

- Water levels vary dramatically from year-to-year
- On most years, the Spur is isolated from Bear River Bay sometime during the summer

Conceptual models

- How might excess nutrient loads positively, or negatively, impact the uses of the Spur?
  - Early hypothesis: If negative effects could occur, it would be under low flow conditions
- What do we need to measure in order to evaluate the linkages between the plant discharge and responses within the Spur?
  - Where?
  - At what frequency?
- How to characterize key aspects of the biological uses that we're trying to protect?

Year 1: Baseline Data & Problem Formulation

- Developed an aggressive and extensive baseline monitoring effort
  - How can we access sites?
  - What background data are required?
    - i.e., weather and flow stations
- Conditions: probably near best case scenario
  - Not ideal considering were interested in limiting conditions
- Key results
  - Background nutrients are relatively low within both water and sediments
  - Plants inputs are extremely small relative to other sources
  - While macrophyte growth is vigorous, water clarity was very high
    - Diatoms typical of other wetlands, but smaller

        - Many piscivorous birds
        - Macroinvertebrates fairly typical of other healthy wetlands
    - Overall:
        - An incredible ecosystem that deserves careful protection
        - Impacts under these conditions unlikely, but these are best case scenarios
- Developoed RFPs:
    - Literature reviews to characterize biological uses: fish , bugs, plants
    - Evaluate causes and effect linking nutrient inputs and biological responses
- Designed ongoing monitoring
    - Reduced intensity based on preliminary investiagations

Year 2: Project Implementation

- A dry year! Background conditions entirely different and more aligned with worse-case scenarios
- Year 1: U of U experiments
    - Evaluate treatments and responses: preliminary conclusions & refine experiments
        - What indicators seem most responsive? How did they respond?
    - Measure sediment uptake and release, without macrophytes
    - Evaluate experimental successes and potential improvements
- Monitoring
    - Background biogeochemical conditions were vastly different from the first year
    - Within-year variation in chemical parameters and biological responses was pretty dramatic
    - Started evaluating ecosystem processes: metabolism (GPP and ER)
    - Continued evaluation of nutrient limitation
- Primary conclusion: Willard Spur is an amazing dynamic ecosystem that seems to be pretty resilient to environmental variability
    - This resilience is a key attribute that warrants protection

Year 3: Refine Process & Fill Data Gaps

- Revised and streamlined monitoring approaches
    - Continue to refine monitoring SOPs
- Revised experimental approaches
    - Continue to identify and evaluate ecological responses
- Identified important data gaps associated with nutrient cycling and developed experimental approaches to answer key questions
    - uptake within spur and in the tailrace
    - Mesocosm experiments to fill better link monitoring with response experiments
- Evaluations of alternative discharge locations

Reflection and Next Steps

- We've maintained productive dialogue and gained <u>many</u> insights
    - Despite the challenges, we've maintained a textbook example of adaptive management processes
    - Many thanks!
- Uncertainly remains, but we need to make management recommendations
    - Please, consider research results in the context of our recommendations
- **Given what we know now, what recommendations can we make with regard to minimization of risk and identifying unforeseen concerns**