Center for Integrated Multi-scale Nutrient Pollution Solutions (aka CNS)

FACs

- One of 4 recently centers funded under the EPA-STAR program for "National Centers for Innovative and Sustainable Water Research, Incorporating a Systems View of Nutrient Management"
  - Novel science to achieve sustainable and cost effective health and environmental outcomes
  - Demonstration projects to support efficacy of water management systems with and beyond current technology and information at appropriate scales
  - Community involvement in the design, acceptance and implementation of nutrient management systems
- Others at Colorado State University, University of South Florida (USF), and Water Environment Research Foundation

FACs

- Partners
  - Funded (including subcontracts): PSU, UMES, VTES, CRC, FTN
  - "Unfunded": USDA-ARS, Community Partners
  - Significant co-funding from PSU (especially CAS)
- Project launch(es)
  - Research/outreach team – Dec. 4/5
  - Community partners – Jan. 31

Solving Nutrient Pollution
Old Paradigm

- Focused on enterprise level "tactics" (discharge limits for point sources, BMPs for nonpoint sources – the "BMP Fix")
- Inadequate attention to "systems" level challenges
  - Landscape scale mass balance/ nitrogen cascade
  - Watershed based management
  - All nutrient sources
  - Tradeoffs between sources
  - Timing, location, selection among tactic (e.g. BMP) types
- And to people, economics, institutions, etc. E.g.,
  - What works within profitable farming systems?
  - What kinds of informal or formal incentives will best result in needed BMP adoption (tactics) or structural change (agricultural systems)?

CNS Project Themes

- "…highly integrated process … to identify optimal locations for nutrient interventions, both *tactics* and *strategies*, within watersheds."
- "…authentic engagement of stakeholders is an integral part of our process to find solutions through *shared discovery*."
- "…challenge each other to find ways for agricultural industries, urban economies, and ecosystem services to coexist sustainably."

CNS Project Themes – unpacked

- *Strategies*, addressing the system level challenges, deal with the structure and relationship between contemporary crop and animal agriculture, and their relationship to other major nutrient sources – primarily at landscape and watershed scales
- *Tactics*, addressing enterprise level challenges, relate to the management practices influencing nutrient retention and loss on individual farms or stormwater facilities
- Seek interventions that control, reduce, or remediate nutrient flows into waters

CNS Project Themes – unpacked

- … *shared discovery* is a decision support approach where both researchers and partners collaborate to identify the drivers that control nutrient inputs and outputs within a study area, and develop the scenarios that feature a realistic set of interventions.”

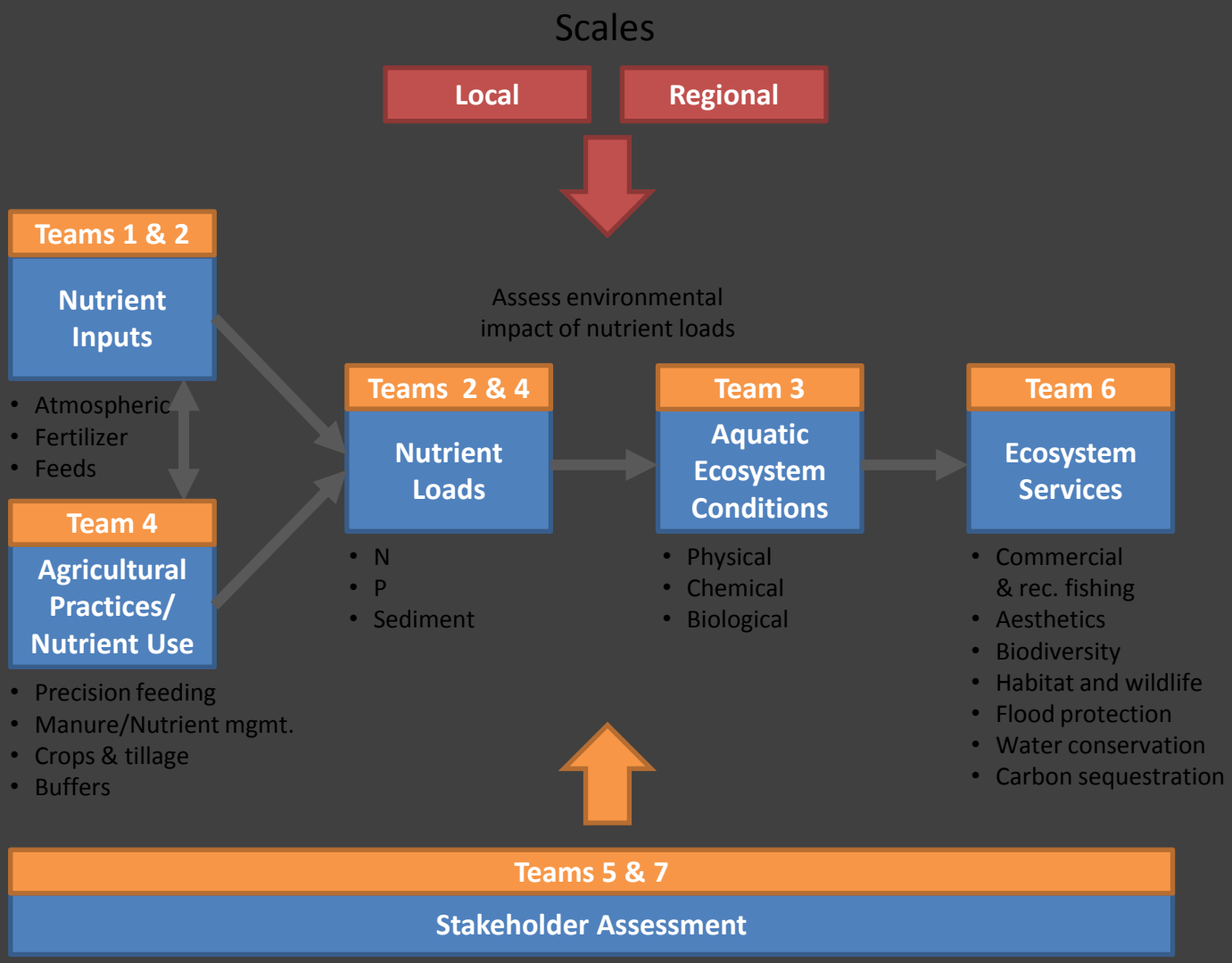
- Innovative process to identify nutrient interventions combined with an explicit engagement process

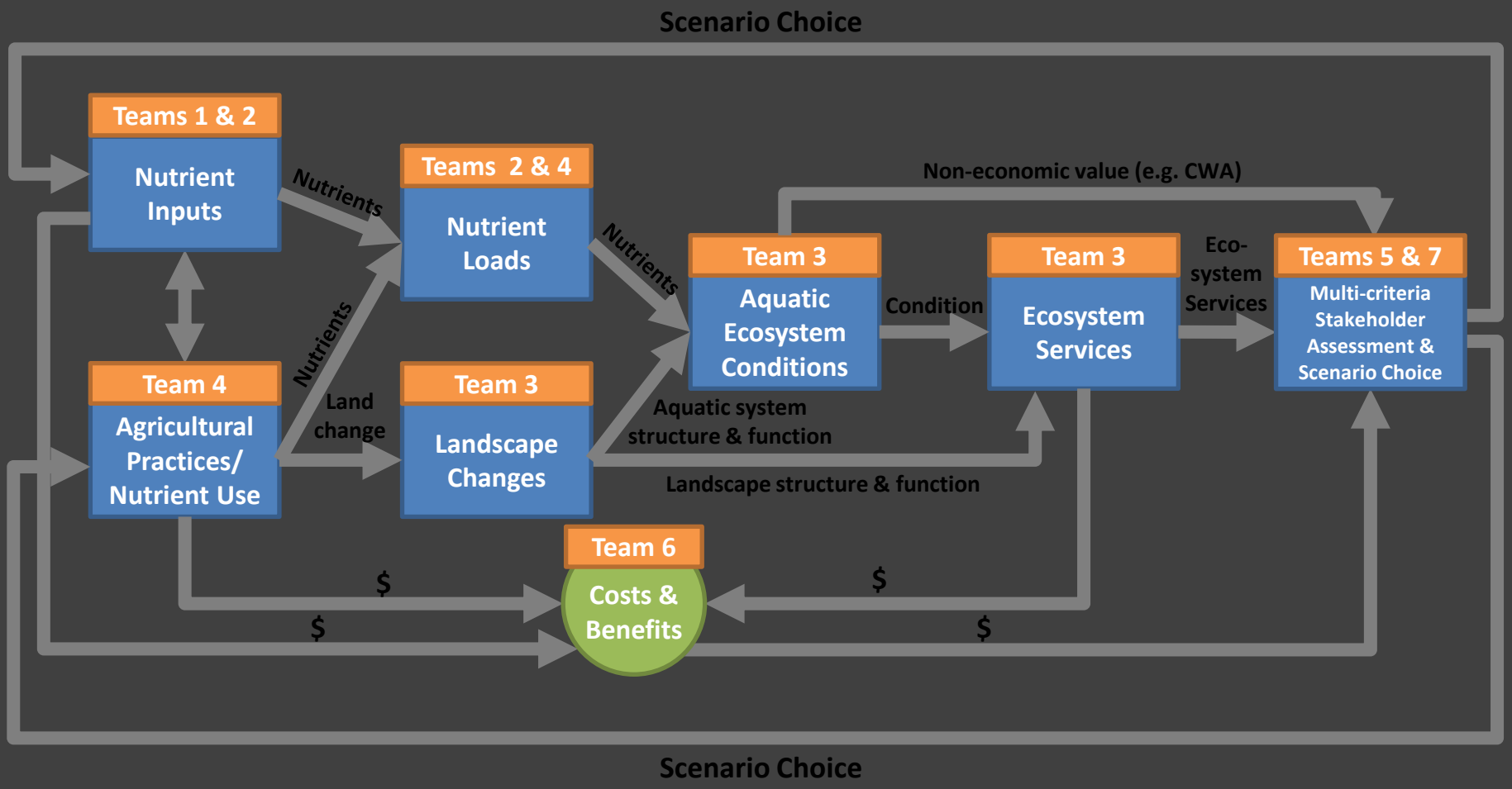
Components

- Technical Teams
  - Drivers and interventions (Boyer, Beegle, Shortle)
    - Landscape scale nutrient flows, nitrogen cascade, mass balances
  - Agricultural BMPs (Kleinman et al., ARS, UMES, VTES)
  - Harmonizing models (Kemanian, Duffy)
    - Nitrogen in PHIM
    - Model inter-comparisons (PHIM, SWAT, CEAP etc.)
  - Ecological Assesment (Brooks et. al.)
    - Model outcome validation
    - Ecological condition responses

Components

- Integration teams
  - Environmental Informatics (Bills, Miller, Bishop)
    - Internal data service
    - Online tools development
  - Economics and ecosystem services (Ready, Shortle)
    - Costs and benefits at multiple scales
  - Engagement and outreach (Royer, Sellner)
    - Shared discovery
    - Multiple scales


Scales
Local
Regional
Assess environmental impact of nutrient loads
Teams 1 & 2
Nutrient Inputs
• Atmospheric
• Fertilizer
• Feeds
Team 4
Agricultural Practices/ Nutrient Use
• Precision feeding
• Manure/Nutrient mgmt.
• Crops & tillage
• Buffers
Teams 2 & 4
Nutrient Loads
• N
• P
• Sediment
Team 3
Aquatic Ecosystem Conditions
• Physical
• Chemical
• Biological
Team 6
Ecosystem Services
• Commercial & rec. fishing
• Aesthetics
• Biodiversity
• Habitat and wildlife
• Flood protection
• Water conservation
• Carbon sequestration
Teams 5 & 7
Stakeholder Assessment


Scenario Choice
Teams 1 & 2
Nutrient Inputs
Nutrients
Teams 2 & 4
Nutrient Loads
Nutrients
Team 3
Aquatic Ecosystem Conditions
Non-economic value (e.g. CWA)
Condition
Team 3
Ecosystem Services
Eco-system Services
Teams 5 & 7
Multi-criteria Stakeholder Assessment & Scenario Choice
Nutrients
Team 4
Agricultural Practices/ Nutrient Use
Land change
Team 3
Landscape Changes
Aquatic system structure & function
Landscape structure & function
Team 6
Costs & Benefits
$
$
$
$
Scenario Choice

Study Locations

- Conewago Creek (PA)
- Mahantango Creek (PA)
- Manokin River (MD)
- Spring Creek (PA)

Phases

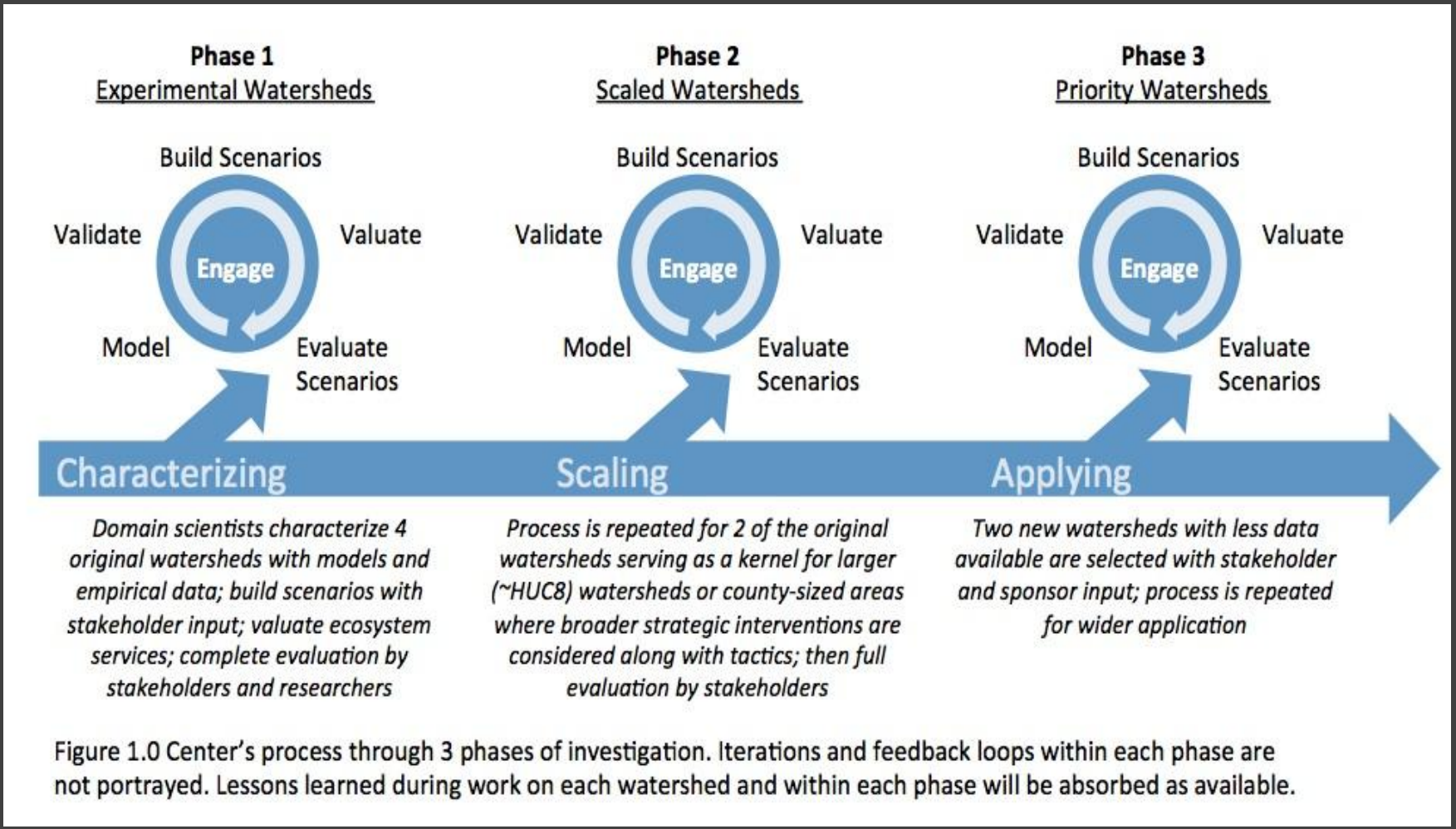
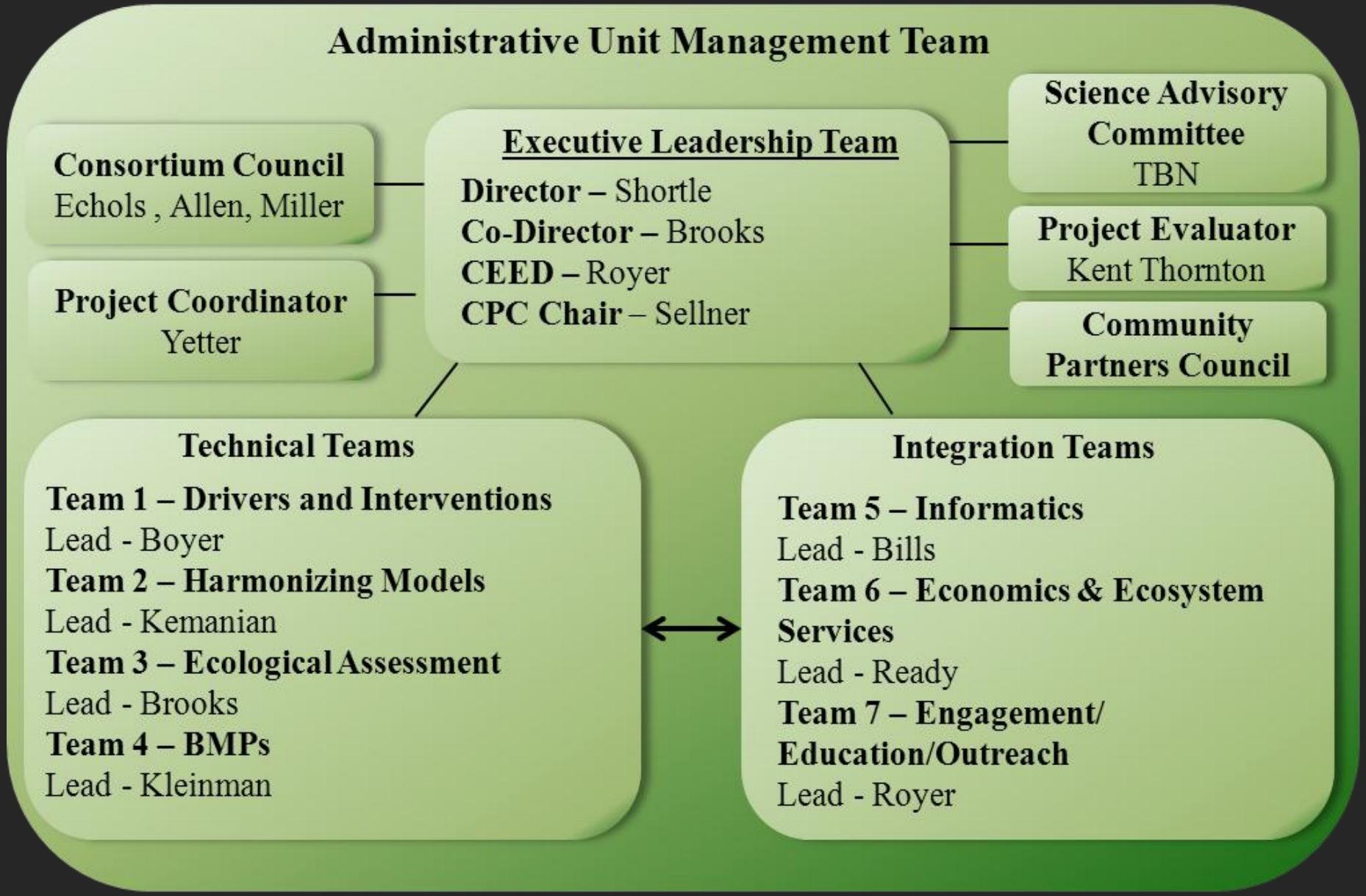


Figure 1.0 Center's process through 3 phases of investigation. Iterations and feedback loops within each phase are not portrayed. Lessons learned during work on each watershed and within each phase will be absorbed as available.


Administrative Unit Management Team
Consortium Council
Echols , Allen, Miller
Project Coordinator
Yetter
Executive Leadership Team
Director – Shortle
Co-Director – Brooks
CEED – Royer
CPC Chair – Sellner
Science Advisory Committee
TBN
Project Evaluator
Kent Thornton
Community Partners Council
Technical Teams
Team 1 – Drivers and Interventions
Lead - Boyer
Team 2 – Harmonizing Models
Lead - Kemanian
Team 3 – Ecological Assessment
Lead - Brooks
Team 4 – BMPs
Lead - Kleinman
Integration Teams
Team 5 – Informatics
Lead - Bills
Team 6 – Economics & Ecosystem Services
Lead - Ready
Team 7 – Engagement/ Education/Outreach
Lead - Royer

Community Partners Council

Partner Name	Affiliation
Kevin Sellner - Chair	Chesapeake Research Consortium
Jennifer Reed Harry - Co-Chair	Penn Ag Industries Association
Marel Raub	Cheapeake Bay Commission
Dan Dostie	USDA NRCS
Lamonte Garber	Cheapeake Bay Foundation
Andrew Zemba	PA DEP
Don McNutt	Lancaster County (PA) Conservaton District
Kristen Saacke Blunk	Spring Creek Watershed Association
Al Todd	Alliance for the Chesapeake Bay
Joanne Throwe	UMD Environmental Finance Center
Dana York	Green Earth Connection LLC
Robert Ensor	Howard County (MD) Soil Conservation District
Karl Brown	PA State Conservation Commission
Bill Neilson	PA Farm Bureau