Current Issue for MS Envirothon

Water Resource Management: Local Control and Local Solutions

Water Resource Management
Typical Issues/Concerns

1) Runoff/flooding
2) Drinking water (groundwater/surface water)
3) Recreational water use (boating, swimming, fishing)
4) Pollutants in waters
5) Natural areas and Wildlife use of waters
6) Erosion related to water bodies
7) Others that you identify

Key Topics

#1: Understanding how groundwater and surface water systems function.

#2: Understanding the importance of water quality and quantity as a foundation in a healthy ecosystem.

#3: Understanding a variety of water quality indicators in different landscapes

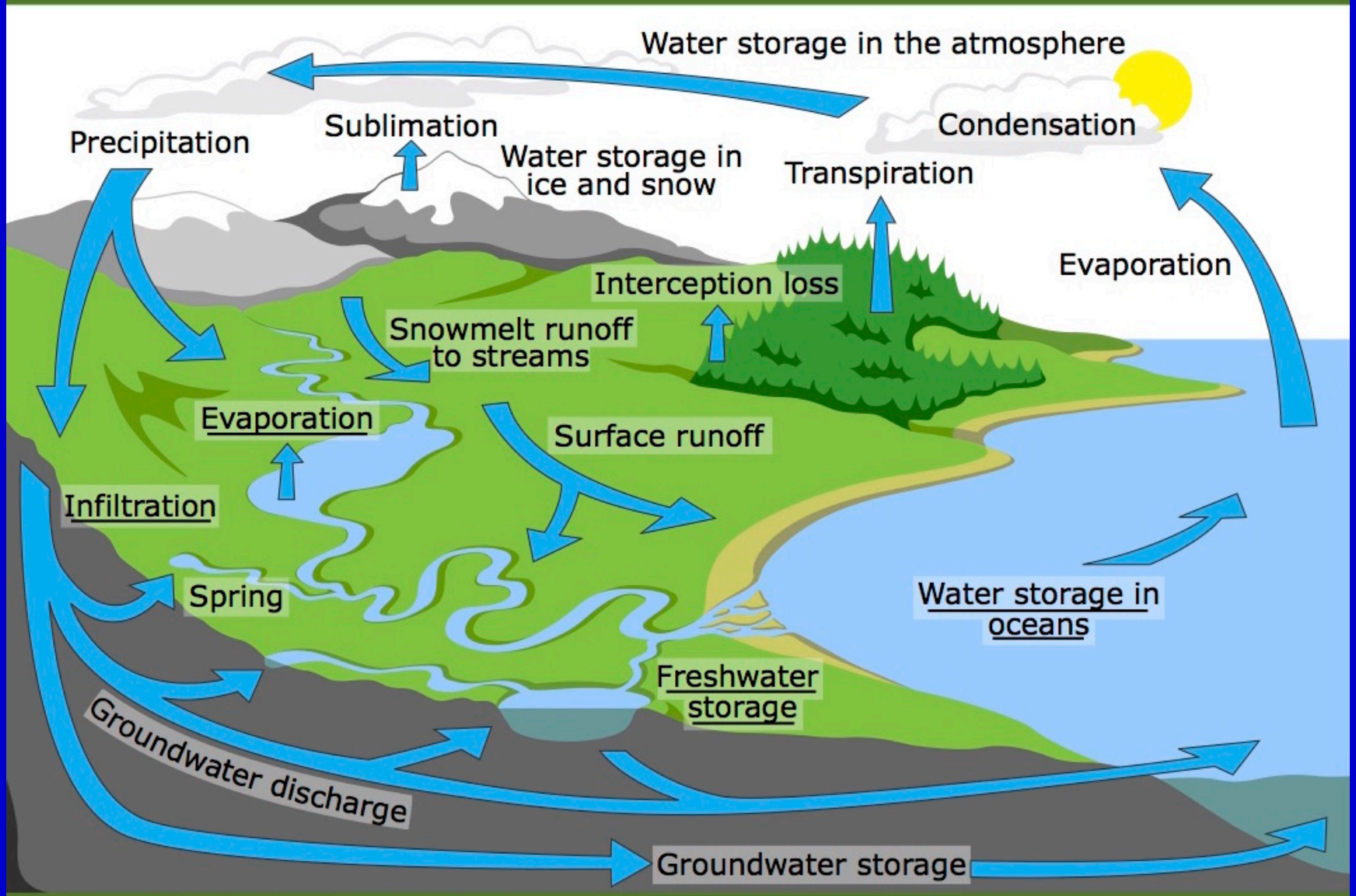
#4: Understanding a variety of water quantity indicators in different landscapes

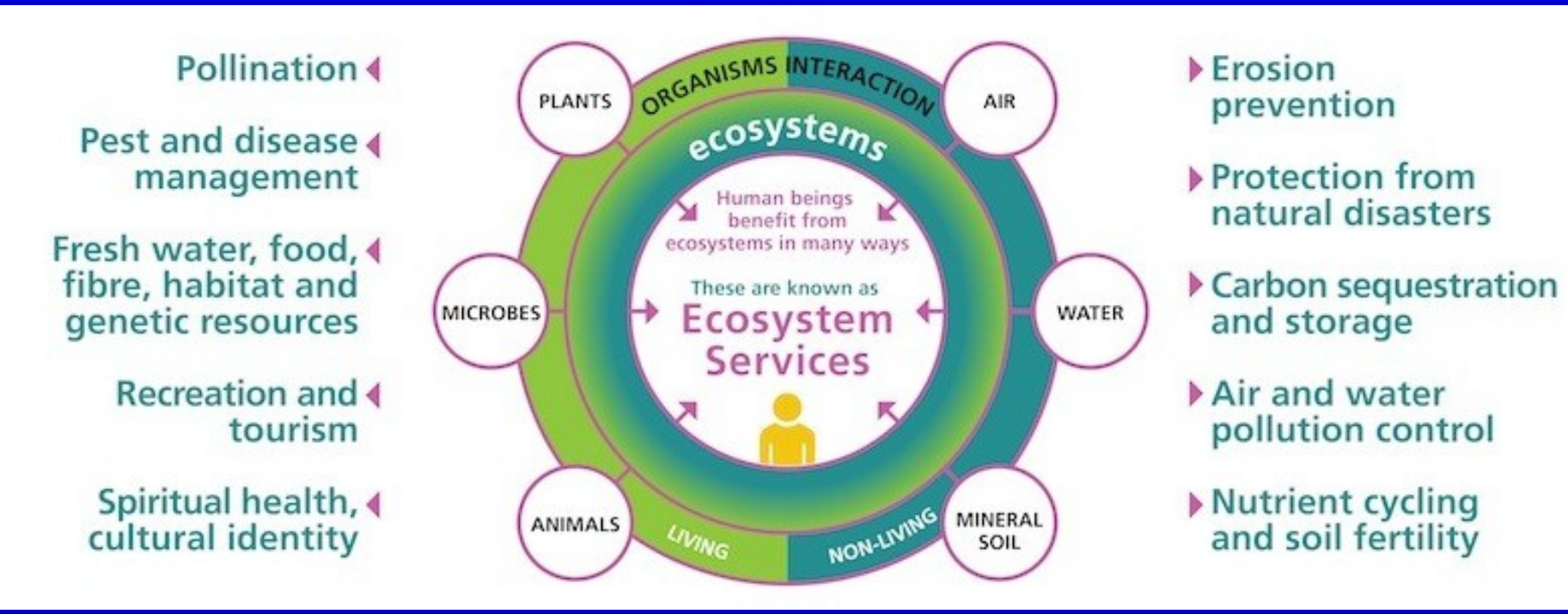
#5: Understanding how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife

#6: Understanding the differences of local, regional, and national systems that manage natural resources and the importance of each in water resources

#7: Understanding the social, economic, political impacts of natural resources management and decision making.

DYNAMIC AND COMPLEX: THE GLOBAL WATER CYCLE




Pollination
Pest and disease management
Fresh water, food, fibre, habitat and genetic resources
Recreation and tourism
Spiritual health, cultural identity
PLANTS
ORGANISMS
INTERACTION
AIR
ecosystems
Human beings benefit from ecosystems in many ways
These are known as
Ecosystem Services
MICROBES
WATER
ANIMALS
LIVING
NON-LIVING
MINERAL SOIL
Erosion prevention
Protection from natural disasters
Carbon sequestration and storage
Air and water pollution control
Nutrient cycling and soil fertility

Water Quality Factors

TEMPERATURE

TURBIDITY

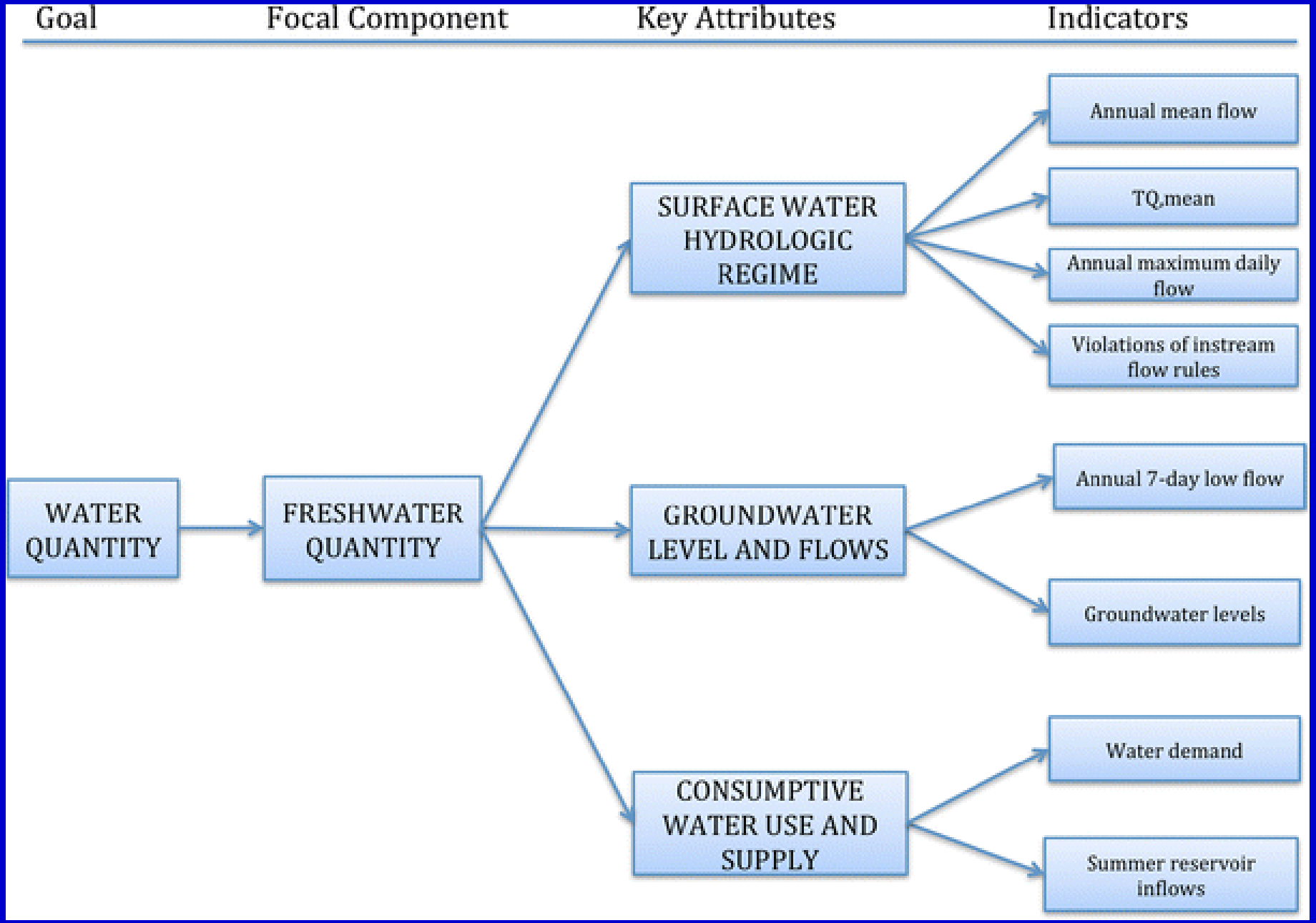
DISSOLVED OXYGEN (DO)

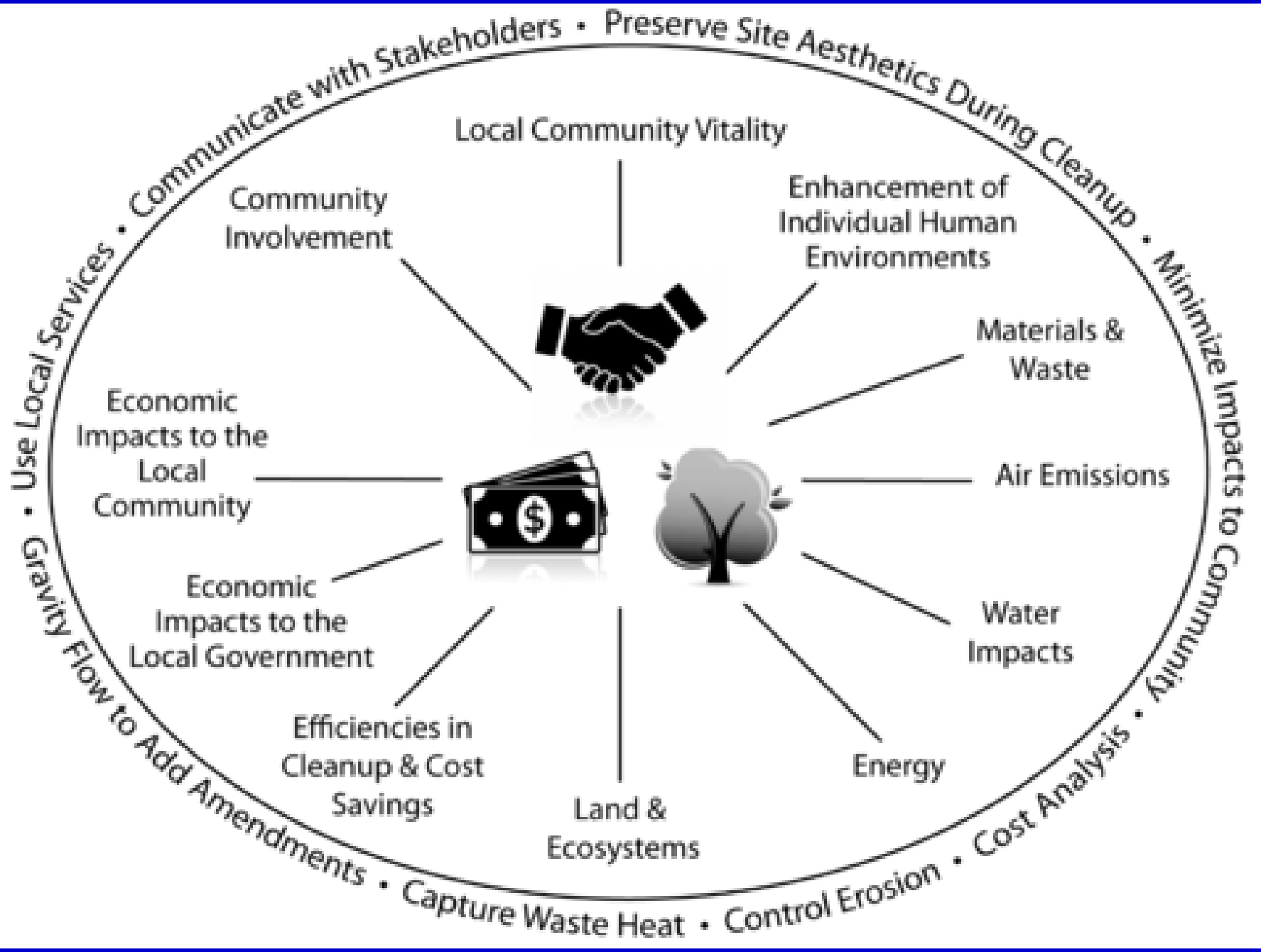
PHOSPHATES

BIO-INDICATORS

pH

NITROGEN


Goal
Focal Component
Key Attributes
Indicators
WATER QUANTITY
FRESHWATER QUANTITY
SURFACE WATER HYDROLOGIC REGIME
GROUNDWATER LEVEL AND FLOWS
CONSUMPTIVE WATER USE AND SUPPLY
Annual mean flow
TQ.mean
Annual maximum daily flow
Violations of instream flow rules
Annual 7-day low flow
Groundwater levels
Water demand
Summer reservoir inflows


Local Community Vitality
Community Involvement
Enhancement of Individual Human Environments
Materials & Waste
Air Emissions
Water Impacts
Energy
Land & Ecosystems
Efficiencies in Cleanup & Cost Savings
Economic Impacts to the Local Government
Economic Impacts to the Local Community
Use Local Services • Communicate with Stakeholders • Preserve Site Aesthetics During Cleanup • Minimize Impacts to Community • Cost Analysis • Control Erosion • Capture Waste Heat • Gravity Flow to Add Amendments

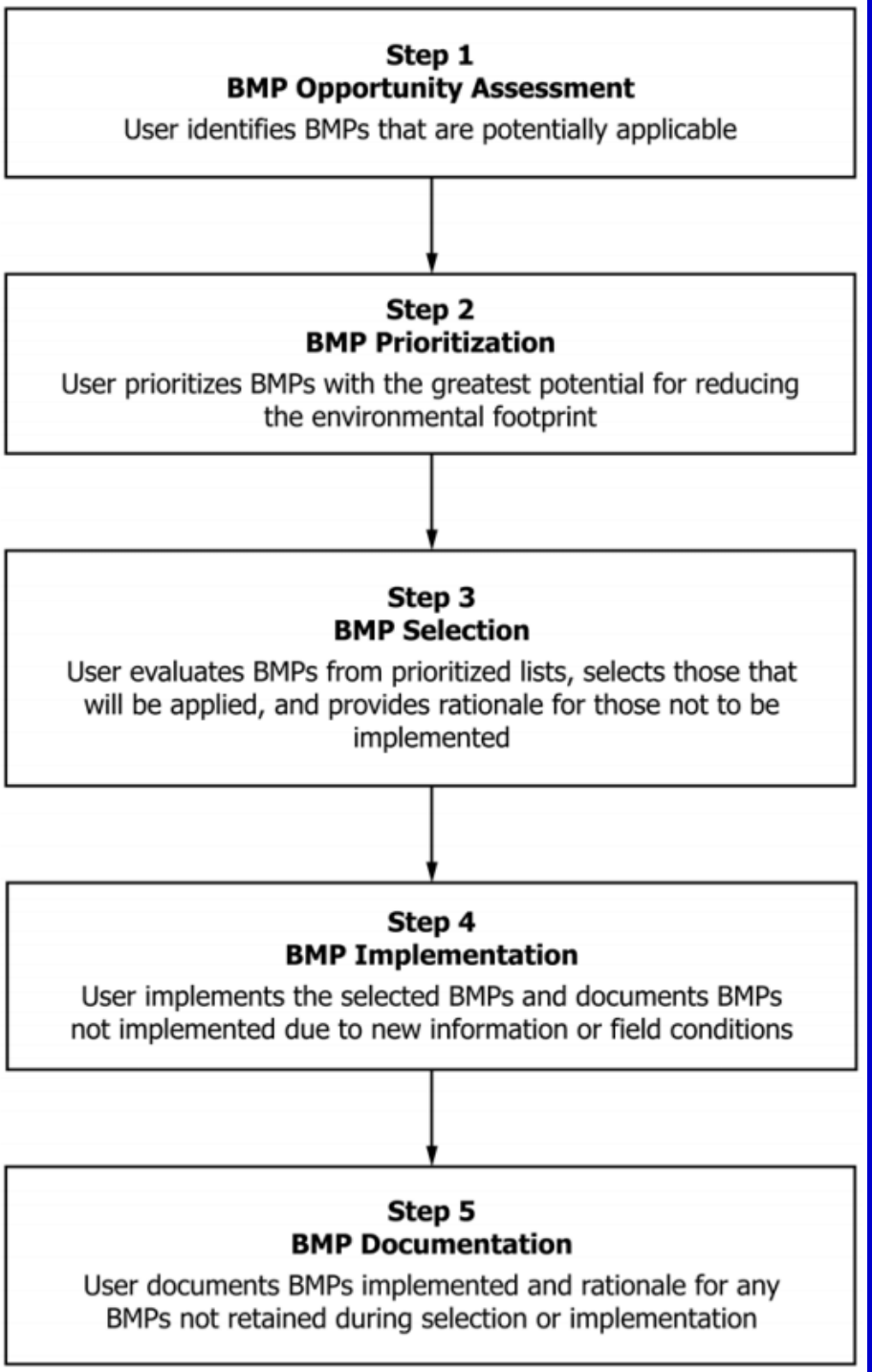
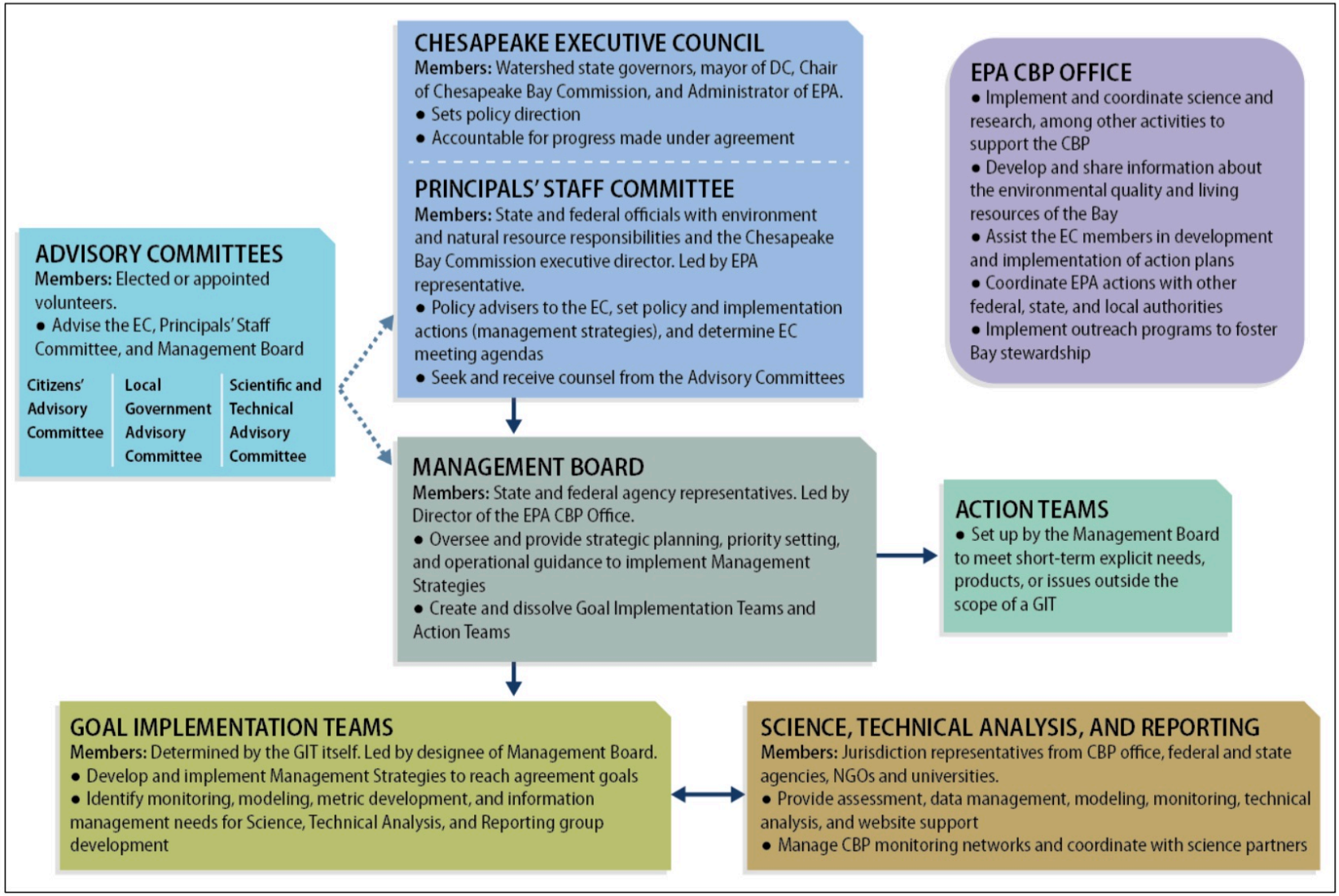
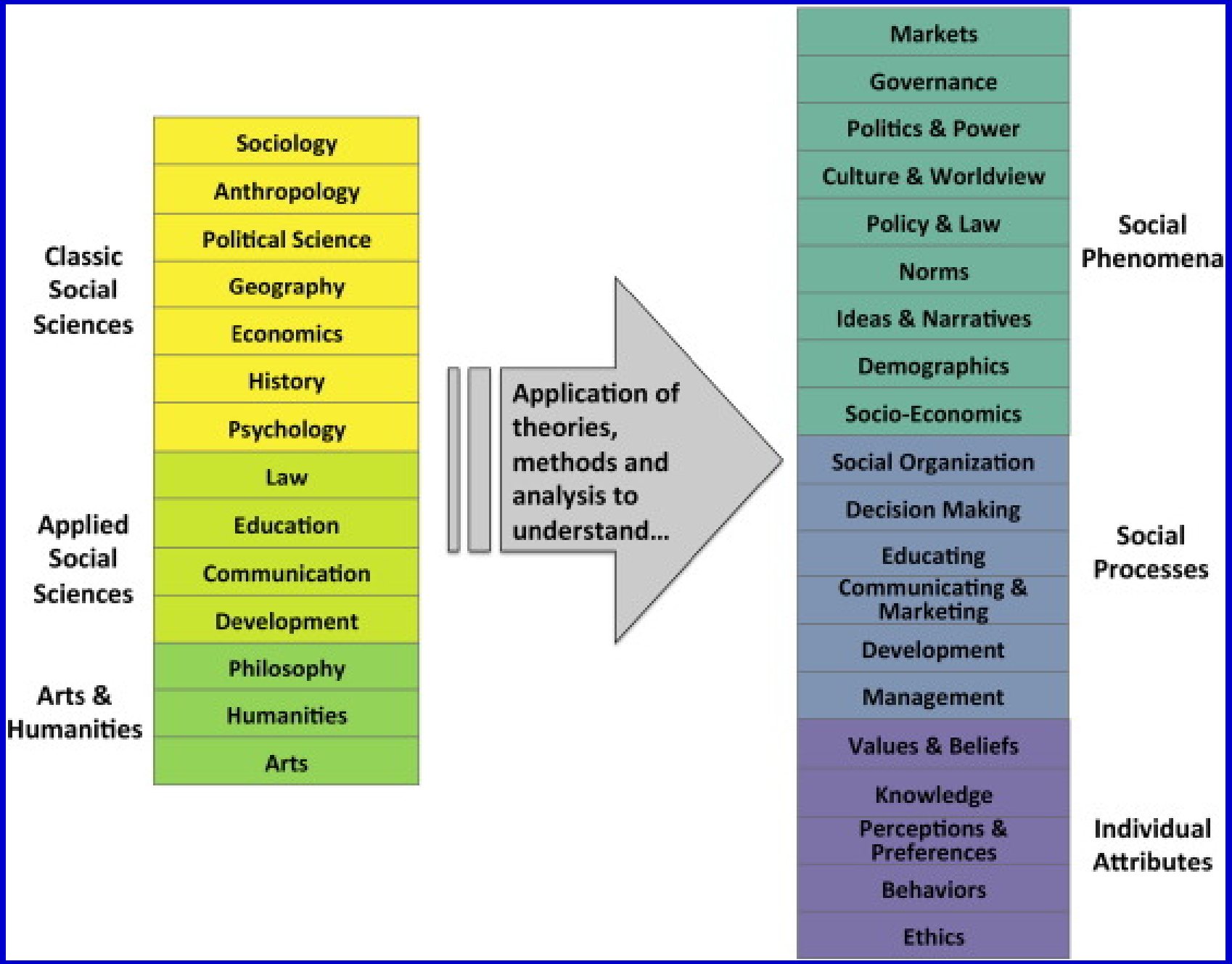
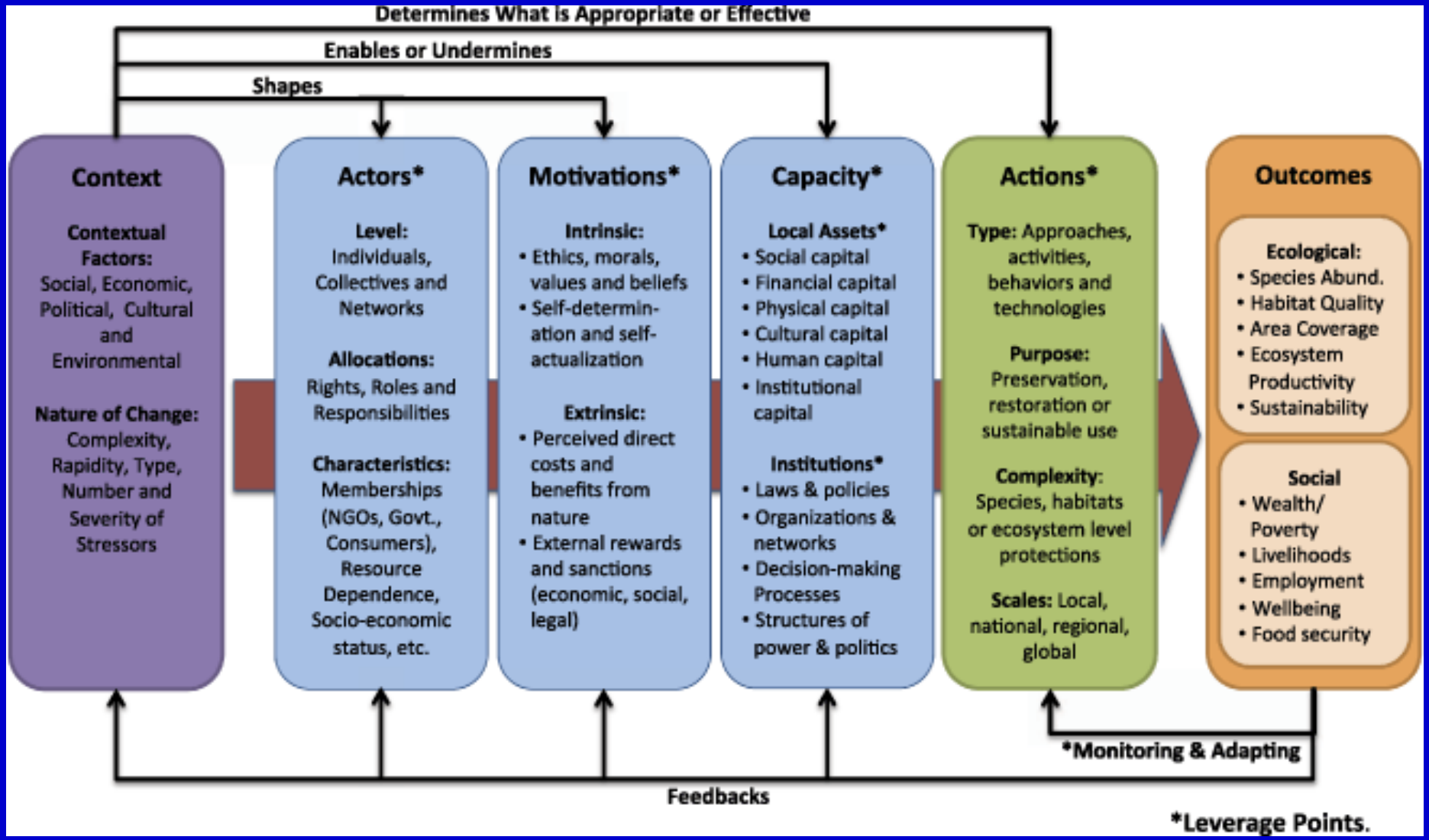

Step 1
BMP Opportunity Assessment
User identifies BMPs that are potentially applicable
Step 2
BMP Prioritization
User prioritizes BMPs with the greatest potential for reducing the environmental footprint
Step 3
BMP Selection
User evaluates BMPs from prioritized lists, selects those that will be applied, and provides rationale for those not to be implemented
Step 4
BMP Implementation
User implements the selected BMPs and documents BMPs not implemented due to new information or field conditions
Step 5
BMP Documentation
User documents BMPs implemented and rationale for any BMPs not retained during selection or implementation

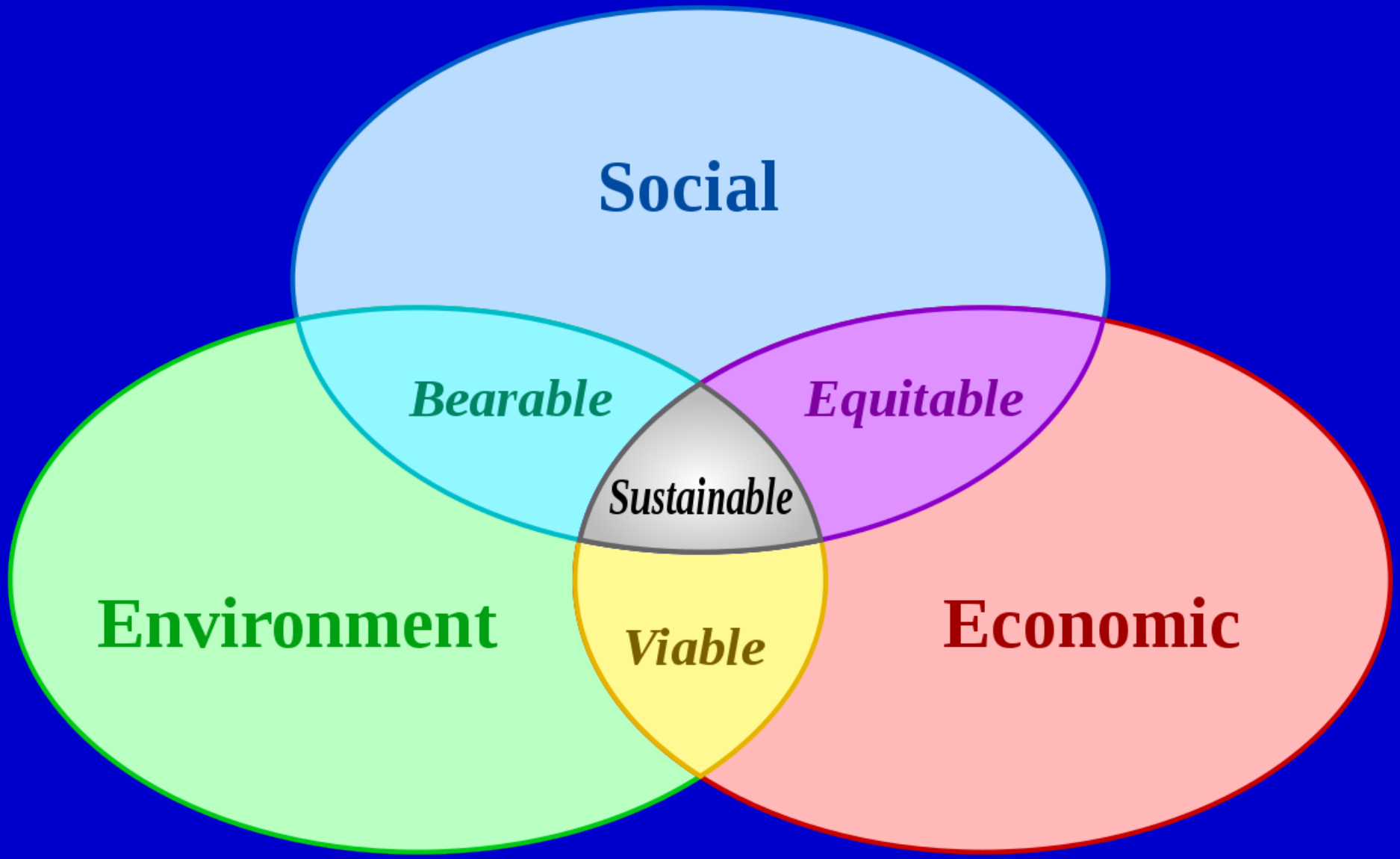
Figure 6. Chesapeake Bay Program Components, Members, and Responsibilities



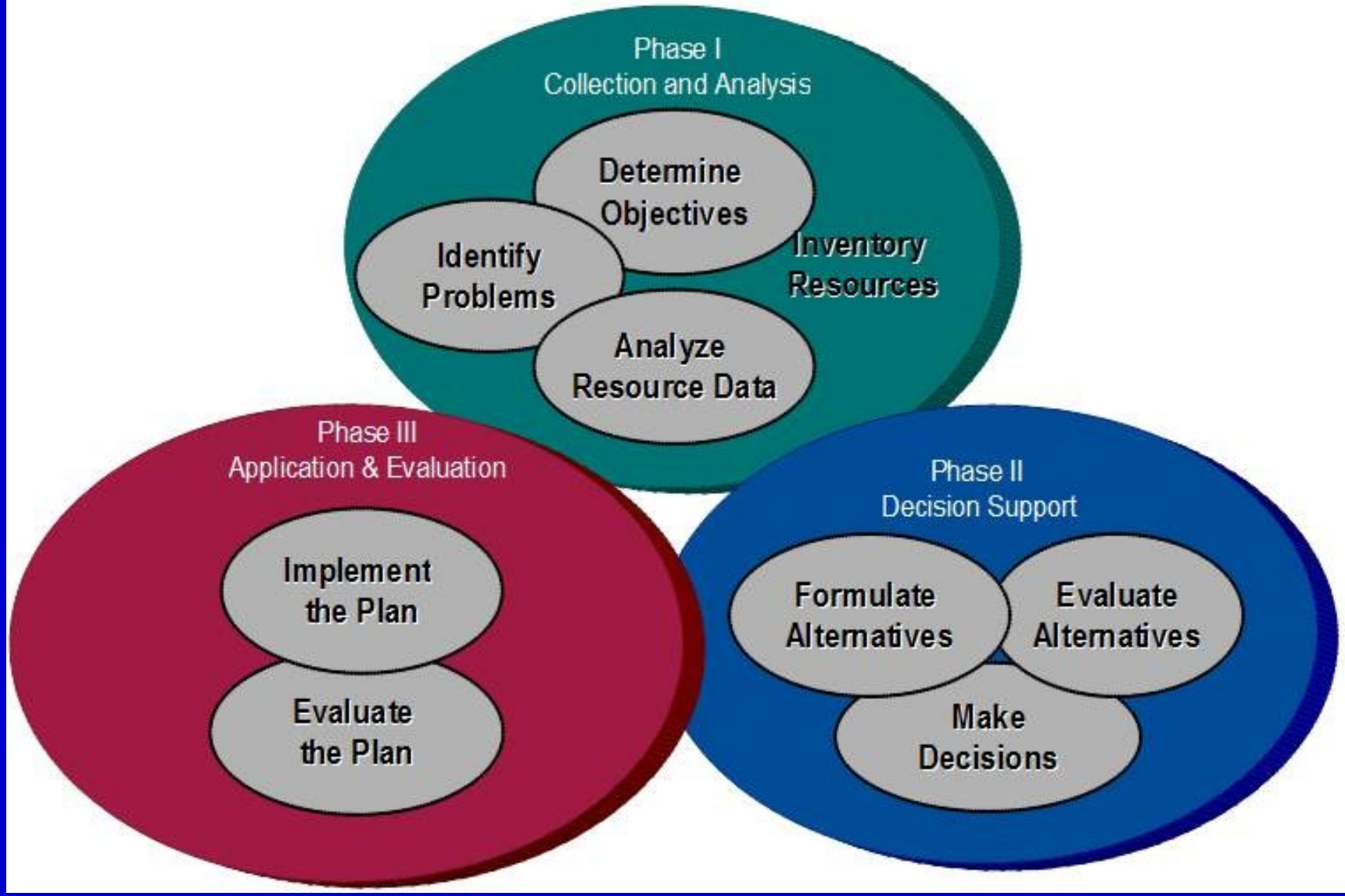
Source: CRS, adapted from CBP, *Governance and Management Framework for the Chesapeake Bay Program Partnership*, 2015, at https://www.chesapeakebay.net/channel_files/22179/cbp_governance_document_7-14-15.pdf; 33 U.S.C. 1267.


Classic Social Sciences
Sociology
Anthropology
Political Science
Geography
Economics
History
Psychology
Applied Social Sciences
Law
Education
Communication
Development
Arts & Humanities
Philosophy
Humanities
Arts
Application of theories, methods and analysis to understand…
Markets
Governance
Politics & Power
Culture & Worldview
Policy & Law
Norms
Ideas & Narratives
Demographics
Socio-Economics
Social Phenomena
Social Organization
Decision Making
Educating
Communicating & Marketing
Development
Management
Social Processes
Values & Beliefs
Knowledge
Perceptions & Preferences
Behaviors
Ethics
Individual Attributes

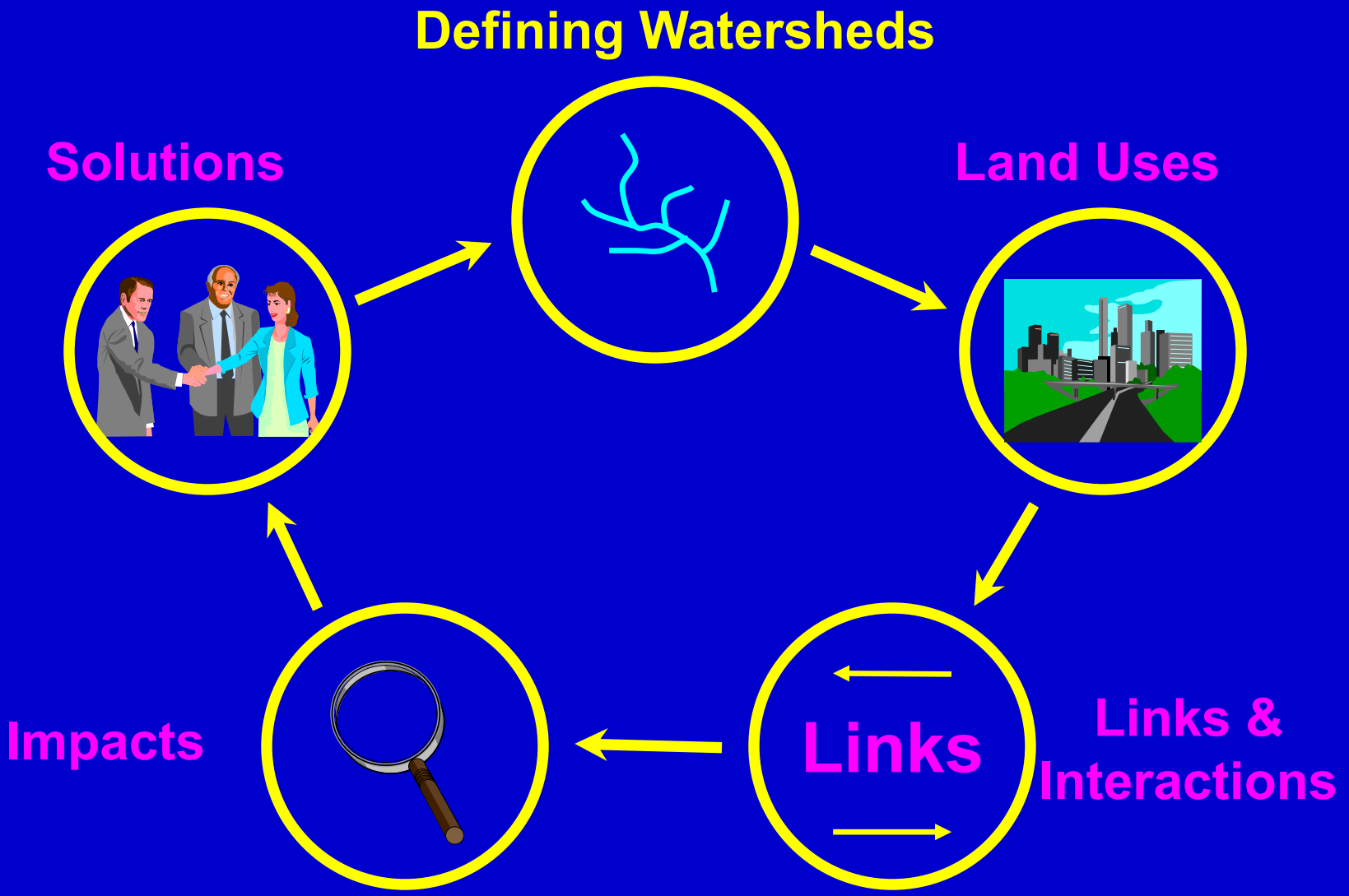

Determines What is Appropriate or Effective
Enables or Undermines
Shapes
Context
Contextual Factors: Social, Economic, Political, Cultural and Environmental
Nature of Change: Complexity, Rapidity, Type, Number and Severity of Stressors
Actors*
Level: Individuals, Collectives and Networks
Allocations: Rights, Roles and Responsibilities
Characteristics: Memberships (NGOs, Govt., Consumers), Resource Dependence, Socio-economic status, etc.
Motivations*
Intrinsic:
• Ethics, morals, values and beliefs
• Self-determination and self-actualization
Extrinsic:
• Perceived direct costs and benefits from nature
• External rewards and sanctions (economic, social, legal)
Capacity*
Local Assets*
• Social capital
• Financial capital
• Physical capital
• Cultural capital
• Human capital
• Institutional capital
Institutions*
• Laws & policies
• Organizations & networks
• Decision-making Processes
• Structures of power & politics
Actions*
Type: Approaches, activities, behaviors and technologies
Purpose: Preservation, restoration or sustainable use
Complexity: Species, habitats or ecosystem level protections
Scales: Local, national, regional, global
Outcomes
Ecological:
• Species Abund.
• Habitat Quality
• Area Coverage
• Ecosystem Productivity
• Sustainability
Social
• Wealth/ Poverty
• Livelihoods
• Employment
• Wellbeing
• Food security
*Monitoring & Adapting
Feedbacks
*Leverage Points.


Social
Bearable
Equitable
Sustainable
Environment
Viable
Economic

The Nine-Step Conservation Planning Process



Water Resource Management: Local Control and Local Solutions



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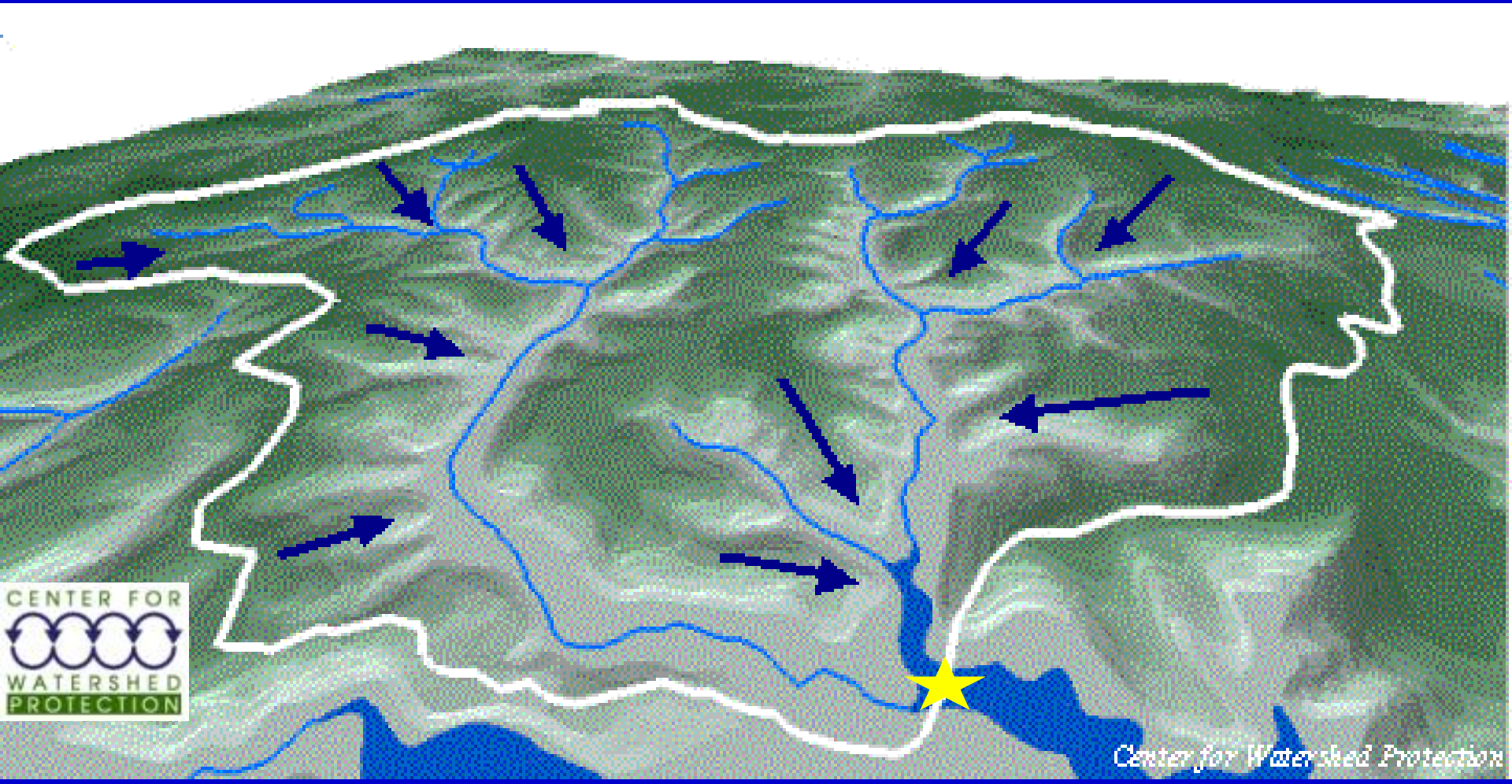
What is a Watershed?

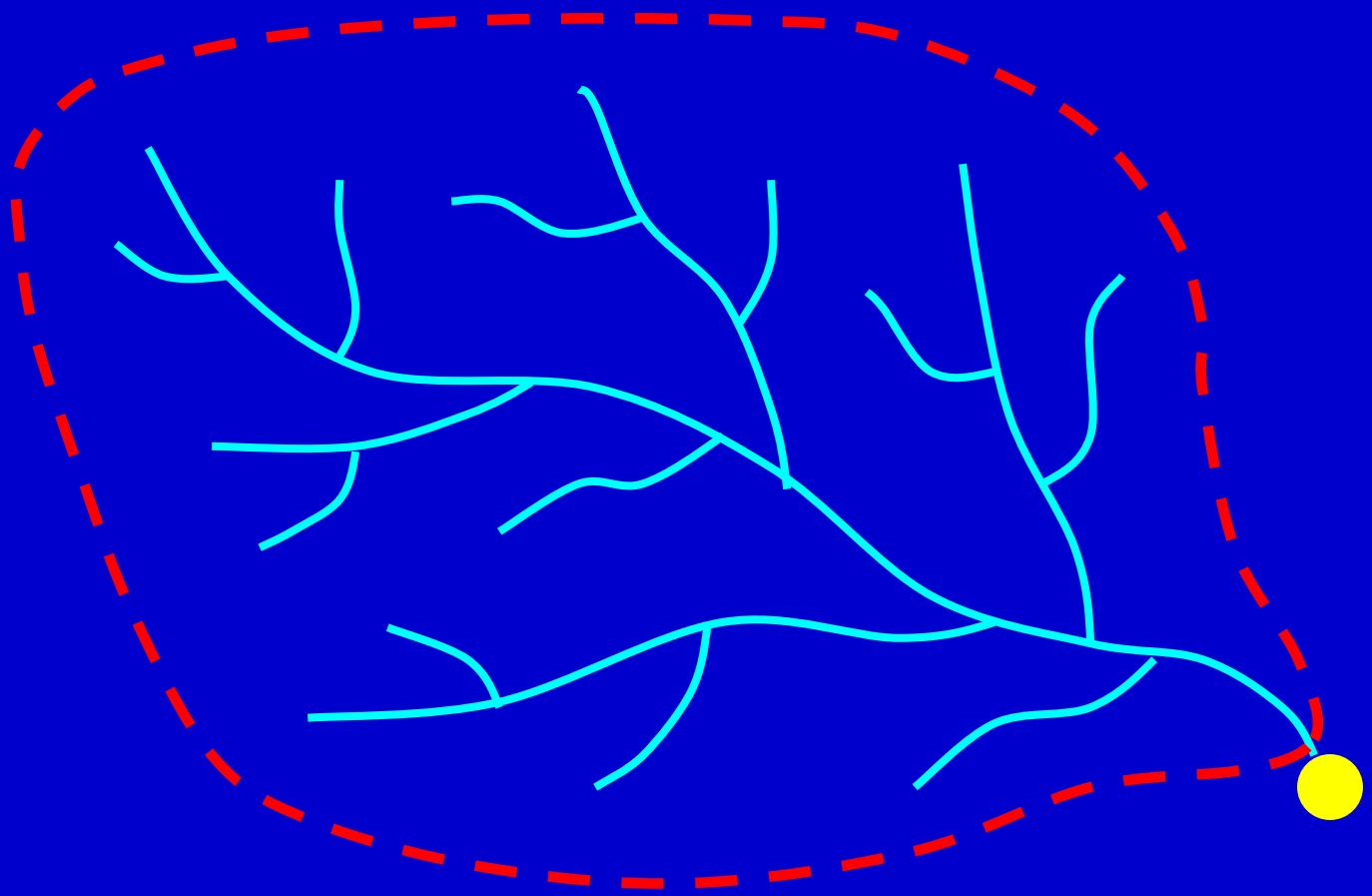
… an area of land from which water drains to a given point

What is a Watershed?



… an area of land from which water drains to a given point

Boundaries



Red- Watershed Boundary

Blue - Stream in watershed

Yellow - Point of interest

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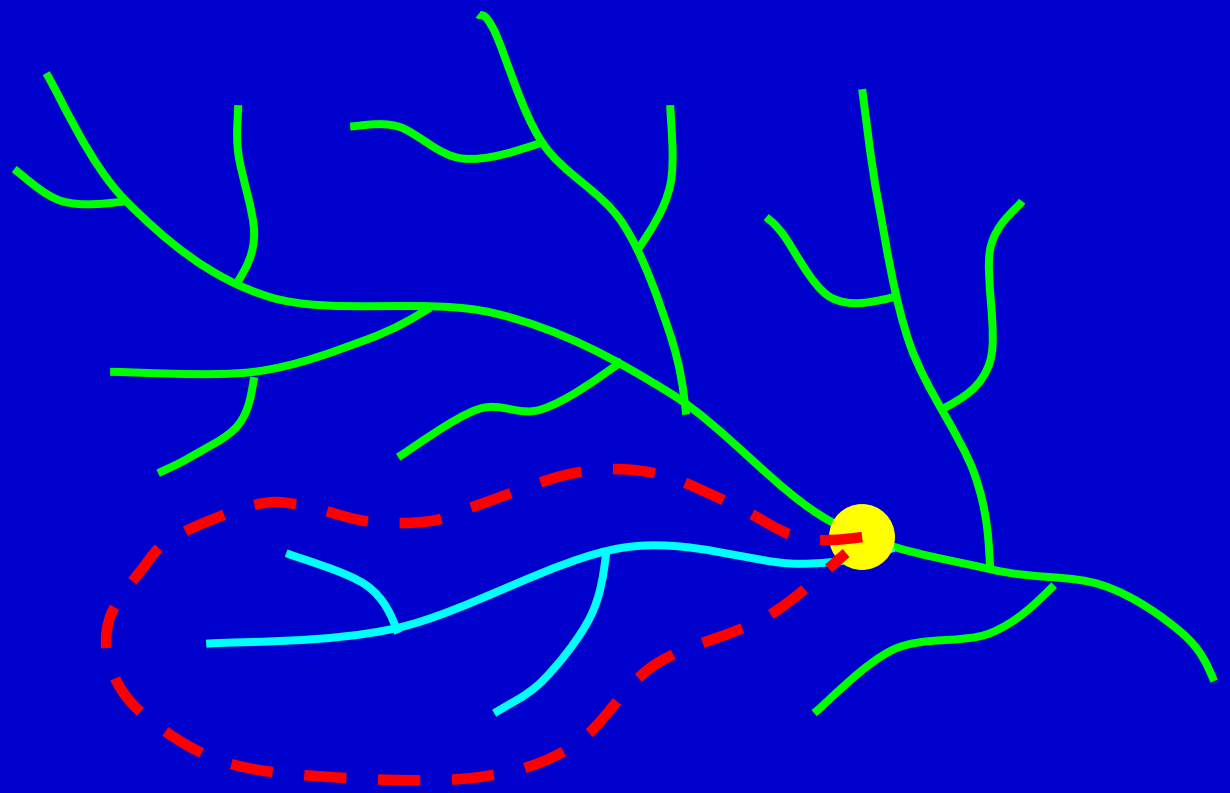
Boundaries



Red- Watershed Boundary

Blue - Stream in watershed

Green - Stream outside of watershed

Yellow - Point of interest

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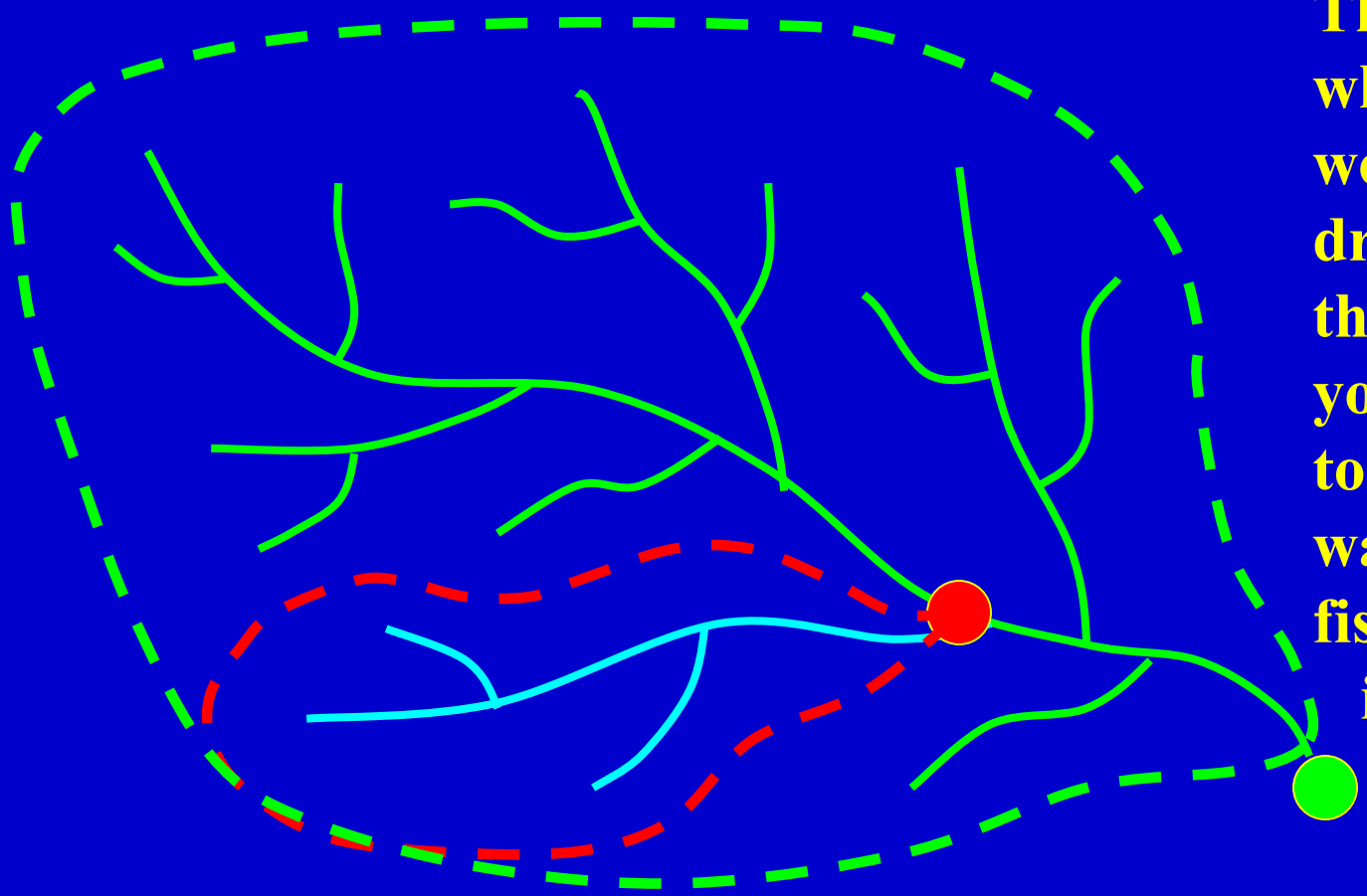
Boundaries



The watershed where you work may drain through the watershed you live in to the watershed you fish and swim in.

Dr. Mark LaSalle, MSU Coastal Research and Extension Center

What is a Watershed?

… an area of land from which water drains to a given point

… an area of land where we live, work, play, raise our children, breathe the air, drink the water, enjoy the outdoors and wildlife, fish, swim, ski, etc., etc., etc.

… an area of land where we depend upon clean, safe, abundant quantities of air, water, and wildlife

To understand your watershed's ecological health, you must ask two important questions.

1. How is water used in my watershed?

2. How is land used in my watershed?

Survey Your Watershed:

… determine the activities in your watershed and their affect on the quality of the environment.

How might the presence of this construction site in your watershed affect your steams water quality?

You should look for:

- ✓ Land use activities
- ✓ Land cover
- ✓ Manmade discharges

Question to ask:

How **are the activities in my watershed related to the water quality of my stream?**

Sources of Water:

- Groundwater
- Manmade discharges
  (Point Source Discharges)
- Runoff from rainfall
  (Nonpoint Source Discharges)

MANMADE DISCHARGES

Point Source Wastewater Discharge

… a discharge of wastewater from a specific source such as a municipal, industrial, or commercial discharge pipe.

POINT SOURCE DISCHARGE

- a pipe

- the foaming is not necessarily bad.

Assuring

Adequate Treatment

… the National Pollutant Discharge Elimination System (NPDES) permit.

Agency: EPA, MS Dept of Environmental Quality, local(?)

The NPDES permit gives:

- permission to discharge
- allowable pollutant quantities, ppm
- allowable discharge flow, cfs
- monitoring requirements (what, when)
- reporting requirements (timing, spills)

Wastewater Sources

Industries:

- Natural Resources Mining
- Furniture manufacturers
- Power Production
- Clothing/Textile Mills
- Raw Chemicals
- Paper Mills
- Electroplating
- Food Processors

Municipalities:

- Sanitary Waste
- Pretreated Industrial Waste

Commercial Establishments:

- Trailer parks
- Sub-divisions
- Car/Truck Washes
- Schools

Wastewater Pollutants

Nutrients:

Nitrogen Phosphorous

Solids:

Floating Suspended Dissolved

Color **Temperature** **Heavy Metals**

Oxygen Demand **Organic Chemicals**

Bacteria **Oil and Grease**

Permits contain appropriate limits, however occasionally:

- **treatment plants malfunction**

  power outage, computer glitch

- **accidental spills occur**

  operator error, pipe breaks

- **inadequate treatment is present**

  facility expansion

- **unpermitted discharging occurs**

  facility construction re-routes materials

Municipal Wastewater Treatment Facility - has a discharge to stream.

Wastewater Treatment

for

Pollutant Removal

… a Best Management Practice (BMP).

Sources of Water:

- Groundwater (USGS, MDEQ)
- Manmade discharges (Point Source Discharges) (EPA, MDEQ)
- Runoff from rainfall (Nonpoint Source Discharges)

Runoff From Rainfall

NONPOINT SOURCE (NPS) Discharge

Excessive amounts of runoff, sediment, nutrients, or chemicals in runoff is NPS pollution.

Least regulated: EPA, MDEQ, city/county ordinances/permits

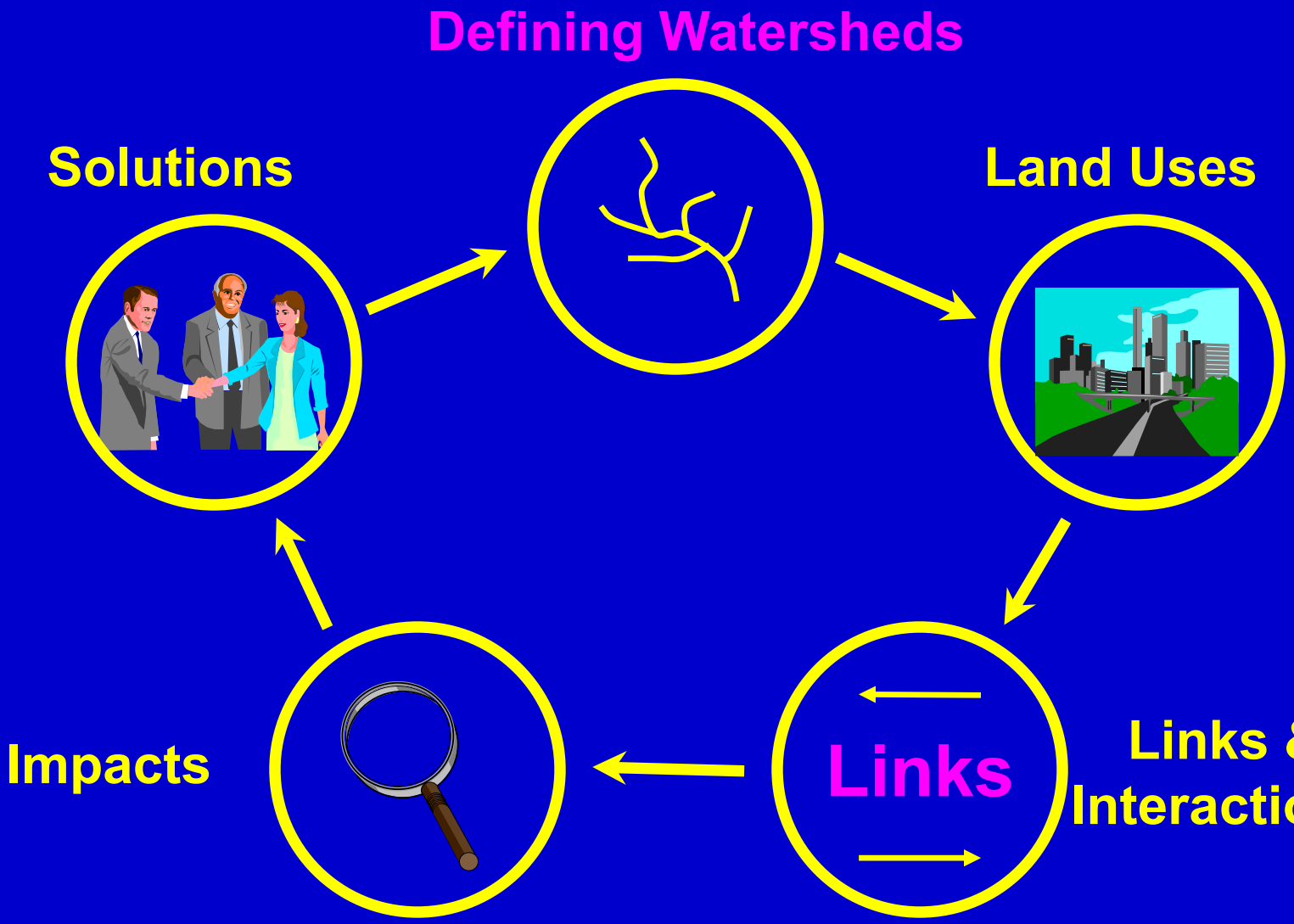
Some land uses exempted

Land Use Activities

and

Best Management Practices

Water Resource Management: Local Control and Local Solutions



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Land Use in Mississippi

Forestry	**50%**
Agriculture	**34%**
Cropland	**21%**
Pasture	**13%**
Urban	**15%**
Surface Water	**1%**

Land Use Activities used in A-A-S

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal

Land Use Activities:
are not inherently good or bad.

It all depends on how we manage them.

1. Forestry (MS Forestry Commission, MS Forestry Association)
2. Agriculture (USDA, NRCS, MSWCC, SWCD, Extension)
3. Urban and Commercial (EPA, MDEQ, city and county)
4. Construction (EPA, MDEQ, city/county)
5. Surface Mining (EPA, MDEQ, MSWCC, SWCD)
6. Household Wastewater Disposal (MS Dept of Health)

Best Management Practices (BMPs)

…. are practices that are used to prevent or minimize pollution from land use activities.

BMPs may be vegetative or structural, temporary or permanent.

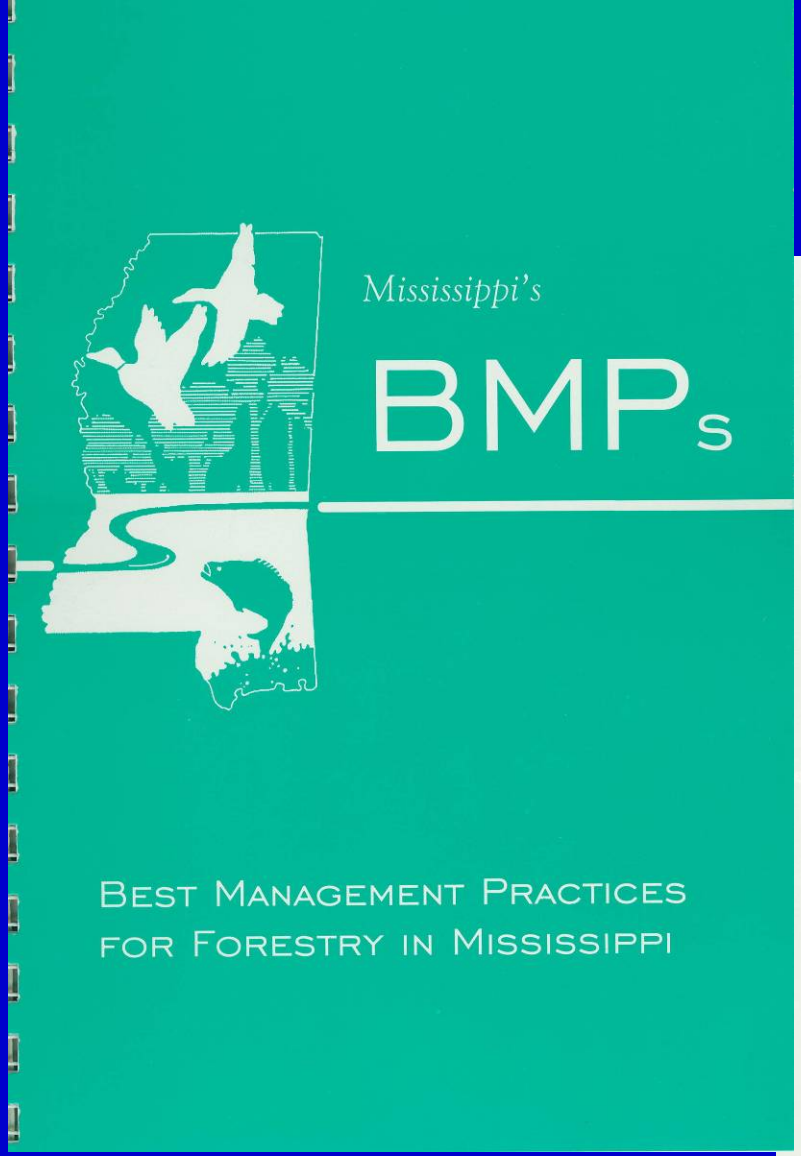
Example: Straw (a temporary, vegetative BMP) is applied to a bare soil surface created in road construction (Land Use) to prevent erosion and sedimentation (Pollutant).

FORESTRY

Contaminants may include sediment, woody debris, and chemicals from silviculture and timber harvesting activities.

Logging operations can cause significant land cover disturbance.

Reforested area after a harvest. Pine plantation.



Mississippi Forestry Association -members agree to follow BMPs Private Sector

MISSISSIPPI
FORESTRY COMMISSION

The Best Management Practices Handbook was developed by individuals representing a cross section of the forestry community, working through the Environmental Affairs and Wildlife Committee of the Mississippi Forestry Association.

The Mississippi Forestry Commission provides equal employment opportunity and services to all individuals regardless of disability, race, age, religion, color, gender, creed, national origin, or political affiliation.

Third Edition
March 2000

MFC Publication #107

Mississippi Forestry Commission - Sustainable Forestry Public Agency

RIPARIAN ZONE

The vegetated area along the banks of a water body. Stabilizes banks, filters runoff, provides shading of stream.

A.K.A.
Buffer Zone,
Streamside Management Zone

SMZ Guidelines for Perennial Streams

Allowed	Not Allowed
• Select Harvest: Must leave 50 square feet of *basal area* per acre within the SMZ in the absence of an understory.	• Roads (except perpendicular stream crossings • *Excessive rutting* • Damage to stream bank • Any chemical application • Any fertilizer application • *Prescribed burning* • *Mechanical site preparation* • *Log decks* or landings

Perennial Stream SMZ Width by Slope

The *perennial stream* SMZ will have a minimum width of 30 feet extending from both sides of the stream measured from the banks.
As the slope of the land increases, the SMZ width will increase.

Percent Slope	SMZ Width
0% - 5%	30 feet
6% - 20%	40 feet
21% - 40%	50 feet
Over 40%	60 feet

Water Bars

A *water bar* is a mound of soil designed to divert runoff water away from the road.

- Water bars should cross roads at a 30 degree angle.
- Shallow water bars may be constructed prior to and during logging use and should be considered a temporary structure.
- Deep water bars are utilized when use of the road is finished and are considered a permanent structure.
- Water bars may be constructed by hand or by bulldozer.

Water Bar Spacing

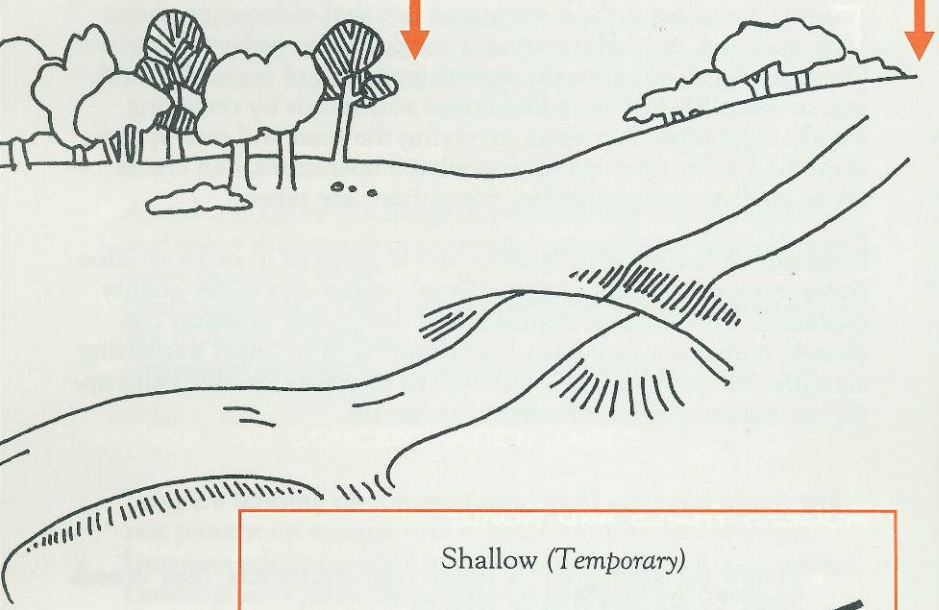
Grade of Road (percent)	Approximate Distance (feet)
2	250
5	135
10	80
15	60
20	45
25	40
30	35
40	30

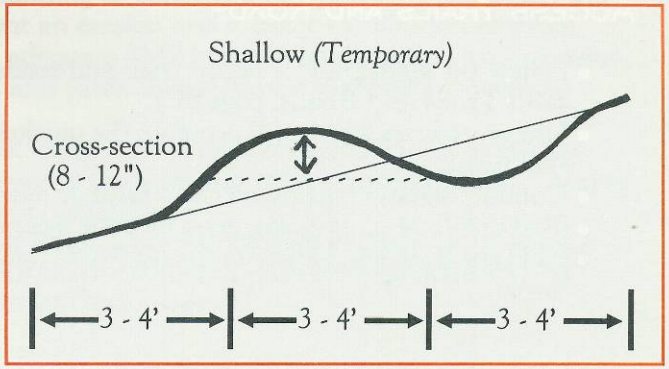
Outslopes

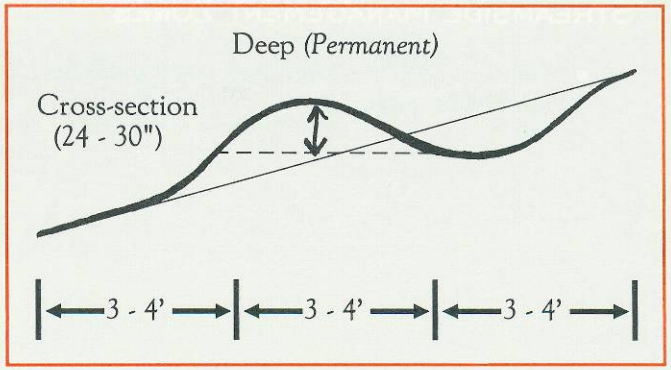
- Design the outslopes to effectively move water away from the center of a road.
- Outslope the entire width of the road to reduce the number of *drainage structures* needed.
- A recommended slope is 1/4" per foot of road width.
- Outsloping is not recommended for highly erodible soils.

Broad-based
Drainage Ditch

Water Bars







Erosion Control Methods

Land Use Activities To Look For In Your Watershed

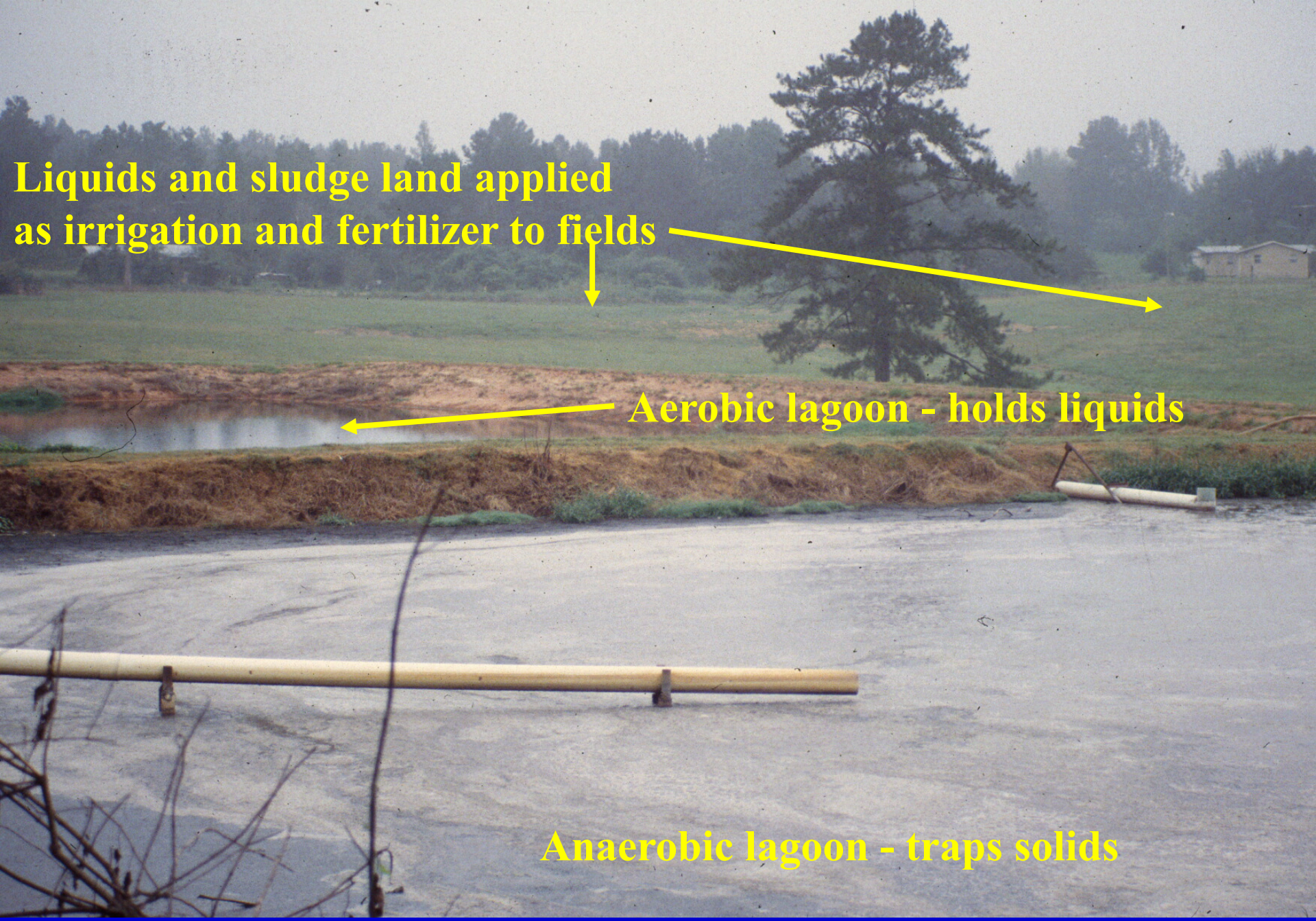
1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal

AGRICULTURE

Runoff may contain sediment, pesticides (herbicides, insecticides, fungicides, etc.), fertilizers (nitrogen, phosphorous), and animal wastes (nutrients, pathogens).

Cattle destroy vegetation on stream banks with hooves and grazing. Destroy in-stream habitat. Waste products directly in stream.

Fencing allows restoration and preservation of riparian zone. Direct access to stream denied. In-stream habitat preserved.



Confined animal feeding operations have no discharge waste water systems

What is this?

In this instance, fertilizer (like you put on your lawn or garden) is being applied to a rice field.

Crop Dusters are Licensed Pesticide Applicators

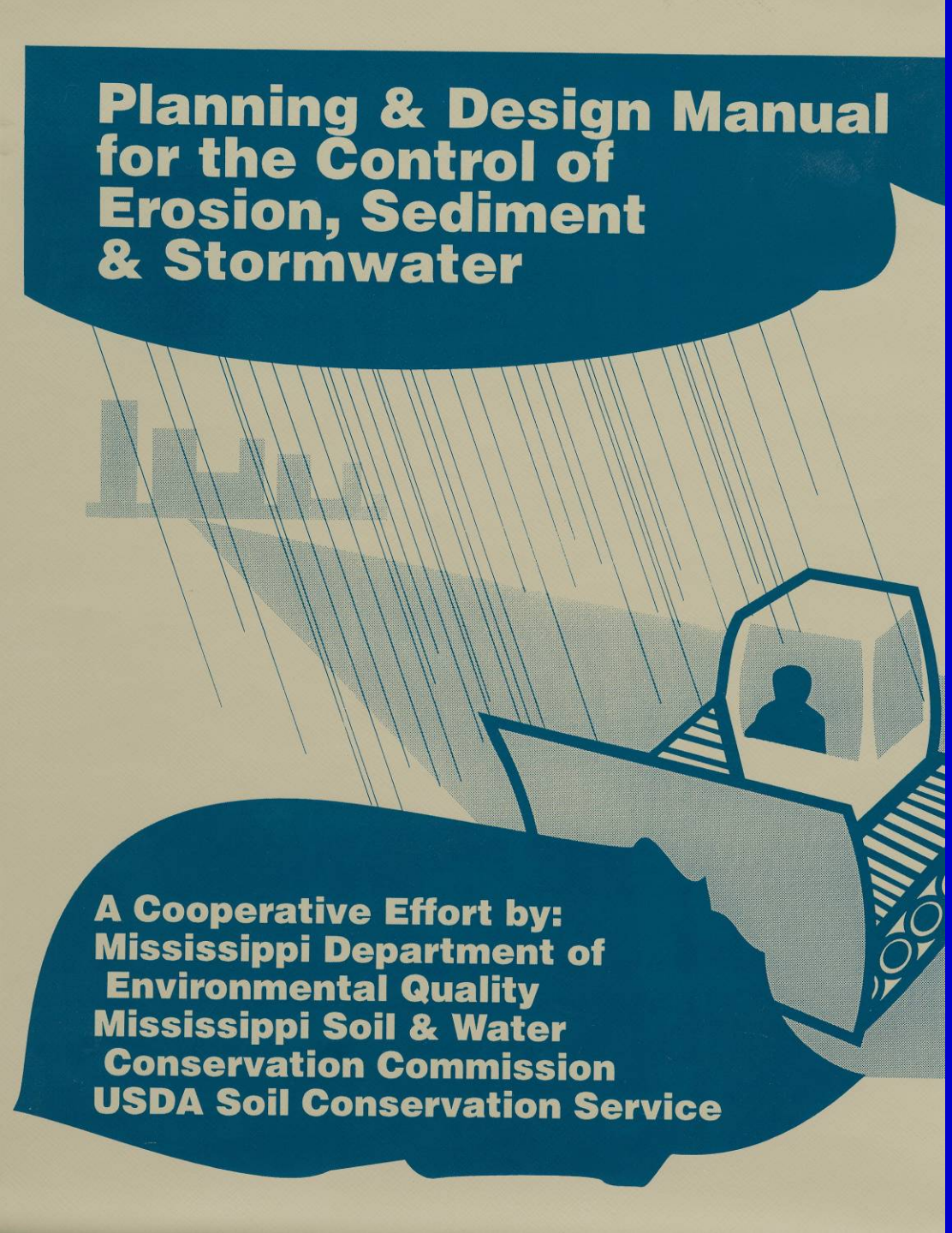
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal

URBAN AND COMMERCIAL

Runoff contains truck and automobile fluids (oil, gas, antifreeze, grease), lawn and garden chemicals, and other pollutants from city streets, parking lots, and industrial lots.

Water flows from parking lot, through grass median, to drain. This allows vegetation to filter runoff and to provide infiltration time.



Manuals exist to assist in the planning, selection and design of BMPS .

IMPACT OF LAND CONVERSION

Increased runoff rates and volumes result from changing grass or forested areas to impervious areas (rooftops, parking lots, roads)

Flooding, erosion, and stream degradation (bank sloughing) can result

IMPACT OF LAND CONVERSION ON STREAMS DRAINING WATERSHED

An increase of 20% impervious area in a watershed will cause the stream draining the watershed to degrade to seek a new equilibrium.

This degradation can be prevented by mitigating the land cover change with runoff detention basins (pre- and post-runoff equal).

Impacts of Land Conversion on Runoff

Landuse 1 acre	Rainfall 2-yr, 24 hr (inches)	Runoff volumes (gallons)	Runoff rates (gpm)		Increase over Forest
100% Runoff	4.4	119,470	3150	Vol	Rate
Forest	4.4	19,000	450	-	-
Pasture	4.4	27,150	450	43%	0%
Lawn	4.4	40,730	900	114%	100%
Cropland	4.4	43,440	900	129%	100%
Roof/ Parking lot	4.4	114,040	3150	500%	600%

Pond to prevent downstream flooding and water quality problems.

Waterfall provides aesthetics as well as aeration in detention pond system

Detention pond in Madison sub-division. Waterfall of previous picture is to left and behind camera.

Picture of Commercial Detention

Extreme event overflow

Design Detention

Normal rains, drawdown

Road ditch turnout

1. Prevents water from going entire slope-length, top of hill to bottom of hill. That would cause excessive erosion.

2. Turnouts put water out into vegetative areas.

Note: Kudzu is ineffective as a groundcover for erosion control.

Bermuda grass is very good.

Forests are excellent.

Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal

CONSTRUCTION

Runoff contains sediment from land clearing and grading activities.

During construction, sediment loss from a site should be restricted to 15% above the natural condition before construction

Highway construction is largest land disturbing construction activity in state. Streams crossed are susceptible to sediment inflows.

Highway construction with visible BMPs: mulching, seeding, rock check dams.

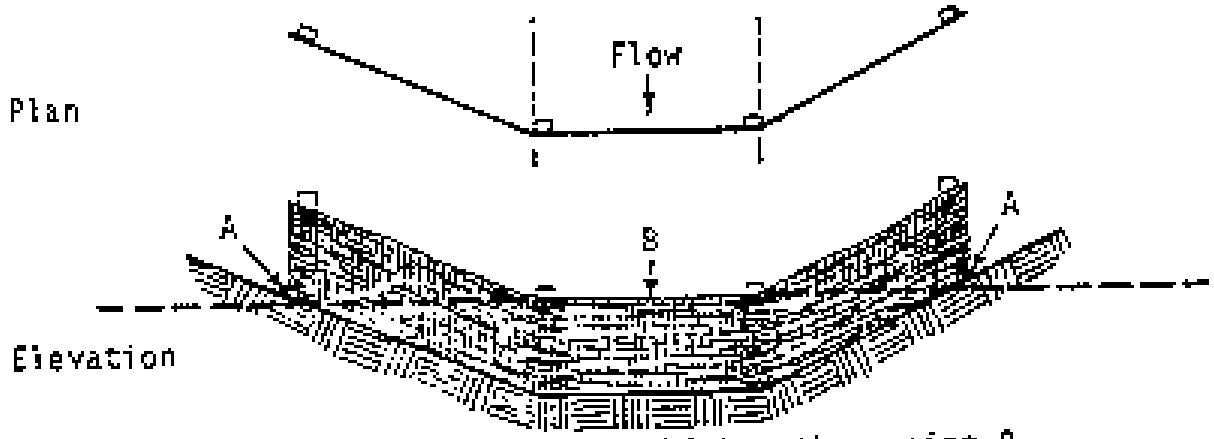
House Site: Avoid, minimize disturbance; restore groundcover as quickly as possible (mulch, grasses). Not followed on this site.

2-tons per acre of straw mulch over grass seed and fertilizer will stabilize slopes up to 3:1 until vegetation grows. Steeper slopes need erosion control blankets. No run-on water allowed to flow down slopes.

Hydraulic mulch applies seed, fertilizer and mulch in one step. Green color is added for aesthetics only.

Slope drains carries runoff down slope without contacting the slope, preventing slope erosion.

Improperly designed and installed check dam. Water concentrated and flowed around, increasing velocity, erosive power, resulting in bank erosion. Water is meant to flow over check dam in center of drainageway.



Points A should be higher than point B

PROPER PLACEMENT OF A FILTER BARRIER IN A DRAINAGE WAY

Check dams are the most misapplied construction BMP in Mississippi. Check dams can be built from: vegetation, gravel, silt fence, and straw bales.

Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal

SURFACE MINING

Sand and Gravel, Lignite

Runoff from sand, gravel, dirt, or mineral mining may contain heavy sediment loads and alter surface terrain affecting runoff.

During mining, sediment loss from a site should be restricted to 15% above the natural condition before mining.

Many of MS sand and gravel mines are pits with no surface runoff. Groundwater contamination from fuel spills would be of most concern.

A sediment trap removes sediment from runoff out of a surface mine before it enters a stream. Works by reducing runoff velocity, allowing soil particles to settle in trap, which must be cleaned out after events.

Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal

HOUSEHOLD WASTEWATER DISPOSAL

Surface and groundwater may become contaminated by bacteria and nutrients from improperly designed or unmaintained systems.

Standing sewage. Poor system and/or soils. Bacteria and nutrients possible pollutants. Breeding ground for mosquitoes.

A properly designed and maintained individual wastewater treatment system can be a positive presence on a home lot. Rock-Reed gravel system.

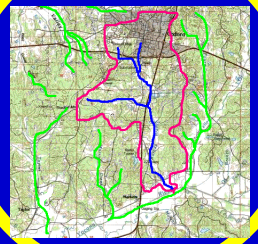
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal


ADOPTED STREAM
MONITORING STATION
TILLED LAND
DEVELOPED AREA
FORESTED
SANITARY LANDFILL
TILLED LAND
WASTE WATER TREATMENT FACILITY
FEED LOT
FORESTED
FIELD PASTURE
INDUSTRIAL DISCHARGE
FORESTED

Water Resource Management: Local Control and Local Solutions

Defining Watersheds



Planned Land Uses

Recognize watershed responses to change

Impacts Mitigated by BMPs

Solutions that meet ecological and growth goals

Individual citizens must accept that they are the only <u>cause of</u> and <u>solution to</u> pollution.

WHAT CAN YOU DO?

1. Conduct runoff survey around your own home, business, or workplace.

2. Support Local Building/Zoning Codes for Stormwater Runoff/Greenspace requirements/etc.

3. Educate others about Runoff.

4. Adopt an Urban Stream: monitor, stream clean-up, report problems

Solutions

Conservation: most economical means of ensuring the future supply of the resources. Reduces production of by-products. (Reduce usage of lights, water, gasoline, oil, etc.)

Recycling: maximum utilization of resource, conserves energy (oil, paper, aluminum, metal recycling)

Responsible Consumption of:

- **recycled products**
- **resource conscientious products**

Typical Ordinances:

- pre- and post-stormwater runoff control
- first flush runoff treatment
- Individual household wastewater treatment
- greenspace
- greywater reuse

Typical Zoning:

- floodplain
- Individual vs. central wastewater treatment or lot size
- stream corridors
- traffic corridors
- residential (single, multi), commercial, industrial

Want to Learn More?

Explore Agency Websites

1) Environmental Protection Agency (EPA)
2) Mississippi Department of Environmental Quality (MDEQ)
3) United States Geological Survey (USGS)
4) Natural Resources Conservation Service (NRCS)
5) Mississippi Soil and Water Conservation Commission (MSWCC)
6) Madison County (good example of local planning, leadership)
7) MS Forestry Commission
8) MS Department of Agriculture

MS Erosion and Sediment Control Manual

https://www.mdeq.ms.gov/water/surface-water/nonpoint-source-pollution-program/erosion-and-sediment-control-manual/

Sustainable Communities
https://www.mafes.msstate.edu/research/areas.asp?id=5

Water Resource Management:
Local Control and Local Solutions

1) What is your watershed/aquifer of concern
2) Identify history, present conditions, future planning and actions
3) What local organizations can guide and assist (SWCD)
4) What local action can be taken to meet your future goals
   (ordinances, permits, economic incentives)
5) How will you organize and coordinate various interest groups.
6) How will you coordinate local groups with state and federal
   agencies
7) What is the benefit of Local Control and Local Solutions
8) How will plan be funded (taxes, prices of good and services)

Key Topics

#1: Understanding how groundwater and surface water systems function.

#2: Understanding the importance of water quality and quantity as a foundation in a healthy ecosystem.

#3: Understanding a variety of water quality indicators in different landscapes

#4: Understanding a variety of water quantity indicators in different landscapes

#5: Understanding how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife

#6: Understanding the differences of local, regional, and national systems that manage natural resources and the importance of each in water resources

#7: Understanding the social, economic, political impacts of natural resources management and decision making.

We must never forget that

PEOPLE

are our most important resource.

So THANK YOU for being here!

Mississippi Soil & Water Conservation Commission

EARTH GREEN - WATER CLEAN

CONSERVE MISSISSIPPI
PARTNERS IN CONSERVATION

Tesheva Cr., Yazoo Co., MS