




# Water Quality Monitoring

In Bighorn Canyon  
National Recreation Area

# Introduction

- ◆ Since 1916 the responsibility of the National Park Service has been to provide for public enjoyment of America's greatest natural and cultural resources while simultaneously conserving these resources for future generations (NPS Organic Act, 1916)
- ◆ Maintaining a balance between these two different and sometimes conflicting objectives has been difficult

# Bighorn Canyon NRA

- ◆ Bighorn Canyon NRA (BICA) was created in 1966, following construction of the Yellowtail Dam on the Bighorn River
  - ◆ BICA is involved in a program (the Inventory & Monitoring Program) designed to develop and implement long-term monitoring of park resources
- 

# What is the Inventory and Monitoring Program?

- ◆ In 1998 the National Parks Omnibus Management Act mandated that: “The Secretary shall undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the long-term trends in the condition of National Park System resources.”

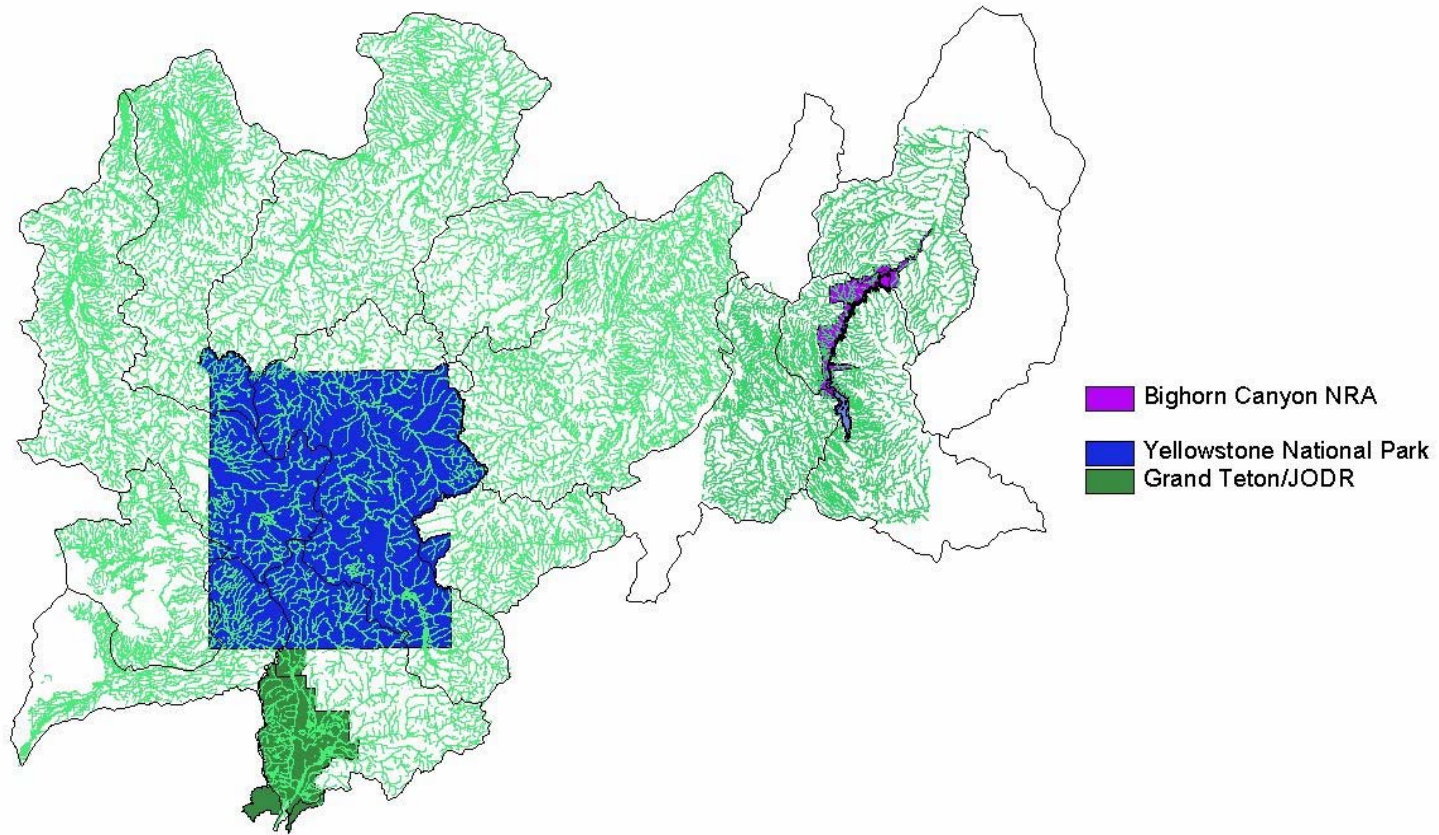
# What is an Inventory and Monitoring Network?

- ◆ In response to the Omnibus Act, 270+ units of the NPS were organized into 32 Networks
- ◆ BICA is one of three parks belonging to the Greater Yellowstone Inventory and Monitoring Network (GRYN)


# What is the GRYN?

- ◆ The Greater Yellowstone Network is made up of three parks:
  - Yellowstone National Park
  - Grand Teton National Park
  - Bighorn Canyon National Recreation Area

# The Greater Yellowstone Network




# What has the GRYN done in BICA related to water quality?

- ◆ Summarized threats and issues
  - ◆ Summarized historic monitoring
  - ◆ Recommending monitoring of state impaired waters (303[d] streams)
  - ◆ Recommending long-term monitoring of vital signs
- 



# Threats and Issues

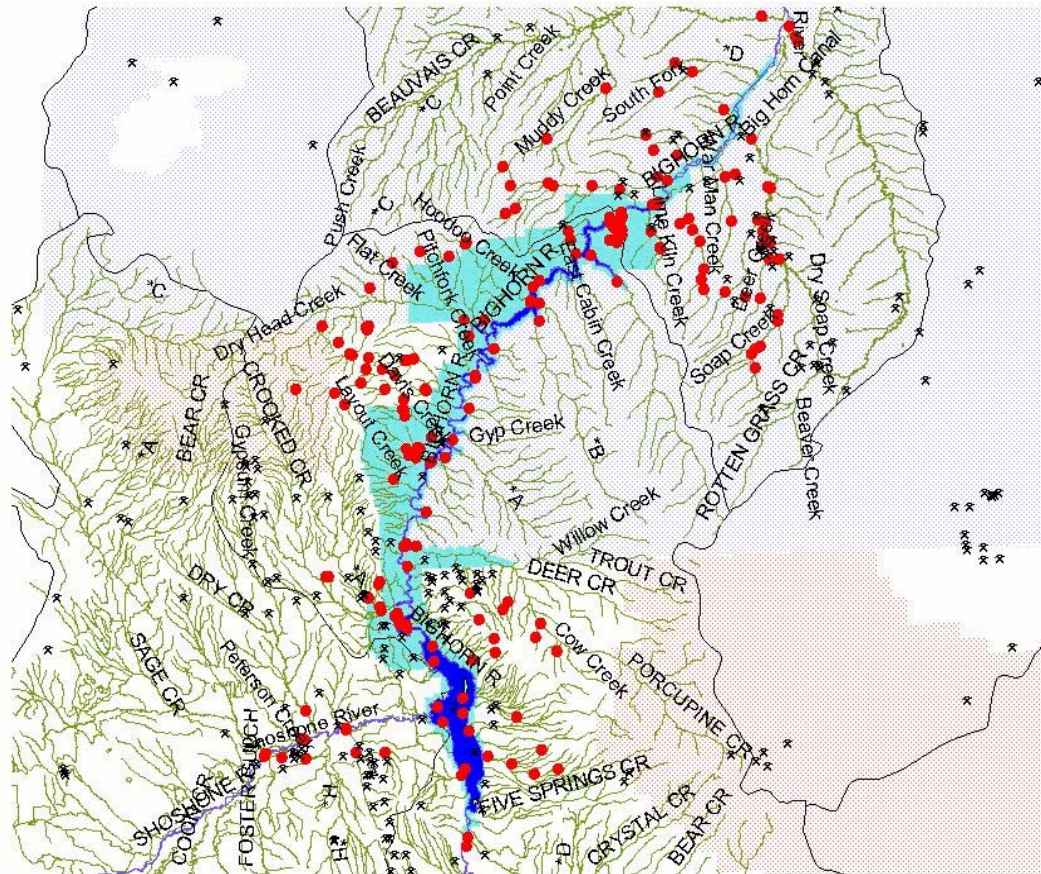
- ◆ Sediment accumulation
  - ◆ Invasion of non-indigenous plants in wetland and riparian areas
  - ◆ Water quality (bacteria and blue-green algae) at swimming beaches
  - ◆ Loss of riparian habitat due to trailing and grazing
  - ◆ Non-point pollution to water resources (agricultural chemicals, nutrients, sediment)
- 
- A decorative graphic of a teal mountain range is located in the bottom right corner of the slide.

# Historic Water Quality Monitoring

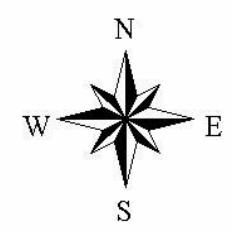
- ◆ Sediment accumulation patterns
- ◆ Trophic status of Bighorn Lake
- ◆ Limnological studies
- ◆ Montana Game & Fish

Note: Most of the sampling of physical and chemical properties of Bighorn Lake occurred shortly after impoundment.

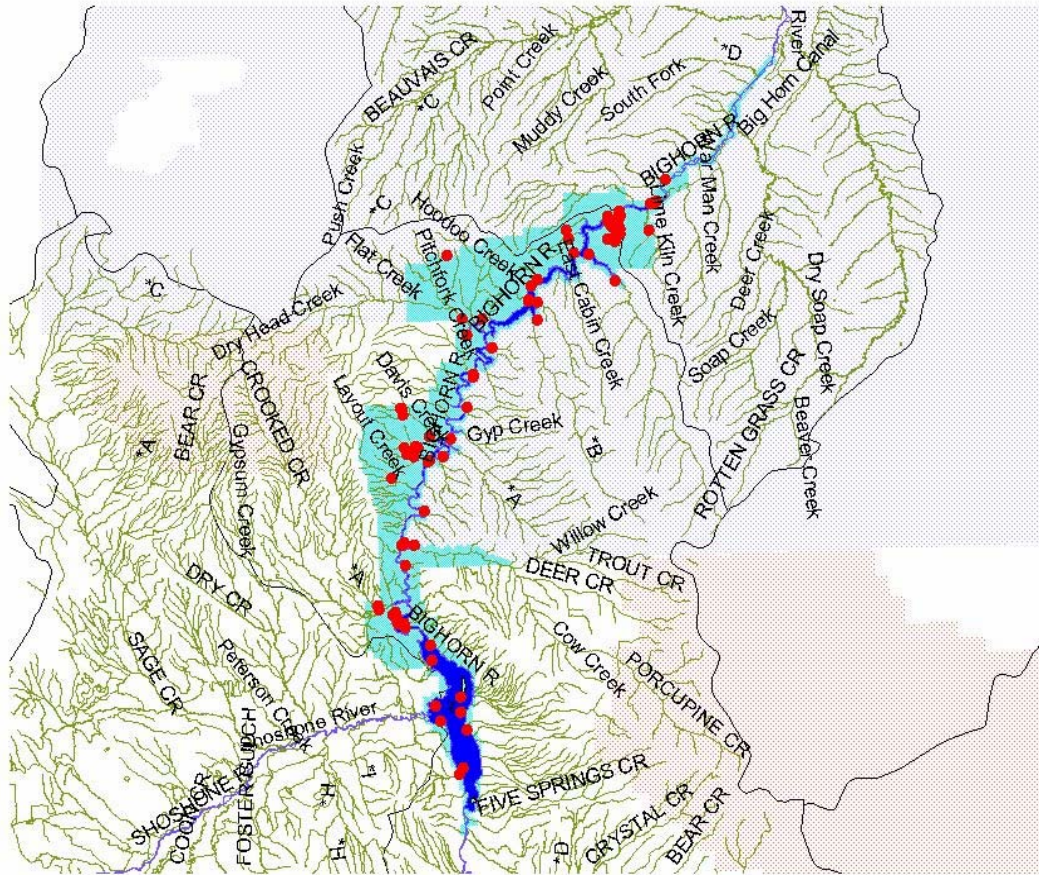
# Bighorn Canyon NRA



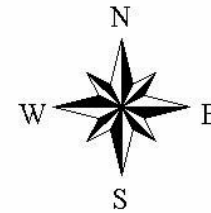
- \* Mines
- Water Quality Stations
- Rivers
- Streams
- Lakes
- Hydrologic Unit Boundaries
- Bighorn Canyon NRA
- National Forest
- Indian Reservation



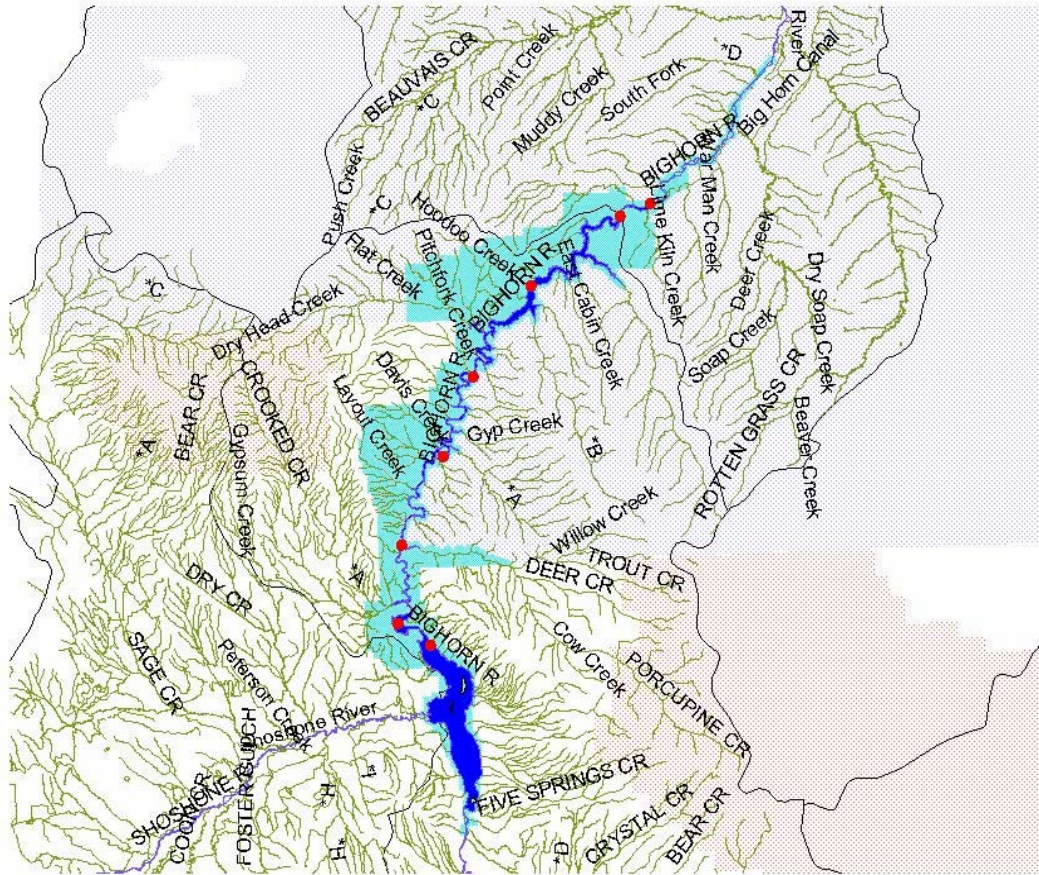
# Bighorn Canyon NRA



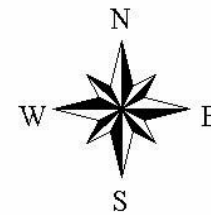
- Stations in Park
- Rivers
- Streams
- Lakes
- Hydrologic Unit Boundaries
- Bighorn Canyon NRA
- National Forest
- Indian Reservation



# Bighorn Canyon NRA



- Longterm Stations
- Rivers
- Streams
- Lakes
- Hydrologic Unit Boundaries
- Bighorn Canyon NRA
- National Forest
- Indian Reservation




# Review of Historical Monitoring:

- ◆ Although water quality has been sampled at many locations within BICA, there are insufficient data to determine any long-term trends

# State Impaired Waters


Impaired Waterbody	Cause for listing	What will be monitored?
Shoshone River	Fecal coliforms	Fecal coliforms; <i>E. coli</i>
Bighorn River	Nutrient loading	Nitrogen; benthic macro invertebrates

# Vital Signs Monitoring


- ◆ Vital Signs are key elements that indicate the health of an ecosystem
  - ◆ Vital signs may occur at any level of organization including landscape, community, population, or genetic levels
  - ◆ They may be compositional (referring to the variety of elements in the system), structural (referring to the organization or pattern of the system), or functional (referring to ecological processes)
  - ◆ Vital signs can be any measurable feature of the environment that provides insights into the state of the ecosystem.
- 




# Goals of Vital Signs Monitoring

1. Provide data to better understand the dynamic nature and condition of park ecosystems and to provide reference points for comparisons with other, altered environments.
  2. Provide data to meet certain legal and Congressional mandates related to natural resource protection and visitor enjoyment.
  3. Provide a means of measuring progress towards performance goals.
- 

# Goals of Vital Signs Monitoring (cont'd)

4. Determine status and trends in selected indicators of the condition of park ecosystems to allow managers to make better-informed decisions and to work more effectively with other agencies and individuals for the benefit of park resources.
  5. Provide early warning of abnormal conditions of selected resources to help develop effective mitigation measures and reduce costs of management.
- 

# What Vital Signs will most likely be monitored in BICA?


- ◆ Streamflow
  - ◆ Water chemistry
  - ◆ River invertebrate assemblages
  - ◆ Algal species composition and biomass
  - ◆ Continuous water temperature
  - ◆ Reservoir elevation
  - ◆ Springs and seeps
- 

# Monitoring Recommendations for Bighorn Canyon NRA

1. Permanent monitoring stations should be established at 3 to 5 locations in Bighorn Lake, located at or near points of maximum recreational use, such as the swimming beaches at Horseshoe Bend and at Ok-A-Beh. The stations should be monitored at least quarterly for temperature, pH, specific conductance, dissolved oxygen, major cations and anions, nutrients, bacteria, and turbidity.

# Monitoring Recommendations (cont'd)

2. Existing water quality monitoring being conducted by the USGS on the Bighorn and Shoshone Rivers upstream from Bighorn Lake should be supplemented with additional monitoring as necessary to obtain quarterly “full suite” analyses.

A stylized, teal-colored silhouette of a mountain range is positioned in the bottom right corner of the slide, extending from the right edge towards the center.

# Monitoring Recommendations (cont'd)

3. Permanent monitoring stations should be established along smaller tributary streams draining into Bighorn Lake, particularly in areas of high grazing intensity (Crooked Creek, Layout Creek and Trail Creek). These streams should be sampled for temperature, pH, specific conductance, dissolved oxygen, nutrients, bacteria and turbidity on at least a quarterly basis.

# Monitoring Recommendations (cont'd)

4. Monitoring of the riparian and stream channel conditions and benthic macroinvertebrate populations should be conducted at permanently established sites along streams impacted by grazing and along relatively unimpacted streams. Potentially suitable impacted sites are located along Crooked Creek, Layout Creek and Trail Creek.

# Monitoring Recommendations

- ◆ The GRYN is presently in the process of designing a statistically valid sampling scheme for monitoring water quality related vital signs in Bighorn Canyon. Hopefully, pilot monitoring will begin in 2005.



# Availability of Monitoring Data

- ◆ Data collected by the Inventory and Monitoring Program will be uploaded to EPA's STORET database, and available to the public.

# For more information:

- ◆ Susan E. O'Ney
- ◆ (307) 739-3666
- ◆ Susan\_o'ney@nps.gov
- ◆ <http://nature.nps.gov/im/units/gryn>