

# **The U.S. Inland Waterway Transport System: Multipurpose & Integrated Uses on North American Rivers**

**3<sup>rd</sup> World Water Forum  
Kyoto, Japan  
March 18, 2003**

**Robert A. Pietrowsky  
Director, Institute for Water Resources  
U.S. Army Corps of Engineers**



# *U.S. Army Corps of Engineers Activities*



## ■ Water Resources Missions

- Primary

- Navigation
- Flood Control & Shore Protection
- Ecosystem Restoration
- Disaster Response & Recovery



- Allied Purposes

- Hydropower
- Environmental Stewardship
- Water Supply
- Recreation

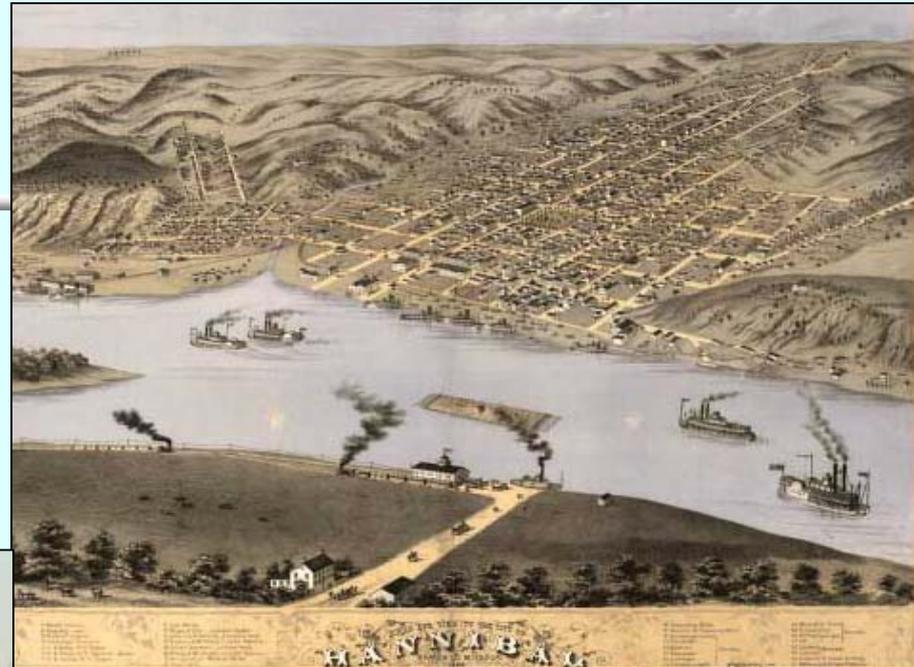


- Regulatory Programs

# U.S. Federal Role in Waterway Transport



- 1824 – authority to clear snags and make improvements
- Canal building era to mid-1800s (states)
- Post Civil War – suction dredging, jetties
- 1885: 1<sup>st</sup> of 46 locks and dams on Ohio
- 1930s: Present system of locks constructed on Upper Miss, Illinois, Tennessee and other waterways
- 1950s: Construction starts on present-day higher lift locks on Ohio
- 1960s-70s: Navigation improvements to Columbia-Snake, Arkansas River
- 1985: Tenn-Tom Waterway completed
- 1994-Present: Upper Mississippi River & Illinois Waterway Navigation Study





# U.S. Federal Role in Waterway Transport

- 1824 – authority to clear snags and make improvements
- Canal building era to mid-1800s (states)
- Post Civil War – suction dredging, jetties
- 1885: 1<sup>st</sup> of 46 locks and dams on Ohio
- 1930s: Present system of locks constructed on Upper Miss, Illinois, Tennessee and other waterways
- 1950s: Construction starts on present-day higher lift locks on Ohio
- 1960s-70s: Navigation improvements to Columbia-Snake, Arkansas River
- 1985: Tenn-Tom Waterway completed
- 1994 – Present: Upper Mississippi River & Illinois Waterway Navigation Study



# Water Resources Development Context

1824 – 1936: *Nation Building Era* of primarily Single Purpose Navigation Projects

1936 – 1986: *Era of Economic Efficiency* focusing on Multi-Purpose Projects

1969 – 1986: *Era of Environmental Enlightenment*, focusing on Multi-Objective Planning

1986 – Present: *Beneficiary Pays Era*, evolving towards *Integrated Water Resources Management*



## Federal Objective in the U.S.

---

**“ Contribute to National Economic Development consistent with protecting the Nation's environment ...”**

***Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* March 10, 1983**



# Trend Towards Integrated Water Resources Management

---

- Environmentally sustainable water resources development & management - where environmental and economic considerations are effectively balanced in project planning, design, construction, operation and maintenance ...

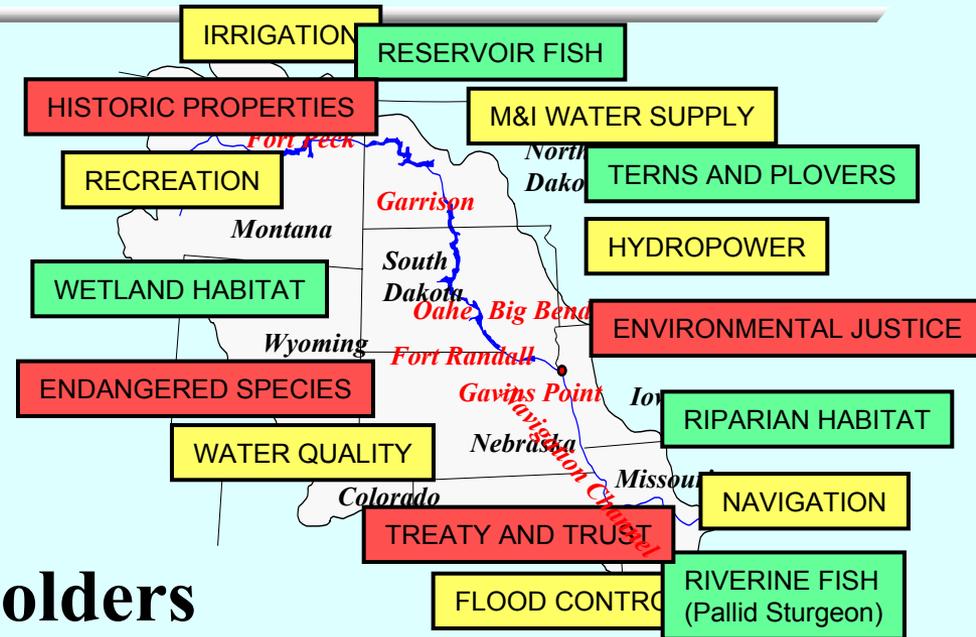


***IWRM thru a vision shared by all stakeholders***



# Watershed Planning

- Collaborative, **shared vision planning** approach
- Partnerships between all levels of government
- Early and continuous involvement by all stakeholders
- Technical process of jointly building transparent analytical models
- Multi-objective, environmentally sustainable watershed perspective
- Operating projects monitored, adaptively managed





# United States Water Transport System

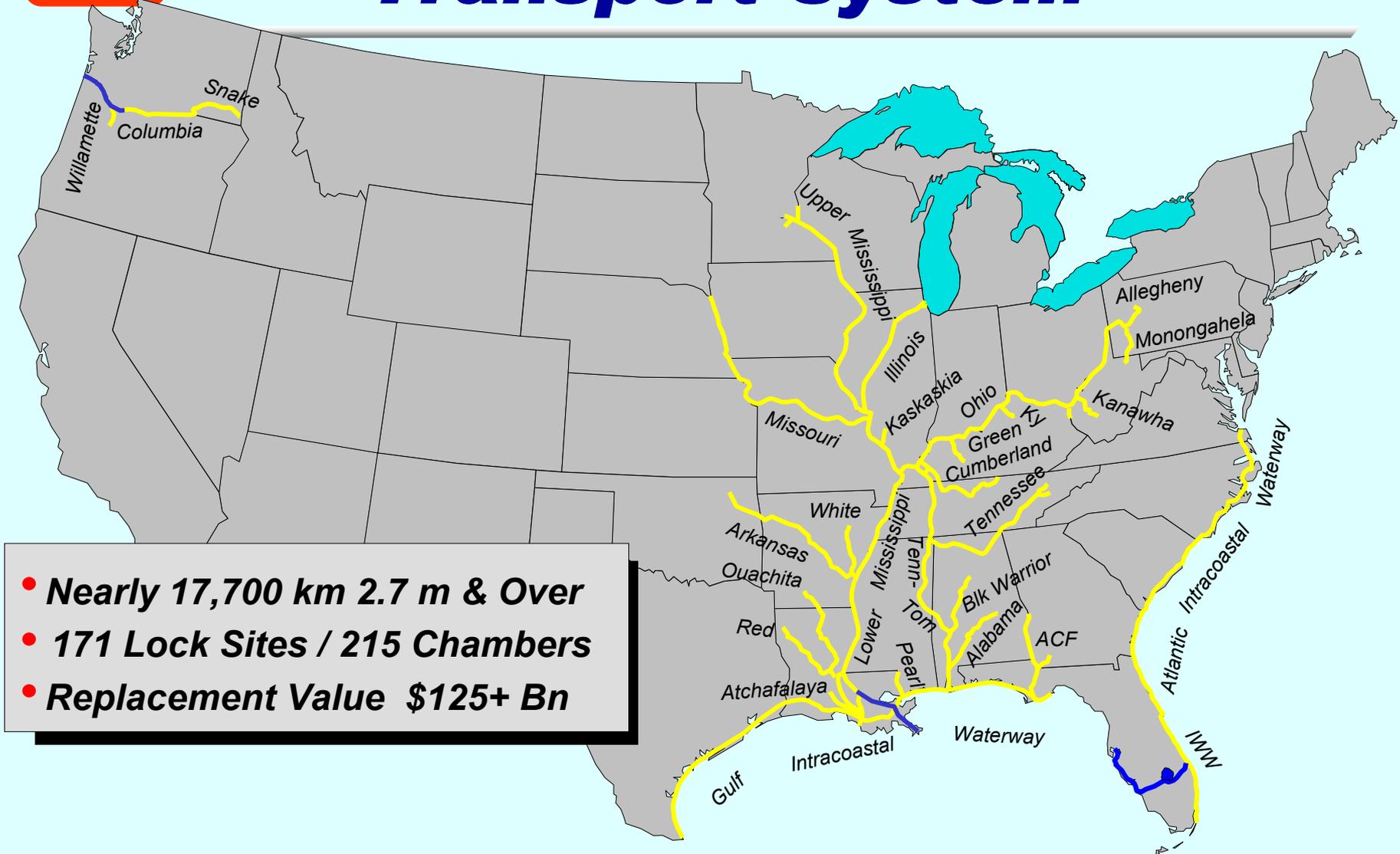
- **Contributes ~ 8% GDP**
- **System nearing capacity**
- **Commerce expected to double by 2020**
- **Already a generation behind in channel design or lock capacity at key U.S. load centers & system choke points**
- **Capacity constraints increase transportation costs, pollution, congestion**



## National Need

**An environmentally sustainable,  
robust maritime transportation  
system**

# U.S. Inland Waterway Transport System

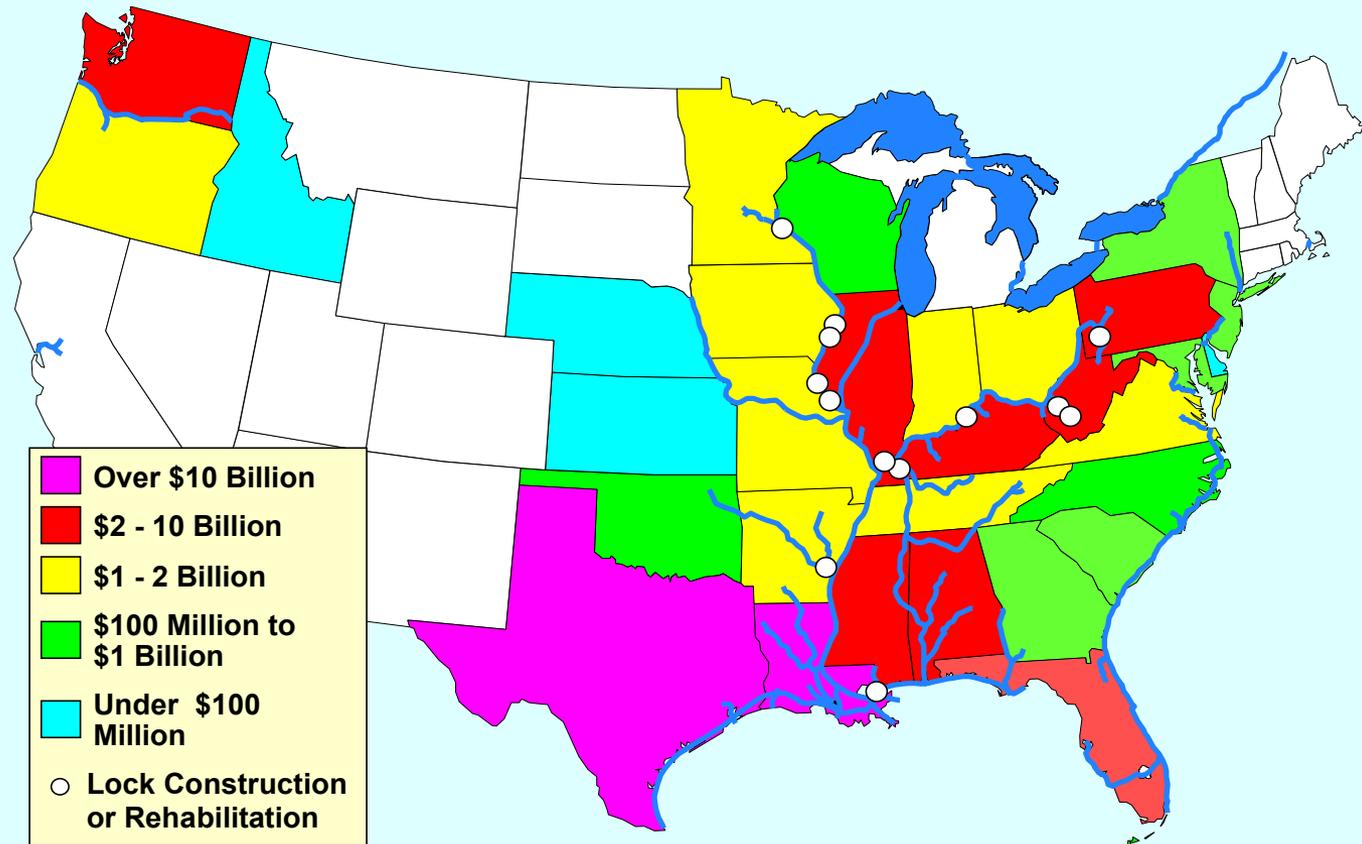




# ***Value of Inland & Intracoastal Waterborne Cargo in U.S.***

***by State of Origin***

- **Over 550 million metric tons shipped from 31 U.S. states (2001)**
- **Cargo worth ~ \$112 billion**
- **Average cost savings of ~ \$11/ton**



***Based on 1999 data developed by TVA and USACE.***



# ***U.S. Waterways Role in Economic Development***

## ■ **Grain Exports**

- *82 million metric tons (90 million tons) annually*

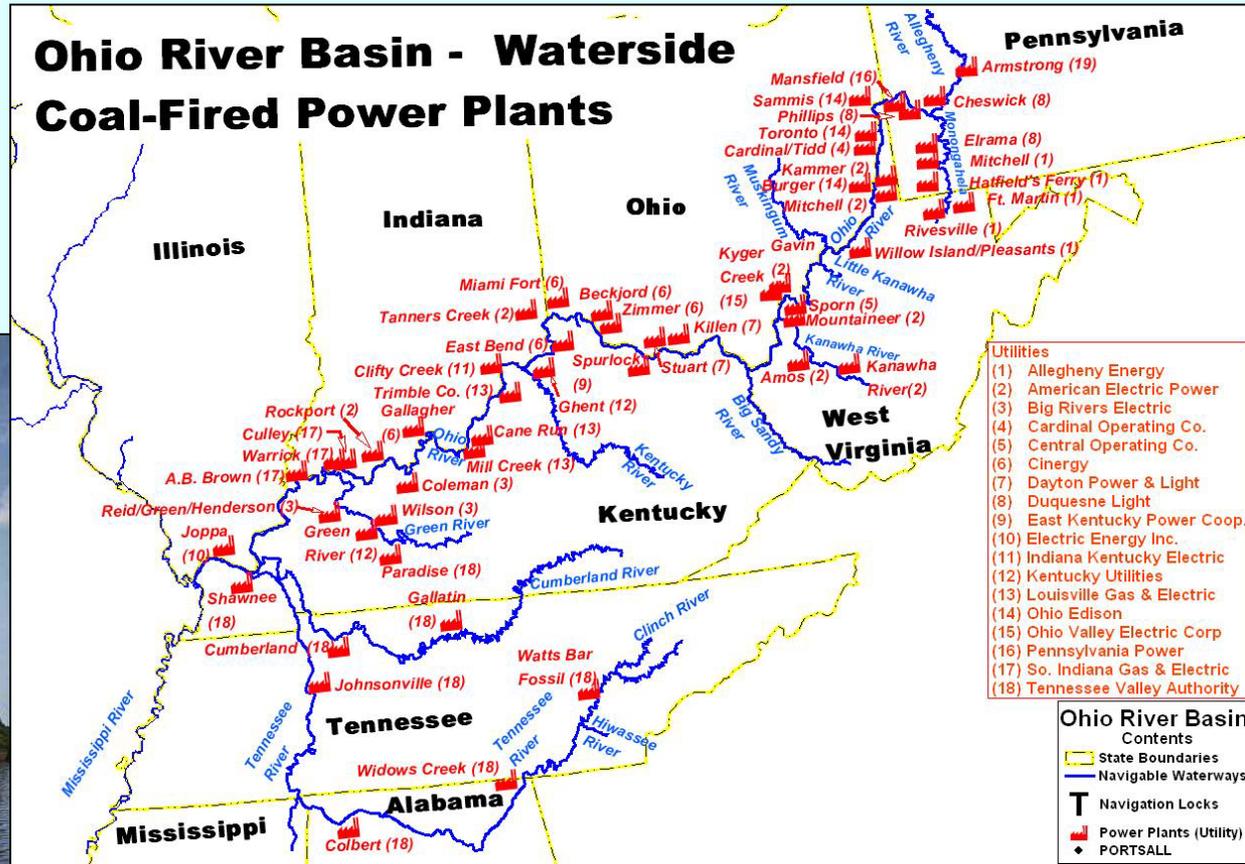




# U.S. Waterways Role in Economic Development

## ■ Coal for power plants

- 154 million metric tons (170 million tons) annually
- 20 % of utility coal supplied by inland waterway





# ***U.S. Waterways Role in Economic Development***

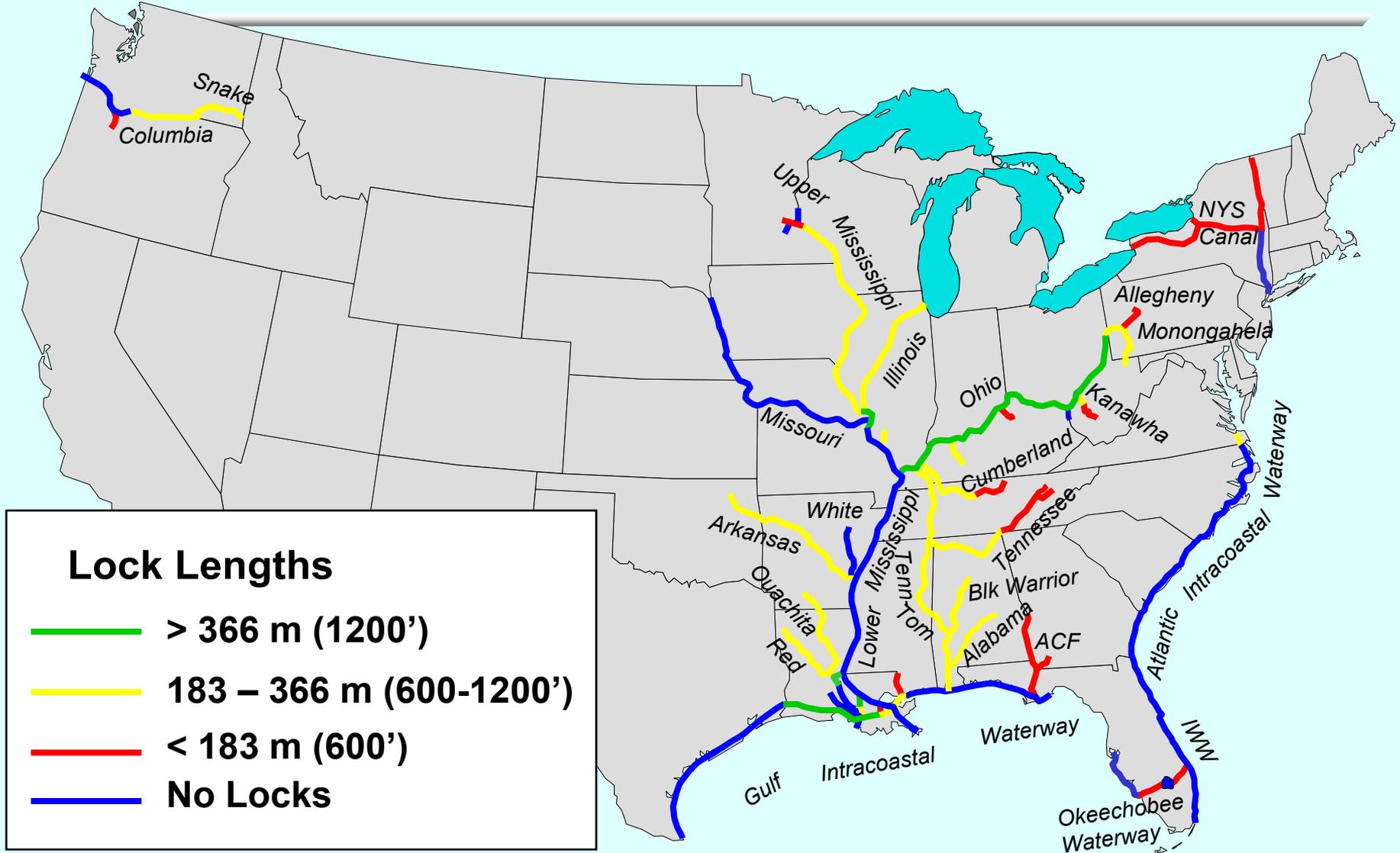
## ■ **Petroleum**

- *136 million metric tons (150 million tons) annually*





# U.S. Inland Waterway Lock Dimensions



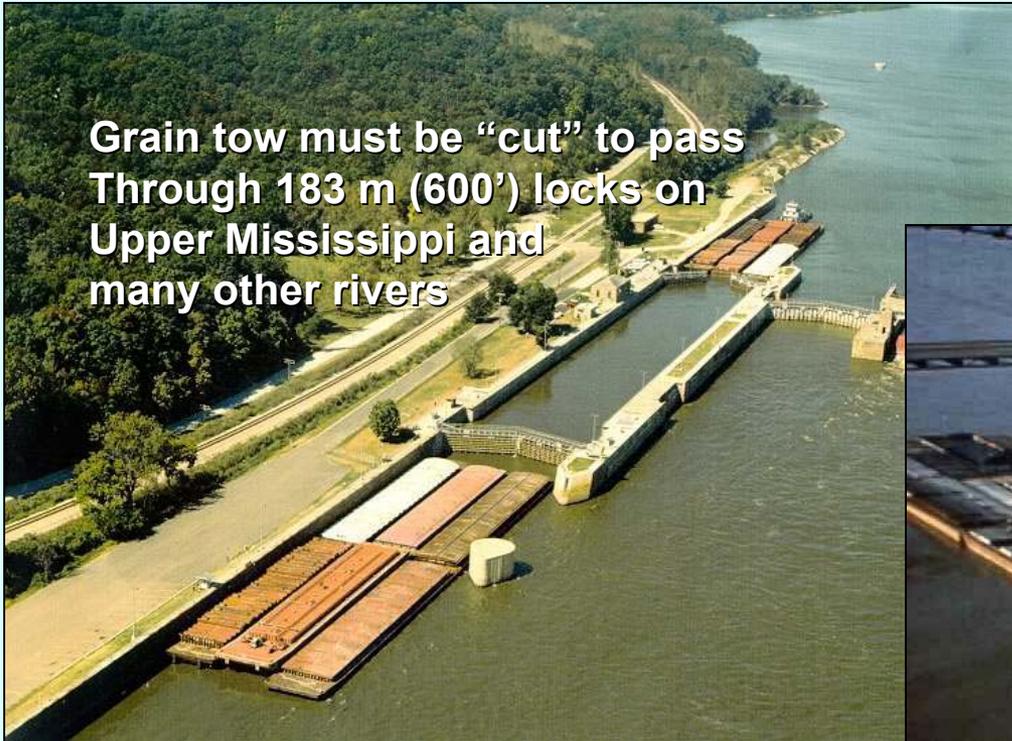


# **Lock Sizes**

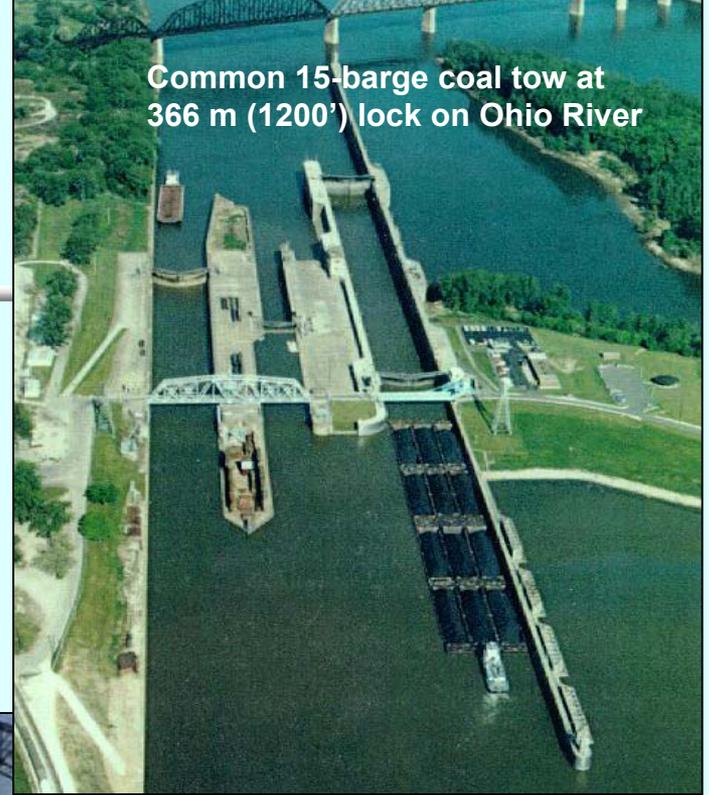
## ***And Waterway Characteristics***

Variations in capacity by waterway...

Grain tow must be “cut” to pass through 183 m (600’) locks on Upper Mississippi and many other rivers



Common 15-barge coal tow at 366 m (1200’) lock on Ohio River



Large mixed tows of over 30 barges common on open stretches of Lower Mississippi River



# U.S. Ports & Harbors System

Ports handling >10 million metric tons (2001)





# Emerging U.S. Water Transport Challenges

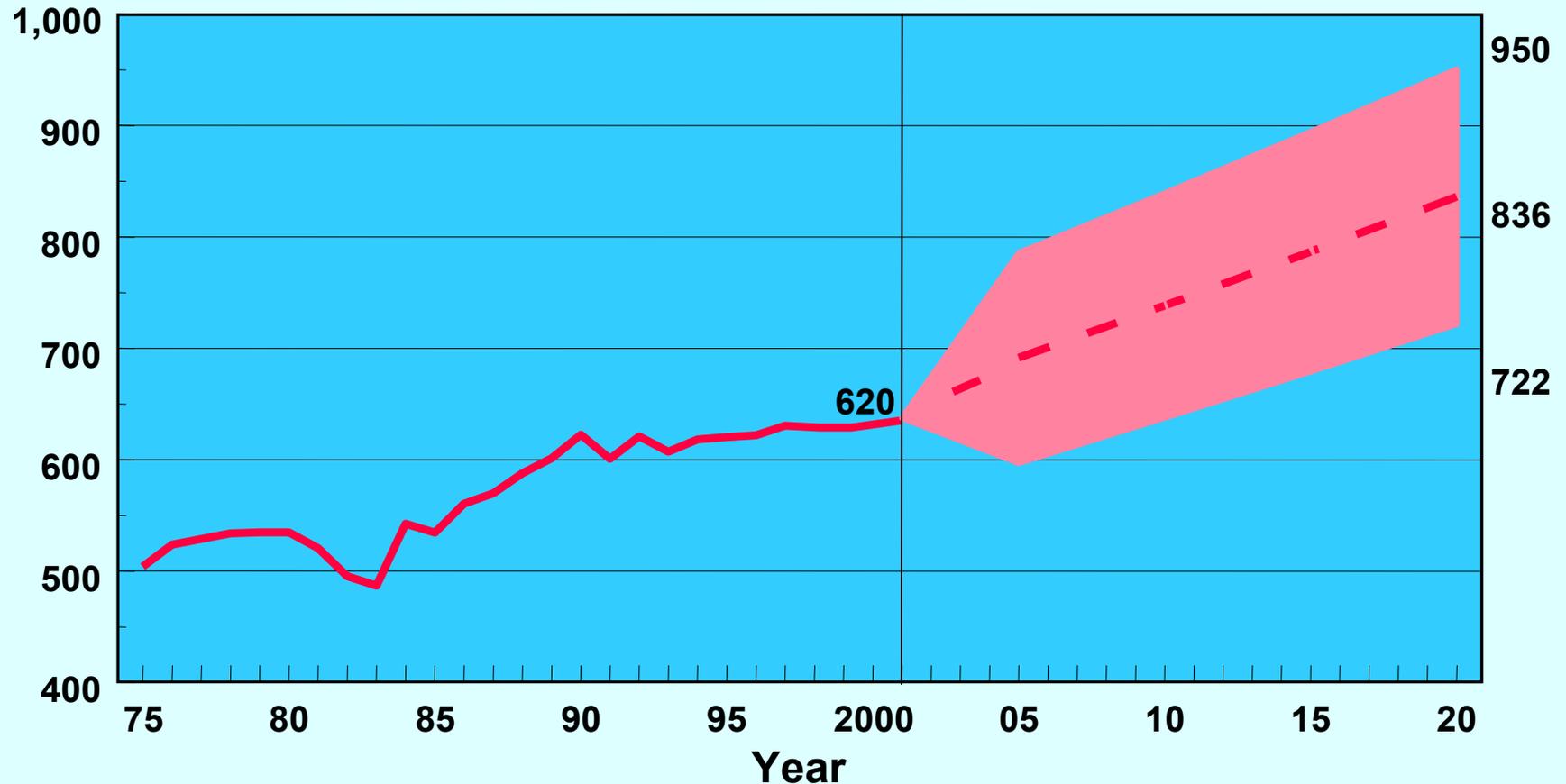
- **Increasing Domestic & International Trade**
- **System Capacity Problems**
- **Aging Infrastructure**
- **Constrained Funding**
- **Need for Integrated Solutions to Water Resources Challenges**
  - **Navigation Systems**
  - **Environmental Restoration**
  - **Flood Management**
  - **Water Quantity & Quality**





# Challenge: U.S. Waterway Traffic Projected to Grow 33% by 2020

Million Tons





# **Challenge: Growing Traffic = Increased Lock Delays**

**Multiple lockages to pass a tow  
result in long queues that are  
costly and inefficient.**



**Queues at old L&D 26 on  
the Mississippi could last  
up to several days.**

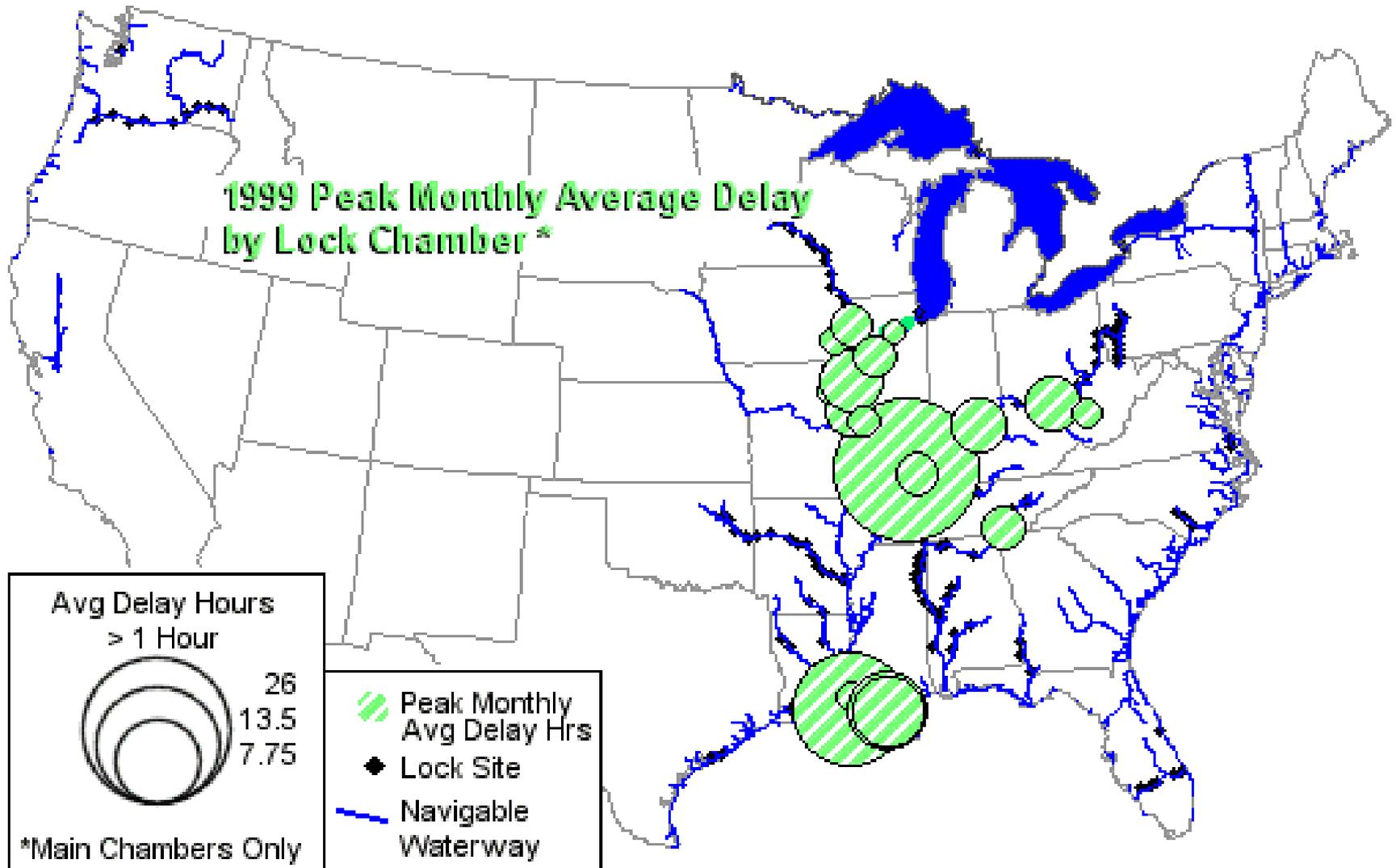
**A new 1200' main chamber allows  
tows of 15 barges to pass in a  
single lockage, eliminating most  
of the delay.**

**The new lock handles over 75  
million tons annually -- mostly  
export grain.**



# Animated Display of Average Lock Delay

Greater Than 1 Hour Delay

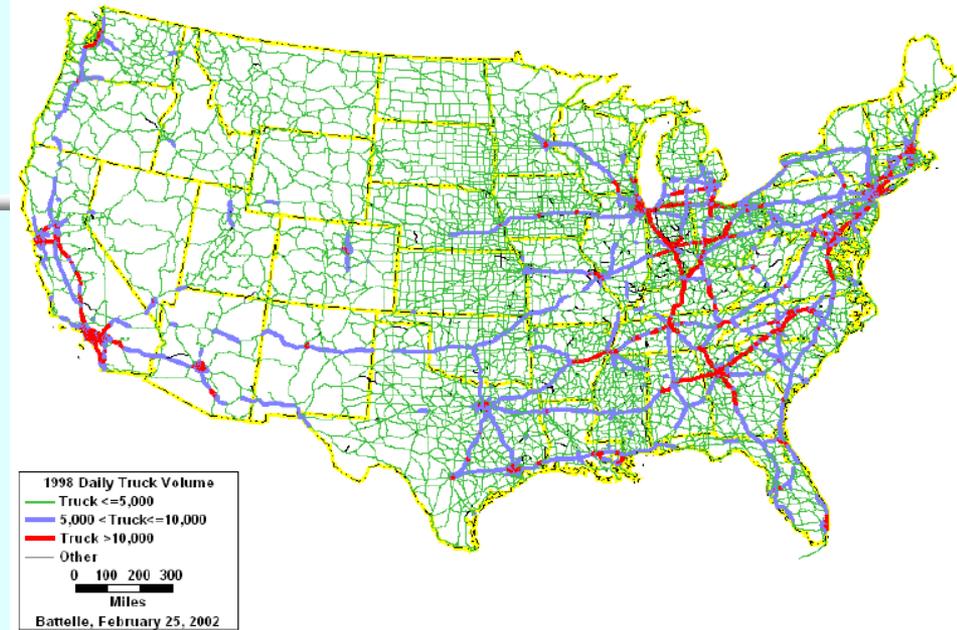




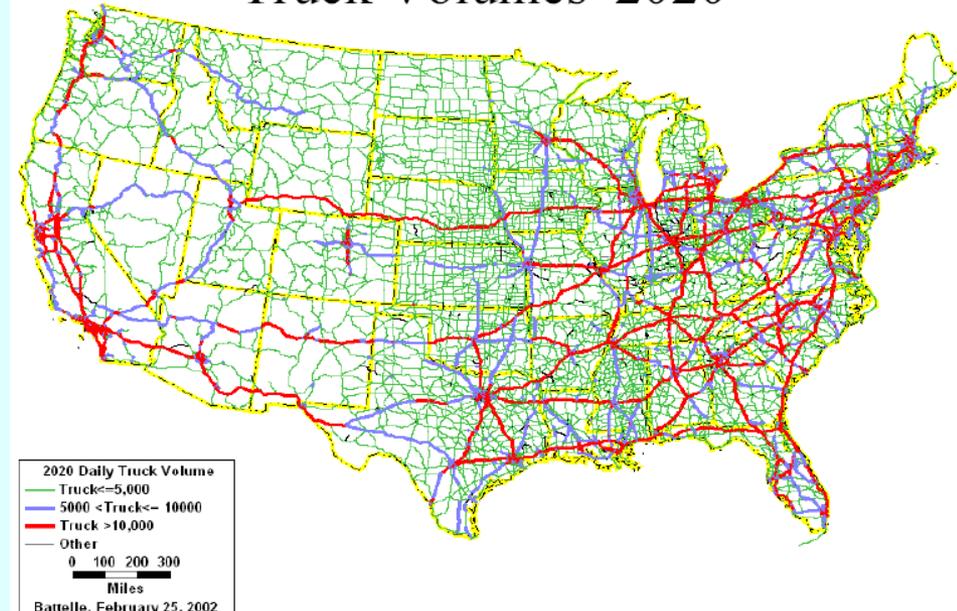
## **Future Freight Demand in U.S.**

- Freight traffic expected to increase by 67%
- General cargo freight by 113%
- Highway traffic grows from 11 billion to 19 billion tons (17.2 billion metric tons)
- Rail grows from 2 to 3.7 billion tons (3.4 billion metric tons)
- How is this cargo going to move?
  - Little room left to expand highways, especially in urban areas
  - Rail mileage has been decreasing; much former right-of-way has been developed
  - Rail capacity constraints in urban areas, tunnel clearances, single-track bridges

Truck Volumes –1998



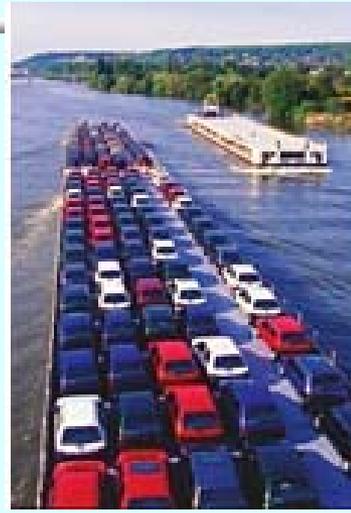
Truck Volumes–2020





# ***U.S. Waterway Transport Alternative***

- More freight could shift to barge
- Europeans promoting waterways as environmentally-friendly alternative to highways and rail
- Container-on-barge highly developed in Europe
- Examples in US: Columbia-Snake; Gulf Coast service; Coastal movements along Atlantic
- More in the future?





# **Challenge: Aging U.S. Water Resources Infrastructure**

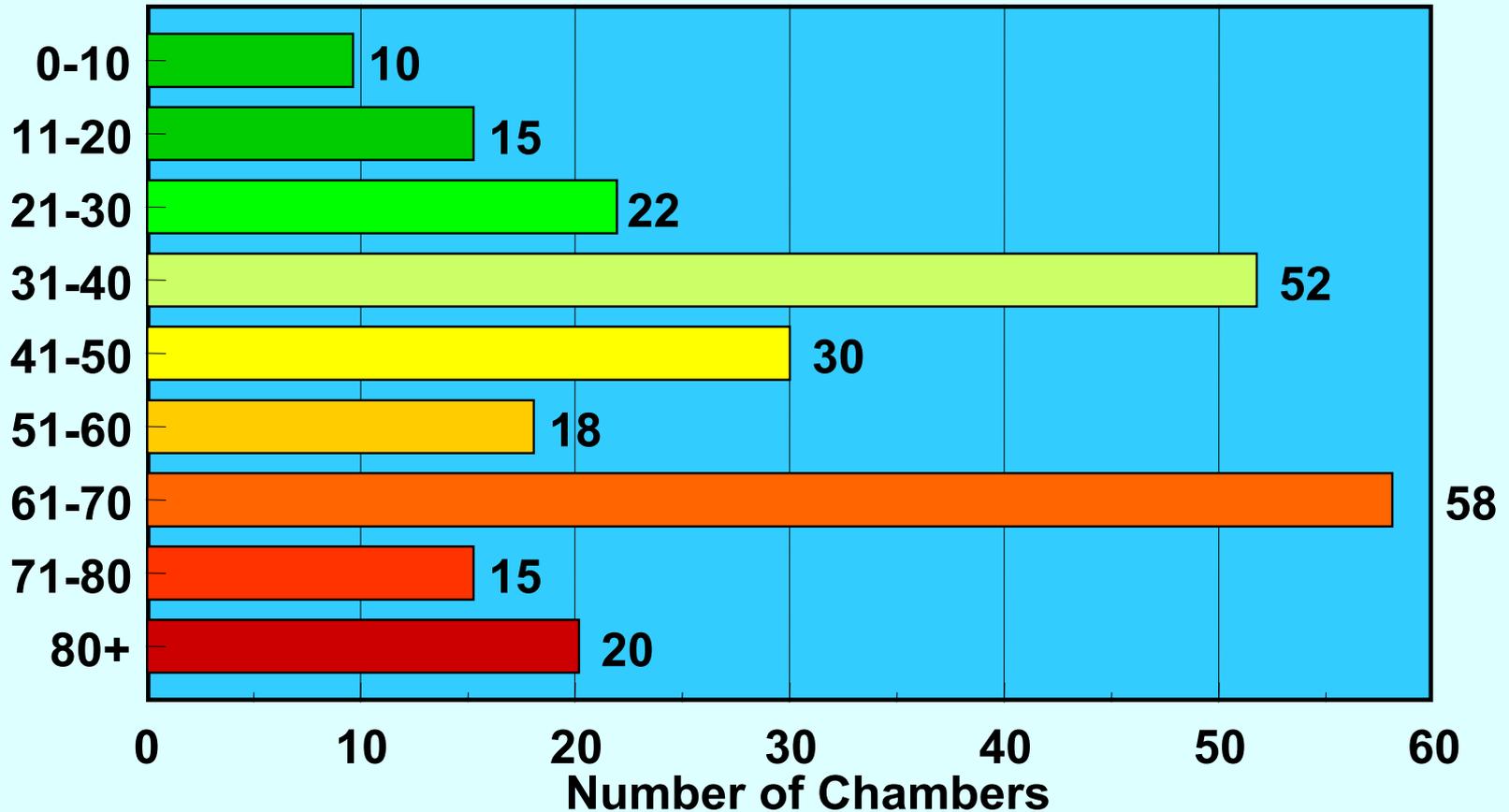
- Investments in water resources infrastructure have declined in real terms
- Aging infrastructure results in more frequent closures for repairs, decreased performance and costly delays





# **Challenge: Aging Lock Inventory\***

Age in 2000 (Years)



\*Includes all operational deep and shallow draft Corps and TVA navigation locks.



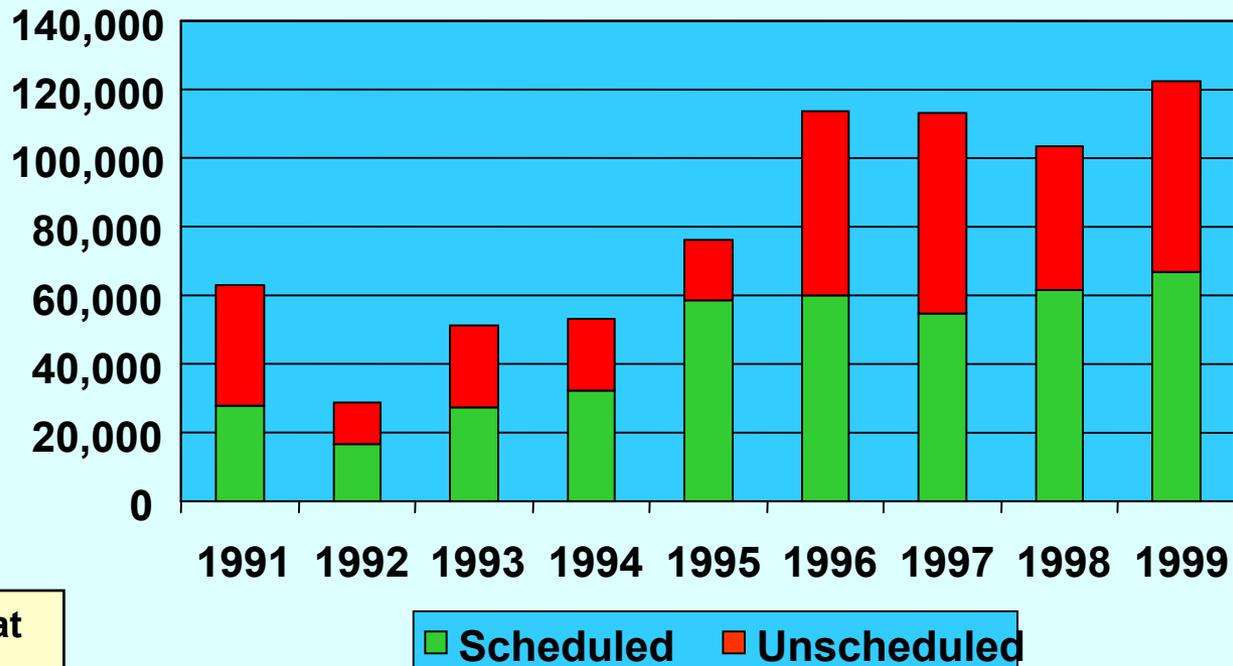
# Challenge: Aging Infrastructure + O&M Backlog = Increasing “Downtime” at Locks



A major lock gate failure occurred at John Day L&D in 2002. It will take months and over \$5 million to repair. Meanwhile, commerce is experiencing major delays to transit.

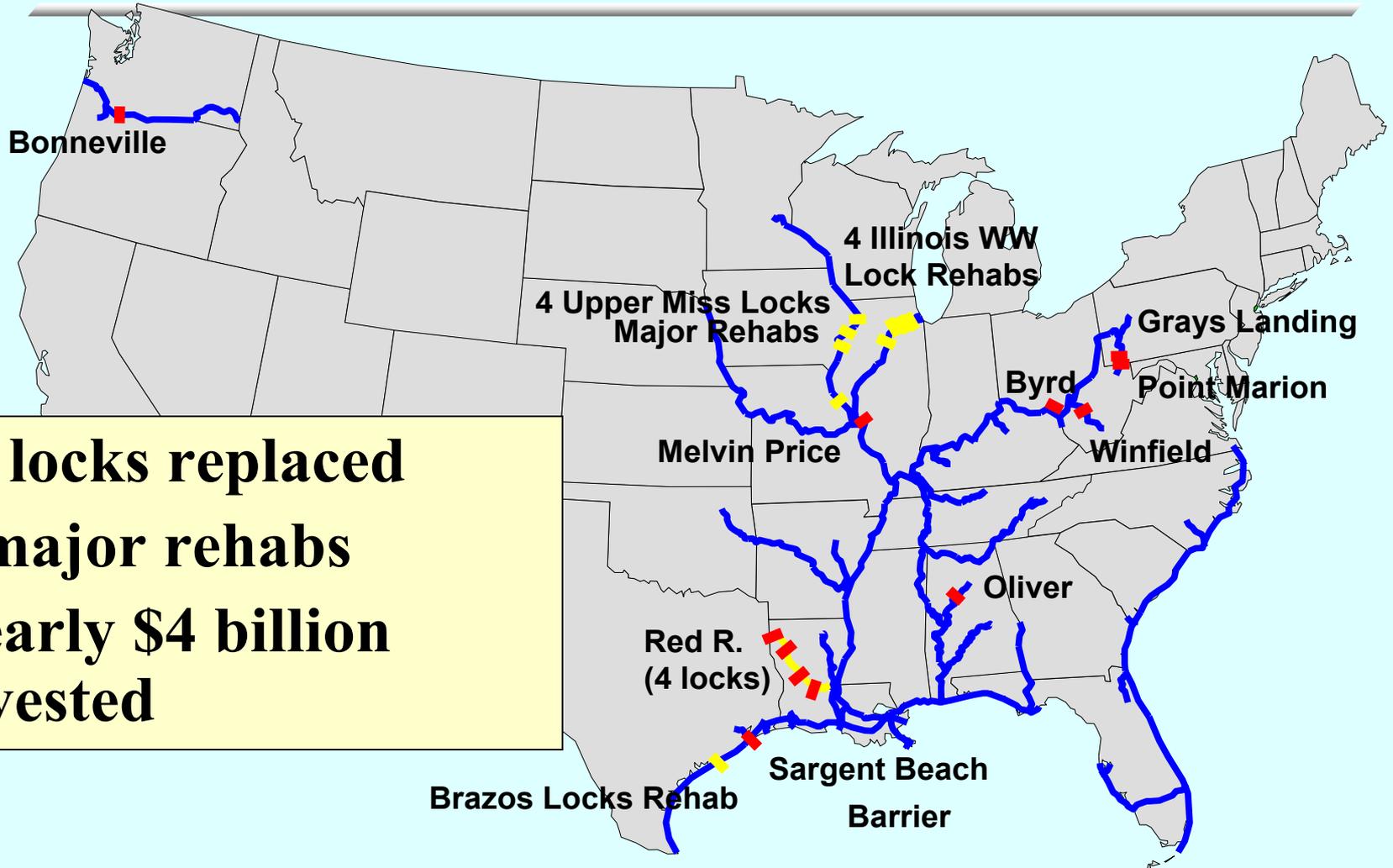
## Navigation Lock Unavailability Total Hours - Scheduled vs. Unscheduled

Hours Unavailable





# ***U.S. Waterway Projects Placed in Service Since 1986***



- **11 locks replaced**
- **9 major rehabs**
- **Nearly \$4 billion invested**



# U.S. Waterway Construction Projects Underway

## ■ Ongoing construction:

- 9 lock & dam construction projects
- 5 major rehabs
- Cost: \$4.4 billion

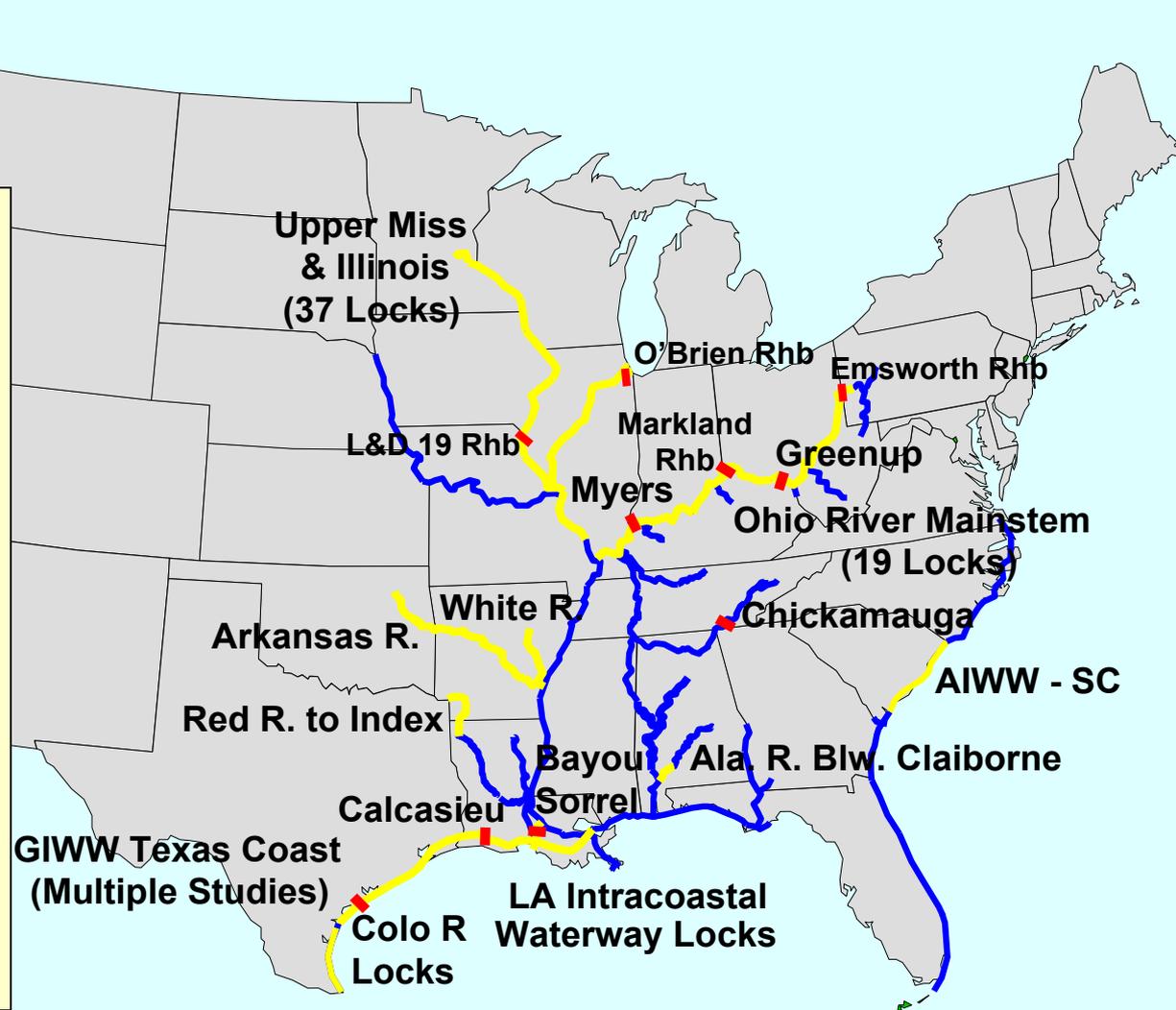




# Future Needs: Major U.S. Waterway Studies

## Several major studies of inland navigation needs to and beyond 2020:

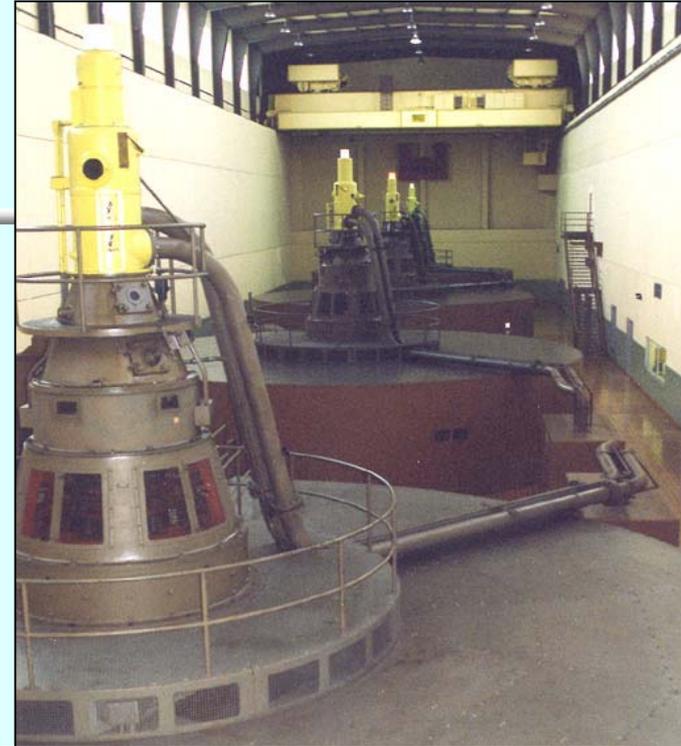
- Ohio River Greenup and Myers Locks authorized
- Upper Miss / IL Wwy: Possibly 7 new locks or extensions
- GIWW: New locks at Bayou Sorrel & Calcasieu
- Chickamauga Lock replacement
- GIWW and AIWW channel realignments
- Arkansas River study





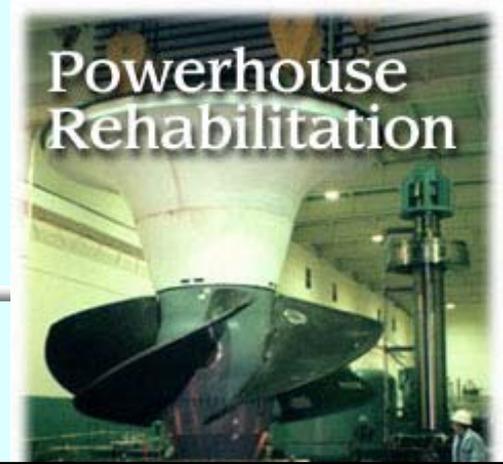
# ***Multi-Purpose Management***

- **Past development allows U.S. inland waterway transport systems to also serve a variety of other uses:**
  - **Hydropower**
  - **Flood Protection**
  - **Water Supply**
  - **Recreation**
  - **Environmental Stewardship**



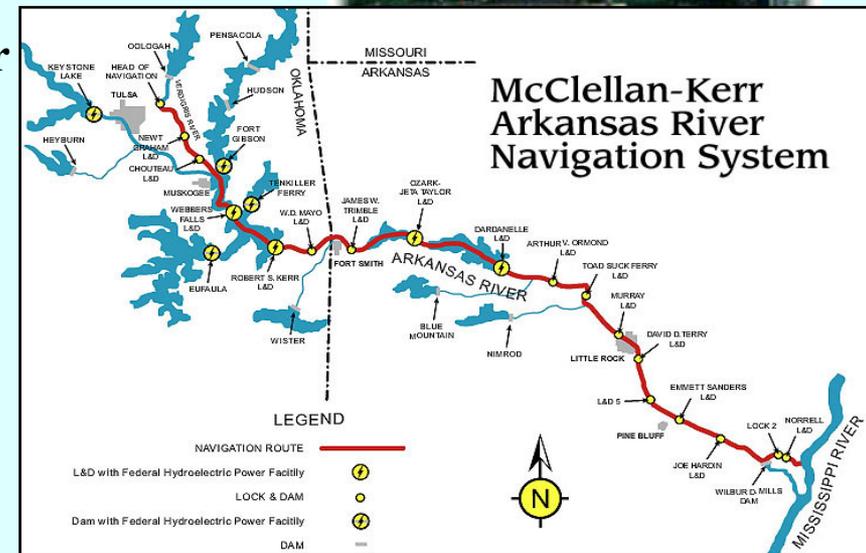


# U.S. Multi-Purpose Era: Arkansas River Navigation System



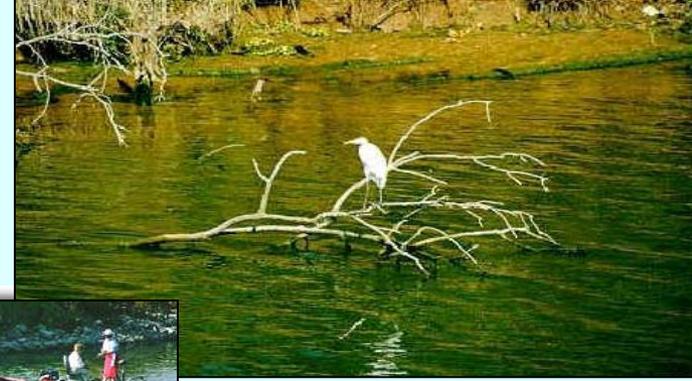
## Multi-use elements:

- Four locks & dams are multi-purpose
- projects that include a Federal hydropower facility:
  - Dardanelle (140 MW)
  - Ozark-Jeta Taylor (100 MW)
  - Robert S. Kerr (110 MW)
  - Webbers Falls (60 MW)
  - 4 other locks have non-Federal hydropower
- 15 reservoirs provide water supply for navigation as well as flood control, recreation and, at four dams, hydropower
- Over \$5 billion in potential flood damages have been prevented by MCK facilities





# Multi - Objective Planning: Red River Waterway



## Environmental Mitigation & Recreation:

- Oxbow lakes preserved and remain connected to main channel
- Provide migrating waterfowl habitat & outstanding sport fishery
- Bottomland hardwood losses mitigated
- Feds own mitigation land but Red River Commission manages
- Recreation – 2 million annual visitors
- Recreation sites cost-shared & managed by Red River Commission



# Current Focus on Environmental Restoration in U.S.





# IWRM Through Shared Vision Planning

1. **Build a team** & identify problems.
2. Develop objectives **and metrics** for evaluation.
3. Describe the **baseline condition scenarios**, including:
  - a. Future if status quo persists.
  - b. "Future sustainable state".
4. Formulate alternatives.
5. Evaluate alternatives.
6. **Implement** a solution.
7. **Monitor, use, exercise** and update the solution.

## Shared Vision Models

Team and stakeholders actively participate in development & application of technical models.



# U.S. Waterway Transport & IWRM: The Future?

## Upper Mississippi Navigation Study

- Emphasizes U.S. need to sustain both quality ecosystem and effective water transport system
- Highly visible U.S. test of evolution towards integrated water resources management
- Outcome not yet clear





# ***U.S. Waterway Transport - Summary***



- **Critical to the U.S. economy**
  - **15% of intercity freight including 50% of U.S. grain exports & 20% of U.S. coal for electricity moving on waterways**
  - **Low cost and efficient with relatively fewer environmental impacts**
  - **Increasing number of waterway segments being managed as part of an integrated system also serving other purposes: hydropower, flood protection, water supply, recreation, environmental enhancement**
  - **With a relatively few capacity improvements, the system could help keep pace with future North American freight demand**
- **But -**
  - **Waterway transport demand increasing, & capacity problems persist**
  - **Aging infrastructure in need of modernization**
  - **Integrated water resources approach needed**
  - **Public financing constraints likely to challenge modernization**

