

The background of the slide is a close-up of the American flag, showing the stars and stripes. Overlaid on the right side of the flag is a silhouette of a castle with two towers and a central archway.

# ***Mississippi River Water Level Management in Pools 5 & 8***

***Presentation  
for the***

***Upper Midwest Stream  
Restoration Symposium***

***by***

***Scott Jutila  
Hydraulic Engineer***

***19 February 2010***



US Army Corps  
of Engineers®



# History

## Mississippi River

### Prior to 1866

- Series of channels and islands
- Shallow enough in some places to walk across
- Too dangerous and unreliable for commercial navigation

### 1866 the 4-foot channel project began

- Series of wing dams and channel revetment
- Improved navigation

### 1930s the locks and dams were constructed

- Created a series of navigation pools
- Stable water levels ensured passage of tows and barges
- Provided for a 9-foot channel



US Army Corps  
of Engineers®



# Changes in River Habitat

**For several decades these pools supported a wealth of fish, wildlife, and aquatic habitat, however, many pools now have wide open expanses of shallow water above the lock and dam.**

## **As a result of the stable high water levels:**

- Islands became vulnerable to erosion from waves
- Aquatic plant beds near the islands disappeared or diminished in size
- Loss of vegetation reduced food and shelter for fish and wildlife



US Army Corps  
of Engineers®

# Lock and Dam



22 February 2010

One Team: Relevant, Ready, Responsive and Reliable



US Army Corps  
of Engineers®

# Spring Lake Pool 5



1951



1991



Aug 2005



22 February 2010

One Team: Relevant, Ready, Responsive and Reliable

5



US Army Corps  
of Engineers®



# Effect on Aquatic Plants

## Emergent Perennial Plants

- Depend on natural seasonal fluctuations
  - ✓ Sprouting of new plants from seeds
  - ✓ Long term survival
- Stable water
  - ✓ Prevents areas from drying out
  - ✓ Prevents perennial vegetation from sprouting from seeds
  - ✓ Plant beds could not become reestablished

## Water Level Management Drawdowns

- Mimics low water conditions
- Allows plants to germinate
- Consolidates Sediments



US Army Corps  
of Engineers®

# Water Level Management Mississippi River Pools 1-10



## Water Level Task Force

- Formed by River Resource Forum
- Began WLM on UMR in early 1990s
- Conducted small scale water level drawdown in backwater areas
- Conducted drawdown in Pool 8 in 2001 and 2002
- Conducted drawdown in Pool 5 in 2005 and 2006



US Army Corps  
of Engineers®

# Water Level Management



## Task Force Participants



**Commercial Navigation  
Industry**

• **Citizen Groups**





US Army Corps  
of Engineers

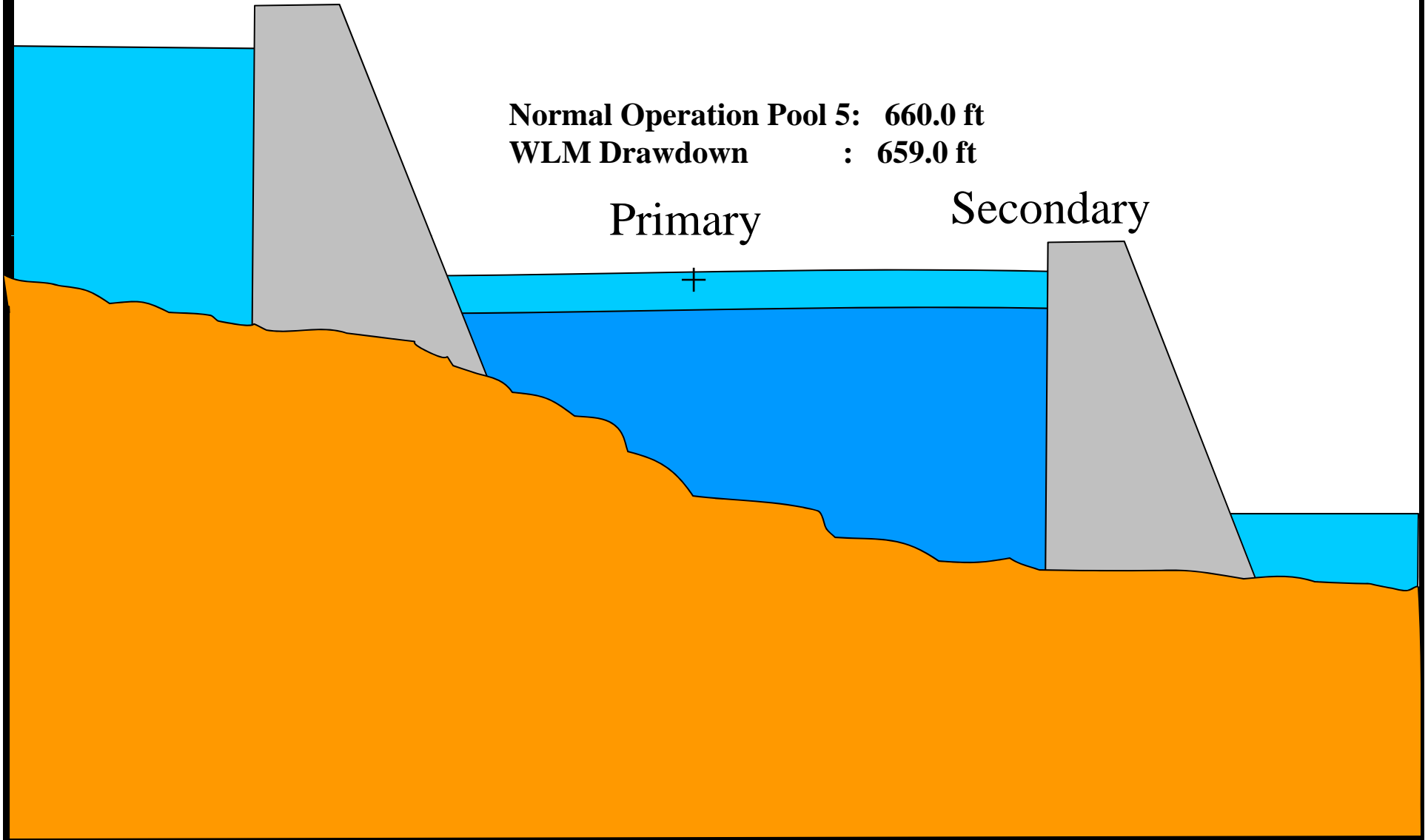


# Pool 5 Primary Control Low Flow – Flat Pool

Normal Operation Pool 5: 660.0 ft  
WLM Drawdown : 659.0 ft

Primary

Secondary

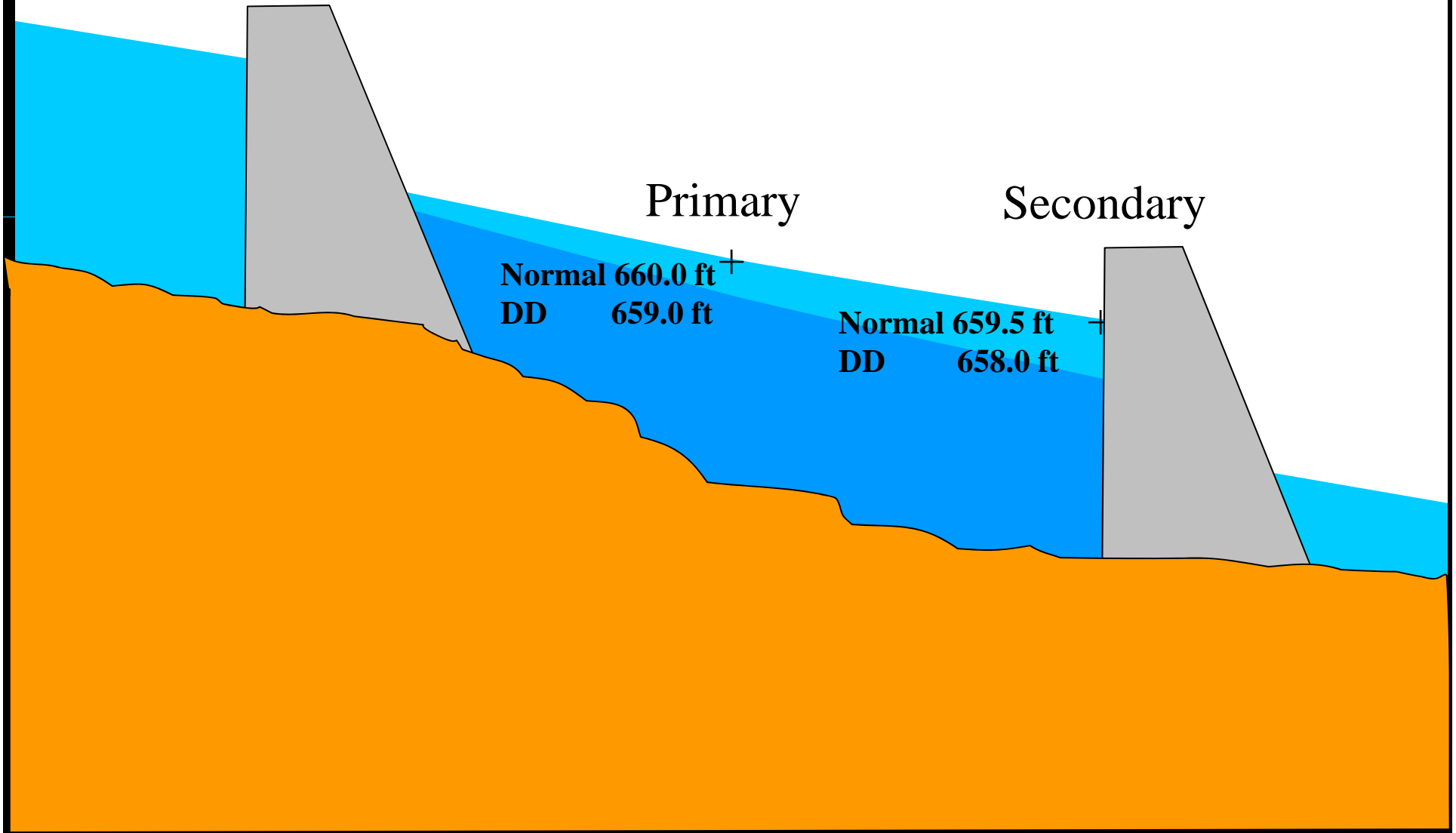




US Army Corps  
of Engineers



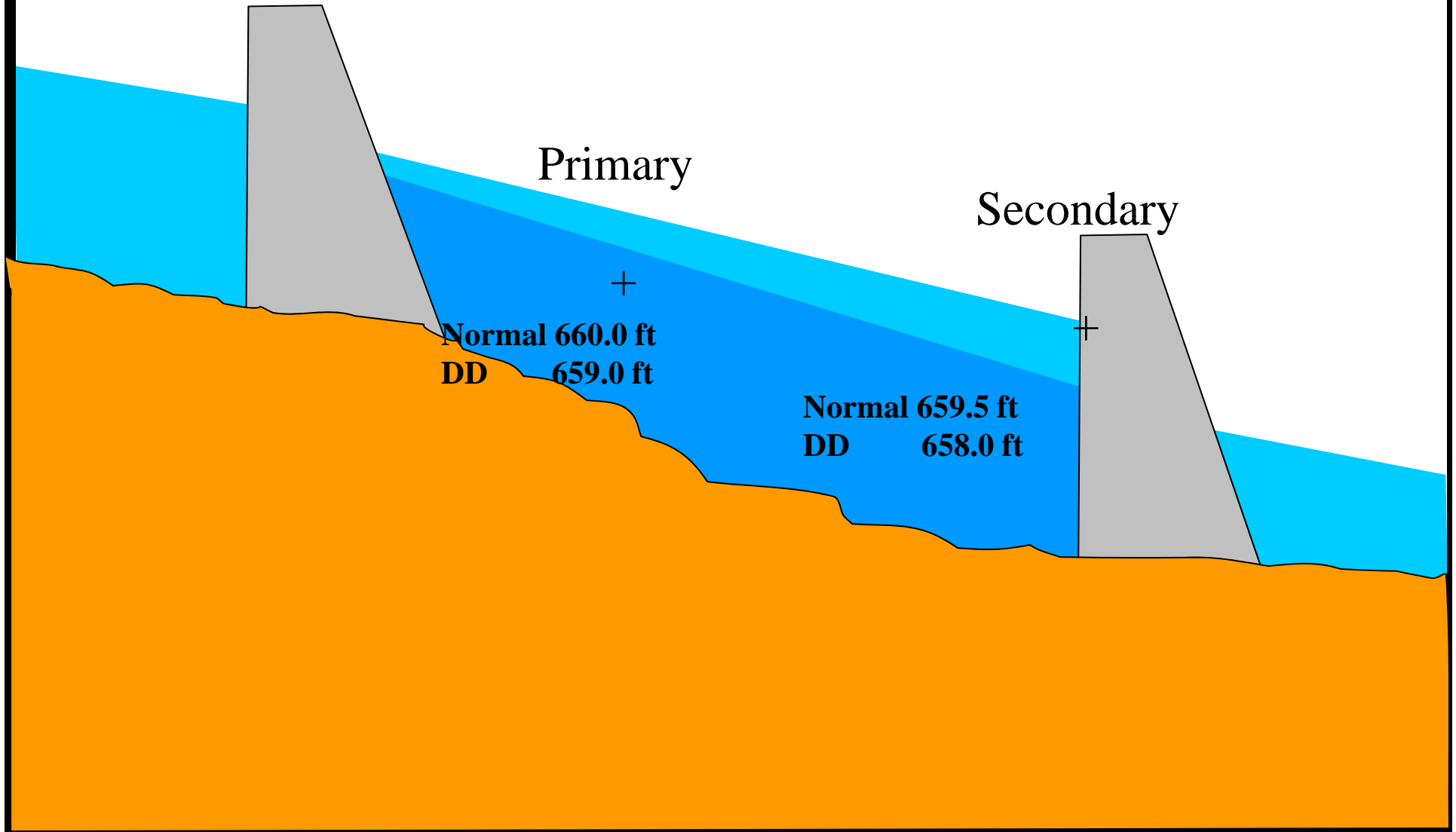
# Pool 5 Transition from Primary to Secondary Control





US Army Corps  
of Engineers

# Pool 5 Secondary Control





US Army Corps  
of Engineers.

# Mississippi River Pools 5 and 8



22 February 2010

One Team: Relevant, Ready, Responsive and Reliable

12



US Army Corps  
of Engineers®

# Pool 5 and Pool 8 Drawdowns



**Conducted mid-June through September**

**Pools lowered 0.1-feet to 0.2-feet per day  
until target was reached**

## **Pool 5 (River Miles 738.3 to 752.6)**

- 2005 and attempted in 2006
- 1.5-foot drawdown at dam
- 1.0-foot drawdown at Primary Control Point (Alma, Wisconsin)
- 1000 acres exposed

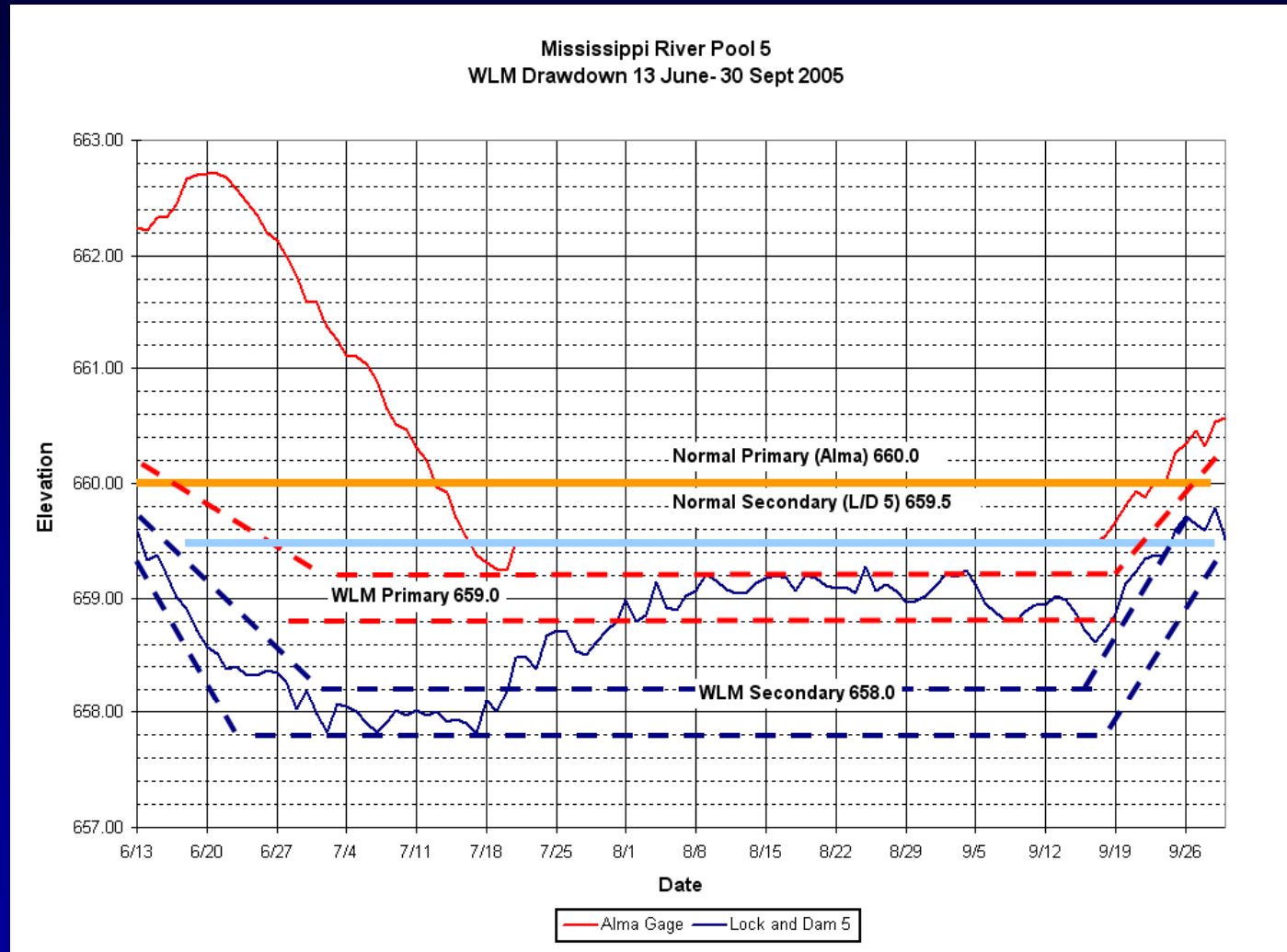
## **Pool 8 (River Miles 679.4 to 702.2)**

- 2001 and 2002
- 1.5-foot drawdown at dam
- 0.5-foot drawdown at Primary Control Point (Lacrosse, Wisconsin)
- 2000 acres exposed



US Army Corps  
of Engineers®

# Pool 5 Hydrographs



22 February 2010

One Team: Relevant, Ready, Responsive and Reliable

14

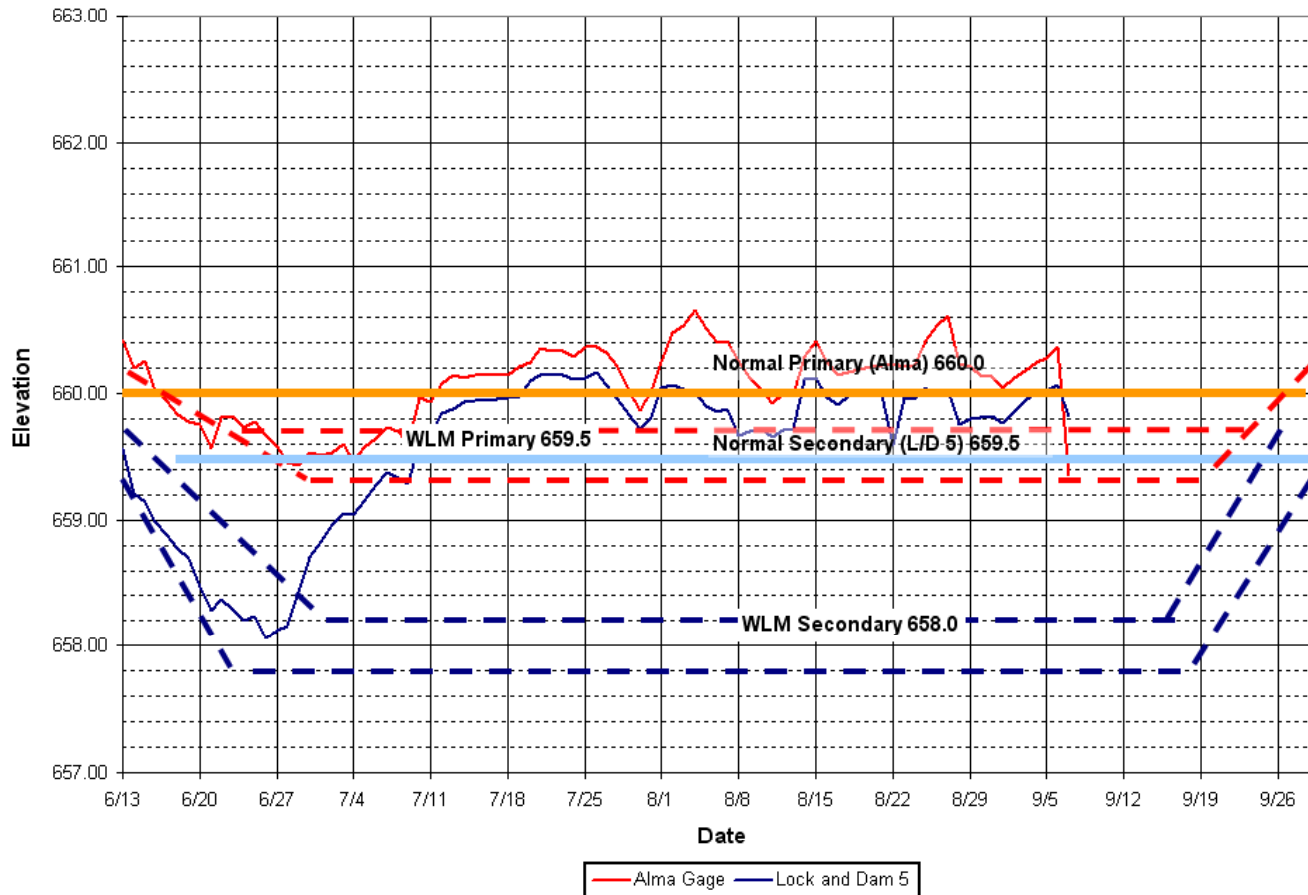


US Army Corps  
of Engineers®

# Pool 5 Hydrographs



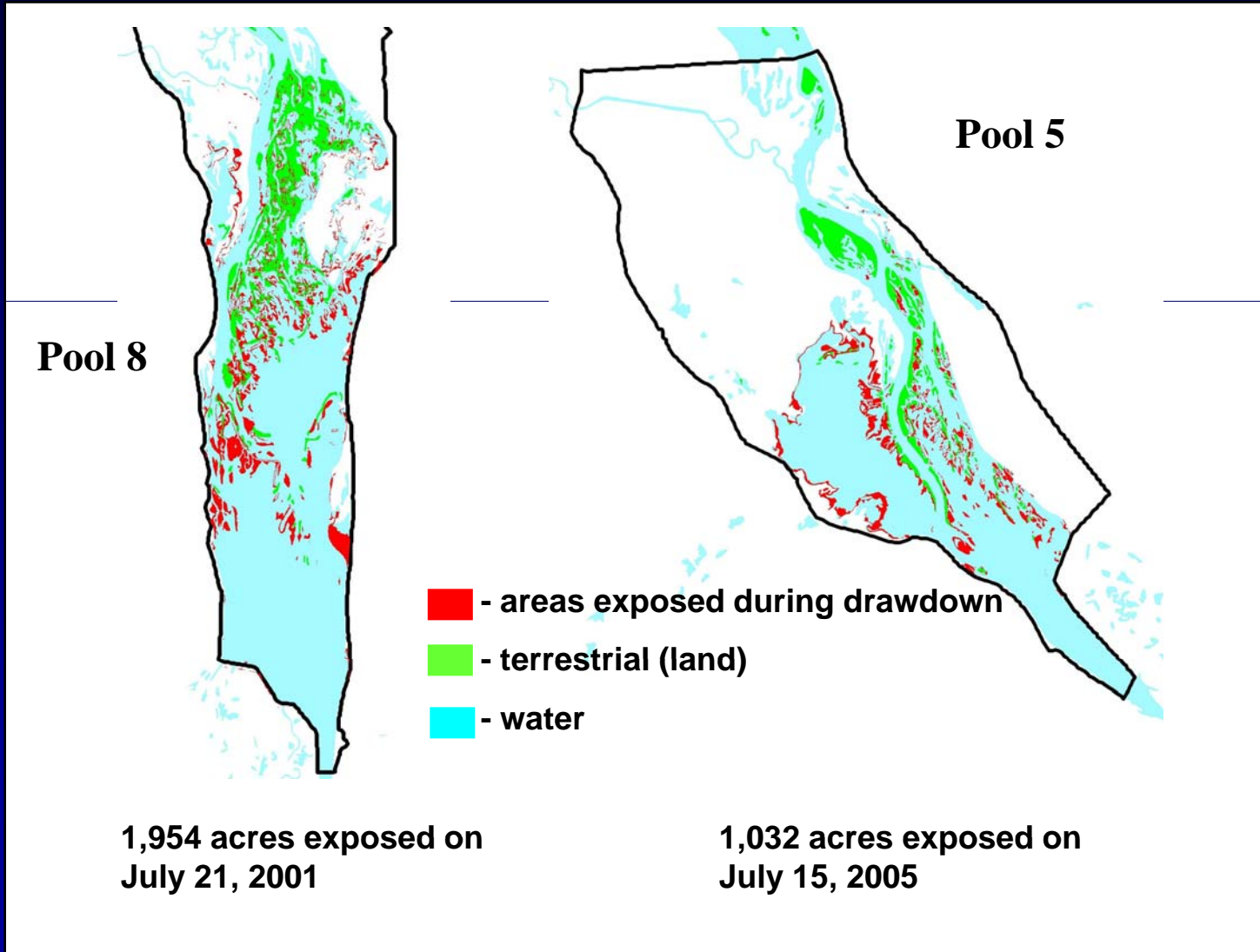
Mississippi River Pool 5  
WLM Drawdown 13 June-7 Sept 2006





US Army Corps  
of Engineers®

# Areas Exposed During Drawdowns



22 February

One Team: Relevant, Ready, Responsive and Reliable

16





US Army Corps  
of Engineers®

# Pool 5 2005



8/05/2003



6/23/2005



8/30/05



10/25/05

22 February 2010

One Team: Relevant, Ready, Responsive and Reliable

17



US Army Corps  
of Engineers®

# Pool 5 2005



22 February 2016



US Army Corps  
of Engineers®

# Pool 5 2005



22 February 2010

One Team: Relevant, Ready, Responsive and Reliable

19



US Army Corps  
of Engineers®

# Pool 8 2001



22 February 2010

20



US Army Corps  
of Engineers®

# Pool 8 2002



22 February 2010

One Team: Relevant, Ready, Responsive and Reliable

21



US Army Corps  
of Engineers®

# Vegetation



## Drawdowns resulted in:

- A reduction in open water
- An increase in areas dominated by:
  - ✓ Emergent perennial vegetation
  - ✓ Submersed vegetation

**From the first to second year of the drawdown vegetation shifted from mostly annual to mostly perennial species**



US Army Corps  
of Engineers®

# Emergent Vegetation



**Emergent vegetation that once covered large areas of the Upper Mississippi River increased as a result of the drawdowns**

**The primary objective of drawdowns is to restore perennial emergent vegetation including:**

- Arrowhead
- Giant reed grasses

**These plants would not have been reestablished under normal water levels**

**Secondary objectives included:**

- Stabilizing bottom sediments
- Providing critical habitat for
  - ✓ Waterfowl
  - ✓ Furbearers



US Army Corps  
of Engineers®

# Emergent Vegetation



22 February 2010

24





US Army Corps  
of Engineers®

# Submersed Vegetation



**Submersed vegetation increased**

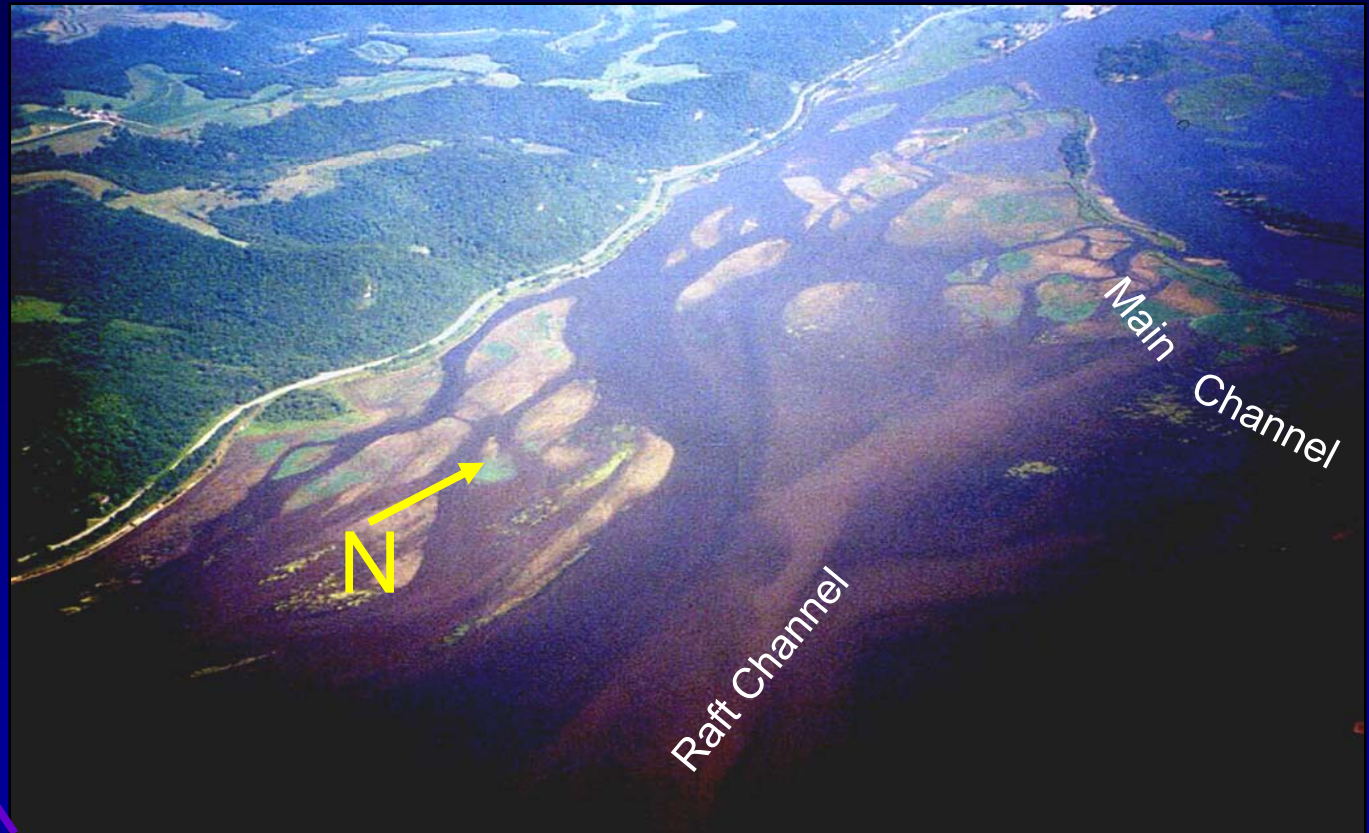
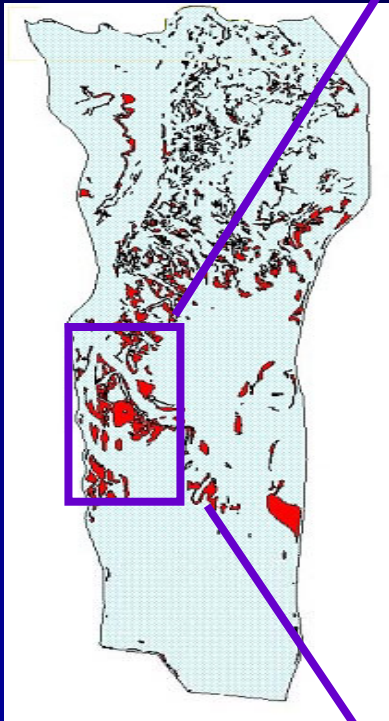
**Similar increases were observed in other  
pools that were not drawn down**

**Additional monitoring is needed to determine  
the effects of drawdowns on submersed  
plants**



US Army Corps  
of Engineers®

# Pool 8



22 February 2010

26

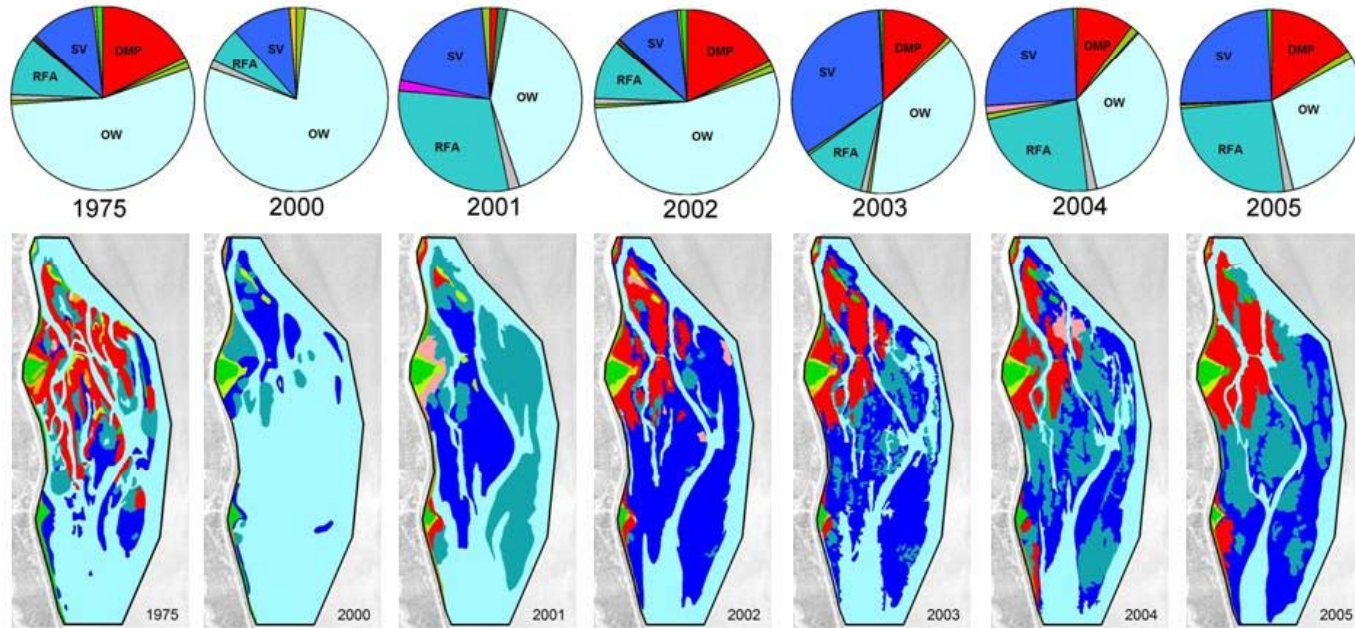


US Army Corps of Engineers®

# How long does vegetation last?



Pool 8 Raft Channel West Time Series, 1975-2005



**Emergent vegetation continues to persist in areas of Pool 8 that were exposed over 5 years ago.**



- Open Water
- Submerged Aquatic Vegetation
- Rooted Floating Aquatics
- Deep Marsh
- Shallow Marsh
- Wet Meadow
- Sand/Mud
- Grass/Forbs
- Scrub-Shrub
- Wet Shrub
- Wet Forest
- Upland Forest
- Agriculture
- Road/Levee
- Developed
- No Photo Coverage/Unknown



US Army Corps  
of Engineers®



# Water Quality

**Water quality improvements were observed in localized areas where vegetation was established**

- Less sediment
- Reduced Waves
- Stable bottom substrates
- Clearer water
- Reduced nutrient loading



**Water quality improvements were not apparent in other areas of the pool**



US Army Corps  
of Engineers®

# Waterfowl



**As a result of the drawdowns and subsequent increase in vegetation in Pool 8 and Pool 5, waterfowl use increased including:**

- Diving ducks (especially canvasbacks)
  - ✓ Canvasbacks consume more plant material than other diving ducks
  - ✓ Canvasbacks comprise the large majority of diving ducks on the Upper Mississippi River
- Dabbling ducks
  - ✓ Feed primarily in backwater areas
  - ✓ Feed on plant seeds and Insects
- Tundra Swans
  - ✓ Are fond of arrowhead tubers
  - ✓ Concentrate around large beds of arrowhead



US Army Corps  
of Engineers®

# Other Wildlife



## Other species of wildlife monitored during the drawdowns included:

- Shorebirds
  - ✓ The drawdowns created shallow water areas
  - ✓ The drawdowns attracted hundreds of migrating shorebirds
- Tree swallows
- Furbearers

## Many other species of wildlife may benefit from drawdowns, such as:

- Frogs
- Sandhill cranes
- Muskrats

# Fish and wildlife species benefit from vegetation.



<http://www.schmoker.org/BirdPics/Photos/Blackbirds/VHBL116.jpg>



<http://www.ctbirding.org/images/goldeneye%20lefta.jpg>



[http://www.cmsu.edunaturecentral/pictures/whitetail\\_deer.jpg](http://www.cmsu.edunaturecentral/pictures/whitetail_deer.jpg)



[http://www.fs.fed.us/r10/ronnata/p10/images/photos/wildlife/wildlife\\_pam\\_schick.JPG](http://www.fs.fed.us/r10/ronnata/p10/images/photos/wildlife/wildlife_pam_schick.JPG)



<http://www.dcwild.com/images/Mammals/Muskrat>



<http://www.green.i>



<http://www.webofnature.com/DR-6-3-04-0028-Blandings.jpg>



<http://www.mkk.szie.hu/~tejfol/csuka2.jpg>





**US Army Corps  
of Engineers®**



Pool 5 drawdown. Pool 4, site 3, 1 ft depth.  
Clearing out permanent grid. 25 Aug. 2005. M. Davis photo.

22 February 2010

*One Team: Relevant, Ready, Responsive and Reliable*

32





US Army Corps  
of Engineers®

# Native Freshwater Mussels



**28% of mussels died in shallow water areas in Pool 5.**

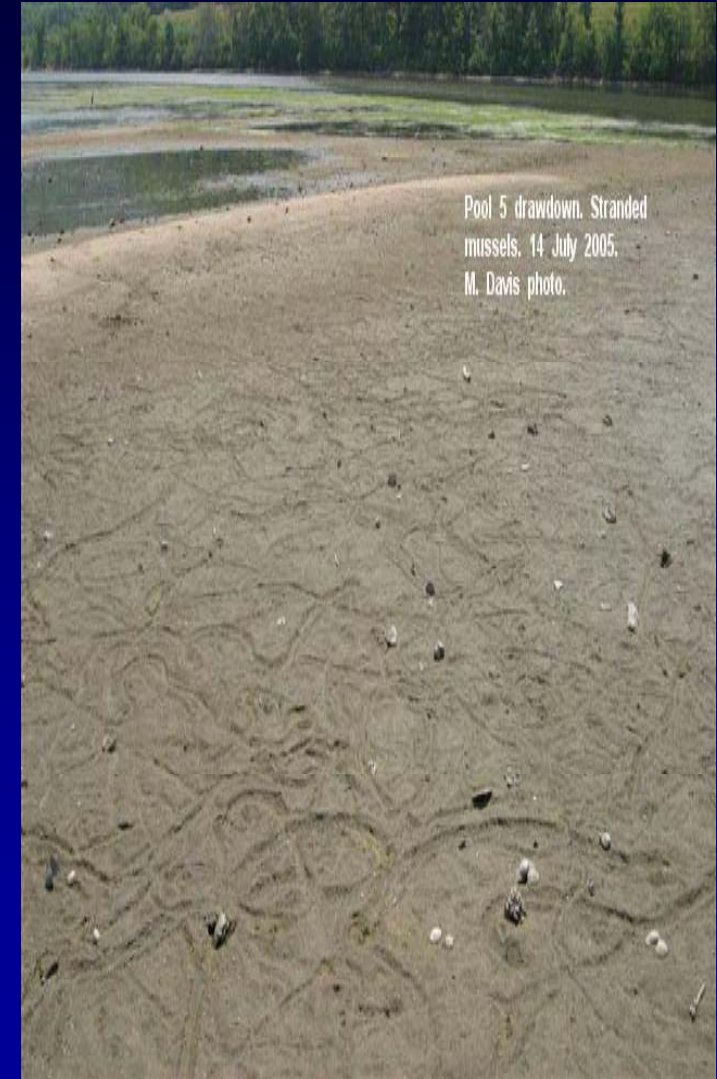
**(less than 1.5 feet)**

**The 2005 monitoring plan was not designed to quantify the mussels mortality.**

**A 2006 Study was designed to estimate the total Pool 5 mussel population**

**The mussel population in Pool 5 was estimated at 189 million.**

**The majority of mussels were in depths greater than 1.5 feet.**



Pool 5 drawdown. Stranded mussels, 14 July 2005.  
M. Davis photo.



US Army Corps  
of Engineers®

# Fish



**It is too early to determine the effects of drawdowns on fish. Several years of monitoring are needed.**

## **Drawdowns could affect fish in a variety of ways**

- Negative effects include:
  - ✓ Some fish may become stranded and die
  - ✓ Spawning nests for some species could become exposed
  - ✓ Some species may experience higher predation
- Positive changes may include:
  - ✓ Improved vegetation and water clarity
  - ✓ Increased cover
  - ✓ Increased food supply
  - ✓ Increased spawning habitat
- Backwater species like bluegill and largemouth bass would be expected to benefit most from drawdowns.



US Army Corps  
of Engineers®

# Cultural Resources



For the Pool 5 and Pool 8 drawdowns, a total of 38 sites were monitored.



Prior to the drawdown, almost half of these sites had a high probability of negative impact from erosion or looting.

In some cases, the drawdowns have helped to preserve sites by allowing vegetation to reestablish which reduced or eliminated erosion.

Cultural resources have not been adversely impacted by the drawdowns.



22 February 2010

35



US Army Corps  
of Engineers®



# Sediment Transport and Consolidation

**The amount and cost of additional dredging to maintain adequate depth for commercial navigation during drawdowns varies by pool.**

- In Pool 8, average annual dredging increased 11% over the 3-year period 2001 to 2003
- In Pool 5, average annual dredging increased by 50% in 2005 and 2006.

**Main channel flow and sediment transport increased during the Pool 8 drawdown.**

**It was anticipated that sediments might consolidate and settle as they dry out.**

**Limited consolidation of sediments occurred in the drawdown zone in lower Pool 8.**



**US Army Corps  
of Engineers®**

# Recreational Boating



**During the 2006 boating season, 998 surveys were randomly distributed, in Pool 5, with 431 returned.**

**94% of boaters in Pool 5 were satisfied or very satisfied with their boating experience.**

**91% of boaters in Pool 5 had some knowledge about the drawdown.**

**76% of the boaters in Pool 5 observed an increase in aquatic vegetation.**

**51% of the boaters in Pool 5 rated the drawdown as very effective or mildly effective for improving fish and wildlife habitat.**



US Army Corps  
of Engineers®

# Commercial Navigation



- Normal amount of groundings, none directly related to drawdown
- Inconvenience to some tow operators (based on tow pilot survey)



22 February 2010

38



US Army Corps of Engineers®

# Linking It Together



Drawdowns expose sediments which sprout vegetation



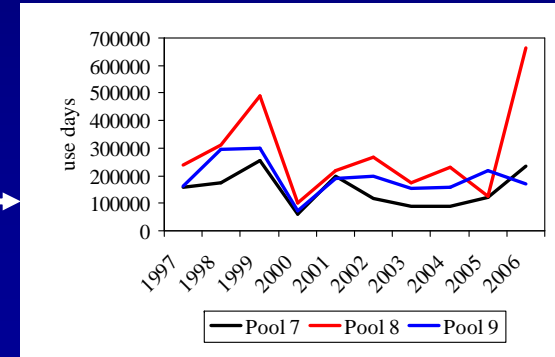
Vegetation is reflooded and collects sediment, improving water clarity



Clear water helps vegetation persist



Vegetation provides food and cover for wildlife



Wildlife numbers increase