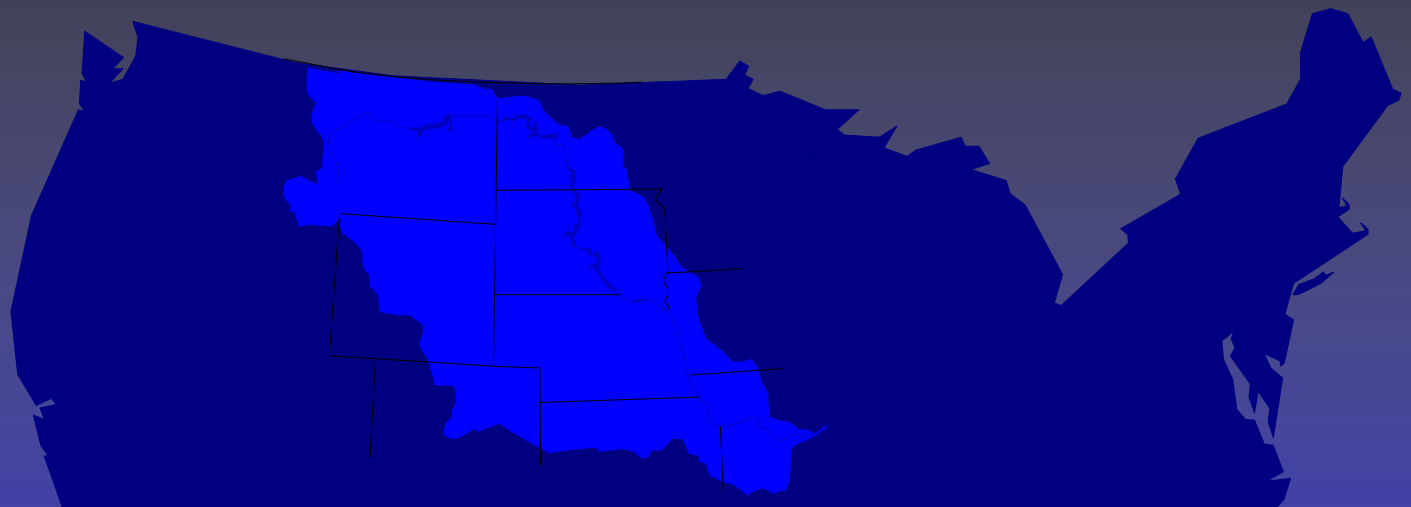
Missouri River Basin
RCC
Since 1953
Water Management Division

Missouri River Mainstem System



Spring 2006-2007 AOP Meetings

April 9, 2007 7 p.m. Fort Peck, Montana
April 10, 2007 11 a.m. Bismarck, North Dakota
April 10, 2007 7 p.m. Pierre, South Dakota
April 11, 2007 6 p.m. Omaha, Nebraska
April 12, 2007 7 p.m. Kansas City, Missouri
April 13, 2007 11 a.m. St. Louis, Missouri

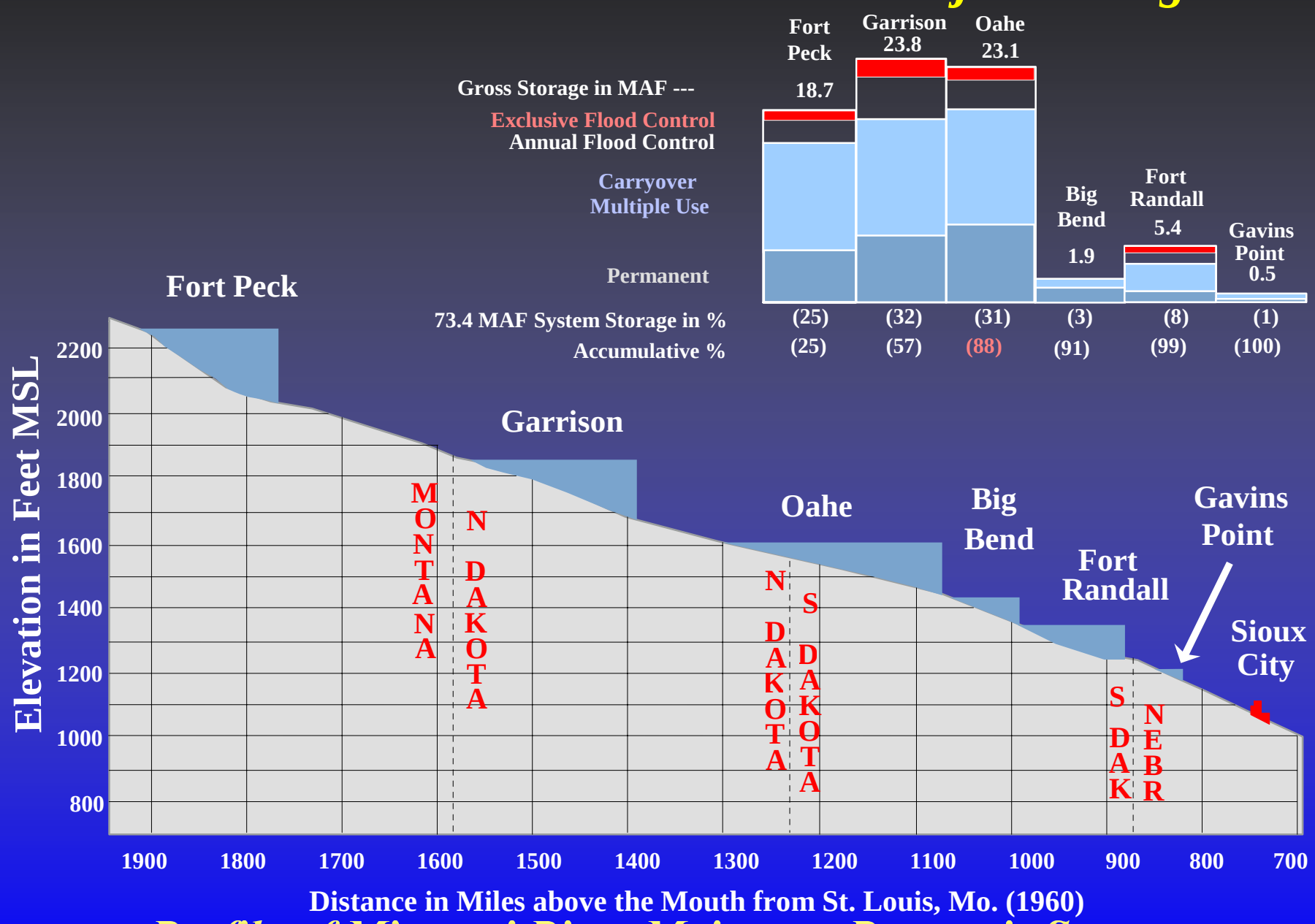
Off Duty Hours Telephone Contact 402-659-7170

US Army
Corps of Engineers

Missouri River Mainstem System

Water Management Office, 12565 West Center Road, Omaha, NE 68144-3869
Internet Address: http://www.nwd-mr.usace.army.mil/rcc

Mainstem Project Storage



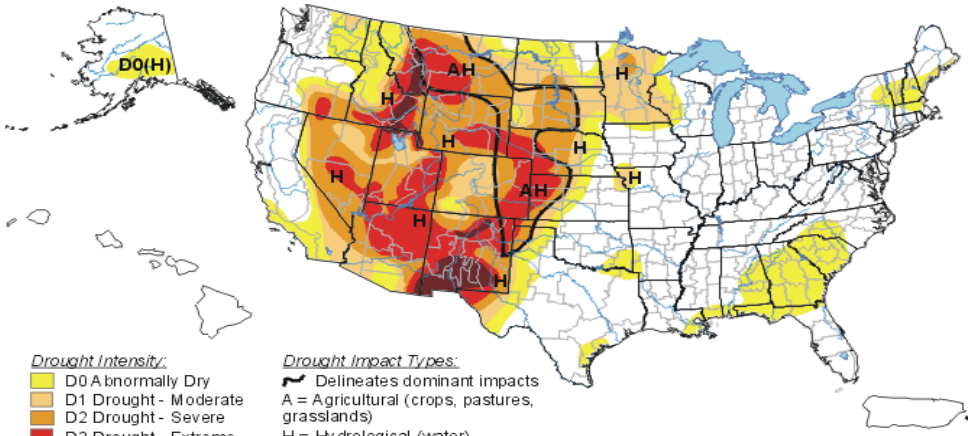
Profile of Missouri River Mainstem Reservoir System

Mainstem Congressionally Authorized Project Purposes

- **Flood Control**
- **Navigation**
- **Hydroelectric Power**
- **Irrigation**
- **Water Supply and Water Quality**
- **Recreation**
- **Fish and Wildlife**
  - **Endangered Species**

U.S. Drought Monitor

March 30, 2004
Valid 7 a.m. EST



Drought Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)
- (No type = Both impacts)

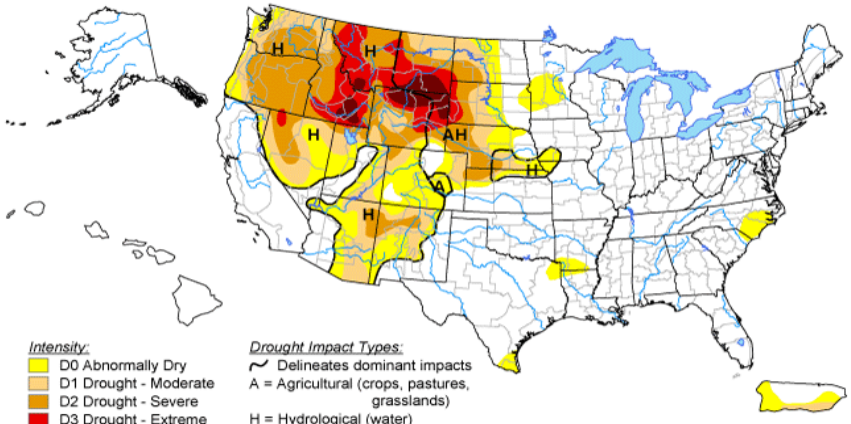
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, April 1, 2004
Author: Brad Rippey, U.S. Department of Agriculture

U.S. Drought Monitor

March 29, 2005
Valid 7 a.m. EST



Intensity:
- D0 Abnormally Dry
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Drought Impact Types:
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- H = Hydrological (water)
- (No type = Both impacts)

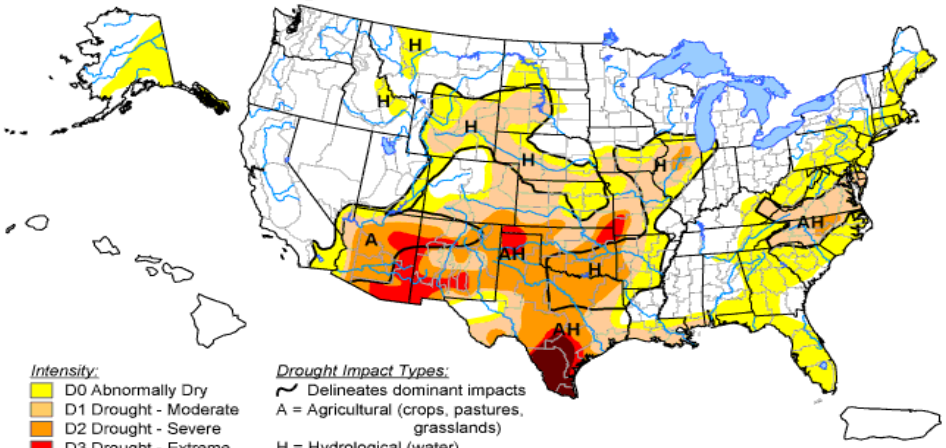
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, March 31, 2005
Author: Douglas Le Comte, CPC/NOAA

U.S. Drought Monitor

April 4, 2006
Valid 7 a.m. EST



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- Delineates dominant impacts
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- H = Hydrological (water)
- (No type = Both impacts)

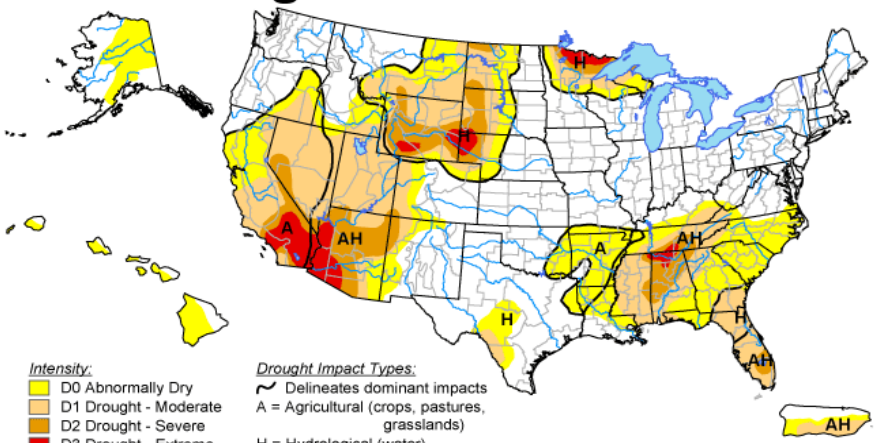
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, April 6, 2006
Author: Douglas Le Comte, CPC/NOAA

U.S. Drought Monitor

April 3, 2007
Valid 8 a.m. EDT



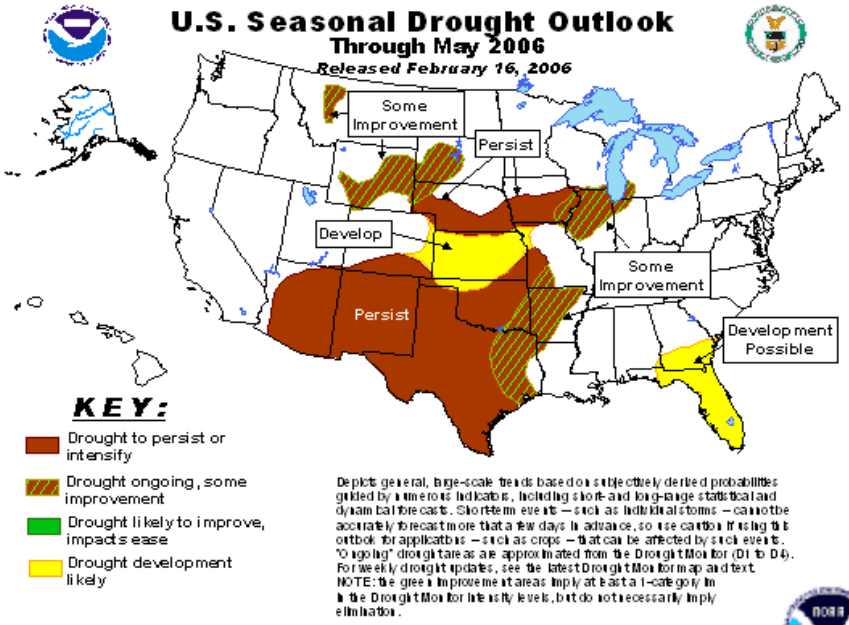
Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

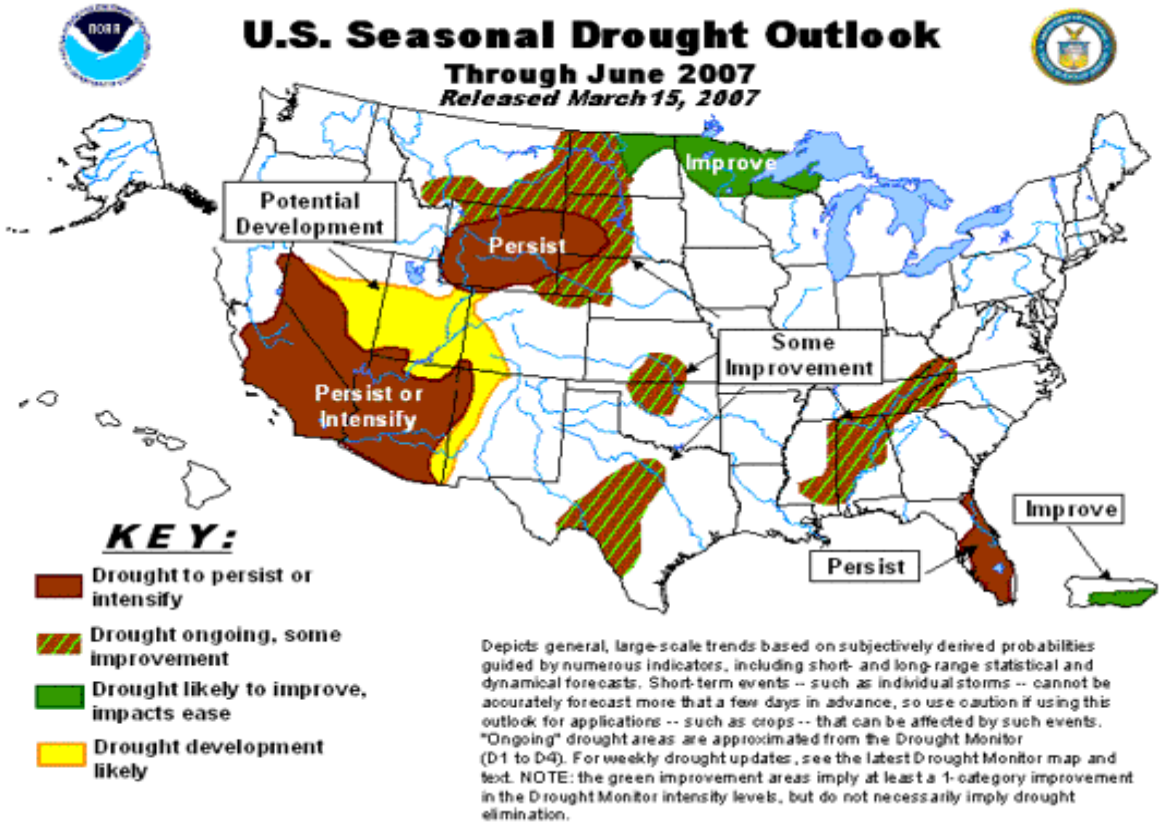
Drought Impact Types:
- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

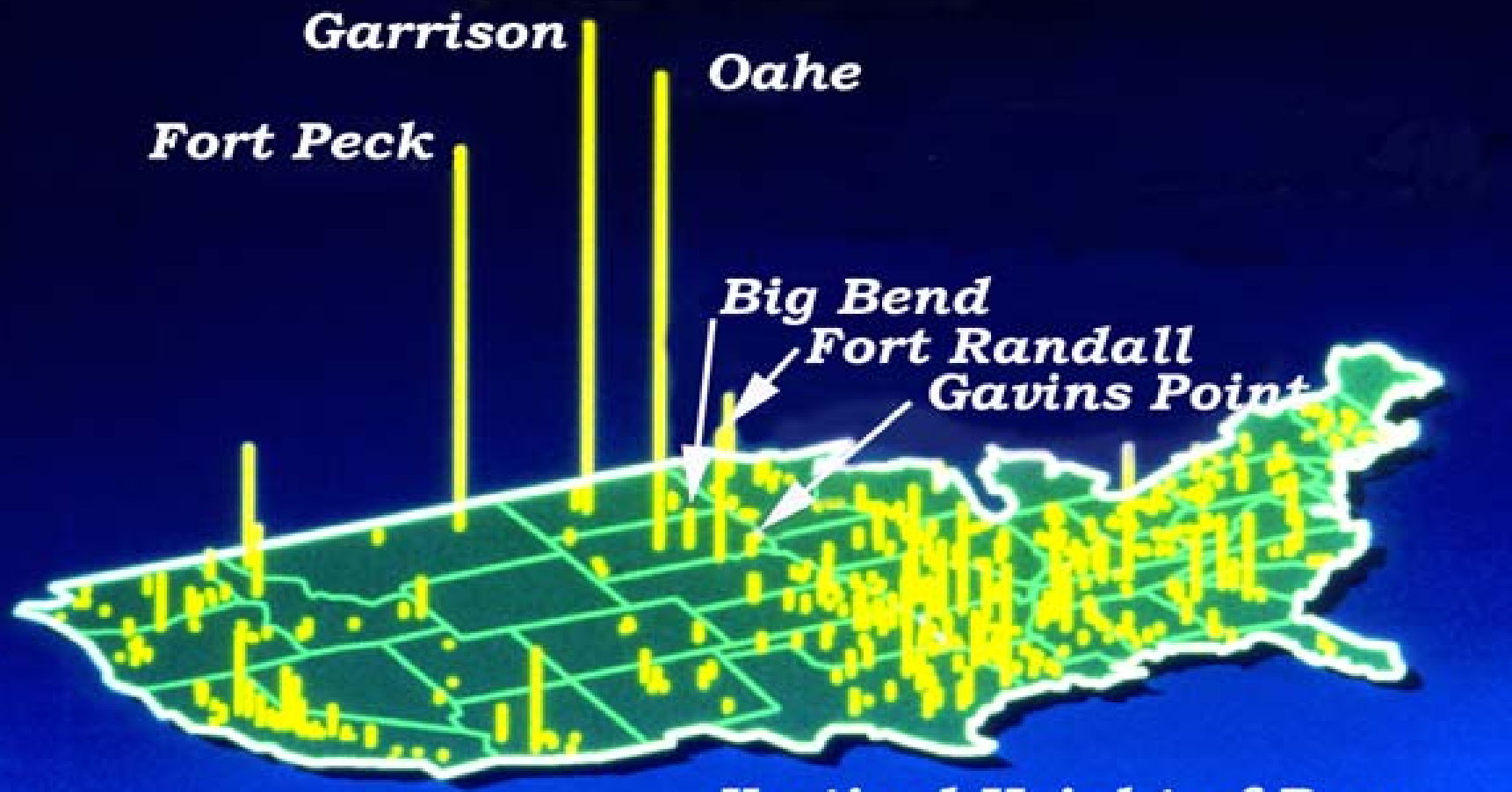
http://drought.unl.edu/dm

Released Thursday, April 5, 2007
Author: Thomas Heddinghaus, CPC/NOAA


U.S. Seasonal Drought Outlook
Through May 2006
Released February 16, 2006
Some Improvement
Persist
Develop
Some Improvement
Persist
Development Possible
KEY:
Drought to persist or intensify
Drought ongoing, some improvement
Drought likely to improve, impacts ease
Drought development likely
Depicts general, large-scale trends based on subjectively derived probabilities guided by numerous indicators, including short- and long-range statistical and dynamical forecasts. Short-term events — such as individual storms — cannot be accurately forecast more that a few days in advance, so use caution if using this outlook for applications — such as crops — that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4). For weekly drought updates, see the latest Drought Monitor map and text. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply elimination.

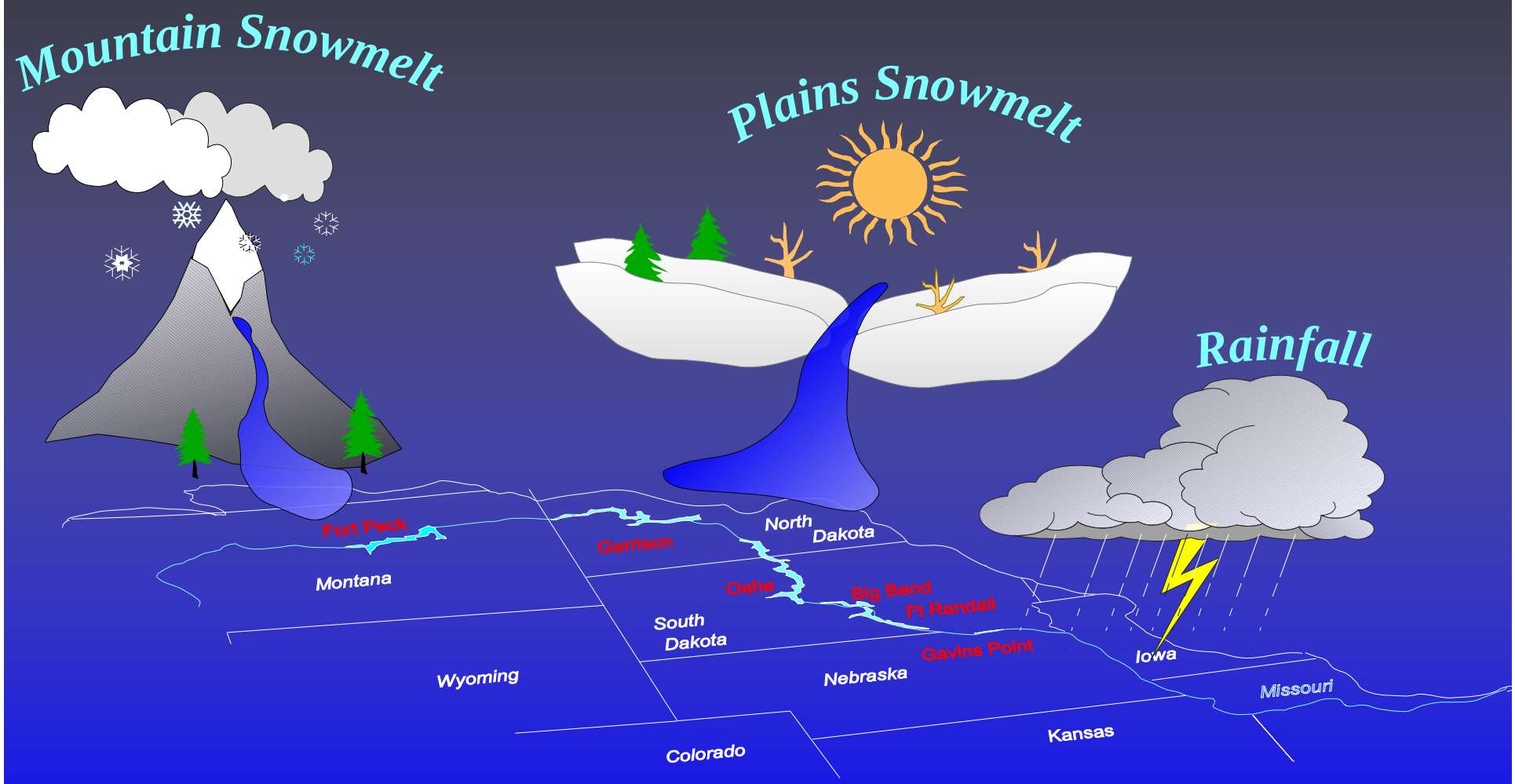

U.S. Seasonal Drought Outlook
Through June 2007
Released March 15, 2007
Improve
Potential Development
Persist
Some Improvement
Persist or Intensify
Improve
Persist
KEY:
Drought to persist or intensify
Drought ongoing, some improvement
Drought likely to improve, impacts ease
Drought development likely
Depicts general, large-scale trends based on subjectively derived probabilities guided by numerous indicators, including short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more that a few days in advance, so use caution if using this outlook for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4). For weekly drought updates, see the latest Drought Monitor map and text. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

Storage Capacity of Corps Lakes

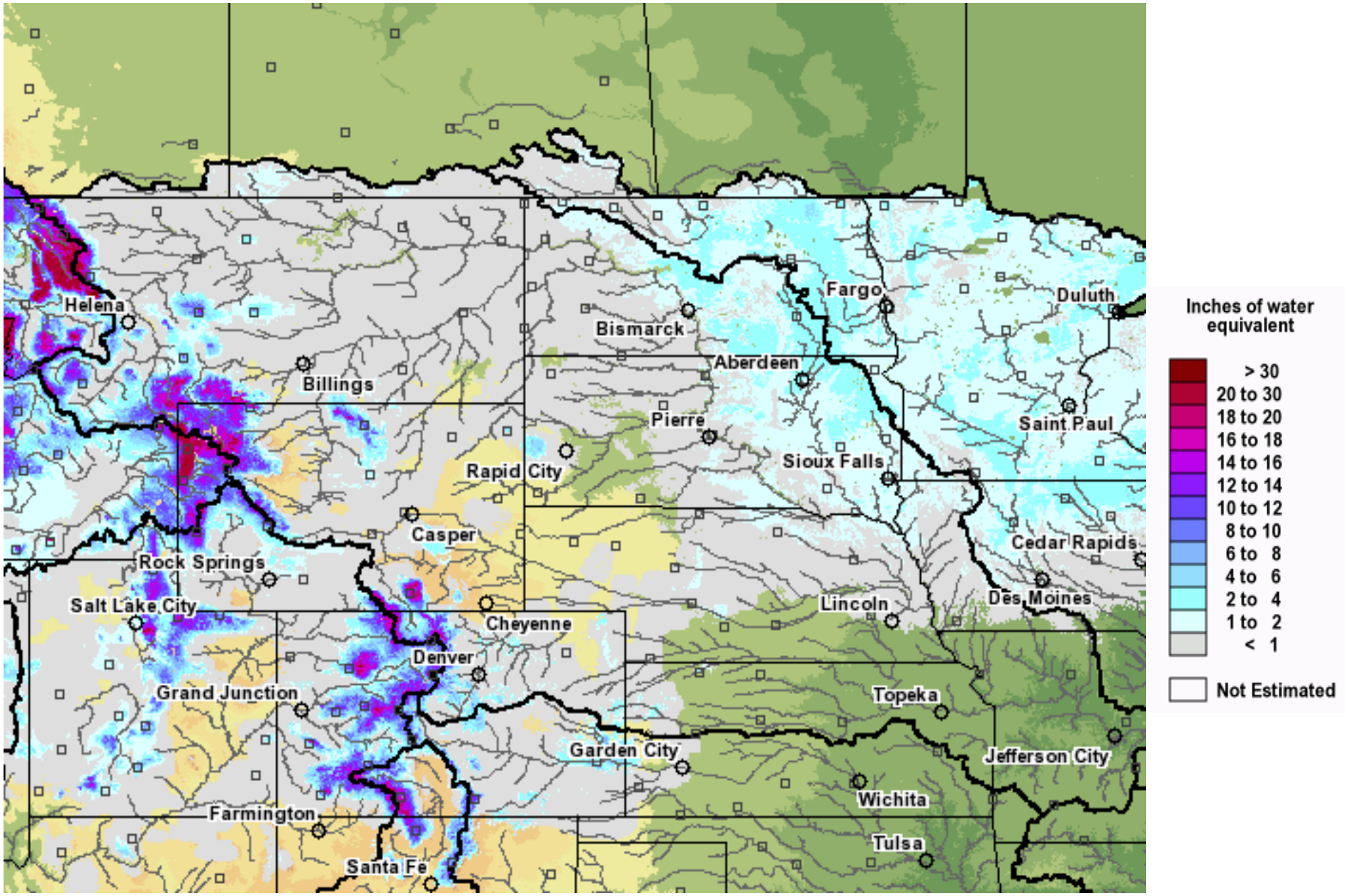


Vertical Height of Bar Indicates Relative Volume

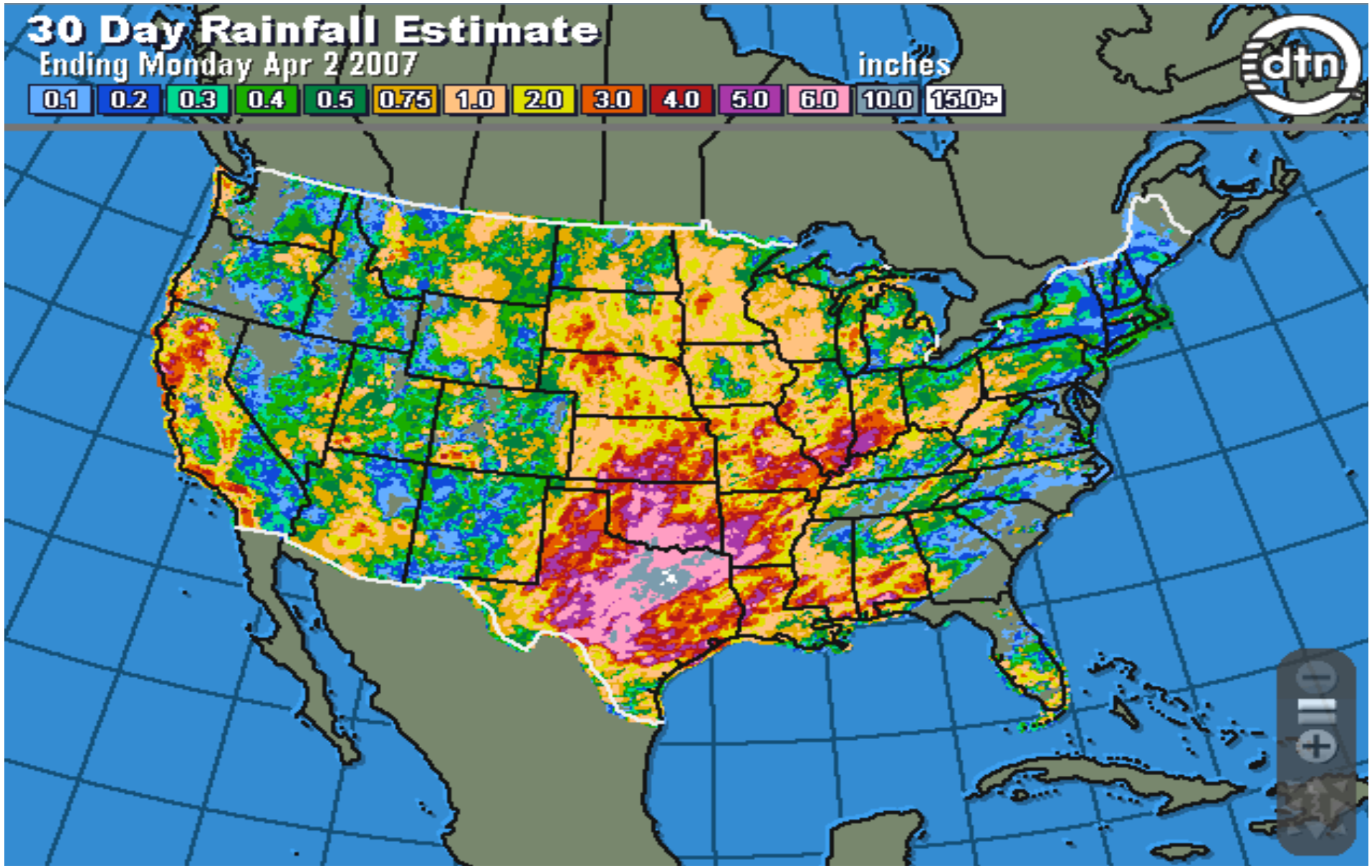
Types of Missouri Basin Runoff



Mountain Snowpack	+	Plains Snowpack	+	2007 Rainfall	=	20.5 MAF
73% 75% = 74%		Minor		???		82% of Normal



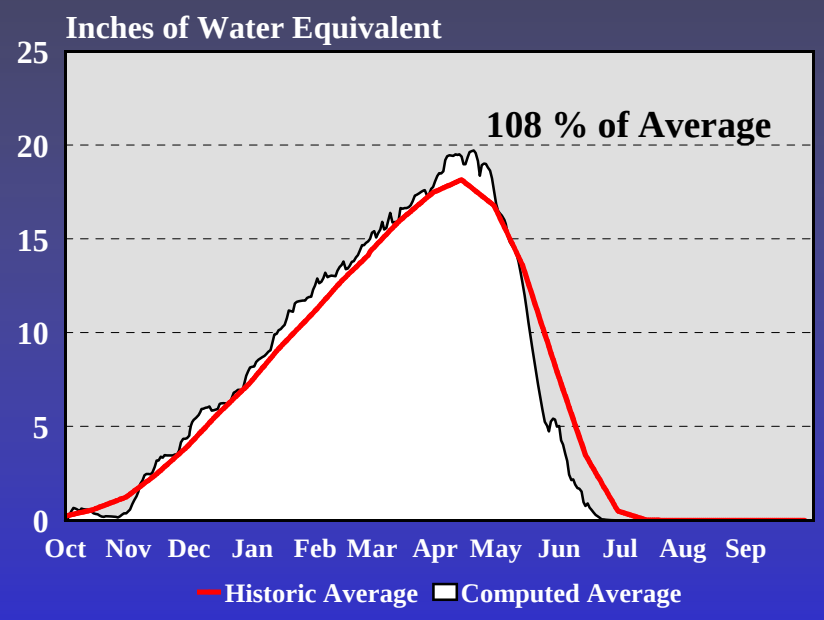
Plains Snow - March 1, 2007



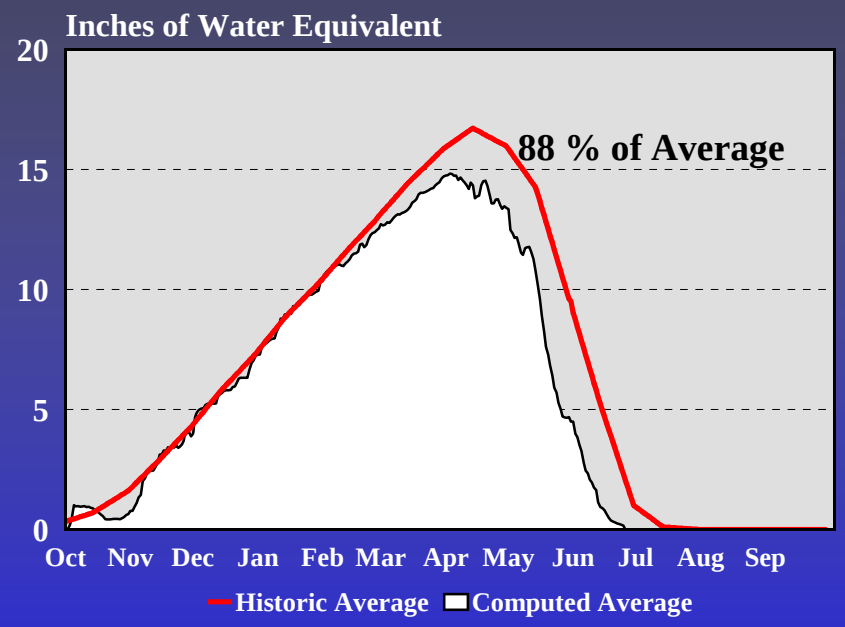
March 2007 - Rainfall Totals

Missouri River Basin Mountain Snowpack Water Content 2005-2006

Total Above Fort Peck



Total Fort Peck to Garrison



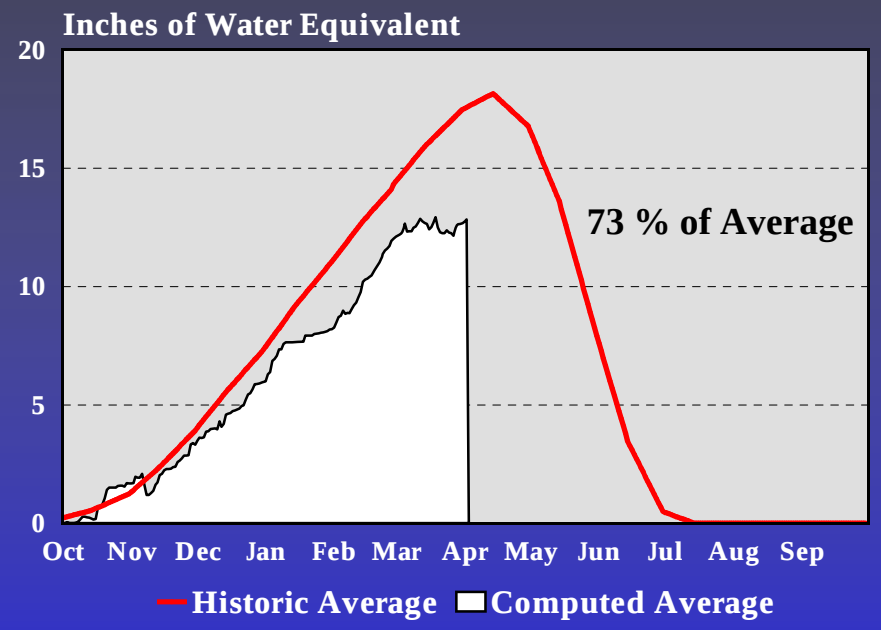
The Mountain Snowpack in the reach above Fort Peck peaked at 108% of the normal peak accumulation on April 20.
The Mountain Snowpack in the reach between Fort Peck and Garrison peaked at 88% of the normal peak accumulation on April 3.
The Missouri River basin Mountain Snowpack normally peaks near April 15 and 5% normally remains on July 1.

July 3, 2006

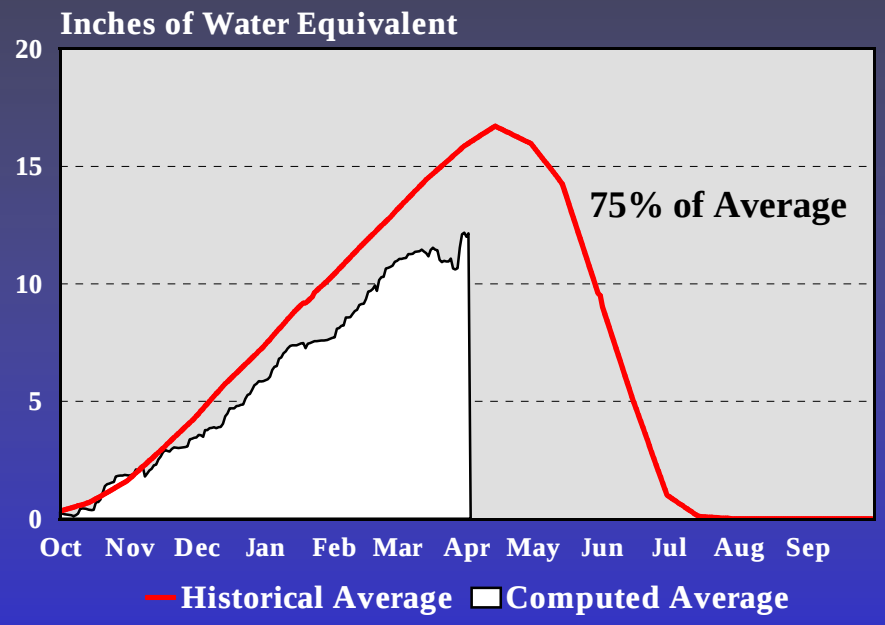
Provisional data subject to revision.

Missouri River Basin Mountain Snowpack Water Content 2006-2007

Total Above Fort Peck



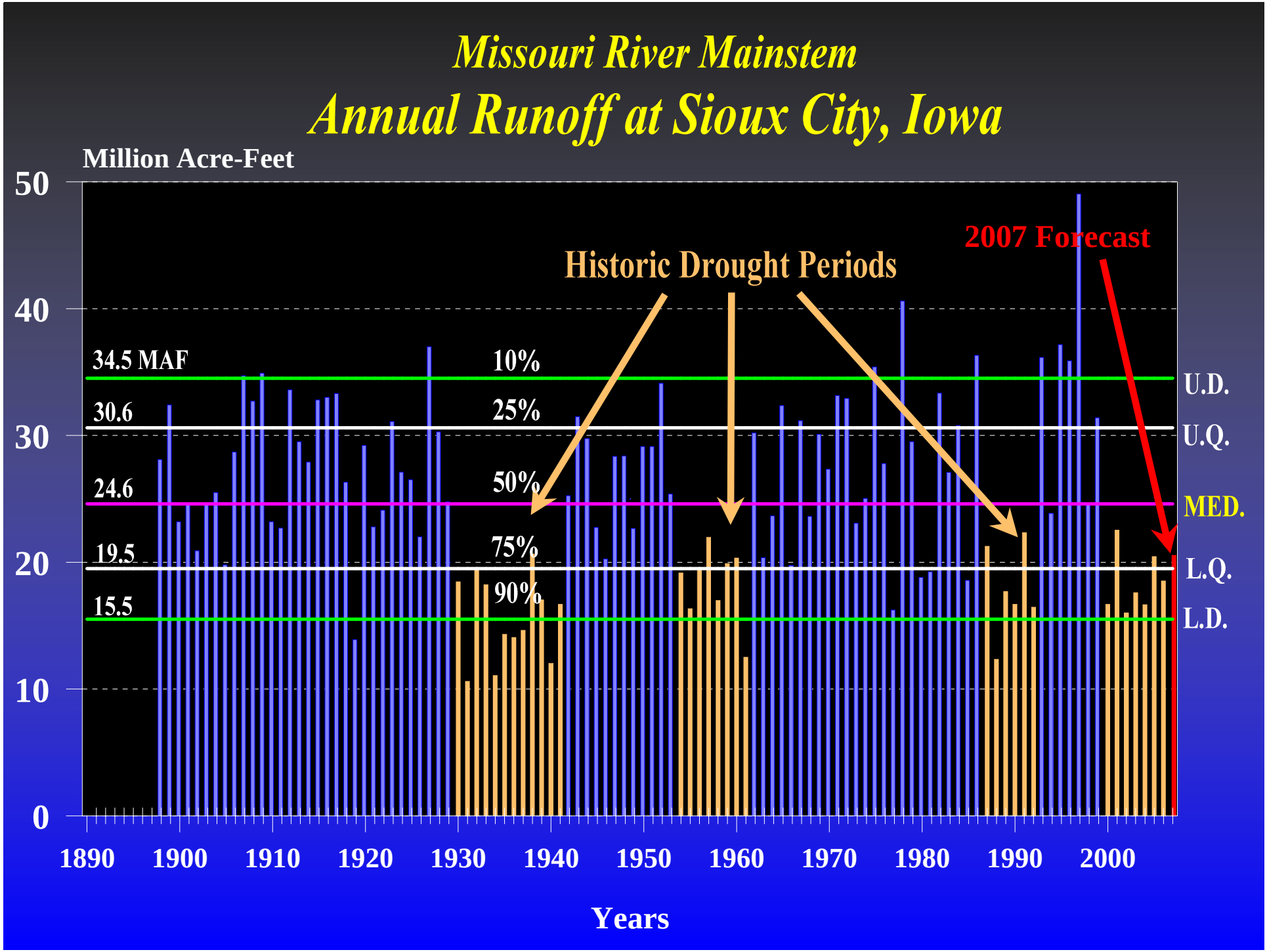
Total Fort Peck to Garrison



Missouri River basin Mountain Snowpack normally peaks near April 15.
Normally 96 percent of the peak accumulation has occurred by April 1.

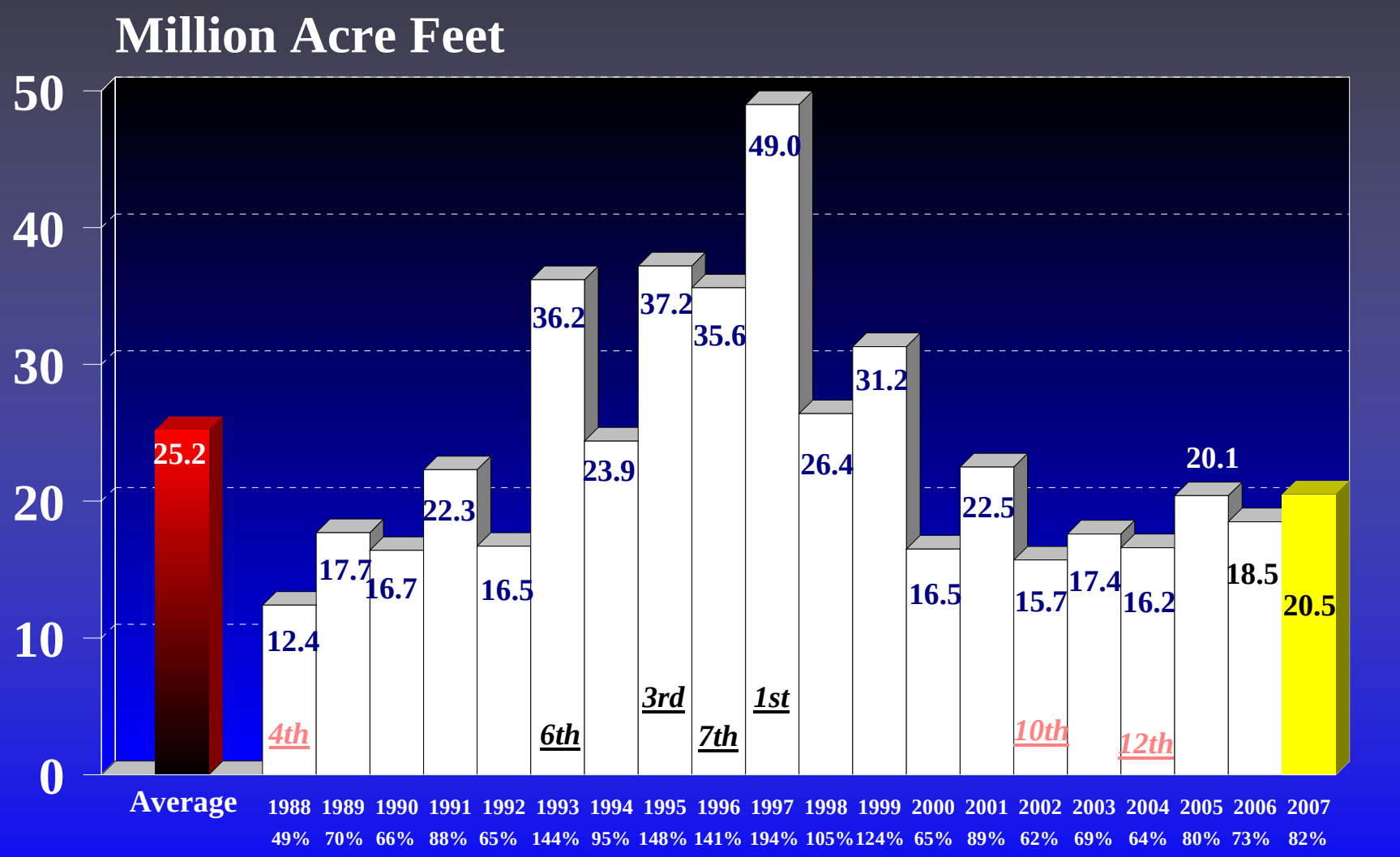
April 2, 2007

Provisional data subject to revision.


Missouri River Mainstem
Annual Runoff at Sioux City, Iowa
Million Acre-Feet
50
40
30
20
10
0
34.5 MAF
30.6
24.6
19.5
15.5
10%
25%
50%
75%
90%
Historic Drought Periods
2007 Forecast
U.D.
U.Q.
MED.
L.Q.
L.D.
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Years

Missouri River Runoff Above Sioux City

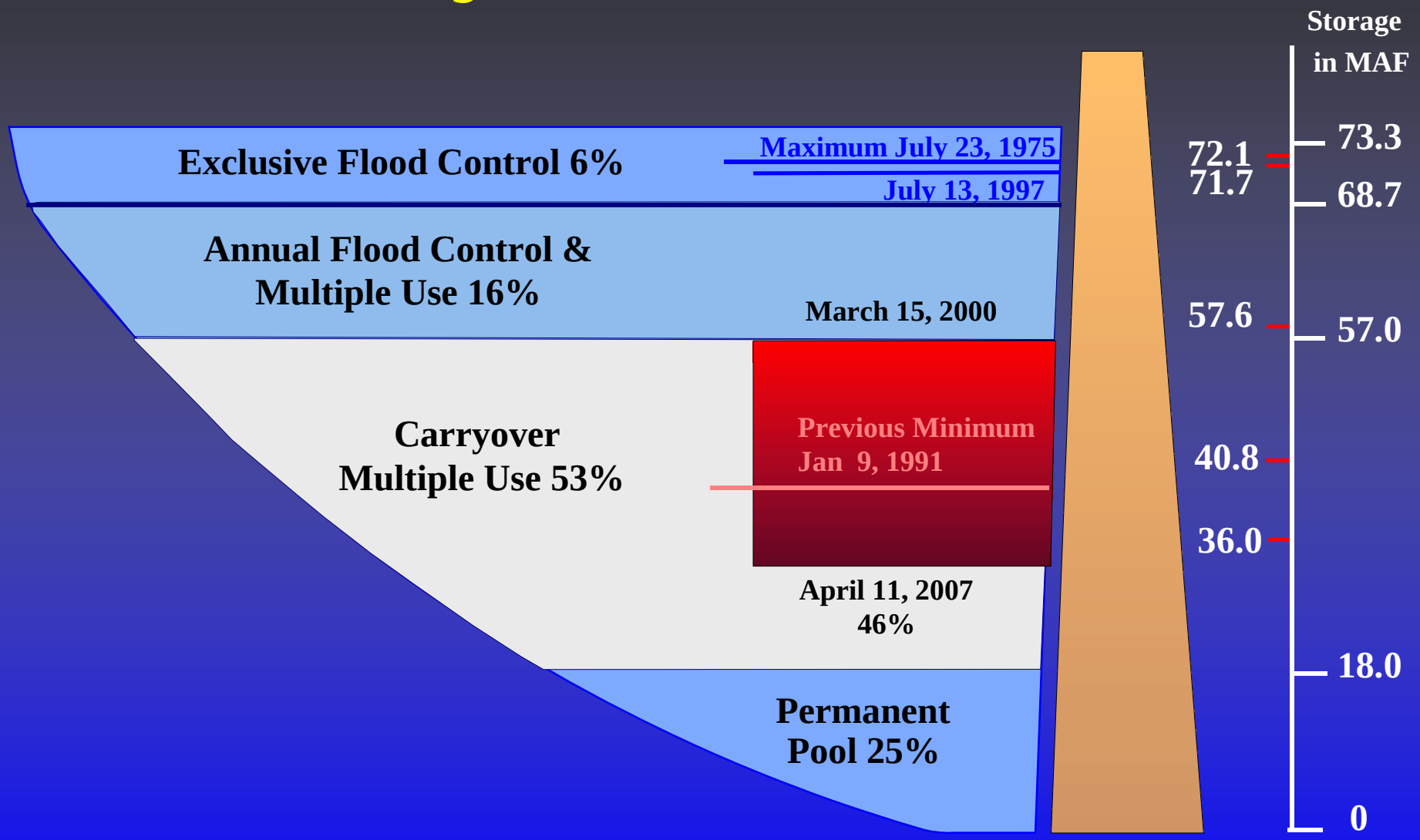
CY 1988-2007 vs Normal



February 2007

Missouri River Mainstem System

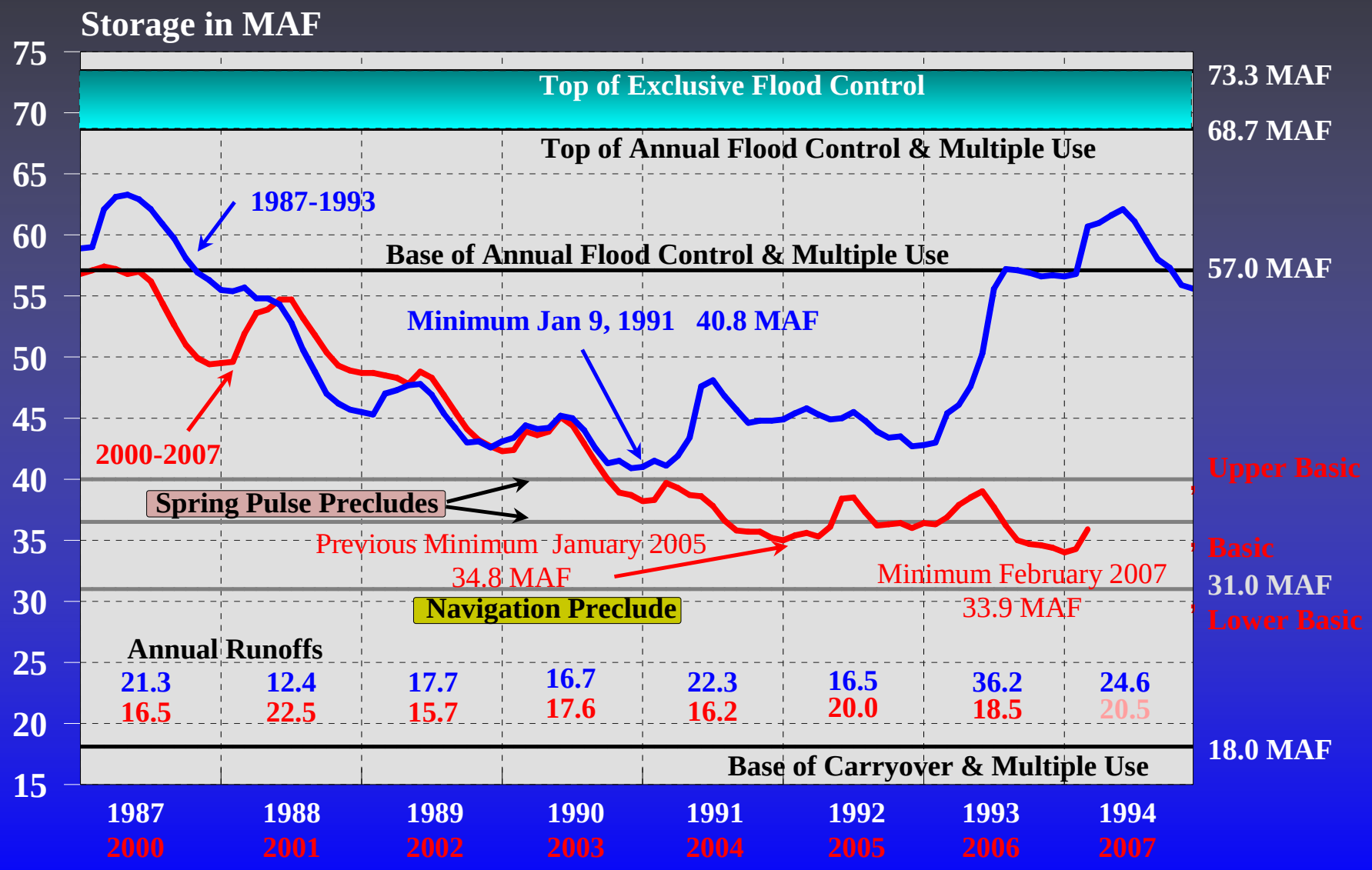
Storage Allocations



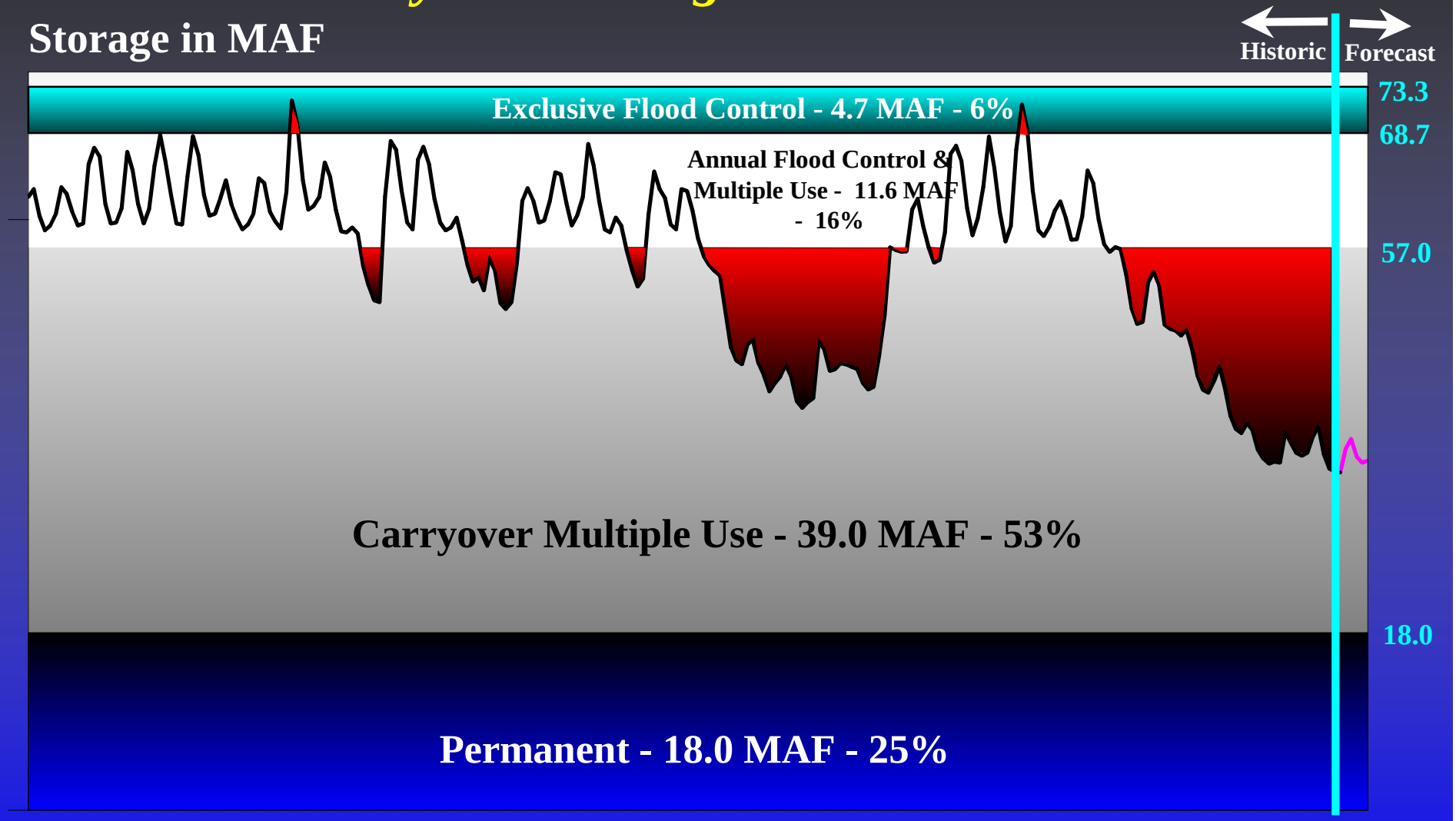
Total Storage = 73.4 MAF

Missouri River Mainstem

Historic Comparisons 1987-1994 & 2000-2007



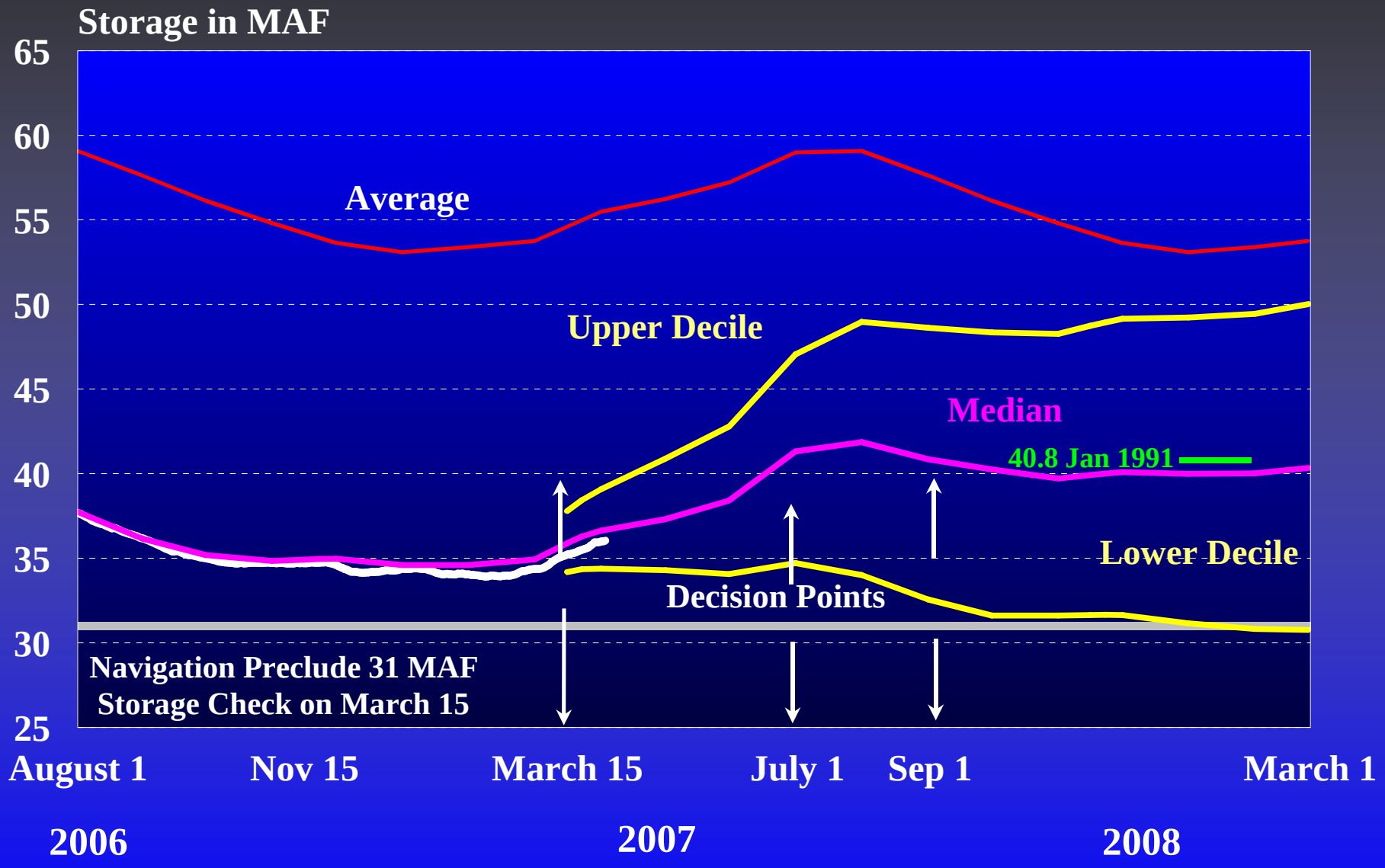
Missouri River Mainstem System Storage 1967-2007



April 2007 - Update

System Storage

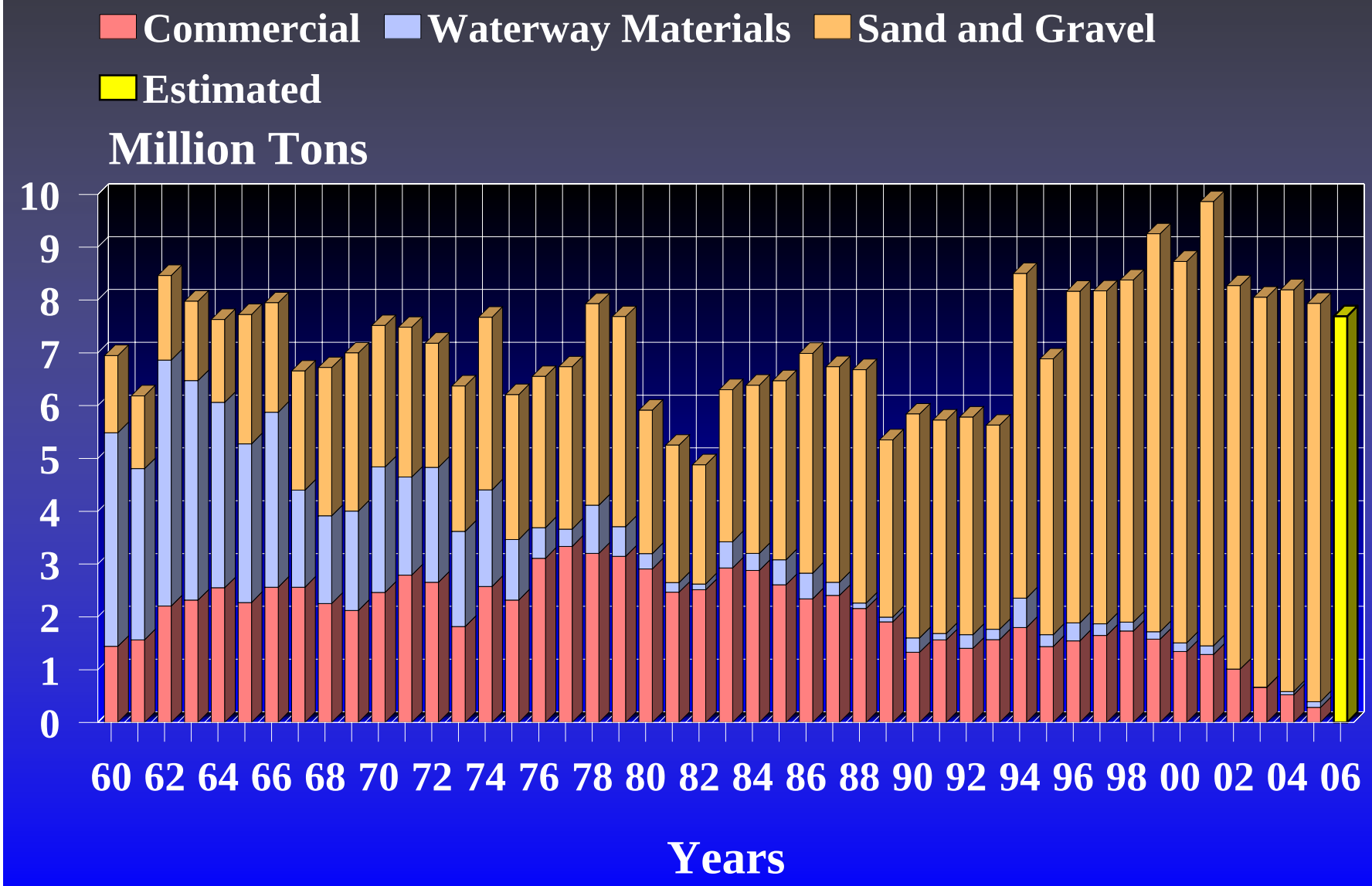
2006 - 2007 AOP vs Actual



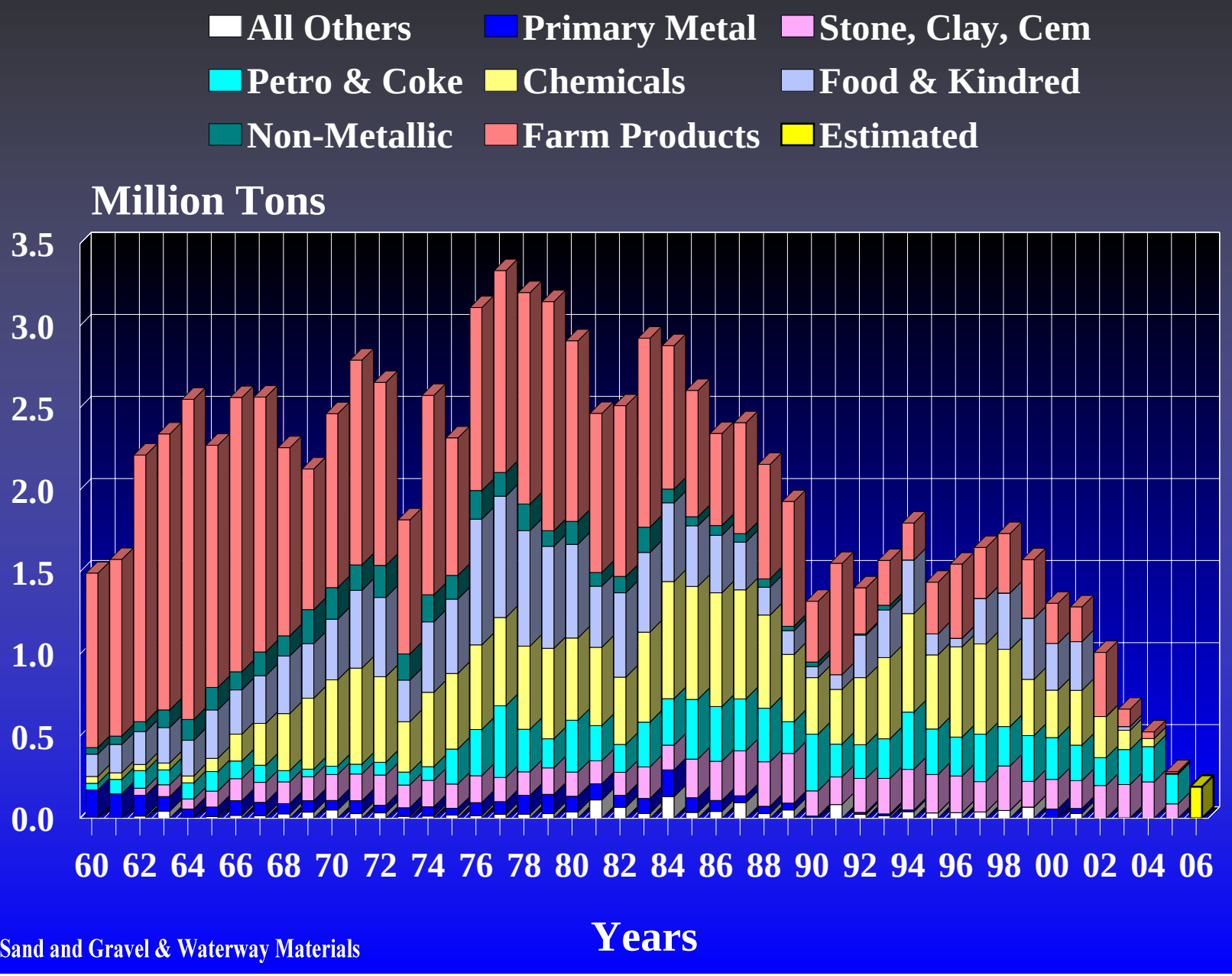
Missouri River Navigation Season Support for 2007 Navigation Season

Runoff Scenario	Annual Runoff Volume (MAF)	July 1 System Storage (MAF)	Flow Level Above or Below Full Service (in CFS)		Season Reduction (Days)
			Spring	Fall	
Upper Basic	27.3	41.1	-6,000	-6,000	31
Basic	20.5	37.7	-6,000	-6,000	53
Lower Basic	14.2	34.7	-6,000	-6,000	61

Missouri River
Total Navigation Tonnage



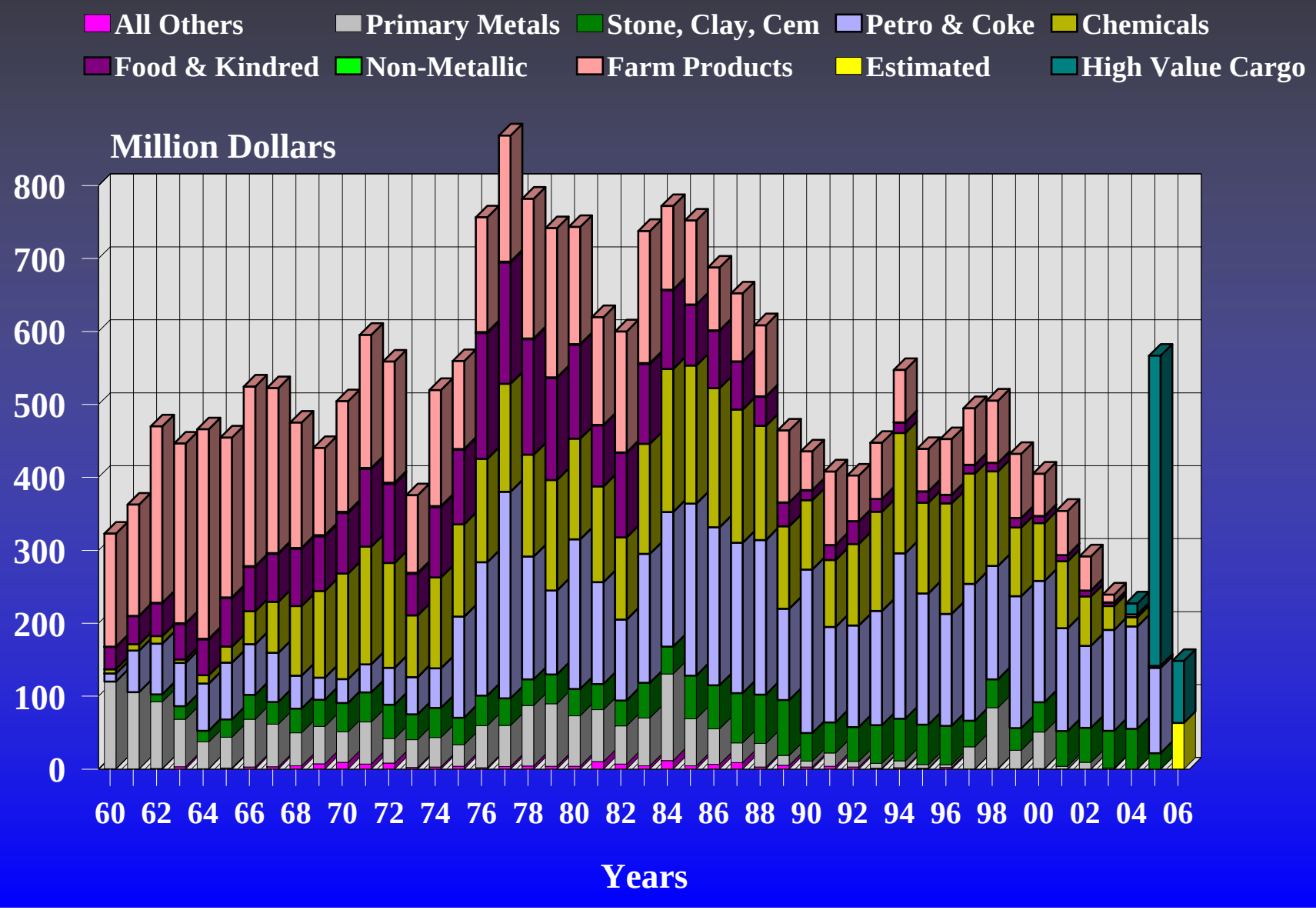
Commercial Navigation Tonnage



Excludes Sand and Gravel & Waterway Materials

Transporting Alfalfa Pellets from Blair, Nebraska 2006

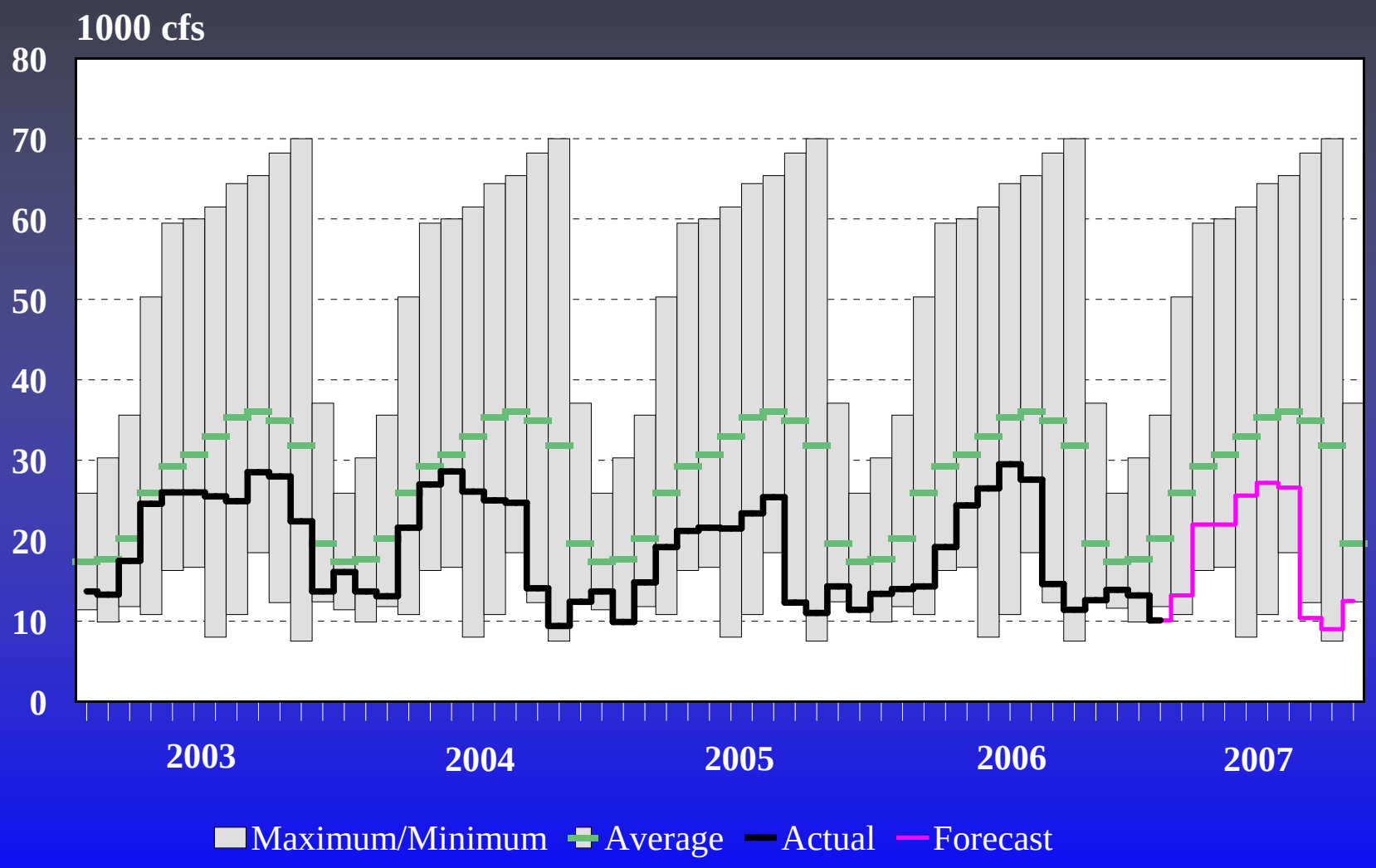
Commercial Navigation Tonnage Value based on 2006 Present Worth



Unloading Nuclear Generator - Brownville, Nebraska 2006

Gavins Point Monthly Releases

2003 through 2007 Forecast



Max, Min, and Avg 1967-97

Missouri River Navigation Season
2007 Opening Dates & Minimum Service Flow Targets

Sioux City	March 23	25,000 cfs
Omaha	March 25	25,000 cfs
Nebraska City	March 26	31,000 cfs
Kansas City	March 28	35,000 cfs
Mouth near St. Louis	April 1	

*Estimated Missouri River Stages & Flows**
For May - October 2007

Gage Location	*River Stage*	*Flow in cfs*
Sioux City	**13.3 - 16.5 feet**	**25-38,000 cfs**
Decatur	**20.5 - 24.5 feet**	**25-38,000 cfs**
Omaha	**14.3 - 18.9 feet**	**25-41,000 cfs**
Nebraska City	**8.1 - 12.0 feet**	**31-48,000 cfs**
Rulo	**8.0 - 12.0 feet**	**32-51,000 cfs**
St. Joseph	**7.2 - 11.4 feet**	**33-54,000 cfs**
Kansas City	**8.9 - 13.8 feet**	**35-60,000 cfs**
Waverly	**9.6 - 13.5 feet**	**35-60,000 cfs**
Boonville	**5.7 - 12.0 feet**	**35-70,000 cfs**
Hermann	**4.0 - 9.4 feet**	**35-70,000 cfs**

**** based on normal runoff conditions in all reaches and summer water temperatures.***

Missouri River Basin Intakes

Location	Powerplant	Irrigation	Municipal
Above System	7	786(196)	38(11)
Below System	18	105(3)	19
Total	25	891(199)	57(11)

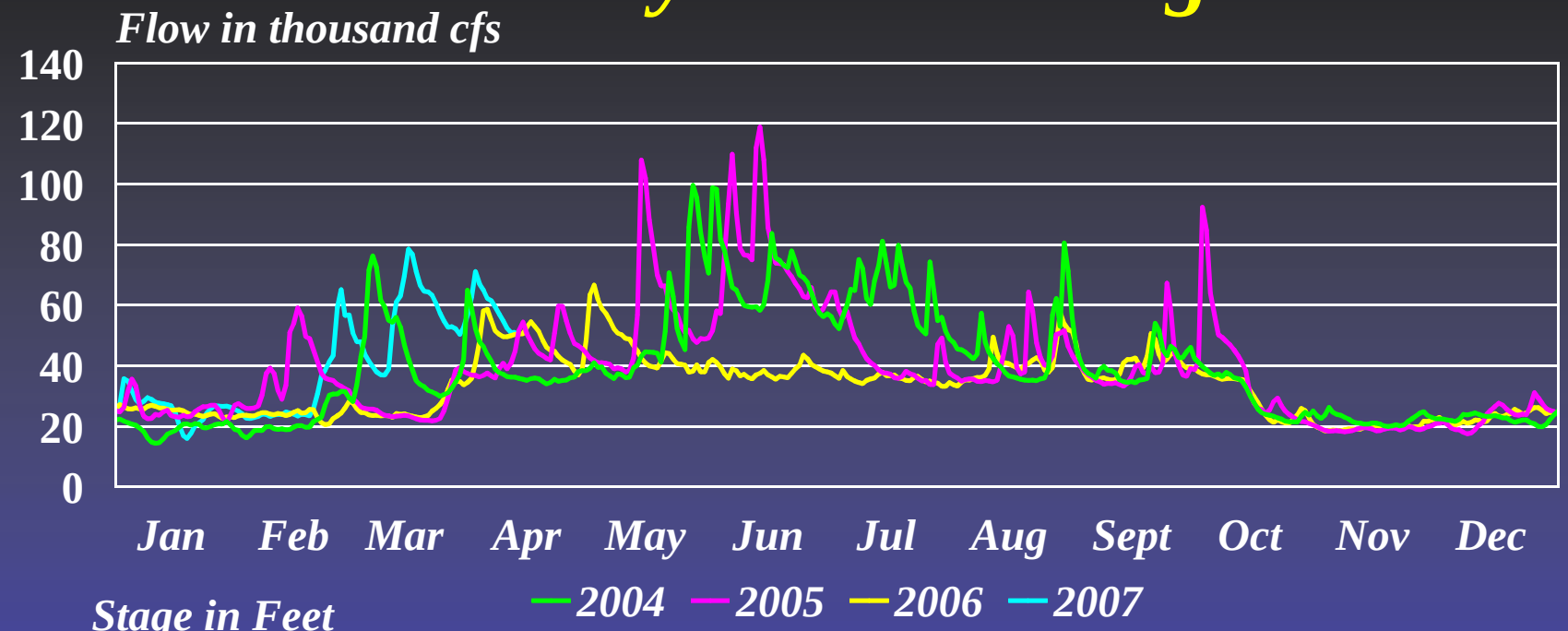
( ) denotes tribal intake

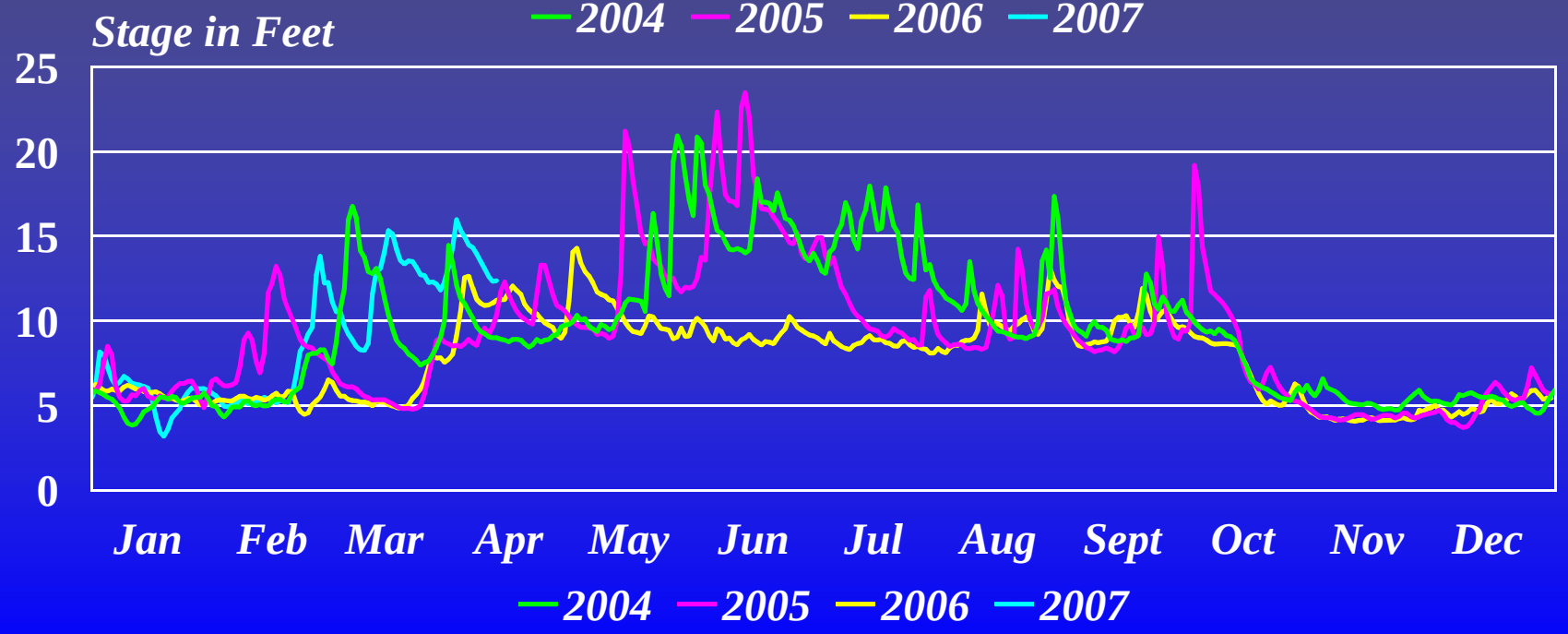
Location	Powerplant	Capacity in MW	Percent
Above System	7	4,026	26%
Below System	18	11,058	74%
Total	25	15,084	

Location	Irrigation	Acres	Percent
Above System	786(196)	289,000	58%
Below System	105(3)	209,600	42%
Total	891(199)	498,600	

Location	Municipal	Population	Percent
Above System	38(11)	0.2 Million	6%
Below System	19	2.9 Million	94%
Total	57(11)	3.1 Million	

Kansas City Flows & Stages





Dredging Dodge Park Marina October 2006

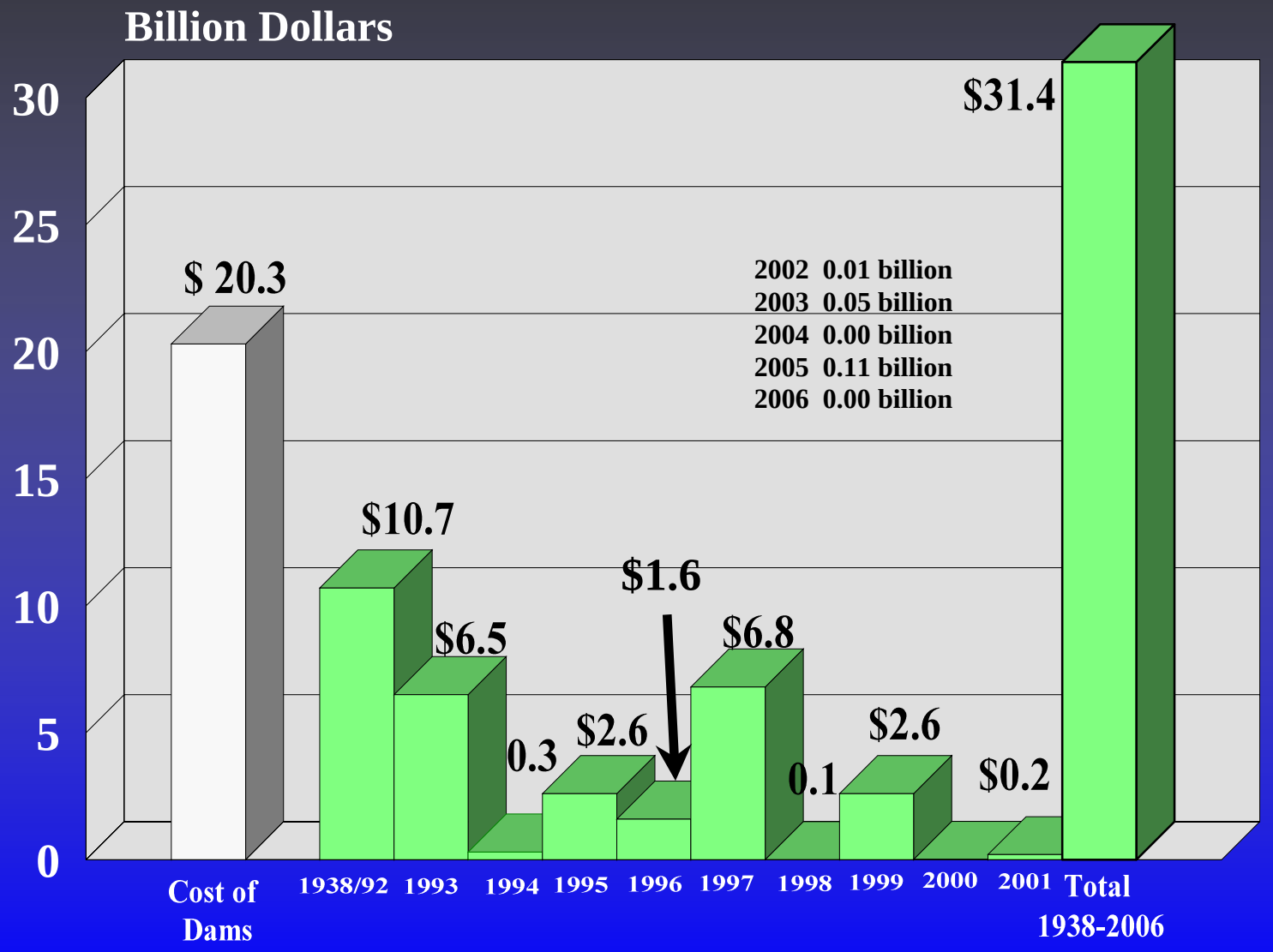
Missouri River Downstream Water Supply

Intake Low Water Expense Below Gavins Point

2000 - 2004	*$ 18,773,321*
2004-2010	*$ 63,159,120*
Beyond 2010	*$ 286,075,000*

Missouri River Mainstem Reservoirs

Flood Damages Prevented Indexed to 2006



Congressionally Authorized Project Purposes

2006 - 2007 AOP Expected Results

- **Flood Control -** significant flood control storage available
- **Navigation -** minimum service & short season (31-61 days)
- **Hydroelectric Power**
- **Irrigation -**
- **Water Supply & WQ -** should meet requirements but fall season could be lower because of reduced season length.
- **Recreation (below System) -** reduced season length and continued access problems similar to recent years
- **Fish and Wildlife -**
  - 2 **Endangered Species**

Corps Water Management System

- Convert to New System During May 2007
- Replaces old system used since 1978
- Corps Hydrologic Modeling System(HMS) developed by Hydrologic Engineer Center (HEC) includes actual radar precipitation and forecasted precipitation (QPF) as model input.
- HMS Integrated into current 14 day Missouri River forecast with QPF for pulse period and flood control regulation and radar precip during periods when significant runoff expected.

Cooperative Stream Gaging Funding Issue

- In fiscal year 2007, Corps of Engineers water management funding for data collection was reduced by 8%.
- Additional cuts are likely to occur in fiscal year 2008.
- Corps of Engineers funding for USGS Cooperative Program in fiscal year 2006 was $1,288,000 in Omaha District and $1,298,000 in Kansas City District
- Private Sector Funding is one solution to continuation of network.

Cooperators in Missouri River Basin

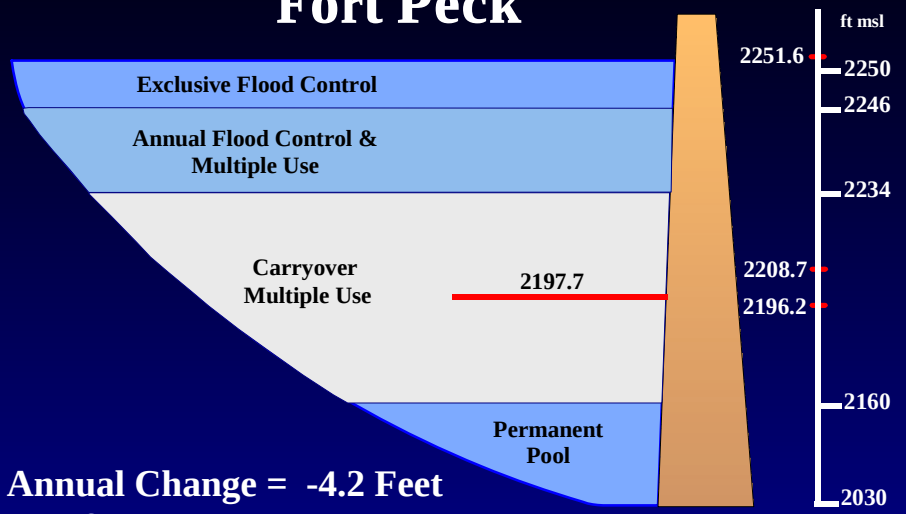
Location	State	Munic.	County	Tribal	Other	Total
Iowa	3	17	1	0	3	24
Kansas	4	7	1	1	1	14
Missouri	7	6	0	0	3	16
Montana	6	1	1	5	7	20
Nebraska	3	4	1	3	16	27
North Dakota	3	3	0	3	7	16
South Dakota	5	7	7	4	11	34
Wyoming	3	1	2	1	2	9
TOTAL	34	46	13	17	50	160

Drought Impacts

- Water Intakes
- Irrigation
- Boat Ramps and Marinas
- Noxious Weeds
- Cultural Resources
- Fisheries
- Power Production
- Navigation

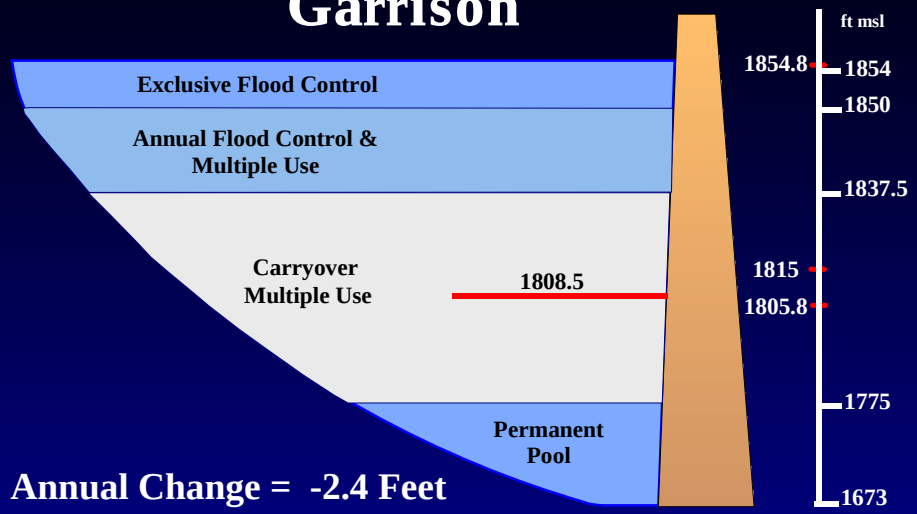
Missouri River Mainstem Reservoirs

Fort Peck



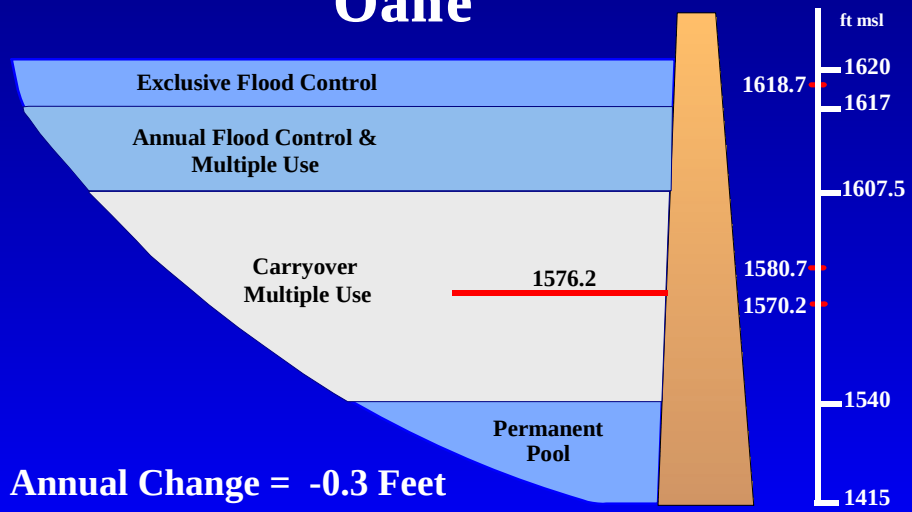
Annual Change = -4.2 Feet
36.3 feet below desired

Garrison



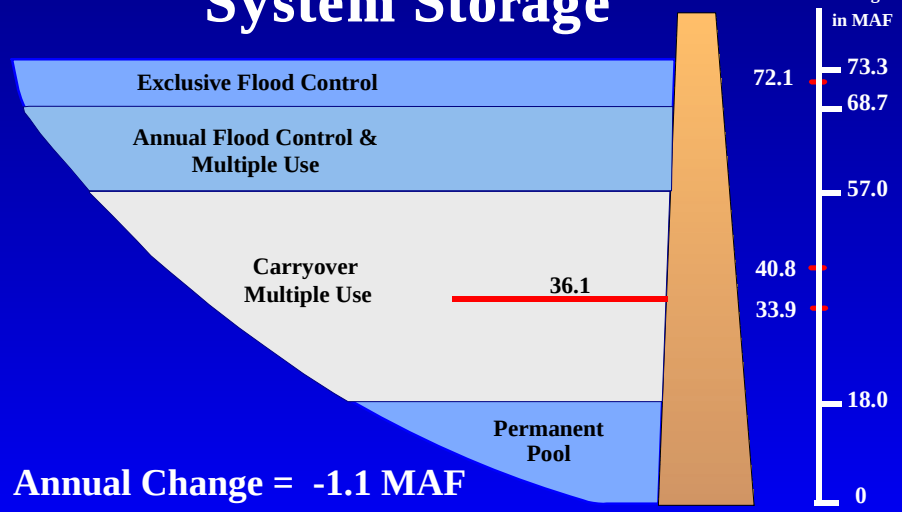
Annual Change = -2.4 Feet
29.0 feet below desired

Oahe



Annual Change = -0.3 Feet
31.3 feet below desired

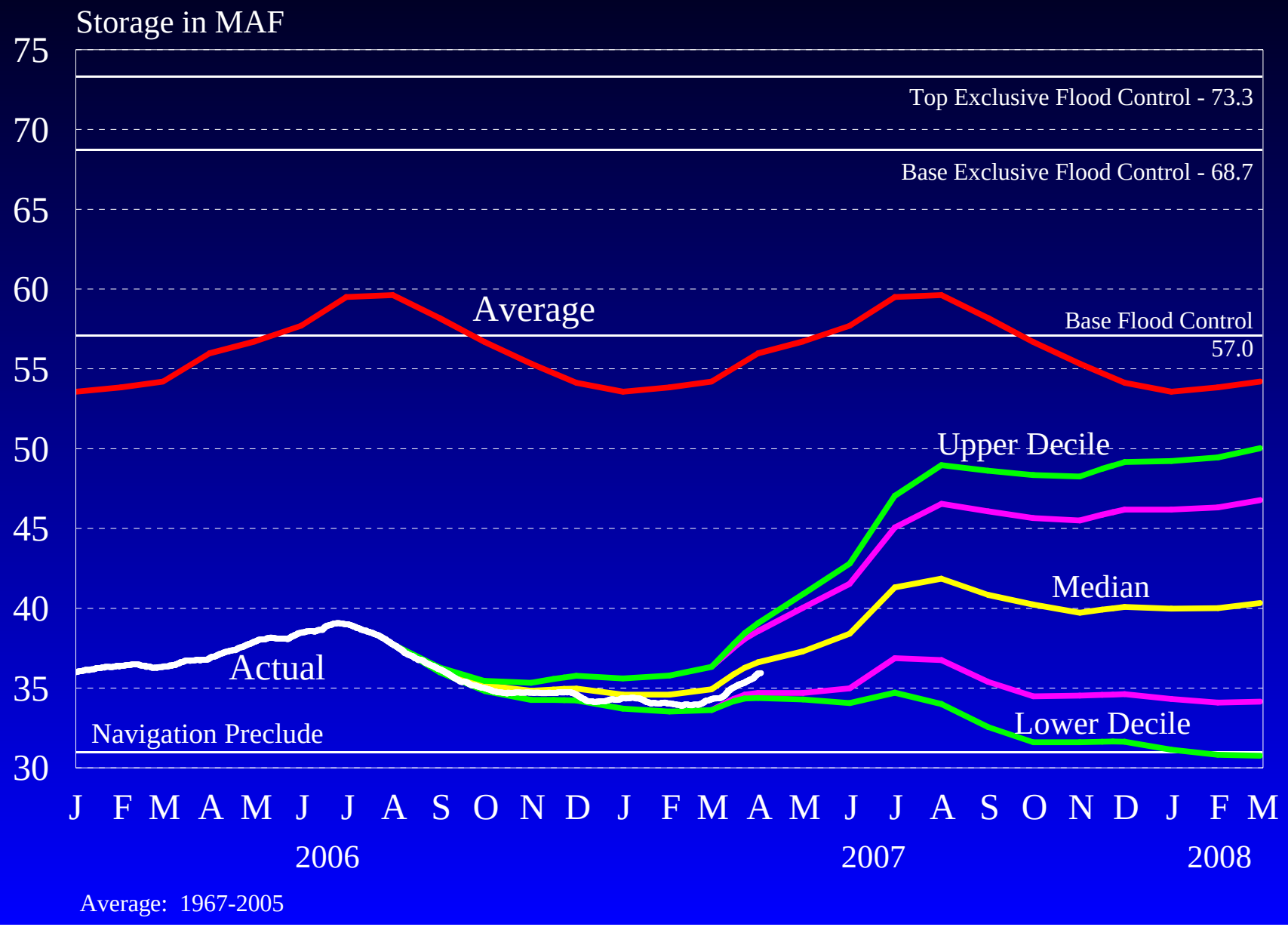
System Storage



Annual Change = -1.1 MAF
20.9 MAF below desired

System Storage

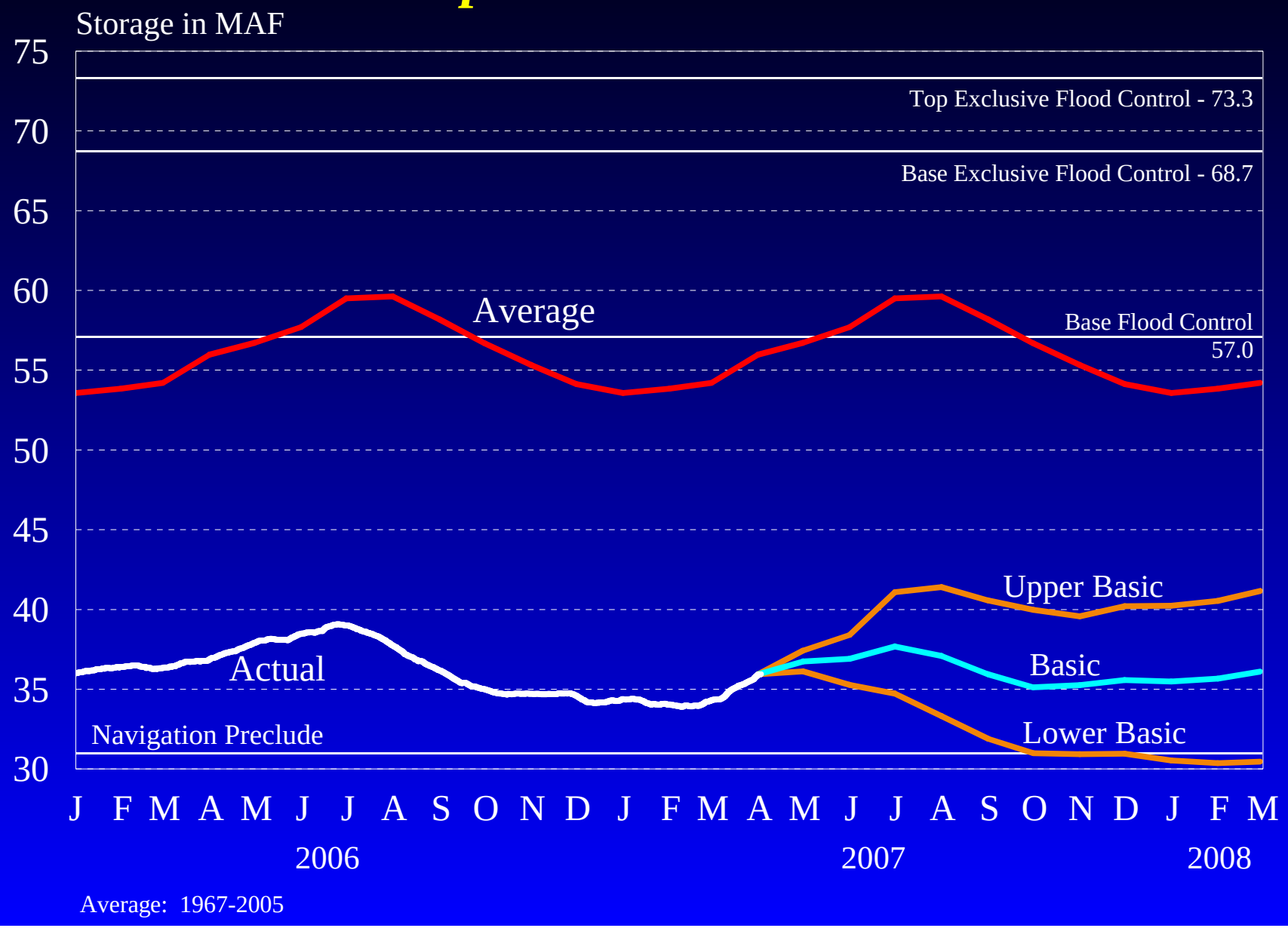
2006-2007 AOP Forecast



Average: 1967-2005

System Storage

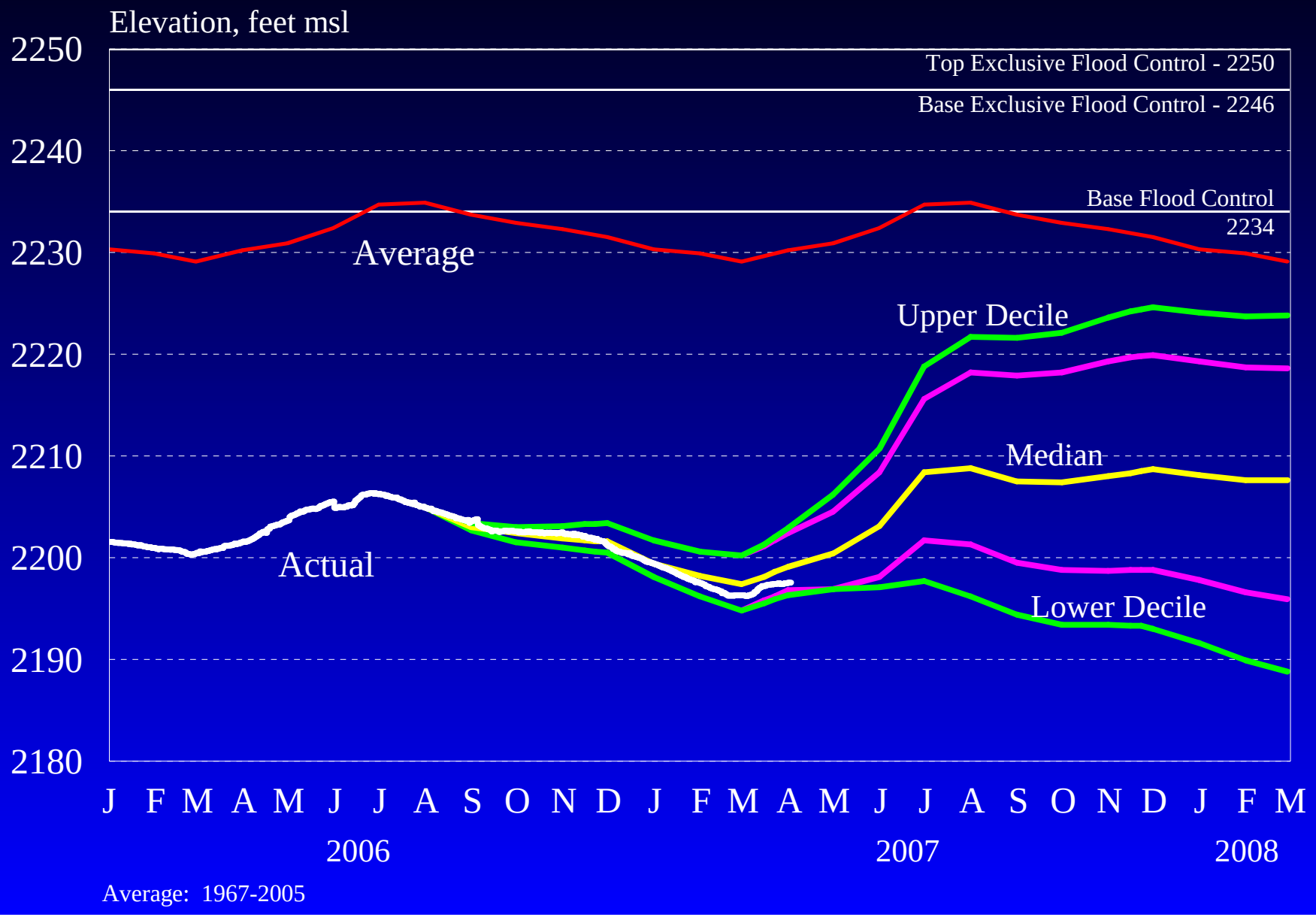
April 1 Forecast



Average: 1967-2005

Fort Peck

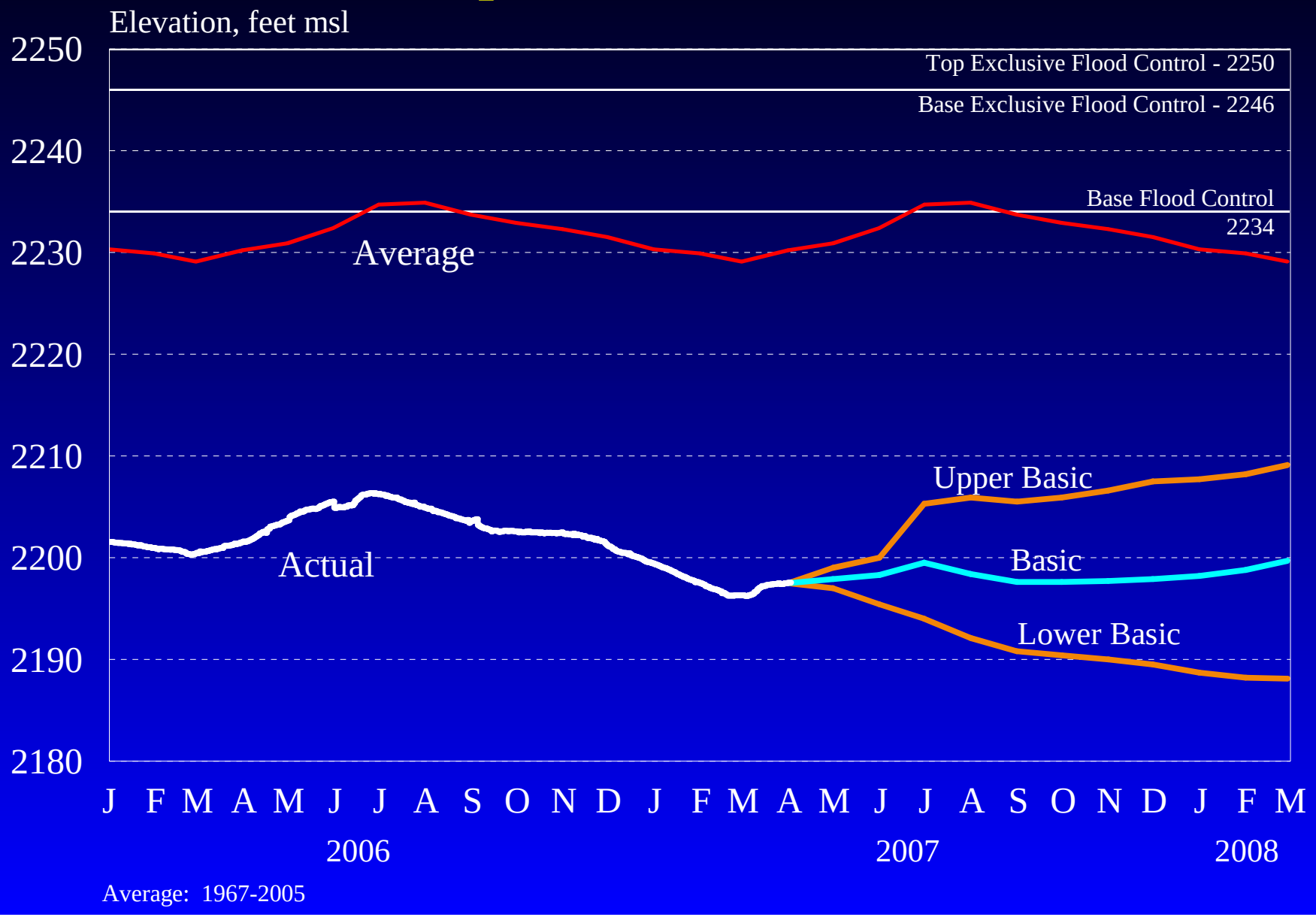
2006-2007 AOP Forecast



Average: 1967-2005

Fort Peck

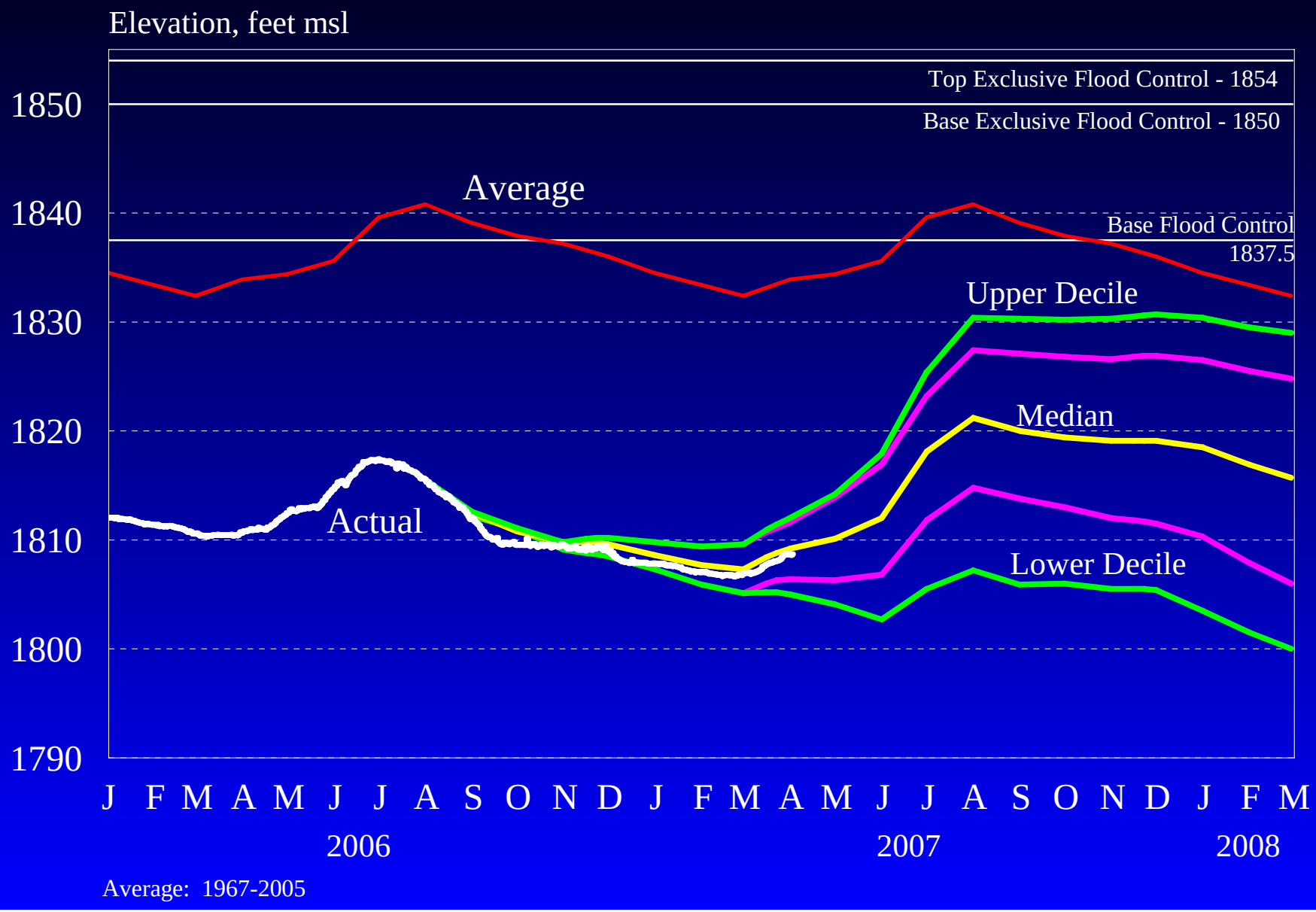
April 1 Forecast



Average: 1967-2005

Garrison

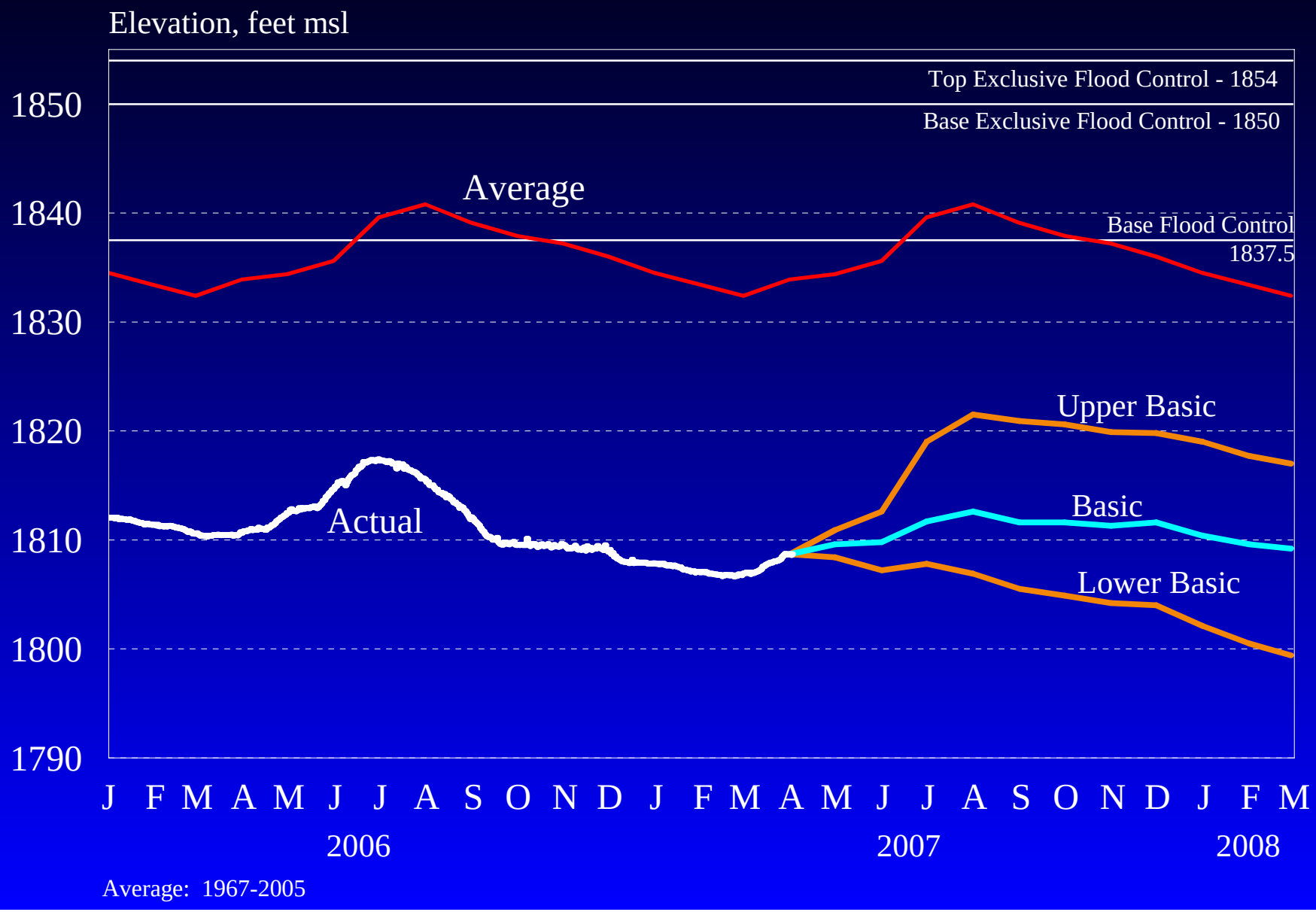
2006-2007 AOP Forecast



Average: 1967-2005

Garrison

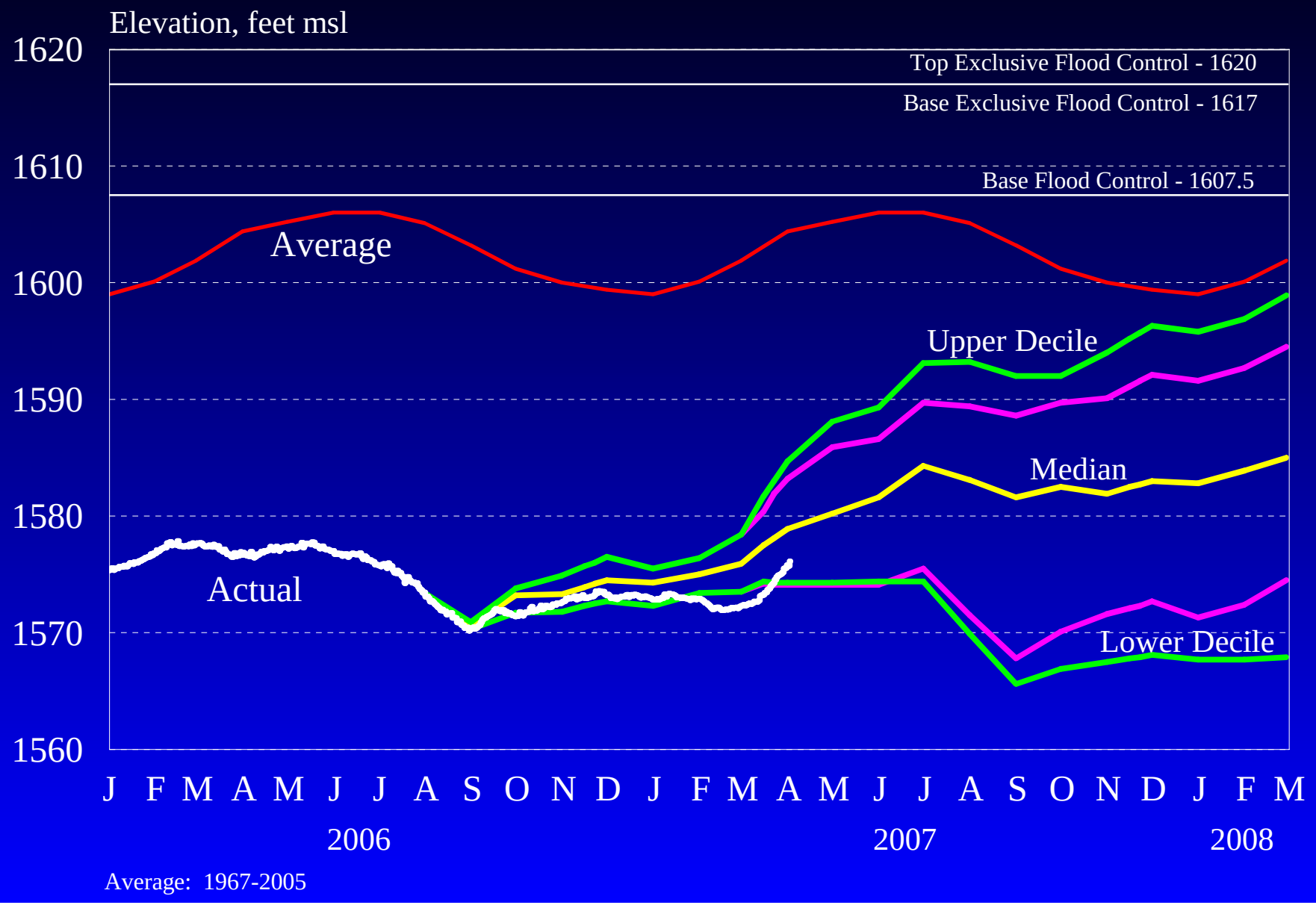
April 1 Forecast



Average: 1967-2005

Oahe

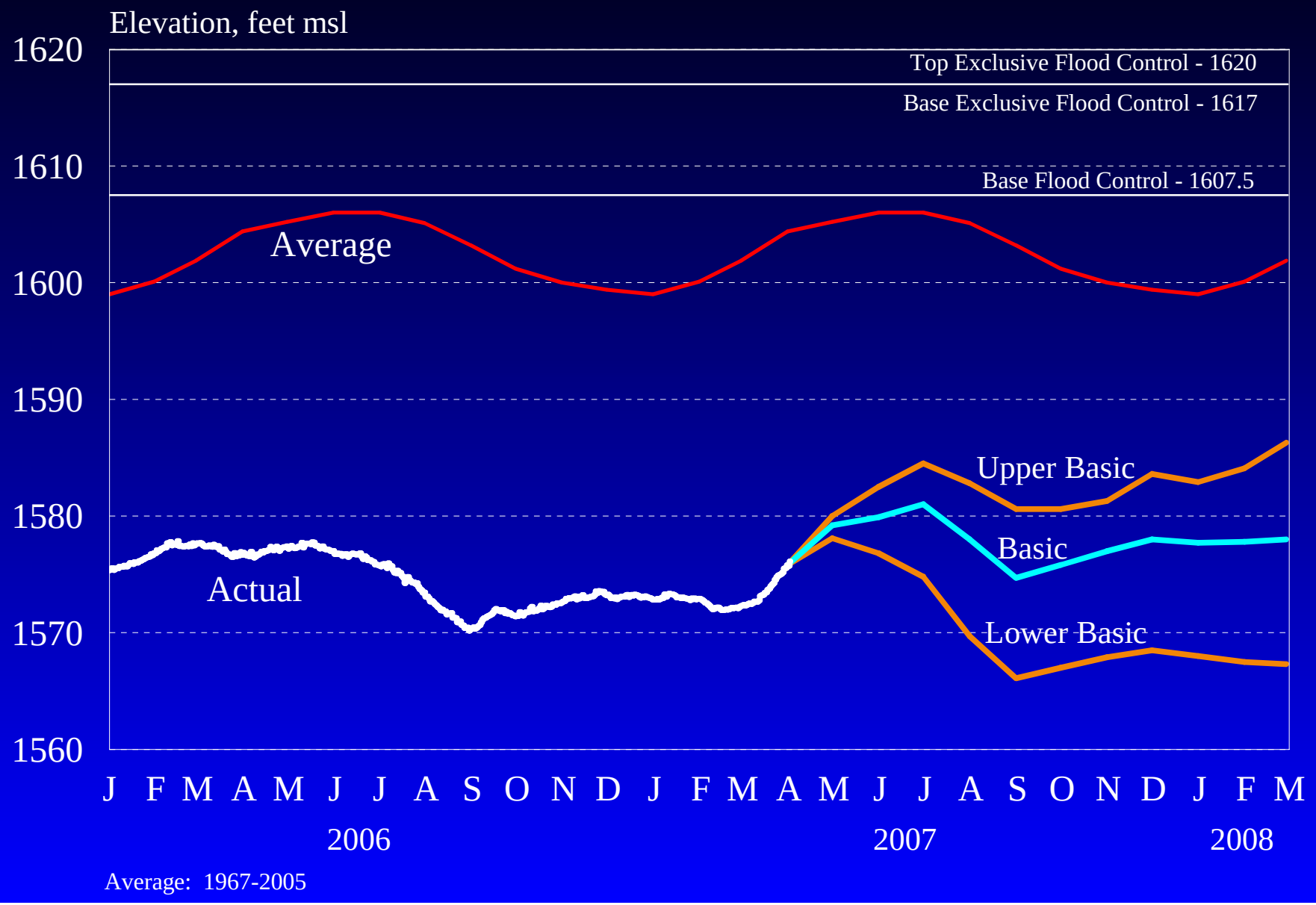
2006-2007 AOP Forecast



Average: 1967-2005

Oahe

April 1 Forecast



Average: 1967-2005

Municipal Water Intakes

Garrison Intakes

- Four Bears
- Mandaree
- Twin Buttes
- White Shield
- Parshall
- SW Pipeline
- Garrison
- Riverdale
- Pick City

Oahe Intakes

- Fort Yates
- Wakpala
- Mobridge
- WEB Water System
- Mni Waste'
- Mid Dakota Rural Water

Fort Peck Intakes

- Fort Peck

River Intakes

- Bismarck
- Mandan

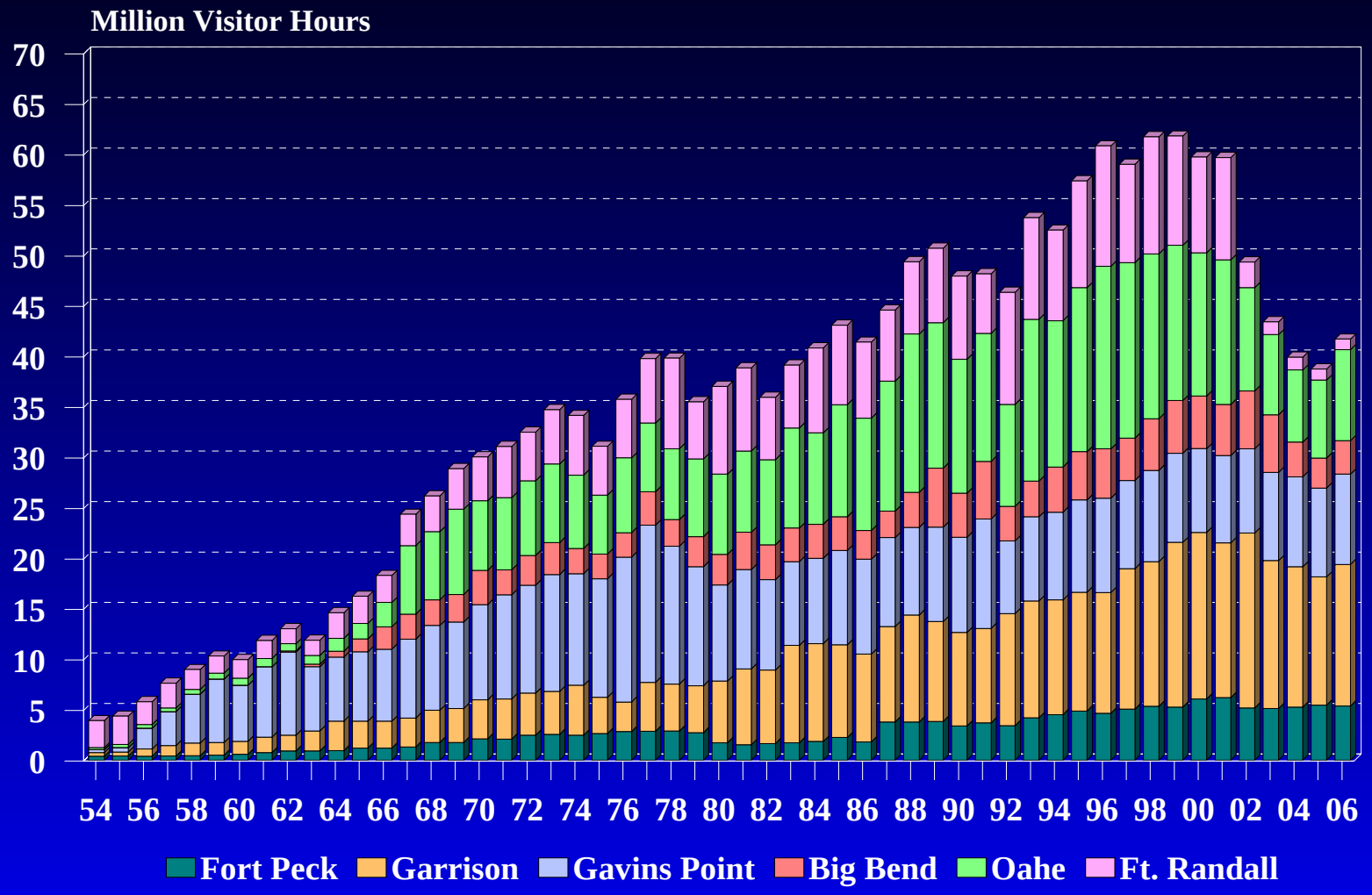
2007 Reservoir Access Areas

	Usable	Total
Fort Peck	8	11
Garrison	21 - 25	35
Oahe		
- North Dakota*	8	13
- South Dakota	15 - 20	27

*** All Oahe boat ramps in North Dakota are in river conditions.**

Mainstem Project Visits

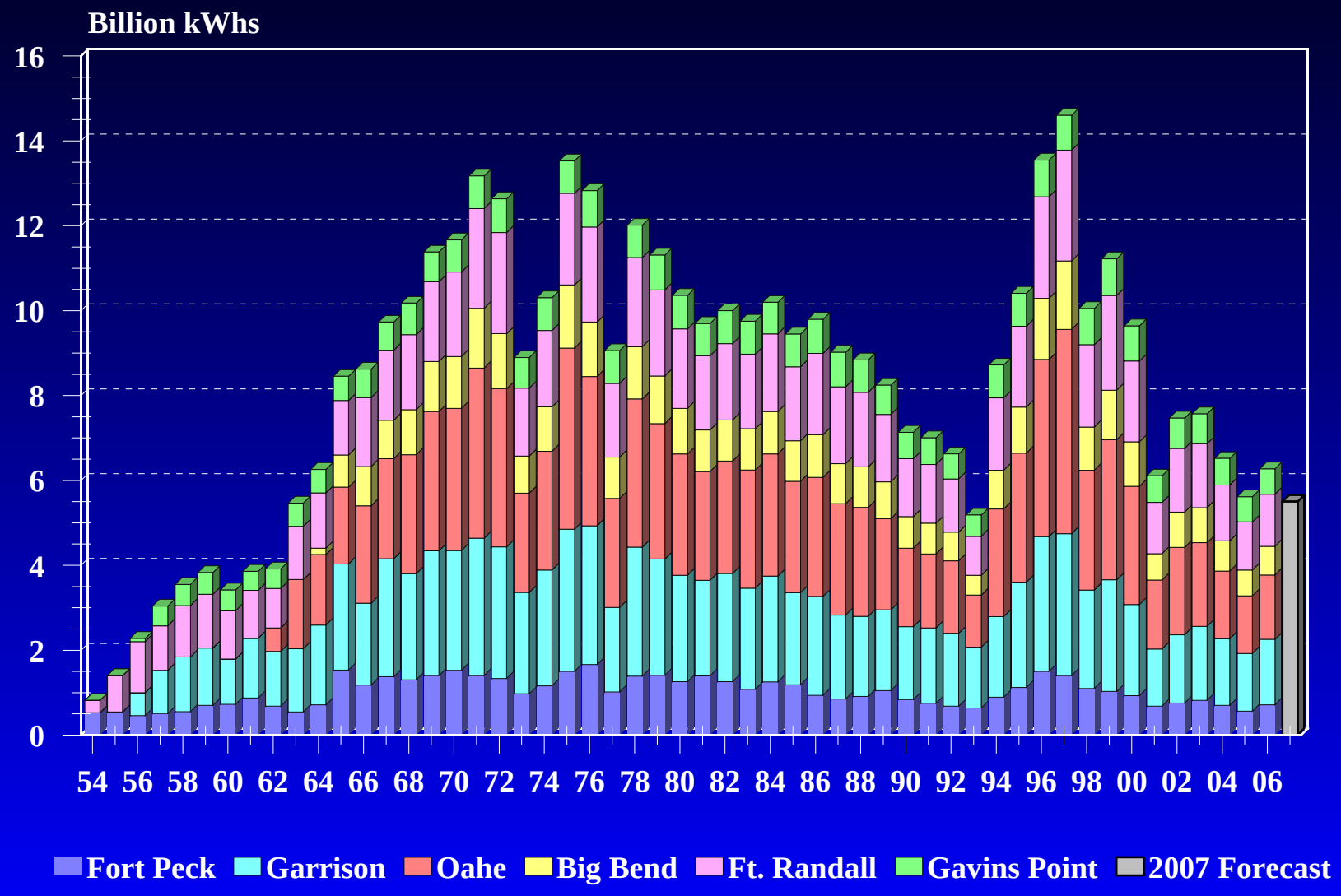
1954 - 2007



1954 through 1988 data in Calendar Years
1989 to 1991 in Fiscal Years
1992 to present in VERS System
2002 to present reflect changed accounting due to Title 6 land transfer to state of SD

Mainstem Hydropower Generation

1954 - 2007



Pick-Sloan Missouri Basin Program

Eastern Division

Composite Rate ($/MWh)	Percent Increase	Implementation Date
14.23		Oct 1994
16.04	12.7	Feb 2004
16.51	2.9	Oct 2004
18.47	11.9	Jan 2006
19.54	5.8	Jan 2007

Conservation of Coldwater Habitat at Garrison Dam

- **Plywood installed over lower 50 feet of two trashracks during July 2005**
- **One additional trash rack will be modified in May 2007**
- **Lowered head gates on additional units to increase velocity of water drawn into penstocks**
- **Adjusted peaking pattern to maximize warm water released from reservoir**

2007 Forage Fish Spawn

- Provide steady to rising reservoir levels at the upper three reservoirs from April to June

- Favor Fort Peck and Oahe if runoff is not sufficient to keep all three reservoirs rising
  - Reduce Fort Peck release to minimum required for water supply and irrigation below the dam
  - Adjust releases from Garrison and use water in Fort Randall to supplement navigation support flows to keep Oahe steady to rising

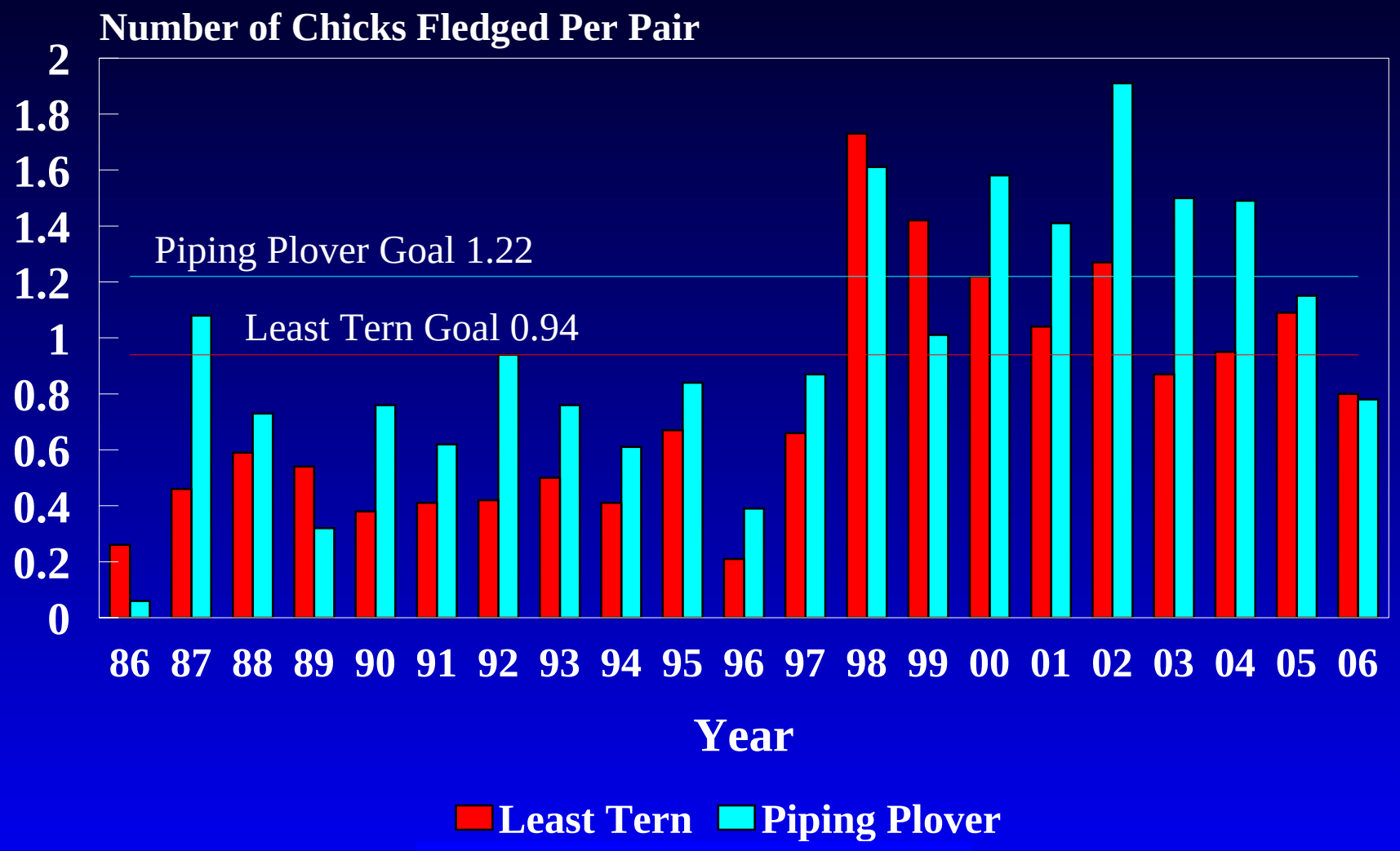
- Emphasis will shift back to Garrison in 2008

Interior Least Tern

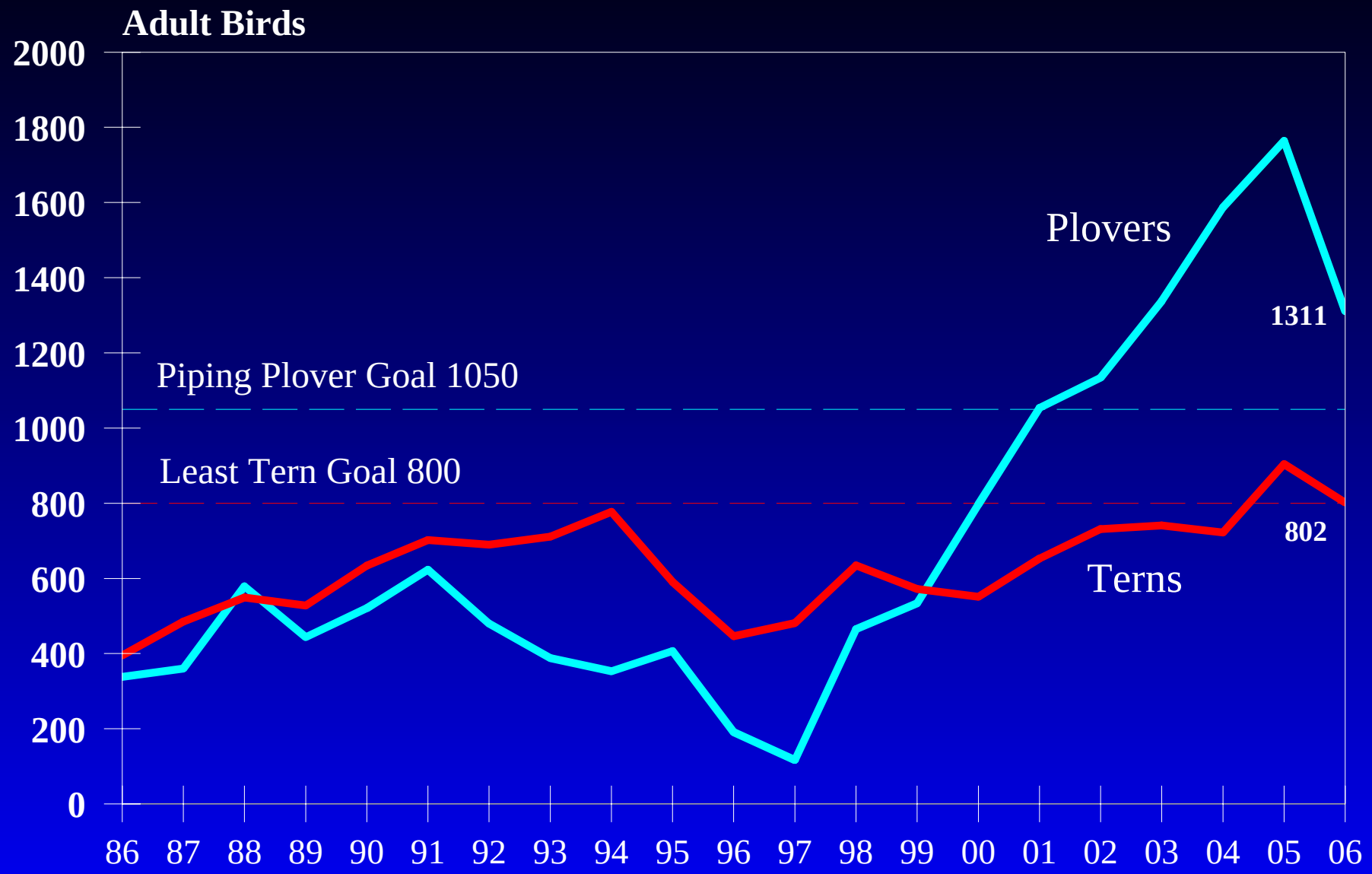
Piping Plover

Pallid Sturgeon

Fledge Ratios - Missouri River 1986-2006



Adult Census - Missouri River 1986-2006



Congressionally Authorized Project Purposes

2007 Expected Results

- **Flood Control**
- **Navigation**
- **Hydroelectric Power**
  - **Forecast 55 % of normal in 2007.**
- **Irrigation**
  - **Continued access problems due to low lake levels and releases.**
- **Water Supply & Water Quality**
  - **Continued access & water quality problems at Tribal, municipal, and industrial water intakes.**
- **Recreation**
  - **Continued access problems due to low lake levels and releases.**
- **Fish and Wildlife**
  - **Endangered Species**
    - **No March or May spring pulse from Gavins Point dam.**
    - **Releases adjusted when birds begin nesting activities.**
  - **Attempt to keep lakes steady to rising during fish spawn; favor Oahe and Fort Peck if necessary.**
  - **Preserve cold water habitat in Garrison to the extent possible.**