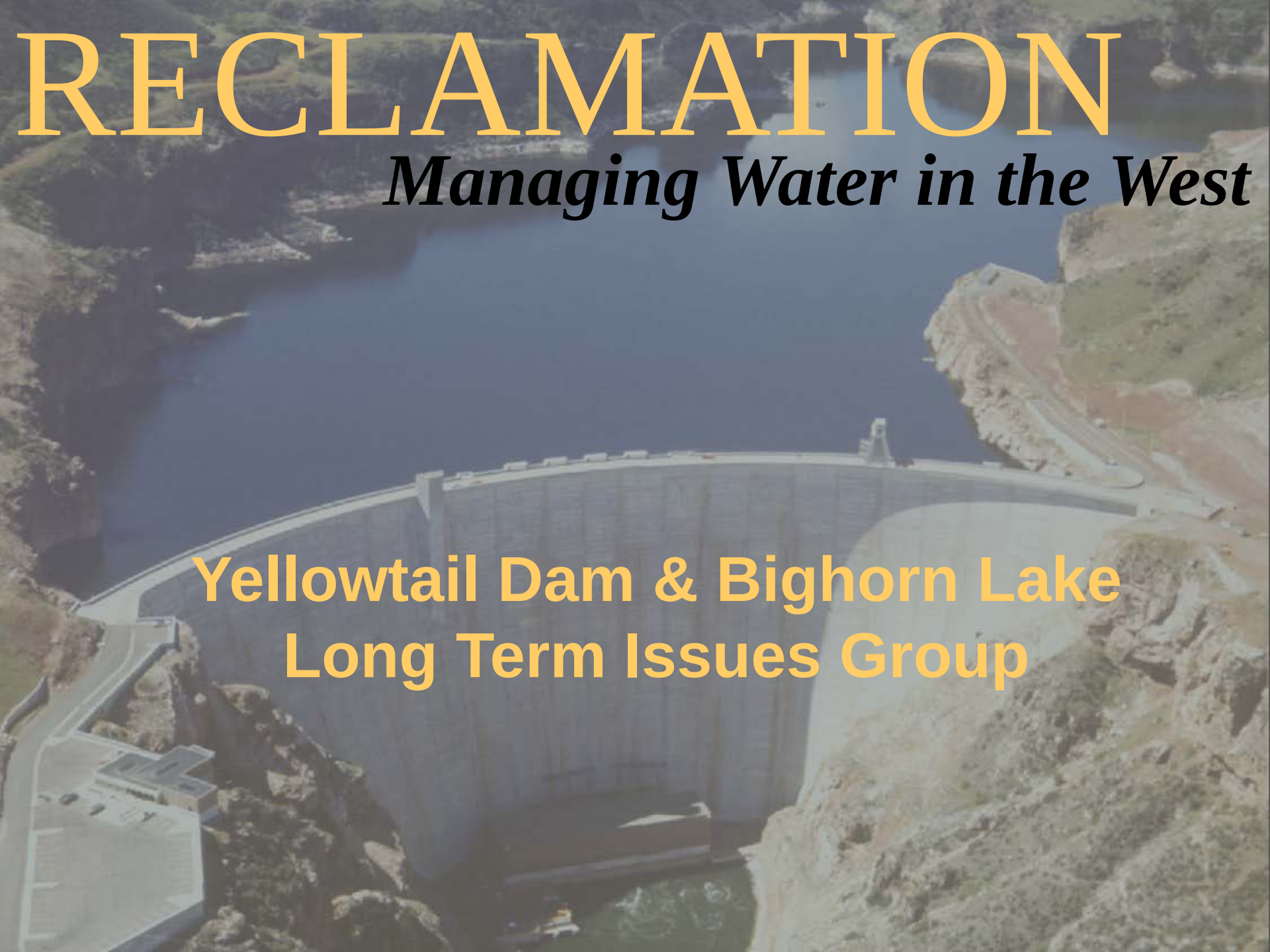


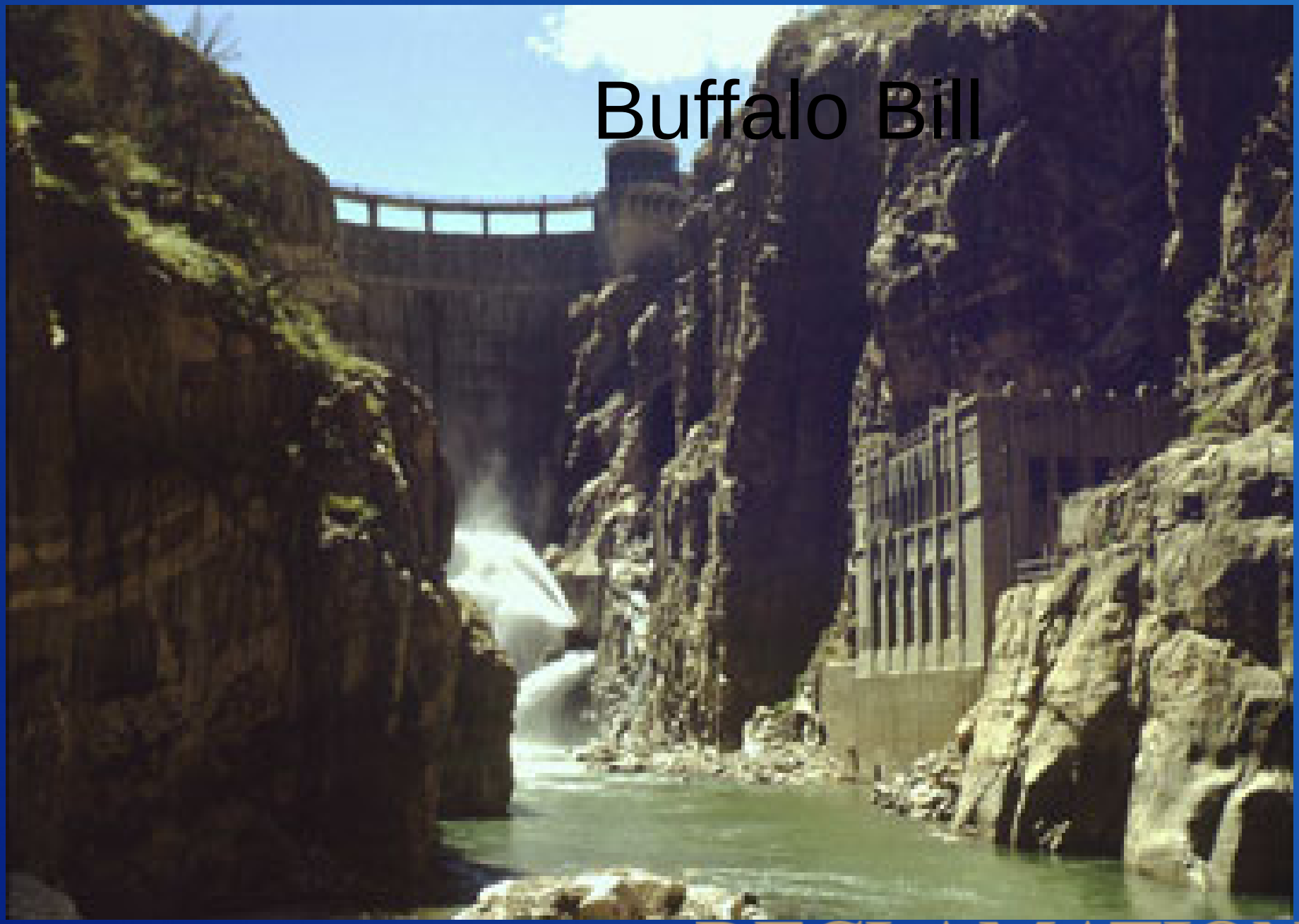
RECLAMATION

Managing Water in the West

Yellowtail Dam & Bighorn Lake
Long Term Issues Group

Boysen

RECLAMATION



RECLAMATION

Bull Lake

RECLAMATION

YELLOWTAIL DAM, BIGHORN LAKE and AFTERBAY

RECLAMATION

YELLOWTAIL DAM, BIGHORN LAKE AND AFTERBAY

RECLAMATION

Yellowtail Unit

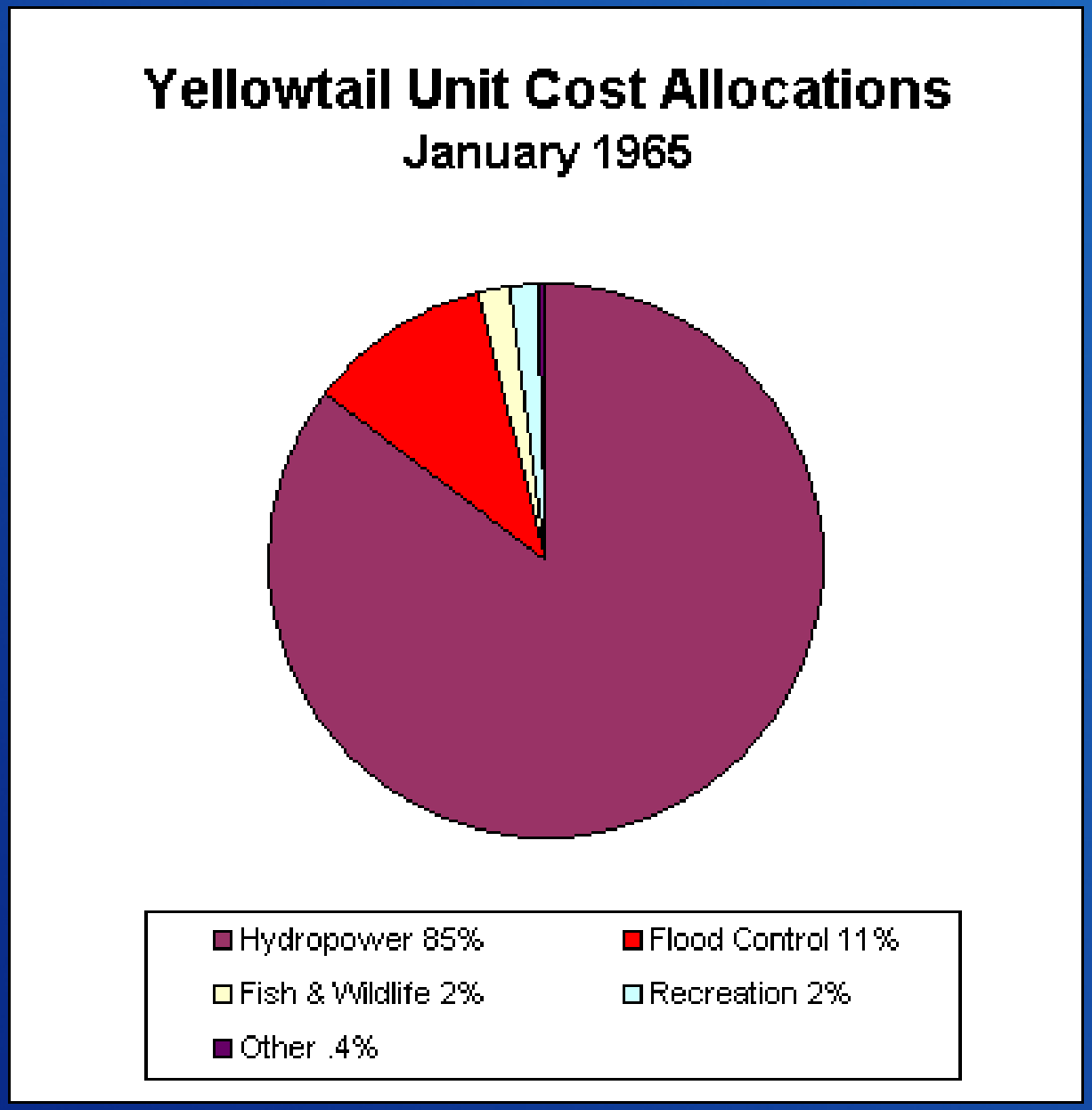
- Authorization:

  Flood Control Act of Dec. 22, 1944 (ch.665 Stat. 887)

  Senate Document 191—USACE/Reclamation plan for Missouri River Basin Development

- Project Purposes
  - Flood Control
  - Hydropower
  - Irrigation
  - Recreation
  - Fish & Wildlife
  - Sediment storage

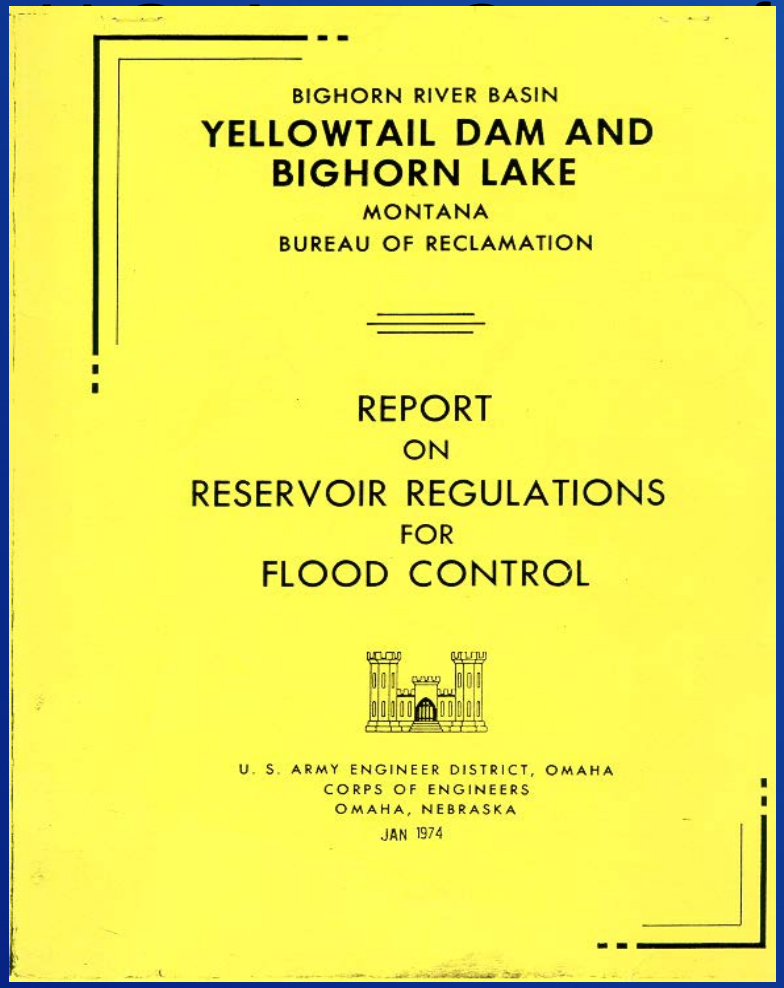
RECLAMATION



RECLAMATION

Yellowtail Unit

Project Purposes- Flood Control (Exclusive flood storage = 259K af), Coordinated with [illegible] Engineers



BIGHORN RIVER BASIN

YELLOWTAIL DAM AND BIGHORN LAKE

MONTANA

BUREAU OF RECLAMATION

REPORT ON RESERVOIR REGULATIONS FOR FLOOD CONTROL

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

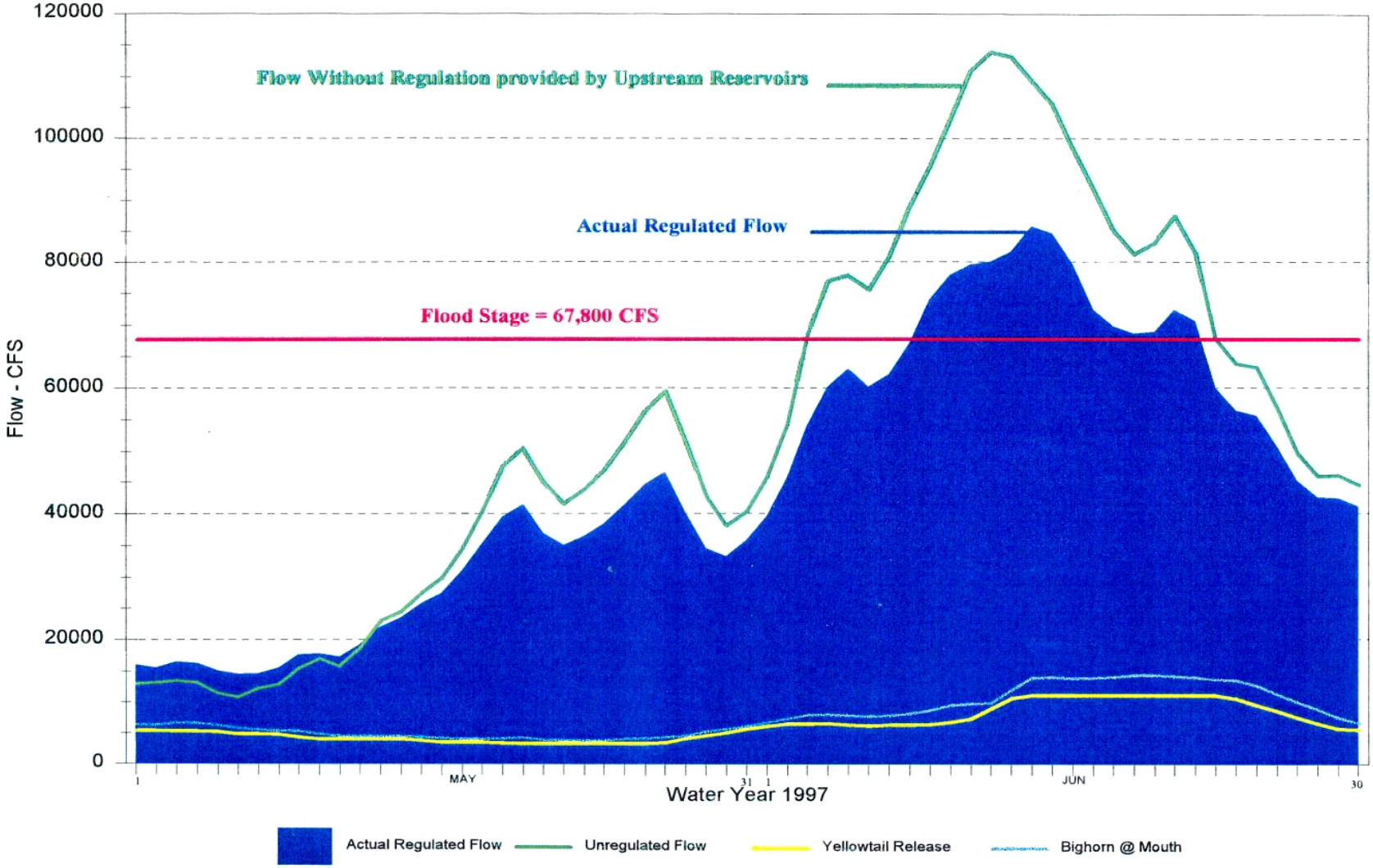
JAN 1974

RECLAMATION

Figure MTG13

Yellowstone River @ Forsyth

And Bighorn River Below Yellowtail Dam



RECLAMATION

Bighorn Canyon National Recreation Area

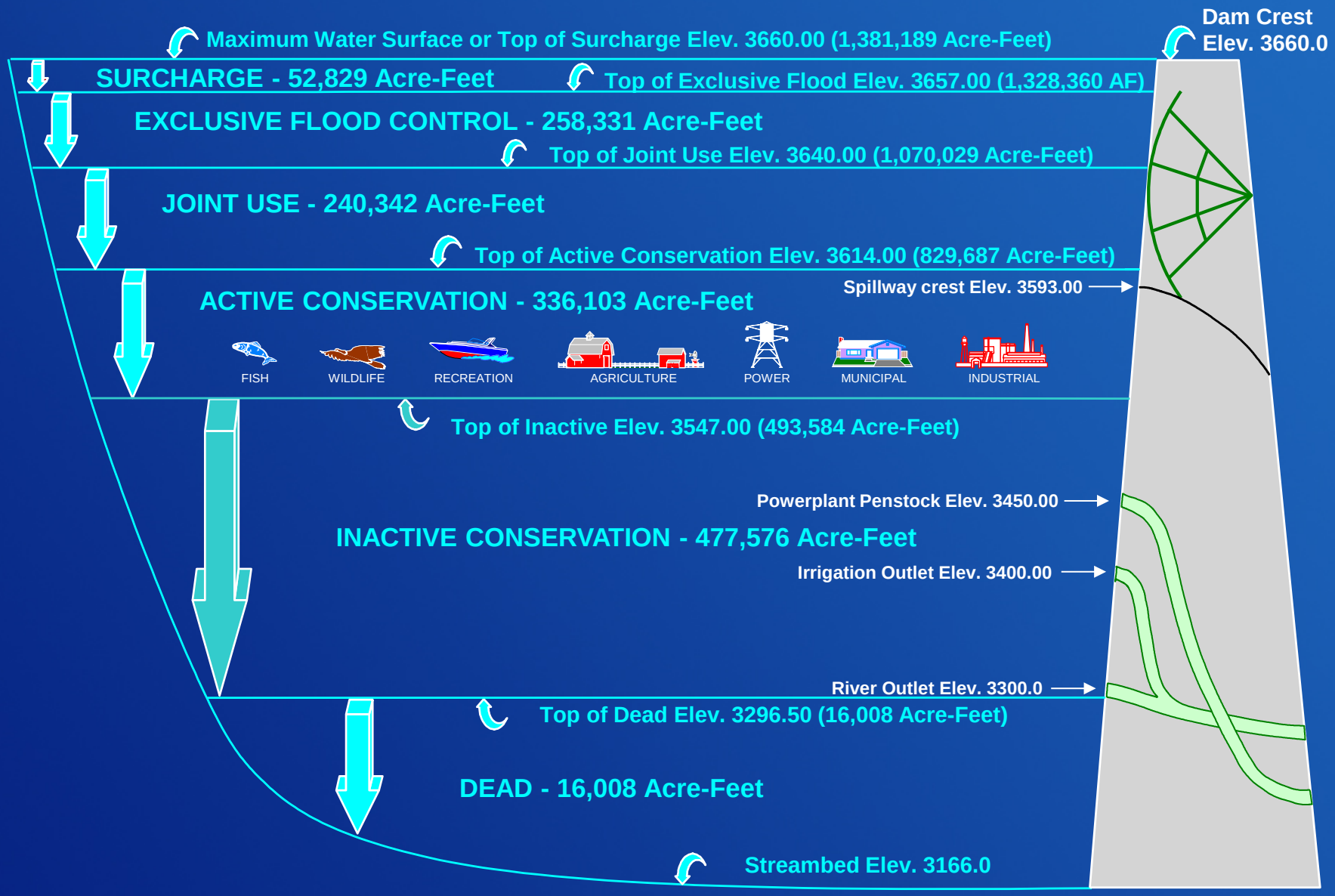
Authorization: Public Law 89-664, October 15, 1966

Purpose

"In order to provide for public outdoor recreation use and enjoyment of the proposed Yellowtail Reservoir and lands adjacent thereto in the States of Wyoming and Montana by the people of the United States…."

RECLAMATION

BIGHORN RESERVOIR ALLOCATIONS



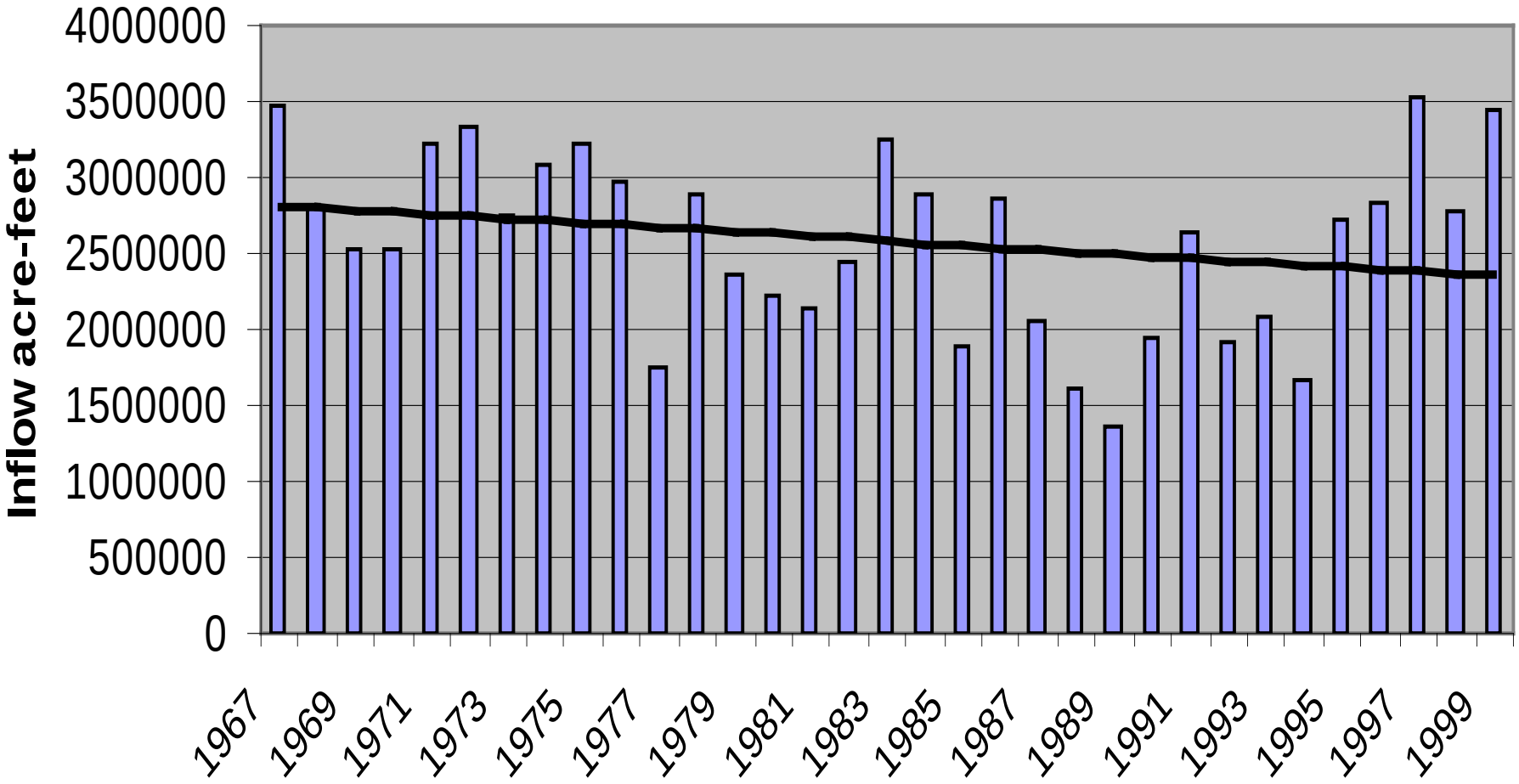
RECLAMATION

Record Drought Water Years

• Average Bighorn Lake Inflow 1967-2006	2,373 kaf
• DPR avg. 1934-1940 Drought:	1,558 kaf
• Average Inflow Drought 2000-2006	1,384 kaf
• Lowest annual inflow of record 2002	1,030 kaf

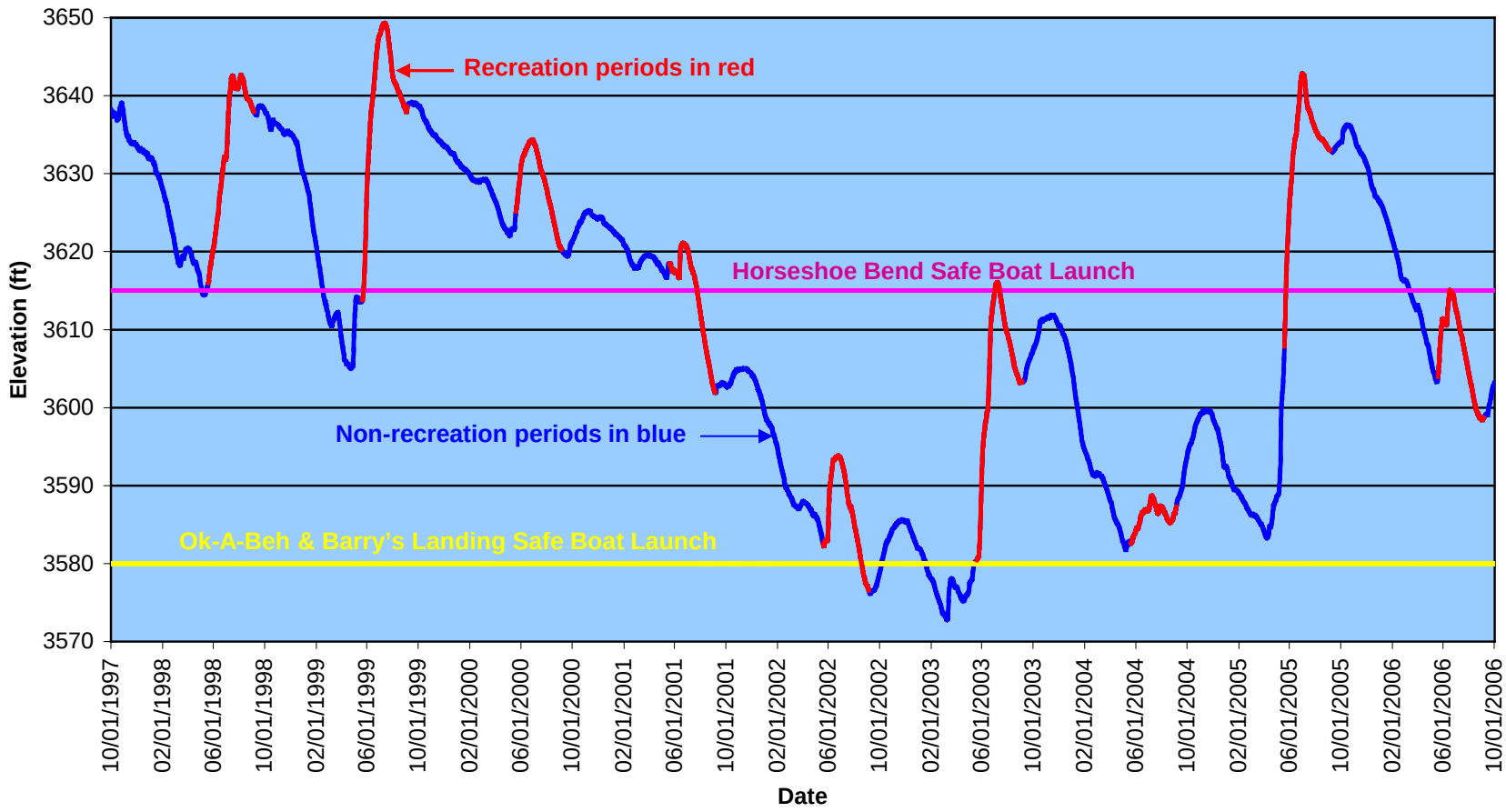
RECLAMATION

Bighorn Lake Annual Inflow Trend



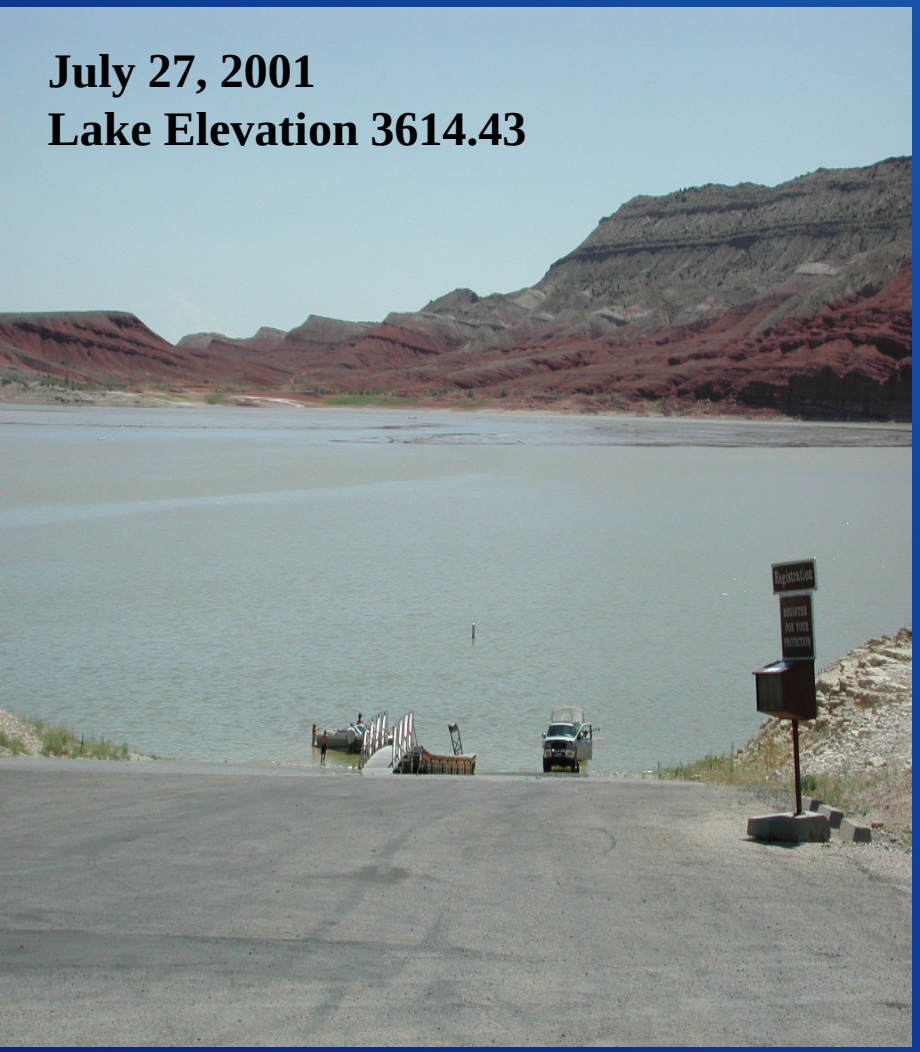
RECLAMATION

Lake Level Versus Current Safe Launch Levels



RECLAMATION

HORSESHOE BEND RAMP



RECLAMATION

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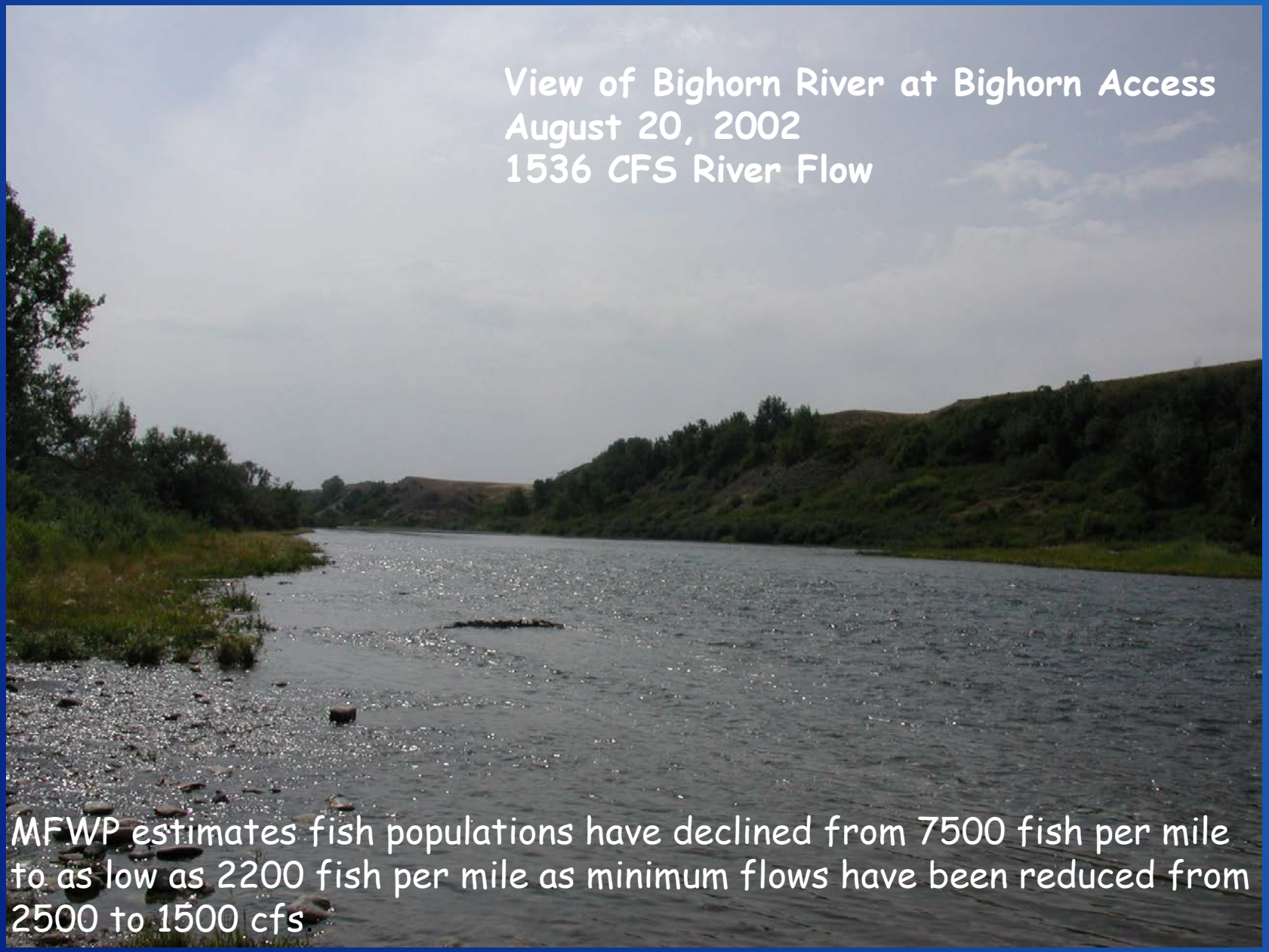
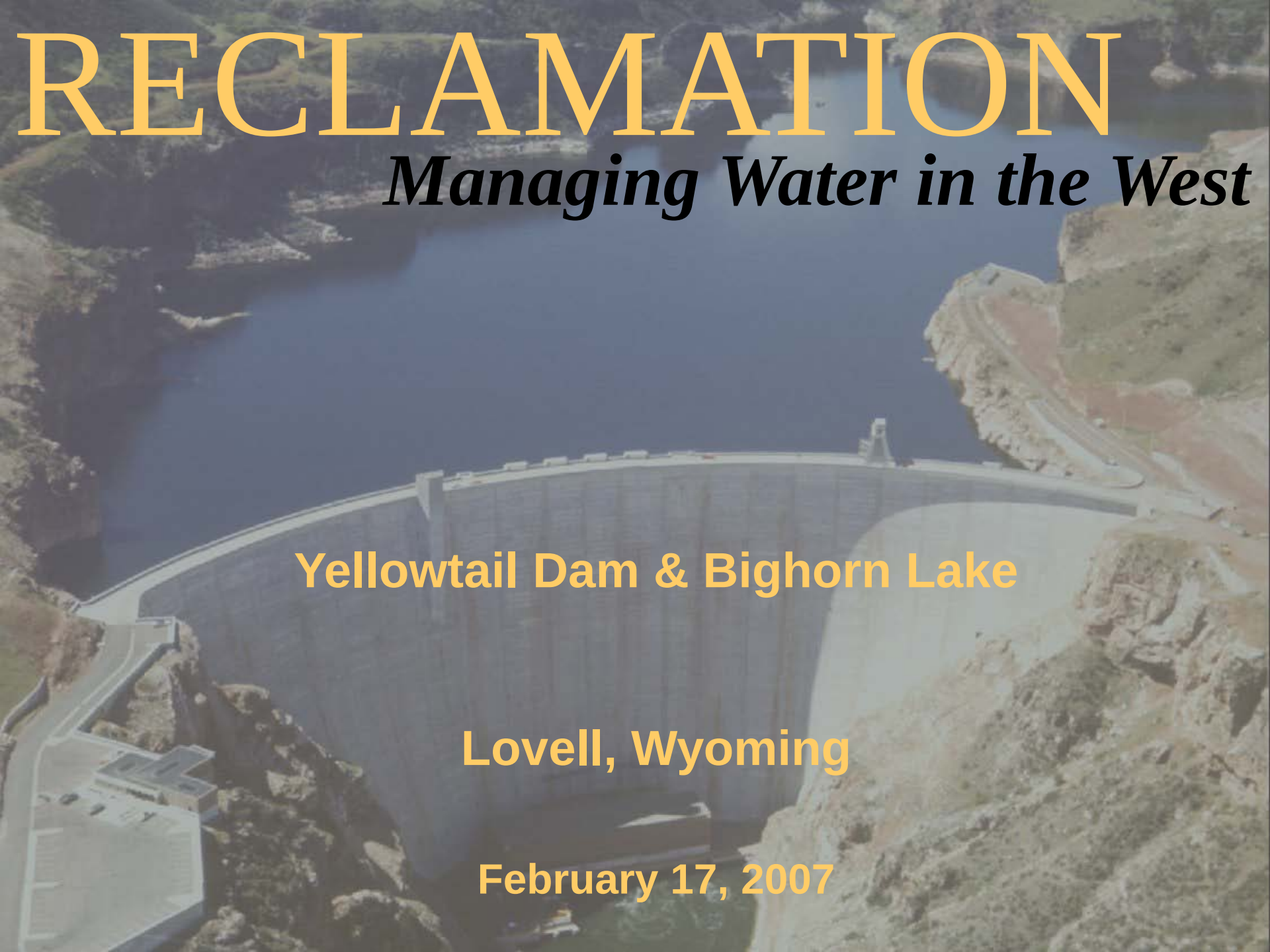


MFWP estimates fish populations have declined from 7500 fish per mile to as low as 2200 fish per mile as minimum flows have been reduced from 2500 to 1500 cfs.

RECLAMATION

RECLAMATION

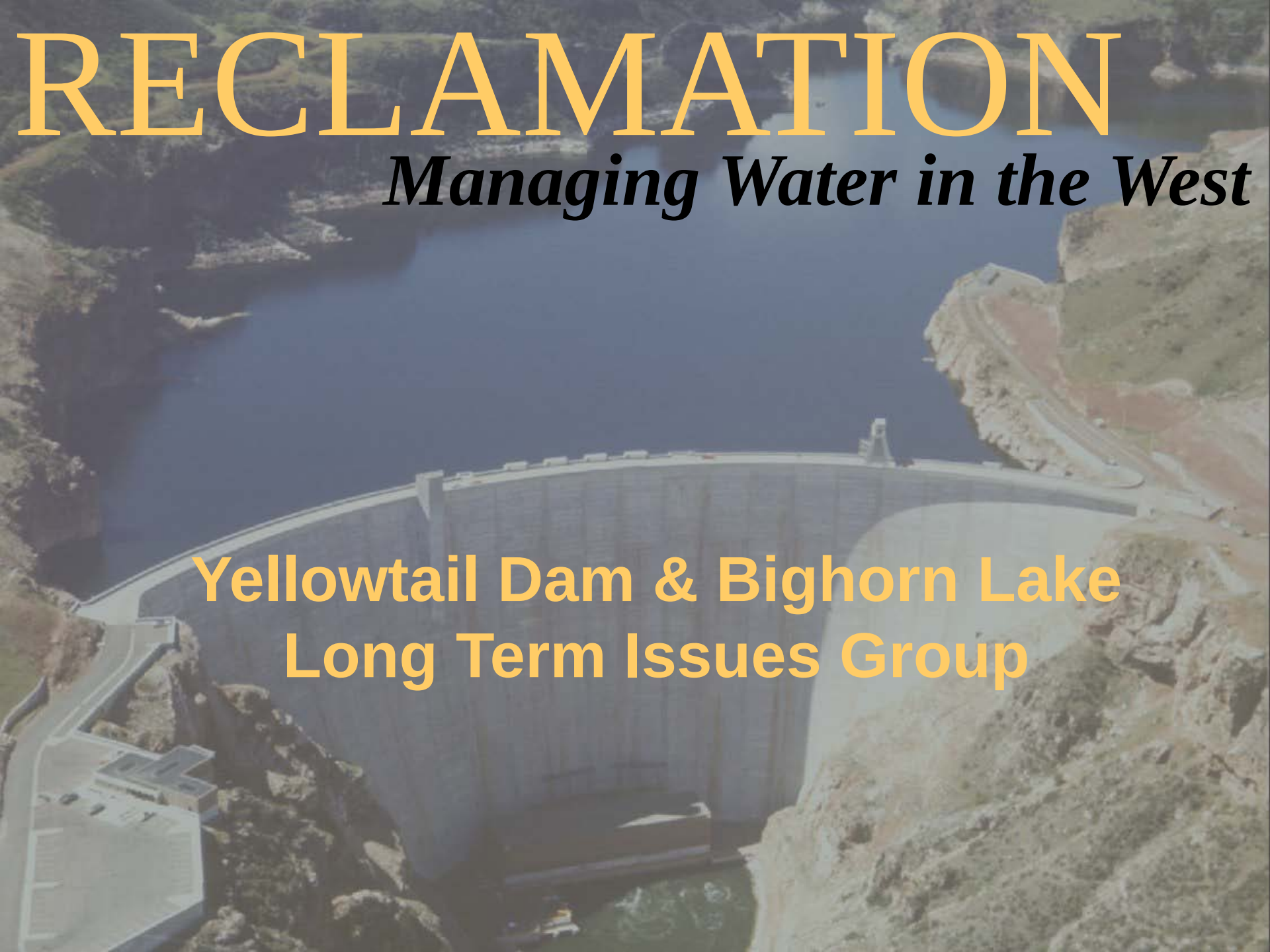
Managing Water in the West



Yellowtail Dam & Bighorn Lake

Lovell, Wyoming

February 17, 2007



RECLAMATION

Managing Water in the West

Yellowtail Dam & Bighorn Lake
Long Term Issues Group

Bighorn River System

Long-Term Issues Group

Montana: Fish Wildlife & Parks, Department of Natural Resources and Conservation

Wyoming: Fish and Game, State Engineer

Crow & Northern Cheyenne Tribes

Bighorn County Wyoming

Bighorn County Montana

Congressional Representatives

Passionate Public: Friends of Bighorn Lake, Friends of Bighorn River

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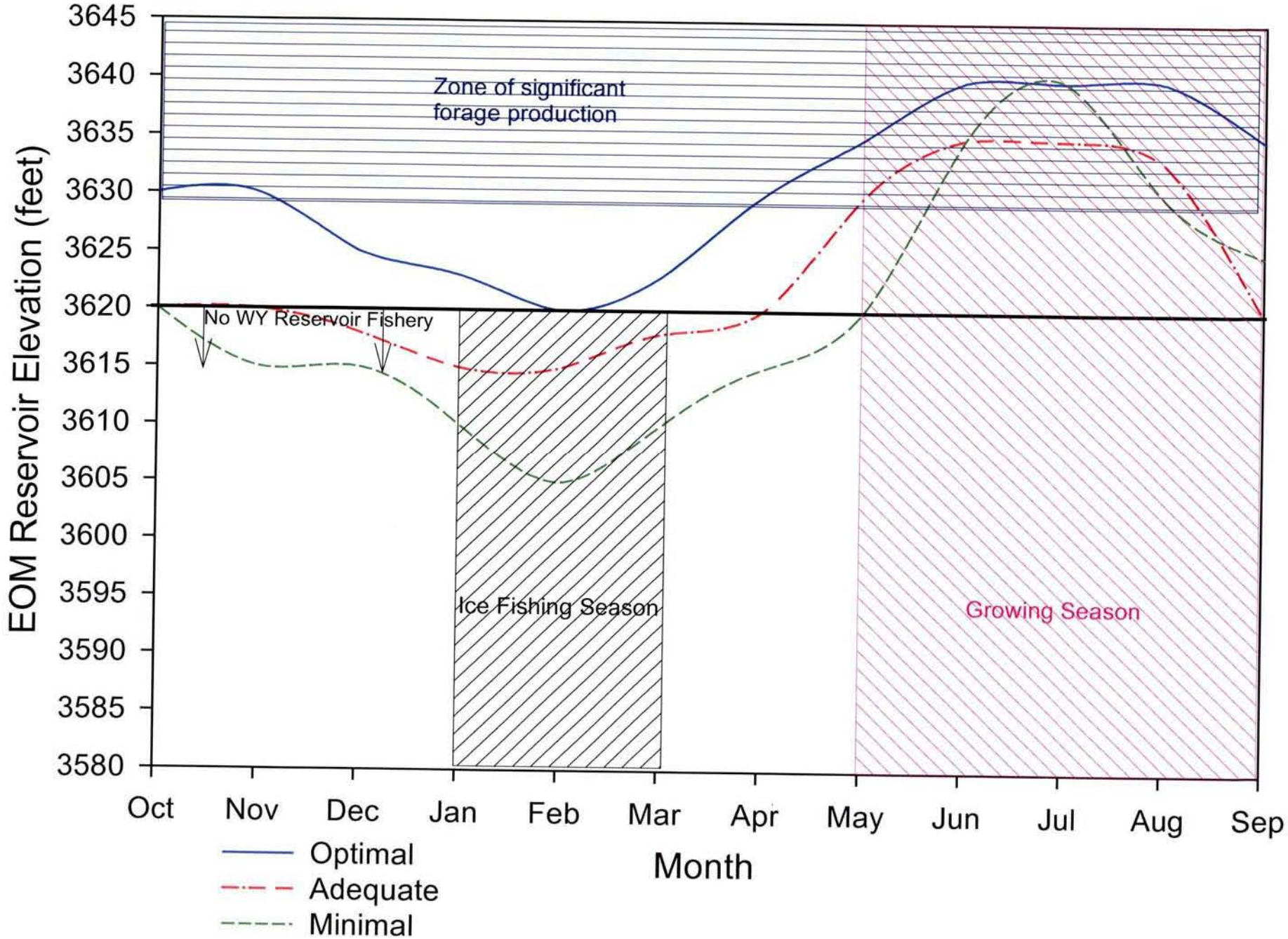
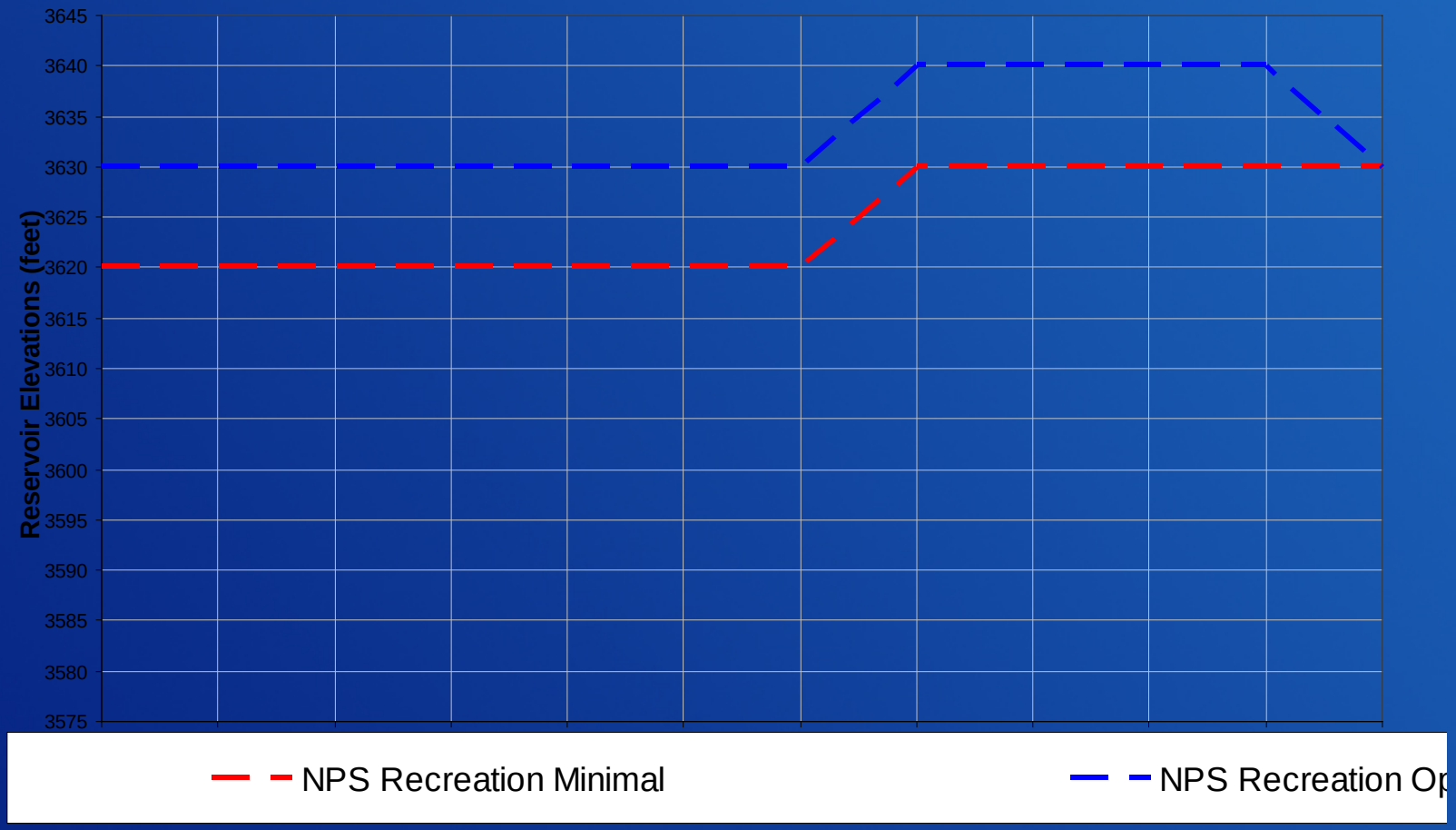
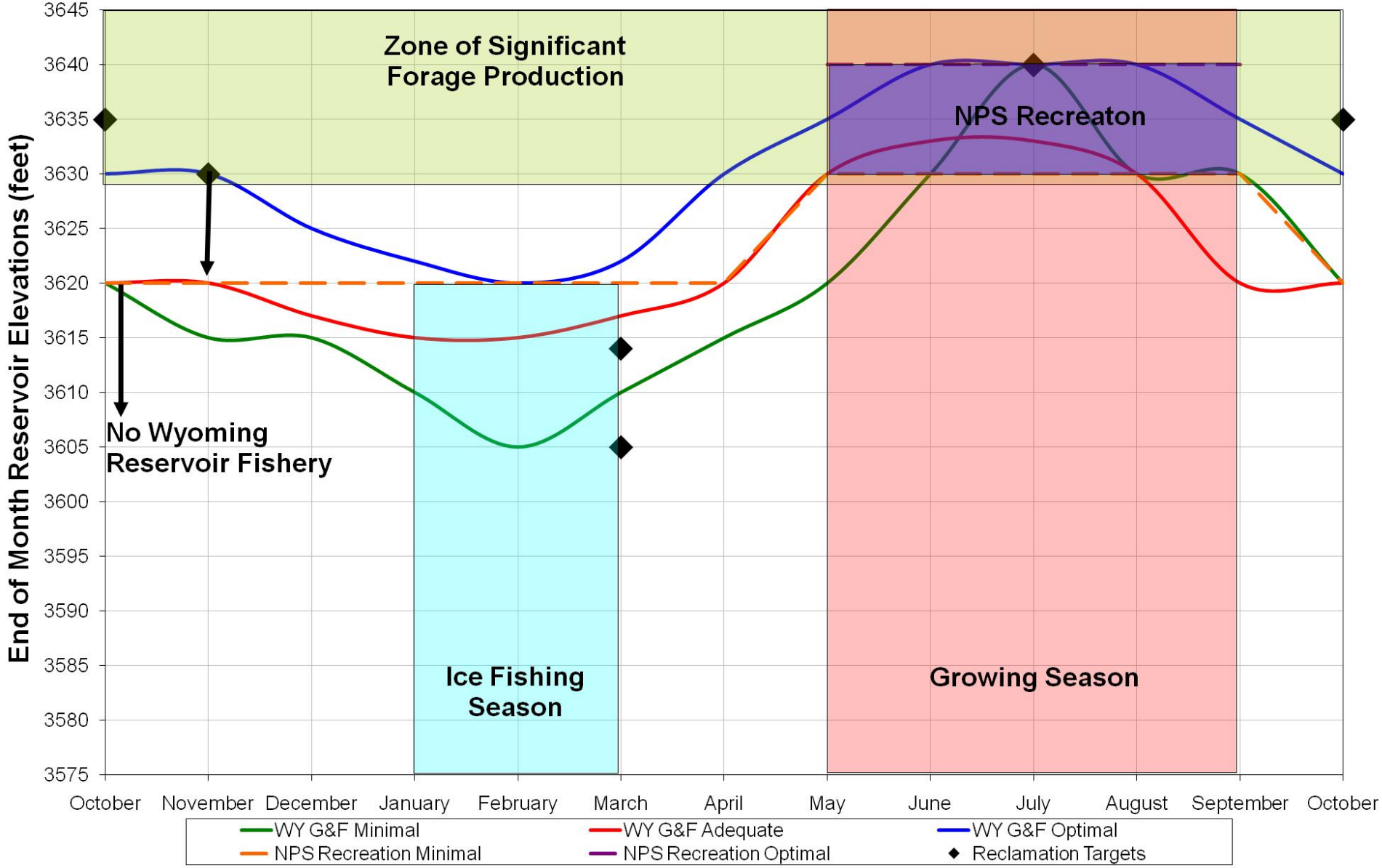

EOM Reservoir Elevation (feet)
3645
3640
3635
3630
3625
3620
3615
3610
3605
3600
3595
3590
3585
3580
Zone of significant
forage production
No WY Reservoir Fishery
Ice Fishing Season
Growing Season
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
Optimal
Adequate
Minimal

National Park Service



RECLAMATION

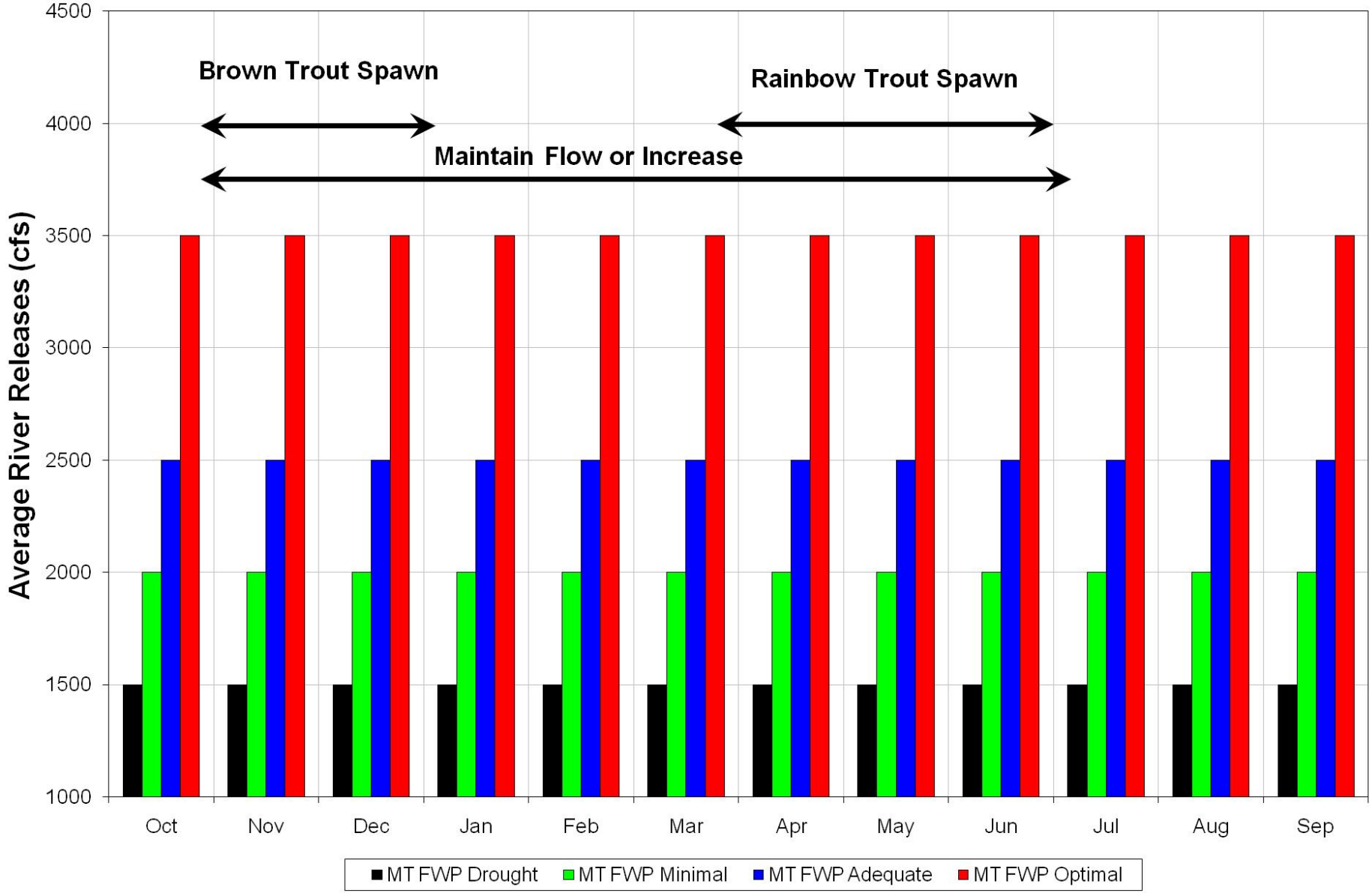


RECLAMATION

BIGHORN FLOW RECOMMENDATIONS (MT FW&P)

- Optimal Flow - 3,500 cfs
- Target Minimum Flow – 2,500 cfs
- Preferred Min. Fisheries Flow – 2,000 cfs
- Absolute Min. Fisheries Flow - 1,500 cfs

RECLAMATION



RECLAMATION

YELLOWTAIL DAM / BIGHORN RESERVOIR: Resourse Needs by Month

1 = Optimal, 2 = Adequate, 3 = Minimal

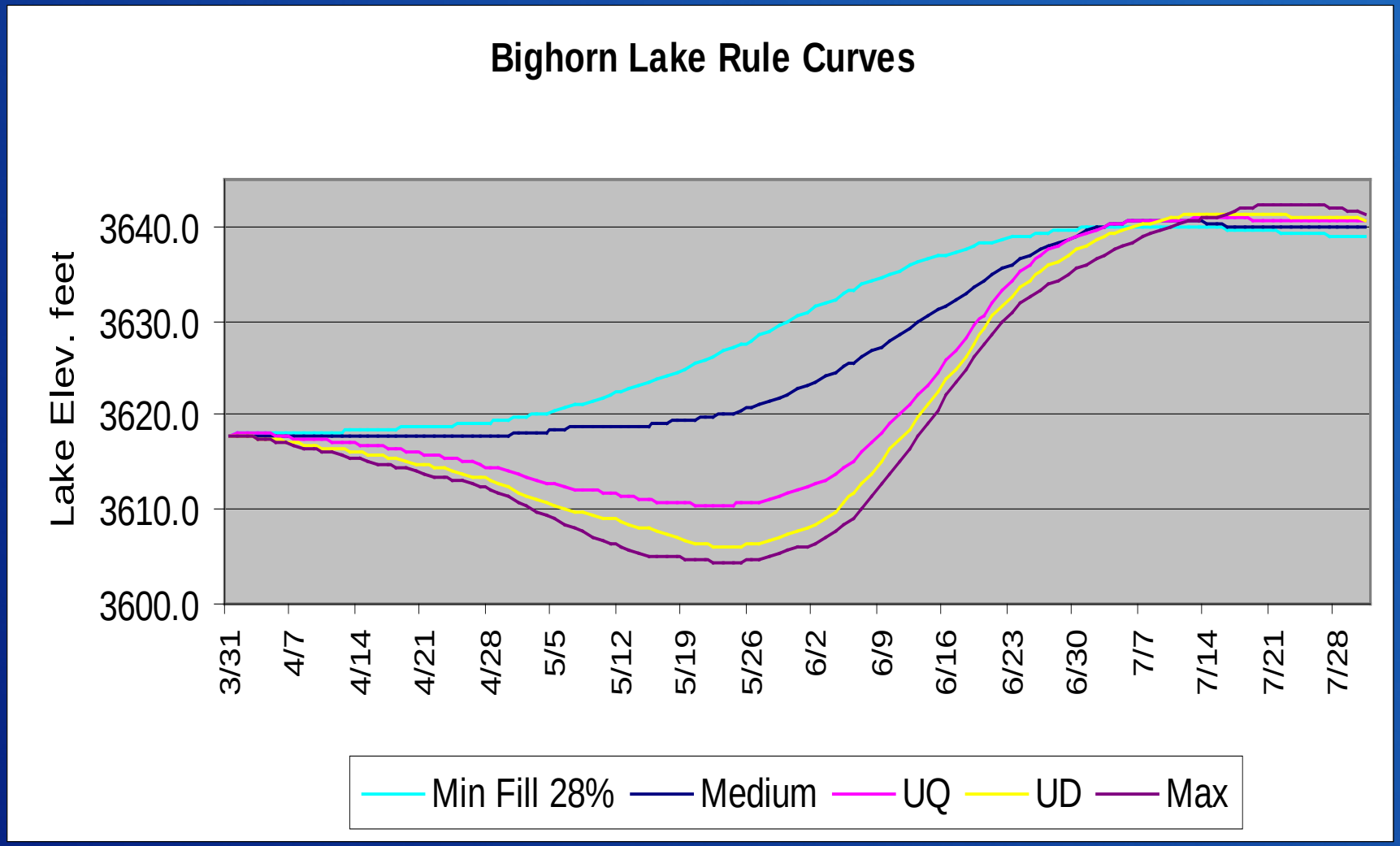
Purpose	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
River Fishery Flows (FWP)												
1	3,500+								6,000-8,000	3,500+		
2	2,000											
3	1,500											
River Fishery Flows (Grant)												
1	2,500											
2	2,000											
3	1,500											
Power Generation (Western)												
for marketing (cfs)	2,539	3,326	3,230	3,066	3,364	3,066	3,290	2,903	3,917	3,589	2,236	2,376
for reliability (cfs)	3,533	3,600	3,600	3,600	3,600	3,600	3,590	3,419	3,432	3,150	3,164	3,284
Flood Control (Reclamation)												
1	0 - 8,200 cfs											
2	8,200 - 14,000 cfs											
3	14,000 - 20,000 cfs											
Mandatory/Legal (Reclamation)												
Canal	150	0	0	0	0	0	150	550	550	550	550	550
River	1,000	1,000	1,000	1,000	1,000	1,000	1,400	1,400	1,400	1,400	1,400	1,400

Reservoir Level Targets

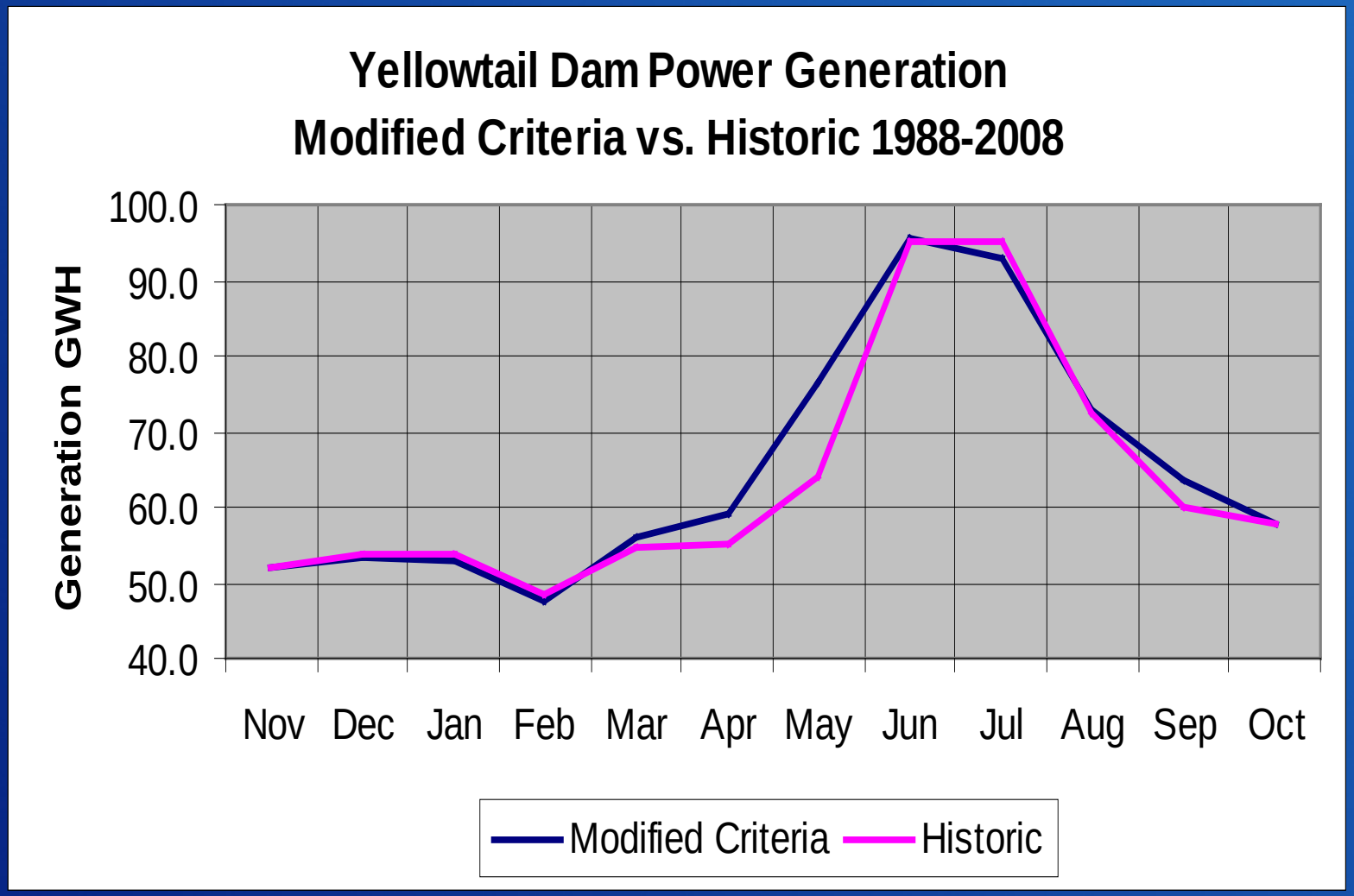
Date	Revised Criteria Target Elevation	Old Criteria Targets
Oct 31	3638-3640	3630-3635
(Revised Fall/Winter Inflow Formulas, On Web-Site)		
Mar 31	3616.7-3620.6	3605-3614
Apr-July	Rule Curve	
July 31	3640	3640

RECLAMATION

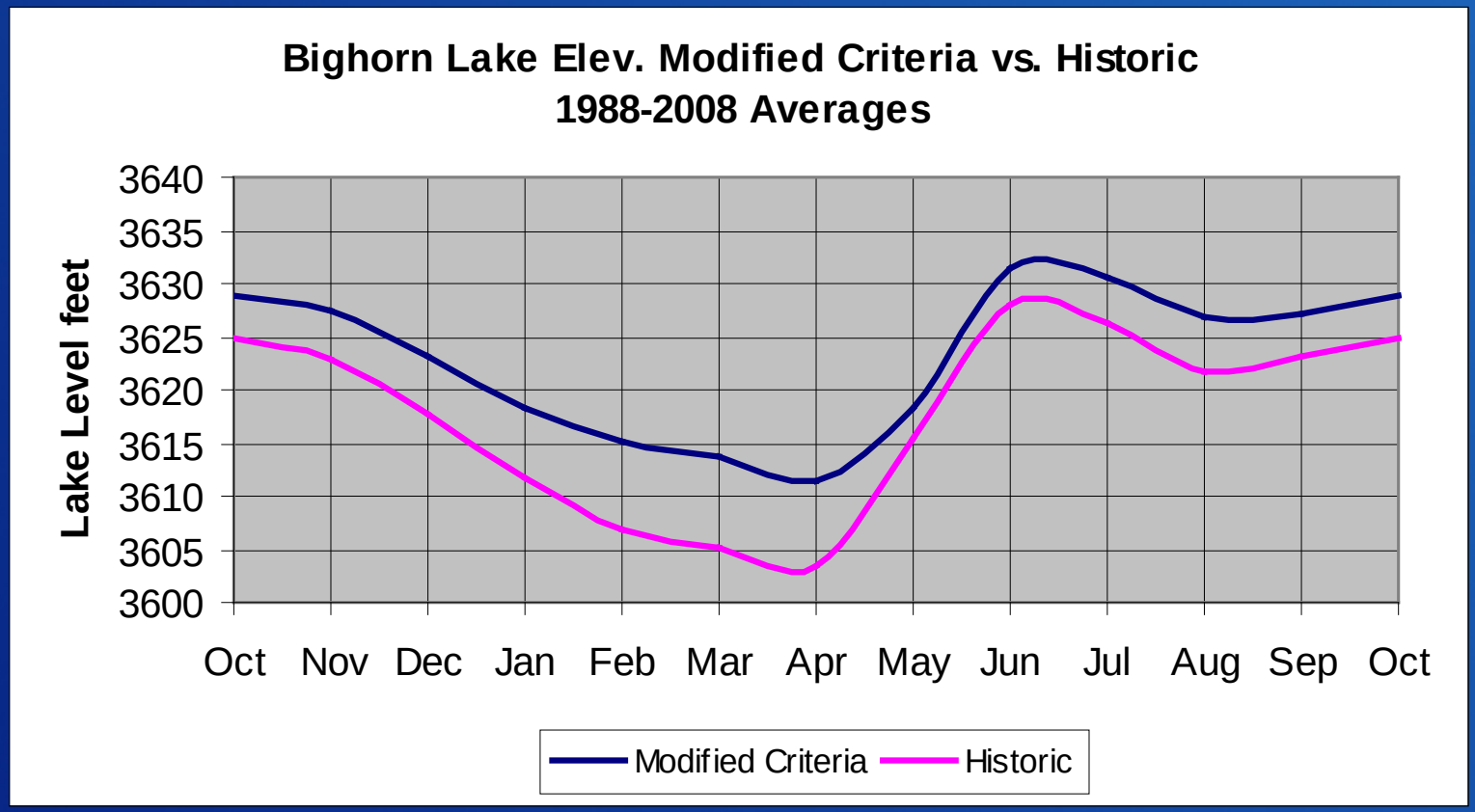
Rule Curve Example



RECLAMATION



RECLAMATION



RECLAMATION

River Release Targets

Existing SOP Criteria

- Optimum Instream Flow 2,500 cfs
- Standard Instream Flow 2,000 cfs
- Minimum Instream Flow 1,500 cfs
- Absolute Minimum 1,000 cfs

Revised Criteria

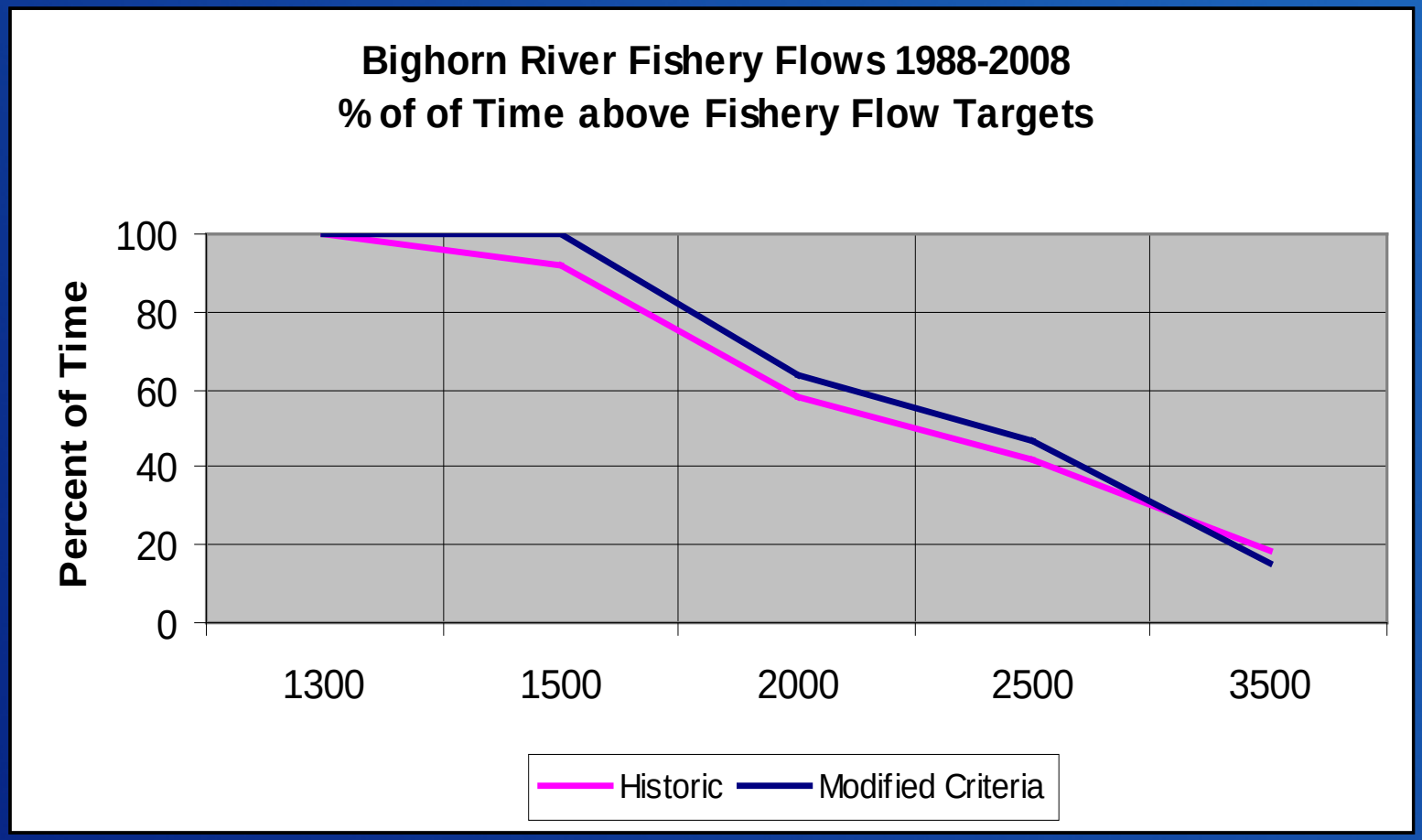
- Prefered Instream Flow 3,500 cfs
- Optimum Instream Flow 2,500 cfs
- Standard Instream Flow 2,000 cfs
- Minimum Instream Flow 1,500 cfs
- Absolute Minimum 1,000 cfs

(Prefered fishery flow provided by Montana FW&P during issued group meetings.)

RECLAMATION

Bighorn River Flows

Revised Criteria vs. Historic



RECLAMATION

Expected Benefits of Revised Operating Criteria Values Compared to Historic Operation

Lake Levels

January-April	7-8 feet higher
May-June	3 feet higher
July-December	4-5 feet higher

RECLAMATION

Expected Benefits of Revised Operating Criteria

Values Compared to Historic Operation

River Flows	Improvement in Percent of Time Provided
1500 cfs	+8% (met 100% of time for study period)
2000 cfs	+5%
2500 cfs	+5%
3500 cfs	-3%

RECLAMATION

Expected Benefits of Revised Operating Criteria

Values Compared to Historic Operation

Power Generation		
Generation	GWHs Increase	Increased Percent
Annual	+17.9	2%
Dec-Feb	- 2.2	-1%
July-Aug	- 1.8	

RECLAMATION

Expected Benefits of Revised Operating Criteria

Values Compared to Historic Operation

Flood Control

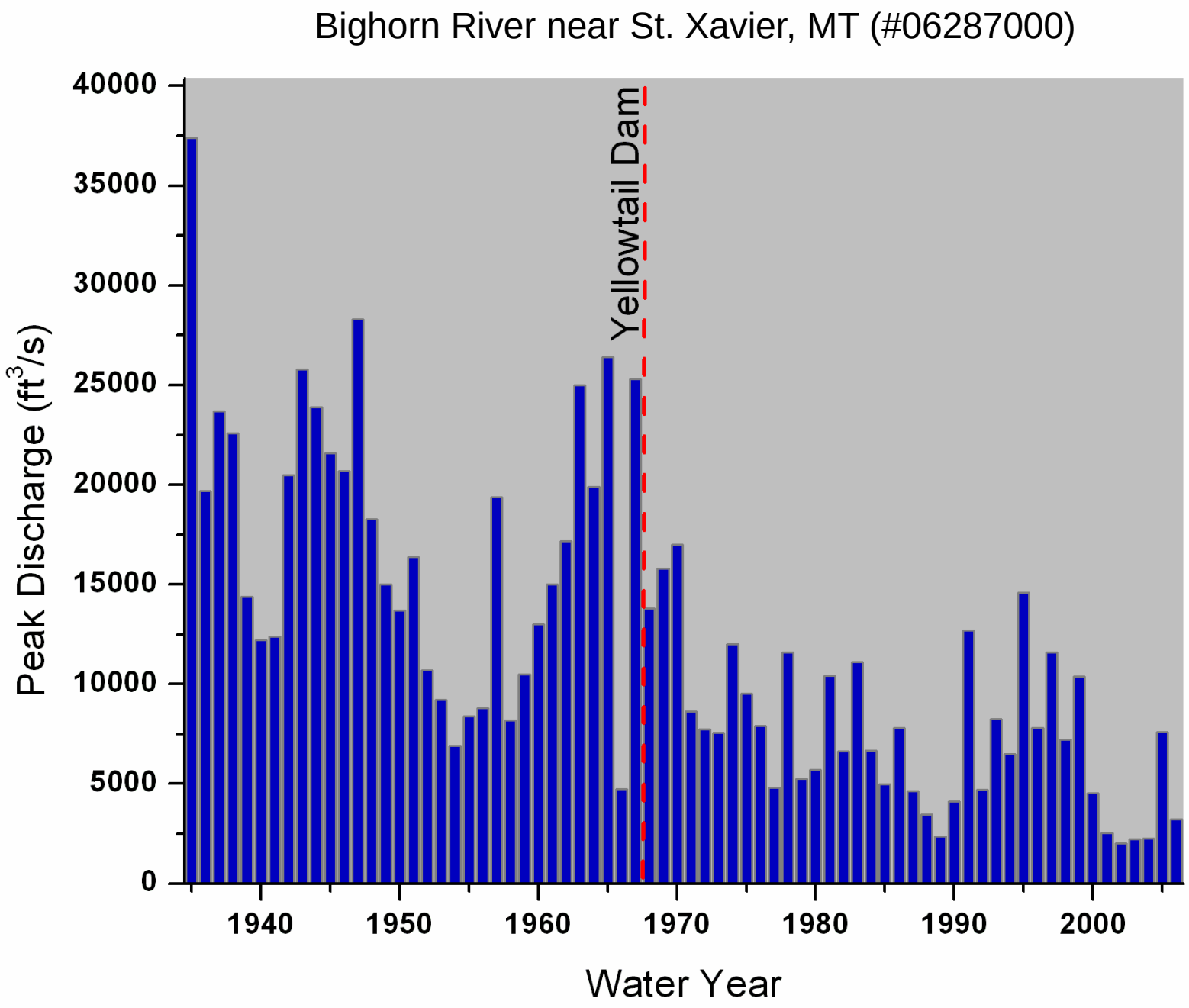
June Slight decrease in peak release rate

Decrease in peak reservoir level for most high runoff years

RECLAMATION

Statement of problem

- Progressive side channel abandonment
- Loss of habitat in side channels
  - Changes from 1939 to 1974 (from Koch et al 1977):
    - Vegetated Islands 23.1%
    - Island Gravel Bars 77.2%
    - Lateral Gravel Bars 34.0%
    - Water Area 7.8%
  - Side channel loss appears to be continuing today (based on field observations)
  - Side channel loss attributed to the construction of Yellowtail Dam


Bighorn River near St. Xavier, MT (#06287000)
Yellowtail Dam
Peak Discharge (ft3/s)
40000
35000
30000
25000
20000
15000
10000
5000
0
1940
1950
1960
1970
1980
1990
2000
Water Year

RECLAMATION

RECLAMATION

RECLAMATION

Managing Water in the West

Technical Report No. SRH-2010-1

Bighorn River Side Channel Investigation: Geomorphic Analysis

U.S. Department of the Interior
Bureau of Reclamation
Technical Services Center
Denver, CO

February 2010

Klines Channel

Water dam at head of Side Channel
Invasive Russian Olive
Salt Cedar holding sediment
Slated for Removal

What did it look like in Feb 2012?

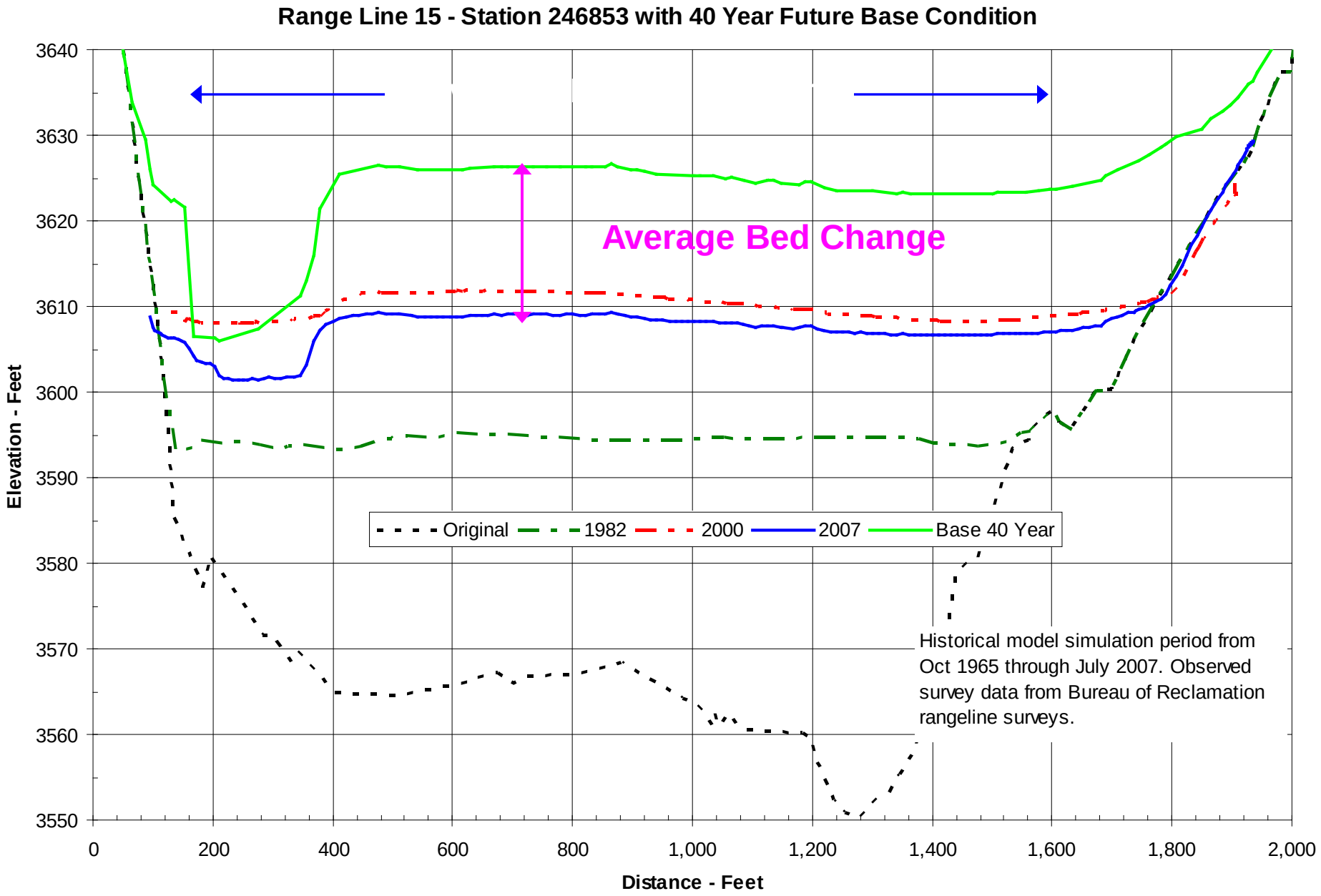
HITACHI

HITACHI

Big Horn Lake
Sediment Management Study

Dan Pridal
Omaha District Corps of Engineers

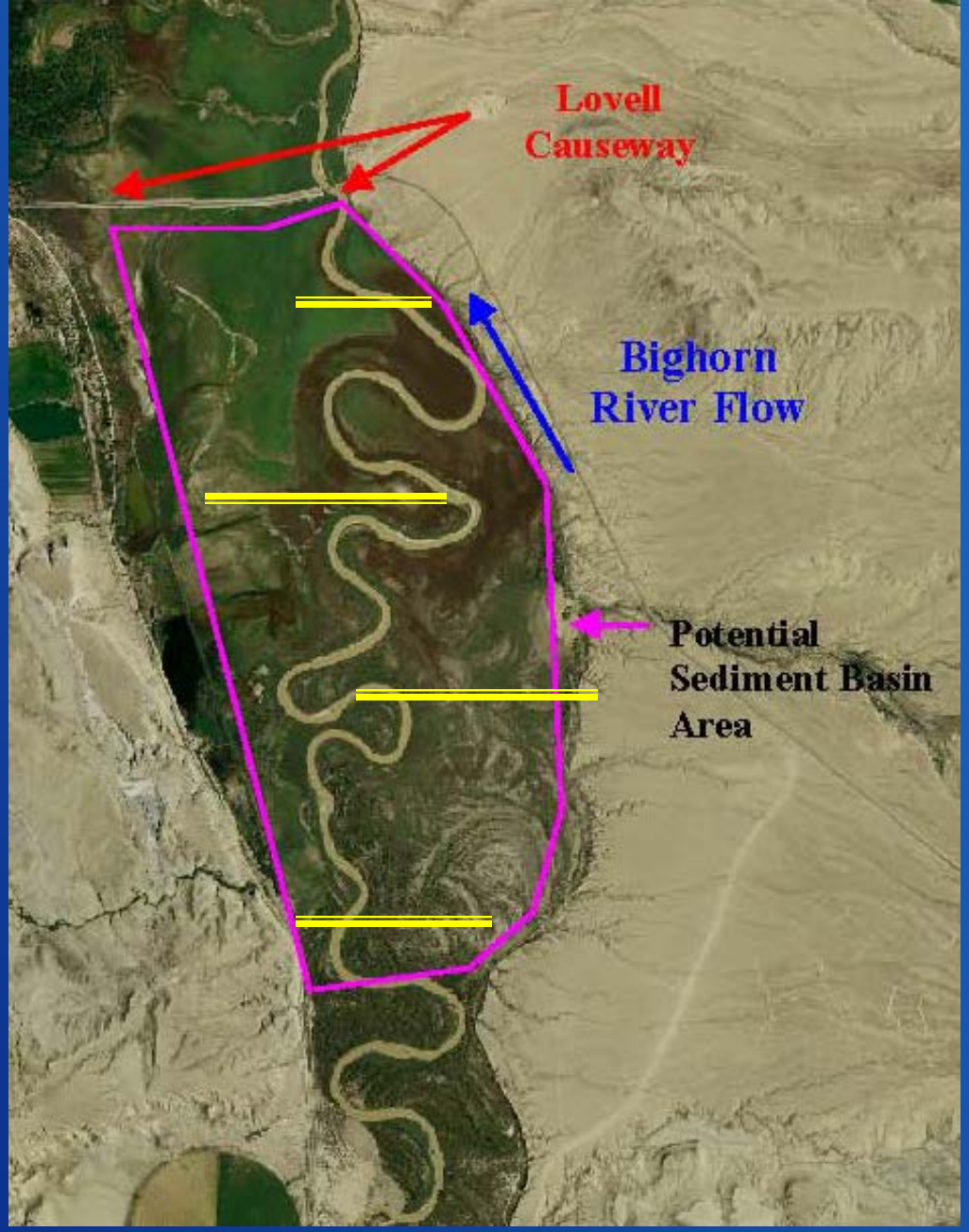
RECLAMATION



RECLAMATION

Construct spaced berms to increase travel time and sediment retention within basin. Size and extent to be determined in next design phase. Sediment trap efficiency decreases for higher flow as travel time reduces.

Second option to restrict Causeway opening and use as dam. May be WY DOT issues with unequal water elevation for embankment.



RECLAMATION