

Updated Hydrologic Modeling Results

For Integrated Plan Scenario
Adjusted Scenarios
Climate Change Impacted Scenarios

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Scenario Descriptions

- Integrated Plan Scenario
 - Non-Surface Storage Projects
 - Enhanced Conservation
 - GW Infiltration
 - Structural Projects
 - K to K Pipeline
 - Kachess Inactive Storage
 - Wymer Reservoir
 - Enlarged Bumping Reservoir
 - Enlarged Cle Elum Reservoir

Changes in Integrated Plan Scenario

- Added bypass of Roza diversions to Thorp Pump Station
- Modified enlarged Bumping operations to reproduce spring and early summer hydrograph
- Moved KID diversion from Columbia back to Yakima
- Lengthened GW Recharge period thru end of March
- Added future M&I consumptive use increase (12,800 AF)

Tabular Summary of Integrated Plan Water Supply Results

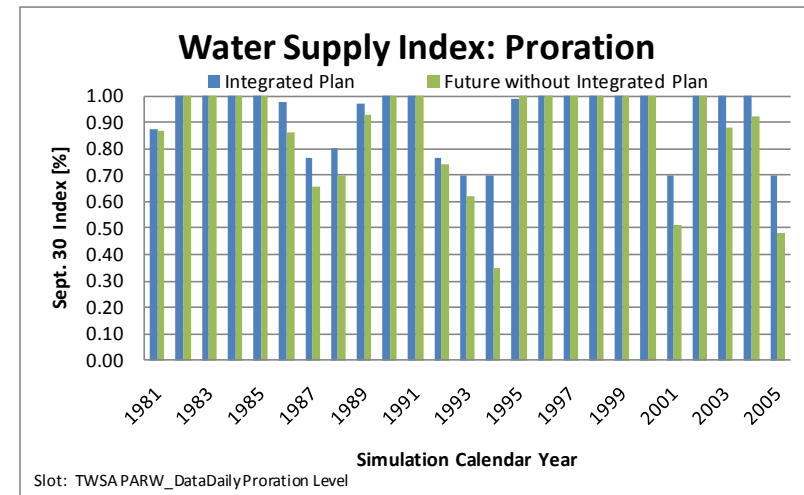
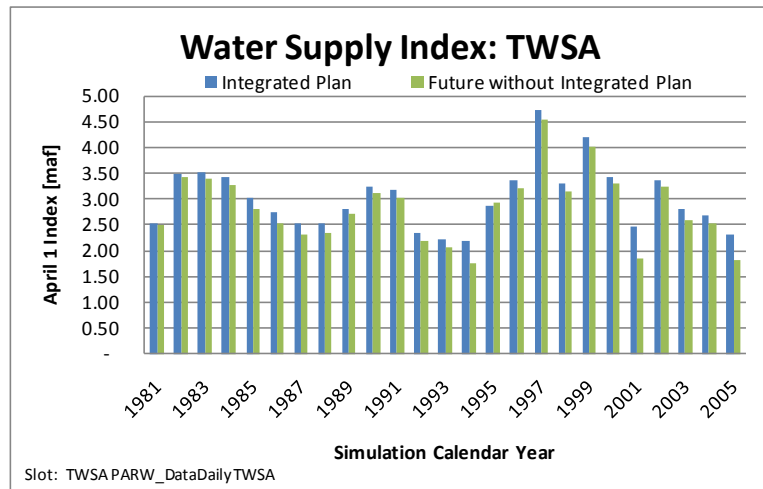
Green: Positive change greater than 10% or Prorating greater than 70%

Pink: Negative change greater than 10% or Prorating less than 70%

Resource indicator (measurement)	Future without Integrated Plan	Integrated Plan	Change from FWIP
WATER RESOURCES			
<i>Average for water years 1981–2005 (maf)</i>			
Water supply			
April 1 total water supply available (TWSA)	2.83	3.01	0.19
Water distribution			
April–September Parker flow volume	0.59	0.59	0.00
April–September diversion	1.63	1.69	0.06
September 30 reservoir contents	0.29	0.57	0.29
Irrigation proration level	86%	92%	6%
<i>1993 dry-year (maf)</i>			
Water supply			
April 1 total water supply available (TWSA)	2.07	2.23	0.16
Water distribution			
April–September Parker flow volume	0.30	0.30	0.01
April–September diversion	1.48	1.55	0.07
September 30 reservoir contents	0.04	0.25	0.21
Irrigation proration level	62%	70%	8%
<i>1994 dry-year (maf)</i>			
Water supply			
April 1 total water supply available (TWSA)	1.75	2.20	0.45
Water distribution			
April–September Parker flow volume	0.26	0.24	-0.01
April–September diversion	1.28	1.53	0.25
September 30 reservoir contents	0.04	-0.08	-0.12
Irrigation proration level	35%	70%	35%
<i>2001 dry-year (maf)</i>			
Water supply			
April 1 total water supply available (TWSA)	1.85	2.45	0.60
Water distribution			
April–September Parker flow volume	0.19	0.20	0.01
April–September diversion	1.40	1.55	0.15
September 30 reservoir contents	0.05	0.21	0.17
Irrigation proration level	51%	70%	19%
<i>2005 dry-year (maf)</i>			
Water supply			
April 1 total water supply available (TWSA)	1.80	2.31	0.51
Water distribution			
April–September Parker flow volume	0.20	0.18	-0.01
April–September diversion	1.38	1.53	0.15
September 30 reservoir contents	0.05	0.12	0.07
Irrigation proration level	48%	70%	22%

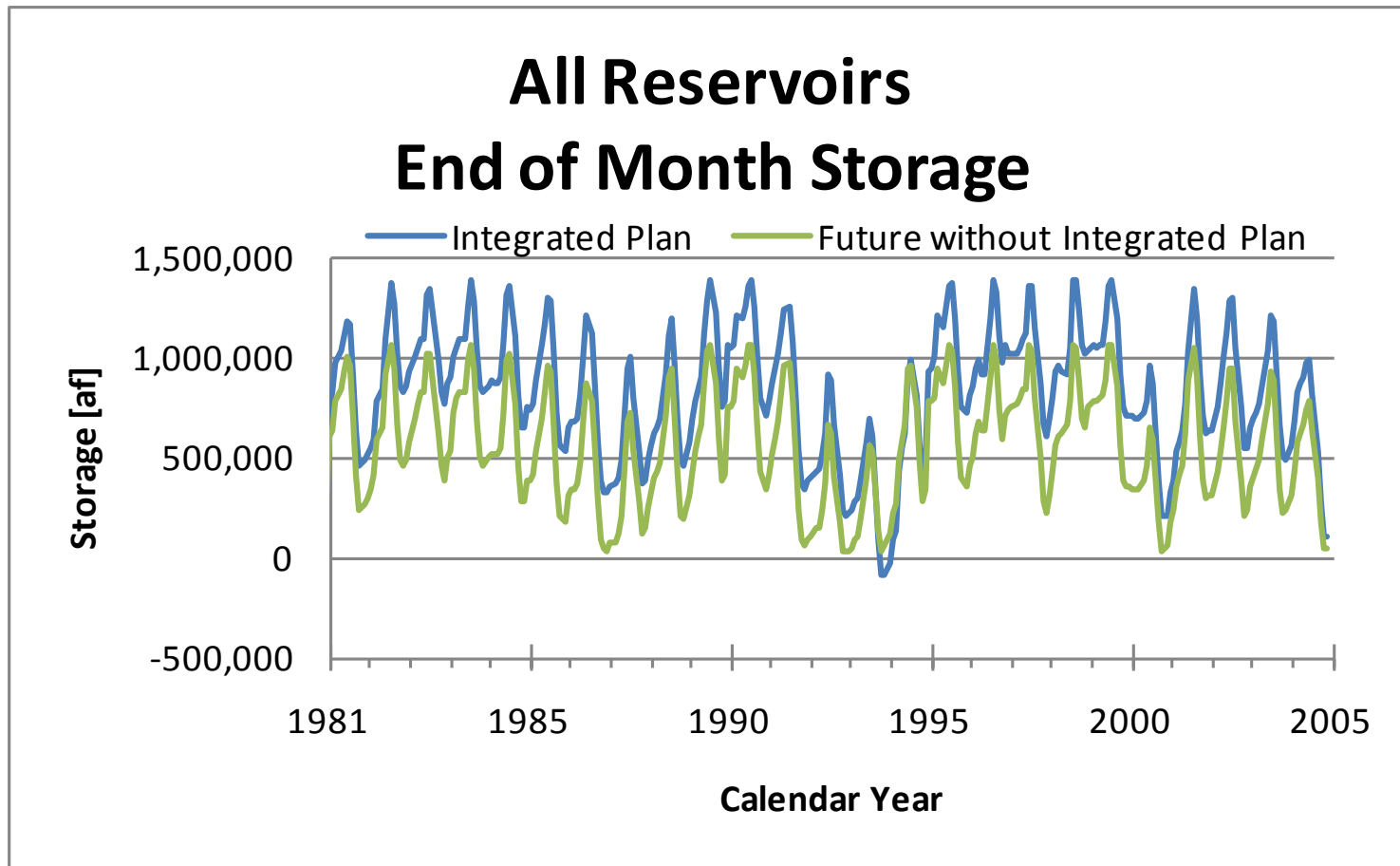
Water Supply Result Highlights

-TWSA and Prorationing



Water Supply Result Highlights

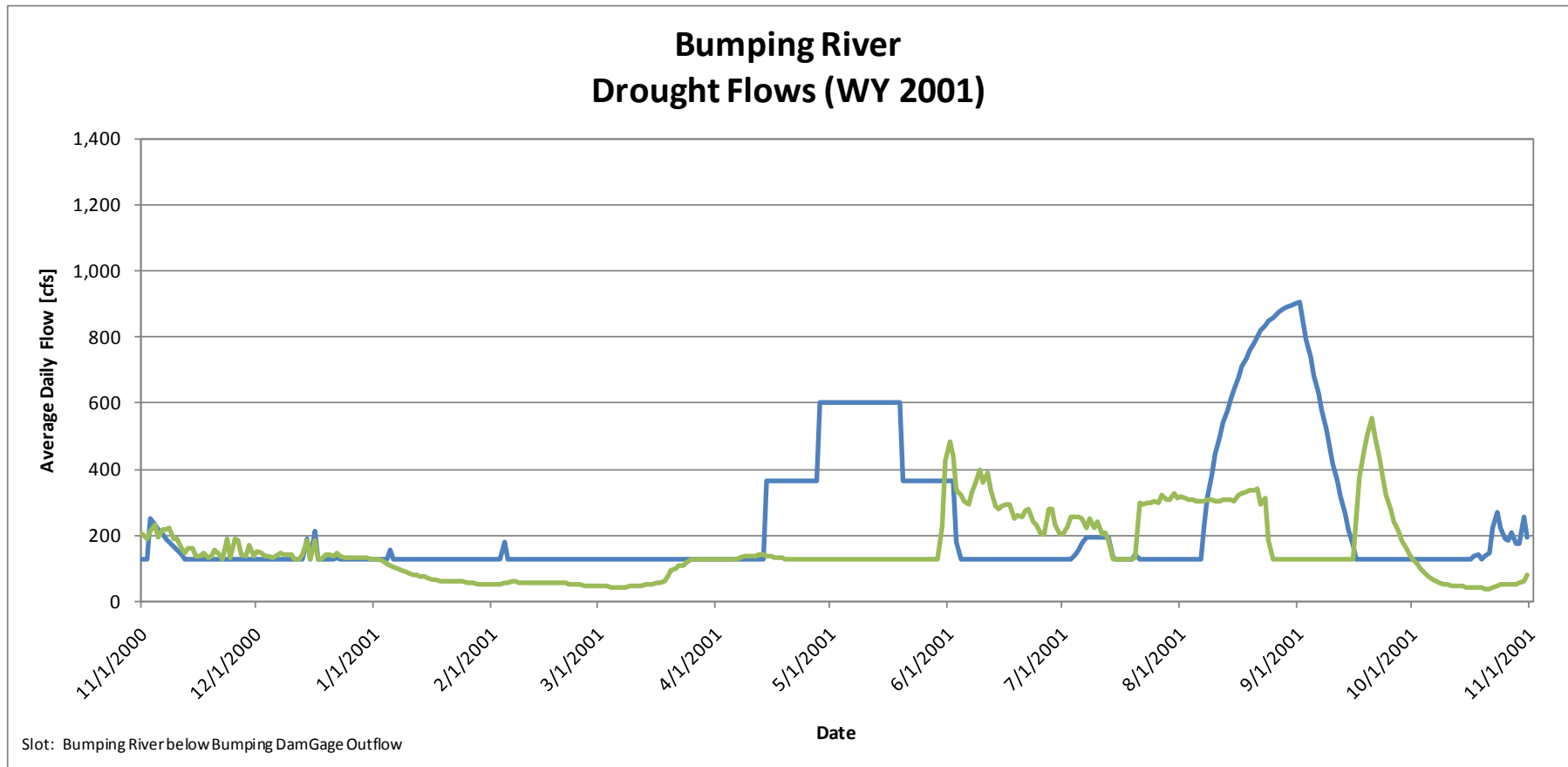
-Reservoir Storage



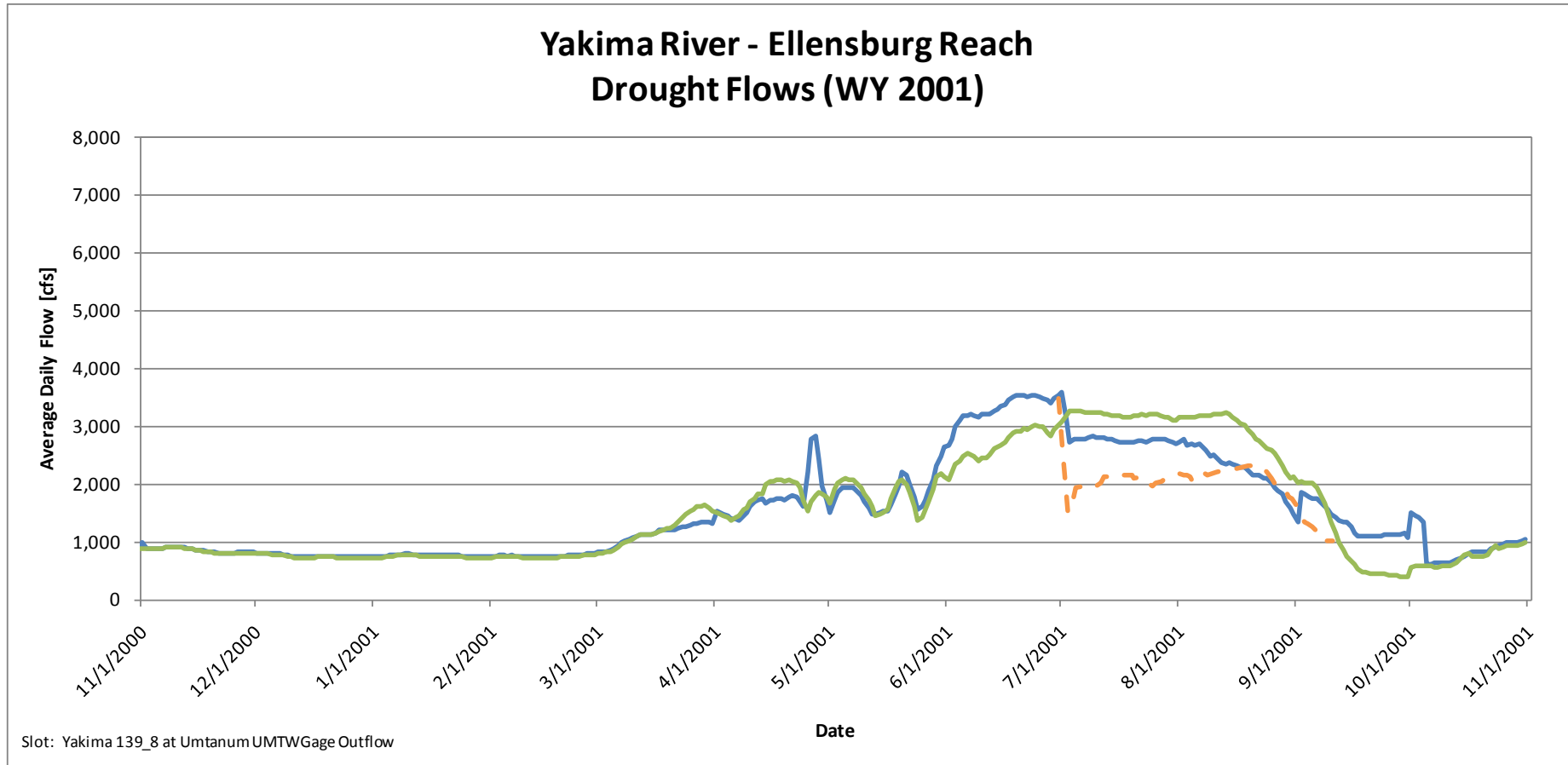
Summary of Integrated Plan Instream Flow Results

- Flow Improvement Matrix:
 - 11 of 14 reaches show improvement in meeting Flow Objectives
 - 8 of 9 high priority reaches show improvement
 - 1 medium priority reach (Lower Naches) shows adverse effects
 - Additional water is available in storage to provide additional improvement in flows

Instream Flow Result Highlights

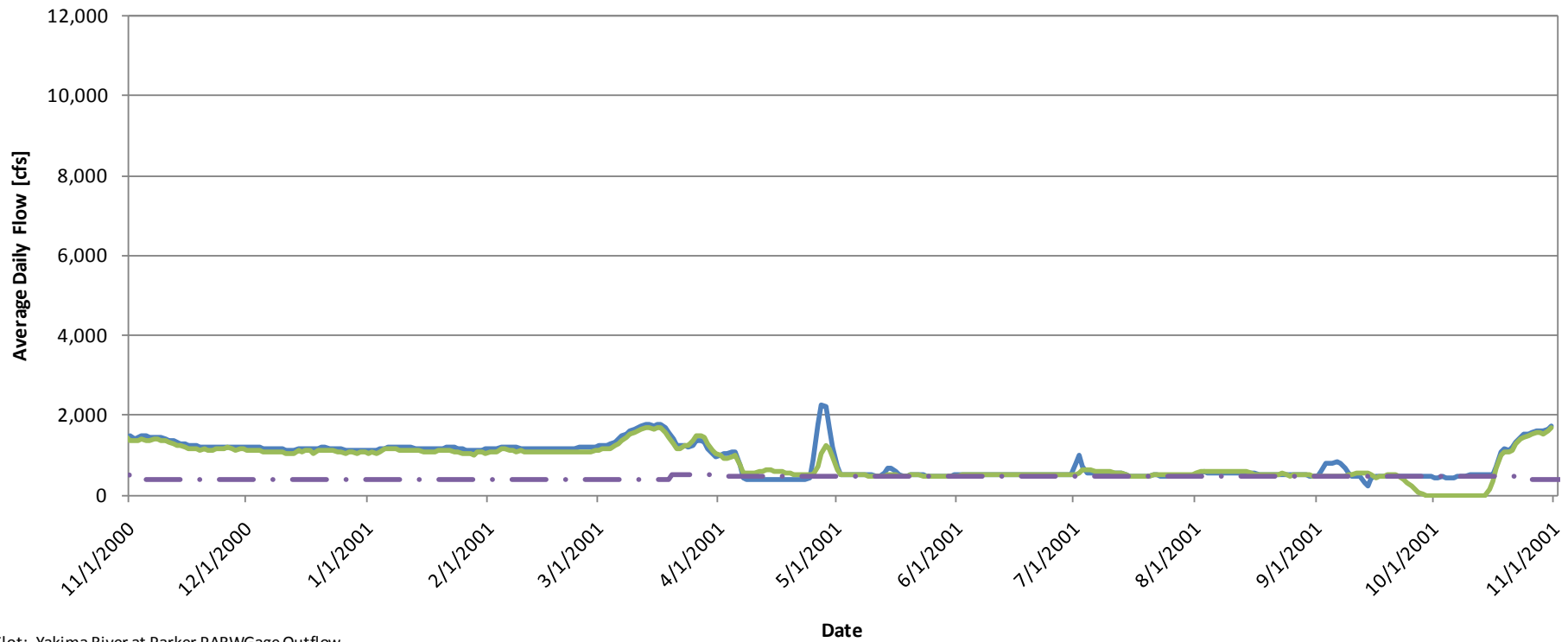


Instream Flow Result Highlights



Instream Flow Result Highlights

**Yakima River at Parker
Drought Flows (WY 2001)**



Slot: Yakima River at Parker PARWGage Outflow

Adjusted Scenarios

- Integrated Plan without Bumping Reservoir Enlargement
- Integrated Plan without Kachess Inactive Storage and without Keechelus to Kachess Pipeline
- Integrated Plan without Wymer Reservoir

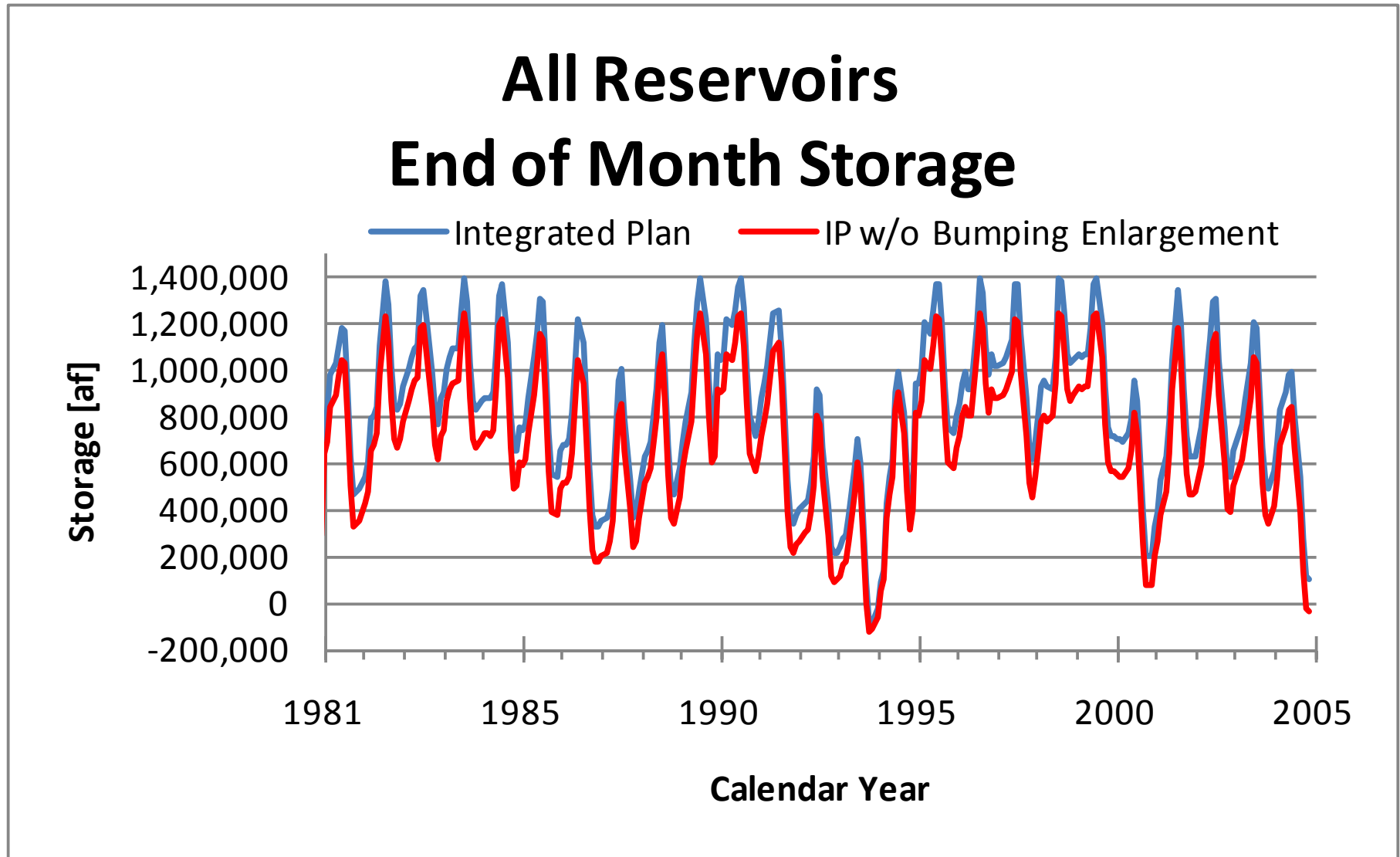
Adjusted Scenarios

Resource indicator (measurement)	Future without Integrated Plan	Integrated Plan	IP w/o Bumping Enlarge.	IP w/o Kachess & KtoK	IP w/o Wymor
WATER RESOURCES					
<i>Average for water years 1981–2005 (maf)</i>					
April 1 total water supply available (TWSA)	2.83	3.01	2.96	3.00	2.88
April–September Parker flow volume	0.59	0.59	0.60	0.60	0.64
April–September diversion	1.63	1.69	1.69	1.69	1.60
September 30 reservoir contents	0.29	0.57	0.43	0.59	0.35
Irrigation proration level	86%	92%	91%	91%	86%
<i>1993 dry-year (maf)</i>					
April 1 total water supply available (TWSA)	2.07	2.23	2.19	2.27	2.12
April–September Parker flow volume	0.30	0.30	0.30	0.30	0.30
April–September diversion	1.48	1.55	1.56	1.56	1.52
September 30 reservoir contents	0.04	0.25	0.12	0.27	0.00
Irrigation proration level	62%	70%	70%	70%	70%
<i>1994 dry-year (maf)</i>					
April 1 total water supply available (TWSA)	1.75	2.20	2.09	1.97	1.88
April–September Parker flow volume	0.26	0.24	0.24	0.24	0.24
April–September diversion	1.28	1.53	1.48	1.42	1.33
September 30 reservoir contents	0.04	-0.08	-0.12	0.06	-0.14
Irrigation proration level	35%	70%	68%	52%	48%
<i>2001 dry-year (maf)</i>					
April 1 total water supply available (TWSA)	1.85	2.45	2.30	2.24	2.22
April–September Parker flow volume	0.19	0.20	0.19	0.20	0.18
April–September diversion	1.40	1.55	1.55	1.55	1.51
September 30 reservoir contents	0.05	0.21	0.08	0.21	0.02
Irrigation proration level	51%	70%	70%	70%	70%
<i>2005 dry-year (maf)</i>					
April 1 total water supply available (TWSA)	1.80	2.31	2.16	2.12	2.07
April–September Parker flow volume	0.20	0.18	0.17	0.20	0.15
April–September diversion	1.38	1.53	1.53	1.53	1.49
September 30 reservoir contents	0.05	0.12	-0.02	0.13	-0.06
Irrigation proration level	48%	70%	70%	70%	70%

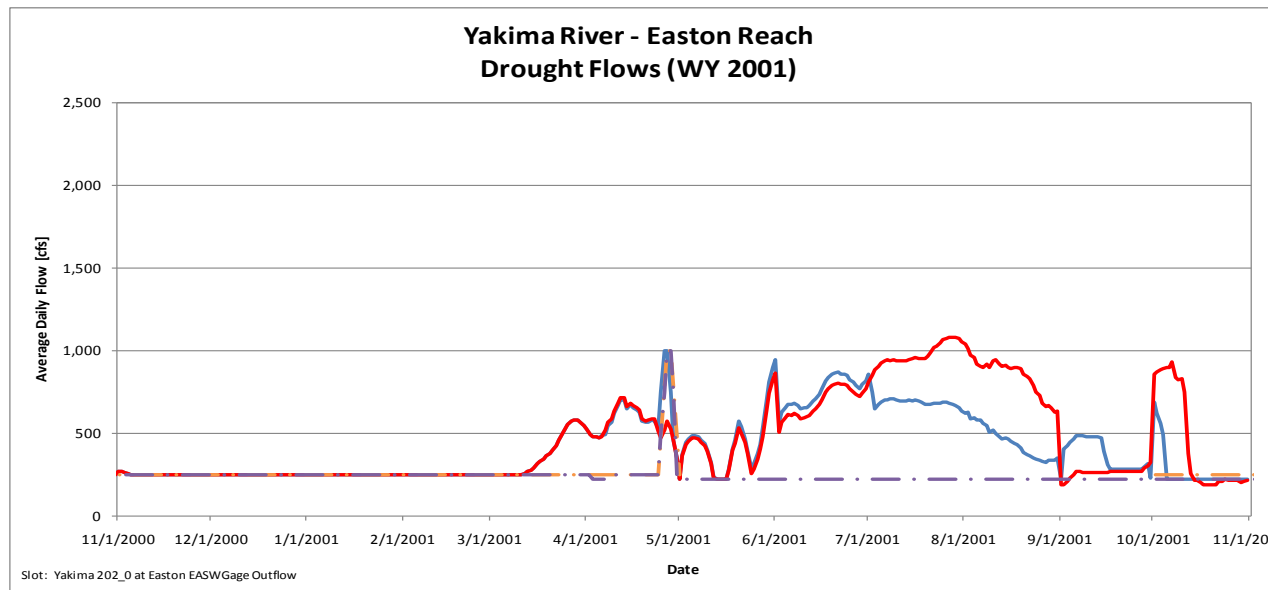
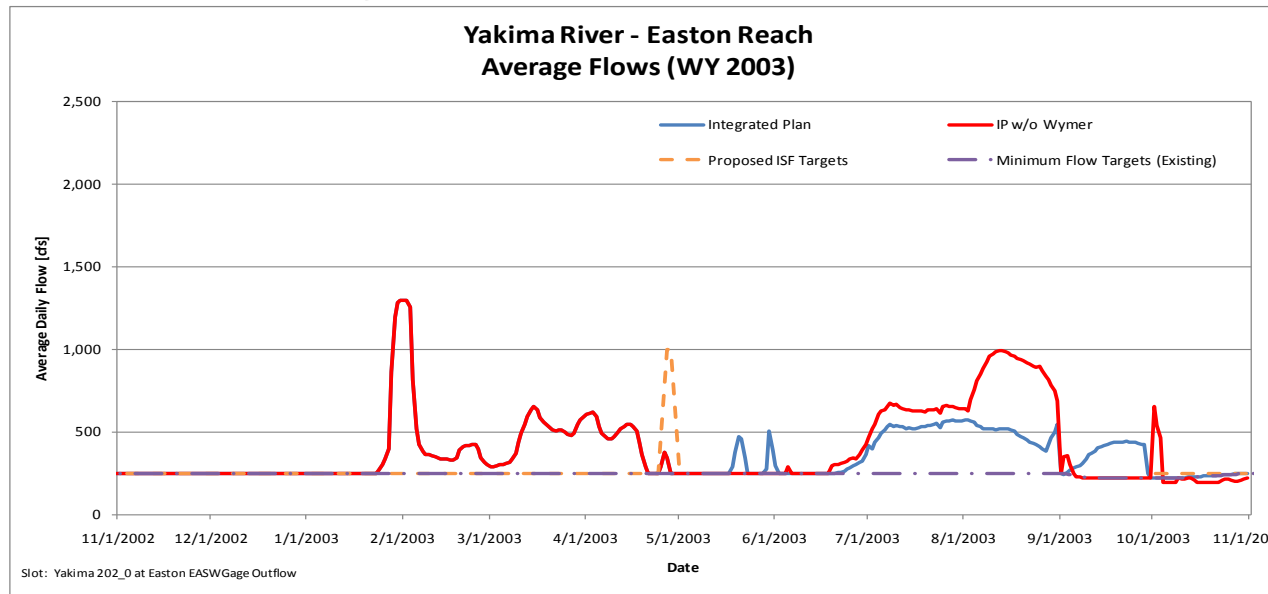
Green: Positive change greater than 10% or Prorating greater than 70%

Pink: Negative change greater than 10% or Prorating less than 70%

Adjusted Scenarios



Adjusted Scenarios



Adjusted Scenarios - Conclusions

- The Adjusted Scenarios do not meet the 70% prorationing water supply goal.
- The Adjusted Scenarios provide less water for irrigation.
- The Adjusted Scenarios provide less carryover storage following dry years.
- The Adjusted Scenarios provide less water for instream flow benefits.

Effects of Potential Climate Change On Integrated Plan Benefits

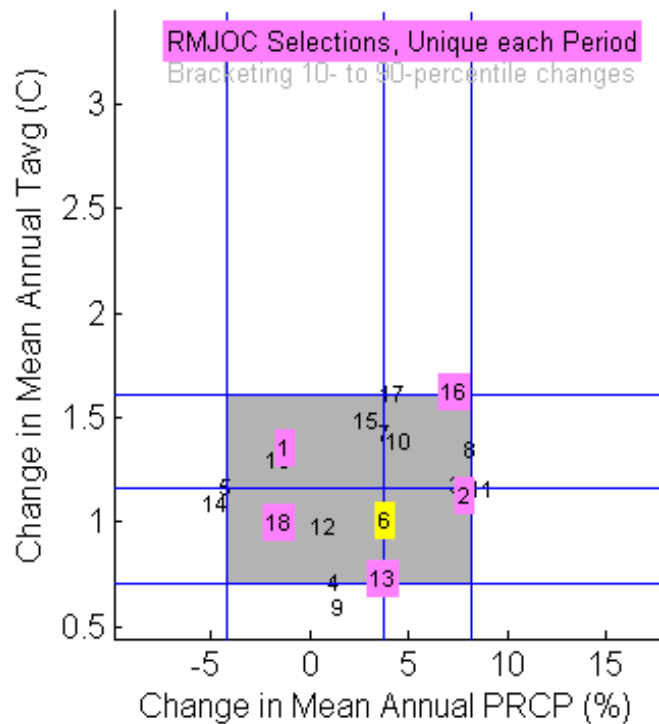
THREE POTENTIAL SETS OF CLIMATE CHANGE CONDITIONS REPRESENTING 2040 WERE EVALUATED:

All three include 9% average increase in Irrigation Demand and 9% average increase in M&I Demand

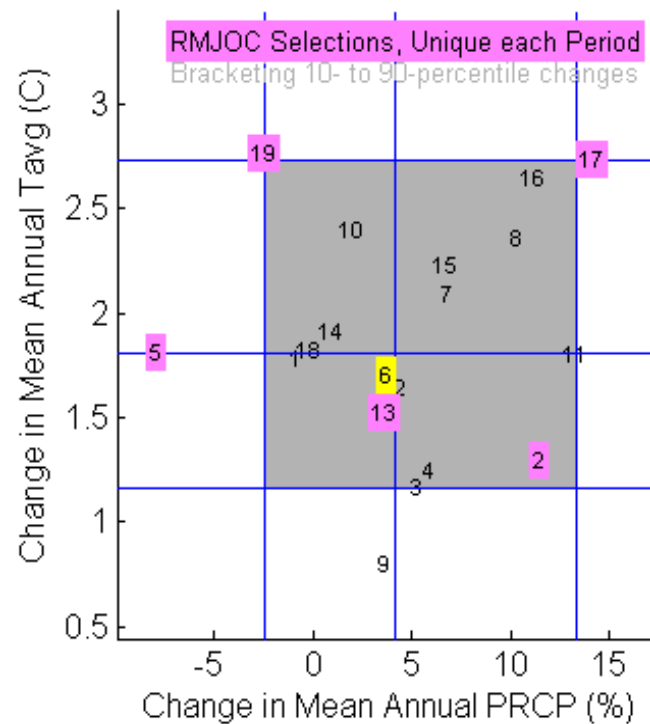
- **Less Adverse:** 8.8 % average increase in Precipitation; 1.2 °C average temperature increase.
- **Moderately Adverse:** 3.8 % average increase in Precipitation; 1.0 °C average temperature increase.
- **More Adverse** : 1.5 % average decrease in Precipitation; 1.3 °C average temperature increase.

Effects of Potential Climate Change On Integrated Plan Benefits

Columbia-Snake Basin, Area-Average Condition
2010-2039 from 1970-1999



2030-2059 from 1970-1999



Less Adverse = 11

Moderately Adverse = 6

More Adverse = 19

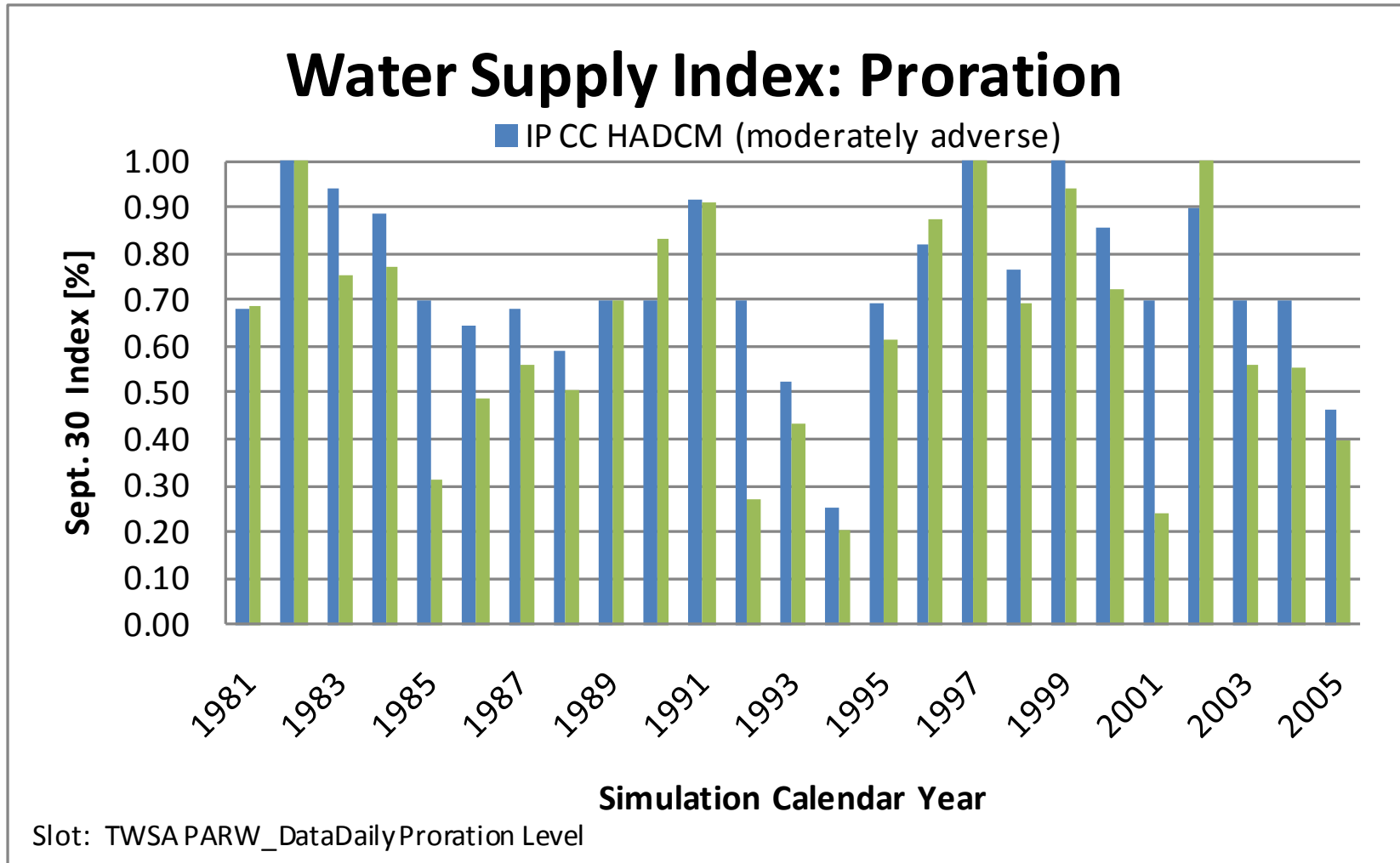
Effects of Potential Climate Change On Integrated

Green: Positive change greater than 10% or Prorating greater than 70%

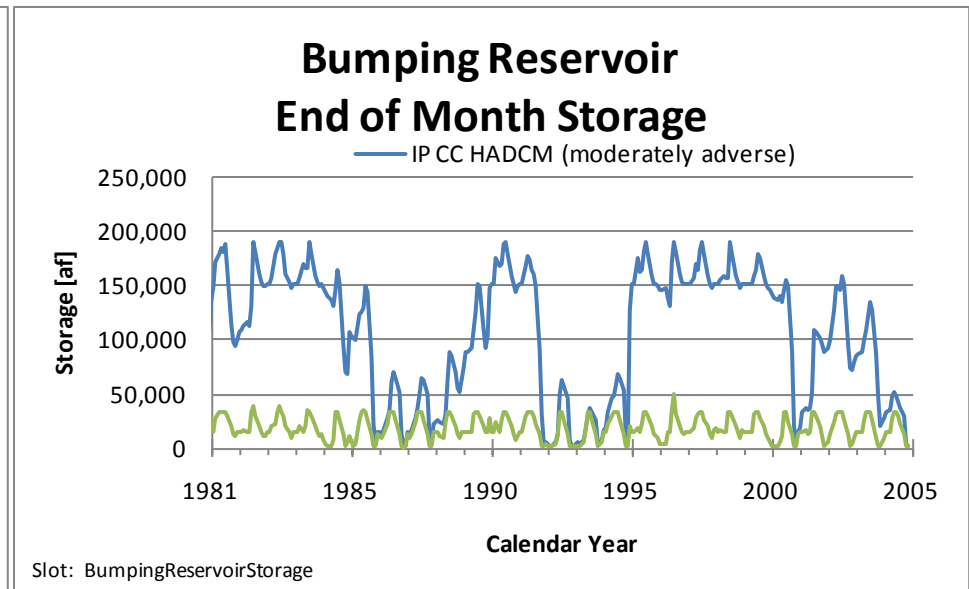
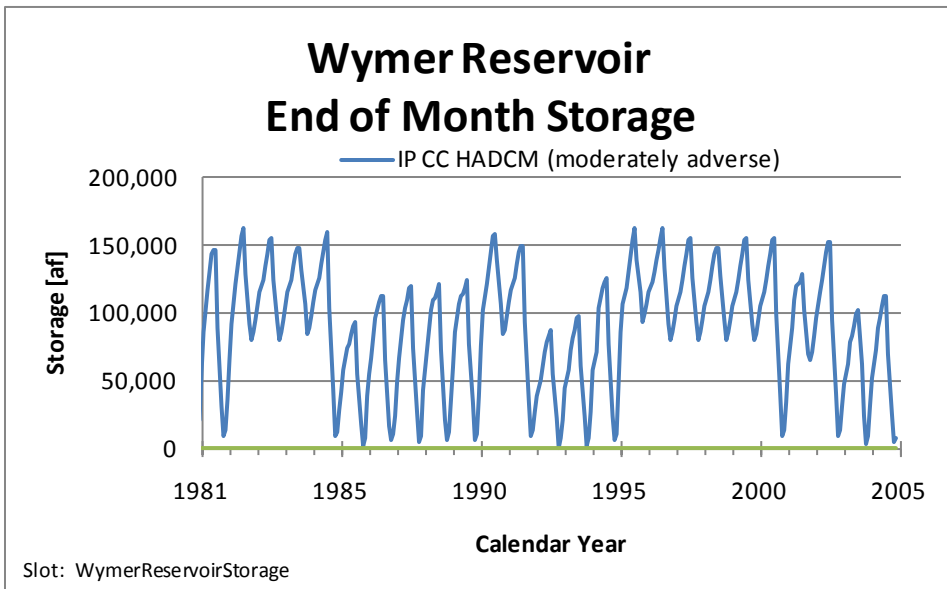
Pink: Negative change greater than 10% or Prorating less than 70%

Resource indicator (measurement)	Future without Integrated Plan NRNI	Integrated Plan NRNI	Change from FWIP	Integ Plan - Moderately Adverse	Integ Plan - Less Adverse	Integ Plan - More Adverse
WATER RESOURCES						
<i>Average for water years 1981–2005 (maf)</i>						
April 1 total water supply available (TWSA)	2.83	3.01	0.19	2.48	2.80	2.00
April–September Parker flow volume	0.59	0.59	0.00	0.45	0.54	0.33
April–September diversion	1.63	1.69	0.06	1.65	1.79	1.44
September 30 reservoir contents	0.29	0.57	0.29	0.09	0.14	0.05
Irrigation proration level	86%	92%	6%	74%	89%	52%
<i>1993 dry-year (maf)</i>						
April 1 total water supply available (TWSA)	2.07	2.23	0.16	1.96	2.69	1.68
April–September Parker flow volume	0.30	0.30	0.01	0.28	0.59	0.28
April–September diversion	1.48	1.55	0.07	1.42	1.64	1.23
September 30 reservoir contents	0.04	0.25	0.21	-0.16	0.22	-0.17
Irrigation proration level	62%	70%	8%	52%	70%	22%
<i>1994 dry-year (maf)</i>						
April 1 total water supply available (TWSA)	1.75	2.20	0.45	1.60	2.19	1.43
April–September Parker flow volume	0.26	0.24	-0.01	0.27	0.20	0.21
April–September diversion	1.28	1.53	0.25	1.20	1.57	1.09
September 30 reservoir contents	0.04	-0.08	-0.12	-0.17	-0.08	-0.14
Irrigation proration level	35%	70%	35%	25%	70%	14%
<i>2001 dry-year (maf)</i>						
April 1 total water supply available (TWSA)	1.85	2.45	0.60	2.16	2.26	1.31
April–September Parker flow volume	0.19	0.20	0.01	0.24	0.23	0.20
April–September diversion	1.40	1.55	0.15	1.55	1.57	1.02
September 30 reservoir contents	0.05	0.21	0.17	-0.12	-0.01	-0.16
Irrigation proration level	51%	70%	19%	70%	70%	3%
<i>2005 dry-year (maf)</i>						
April 1 total water supply available (TWSA)	1.80	2.31	0.51	1.87	2.31	1.58
April–September Parker flow volume	0.20	0.18	-0.01	0.28	0.35	0.25
April–September diversion	1.38	1.53	0.15	1.36	1.61	1.17
September 30 reservoir contents	0.05	0.12	0.07	-0.17	0.29	-0.15
Irrigation proration level	48%	70%	22%	46%	70%	21%

Effects of Potential Climate Change On Integrated Plan Benefits



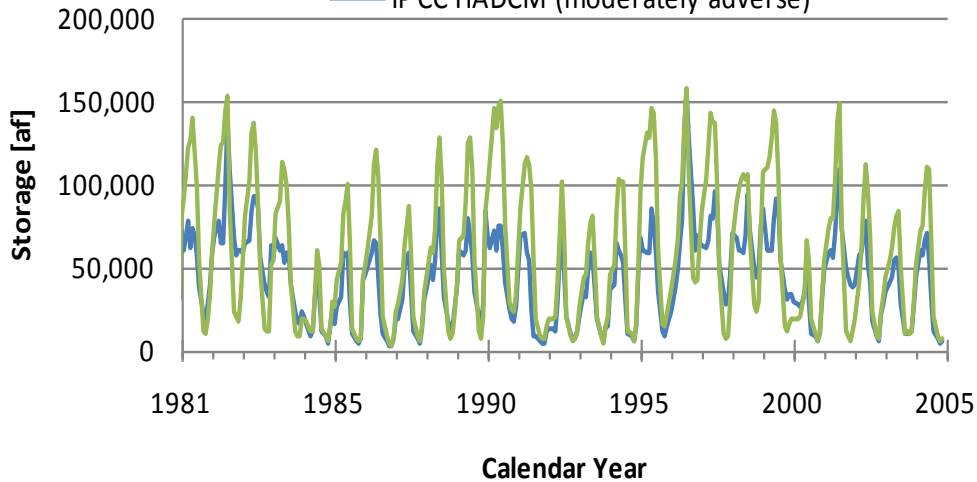
Effects of Potential Climate Change On Integrated Plan Benefits



Effects of Potential Climate Change On Integrated Plan Benefits

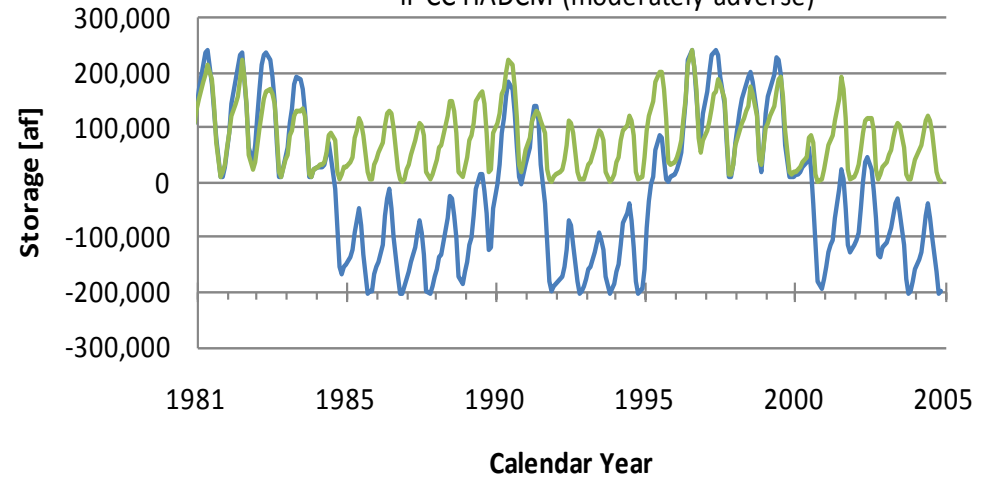
Keechelus Reservoir End of Month Storage

— IP CC HADCM (moderately adverse)



Kachess Reservoir End of Month Storage

— IP CC HADCM (moderately adverse)



Effects of Potential Climate Change On Integrated Plan Benefits

- The predicted Climate Change scenarios would reduce summer flows and increase needs for storage
- The Integrated Plan would deliver comparable benefits under the predicted Climate Change scenarios
- The Integrated Plan would not meet the 70% Prorationing goal under two of three Climate Change scenarios