



# **DSM2 Analysis of Water Level and Water Quality in the South Delta**

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**Presented to  
DSM2 Users Group**

**November 2, 2006**



# Background

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- **Concerns with water levels and low flow conditions in the South Delta in current SDIP studies**
- **Could modified barrier operations alleviate low water level and stagnation events?**
- **Previously analyzed effects of export curtailment and reoperation of barriers with positive results**
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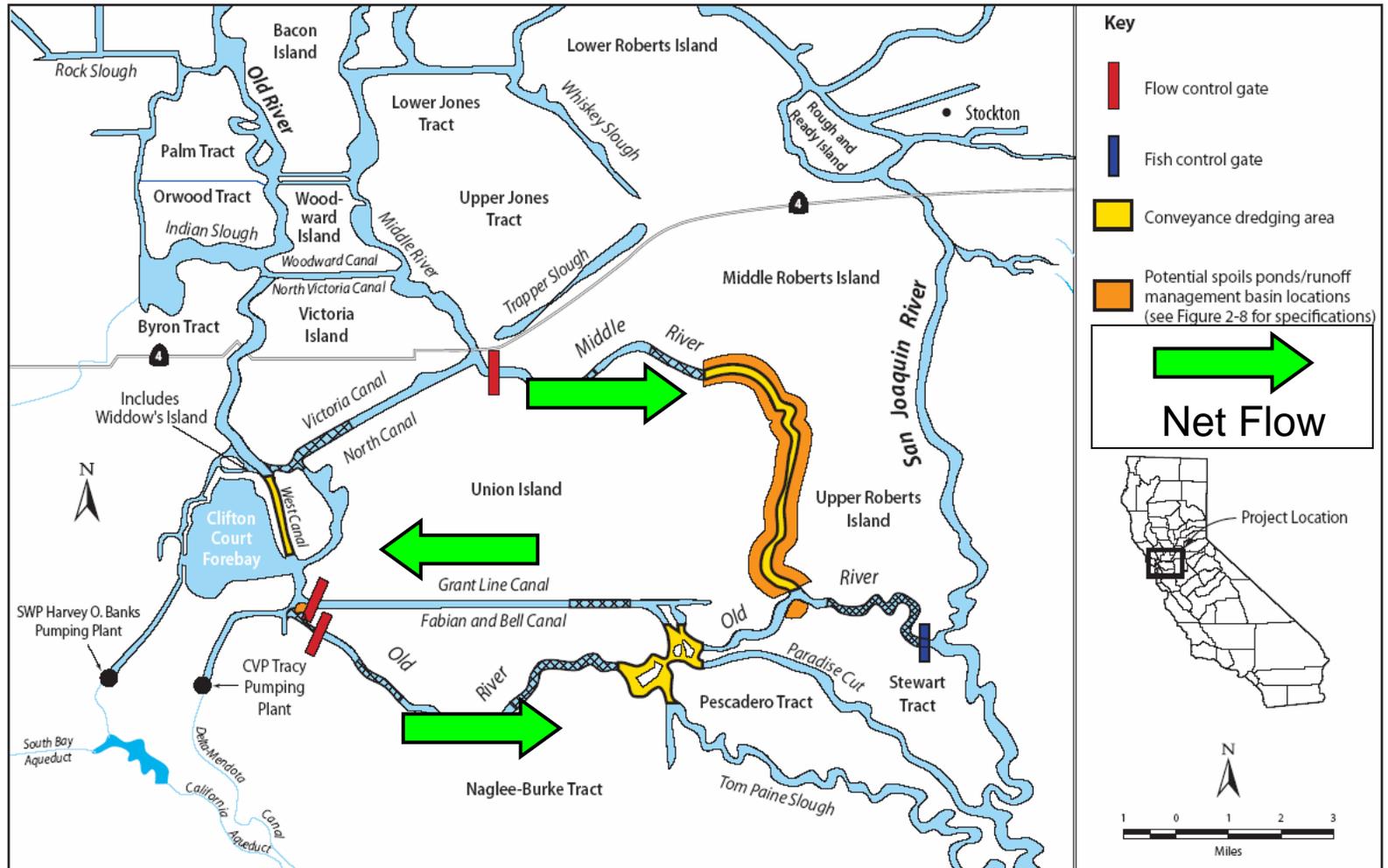
A photograph of a waterfall cascading over dark rocks, with water splashing and creating white foam at the base. The image is positioned on the left side of the slide, partially obscured by a blue vertical bar.

# Summary of Technical Analyses

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- **Updated SJR hydrology and CALSIM runs**
- **Developed DSM2 baseline scenario**
- **Resolved water level and flow issues**
- **Determined water costs associated with minimum flow requirements at Brandt Bridge**
- **Analyzed sensitivity to peak daily Delta Island Consumptive Use (DICU)**

# Plan C Gate Operations and Circulation Patterns at Low Flow (<2500 cfs)



# SDIP Plan C Barrier Operations

Conditions that may trigger the agricultural barrier operation		Middle River	Old River	Grant Line Canal
When HOR is operated during VAMP and OCT-NOV (SJR < 10,000 cfs)		Operated	Operated	Operated
Monthly Flow (cfs)	SJR < 2500	Operated	Operated	Operated
	2500 < SJR < 4000		Operated	Operated
	4000 < SJR < 8000			Operated
	SJR > 8000			



# Definition of Violations

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- **Developed in cooperation with DWR**
- **Water Level Violations**
  - Daily Minimum Water Level Below 0.0' NGVD (DSM2 Datum)
- **Water Quality Violations**
  - Three consecutive days with daily average flow less than 50 cfs
- **April to November timeframe only**

A photograph of a waterfall cascading over dark rocks, with water splashing and creating white foam at the base. The image is positioned on the left side of the slide, partially obscured by a blue vertical bar.

# Compliance Locations

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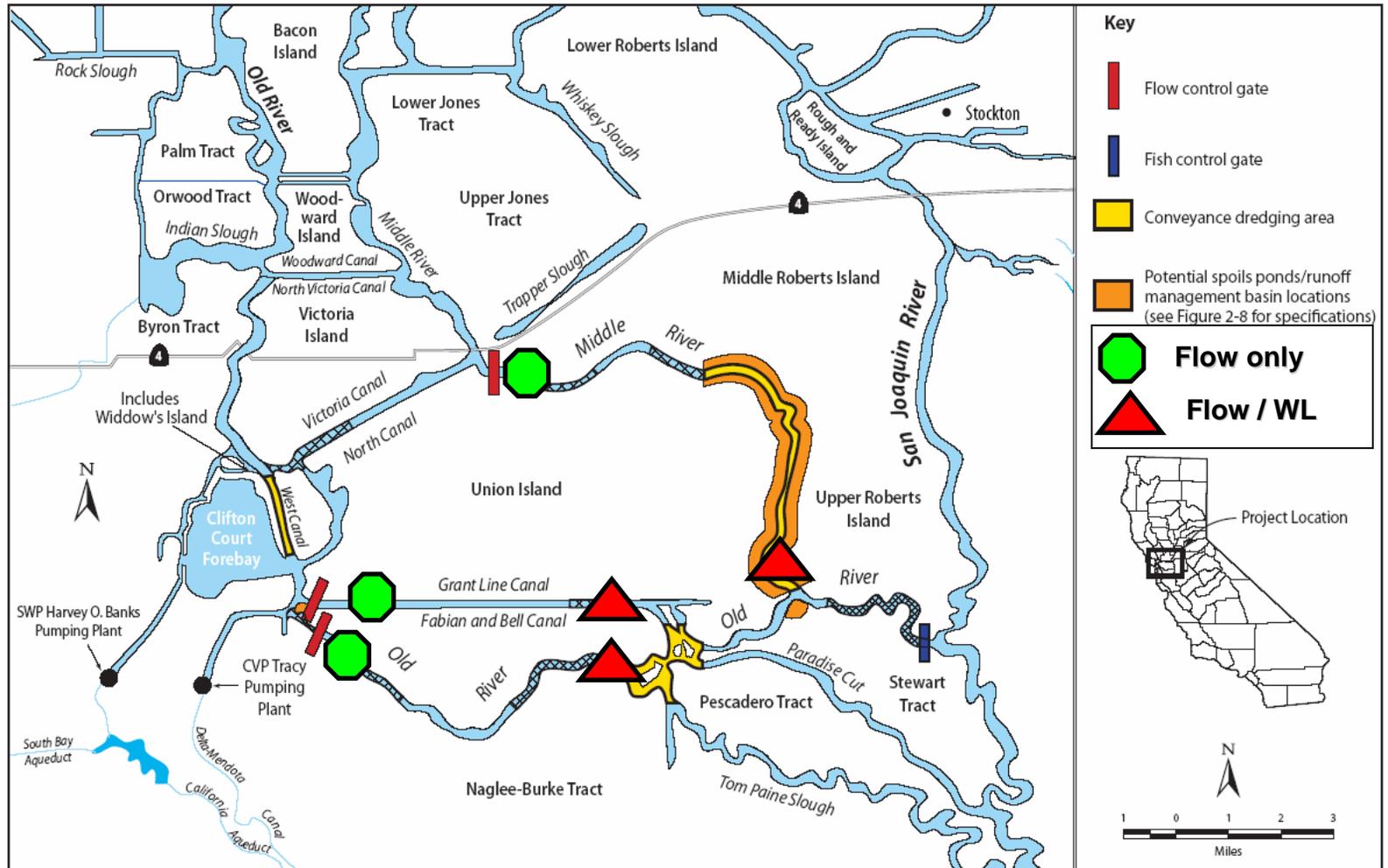
- **Water Level Violations**

- Middle River at Mowry (East end, DSM2 Channel 126)
- Old River at Tracy Road (East End, DSM2 Channel Ch 71)
- Grant Line Canal East (DSM2 Channel 206)

- **Water Quality Violations**

- Middle River at Mowry (East end, DSM2 Channel 126)
- Middle River, Upstream of Barrier (West end, DSM2 Channel 133)
- Old River at Tracy Road (East end, DSM2 Channel Ch 71)
- Old River near Tracy, Upstream of Barrier (West end, DSM2 Channel 79)
- Grant Line Canal East (DSM2 Channel 206)
- Grant Line Canal West, Upstream of Barrier (DSM2 Channel 213)

# Compliance Locations



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## Revised Operation of Gates Under Low Water Level and Flow Conditions

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- **Water level violations occur when SJR > 4000 cfs**
- **Flow violations correlate with neap tides and low flows**
- **Plan C operations vary with a single variable**
- **Revised Gate Operations can decrease violations**
- **Assuming some real time monitoring capacity in the system**
- **Discussion of phased approach toward solving violations (trials 1-5)**
- **Tabulation of decrease in violations**

# Violations Summary

Simulation	Days with Water Level Violations			Low Flow Violations						Total Violations
	Grant Line Canal Up-stream of East Barrier (206)	Middle River at Mowry (126)	Old River at Tracy Road Bridge (71)	Grant Line Canal Down-stream of West Barrier (213)	Grant Line Canal Up-stream of East Barrier (206)	Middle River at Mowry (126)	Middle River Up-stream Barrier (133)	Old River near Tracy Up-stream of Barrier (79)	Old River at Tracy Road Bridge (71)	
Step 1 (Base Line)	17	18	82	10	2	256	160	0	27	572
Step 2	0	1	34	9	8	361	156	0	61	630
Step 3	0	1	0	9	8	361	161	0	61	601
Step 4	0	0	0	1	1	270	6	0	2	280
Step 5 (Final)	0	0	0	1	1	0	2	0	2	6

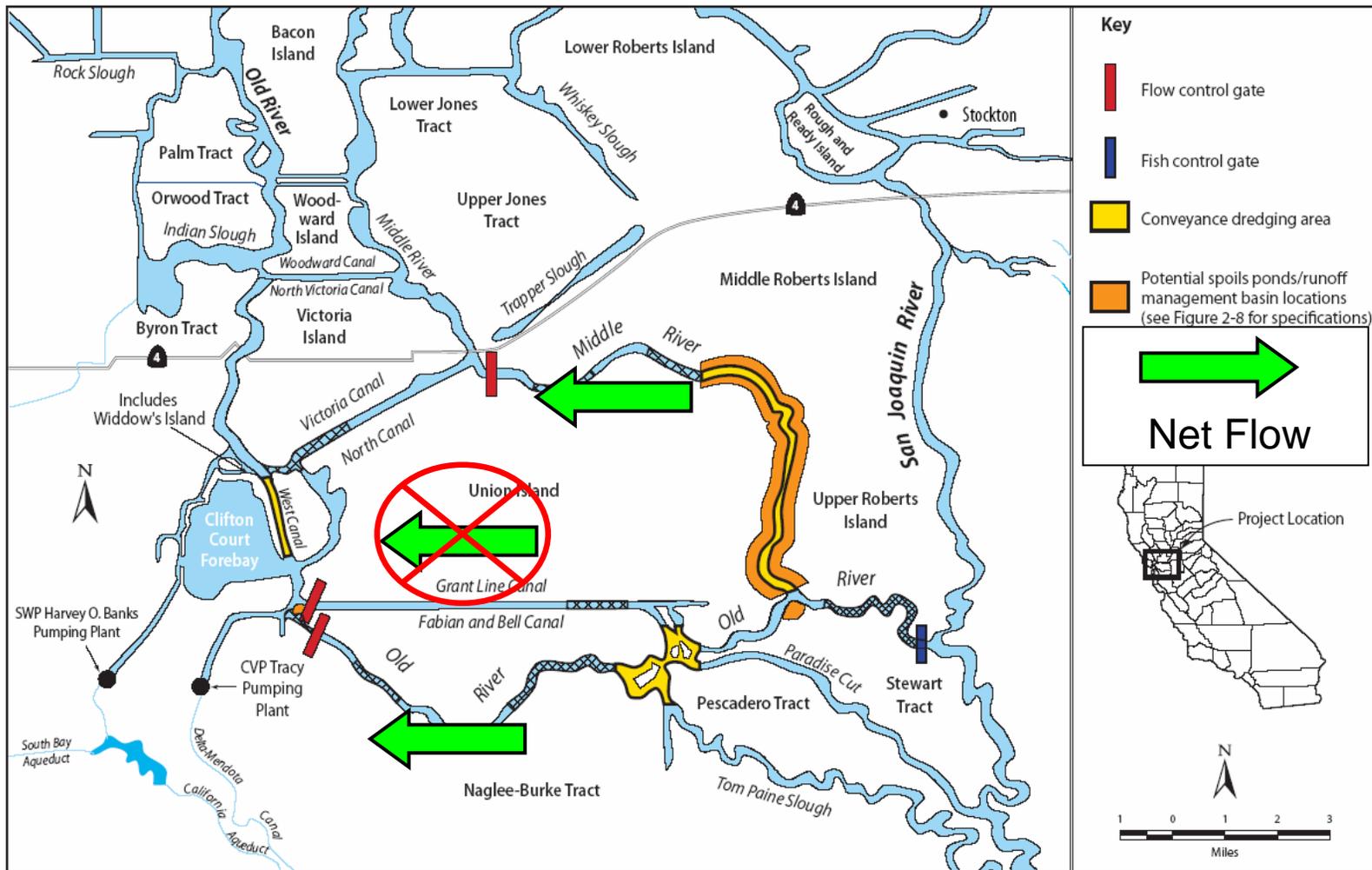
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# Summary of Changes to Plan C Barrier Operations

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- **Water Level Violations**
  - Old River Barrier Operated on days with water level violation as leaky barrier to protect water level
  - GLC pipe invert raised from -0.5 feet to 0.0 feet to protect water level
- **Water Quality Violations – Flushing Flows in Middle River and Old River**
  - Middle River Barrier operated as a leaky barrier to allow net downstream flow; gates closed during flood tides when trying to flush Middle River
  - Old River Barrier operated as a leaky barrier to allow net downstream flow
  - Grant Line Canal Barrier closed for one day (no downstream flow) to promote flushing flows in Middle River and Old River

# Revised Circulation Patterns at Low Flow, (when Plan C Ops result in flow violations)



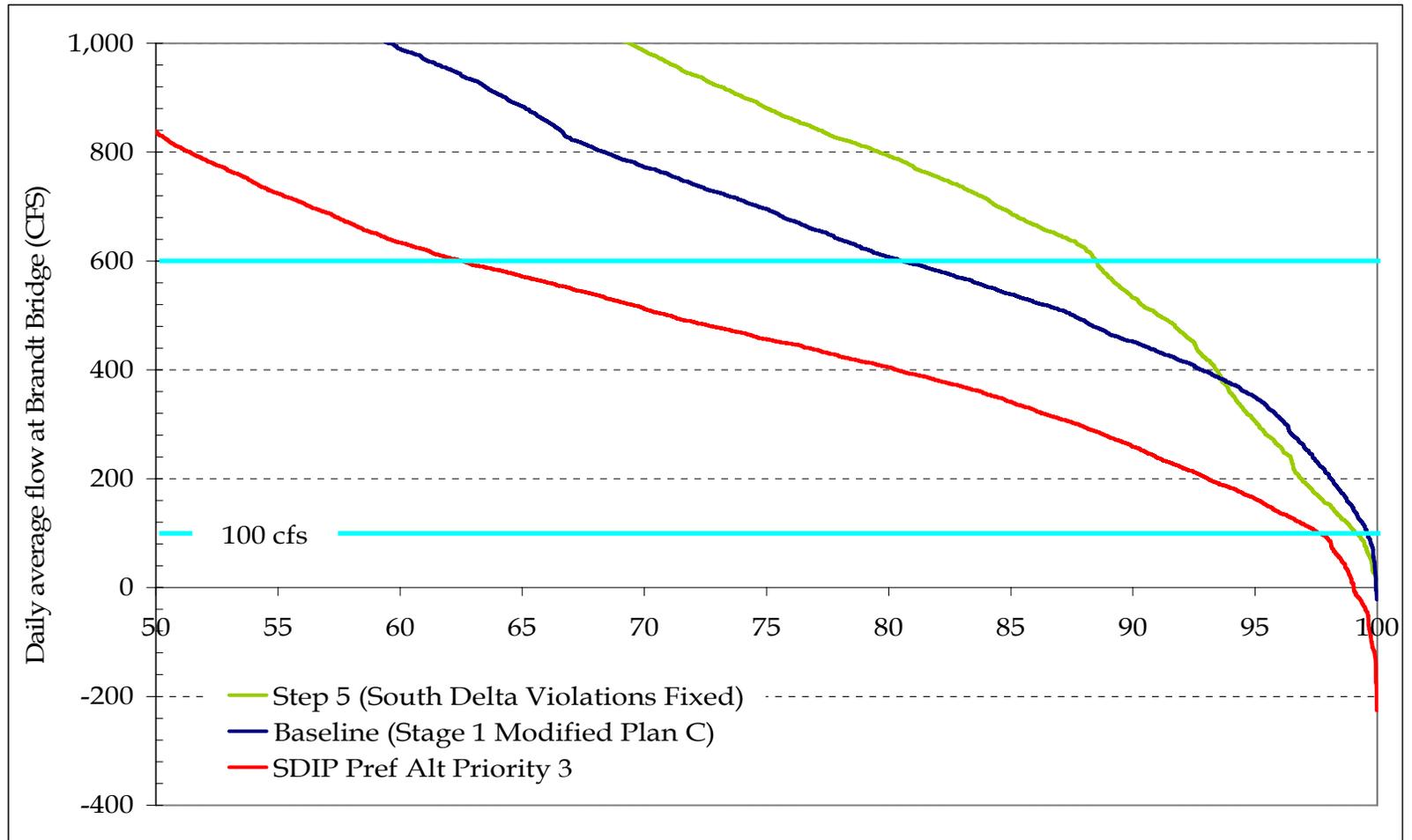


## SJR Flow at Brandt Bridge

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- **Comparison of frequency of low flows at Brandt Bridge**
  - SDIP EIR modeling,
  - new base with SJR hydrology, and
  - revised barrier operations
- **Tabulated deficit to meet 100 cfs and 600 cfs targets (daily average)**
- **24-hour average vs. tidal average**

# Comparison of Daily Average Flow at Brandt Bridge





# Analysis of Maintaining Net Flows at Brandt Bridge

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- **Methodology**

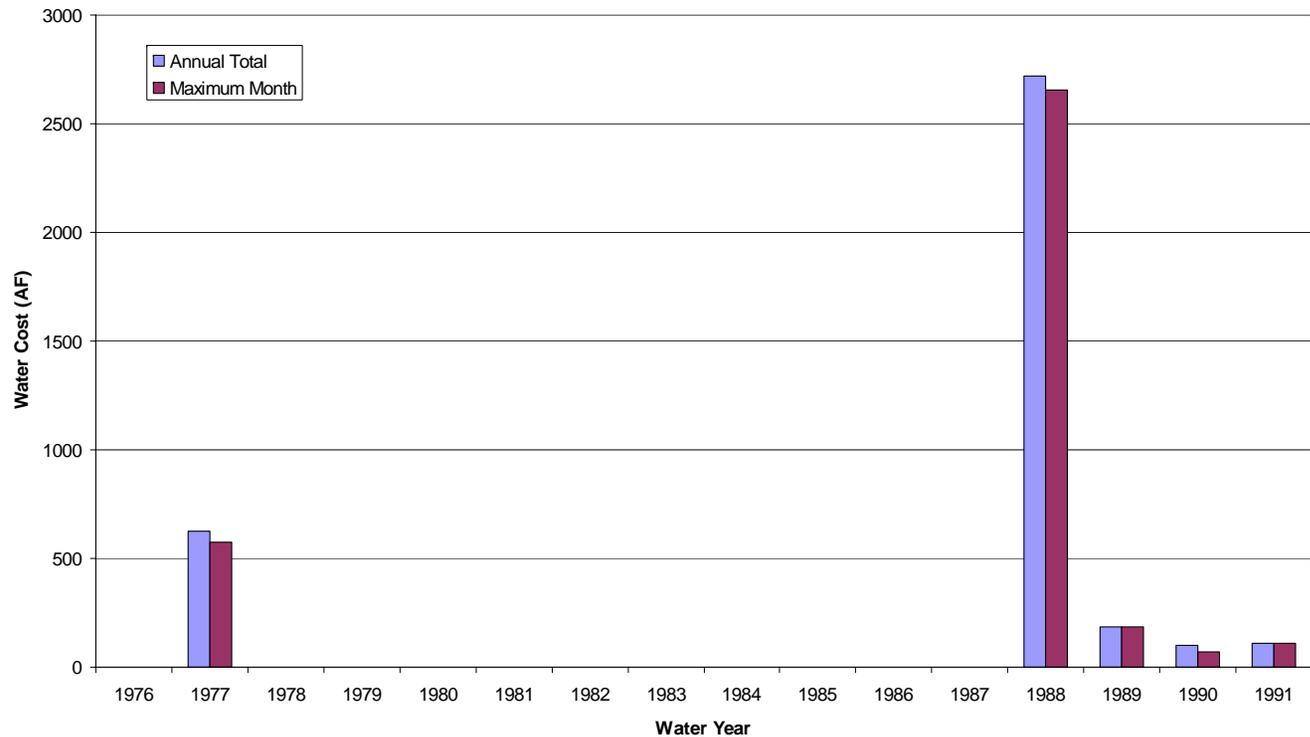
- Calculated deficit based on Step 5 simulation
- Added required flows at Vernalis
- HORB flows complicate matters (additional flow)

- **Results**

- 100 cfs minimum: average of 234 AF / yr (daily)
- 100 cfs minimum: average of 1734 AF / yr (monthly)
- 600 cfs minimum: average of 23,000 AF / yr (daily)

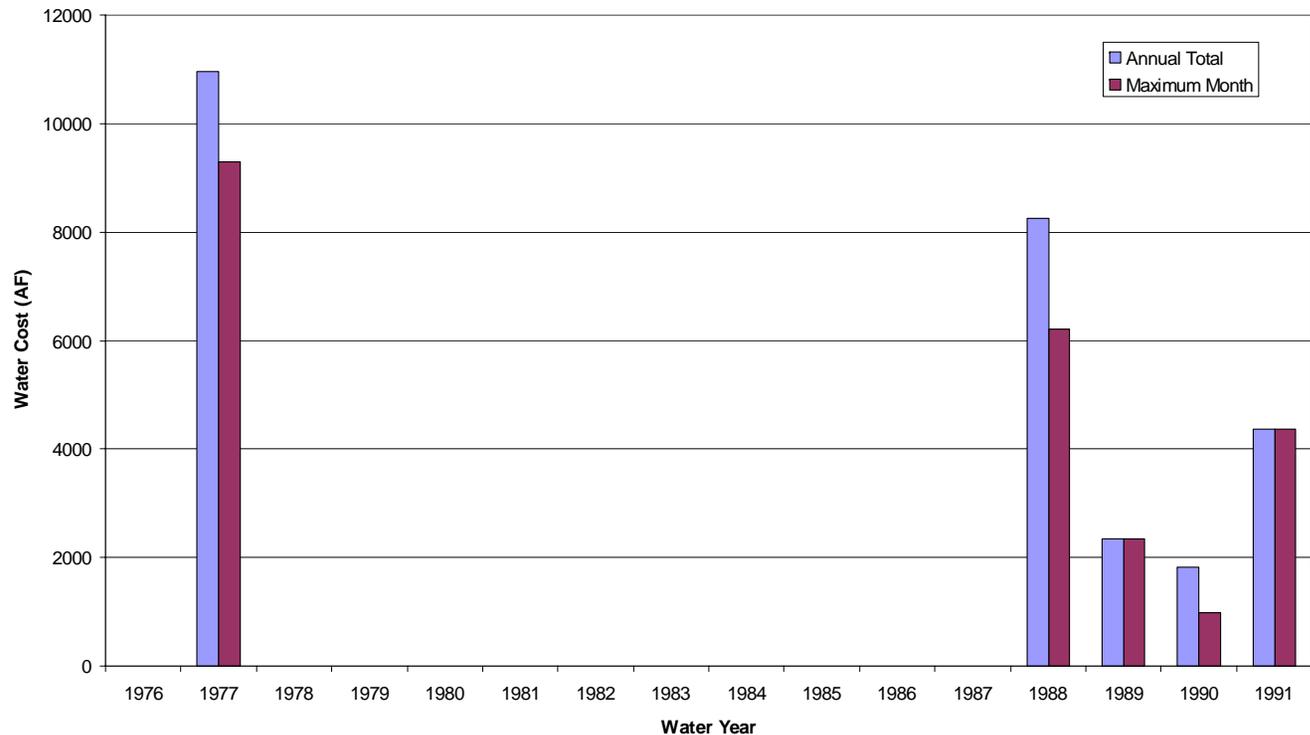
# Water Cost for 100 cfs Flow at Brandt Bridge (based on daily deficit)

Water Cost to meet 100 cfs at Brandt Bridge



# Water Cost for 100 cfs Flow at Brandt Bridge (based on monthly operation)

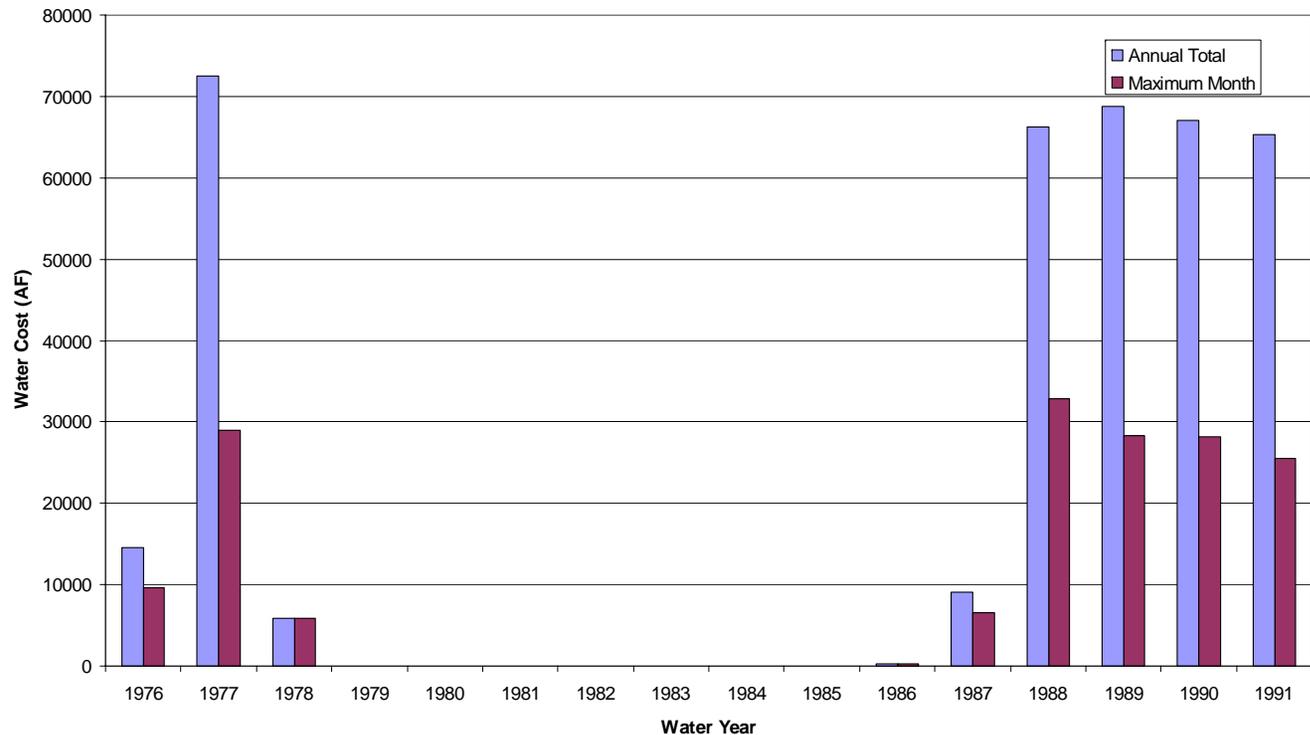
Water Cost to meet 100 cfs at Brandt Bridge





# Water Cost for 600 cfs Flow at Brandt Bridge (based on daily deficit)

Water Cost to meet 600 cfs at Brandt Bridge



# Violations Summary – No Change in South Delta

Simulation	Days with Water Level Violations			Low Flow Violations						Total Violations
	Grant Line Canal Up-stream of East Barrier (206)	Middle River at Mowry (126)	Old River at Tracy Road Bridge (71)	Grant Line Canal Down-stream of West Barrier (213)	Grant Line Canal Up-stream of East Barrier (206)	Middle River at Mowry (126)	Middle River Up-stream Barrier (133)	Old River near Tracy Up-stream of Barrier (79)	Old River at Tracy Road Bridge (71)	
Step 5	0	0	0	1	1	0	2	0	2	6
Step 6	0	0	0	1	1	0	2	0	2	6

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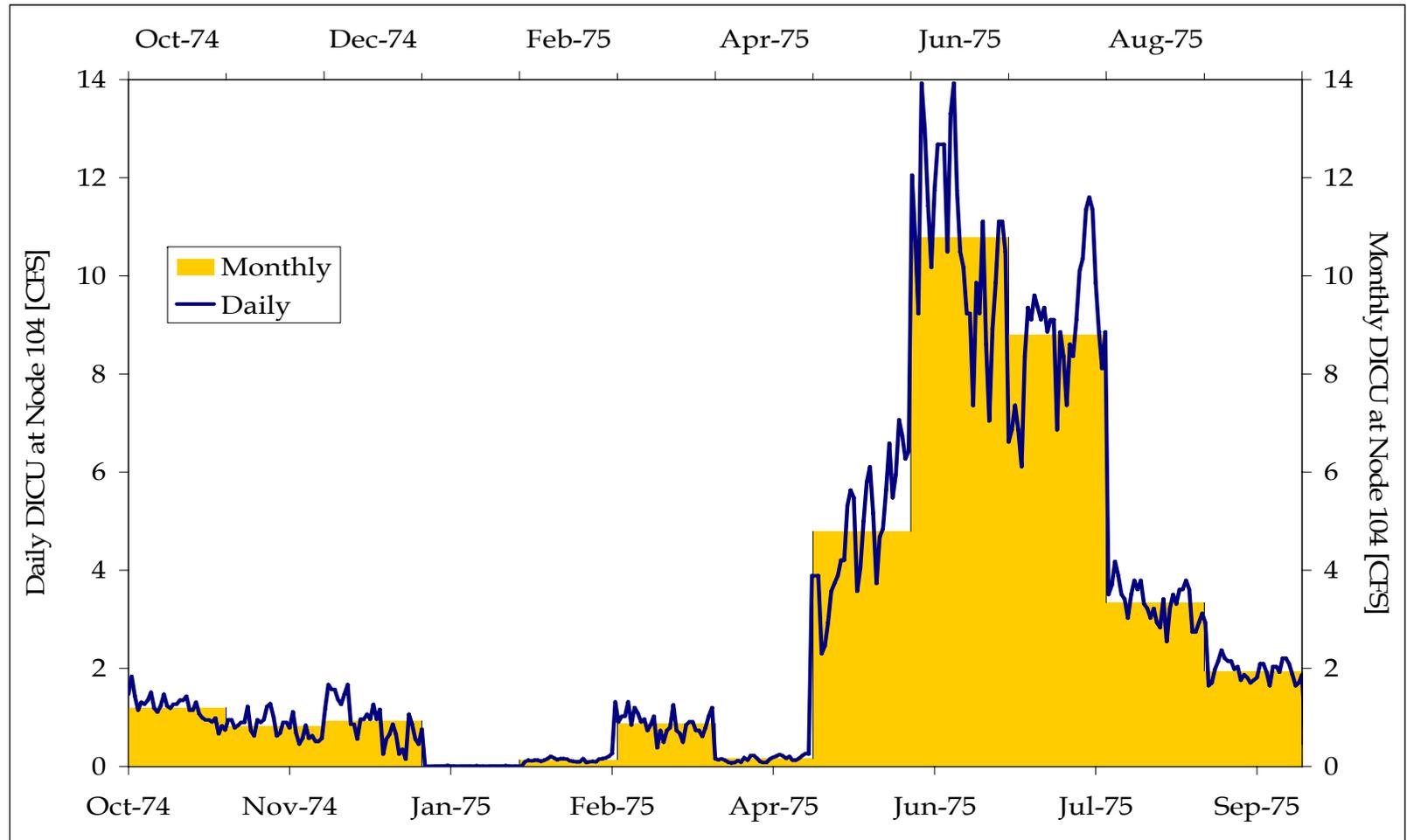
# Analysis of Sensitivity to Peak Daily DICU

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- **Methodology**

- Development of daily DICU patterns
  - *Measured evapotranspiration*
  - *Peak variations above maximum = 389 cfs*
  - *Applied at 47 nodes between Vernalis and 3 Ag barriers*
- Quantity of additional flows at Vernalis
- Results
  - *1 WL violation and 38 flow violations*
- No re-operation of gates for this analysis; high probability of reduction in violations with re-operation of gates

# Comparison of Monthly and Daily DICU Patterns





# Violations Summary

## DICU Sensitivity

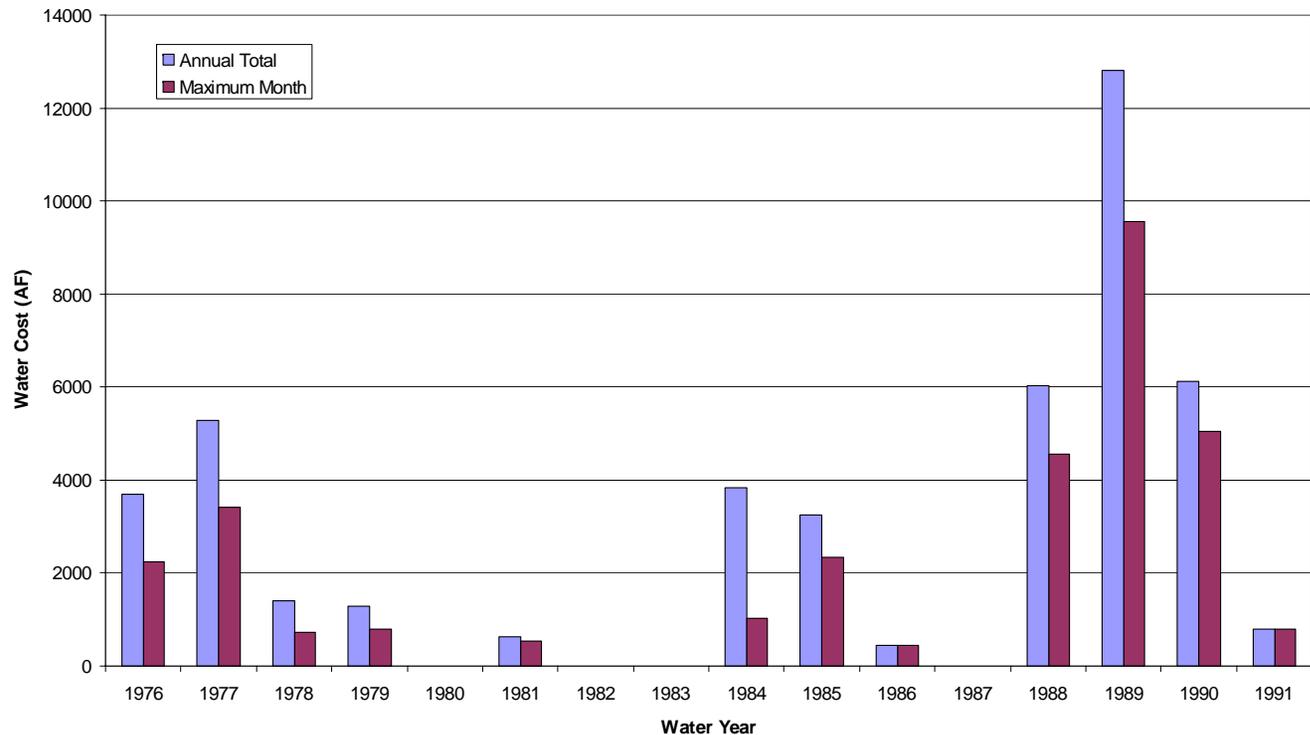
Simulation	Days with Water Level Violations			Low Flow Violations						Total Violations
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Step 6	0	0	0	1	1	0	2	0	2	6
Step 9	0	0	1	6	0	22	2	0	8	39

Brandt Bridge violations (100 cfs) increased from 2 to 21



# Water Cost at Vernalis to meet Peak Daily DICU Demand and 100 cfs at Brandt Bridge

Water Cost to meet 100 cfs at Brandt Bridge and Peak DICU





## Conclusions

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- **Flexible SDIP gates shown to effectively manage water level and flow**
- **Net SJR flow at Brandt Br of 100 cfs achievable at little or no water cost**
- **Peak DICU appears effectively controllable by gate operations**