M e m o r a n d u m

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Subject: Initial Implementation of South Delta Improvements Program (SDIP) Permanent Gate Operations in DSM2v7

This memo documents the South Delta Improvements Program (SDIP) permanent gate operations that will be used for initial implementation into the Delta Simulation Model 2 version 7 (DSM2v7), also known as the data base version of DSM2. One of the expanded capabilities of DSM2v7 is the use of operating rules to control flow structures such as the proposed SDIP permanent operable gates (USBR and DWR, 2005).

Objectives

The goals for the initial implementation of operating rules for the SDIP permanent operable gates into DSM2v7 include:

- Create operating rules to reflect the SDIP permanent gate operations used in the draft EIR-EIS (USBR and DWR, 2005) known as "Modified Plan C" (Shrestha and Nader-Tehrani, 2006)
- Utilize the new capabilities of the DSM2v7 operating rules to develop a revised set of operations for the SDIP permanent gates to represent the desired operations as of November 2006 as documented in this memo. These operations will be referred to as "Plan D".

Overview of SDIP Permanent Operable Gates

The three main objectives of the SDIP permanent operable gates that are to:

- Minimize movement of in and out-migrating salmon towards the export pumps
- Maintain adequate water levels for South Delta farmers to prevent cavitation of irrigation pumps
- Improve water quality in South Delta channels by providing better flow circulation

In order to meet these objectives, four permanent operable gates have been proposed (Figure 1):

- Fish migration protection
  - Head of Old River
- Agricultural water level maintenance
  - Middle River between the confluence of Victoria Canal and Tracy Road Bridge
  - Old River near the confluence of Grant Line Canal and the Tracy Pumping Plant
  - West end of Grant Line Canal

Figure 1: Map of Proposed South Delta Permanent Operable Gates

Proposed SDIP Permanent Gate Operations

Operations of the proposed South Delta permanent operable gates are currently being developed and revised. Objectives used to develop these operations include (Shrestha and Nader-Tehrani, 2006):

- Minimizing movement of in and out-migrating salmon towards the export pumps by closing the gate at the head of Old River to keep salmon in the San Joaquin River. Key protection periods for salmon migration are April 15-May 15 during increased export pumping for the Vernalis Adaptive Management Program (VAMP) and fall/late fall migration during October and November.
- Dredge Middle River to improve flow conveyance
- Maintain a minimum water level of 0.0ft mean sea level (MSL) at three locations
  - Middle River near Undine Road (Mowry Bridge)
  - Old River near Tracy Road Bridge
  - Grant Line Canal near Tracy Road Bridge

For the initial implementation of the SDIP permanent gate operations into DSM2v7, two versions of the gate operations will be implemented:

- ***Modified Plan C*** - the SDIP permanent gate operations used in the SDIP draft EIR-EIS
- ***Plan D***-a revised set of operating rules for the SDIP permanent gates that uses the new capabilities of DSM2v7 to refine the permanent gate operations

The Modified Plan C SDIP permanent gate operations are documented in Shrestha and Nader-Tehrani (2006). The Plan D gate operations were developed by Paul Marshall, Parviz Nader-Tehrani, Eli Ateljevich, and Jamie Anderson in a meeting on 11-9-06. The operations of both plans are presented in this memo. Areas of differences between Modified Plan C and Plan D include:

- The extent of Middle River dredging
- Operation dates for the Head of Old River barrier for salmon migration protection
- Reduction in the amount of time that the agricultural gates are operated for unidirectional flow (open on the flood tide and closed on the ebb tide)
- Increase in the amount of time that the agricultural barriers are operated based on a minimum stage trigger.

Middle River Dredging

SDIP proposes to dredge Middle River to improve flow conveyance and to allow the water level target at Undine Road (Mowry Bridge) to be set at 0.0 ft MSL. The extent of dredging for Modified Plan C is shown in Figure 2.

For Plan D, it is proposed to increase the extent of the dredging in Middle River and taper the dredging from -4.5 ft NGVD at the head of Middle River to -8ft NGVD at the end of the dredged section (Figure 3). The following extended description of this dredging was provided by Jacob McQuirk.

> This geometry is referred to as the Revised Tapered Tracy Blvd Dredge. It includes dredging the Middle River channel from its head 9.7 miles downstream to DSM2 cross section 133_2267 near Tracy Blvd Bridge. The head, DSM2 section 125_1765, is dredged to -4.5 feet NGVD and the channel bottom is tapered for 6.9 mile downstream to DSM2 cross section 130_5565 that is dredged to a channel bottom elevation of -8 feet NGVD. The remaining downstream cross sections are also dredged to -8.0 feet NGVD. The excavated channel cross sections do not encroach in the project levee prism, and have a minimum bottom width of 50 feet. Excavated side slopes are at a 3:1 horizontal to vertical slope. Using the average end area method the dredged volume was estimated to be 236,000 cubic yards. Dredging in the 5 points area or West Canal is not included. This geometry includes additional cross sections from the base DSM2 geometry.

Permanent Gate Operations

A calendar of proposed gate operations is shown in Table 1. Proposed head of Old River permanent gate operations are given in Table 2. Proposed permanent agricultural gate operations

are specified by calendar date based on head of Old River gate operations, San Joaquin River flows, and Vernalis EC in Table 3.

References

USBR and DWR (2005). South Delta Improvements Program Draft Environmental Impact Statement/Environmental Impact Report, prepared for the U.S. Bureau of Reclamation (USBR) and the California Department of Water Resources (DWR) by Jones and Stokes, October, 2005, State Clearinghouse # 2002092065, http://sdip.water.ca.gov/documents/draft_eis_eir.cfm.

Shrestha, B. and P. Nader-Tehrani (2006). "Chapter 6: Using DSM2 to Develop Operation Strategies for South Delta Improvements Program's Proposed Permanent Gates", submitted for *Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh, 27th Annual Progress Report*, scheduled to be released October 2006.

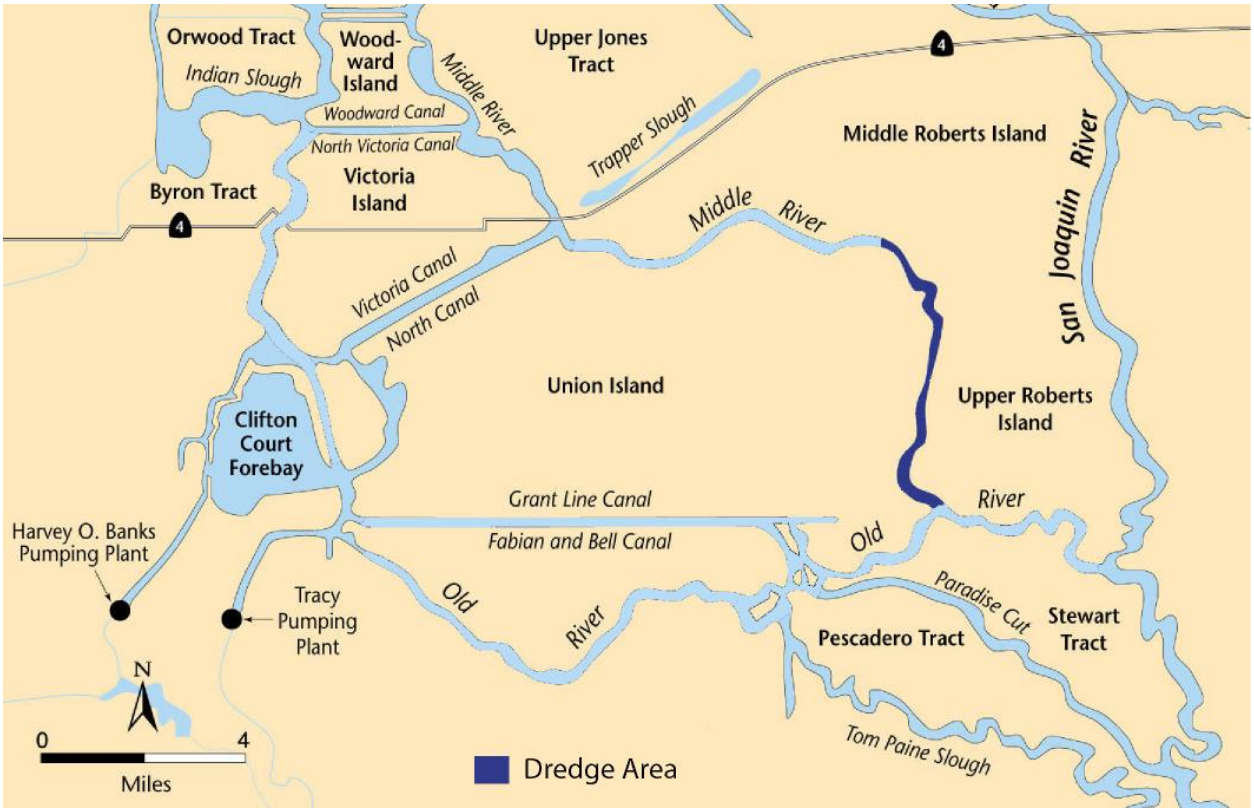

Figure 2: Proposed Middle River Dredging Area for Modified Plan C

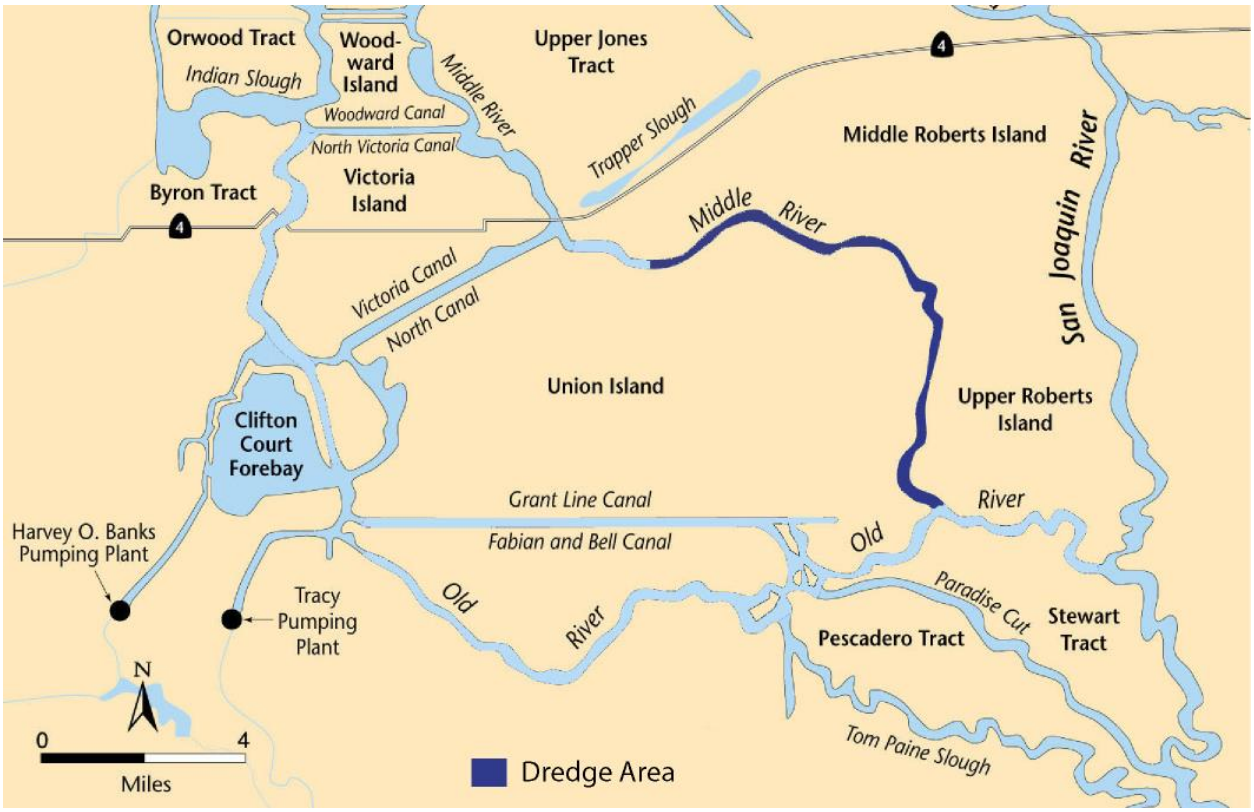

Figure 3: Proposed Middle River Tapered Dredging Area for Plan D

Table 1a: Calendar of Proposed Permanent Gate Operations for Modified Plan C

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
HOR[1]												
AG												

Table 1b: Calendar of Proposed Permanent Gate Operations for Plan D

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
HOR[1]												
AG												

1 Head of Old River (HOR) gate is open if San Joaquin River (SJR) flows >10,000cfs.

2 If HOR is closed or partially closed, agricultural gates are operated either tidally for unidirectional flow or to maintain minimum water level targets. If HOR is open, operations are based on SJR flows

Head of Old River Gate

- Closed is SJR<10,000 cfs
- Partially closed to allow 500cfs into Old River if 800cfs<SJR<2500cfs
- Partially closed to allow about 10%-15% leakage

Agricultural Gates

- Operations are based on if HOR is open or closed or partially closed.[2]
- Operations based on SJR flows

Table 2a: SDIP Permanent Head of Old River Gate Operations for Modified Plan C

Date/Condition	Proposed Operation
SJR flows > 10,000cfs	Open
April 1 – May 30	Closed if SJR<10,000cfs
June 1 – September 30	If 800cfs<SJR<2500cfs, allow 500cfs flow into Old River Else, open
October 1 – November 30	Partial leakage of ~10%-15%
December 1 - March 31	Open

Table 2b: SDIP Permanent Head of Old River Gate Operations for Plan D

Date/Condition	Proposed Operation
SJR flows > 10,000cfs	Open
April 15 – May 15	Closed if SJR<10,000cfs
May 16 – July 15	Open
July 16 – September 30	If 800cfs<SJR<2500cfs, allow 500cfs flow into Old River Else, open
October 1 – November 30	Partial leakage of ~10%-15%
December 1 – April 15	Open

Differences between Modified Plan C and Plan D are highlighted in light yellow.

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Table 3a: SDIP Permanent Agricultural Gate Operations by Date for Modified Plan C

Date	Condition		Middle River Gate	Old River at Tracy Gate	Grant Line Canal Gate
April 1 – May 30	If SJR<10,000cfs, HOR is closed		U	U	GLC-T
	If SJR>10,000cfs, HOR is open		O	O	O
June 1 – Sept. 30	If 800cfs<SJR<2500cfs, HOR partially closed for 500 cfs		U	U	GLC-T
	HOR is open	SJR<800cfs	U	U	GLC-T
		2500cfs<SJR<4000cfs	O	U	GLC-T
		4000cfs<SJR<8000cfs	O	O	GLC-T
		SJR>8000cfs	O	O	O
Oct. 1- Nov 30	If SJR<10,000cfs, HOR is partially closed for 10%-15% leakage		U	U	GLC-T
	If SJR>10,000cfs, HOR is open		O	O	O
Dec. 1 – Mar. 31	HOR is open	SJR < 2500 cfs	U	U	GLC-T
		2500 cfs < SJR < 4000 cfs	O	U	GLC-T
		4000 cfs < SJR < 8000 cfs	O	O	GLC-T
		SJR > 8000 cfs	O	O	O

O= **O**pen

U= (**U**nidirectional flow) Operated tidally for unidirectional flow by opening the gates on the flood tides and closing them on the ebb tides.

GLC-T=(**G**rant **L**ine **C**anal tidal and stage **T**rigger) The Grant Line Canal is fully open during flood tides and the early part of ebb tides. Once the water levels approach the target minimum water levels of 0.0 ft. MSL, then the Grant Line Canal gate is partially closed to protect minimum water levels.

Table 3b: SDIP Permanent Agricultural Gate Operations by Date for Plan D

Date	Condition		Middle River Gate	Old River at Tracy Gate	Grant Line Canal Gate
Apr. 15 – May 15	If SJR<10,000cfs, HOR is closed		U	U	T
	If SJR>10,000cfs, HOR is open		T	T	T
May 16 – July 15	HOR is open	If Vernalis EC < 600 uS/cm	T	T	T
		SJR<2500cfs	U	U	T
		2500cfs<SJR<4000cfs	U	T	T
		SJR>4000cfs	T	T	T
July 16-Sept. 30	If 800cfs<SJR<2500cfs, HOR partially closed for 500 cfs		U	U	T
	HOR is open	SJR<800cfs	U	U	T
		2500cfs<SJR<4000cfs	U	T	T
		SJR>4000cfs	T	T	T
Oct. 1- Nov. 30	If SJR<10,000cfs, HOR is partially closed for 10%-15% leakage		U	U	T
	If SJR>10,000cfs, HOR is open		T	T	T
Dec. 1 – Apr 14	HOR is open	If Vernalis EC < 600 uS/cm	T	T	T
		SJR<2500cfs	U	U	T
		2500cfs<SJR<4000cfs	U	T	T
		SJR>4000cfs	T	T	T

U= (**U**nidirectional flow) Operated tidally for unidirectional flow by opening the gates on the flood tides and closing them on the ebb tides.

T= (stage **T**rigger) Gate is only closed when necessary to protect minimum water level stage targets.