

CalSim 3 Cycle Structure and Use for Operations Implementation and Model QA-QC

CWEMF 2026 Annual Meeting

April 20, 2026

Tom FitzHugh (Stantec)



Outline

- Introduction to CalSim 3 cycle structure
- Examples of Baseline model iterative cycle solutions
- Cycle structure modification for project/operations implementation
 - Sacramento Water Bank
 - Delta Conveyance Project
- Cycle by cycle review for model QA-QC



Cycles in WRIMS/CalSim

Introduction:

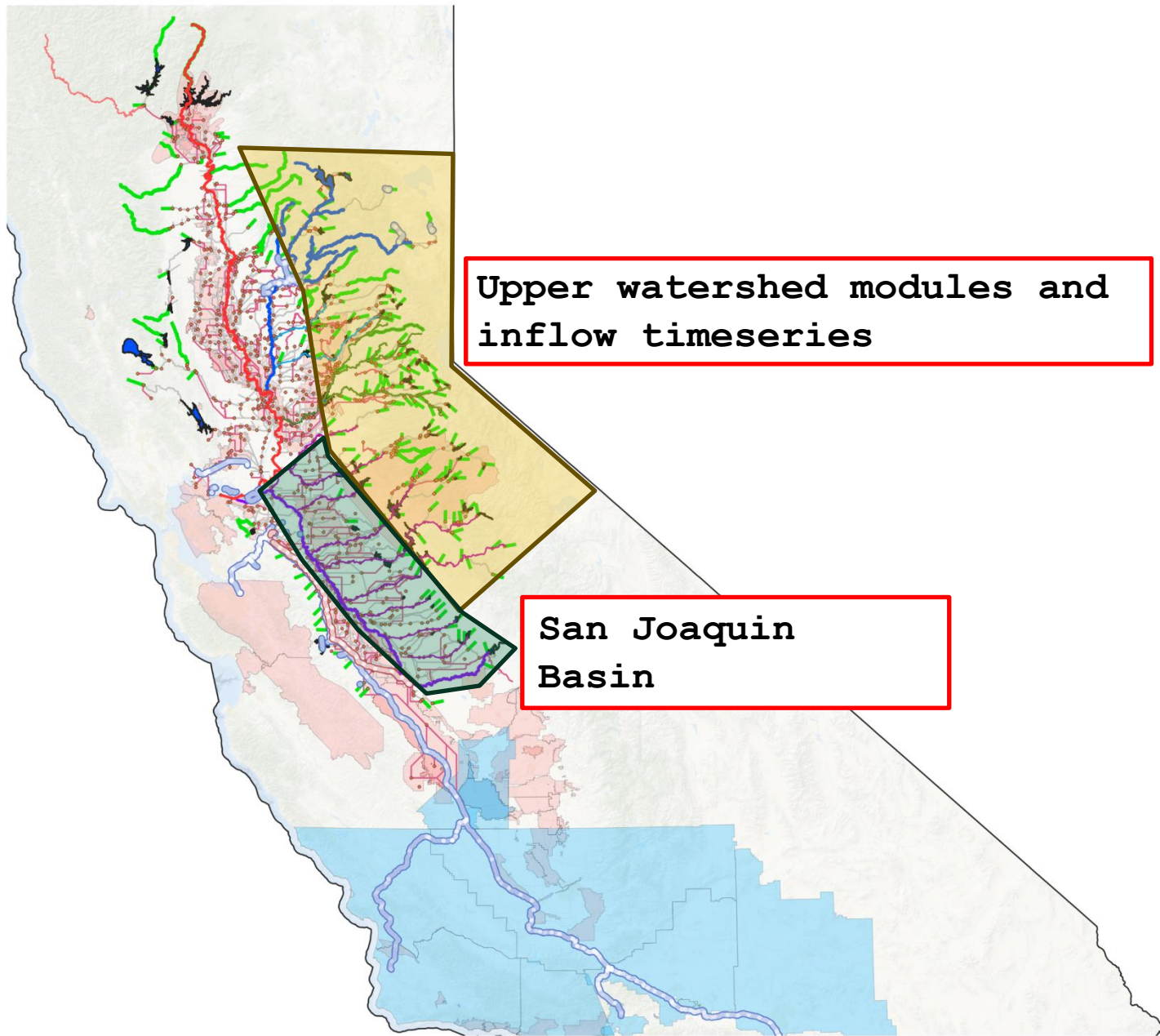
- Current CalSim 3 models have 38 (or more) cycles
- Cycles are separate model solutions, using the code in files are included in that particular cycle
- Because of complexity of the system, need multiple cycles to solve different parts of the system in sequence and to prioritize between different operations
- Later cycles can refer to and use outputs from earlier cycles:
S_SHSTA[WHEELJPOD] or S_SHSTA[-1]



Cycles in WRIMS/CalSim

CalSim 3 cycles in DWR's 2023 Delivery Capability Report (DCR) model:

- Cycles 1-3: Inflow inputs and forecasting
- Cycles 4-13: Upper watershed modules
- Cycles 14-21: San Joaquin Basin simulation
- Cycles 22-23: CalSim Allocation Module (CAM) (currently turned off)
- **Cycles 24-38: Sacramento Basin/Delta simulation**



CalSim 3 Sacramento Basin/Delta Cycles



CalSim 3 Sacramento Basin/Delta Cycles

SEQUENCE CYCLE24 model GW_INITIAL

SEQUENCE CYCLE25 model GW_FIRST

SEQUENCE CYCLE26 model GW_SECOND

SEQUENCE CYCLE27 model GW_THIRD

SEQUENCE CYCLE28 model GW_FOURTH

SEQUENCE CYCLE29 model PRESETUP

SEQUENCE CYCLE30 model SETUP

SEQUENCE CYCLE31 model MONTHLYWEIGHTED

SEQUENCE CYCLE32 model UPSTREAM

D-1641
regulations
and
most
other
upstream
operations
and
minimum
flow
reqs

-CVP and SWP
releases for exports

-Iterates on Sac
Basin GW solution

-Releases for exports
turned off (check for
EI ratio control)

-CVP and SWP releases for exports
-Refines weir spills (daily simulation)
-Adds in Fall X2 and Keswick pulse



CalSim 3 Sacramento Basin/Delta Cycles

SEQUENCE CYCLE33 model DELTA_SRPLS

SEQUENCE CYCLE34 model DELTA

SEQUENCE CYCLE35 model TRANSFERS_STAGE1

SEQUENCE CYCLE36 model WHEELCVC

SEQUENCE CYCLE37 model WHEELJPOD

SEQUENCE CYCLE38 model ITP

Same regulations and operations as prior cycles plus Delta BiOps and ITP regulations

— -Initial COA export sharing
— -Refines weir spills

— Final COA export sharing

— Implements LYRA transfers and Banks CVP wheeling (CVC and JPOD)

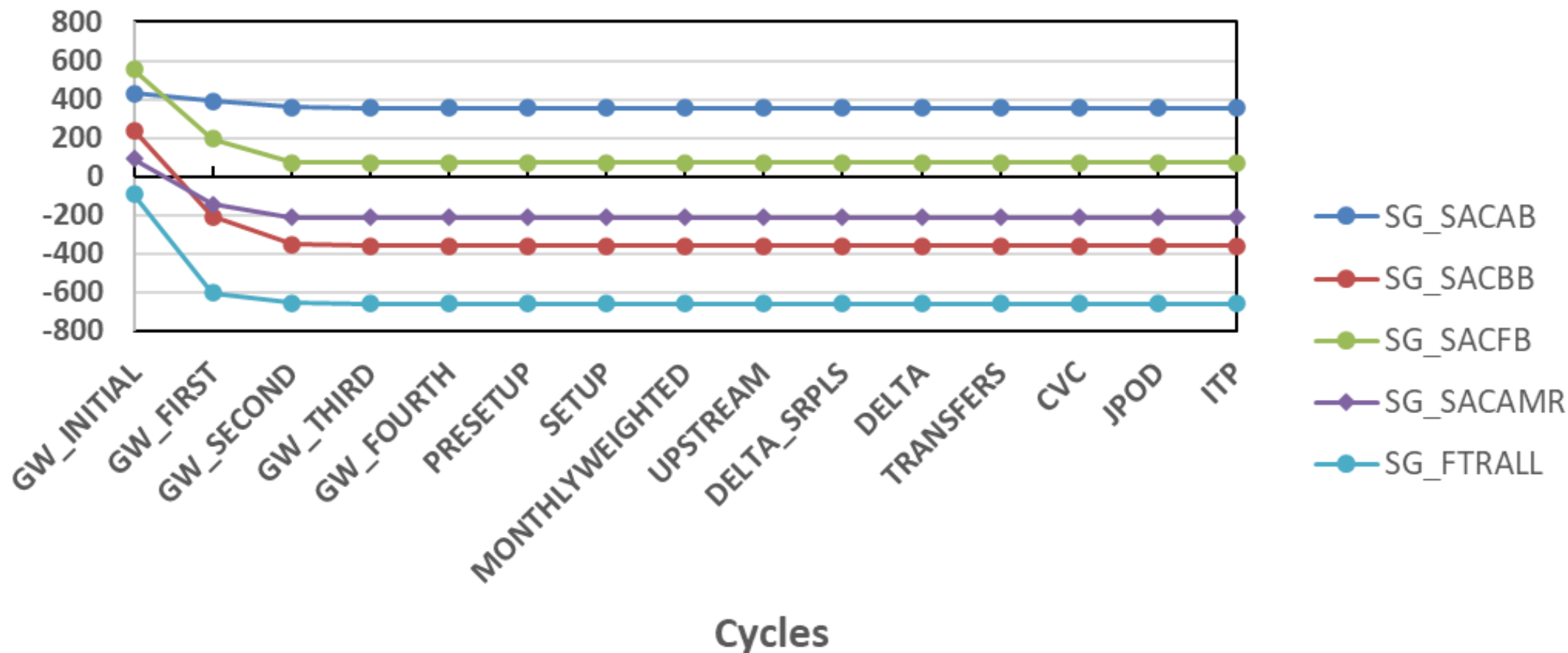
— -Implements DWR ITP Spring and summer export cuts
— -SJRR Delta recapture



Examples of Baseline model iterative cycle solutions – SW/GW interaction

Units: cfs

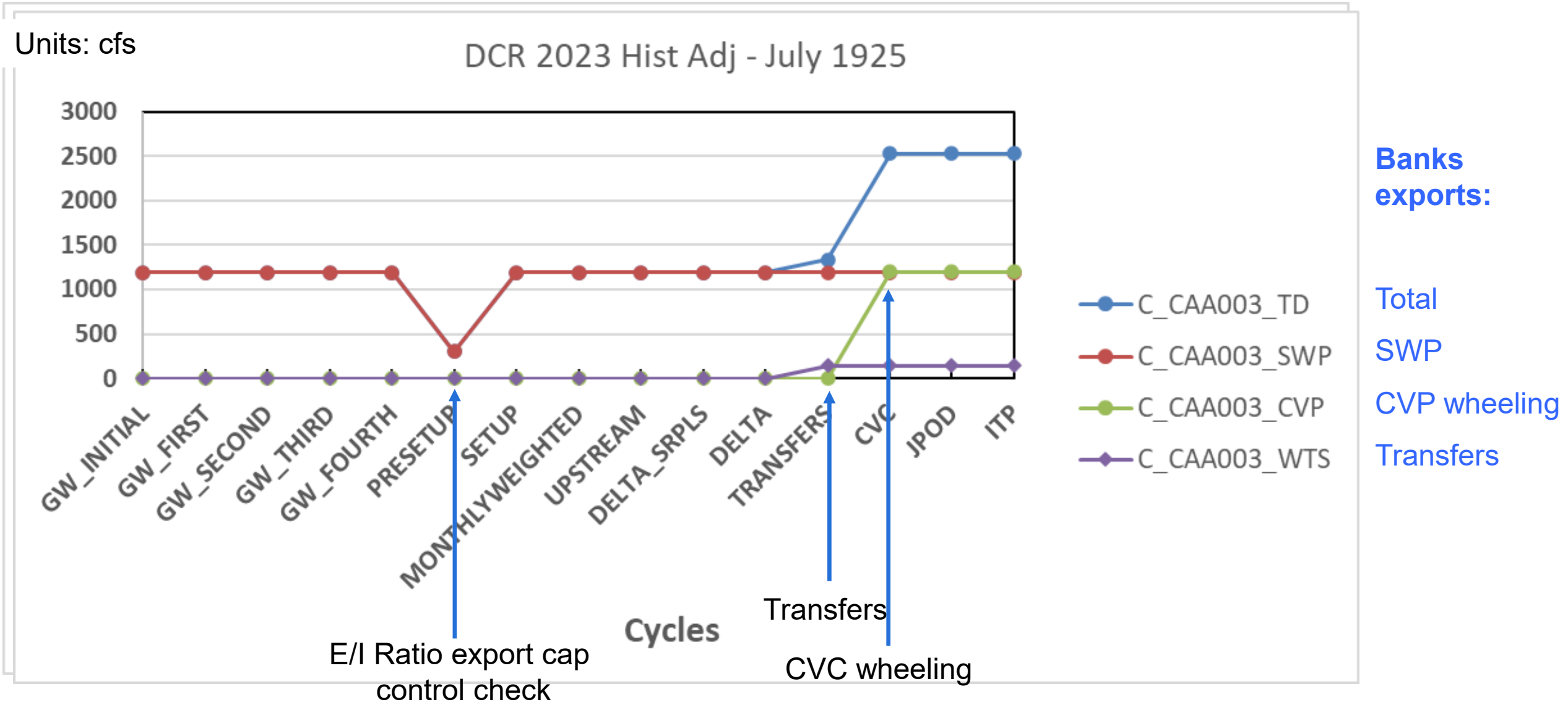
DCR 2023 Hist Adj - July 1999



Regional
surface
water /
ground
water
interaction
terms
(gains and
losses)



Examples of Baseline model iterative cycle solutions – Banks exports

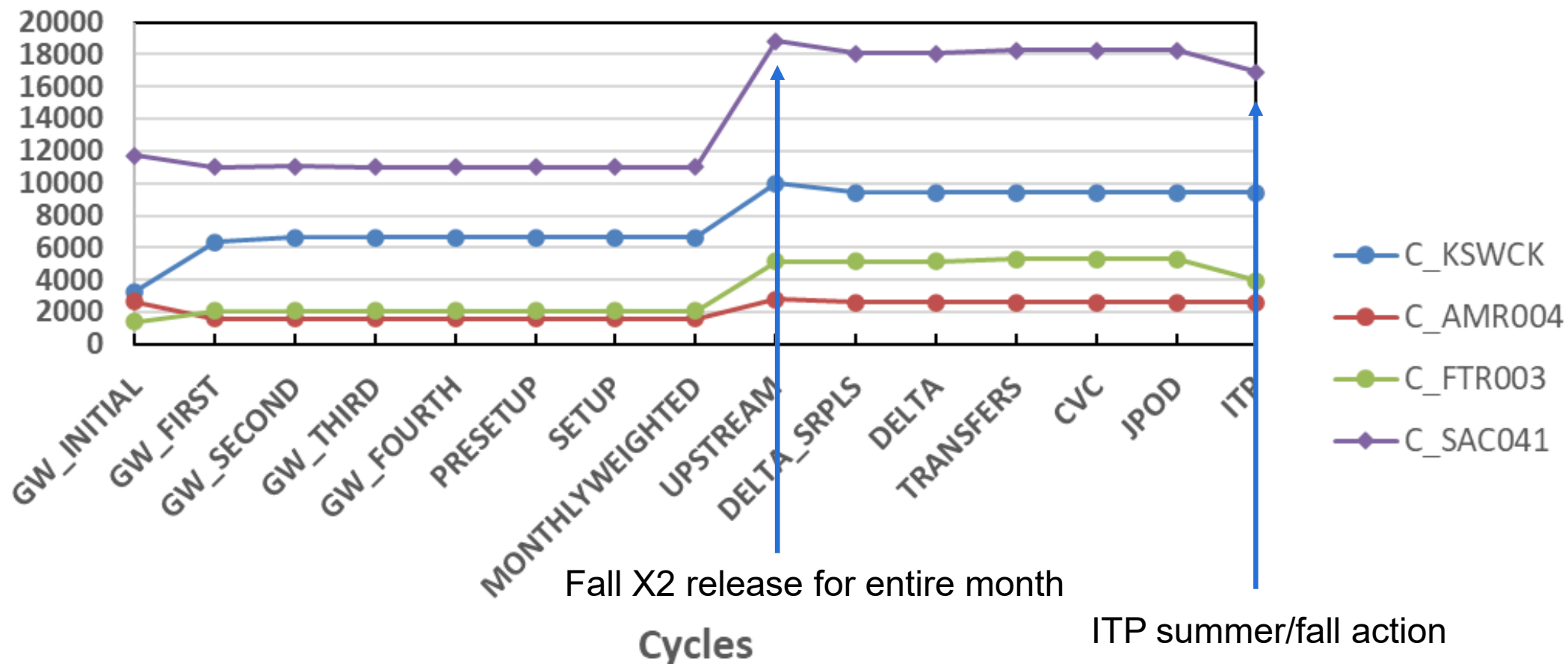




Examples of Baseline model iterative cycle solutions – River flows

Units: cfs

DCR 2023 2043 CC95 - Sep 1980



-Sac River
Keswick

-American
River

-Feather River

-Sac River
Hood



Cycle structure modification for project/operations implementation

- Sacramento Water Bank
 - Addition of operations in the TRANSFERS_STAGE1 cycle
- Delta Conveyance Project:
 - Operations implementation through three additional cycles



Cycle structure modification for Sacramento Water Bank

Implements conjunctive use operations for groundwater bank in the American River Basin (shifts between groundwater pumping and surface water diversions)

- Works well since American River Basin operations are very stable in this cycle



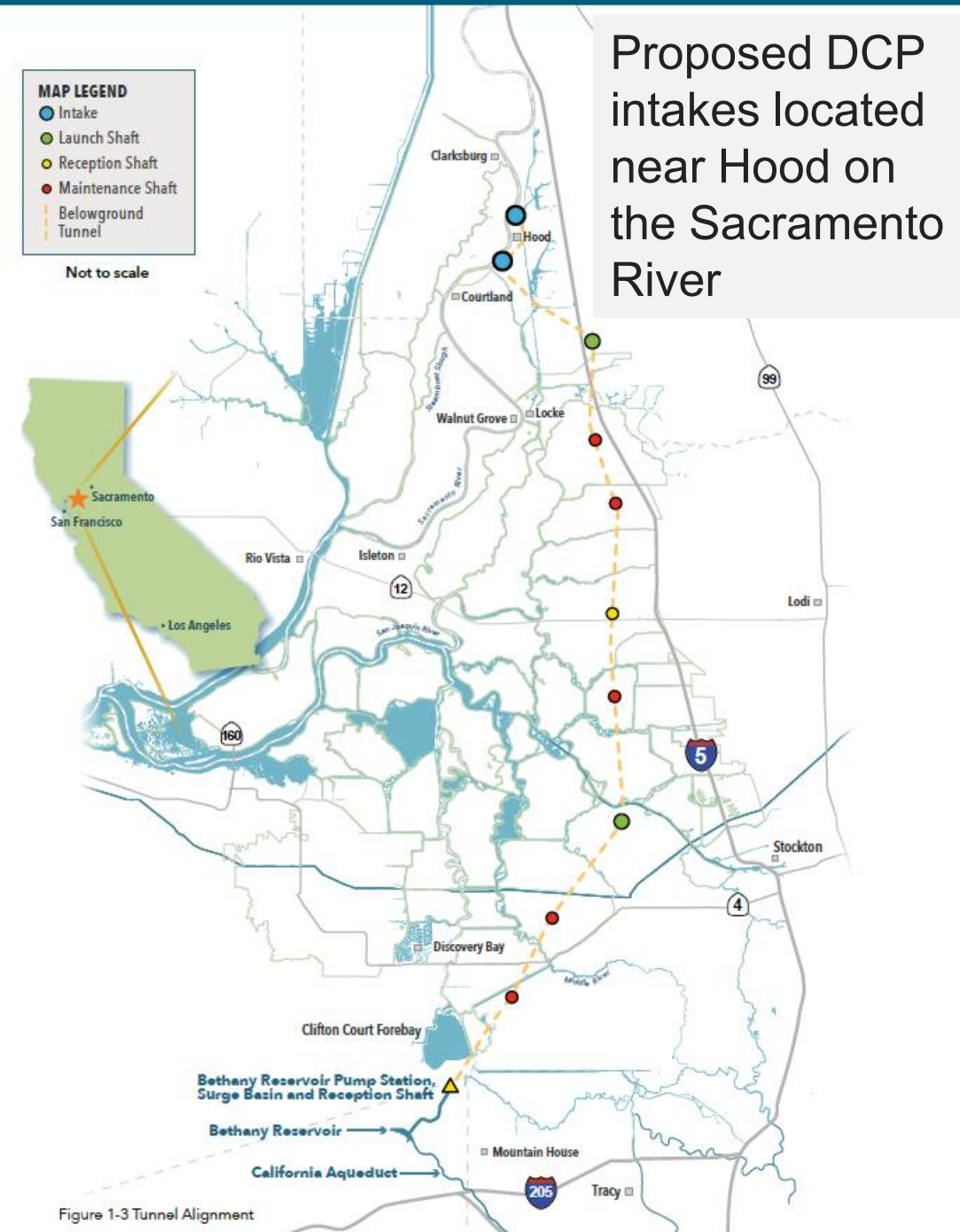
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SEQUENCE	CYCLE27	model	GW_THIRD
SEQUENCE	CYCLE28	model	GW_FOURTH
SEQUENCE	CYCLE29	model	PRESETUP
SEQUENCE	CYCLE30	model	SETUP
SEQUENCE	CYCLE31	model	MONTHLYWEIGHTED
SEQUENCE	CYCLE32	model	UPSTREAM
SEQUENCE	CYCLE33	model	DELTA_SRPLS
SEQUENCE	CYCLE34	model	DELTA
SEQUENCE	CYCLE35	model	TRANSFERS_STAGE1
SEQUENCE	CYCLE36	model	WHEELCVC
SEQUENCE	CYCLE37	model	WHEELJPOD
SEQUENCE	CYCLE38	model	ITP



Cycle structure modification for Delta Conveyance Project

Implementation of:

- Diversions of Delta Excess flows
- Shifting of exports (South to North)
- Refinement of COA sharing
- Improved project diversion accounting





Cycle structure modification for Delta Conveyance Project

NDD cycle: DCP diversions
(excess flows and shifting) and
carriage water benefits

NDD1 cycle: COA sharing
recheck (due to shift to
Balanced conditions or
E/I control)

NDD2 cycle: SWP export of
backed up carriage water
savings from Oroville

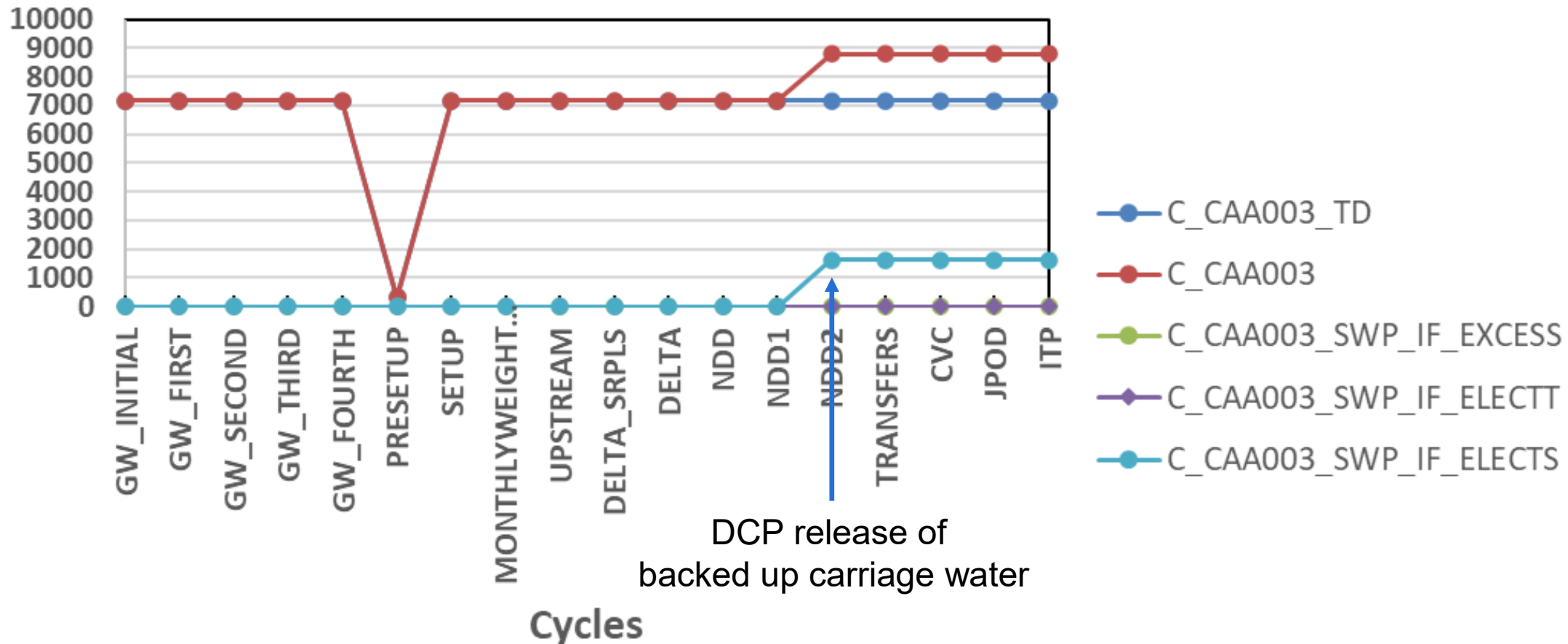
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SEQUENCE	CYCLE32	model	UPSTREAM
SEQUENCE	CYCLE33	model	DELTA_SRPLS
SEQUENCE	CYCLE34	model	DELTA
SEQUENCE	CYCLE35	model	NDD
SEQUENCE	CYCLE36	model	NDD1
SEQUENCE	CYCLE37	model	NDD2
SEQUENCE	CYCLE38	model	TRANSFERS_STAGE1
SEQUENCE	CYCLE39	model	WHEELCVC
SEQUENCE	CYCLE40	model	WHEELJPOD
SEQUENCE	CYCLE41	model	ITP



Cycle structure modification for Delta Conveyance Project

Units: cfs

DCP EIR Alt5 Existing - July 1923



SWP
exports:

South Delta

Total

NDD excess

NDD shifting

NDD carriage
water benefits



Cycle by Cycle QA-QC Procedures

AutoSave Off																		CS3 System Operations QA QC.xlsb																		FitzHugh, Thomas																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		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Conclusions

- CalSim 3 cycle structure is a complex and requires specialized tools to be able to review and understand
- Understanding of internal cycle changes and differences is important for understanding overall model behavior
- The tools presented are a good start in furthering CalSim 3 model user's ability to review and QA-QC the model, but IMHO further improvements are needed



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- DWR (material developed for recent CalSim 3 training course)
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 - Reclamation
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 - DWR
 - Stantec

Questions?

Thank You!
