CalLite 2.00 (Beta) Public Release

650 Capitol Mall

Stanford Room

Sacramento, CA

August 29, 2011

CalLite Development Team

- DWR
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  - Andy Draper
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- FWS
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  - Craig Anderson
- Consultant
  - Tad Slawecki
  - Daniel Rucinski
  - Nadira Kabir

Agenda

- **Model Background and Demo (1hr 30 minutes)**
  - Introductory Remarks
  - Overview of the Model
  - Model features
  - Model Demo
  - Corroboration study result

Break for 15 Minutes

- **Model Users Training and Utilities (1 hr 30 minutes)**
  - Pre and Post processing tools
  - Training exercise

WRIMS-Based CalLite Model Development & Update

Nancy Parker

Bureau of Reclamation

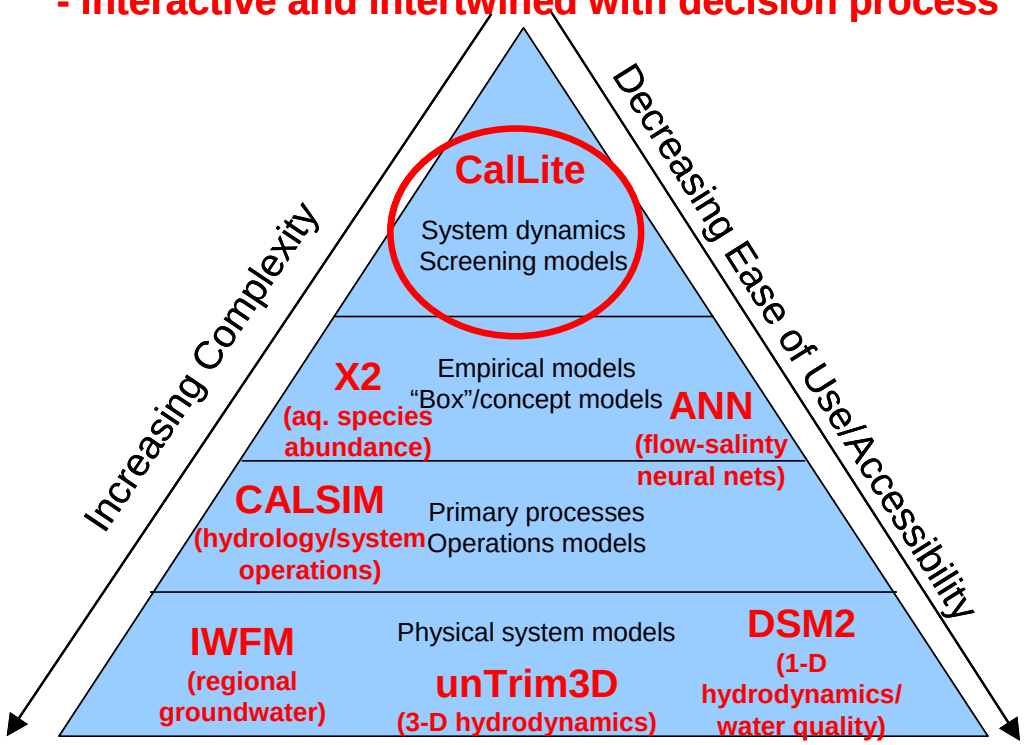
August 29, 2011

Outline

- Background
- WRIMS Implementation
- CalLite Enhancement
- CalLite Design
- CalLite Limitations
- Current Phase
- Future Phases

Background – What is CalLite?

- Open to use by non-experts
- Allows exploration
- Interactive and intertwined with decision process



Expert use only

Background – What Is CalLite?

- Screening tool for use by experienced modelers
- Educational tool for use by stakeholders

Background – CalLite Overview

- Central Valley Water Mgmt. Screening Model
- Maintains hydrologic, operational and institutional integrity represented in CALSIM
- Simulation Period is 82 years (1921-2003)
- Same ANN module used by CalSim represents Delta flow-salinity relationship
- New flexible GUI package enables selection of model options and enhanced output review

Background – Original GoldSim Implementation

- Corroboration studies (CalSim and CalLite) had differences due to solution algorithms
  - GoldSim couldn't use an external solver for optimization (i.e., XA solver for LP problem)
- Proprietary software with limitations on version control, scenario mgmt, and GUI features
- Steep learning curve; model just as complex

WRIMS Implementation

- WRIMS (Water Resources Integrated Modeling System) is developed and maintained by DWR and Reclamation (no proprietary issues)
- Corroboration studies more directly comparable given the same solution algorithm
- WRESL code expertise in place
- CalLite development used as training opportunity
- Platform to expand for daily time step modeling, channel routing, etc.

CalLite Enhancements

- Extended SOD representation includes Article 21 and detailed contractor deliveries
- Wheeling (CVC and JPOD) options
- B2 actions represented
- Biological Opinion RPAs
- SWRCB flow criteria comparisons

CalLite Enhancements

- Enhanced and flexible graphical user interface
  - No limit to number of scenarios
  - Availability of desired GUI elements
  - Improved results display tool
  - Completely separate from the WRIMS model
- Enhanced pre- and post- processing tools
  - WRESL utility "CalSim to CalLite"
  - Report tool
  - Google map based "Data on the Web"

CalLite Design

Developer

WRIMS

WRESL

GUI.xml
GUILink
.table

Compiled
WRESL

Compiled
GUI code

CalLite Package

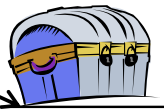
CalLite.exe
Libs/DLLs
Input DSS files
Lookup tables

CalLite GUI

End User

Temp Folder
- CalLite.exe & Libs
-Mod. Input File
- Mod. Look up tables

Run



.cls (CalLite scenario
file to store)

User Input

Alt1.dss

Alt2.dss

. . . . .

Post
Processing

CalLite Limitations

- Switches for D1641 and RPA elements
- User-defined input data limited to certain criteria
- Potential for unanticipated results
- Coarse scale does not capture some flow and delivery results
- Dependent on CalSimII basis

Current Phase

- CalLite beta release includes:
  - Regulations – D1641, B2, BO-RPAs, User Defined
  - Level of Development – Existing and Future
  - Vernalis Adaptive Management Plan– On or Off
  - Demands- Variable, Future/Full, User Defined
  - Other Operations- WSI-DI Allocation, Wheeling

Future Phases

- Water Management Action Implementation
  - Isolated Facility,
  - Banks Pumping Plant
  - Habitat Restoration
  - Storage Investigations
    - NODOS
    - Los Vaqueros Enlargement
    - Shasta Enlargement
    - Upper San Joaquin Storage
- GUI enhancements – scenario mgmt., XML, …

Future Phases

- Daily time step model, including channel routing
- Dynamic San Joaquin River representation
- Hydrology Inputs
  - Probabilistic/Monte Carlo simulations
  - Climate change scenarios
  - CA Water Plan Update
- Forecast-based allocation method options

Anticipated Applications

- Water plan updates
- Reservoir reoperation
- O&M daily operation/forecasting tool
- Storage investigations
- Cost Allocation (Reclamation)
- Delta alternative investigations
- Stakeholder education

Using CalLite

- FREE – no software or licenses to buy
  - Agencies supporting limited XA solver version
  - No FORTRAN compiler required
- Run time ~ 5 minutes
- CalLite results are within 3% of CalSim
- Enhanced pre- and post- processing tools

CalLite Release

- Current Phase Release
  - Software package – Model, GUI, Utilities
  - Documentation – User's Manual and Tutorial
  - Training and Distribution
    - Beta Release – August 29, 2011
    - Beta Release Feedback – October 14, 2011
    - Final Release – Winter 2012

CalLite Model Features

Tom FitzHugh

Bureau of Reclamation

August 29, 2011

Outline

- Summary of model features
- Schematic
- Model structure in WRIMS
- Enhancement of CalLite features

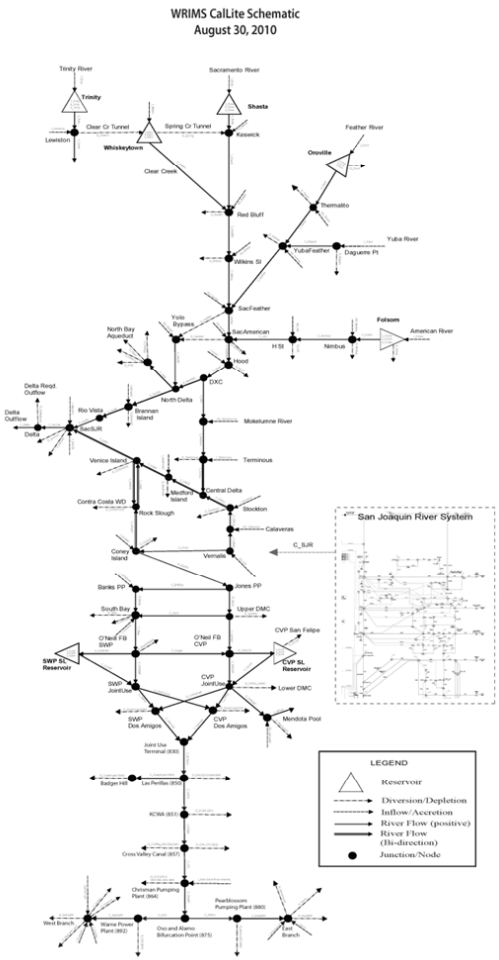
CalLite Model Features

- CalLite Model includes:
  - Regulations – D-1641, B2, BO-RPAs, User Defined, Proposed Delta Flow Criteria
  - Levels of Development – Existing and Future
  - Hydroclimate – 0, 15, and 45 cm Sea Level Rise with ANN
  - Demands – SWP Variable and Full Table A; CVP Full Contract; SWP and CVP User Defined
  - Operations – WSI-DI for Allocation; Wheeling and Intertie Operations

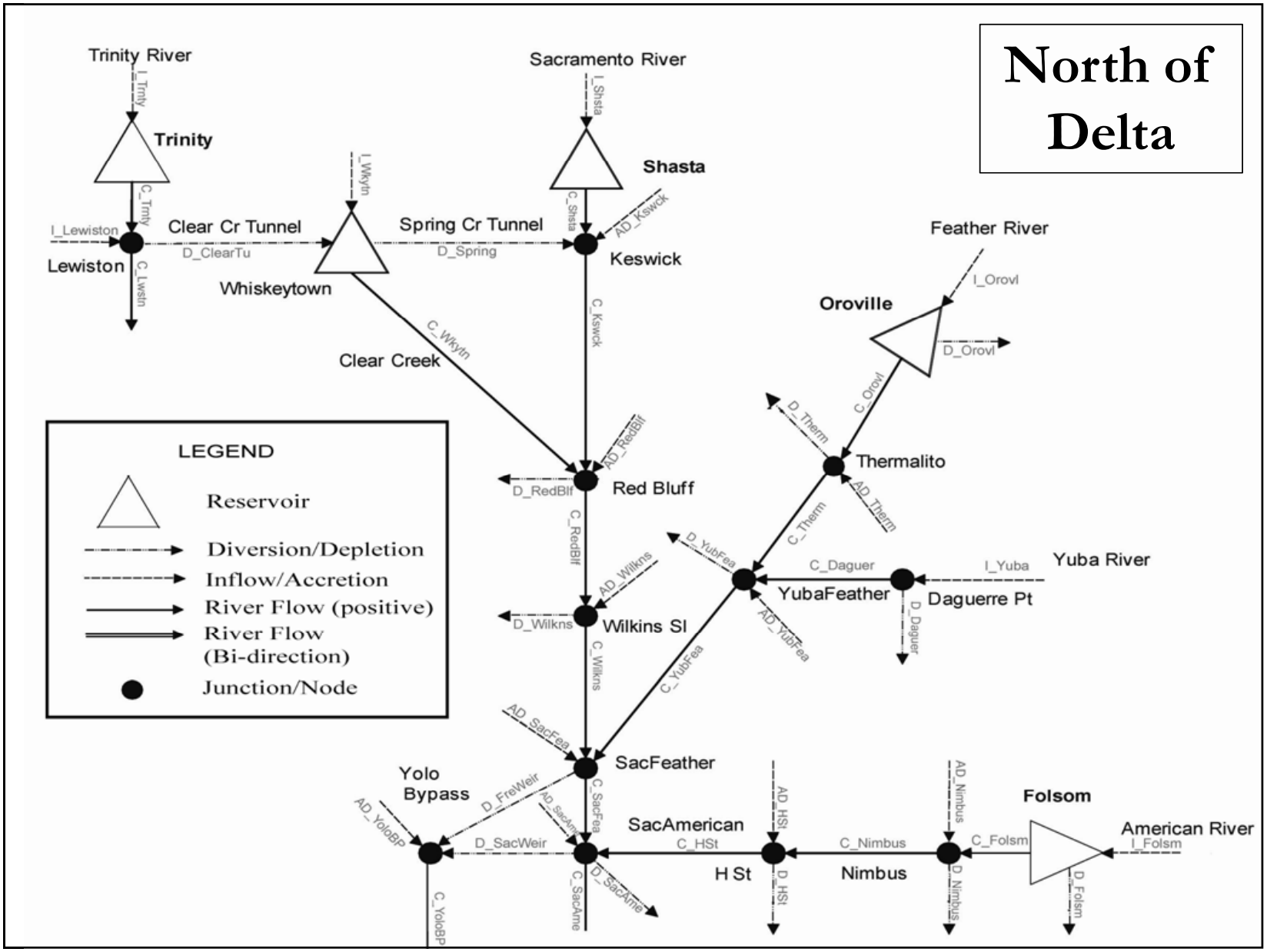
CalLite Schematic

- Current schematic does not include San Joaquin, that is handled as pre-processed input to model.

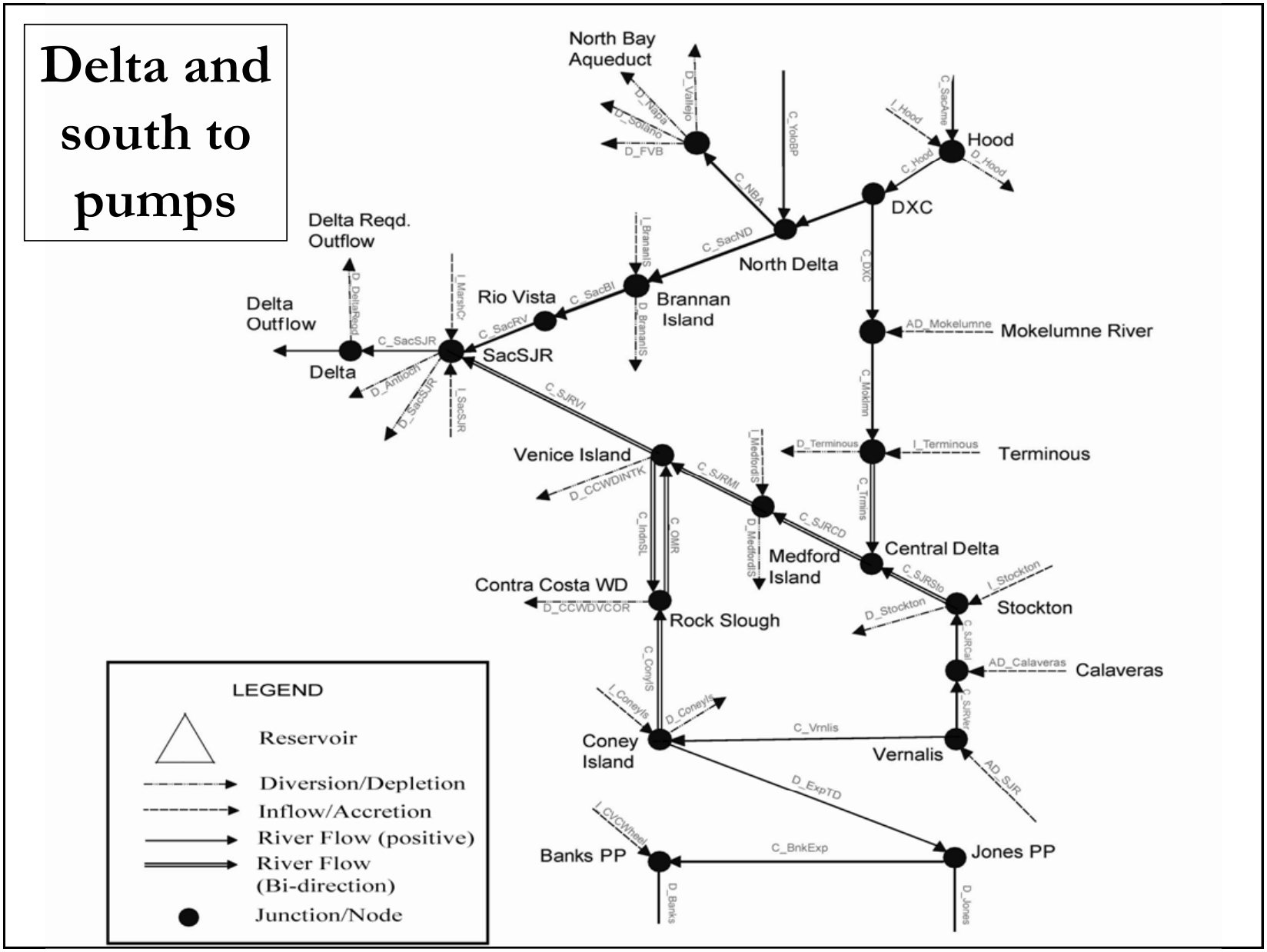
- More detail in South of Delta area than previous CalLite, along California Aqueduct and Delta-Mendota Canal



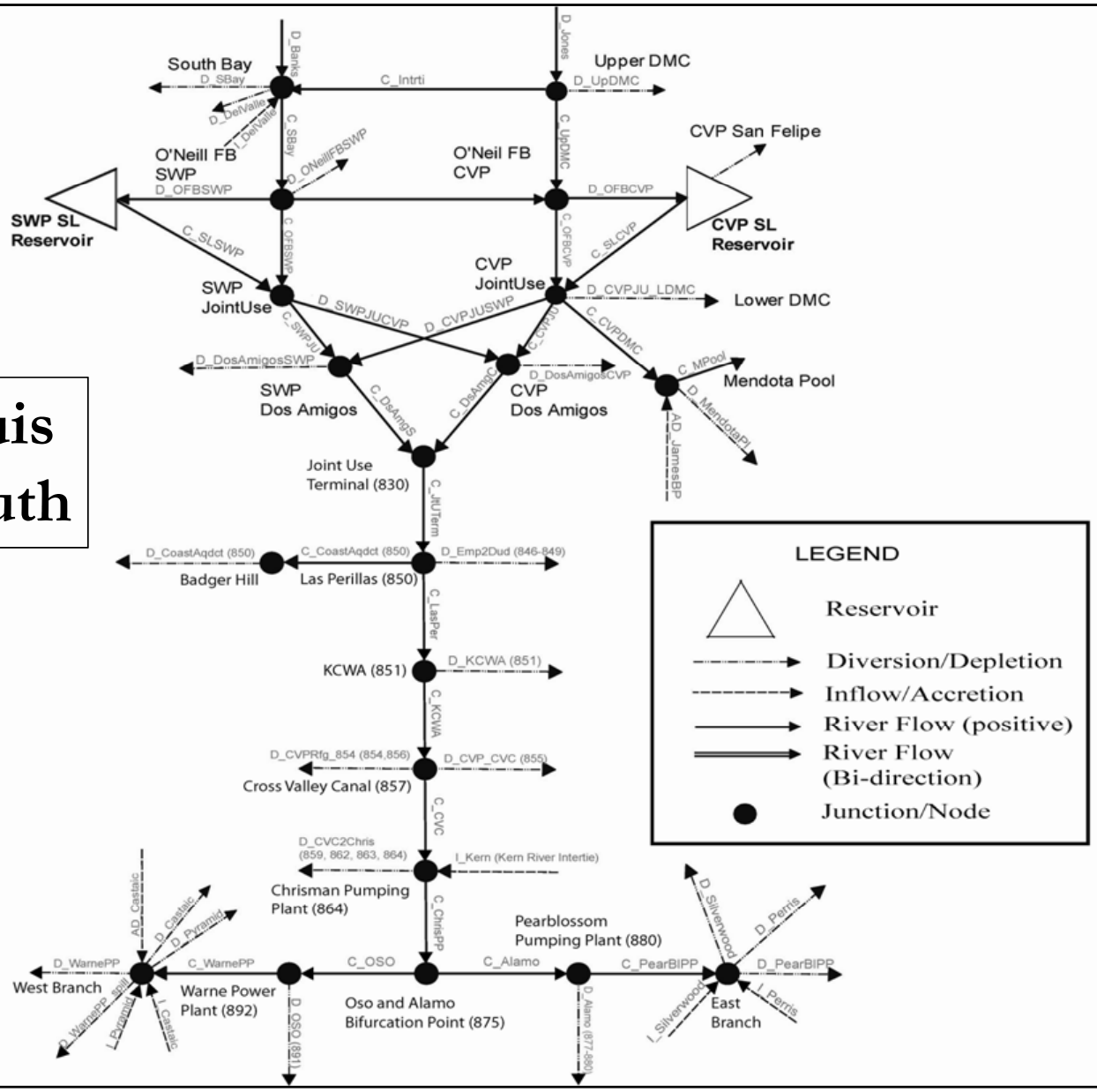
North of Delta



Delta and south to pumps



San Luis and south



WRIMS Model Structure

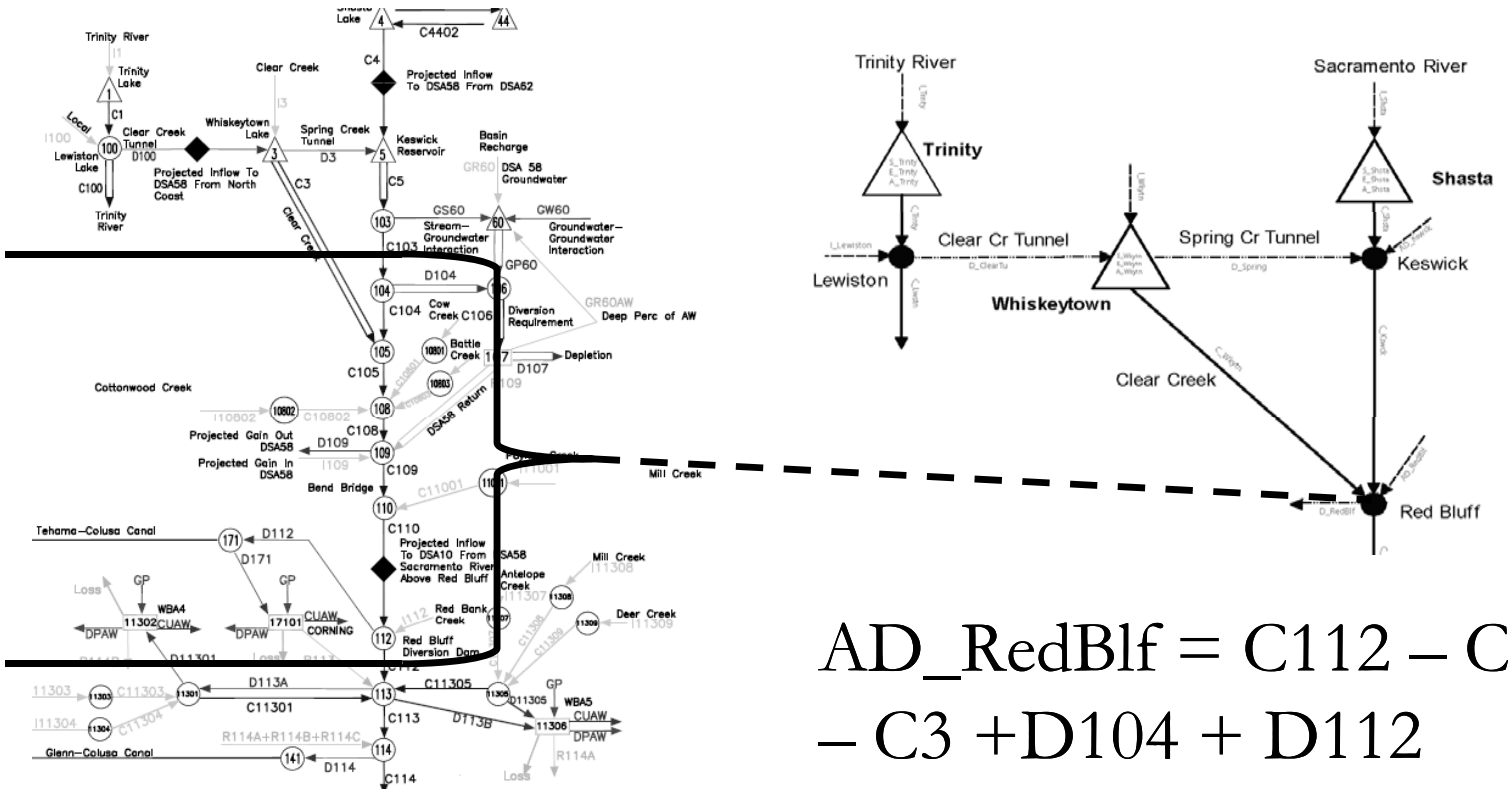
- WRESL code logic mimics logic in CalSim II
  - Changes were made to adjust CalSim II code to the more aggregated CalLite schematic and reduced number of cycles
  - Two cycles in CalLite, vs. 8-10 in a typical CalSim II study
- More aggregated schematic and fewer cycles reduces run-time significantly, to ~5 minutes

WRIMS Model Structure

- Deliveries:
  - CVP and SWP project deliveries simulated dynamically
  - Non-project deliveries are fixed as timeseries from a CalSim II run
- Accretion-Depletion terms:
  - To account for differences between CalSim II and CalLite (more detailed schematic, return flows, gw pumping) adjustments are made at each CalLite node based on Calsim II outputs
  - Implemented as soft constraints, CalLite will report shortages in these terms.

WRIMS Model Structure

- Example of Accretion-Depletion term:



AD_RedBlf = C112 – C5 – C3 +D104 + D112

Regulatory Standards

- In addition to D-1641 standards, CalLite includes:
  - CVPIA (b)(2) water
  - Biological Opinion Reasonable and Prudent Alternative (RPAs) for:
    - Clear Creek and Lower American River
    - Fall X2, Old and Middle River (OMR), and Delta Cross Channel (DCC)
    - Export cap based on Vernalis flow
  - Delta Flow Criteria. Not implemented as constraints in the model, but the user can compare flows to them.

Regulatory Standards

- RPAs in CalLite:
  - Can be switched on or off individually
  - Allocation logic is adjusted depending on which RPAs are on
- User-defined regulatory standards:
  - OMR criteria, DCC criteria, Delta Flow Criteria
  - X2 rqmt and minimum delta outflow
  - Export-inflow ratios for Delta outflow and Vernalis flow
  - Rio Vista, QWEST, and Vernalis minflow rqmts

Project Deliveries

- Allocation and delivery logic computes deliveries just like in Calsim II. Calsim level deliveries are then aggregated into CalLite deliveries
  - Example: D_Wilkns_P = D114 + D122A + D122B + D129A + D128
  - D114, D122A etc deliveries are available in DSS
- SWP Article 56 (carryover) deliveries
- SWP Article 21 (interruptible) deliveries

Project Deliveries

- Wheeling deliveries:
  - Cross-Valley Canal (CVC) wheeling
  - Joint Point of Diversion (JPOD)
- Delta-Mendota Canal/California Aqueduct Intertie
- User-defined CVP and SWP SOD deliveries:
  - CVP: Can specify agriculture, M&I, and refuge max demands
  - SWP: Can specify MWD, other M&I, and agriculture max demands, and max Article 21 deliveries

Conclusions

- WRIMS CalLite replicates Goldsim CalLite features and functionality, with some important enhancements:
  - More detail in SOD area
  - Includes (b)(2) and BO RPA standards
  - Wheeling and Calsim-level deliveries

CalLite 2.00
(Beta) Model Demo

Nazrul Islam, Senior Engineer

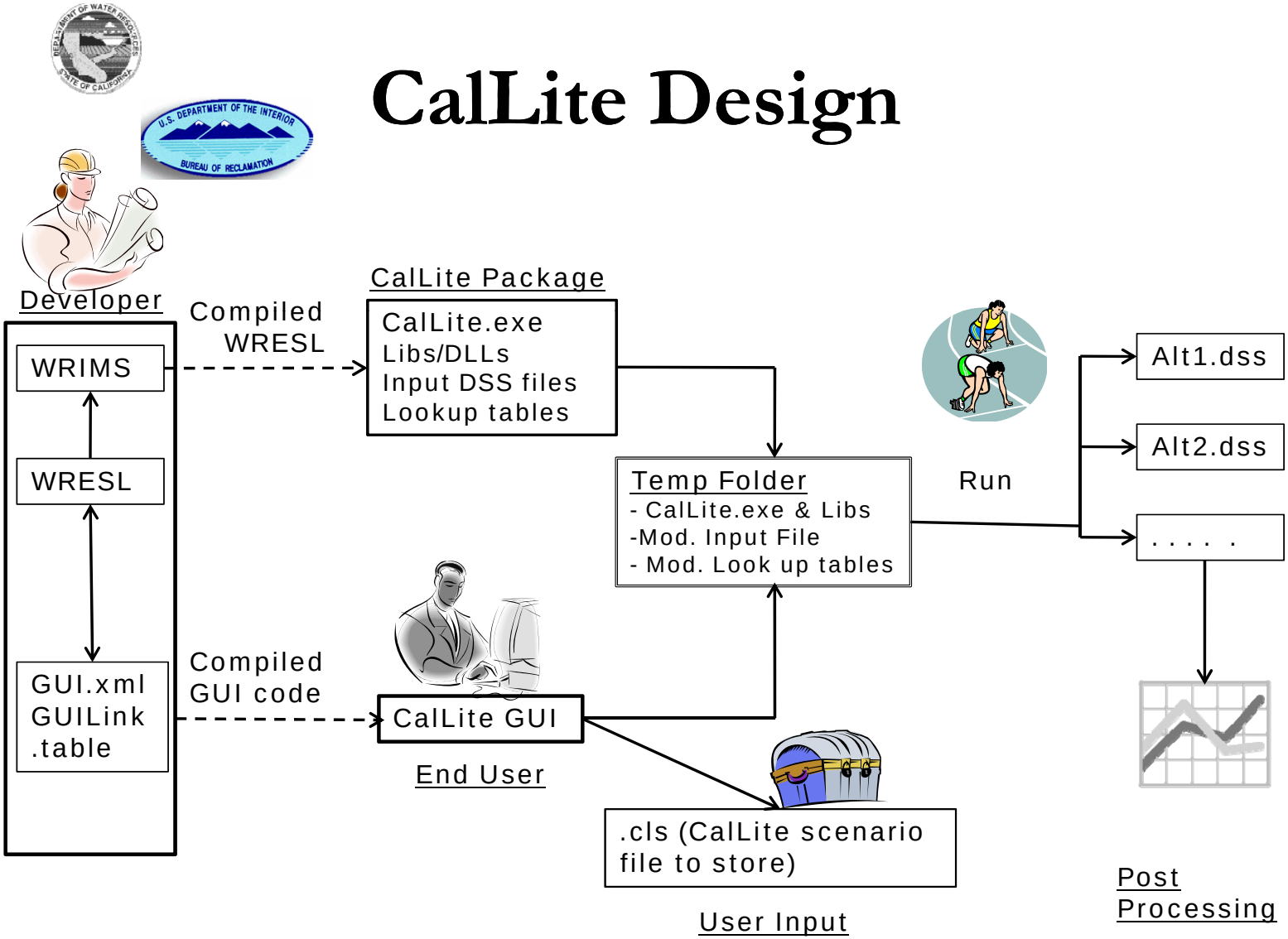
Department of Water Resources, CA

August 29, 2011

CaLite GUI demo

- GUI design
- GUI demo
  - Setup and run a scenario
  - Explore results
- Configuration files - .xml, gui link tables

CalLite Design



GUI.xml

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        <hbox>
            <gridbagconstraints anchor="GridBagConstraints.NORTHWEST"
                gridx="0" gridy="0" insets="0,10,0,0" />
            <button id="btnAddScenario" name="btnAddScenario" text="Add" />
            <button id="btnDelScenario" name="btnDelScenario" text="Delete" />
            <button id="btnClearScenario" name="btnClearScenario"
                text="Clear All" />
        </hbox>

        <scrollpane name="spsl" id="spsl" minimumsize="410,100"
            preferredsize="410,100">
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                anchor="GridBagConstraints.NORTHWEST" gridx="0" gridy="1" />
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            </list>
        </scrollpane>

        <hbox>
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                anchor="GridBagConstraints.WEST" gridx="0" gridy="2" />
            <buttongroup>
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                </radiobutton>
                <radiobutton name="rdbp001" id="rdbp001" text="Comparison"
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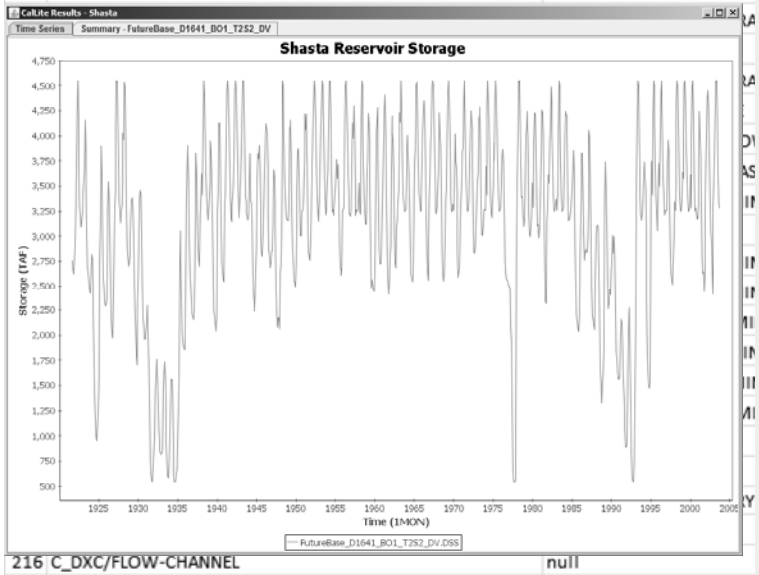
                </radiobutton>
                <radiobutton name="rdbp002" id="rdbp002" text="Difference"
                    enabled="false">
                </radiobutton>
```

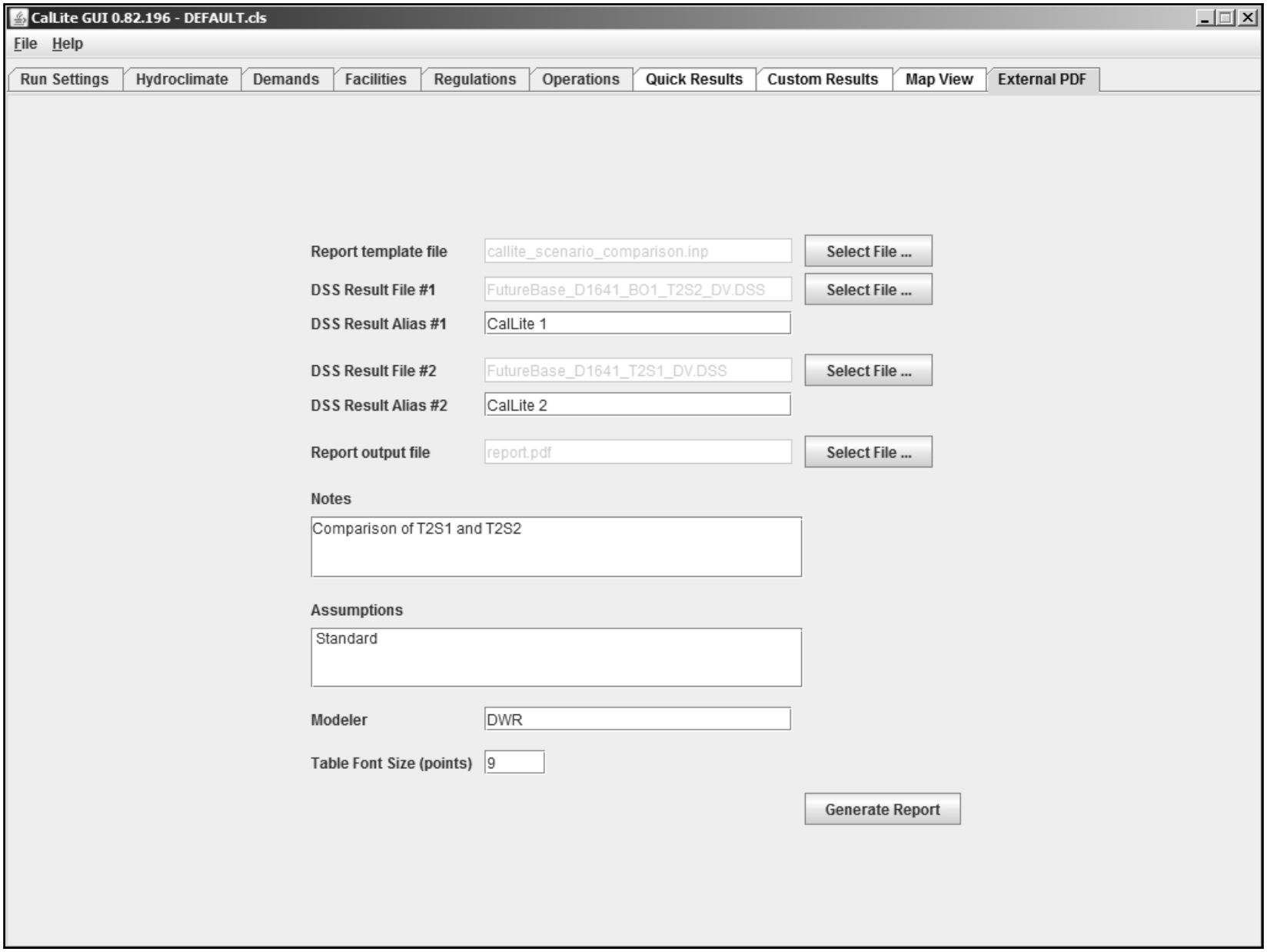
GUI_Links2.table

ckbReg3	GUI_D1641Regs.table	1	-2	DCC_DLTSW - Delta Cross Channel	Regulations	gui_xchanneldays
ckbReg8	GUI_D1641Regs.table	2	-2	EI_DLTSW - Export-Inflow Ratio	Regulations	gui_EIRatio
ckbReg6	GUI_D1641Regs.table	3	-2	NDO_DLTSW - Minimum Net Delta Outflow	Regulations	GUI_NDO_Flow
ckbReg4	GUI_D1641Regs.table	4	-2	RV_DLTSW - Sacramento River at Rio Vista Minimum Fl	Regulations	gui_RioVista
ckbReg7	GUI_D1641Regs.table	5	-2	X2_DLTSW - X2 Requirements	Regulations	gui_x2active|gui_x2km
ckbReg15	GUI_D1641Regs.table	6	-1	X2ROE_DLTSW - Roe Trigger	Regulations	
ckbReg9	GUI_D1641Regs.table	7	-1	VAMP_DLTSW - Vernalis	Regulations	
ckbReg11	GUI_D1641Regs.table	8	-1	EM_DLTSW - Emmaton	Regulations	
ckbReg12	GUI_D1641Regs.table	9	-1	JP_DLTSW - Jersey Point	Regulations	
ckbReg13	GUI_D1641Regs.table	10	-1	RS_DLTSW - Rock Slough	Regulations	
ckbReg14	GUI_D1641Regs.table	11	-1	CO_DLTSW - Collinsville	Regulations	

GUI_Links3.table

ID	Primary	Secondary	Ytitle	Title	Slegend
102	S_TRNTY/STORAGE	null	Storage	Trinity Reservoir Storage	null
103	S_SHSTA/STORAGE+SHSTAE/STORAGE	null	Storage	Shasta Reservoir Storage	null
104	S_FOLSM/STORAGE	null	Storage	Folsom Reservoir Storage	null
105	S_TRNTY/STORAGE+S_SHSTA/STORAGE+S_FOLSM/STORAGE	null	Storage	CVP North of Delta Storage	null
106	S_SLCVP/STORAGE	null	Storage	CVP San Luis Reservoir Storage	null
107	S_OROVL/STORAGE	null	Storage	Oroville Reservoir Storage	null
108	S_SLSWP/STORAGE	null			
111	S_TRNTY/STORAGE	S_TRNTYLEVEL4DV/STORA			
112	S_SHSTA/STORAGE+SHSTAE/STORAGE	S_SHSTALEVEL5DV/STORA			
216	C_DXC/FLOW-CHANNEL	null			
217	C_SACRV/FLOW-CHANNEL	C_SACRV_MIF/FLOW-MIN			
218	C_OMR/FLOW-CHANNEL	C_INDNSL/FLOW-CHANNE			
219	C_SJRVI/FLOW-CHANNEL	null			




CalLite GUI 0.82.196 - DEFAULT.cls
File
Help
Run Settings
Hydroclimate
Demands
Facilities
Regulations
Operations
Quick Results
Custom Results
Map View
External PDF
Report template file
callite_scenario_comparison.inp
Select File ...
DSS Result File #1
FutureBase_D1641_BO1_T2S2_DV.DSS
Select File ...
DSS Result Alias #1
CalLite 1
DSS Result File #2
FutureBase_D1641_T2S1_DV.DSS
Select File ...
DSS Result Alias #2
CalLite 2
Report output file
report.pdf
Select File ...
Notes
Comparison of T2S1 and T2S2
Assumptions
Standard
Modeler
DWR
Table Font Size (points)
9
Generate Report

PDF Report Template

```
# A template file to compare calsim with callite
SCALAR
NAME            VALUE
FILE_BASE       test/2020D09E_121510_DV.DSS #input file 1
NAME_BASE       CalSim
FILE_ALT        test/CL_2020D09E_BO_121510_DV.DSS # input file 2
NAME_ALT        CalLite
OUTFILE         test/Calsim_vs_Callite_021611.pdf
NOTE            "Notes: Corroboration Study with BO; CalSim: BO ver
ASSUMPTIONS     "Assumptions: Future Condition; Wheeling is On"
MODELER         "Nazrul Islam"
END

PATHNAME_MAPPING
VARIABLE                          VAR_CATEGORY    REPORT_TYPE
"Trinirty Storage"                S               Exceedance
"Shasta Storage"                  S               Exceedance
"FolSom Storage"                  S               Exceedance
"NOD Storage"                     S               Exceedance_
"Orovile Storage"                 S               Exceedance
"CVP SanLuis Storage"             S               Exceedance
"SWP SanLuis Storage"             S               Exceedance
"River Flow"                      RF              Average
"Trinity R blw Lewiston"          RF              Average
"Trinity Export"                  RF              Average
"Clear Cr blw Whiskeytown"        RF              Average
"Sacramento R @ Keswick"          RF              Average
"Sacramento R @ Wilkins Slough"   RF              Average
"Feather R blw Thermalito"        RF              Average
"American R blw Nimbus"           RF              Average
"Delta Inflow"                    DI              Average_post
"Sacramento R @ Hood"             DI              Average
"Yolo Bypass"                     DI              Average
"Mokelumne R"                     DI              Average
"San Joaquin R & Calaveras"       DI              Average
"Delta Outflow"                   DO              Average
"Delta Outflow for X2 and NDO"    DO              Average
"Delta Exports"                   DE              Average_post
"Banks SWP"                       DE              Average
"Banks CVP"                       DE              Average
"Jones"                           DE              Average
"SWP SOD Deliveries"              SWPSOD          Avg_Excd_post
"Table A (Incl. Article 56)"      SWPSOD          Average
"Article 21"                      SWPSOD          Average
"Article 56"                      SWPSOD          Average
"CVP SOD Deliveries"              CVPSOD          Avg_Excd
"SWP Table A Allocation"          ALLOC           Exceedance

                                                  //D100/FLOW-DELIVERY//1MON//
                                                  //C3/FLOW-CHANNEL//1MON//
                                                  //C5/FLOW-CHANNEL//1MON//
                                                  //C129/FLOW-CHANNEL//1MON//
                                                  //C203/FLOW-CHANNEL//1MON//
                                                  //C9/FLOW-CHANNEL//1MON//
                                                  //C400+C157+C504+C644/FLOW-CHANNEL//1MON//
                                                  //C400/FLOW-CHANNEL//1MON//
                                                  //C157/FLOW-CHANNEL//1MON//
                                                  //C504/FLOW-CHANNEL//1MON//
                                                  //C644/FLOW-CHANNEL//1MON//
                                                  //C407/FLOW-CHANNEL//1MON//
                                                  //D407/FLOW-DELIVERY//1MON//
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                                                  //SWP_TA_TOTAL+SWP_IN_TOTAL+SWP_CO_TOTAL///1MON//
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                                                  //SWP_IN_TOTAL/SWP_DELIVERY//1MON//
                                                  //SWP_CO_TOTAL/SWP_DELIVERY//1MON//
                                                  //CVPTOTALDEL/FLOW-DELIVERY//1MON//
                                                  //SWP_PERDELDV/SWP-DELIVERY//1MON//
```

System Flow Comparision: CalLite vs CalLite

Comparison of T2S1 and T2S2

Standard

	1922-2003				1929-1934				1987-1992			
	CalLite	CalLite	Diff	% Diff	CalLite	CalLite	Diff	% Diff	CalLite	CalLite	Diff	% Diff
River Flow												
Trinity R blw Lewiston	606	606	1	0	411	411	0	0	472	472	0	0
Trinity Export	638	637	2	0	384	431	-48	-11	431	479	-48	-10
Clear Cr blw Whiskeytown	122	122	0	0	86	86	0	0	102	102	0	0
Sacramento R @ Keswick	6580	6580	3	0	4090	4160	-69	-2	4481	4619	-137	-3
Sacramento R @ Wilkins Slough	6619	6625	-6	0	4066	4140	-73	-2	4724	4883	-159	-3
Feather R blw Thermalito	3167	3170	-3	0	1633	1614	19	1	1625	1567	57	4
American R blw Nimbus	2386	2386	-1	0	1268	1269	-1	0	1119	1136	-16	-1
Delta Inflow	21574	21584	-10	0	9976	10031	-55	-1	10469	10588	-119	-1
Sacramento R @ Hood	18506	18584	12	0	8324	8378	-56	-1	9102	9220	-118	-1
Yolo Bypass	2287	2309	-22	-1	101	101	0	0	141	142	-1	-1
Mokelumne R	666	666	0	0	206	206	0	0	155	155	0	0
San Joaquin R & Calaveras	3024	3024	0	0	1346	1346	0	0	1071	1071	0	0
Delta Outflow	14587	15166	-579	-4	5124	5515	-390	-7	5415	6023	-608	-10
Delta Outflow for X2 and NDO	4392	4337	45	1	4119	4025	94	2	3959	3924	-65	-2
Delta Exports	6815	5449	566	10	3682	3347	336	10	3817	3330	487	15
Banks SWP	2498	3039	-459	16	2164	1844	320	17	2167	1787	379	21
Banks CVP	82	76	7	0	13	11	1	13	26	17	8	44
Jones	2435	2335	101	4	1506	1491	14	1	1625	1525	100	7
SWP SOD Deliveries	3481	3016	465	15	2144	1809	336	19	2177	1769	409	23
Table A (incl. Article 56)	3095	2779	316	11	1735	1694	41	2	1970	1671	299	18
Article 21	264	110	154	139	373	82	291	357	156	21	135	656
Article 56	122	126	-4	-3	36	33	3	9	51	77	-26	-33
CVP SOD Deliveries	2624	2518	106	4	1490	1465	25	2	1742	1633	109	7

PDF Report Template

```
# A template file to compare calsim with callite
SCALAR
NAME            VALUE
FILE_BASE       test/2020D09E_121510_DV.DSS #input file 1
NAME_BASE       CalSim
FILE_ALT        test/CL_2020D09E_BO_121510_DV.DSS # input file 2
NAME_ALT        CalLite
OUTFILE         test/Calsim_vs_Callite_021611.pdf
NOTE            "Notes: Corroboration Study with BO; CalSim: BO version (12/15/2010) and CalLite: BO version*(12/17/2010); Future Co
ASSUMPTIONS     "Assumptions: Future Condition; Wheeling is On"
MODELER         "Nazrul Islam"
END

PATHNAME_MAPPING
VARIABLE                          VAR_CATEGORY   REPORT_TYPE     PATH_BASE                                                    PATH
"Trinirty Storage"                S              Exceedance      //S1/STORAGE//1MON//                                         //S_
"Shasta Storage"                  S              Exceedance      //S4/STORAGE//1MON//                                         //S_
"Folsom Storage"                  S              Exceedance      //S8/STORAGE//1MON//                                         //S_
"NOD Storage"                     S              Exceedance_Post //S1+S4+S8/STORAGE//1MON//                                   //S_
"Orovile Storage"                 S              Exceedance      //S6/STORAGE//1MON//                                         //S_
"CVP SanLuis Storage"             S              Exceedance      //S11/STORAGE//1MON//                                        //S_
"SWP SanLuis Storage"             S              Exceedance      //S12/STORAGE//1MON//                                        //S_
"River Flow"                      RF             Average         IGNORE                                                       IGNO
"Trinity R blw Lewiston"          RF             Average         //C100/FLOW-CHANNEL//1MON//                                  //C_
"Trinity Export"                  RF             Average         //D100/FLOW-DELIVERY//1MON//                                 //D_
"Clear Cr blw Whiskeytown"        RF             Average         //C3/FLOW-CHANNEL//1MON//                                    //C_
"Sacramento R @ Keswick"          RF             Average         //C5/FLOW-CHANNEL//1MON//                                    //C_
"Sacramento R @ Wilkins Slough"   RF             Average         //C129/FLOW-CHANNEL//1MON//                                  //C_
"Feather R blw Thermalito"        RF             Average         //C203/FLOW-CHANNEL//1MON//                                  //C_
"American R blw Nimbus"           RF             Average         //C9/FLOW-CHANNEL//1MON//                                    //C_
"Delta Inflow"                    DI             Average_post    //C400+C157+C504+C644/FLOW-CHANNEL//1MON//                   //C_
"Sacramento R @ Hood"             DI             Average         //C400/FLOW-CHANNEL//1MON//                                  //C_
"Yolo Bypass"                     DI             Average         //C157/FLOW-CHANNEL//1MON//                                  //C_
"Mokelumne R"                     DI             Average         //C504/FLOW-CHANNEL//1MON//                                  //C_
"San Joaquin R & Calaveras"       DI             Average         //C644/FLOW-CHANNEL//1MON//                                  //C_
"Delta Outflow"                   DO             Average         //C407/FLOW-CHANNEL//1MON//                                  //C_
"Delta Outflow for X2 and NDO"    DO             Average         //D407/FLOW-DELIVERY//1MON//                                 //D_
"Delta Exports"                   DE             Average_post    //D419+D419_CVP+D418/FLOW-DELIVERY//1MON//                   //D_
"Banks SWP"                       DE             Average         //D419/FLOW-DELIVERY//1MON//                                 //D_
"Banks CVP"                       DE             Average         //D419_CVP/FLOW-DELIVERY//1MON//                             //D_
"Jones"                           DE             Average         //D418/FLOW-DELIVERY//1MON//                                 //D_
"SWP SOD Deliveries"              SWPSOD         Avg_Excd_post   //SWP_TA_TOTAL+SWP_IN_TOTAL+SWP_CO_TOTAL///1MON//           //SW
"Table A (Incl. Article 56)"      SWPSOD         Average         //SWP_TA_TOTAL/SWP_DELIVERY//1MON//                          //SW
"Article 21"                      SWPSOD         Average         //SWP_IN_TOTAL/SWP_DELIVERY//1MON//                          //SW
"Article 56"                      SWPSOD         Average         //SWP_CO_TOTAL/SWP_DELIVERY//1MON//                          //SW
"CVP SOD Deliveries"              CVPSOD         Avg_Excd        //CVPTOTALDEL/FLOW-DELIVERY//1MON//                          //CV
"SWP Table A Allocation"          ALLOC          Exceedance      //SWP_PERDELDV/SWP-DELIVERY//1MON//                          //SW
```

Flexibility of Approach

- User interface and plotting actions defined separately from code
  - Reconfigurable without recompiling
  - Modeler can control labels, time series, etc. without programming
- Open source, portable implementation
  - Eclipse + Java + SwiXML + HECDSS + JFreeChart

CalLite Model Corroboration Study Results

Erik Reyes

Department of Water Resources

August 29, 2011

Corroboration Studies

- CalLite results compared to CalSim II results under the following conditions:
  - Future (2020) with pre-BO standards. Pre-BO standards are D-1641 and CVPIA (b)(2)
  - Existing (2005) and Future (2020) with BO standards
  - Impacts of switches and use of user-defined demands on model outputs

System Flow Comparison: CalLIte vs CalSim

Notes: Corroboration Study for D1641 regulation; CalSim: PreBO version and CalLite: D1641 regulation; Future LOD and Demand

	1922-2003				1929-1934				1987-1992			
	CalLite Alt	**CalSim Base**	**Diff**	**% Diff**	**CalLite Alt**	**CalSim Base**	**Diff**	**% Diff**	**CalLite Alt**	**CalSim Base**	**Diff**	**% Diff**
River Flows												
Trinity R blw Lewiston	699	697	2	0.2%	411	411	0	0.0%	472	472	0	0.0%
Trinity Export	533	534	-1	-0.2%	399	392	7	1.9%	446	443	3	0.6%
Clear Cr blw Whiskeytown	122	120	2	2.0%	85	85	0	0.0%	102	102	0	0.0%
Sacramento R @ Keswick	6255	6257	-3	0.0%	4105	4099	6	0.2%	4529	4523	6	0.1%
Sacramento R @ Red Bluff	8224	8224	-1	0.0%	5153	5145	8	0.2%	5628	5624	5	0.1%
Sacramento R @ Wilkins Slough	6576	6577	-1	0.0%	4085	4078	8	0.2%	4772	4768	5	0.1%
Oroville Dam Release	3926	3927	-1	0.0%	2297	2299	-2	-0.1%	2212	2223	-11	-0.5%
Feather R blw Thermalito	3167	3164	3	0.1%	1626	1631	-5	-0.3%	1563	1574	-12	-0.8%
YubaFeather Confluence	1454	1454	-1	0.0%	590	593	-3	-0.5%	578	580	-2	-0.3%
Feather R @ Confluence	5602	5598	3	0.1%	2285	2290	-5	-0.2%	2639	2652	-13	-0.5%
Sacramento R @ Verona	13740	13743	-3	0.0%	6938	6935	3	0.0%	8063	8072	-8	-0.1%
American R blw Nimbus	2397	2397	0	0.0%	1271	1270	1	0.1%	1098	1128	-30	-2.6%
Delta Inflow	**21721**	**21718**	**3**	**0.0%**	**10093**	**10089**	**4**	**0.0%**	**10530**	**10568**	**-38**	**-0.4%**
Sacramento R @ Hood	16019	16034	-15	-0.1%	8301	8297	4	0.0%	9054	9092	-38	-0.4%
Yolo Bypass	1848	1831	17	0.9%	102	102	0	0.0%	136	136	0	0.0%
Mokelumne R	666	666	0	0.0%	206	206	0	0.0%	155	155	0	0.0%
San Joaquin R d/s Vernalis	3187	3187	0	0.0%	1485	1485	0	0.0%	1185	1185	0	0.0%
Delta Outflow	**14697**	**14701**	**-3**	**0.0%**	**5179**	**5179**	**0**	**0.0%**	**5413**	**5420**	**-7**	**-0.1%**
Required	4382	4386	-4	**-0.1%**	4136	4137	-1	**0.0%**	3876	3870	6	**0.1%**
Delta Exports	**6038**	**6033**	**5**	**0.1%**	**3715**	**3711**	**4**	**0.1%**	**3806**	**3836**	**-30**	**-0.8%**
Banks SWP	3490	3482	8	**0.2%**	2188	2179	9	**0.4%**	2083	2114	-31	**-1.5%**
Banks CVP	85	86	-1	**-0.6%**	13	13	-1	**-4.0%**	43	43	0	**0.7%**
Tracy	2463	2466	-2	**-0.1%**	1527	1532	-5	**-0.3%**	1723	1722	1	**0.1%**
SWP Deliveries	**3484**	**3476**	**8**	**0.2%**	**2164**	**2149**	**15**	**0.7%**	**2097**	**2113**	**-16**	**-0.8%**
Table A	3155	3155	0	**0.0%**	1772	1765	7	**0.4%**	1904	1920	-17	**-0.9%**
Article 21	202	201	1	**0.5%**	353	345	9	**2.5%**	130	133	-3	**-2.6%**
Article 56	127	120	7	**5.8%**	39	39	0	**0.1%**	63	60	4	**6.2%**
CVP SOD Deliveries	**2632**	**2635**	**-3**	**-0.1%**	**1494**	**1502**	**-8**	**-0.5%**	**1844**	**1840**	**4**	**0.2%**

System Flow Comparison: CalLIte vs CalSim

Notes: Corroboration Study; CalSim_ExistingCVCJPOD_021411 and CalLite_BOCVCJPOD_021411

	1922-2003				1929-1934				1987-1992			
	CalLite Alt	**CalSim Base**	**Diff**	**% Diff**	**CalLite Alt**	**CalSim Base**	**Diff**	**% Diff**	**CalLite Alt**	**CalSim Base**	**Diff**	**% Diff**
River Flows												
Trinity R blw Lewiston	701	695	6	0.8%	410	408	2	0.4%	472	472	0	0.0%
Trinity Export	530	536	-6	-1.1%	434	438	-4	-0.9%	511	509	2	0.4%
Clear Cr blw Whiskeytown	127	125	2	1.8%	87	87	0	-0.1%	106	106	0	0.0%
Sacramento R @ Keswick	6248	6256	-8	-0.1%	4125	4132	-7	-0.2%	4666	4660	6	0.1%
Sacramento R @ Red Bluff	8220	8226	-7	-0.1%	5152	5161	-9	-0.2%	5794	5788	6	0.1%
Sacramento R @ Wilkins Slough	6650	6655	-5	-0.1%	4118	4124	-6	-0.1%	4982	4976	6	0.1%
Oroville Dam Release	3927	3928	-1	0.0%	2262	2277	-15	-0.7%	2180	2209	-30	-1.3%
Feather R blw Thermalito	3180	3179	1	0.0%	1594	1611	-16	-1.0%	1536	1567	-31	-1.9%
YubaFeather Confluence	1454	1457	-3	-0.2%	590	598	-8	-1.3%	578	583	-5	-0.8%
Feather R @ Confluence	5605	5609	-3	-0.1%	2244	2266	-23	-1.0%	2607	2641	-34	-1.3%
Sacramento R @ Verona	13235	13250	-15	-0.1%	6924	6953	-28	-0.4%	8236	8266	-29	-0.4%
American R blw Nimbus	2477	2477	0	0.0%	1328	1328	0	0.0%	1186	1183	3	0.2%
Delta Inflow	**21645**	**21653**	**-8**	**0.0%**	**10007**	**10036**	**-29**	**-0.3%**	**10661**	**10687**	**-26**	**-0.2%**
Sacramento R @ Hood	15672	15691	-19	-0.1%	8324	8353	-29	-0.3%	9281	9308	-27	-0.3%
Yolo Bypass	2248	2237	11	0.5%	94	94	0	0.0%	138	137	1	0.7%
Mokelumne R	666	666	0	0.0%	202	202	0	0.0%	140	140	0	0.0%
San Joaquin R d/s Vernalis	3060	3060	0	0.0%	1386	1386	0	0.0%	1102	1102	0	0.0%
Delta Outflow	**15781**	**15785**	**-3**	**0.0%**	**5543**	**5552**	**-9**	**-0.2%**	**6109**	**6109**	**0**	**0.0%**
Required	5005	5003	2	**0.0%**	4122	4122	0	**0.0%**	3986	3983	3	**0.1%**
Delta Exports	**4909**	**4914**	**-5**	**-0.1%**	**3249**	**3267**	**-18**	**-0.6%**	**3275**	**3308**	**-33**	**-1.0%**
Banks SWP	2639	2641	-2	**-0.1%**	1754	1771	-17	**-1.0%**	1680	1694	-14	**-0.8%**
Banks CVP	79	72	7	**9.2%**	13	13	0	**-3.0%**	22	17	6	**35.7%**
Tracy	2191	2201	-9	**-0.4%**	1495	1496	-1	**-0.1%**	1595	1614	-19	**-1.2%**
SWP Deliveries	**2593**	**2595**	**-2**	**-0.1%**	**1657**	**1676**	**-19**	**-1.1%**	**1651**	**1657**	**-7**	**-0.4%**
Table A	2258	2259	-1	**0.0%**	1551	1557	-6	**-0.4%**	1505	1518	-13	**-0.8%**
Article 21	71	71	0	**0.0%**	58	55	3	**5.7%**	12	11	1	**6.1%**
Article 56	264	265	-1	**-0.4%**	47	63	-16	**-25.1%**	134	128	6	**4.4%**
CVP SOD Deliveries	**2384**	**2387**	**-3**	**-0.1%**	**1492**	**1496**	**-4**	**-0.3%**	**1644**	**1645**	**-1**	**-0.1%**

System Flow Comparison: CalLIte vs CalSim

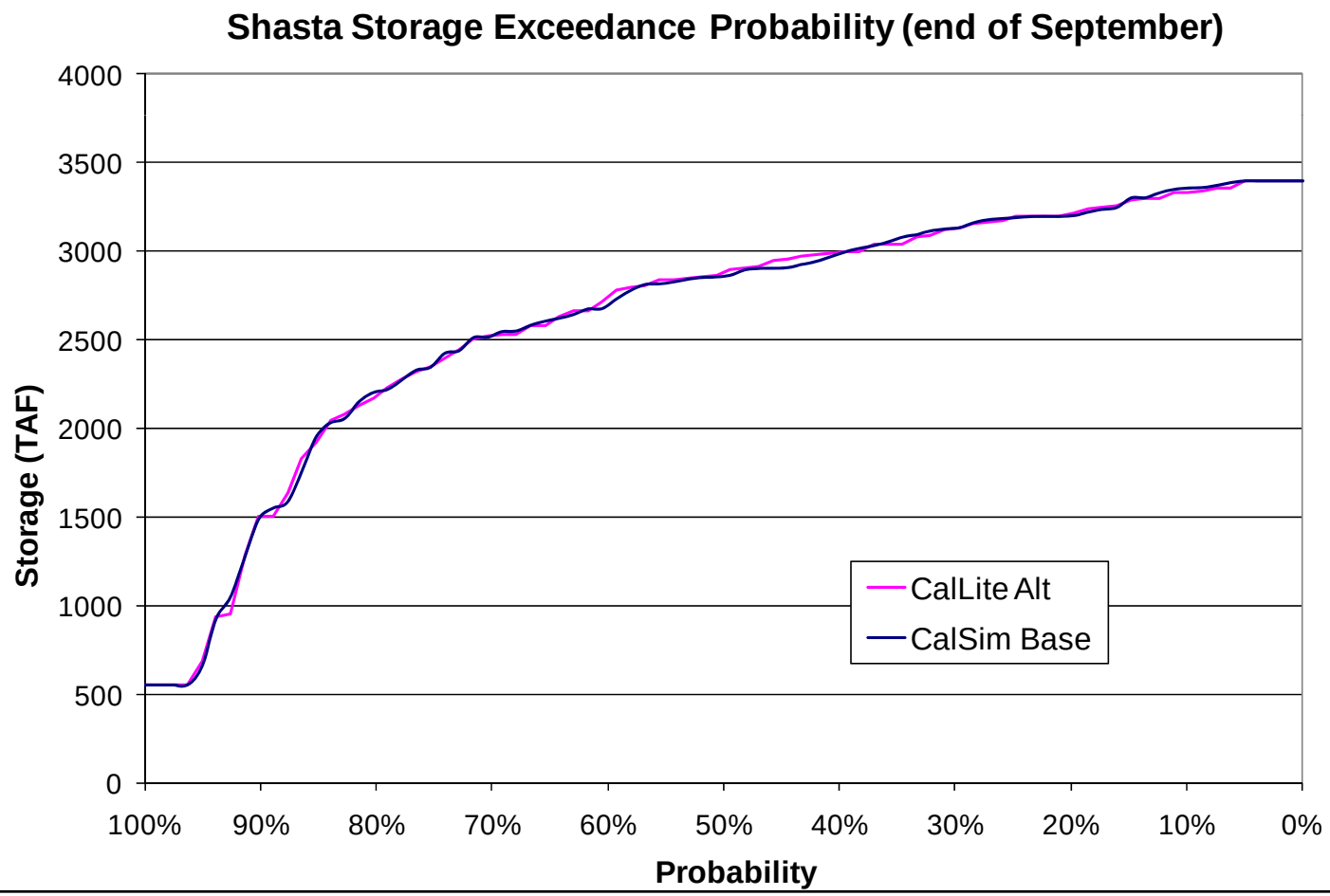
Notes: Corroboration Study;CALSIM_Final_080411 and CalLite_080511; Future BO

	1922-2003				1929-1934				1987-1992			
	CalLite Alt	**CalSim Base**	**Diff**	**% Diff**	**CalLite Alt**	**CalSim Base**	**Diff**	**% Diff**	**CalLite Alt**	**CalSim Base**	**Diff**	**% Diff**
River Flows												
Trinity R blw Lewiston	698	694	4	0.6%	411	408	3	0.7%	472	472	0	0.0%
Trinity Export	533	537	-4	-0.7%	432	435	-2	-0.6%	490	499	-9	-1.8%
Clear Cr blw Whiskeytown	129	127	3	2.0%	101	100	1	0.5%	116	116	0	0.0%
Sacramento R @ Keswick	6250	6256	-6	-0.1%	4101	4107	-6	-0.2%	4636	4646	-10	-0.2%
Sacramento R @ Red Bluff	8249	8254	-5	-0.1%	5176	5185	-10	-0.2%	5790	5801	-11	-0.2%
Sacramento R @ Wilkins Slough	6633	6638	-4	-0.1%	4107	4117	-11	-0.3%	4920	4930	-11	-0.2%
Oroville Dam Release	3927	3927	-1	0.0%	2274	2291	-17	-0.8%	2131	2128	3	0.2%
Feather R blw Thermalito	3180	3180	1	0.0%	1606	1625	-19	-1.1%	1490	1489	0	0.0%
YubaFeather Confluence	1454	1457	-3	-0.2%	590	596	-6	-1.0%	578	583	-5	-0.9%
Feather R @ Confluence	5609	5612	-3	-0.1%	2263	2287	-23	-1.0%	2563	2564	-2	-0.1%
Sacramento R @ Verona	13231	13243	-12	-0.1%	6943	6977	-34	-0.5%	8133	8146	-12	-0.2%
American R blw Nimbus	2388	2389	0	0.0%	1267	1271	-3	-0.2%	1122	1123	-1	-0.1%
Delta Inflow	**21605**	**21613**	**-8**	**0.0%**	**9987**	**10024**	**-37**	**-0.4%**	**10535**	**10548**	**-13**	**-0.1%**
Sacramento R @ Hood	15665	15683	-18	-0.1%	8335	8372	-37	-0.4%	9168	9181	-14	-0.1%
Yolo Bypass	2249	2239	10	0.5%	100	100	0	0.0%	141	141	0	0.3%
Mokelumne R	666	666	0	0.0%	206	206	0	0.0%	155	155	0	0.0%
San Joaquin R d/s Vernalis	3024	3024	0	0.0%	1346	1346	0	0.0%	1071	1071	0	0.0%
Delta Outflow	**15771**	**15777**	**-6**	**0.0%**	**5610**	**5644**	**-34**	**-0.6%**	**6181**	**6184**	**-3**	**-0.1%**
Required	5011	5013	-2	**0.0%**	4107	4112	-5	**-0.1%**	4035	4036	-1	**0.0%**
Delta Exports	**4868**	**4869**	**-1**	**0.0%**	**3196**	**3197**	**-1**	**0.0%**	**3091**	**3101**	**-11**	**-0.3%**
Banks SWP	2620	2624	-4	**-0.1%**	1750	1756	-5	**-0.3%**	1537	1546	-9	**-0.6%**
Banks CVP	63	63	0	**0.0%**	8	8	0	**2.7%**	28	28	0	**1.0%**
Tracy	2185	2182	3	**0.1%**	1445	1441	4	**0.3%**	1553	1555	-2	**-0.1%**
SWP Deliveries	**2599**	**2603**	**-4**	**-0.2%**	**1645**	**1650**	**-5**	**-0.3%**	**1456**	**1466**	**-10**	**-0.7%**
Table A	2466	2471	-5	**-0.2%**	1548	1559	-11	**-0.7%**	1422	1425	-3	**-0.2%**
Article 21	50	48	2	**4.2%**	82	72	11	**14.7%**	12	11	1	**8.8%**
Article 56	83	84	-1	**-1.2%**	15	19	-4	**-20.7%**	22	30	-8	**-25.7%**
CVP SOD Deliveries	**2360**	**2357**	**3**	**0.1%**	**1402**	**1397**	**5**	**0.4%**	**1620**	**1616**	**5**	**0.3%**

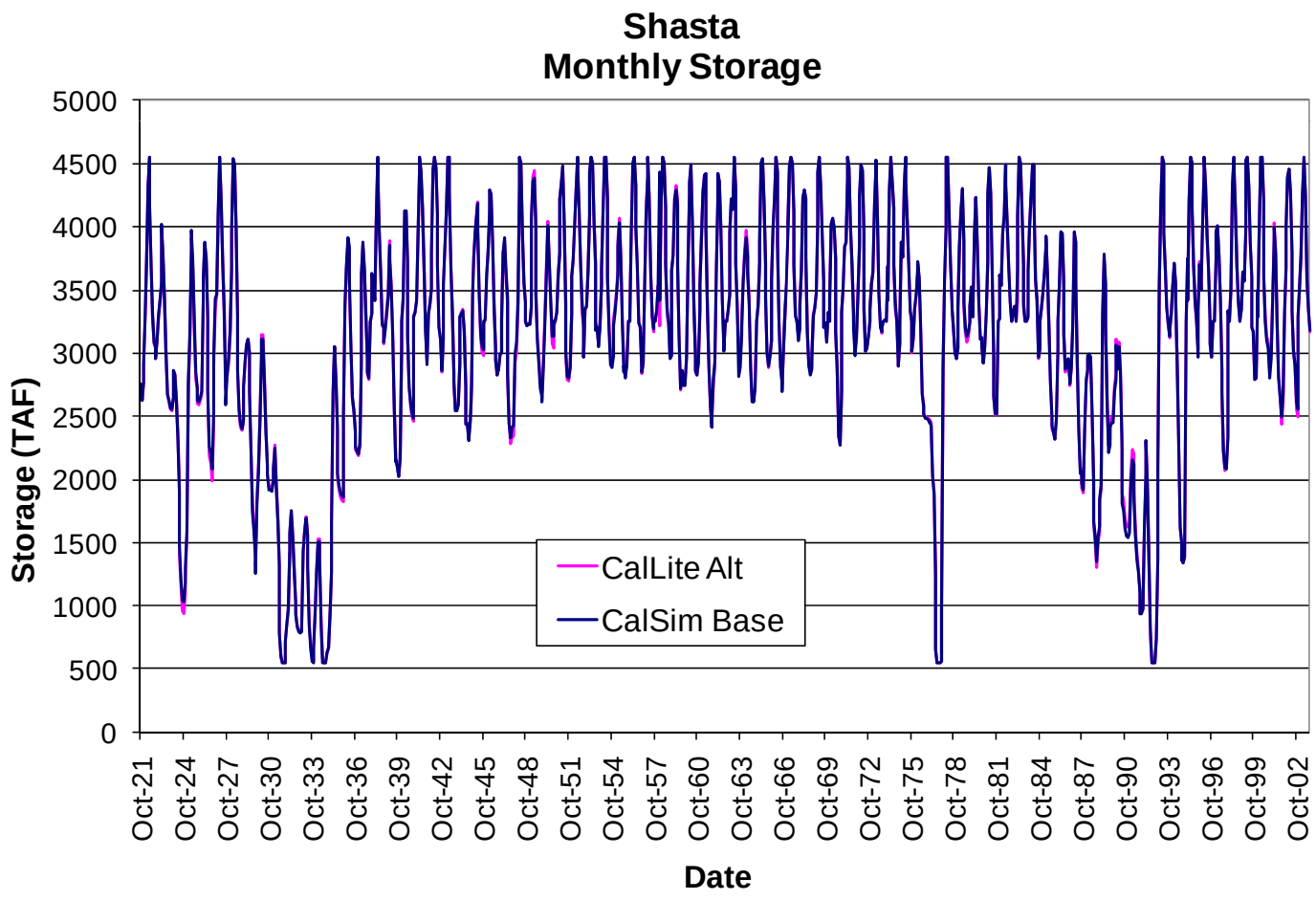
Corroboration Studies

- Exceedance graphs and monthly timeseries for:
  - Shasta, Oroville, and CVP and SWP San Luis Reservoir storage
  - SWP Table A and CVP SOD agricultural allocation
  - X2 position
  - Rock Slough

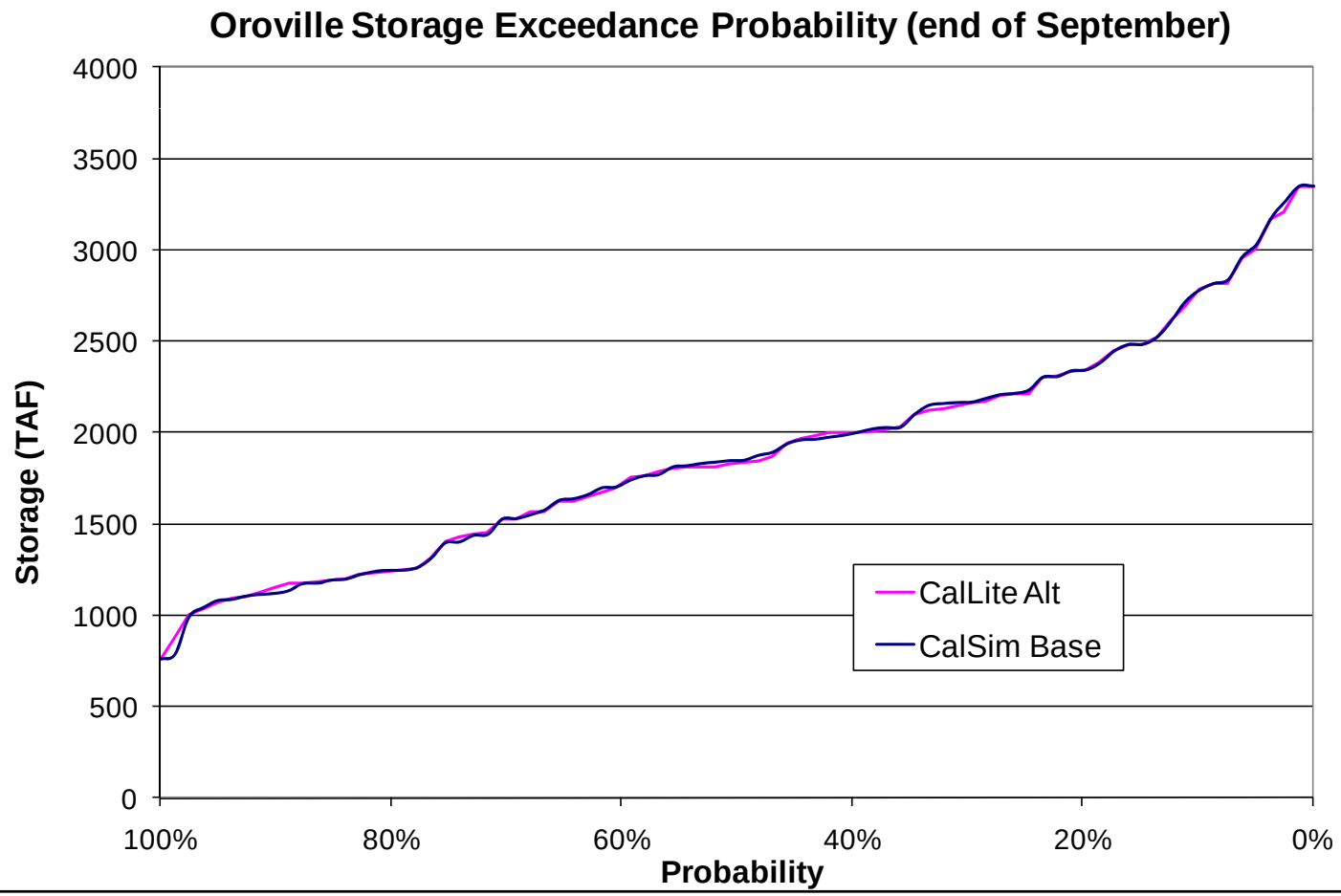
Future LOD, BO standards



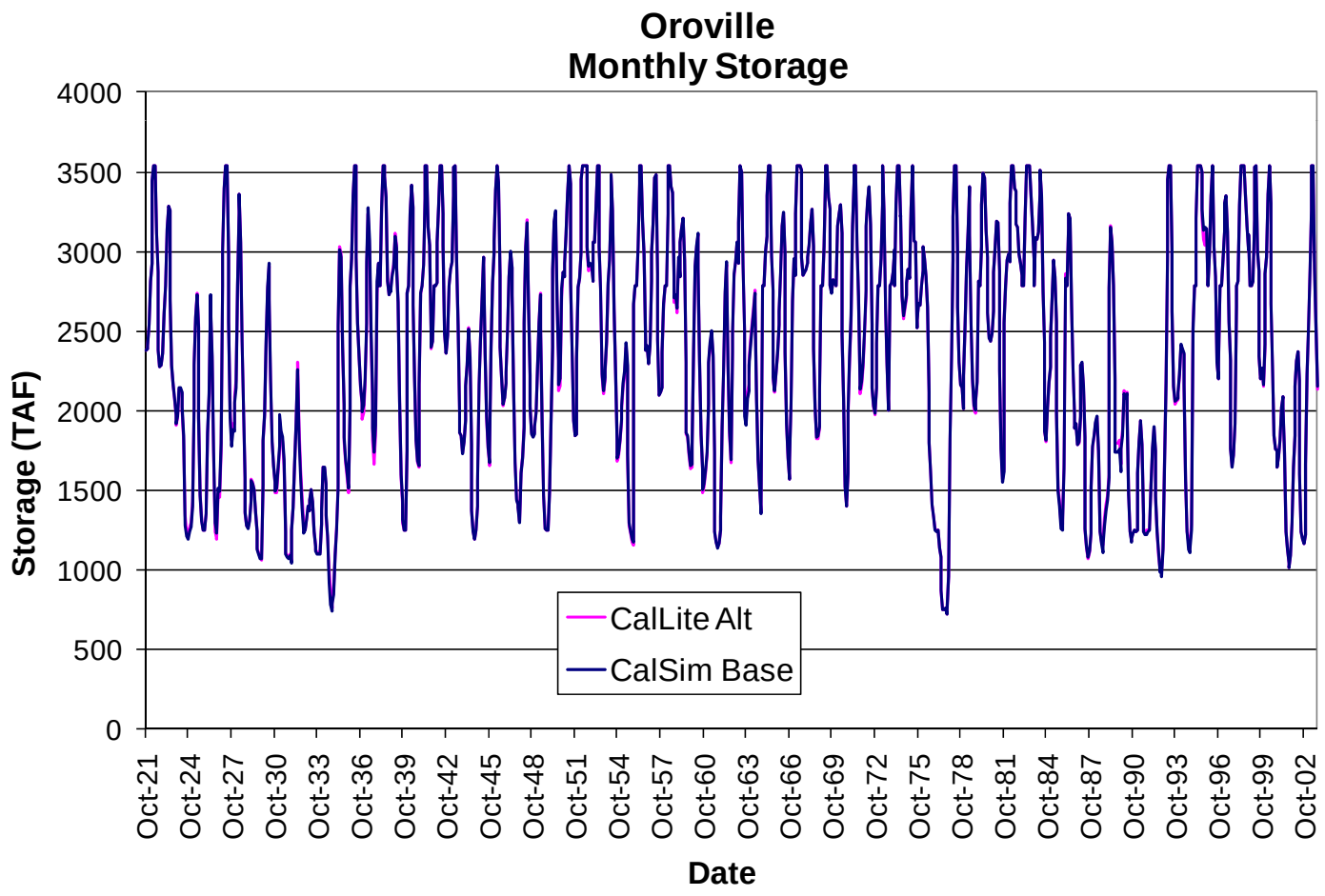
Future LOD, BO standards



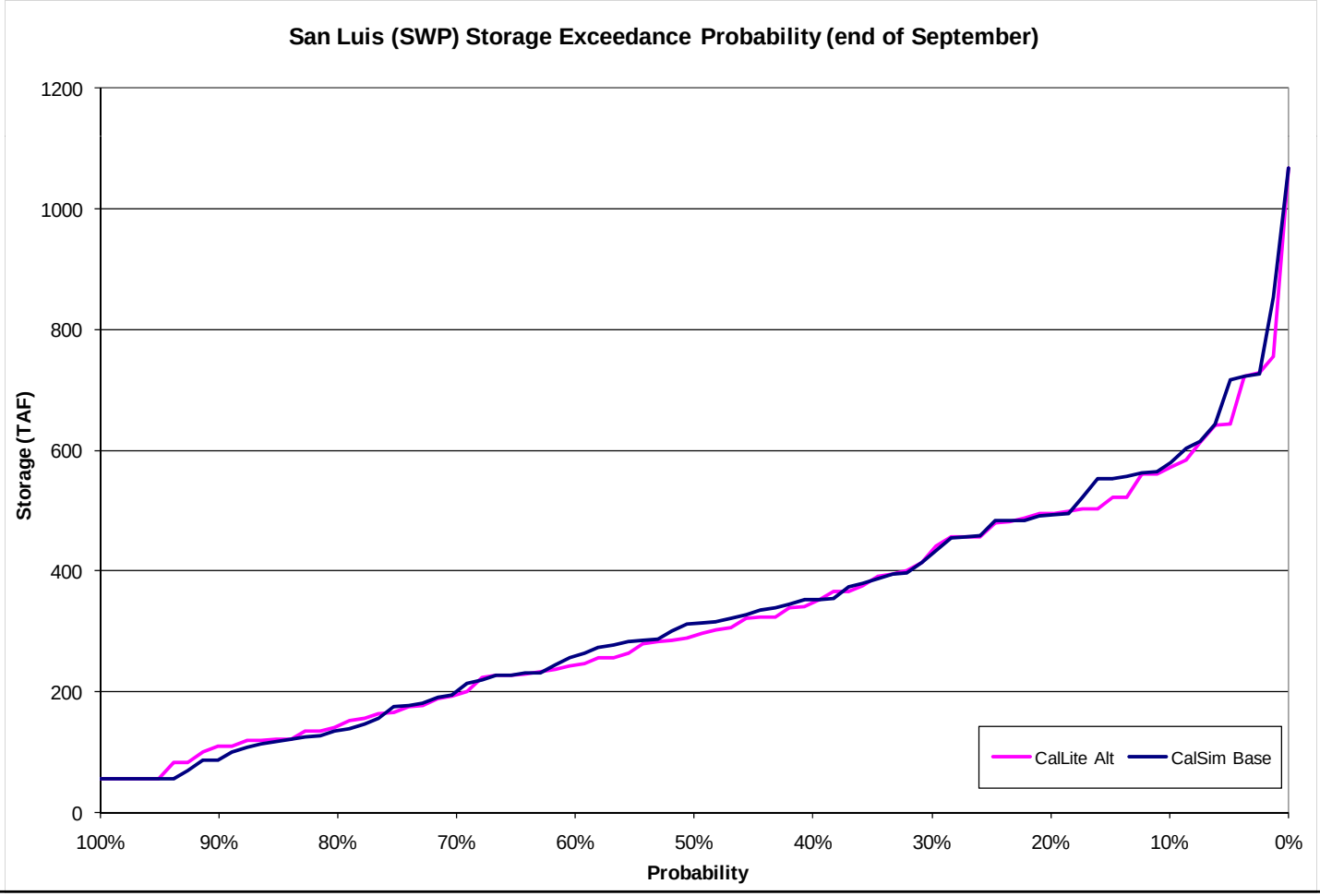
Future LOD, BO standards



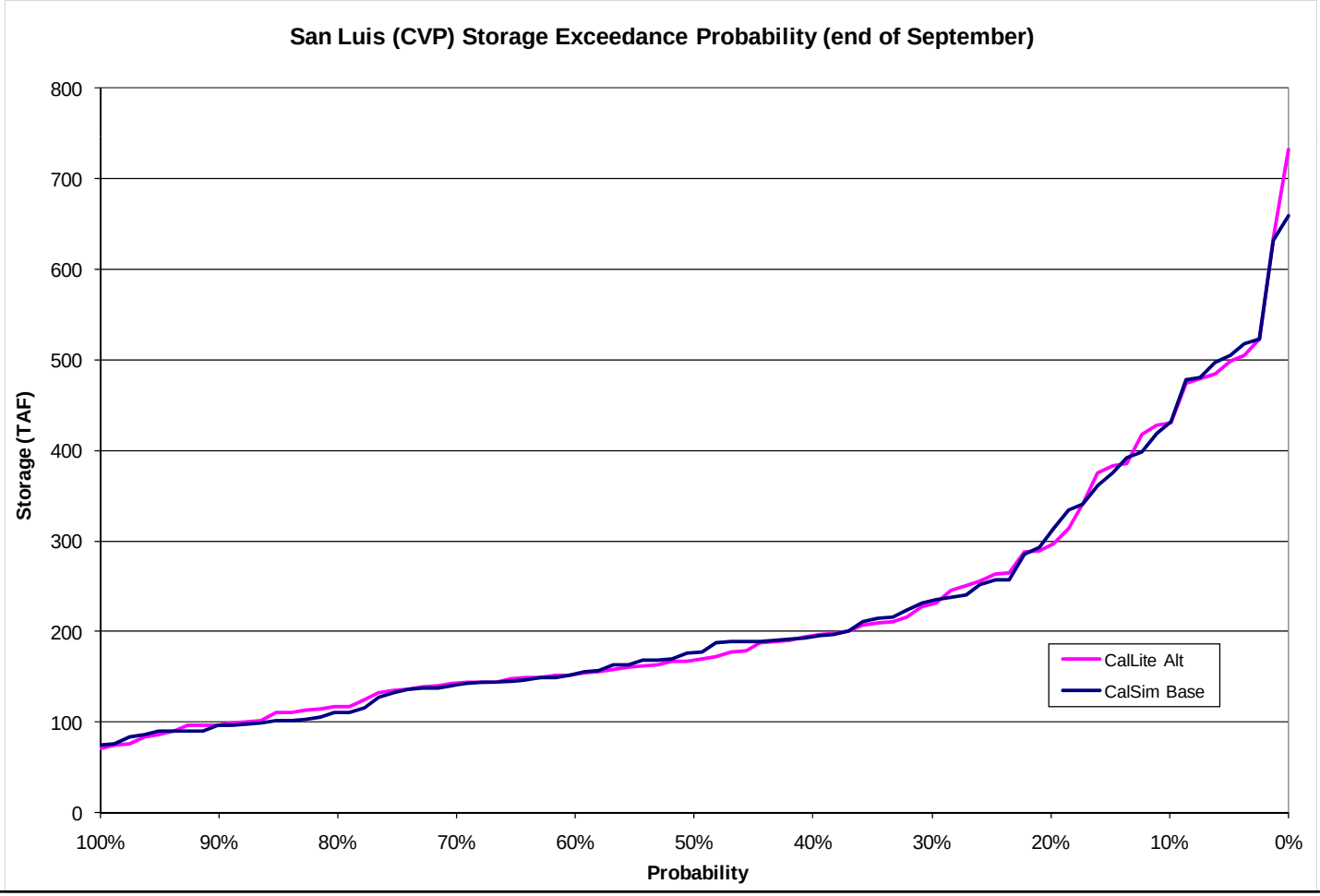
Future LOD, BO standards



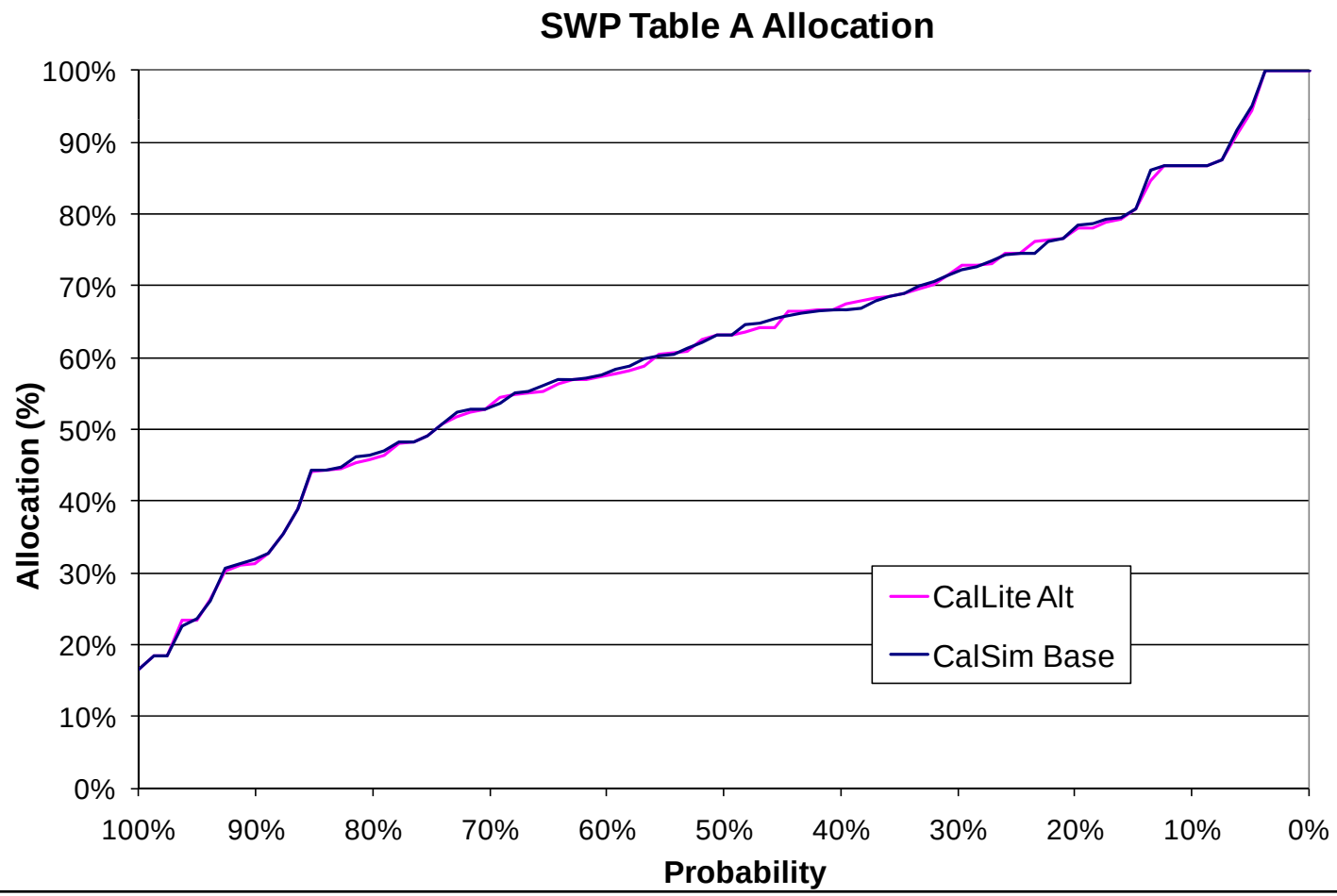
Future LOD, BO standards



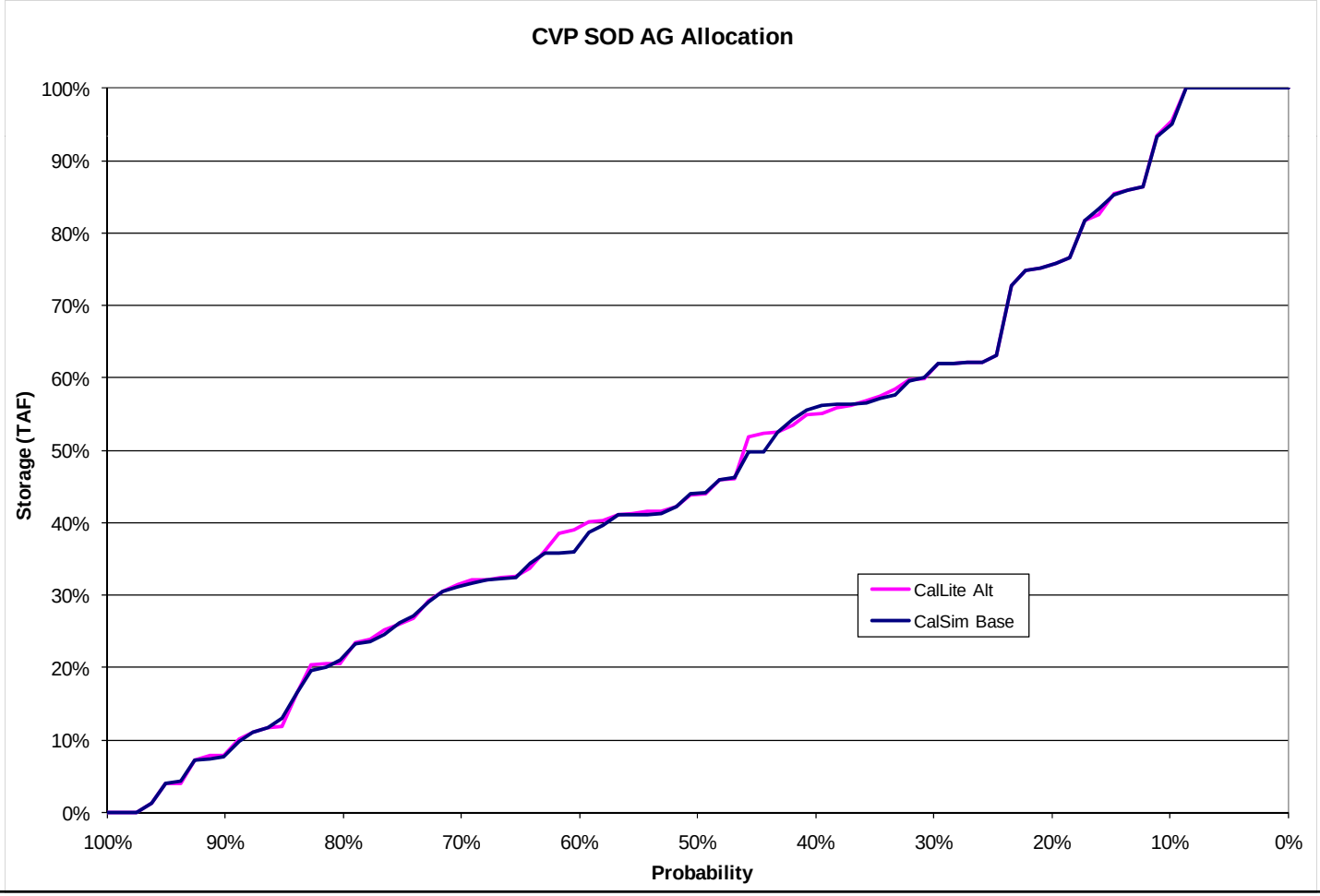
Future LOD, BO standards



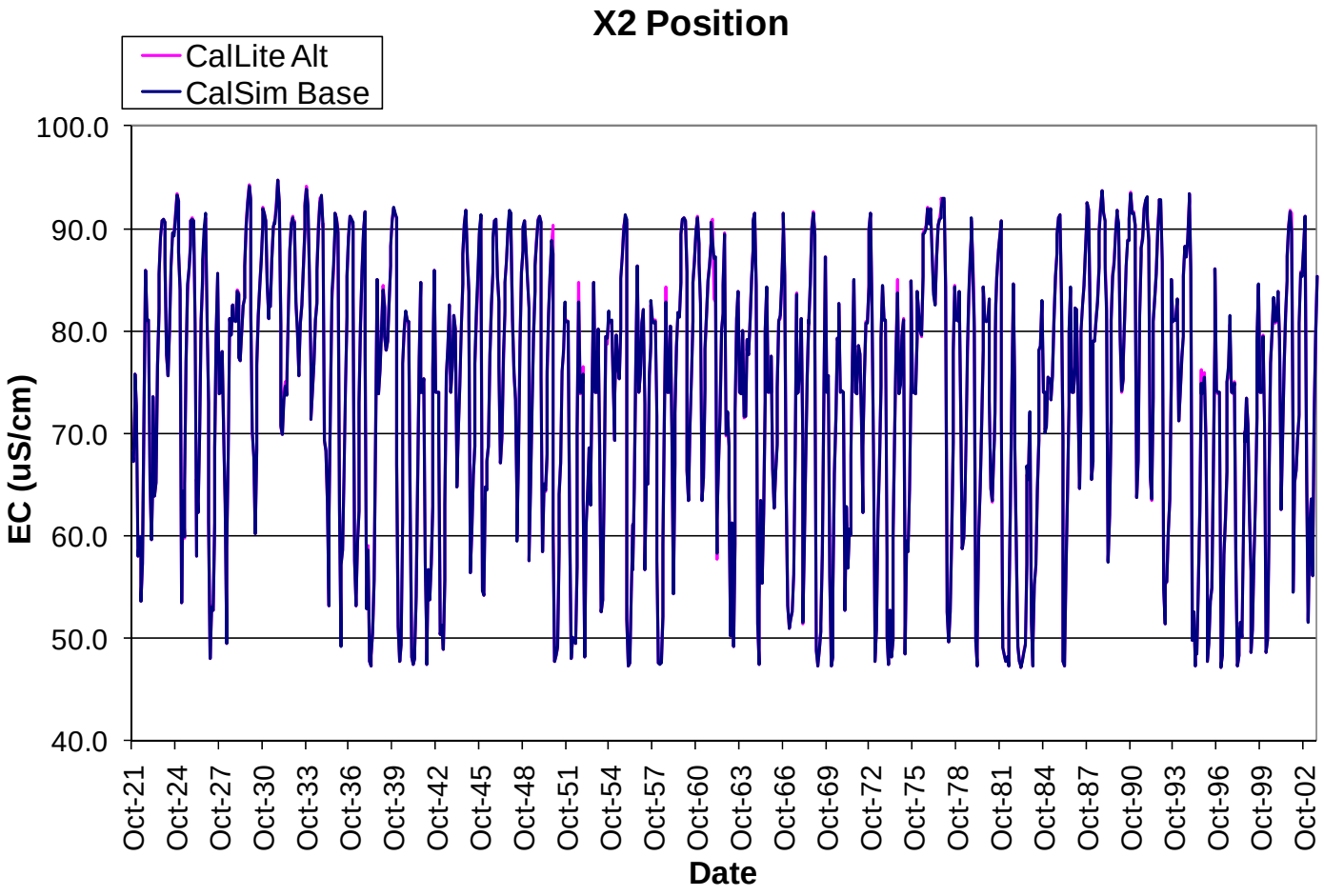
Future LOD, BO standards



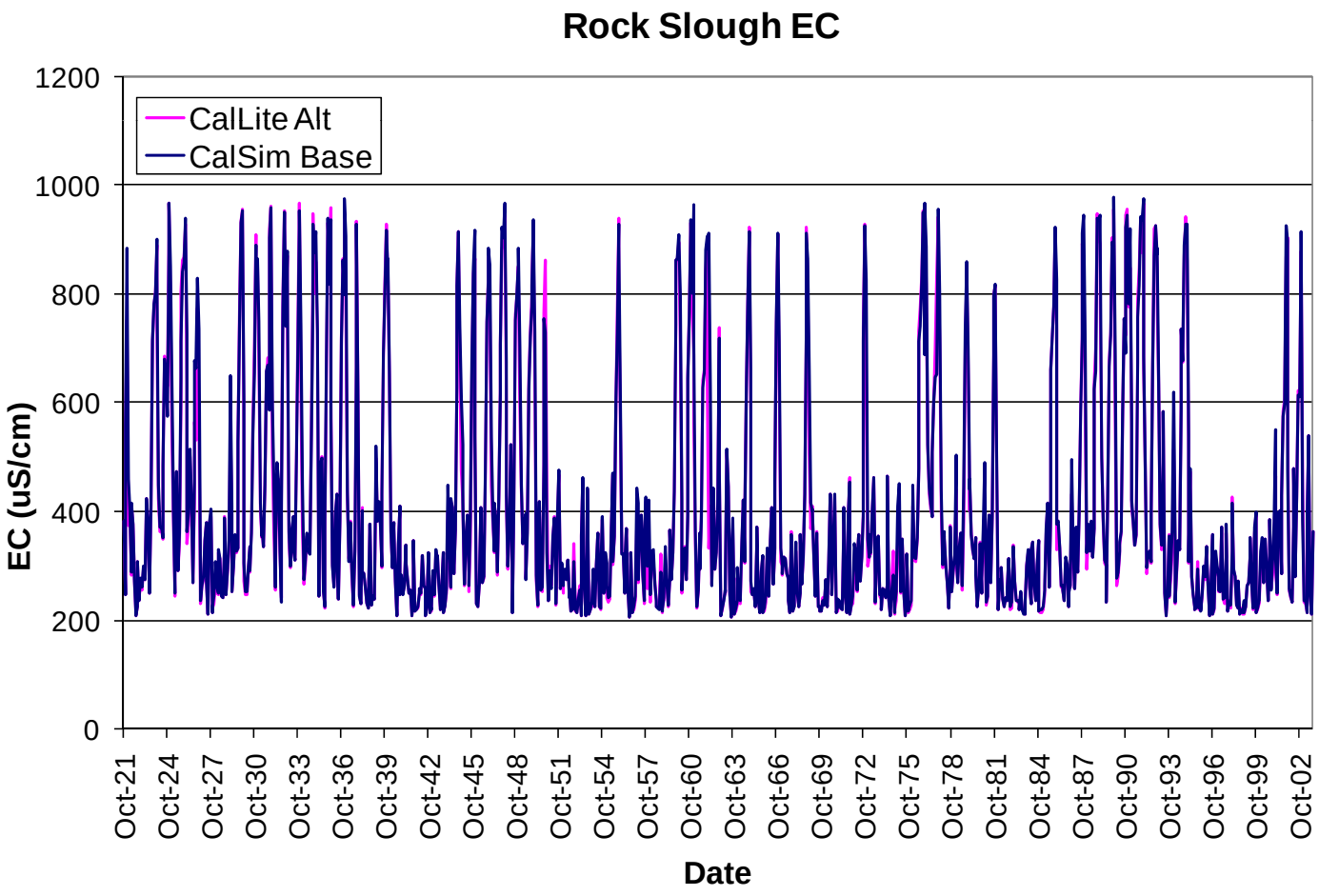
Future LOD, BO standards



Future LOD, BO standards



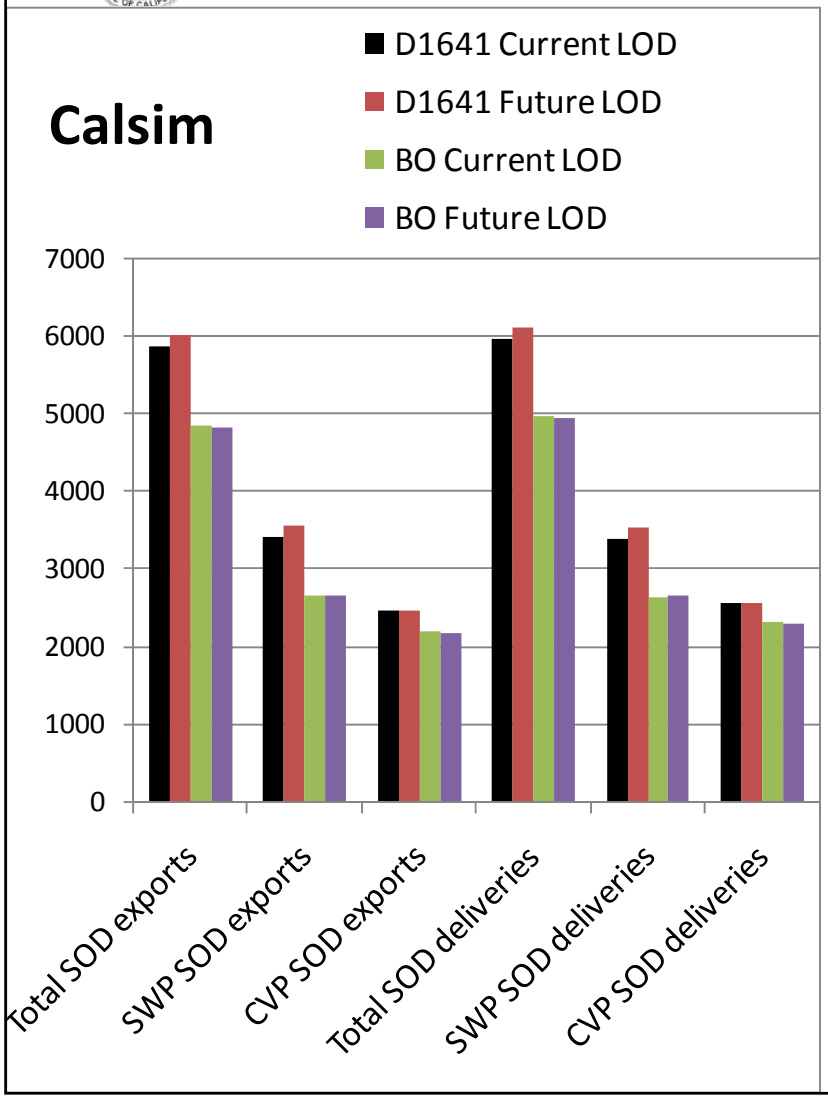
Future LOD, BO standards

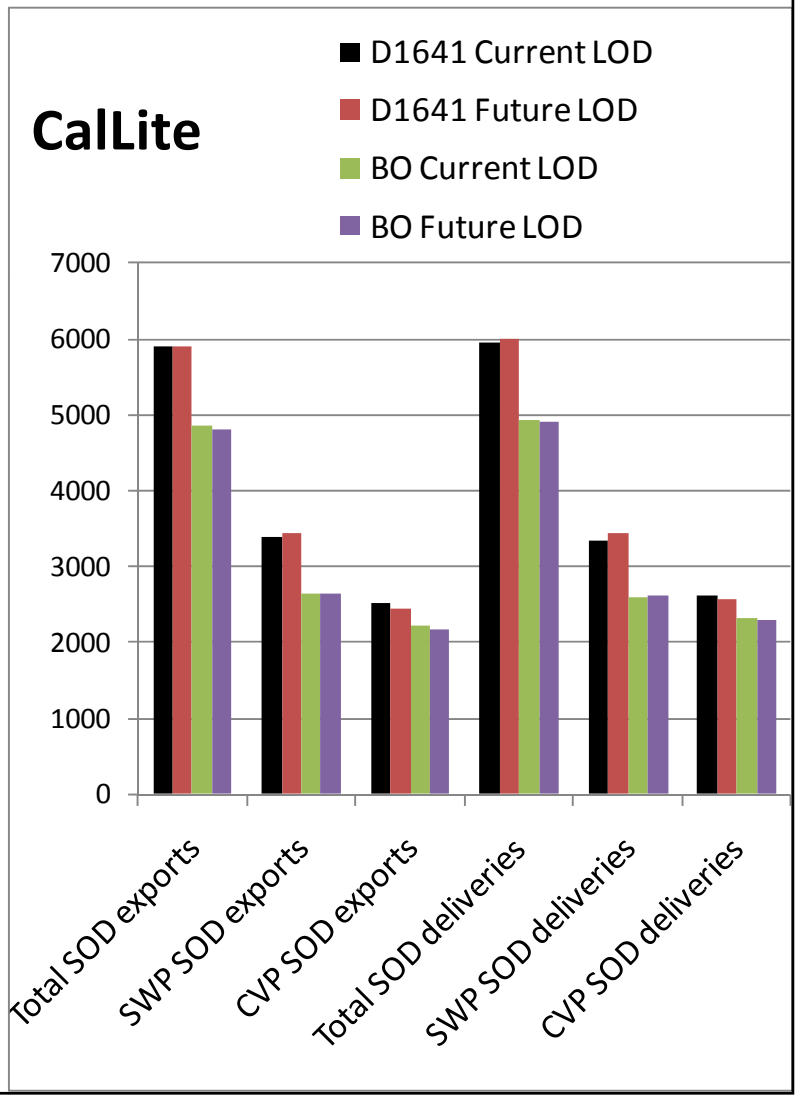


Corroboration Studies

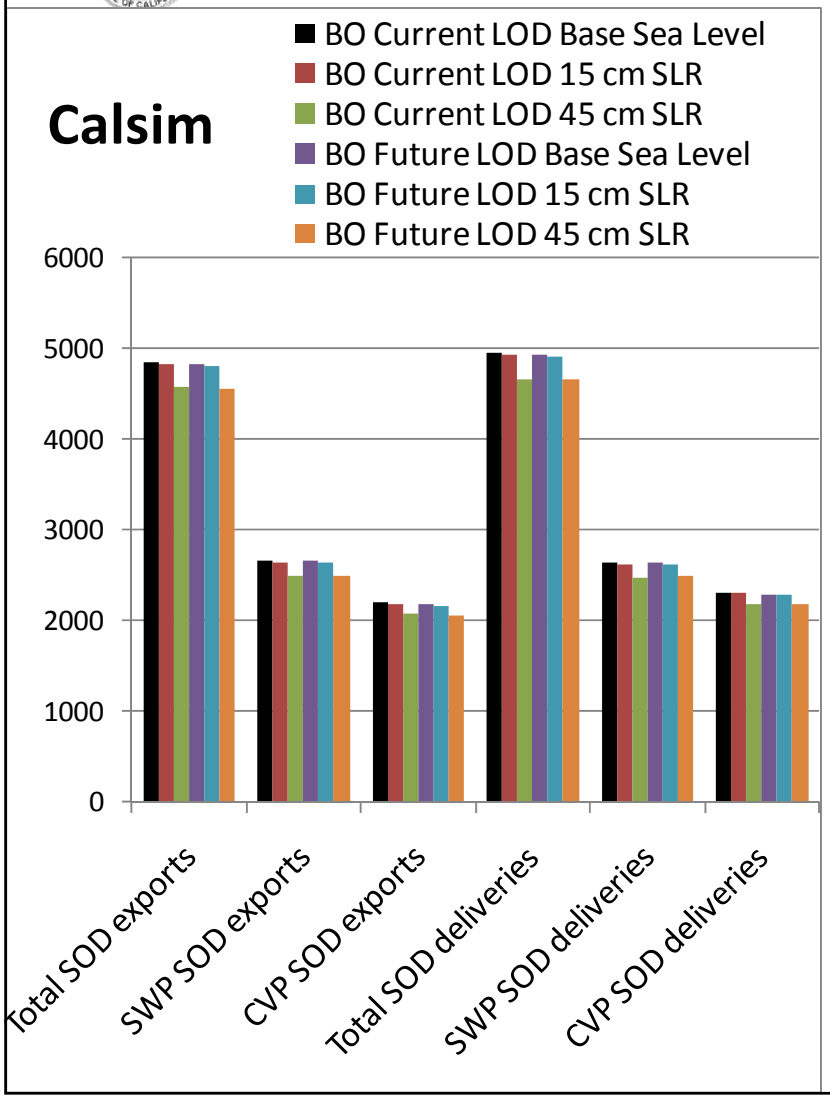
- Comparison of exports/SOD deliveries and reservoir storages under different combinations of RPAs and sea level rise conditions:
  - Future (2020) studies with D-1641 standards and different combinations of RPAs
  - Existing (2005) and Future (2020) studies with different sea level rise assumptions, under D-1641 and BO regulatory standards

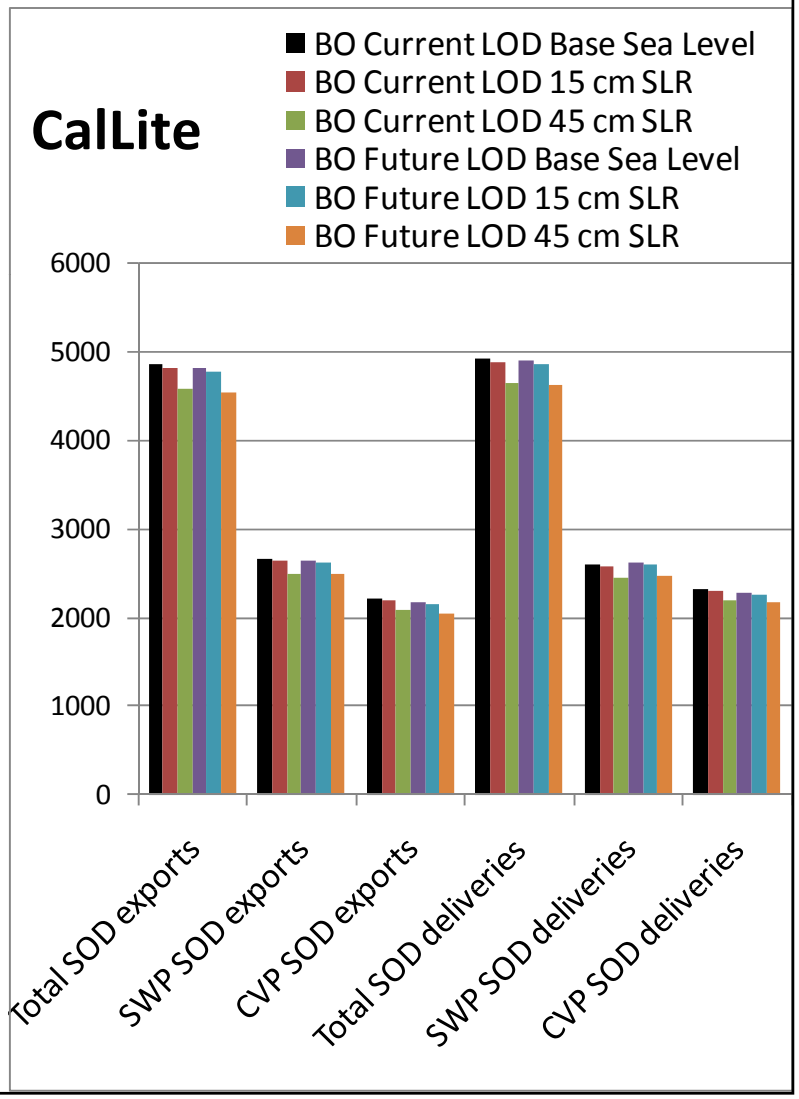
D-1641 vs BO Standards





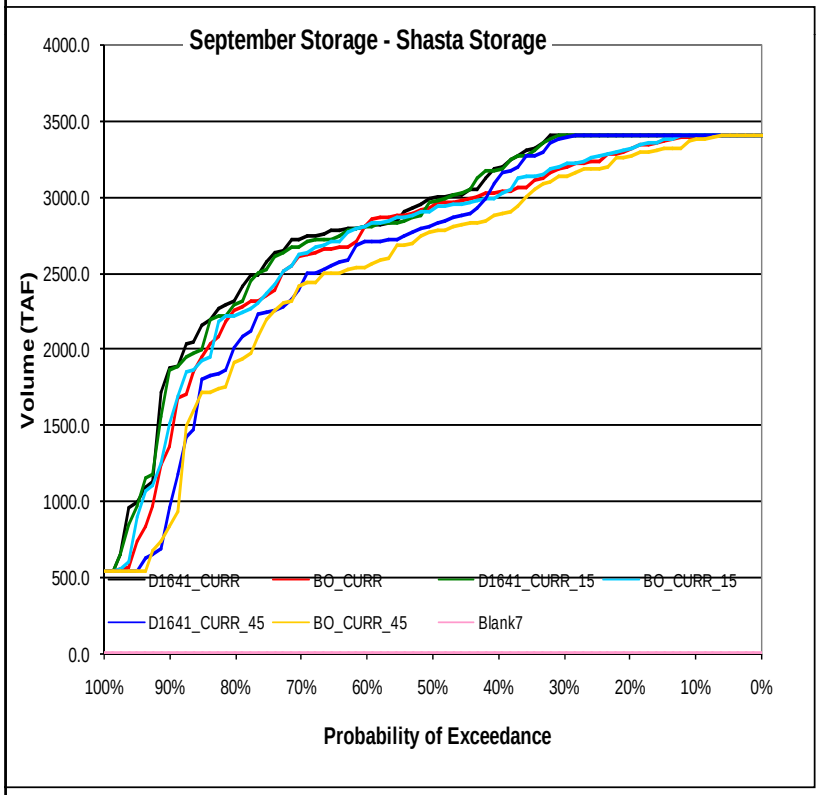
Sea Level Rise Comparisons



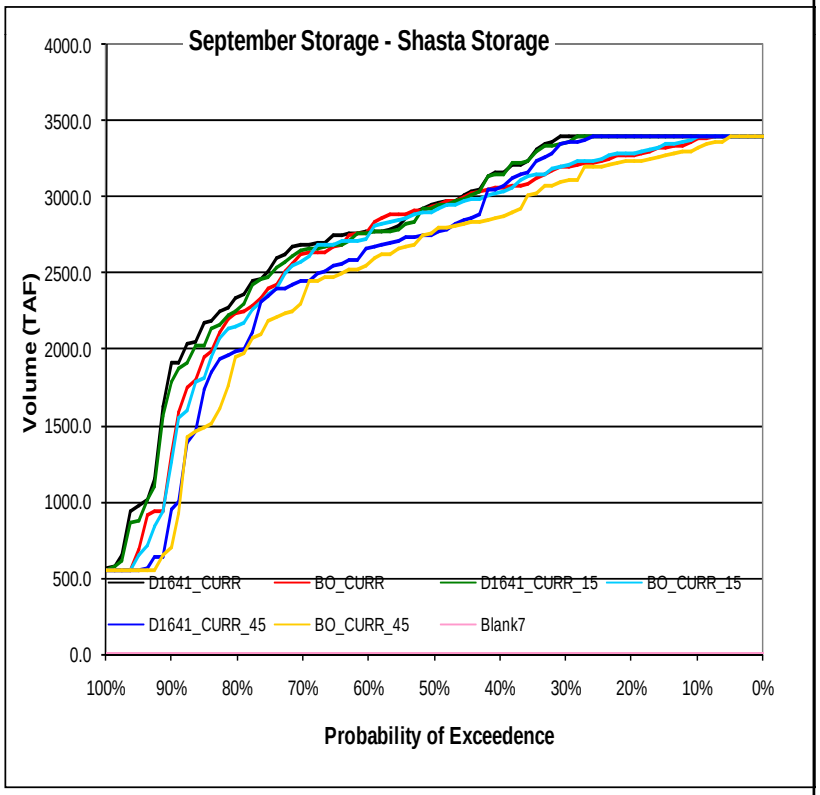


Shasta EOS Storage Current LOD

CalSim-II

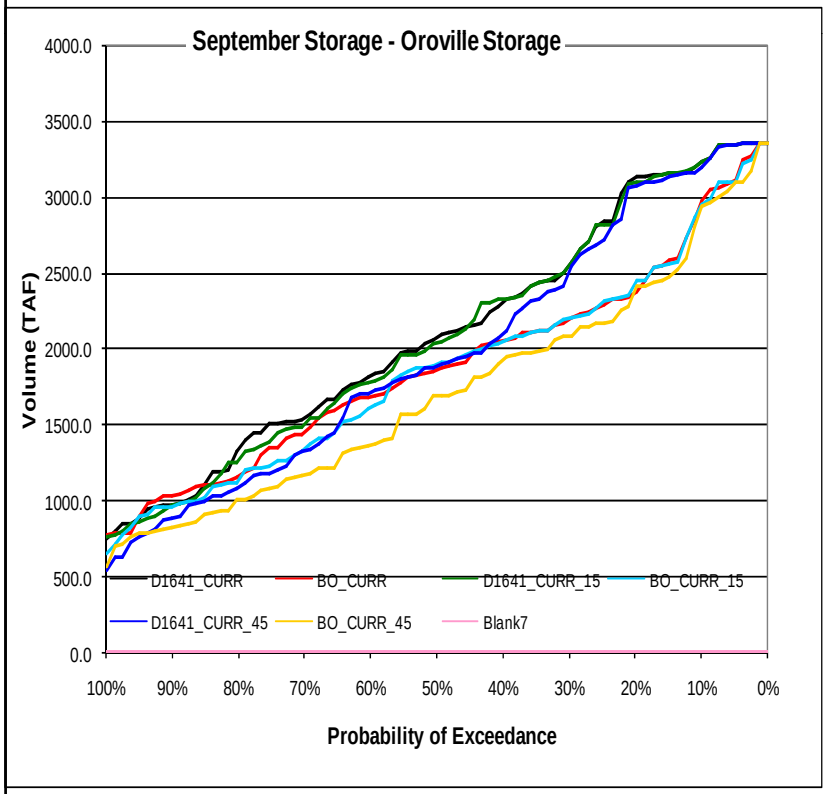


CalLite 2.0



Oroville EOS Storage Current LOD

CalSim-II



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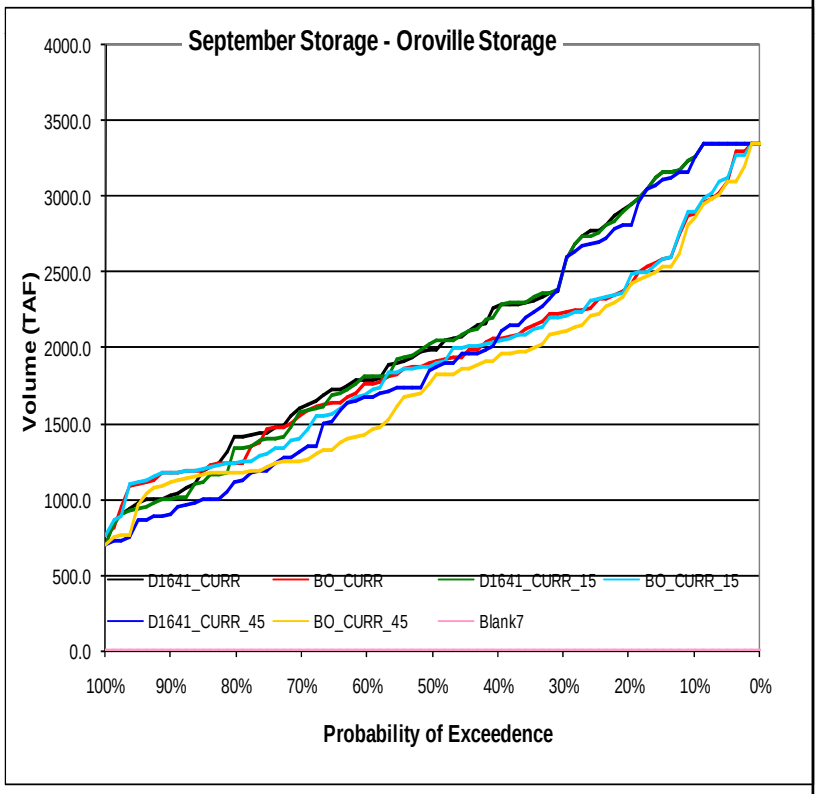
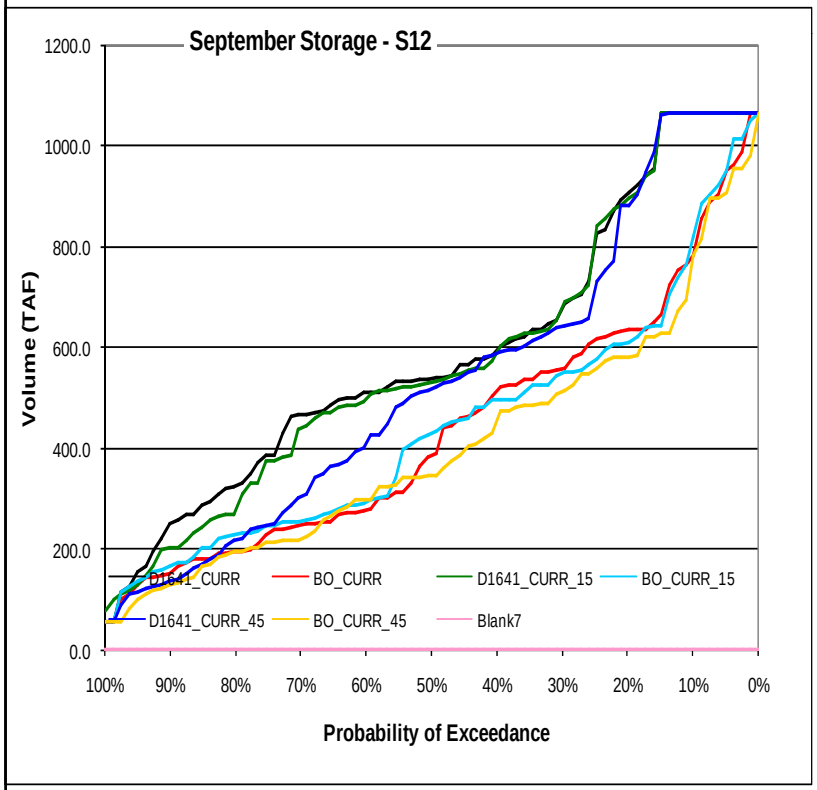


SWP SL EOS Storage Current LOD

CalSim-II



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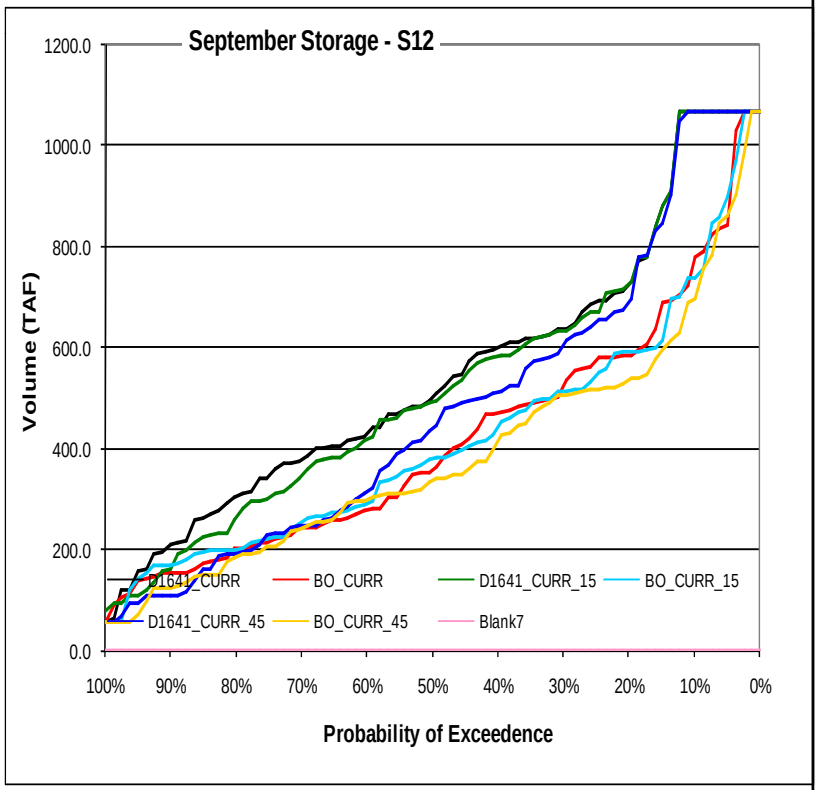
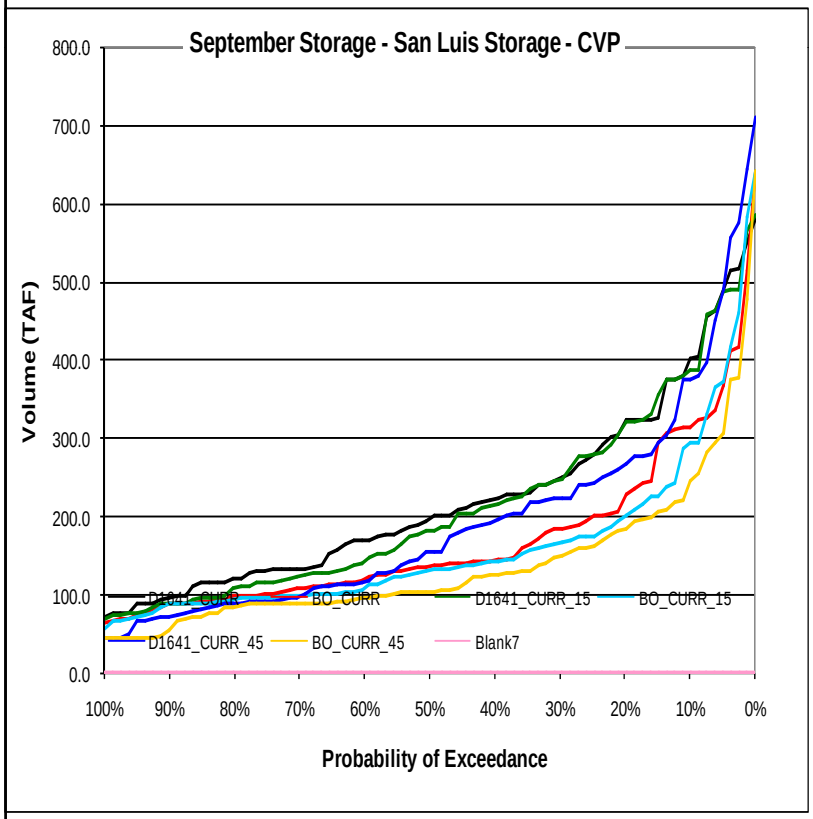


CVP SL EOS Storage Current LOD

CalSim-II



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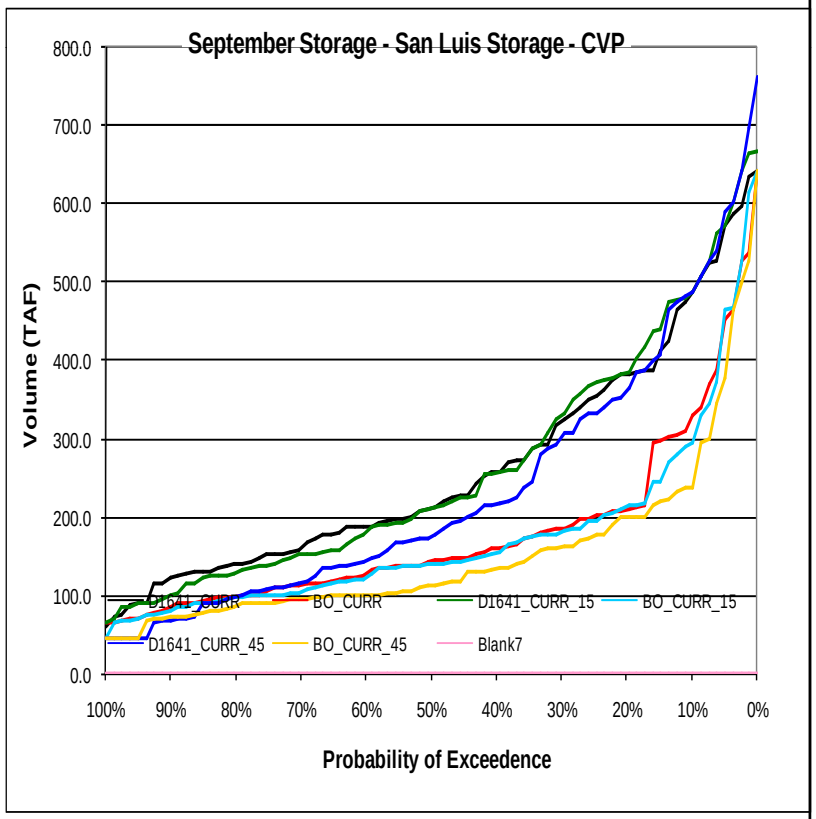
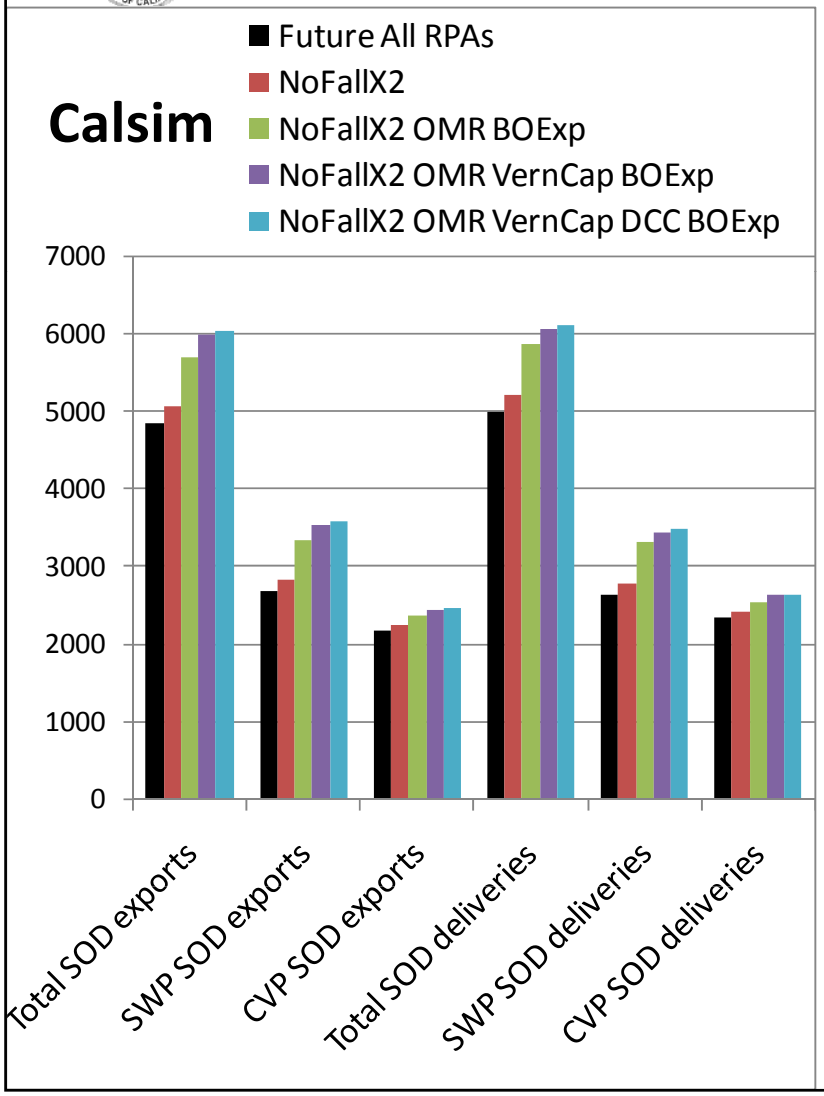
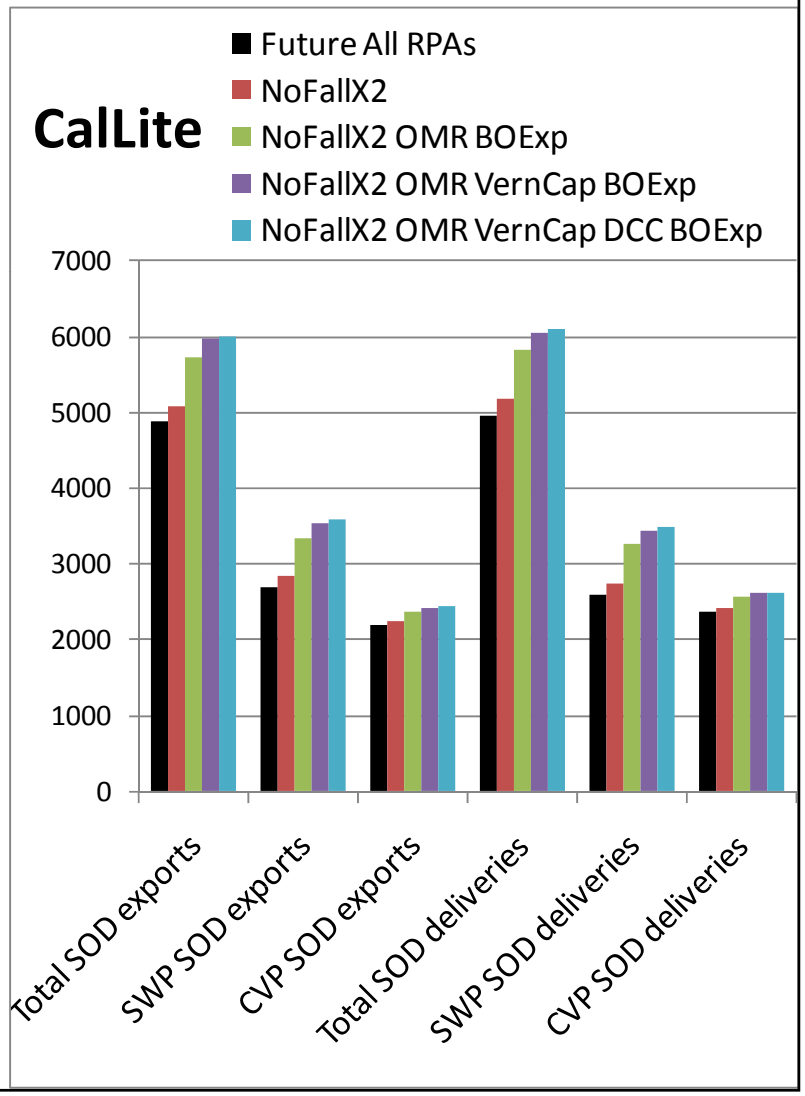
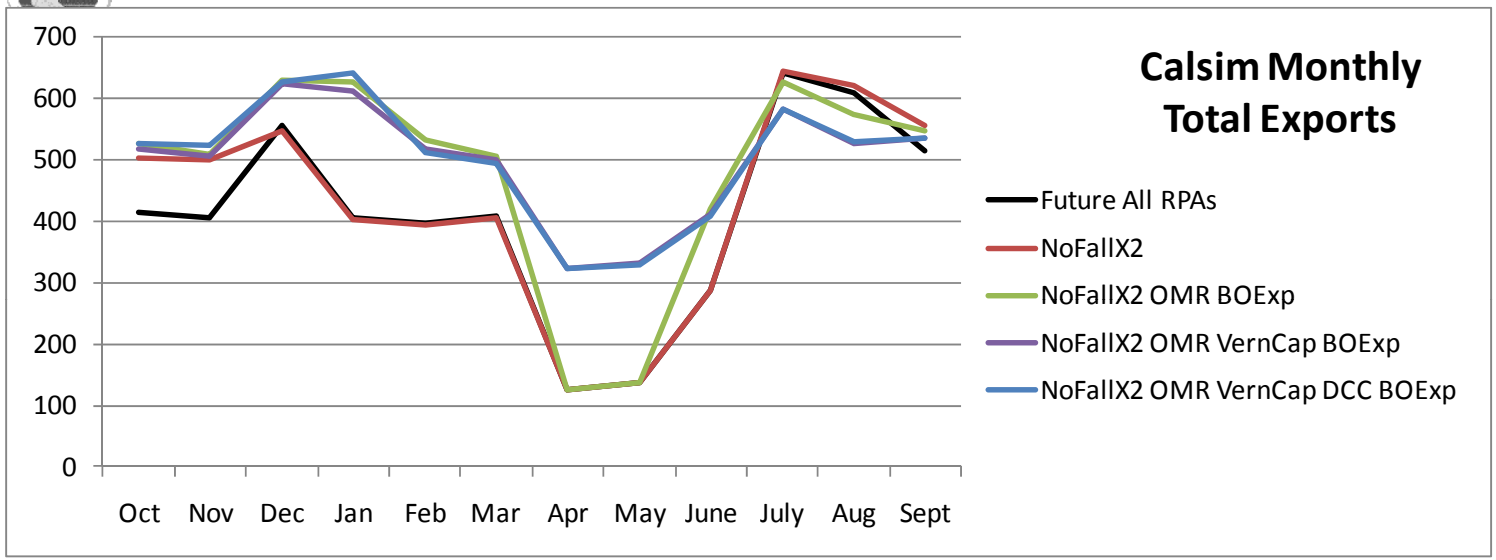


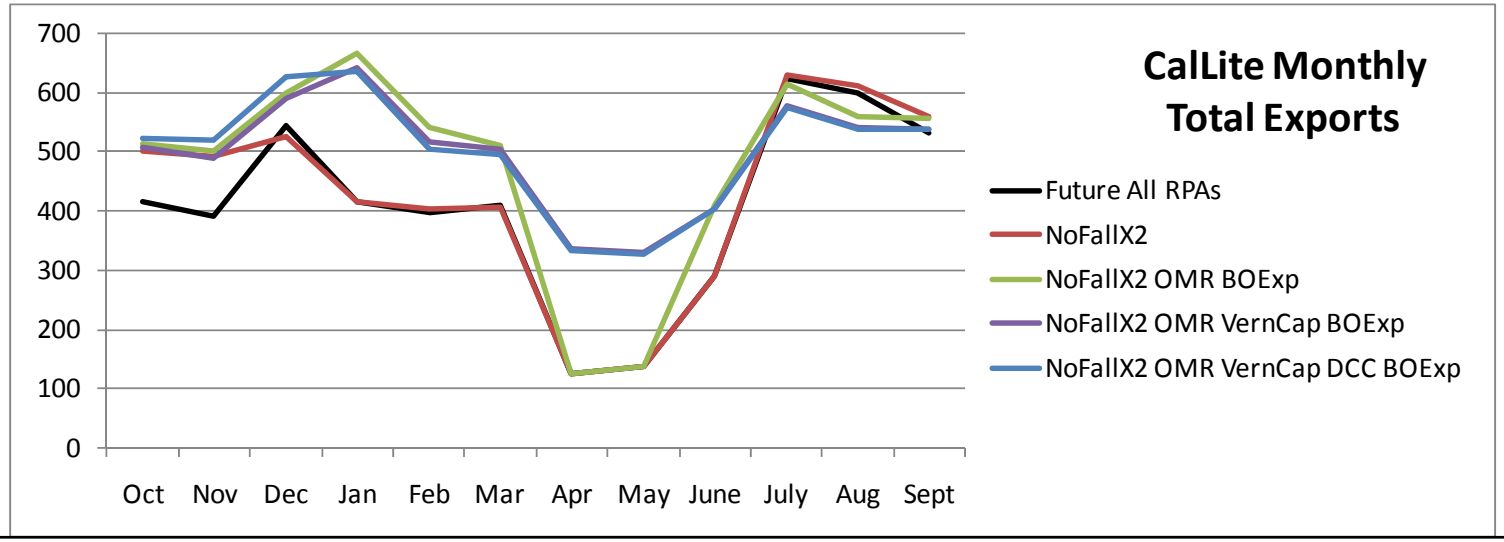
Different RPA Combinations



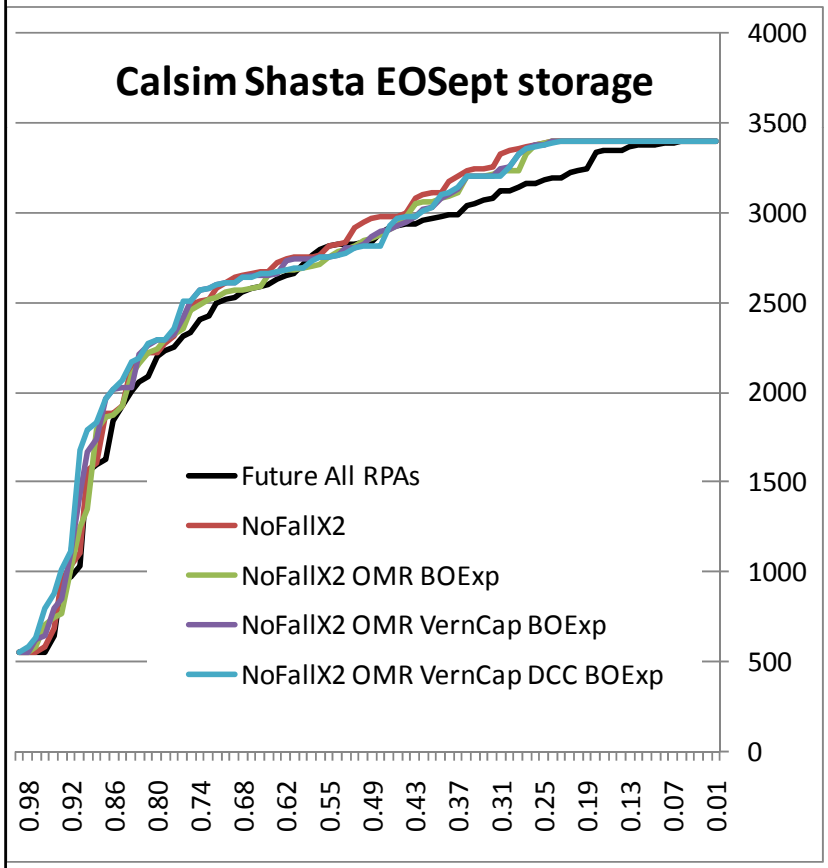


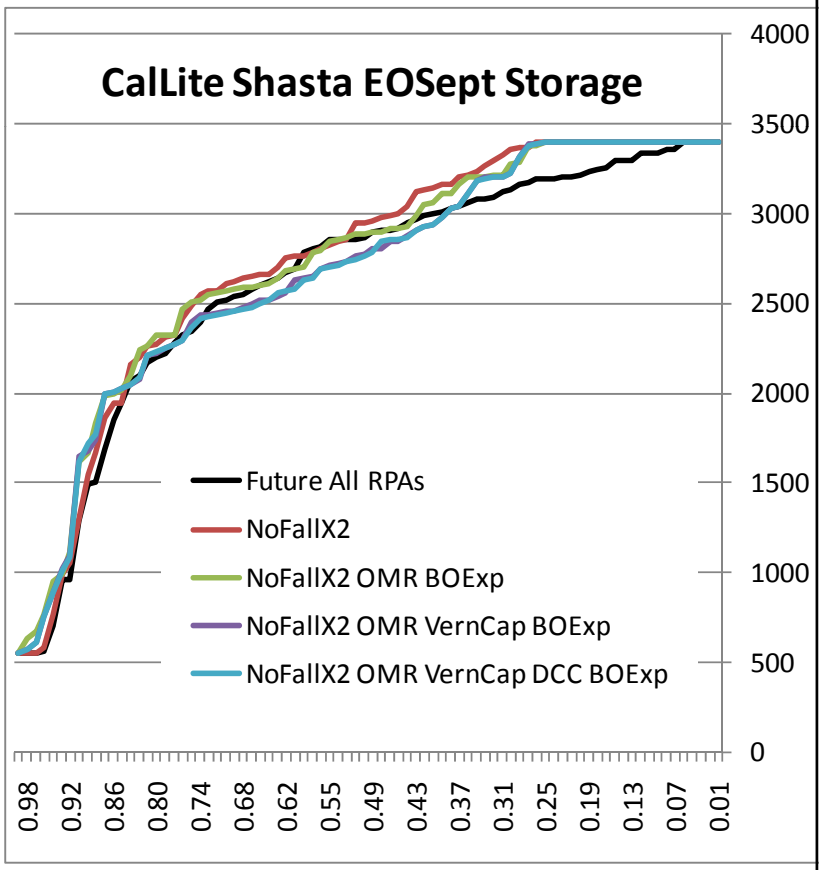
Different RPA Combinations



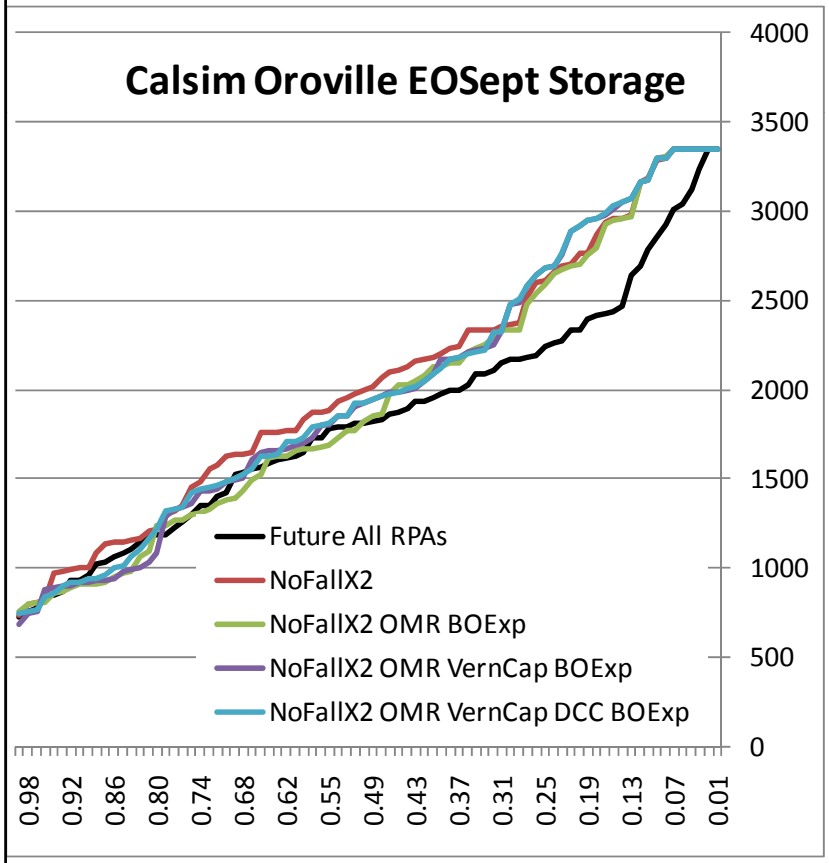


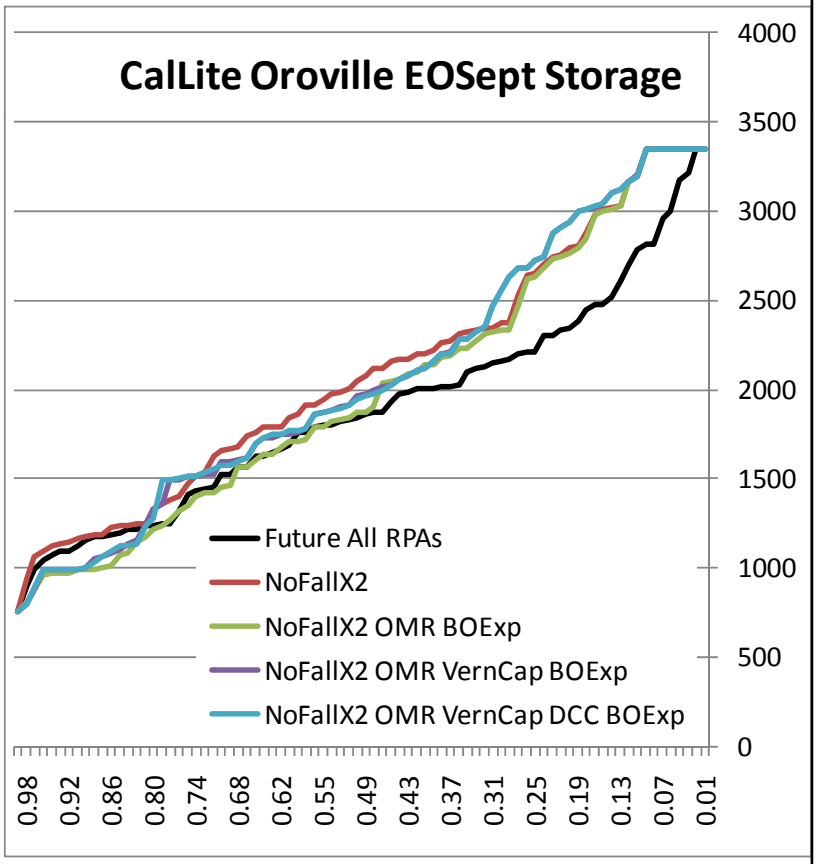
Different RPA Combinations





Different RPA Combinations





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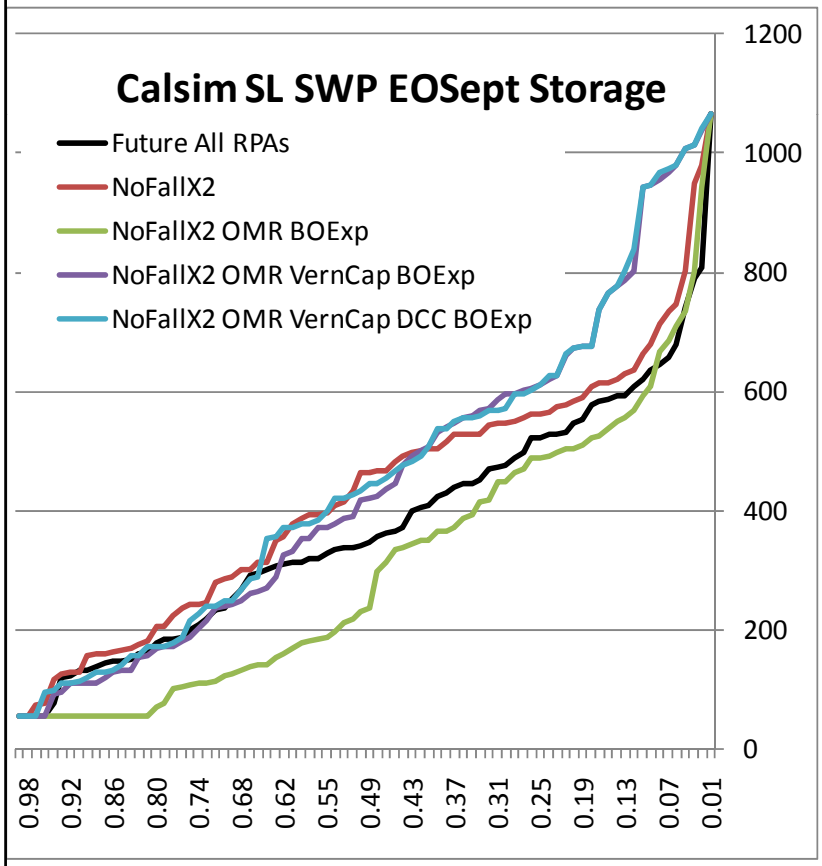
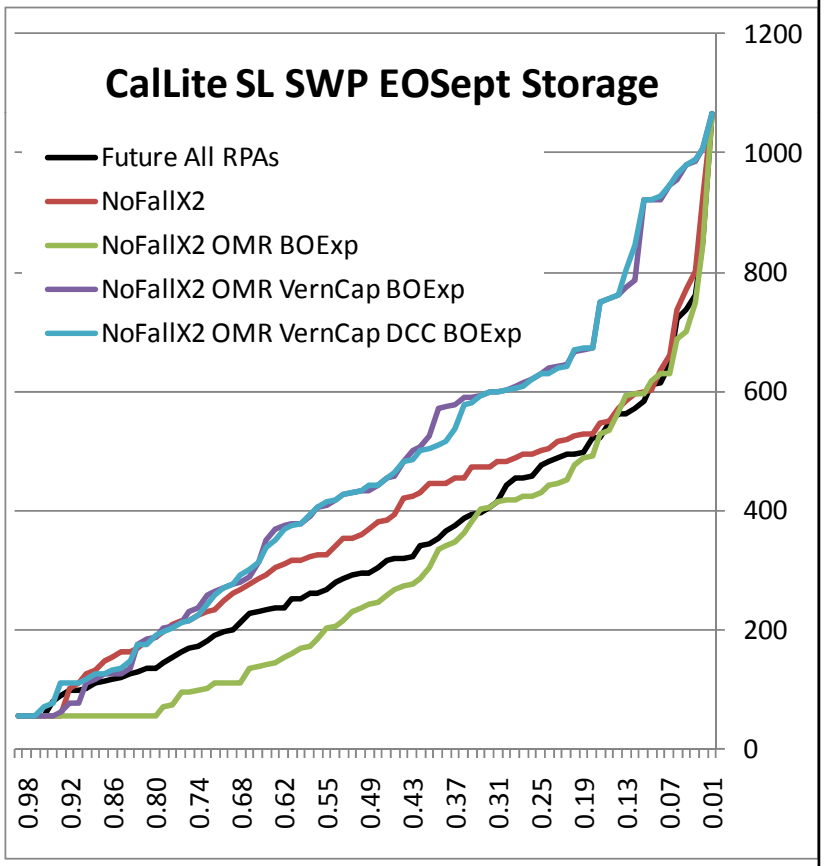
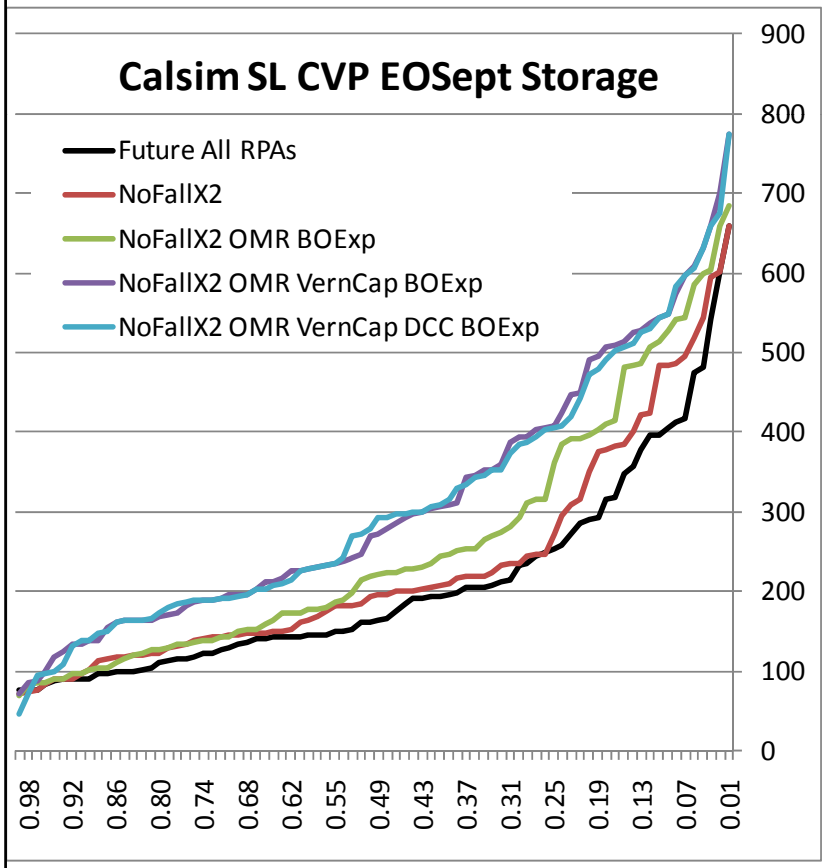
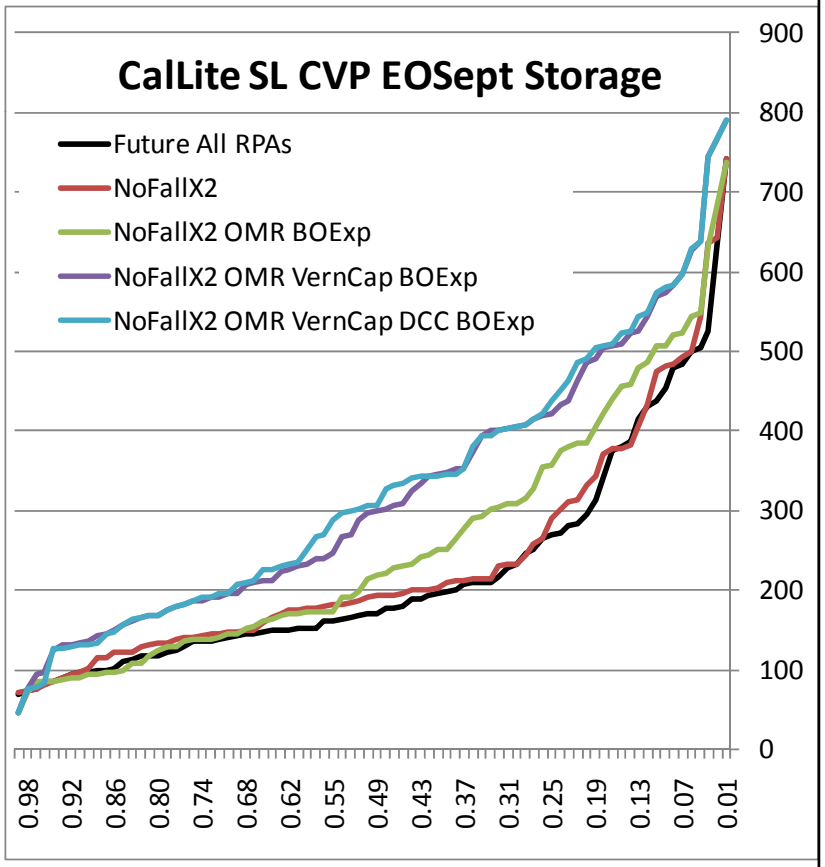




Different RPA Combinations





Conclusions

- Corroboration study shows that CalLite results are very close to CalSim II results, for different levels of development, sea level rise, and regulatory standards

- Though not 100% identical, which is not surprising given the more aggregated nature of CalLite

CalLite Model built in WRIMS – Pre/Post Processing Tools

Hao Xie, Engineer

Bay-Delta Office, DWR

August 29, 2011

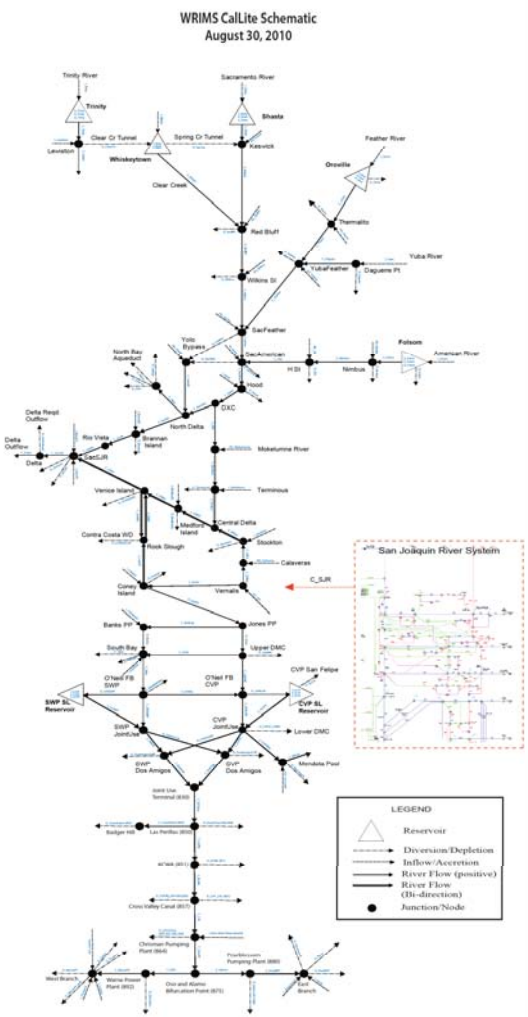
Outline

- Pre-processor to develop CalLite inputs from CalSim output
- Geo-Schematic on Web

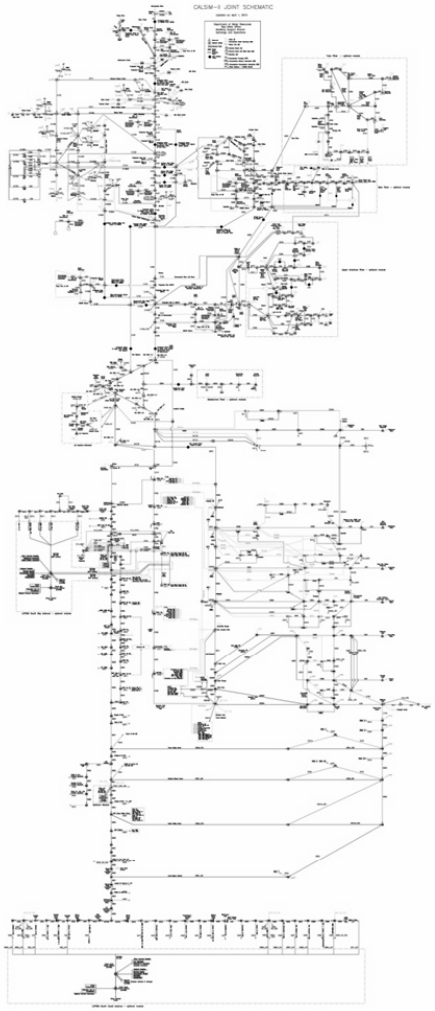
Outline

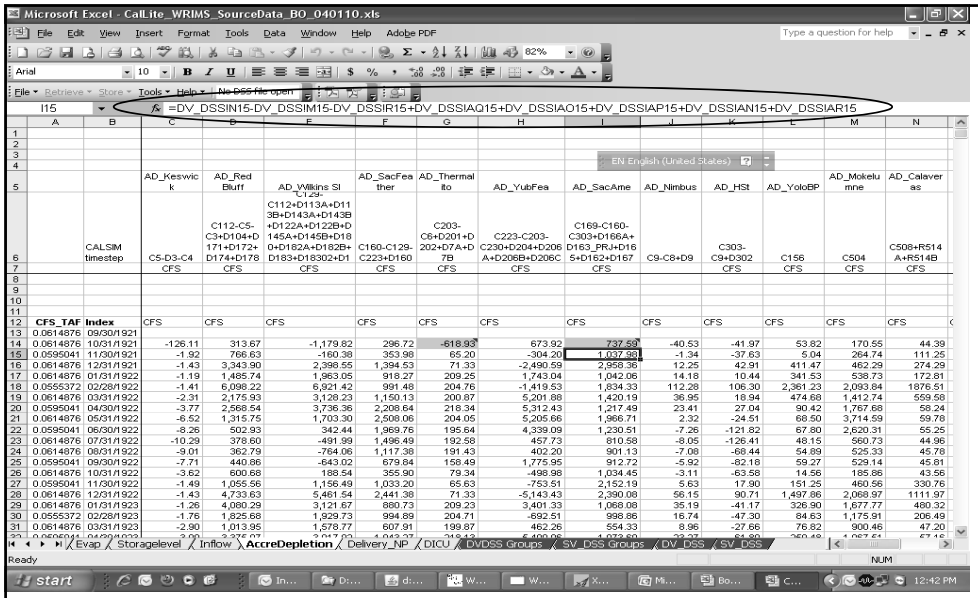
- Pre-processor to develop CalLite inputs from CalSim output
- Geo-Schematic on Web

CalLite Schematics



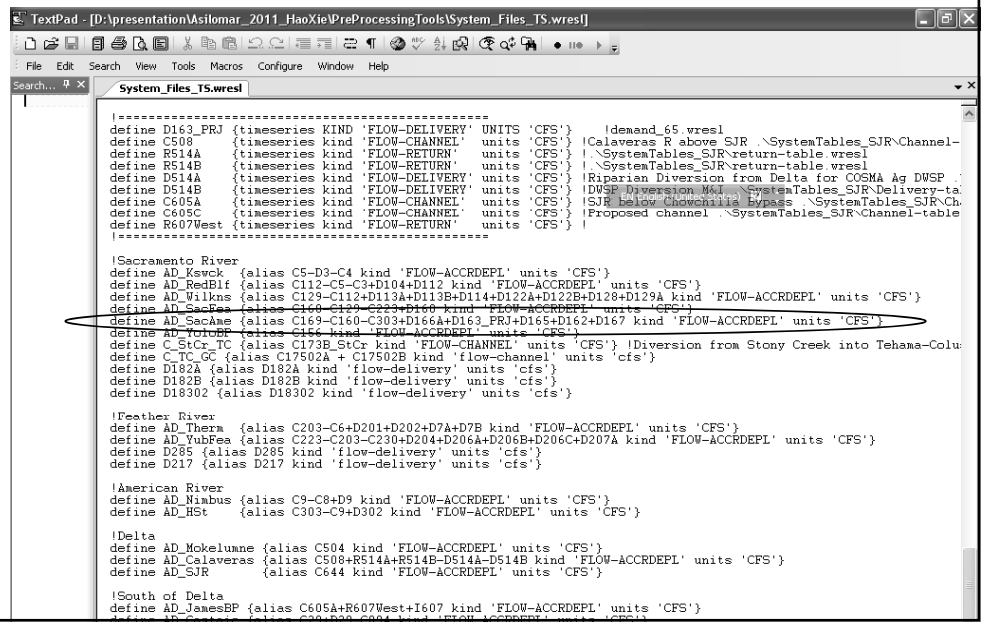
CalSim Schematics





Excel pre-process data

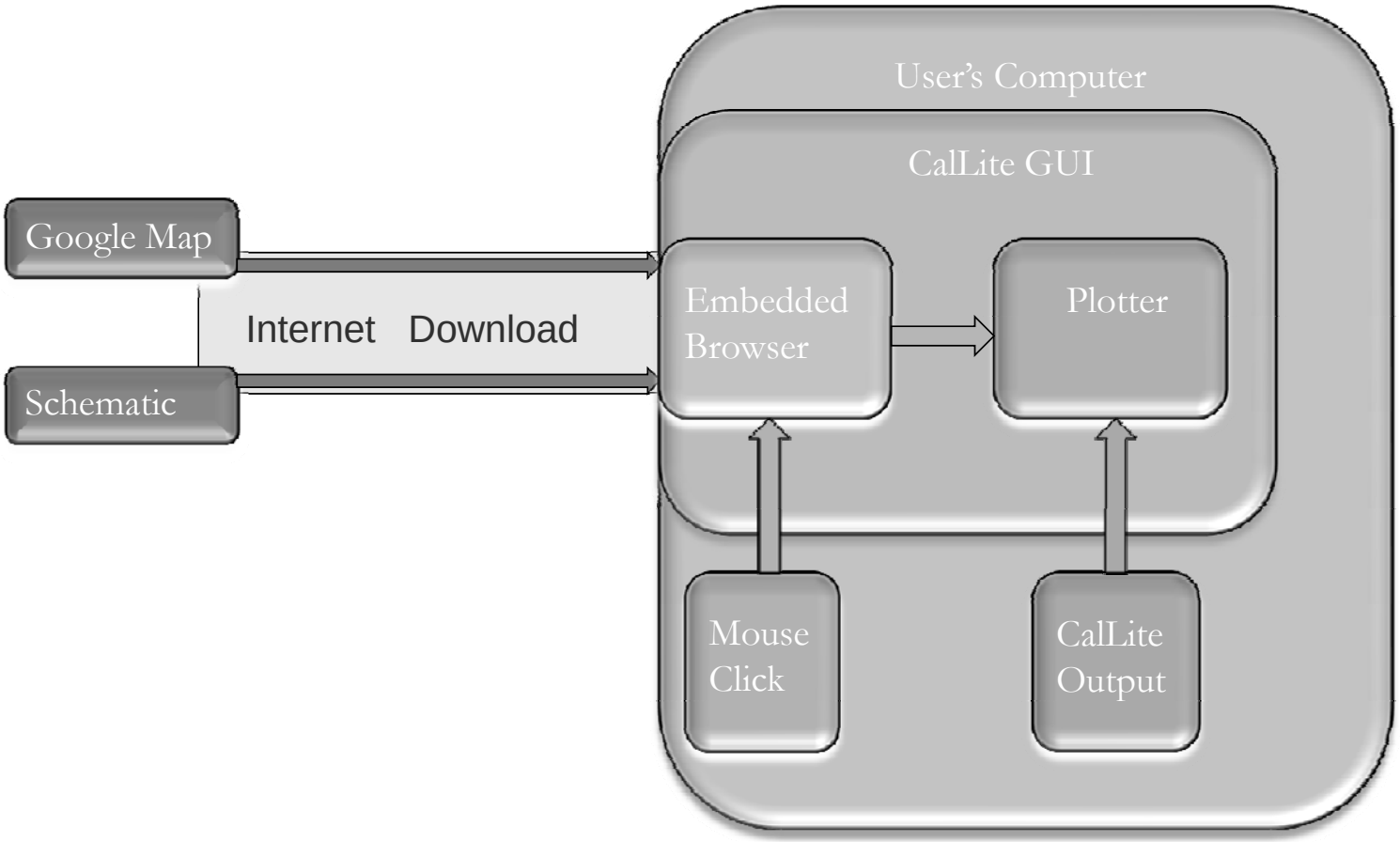
WRIMS-Based Preprocessor



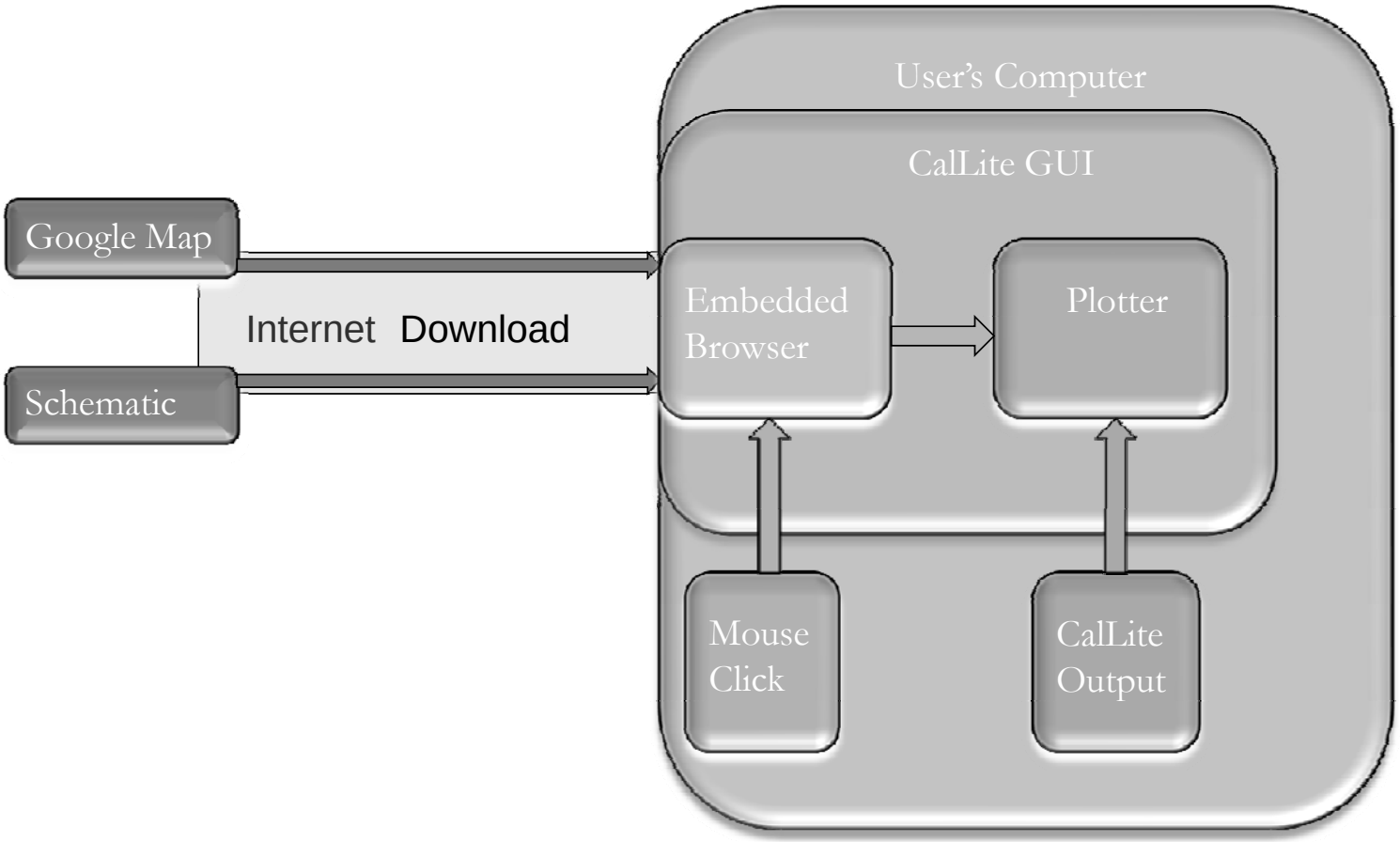
Outline

- Pre-processor to develop CalLite inputs from CalSim output
- Geo-Schematic on Web

Geo-Schematic Structure



Geo-Schematic Structure



Model Users Training

Hands-on Training

Z. Richard Chen & Nazrul Islam

Bay-Delta Office, DWR

CalLite Workshop

August 29, 2011

Outline

- Objective of the Training Studies
- Scenario Settings
  - Scenario 1 (Base Study)
  - Scenario 2 (Alternative Study)
- Analyzing results of Scenario 1 and Scenario 2

Training Studies

- Objective of the Training Studies
  - investigate impact of reduction of SWP South of Delta project demand entitlement by 20% under assumptions of 2030 LOD, current CVP and SWP facilities, and SWRCB D1641 standards in the Delta.
- Scenario 1: Base Study
  - Simulation period – (WY1922 – 2003)
  - Pre-Biological Opinion D1641
  - Future Level of Development (2030 LOD)
  - SWP SOD Demands: Full Table A
  - CVP SOD Demands: Full Contract

Analyzing CalLite Results: Scenario 1

1. What is the Long-Term (1922 – 2003) Average Annual SWP Total Delivery?
2. Plot distribution of Monthly Total SWP Deliveries
3. Plot the exceedence curve of X2 position during Feb.
4. How much can Annual CVP SOD Delivery be expected at 50% Non-Exceedence Level (probability of smaller than the given value) ?

Configuration and Run

- Scenario 2: Base Study + User Defined SWP Demands
  - MWDSC (TAF/year): 1529
  - Other MI(TAF/year): 952
  - AG (TAF/year): 826
  - Article 21 Unchanged 1
- Configuration Steps
  - Load Scenario 1
  - Modify SWP Demands by 20% reduction of the Full Table A
  - Save As Scenario 2
  - Run

Analyzing CalLite Results: Scenarios 1 & 2

1. How much has the average Annual Total SWP Delivery been reduced in the Scenario 2?
2. How does the average Annual CVP SOD Delivery change in the two scenarios?
3. How much has the average Annual Delta Outflow been increased in the Scenario 2?
4. Plot the exceedence curve of Oroville's September Storage under Scenario 1 and Scenario 2.

Answers and Plots

Analyzing CalLite Results: Scenario 1

1) What is the Long-Term (1922 – 2003) Average Annual SWP Total Delivery?

CalLite Results - Total SWP

Summary - PreBO_Scen1_DV

SWP Total Deliveries (TAF) - PreBO_Scen1_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	244.6	222.9	238.1	195.4	240.7	293.8	269.7	329.7	383.9	398.2	388.3	275.3	3480.5

Answers: 3480TAF

Analyzing CalLite Results: Scenario 1

2. Plot distribution of monthly Total SWP Deliveries

CalLite Results - Total SWP

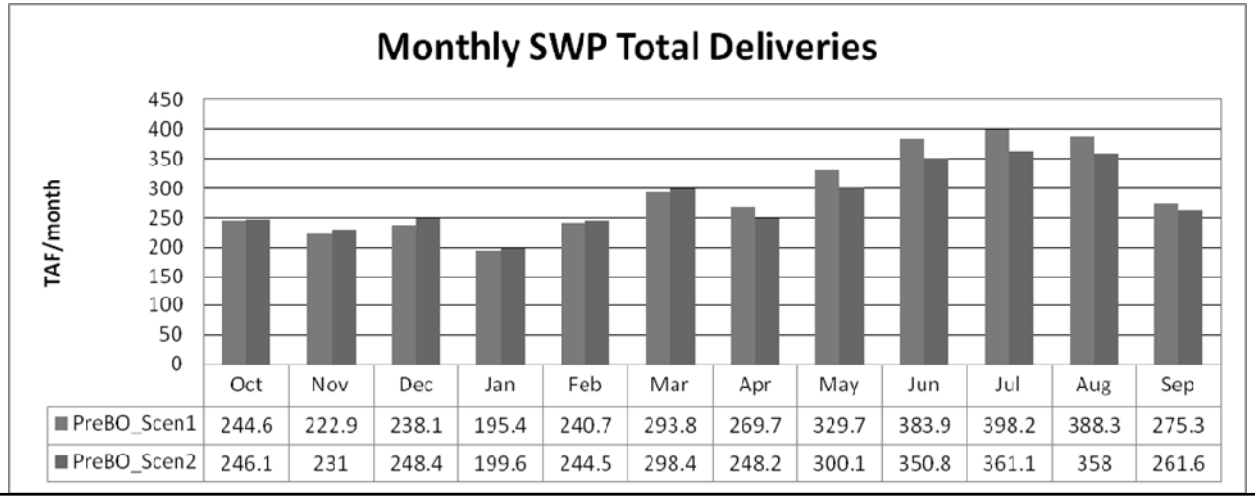
Exceedance (Sep) | Summary - PreBO_Scen1_DV

SWP Total Deliveries (TAF) - PreBO_Scen1_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	244.6	222.9	238.1	195.4	240.7	293.8	269.7	329.7	383.9	398.2	388.3	275.3	3480.5

SWP Total Deliveries (TAF) - PreBO_Scen2_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	246.1	231	248.4	199.6	244.5	298.4	248.2	300.1	350.8	361.1	358	261.6	3347.7



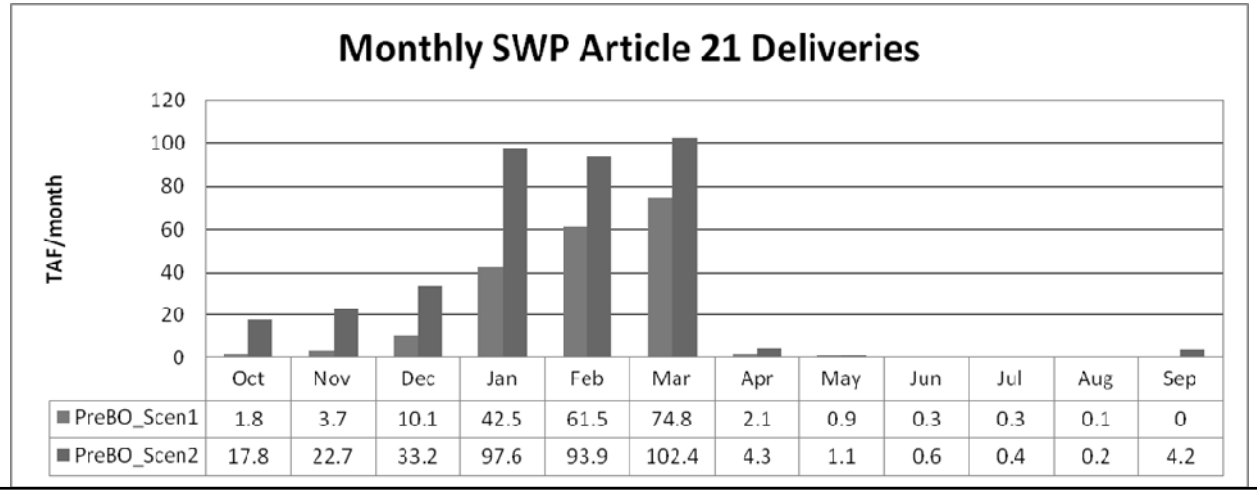
CalLiteGUI Screens

CalLite Results - Total SWP A21

Summary - PreBO_Scen1_DV

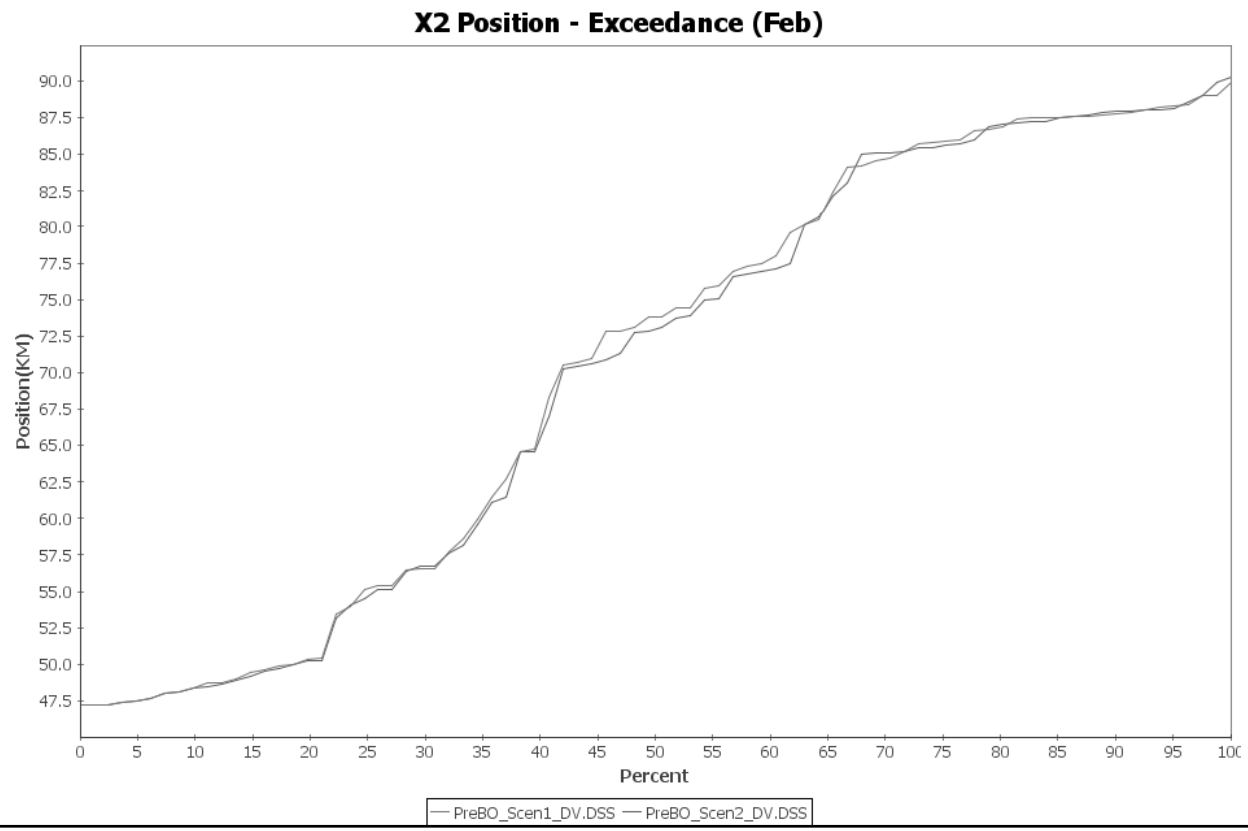
SWP Article 21 (Interruptible) Deliveries (TAF) - PreBO_Scen1_DV.DSS														
Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	1.8	3.7	10.1	42.5	61.5	74.8	2.1	0.9	0.3	0.3	0.1	0	198.2

SWP Article 21 (Interruptible) Deliveries (TAF) - PreBO_Scen2_DV.DSS														
Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	17.8	22.7	33.2	97.6	93.9	102.4	4.3	1.1	0.6	0.4	0.2	4.2	378.2



Analyzing CalLite Results: Scenario 1

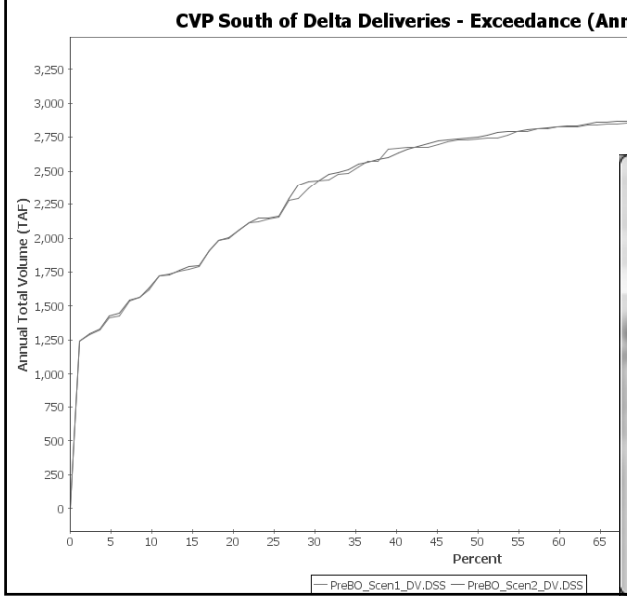
3. Plot the exceedence curve of X2 position during Feb.

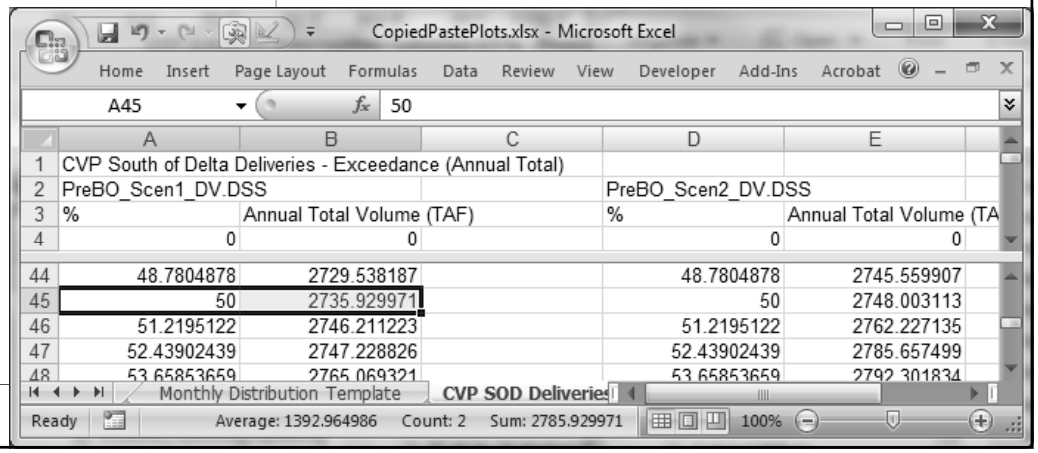


Analyzing CalLite Results: Scenario 1

4. How much Annual CVP SOD Delivery can be expected at 50% Non-Exceedence Level (probability of smaller than the given value) ?

Answer: 2736 TAF





	A	B	C	D	E
1	CVP South of Delta Deliveries - Exceedance (Annual Total)				
2	PreBO_Scen1_DV.DSS			PreBO_Scen2_DV.DSS	
3	%	Annual Total Volume (TAF)		%	Annual Total Volume (TA
4	0	0		0	0
44	48.7804878	2729.538187		48.7804878	2745.559907
45	50	2735.929971		50	2748.003113
46	51.2195122	2746.211223		51.2195122	2762.227135
47	52.43902439	2747.228826		52.43902439	2785.657499
48	53.65853659	2765.069321		53.65853659	2792.301834

Analyzing CalLite Results: Scenario 1 & 2

Analyzing CalLite Results: Scenario 1 & 2

1) How much has the average annual total SWP delivery been reduced in Scenario 2?

CalLite Results - Total SWP

Exceedance (Sep) | Summary - PreBO_Scen1_DV

SWP Total Deliveries (TAF) - PreBO_Scen1_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	244.6	222.9	238.1	195.4	240.7	293.8	269.7	329.7	383.9	398.2	388.3	275.3	3480.5

SWP Total Deliveries (TAF) - PreBO_Scen2_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	246.1	231	248.4	199.6	244.5	298.4	248.2	300.1	350.8	361.1	358	261.6	3347.7

Answer: The reduction of Annual Total SWP delivery is 132.8 TAF in Scenario 2. (3480.5-3347.7=132.8TAF)

2) How does the average annual CVP SOD delivery change?

CalLite Results - Total CVP SOD

Exceedance (Sep) | Summary - PreBO_Scen1_DV

CVP South of Delta Deliveries (TAF) - PreBO_Scen1_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	174.7	103.1	83.2	98.6	118.5	142.9	174.9	266.5	381.2	434.7	363.1	219.9	2561.3

CVP South of Delta Deliveries (TAF) - PreBO_Scen2_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	175.1	103.3	83.5	99.2	119.1	143.5	175.7	267.6	382.9	436.8	365.1	220.4	2572.2

Answer: Average Annual CVP SOD delivery has increased 10.9 TAF (from 2561.3 TAF in Scenario 1 to 2572.2 TAF in Scenario 2)

Analyzing CalLite Results: Scenario 1 & 2

3) How much has the average annual Delta outflow been increased in the Scenario 2?

CalLite Results - Outflow

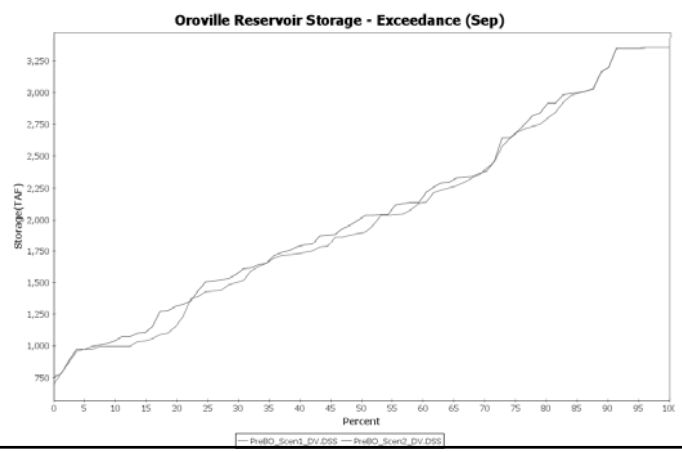
Exceedance (Sep) | Summary - PreBO_Scen1_DV

Delta Outflow (TAF) - PreBO_Scen1_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	306.7	520.9	1306.7	2403.1	2816.8	2565	1680.5	1287.4	782	471.1	263	298.6	14701.9

Delta Outflow (TAF) - PreBO_Scen2_DV.DSS

Year Group	Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
All	Avg	302.7	523.4	1324.3	2439.9	2831.5	2587.2	1683.5	1291	782.6	470.5	265.2	294	14795.8

Answer: Average Annual Delta Outflow has increased 94 TAF (14,796 - 14,702=94 TAF)?

4) Plot the exceedence curves of September storage in Oroville under Scenario 1 and Scenario 2.