CalLite

Central Valley Water Management Screening Model

Version 3.00

User's Guide

November 2014

California Department of Water Resources

and

United States Bureau of Reclamation

Table of Contents

1. Introduction

The CalLite 3.00 User's Guide facilitates the use of the CalLite Graphical User Interface (GUI) by describing all of the screens, dashboards, panels, and options available on the GUI. For detailed information on aspects of the model other than the GUI, see the CalLite 3.00 Reference Manual, which is distributed as a separate PDF.

1.1. The CalLite 3.00 Model

CalLite is an interactive screening model for the planning and management of the State Water Project (SWP) and the Central Valley Project (CVP) in California. It simulates the hydrology of the Central Valley, reservoir operations and delivery allocation decisions for the SWP and CVP, delta salinity responses to river flow and export changes, and habitat-ecosystem indices. The power of a screening model such as CalLite is the ability to rapidly simulate system operations and to incorporate changes with relative ease. The current version of CalLite simulates system operations on a monthly basis for the full 82-year period of record (water years 1922-2003) in approximately 6 minutes (in comparison to 30 minutes in CalSim) on an up-to-date modeling computer. Scenarios can be run with a variety of different user-specified parameters related to hydroclimate, demands, facilities and infrastructure, regulations, and system operations. Results from CalLite runs may be viewed, compared and analyzed by using the model's integrated post-processing tools.

CalLite 3.00, the latest version of the CalLite model, is based on an updated version of the Water Resource Integrated Modeling System (WRIMS 2). Moving to the WRIMS 2 engine allows CalLite to share the same modeling platform as its parent model, CalSim II. CalLite contains much of the same functionality as CalSim II, but is simplified in its spatial and hydrologic detail. Despite these simplifications, the model results corroborate closely with a comparable CalSim II study.

Further information on the CalLite 3.00 model can be found in this User's Guide, in the CalLite 3.00 Reference Manual, and at the CalLite website.

A CalLite tutorial is available at the end of this User's Guide.

1.2. Installation

The CalLite model is currently delivered in a single installer file. Installation consists of extracting all files in the archive (.zip) to a file system location on a Windows XP, Vista, or Windows 7 computer. During installation, a CalLite3.00.exe icon is generated on the desktop. The software is started by double-clicking the icon. Alternatively, users may start the CalLite GUI from start>program>CalLite3.00>CalLite3.00. Users may also start the CalLite GUI by double-clicking on the *run-calgui* batch file in the root directory of the extracted version (see Figure 1-1 below).

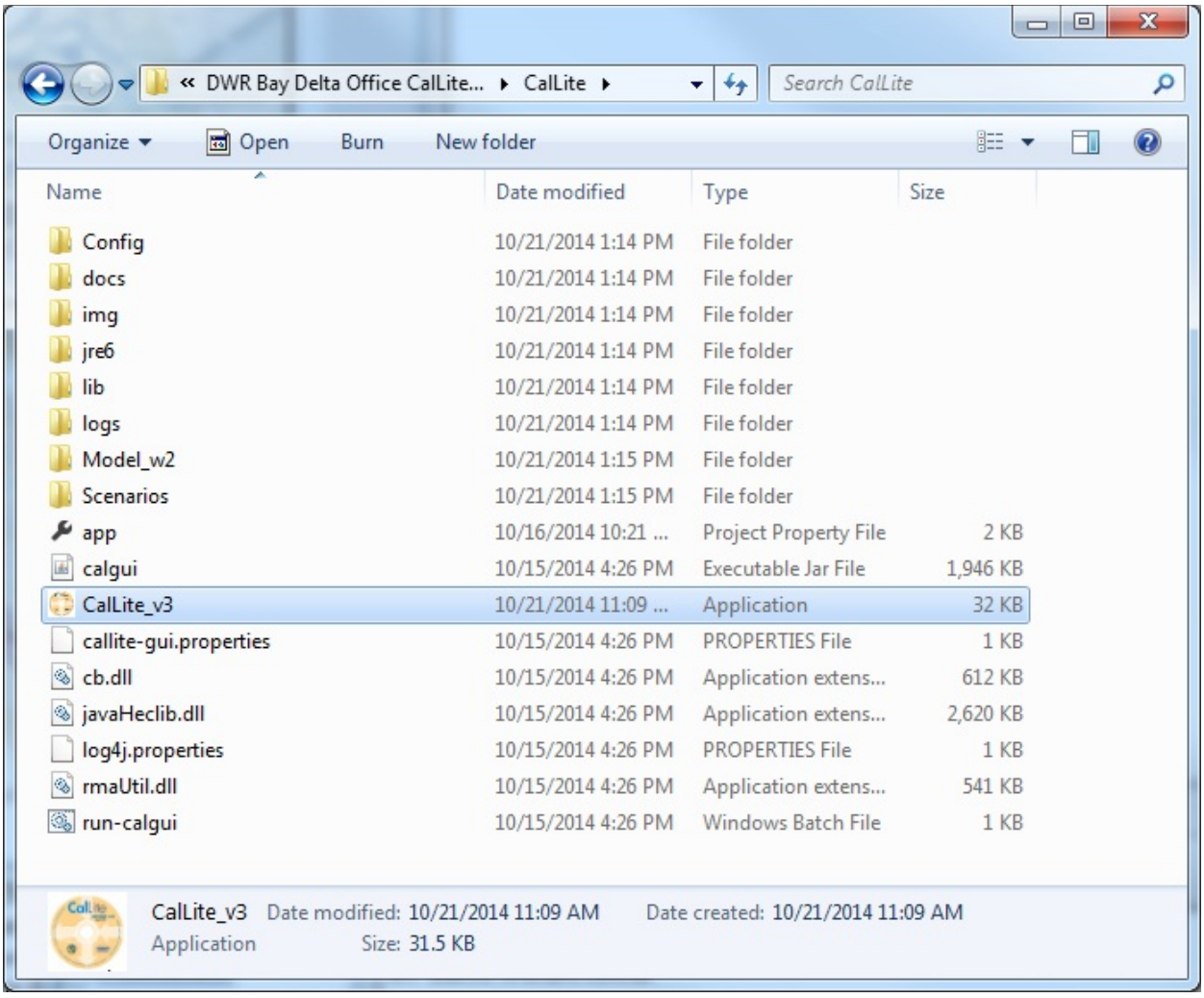


Figure 1-1. The CalLite GUI 3.00 package.

2. Main Menu Options

The majority of user choices in the CalLite GUI are handled on a series of dashboards accessed through tabs across the top of the interface. The six dashboards for specifying scenario settings contain black text (Run Settings, Hydroclimate, Demands, Facilities, Regulations, Operations), while the five dashboards for viewing results contain blue text: (Quick Results, Custom Results, Map View, External PDF, Web Map). See Figure 2-1.

There are two dropdown menus:

- **File:** Options to load, run, save, save as, or delete an existing scenario.
- **Help:** Access to the help system and the current CalLite GUI version information.

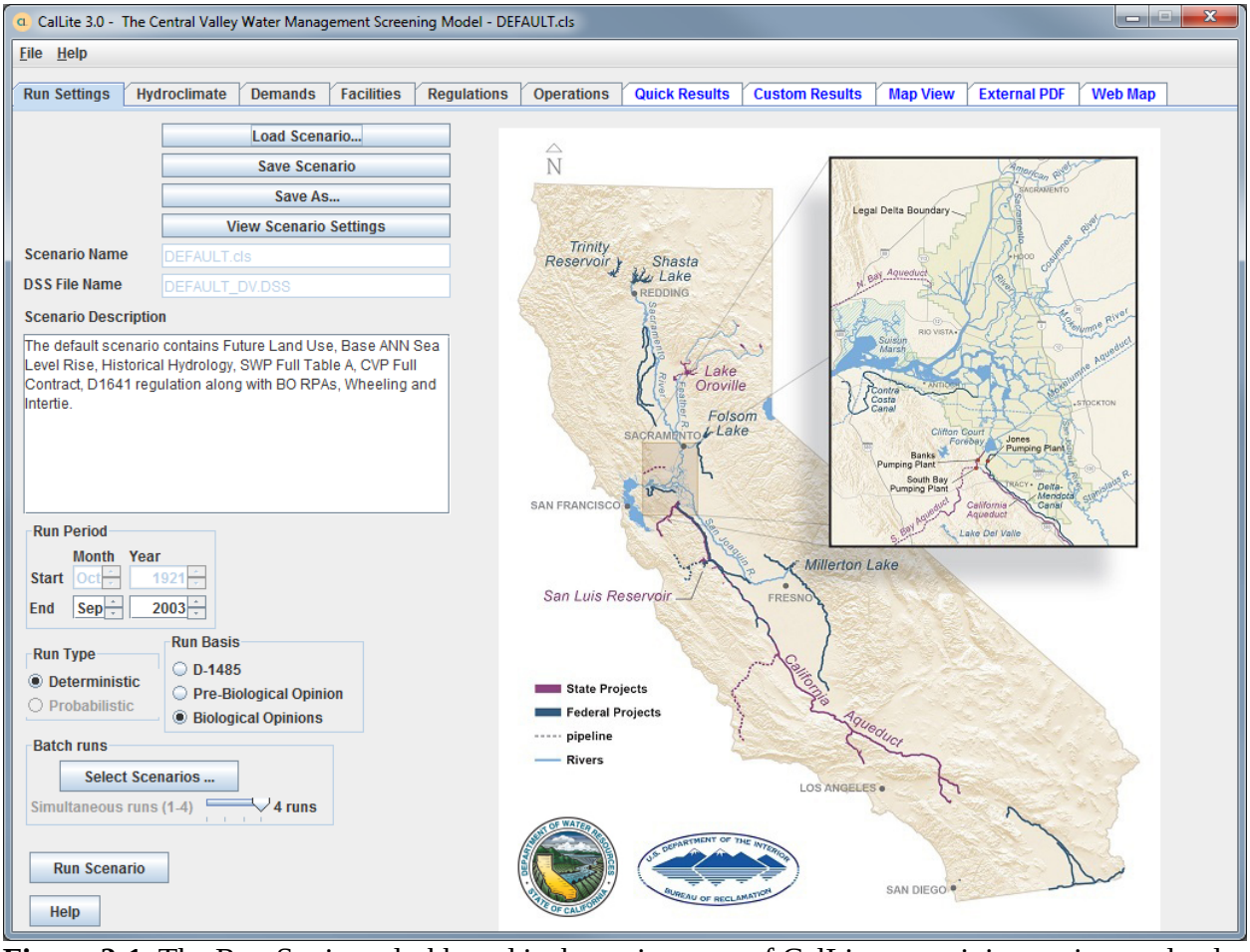


Figure 2-1. The Run Settings dashboard is the main menu of CalLite, containing options to load, save and run scenarios.

3. Scenario Settings Dashboards

The user can set parameters for the current scenario using the Run Settings, Hydroclimate, Demands, Facilities, Regulations, and Operations dashboards.

3.1. Run Settings

The Run Settings dashboard allows the user to load, save, run, select scenario(s), view scenario settings, enter a scenario description, initiate batch runs, specify the run period, run type, and specify the run basis.

Scenario settings are saved with a file extension .cls (CalLite Scenario). The file is portable and can be easily loaded by another user.

The *View Scenario Settings* button allows the user to view all selected scenario options in a summarized table. This should be checked to ensure that all settings are correct before running.

The *Run Period* can be set to any period starting no earlier than Oct 1921 and ending no later than Sep 2003 (water years 1922-2003). In this version of CalLite, only deterministic run types are possible. Probabilistic runs may be added in later versions of the model. The Run Basis sets the type of CalSim II run to use as a baseline of the CalLite run. Currently, three run bases are available: Biological Opinion RPAs, Pre-Biological Opinion RPAs, and D-1485. The base CalSim II run affects the AD (accretion/depletion) terms that are used in CalLite (through the SV input file) and also the WSI-DI tables.

If shortages associated with AD terms in the North of Delta area exist, CalLite will display a warning message at the end of the simulation. See Appendix A of the CalLite Reference Manual for a further description of AD terms and shortages.

The *Batch Runs* option provides the capability to run up to four CalLite studies simultaneously, which is more efficient than having to parameterize and run each individual study through a separate GUI instance.

3.2. Hydroclimate

The Hydroclimate dashboard allows the user to set the following:

- **Climate Projection Period**- The current version of CalLite has the capability to run simulations for the Current Level of Development (LOD) (2005), or Future (2020) LOD under the Historical Hydrology category. In addition, future hydrologic periods of Early Long-Term 2025 or Late Long-Term 2060, under the Climate Change category, provide additional options with different assumptions in regard to the land use and quantity of water demands.

- **Sea Level Rise**- Possible options include the current sea level, a sea level rise (SLR) of 15 cm, and a SLR of 45 cm. The Artificial Neural Network (ANN) method is used to estimate the X2 position (location in the Delta of salinity at 2 parts per thousand). See Appendix F of the CalLite Reference Manual for more information.

- **Climate Change Scenarios**- This version of the model has the capability to simulate operations using historical hydrology and different climate change futures. CalLite includes the option to run a study with one of the five climate changes scenarios (Q1-Q5) used in the BDCP analysis. Each climate change scenario is associated with either the Early Long-Term (ELT) or Late Long-Term (LLT) climate projection period, allowing ten total climate change combinations; ELT Q1-Q5 and LLT Q1-Q5. These scenarios were determined by mapping 112 future climate projections obtained from 15 different global climate models developed by various national climate centers. More information in Appendix F of the CalLite Reference Manual.

- **SV/Init Files**- By default, GUI selects the input hydrology DSS file (the State Variable, or SV file) and the default initial condition DSS file (Init) based on the selected Run Basis and Climate Projection Period. The user can also choose to manually select input files by choosing the *DSS files selected by user* option.

   **WARNING:** Use caution when using a non-default SV file, as a manually selected SV file may not accurately represent the parameters of your study.

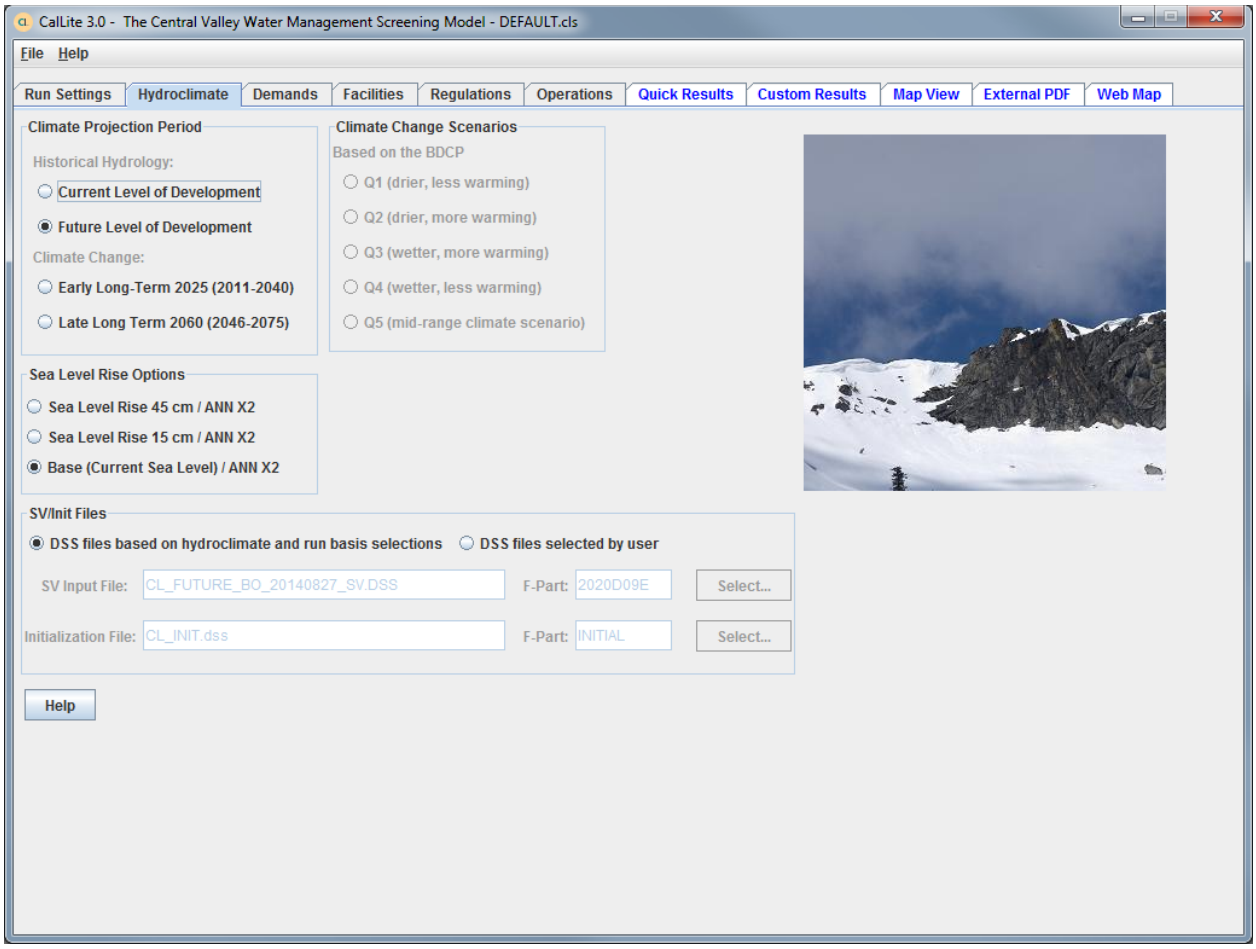


Figure 3-1. The Hydroclimate dashboard contains options for setting the climate projection period, sea level rise, and the SV and Initial Files.

3.3. Demands

The Demands dashboard allows the user to make selections relating to SWP and CVP South of Delta (SOD) demands, as follows:

SWP Demands - South of Delta - A user has the option to select: historical variable Table A demand levels (i.e. *Variable: 3.3-4.2 million acre-feet per year*), full Table A demand levels (i.e. *Fixed (Full Table A): 4.2 million acre-feet per year*), or user-defined demands. When user-defined demands is selected, demand values can be specified for MWDSC (Metropolitan Water District), Other MI (Municipal and Industrial), and AG (Agricultural) demands. The values entered in the boxes cannot exceed the full Table A amount (as specified in the GUI), and must be greater than zero. The user may also enter the proportion of Article 21 interruptible demands to deliver. When selecting the user-defined demand option, values for losses are held constant and Article 56 (carryover) demands are set to zero.

CVP Demands - South of Delta- A user has the option to use full contract or user-defined demands. For user-defined demands, demand values may be specified for AG, MI, and Refuge

demands. The values entered here cannot exceed the full contract amount as specified in the GUI, and must be greater than zero. When selecting user-defined demands, values for losses are held constant and water rights and exchange contractor deliveries cannot be altered.

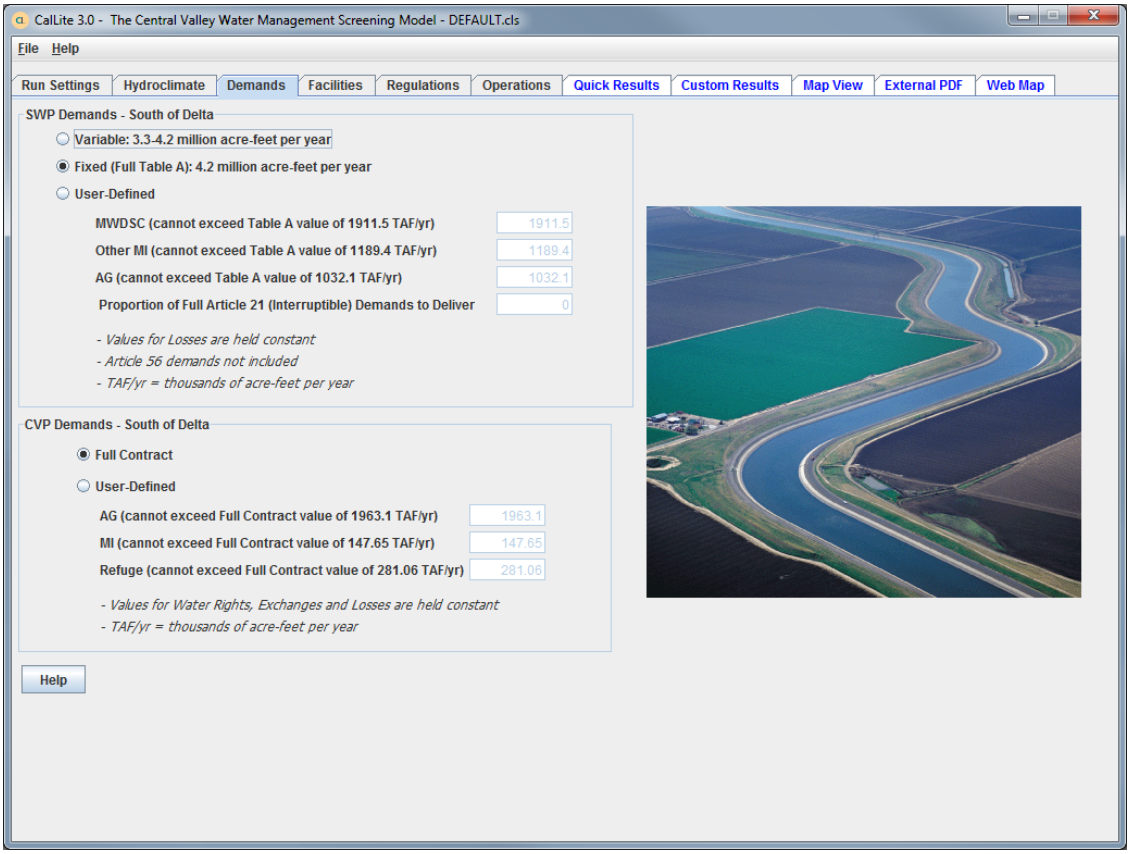


Figure 3-2. The Demands dashboard allows the user to make changes regarding SWP and CVP South of Delta (SOD) demands.

3.4. Facilities

The Facilities dashboard features in CalLite allow the user to set the Shasta and Los Vaqueros enlargement options.

Shasta Enlargement - Three Shasta Dam raise heights are currently available on CalLite: 6.5-feet (256 TAF), 12.5-feet (443 TAF), and 18.5- feet (634 TAF). The user is provided with a check box to turn on/off Shasta Dam Enlargement. If turned on, the user sees three more check boxes representing the three enlargement alternatives.

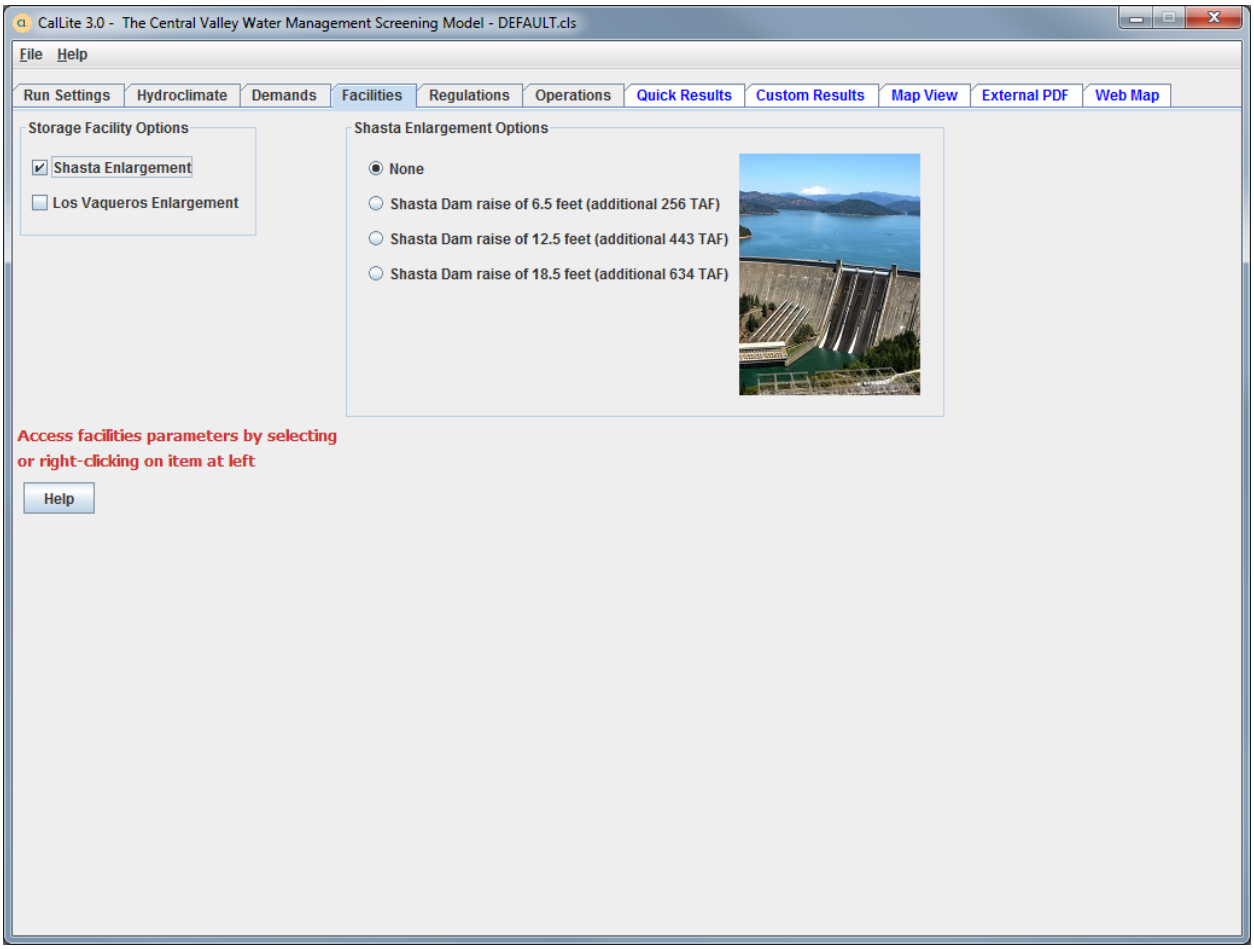


Figure 3-3. Facilities dashboard with options shown for Shasta Enlargement.

Los Vaqueros Enlargement - The Los Vaqueros Expansion Model was developed to simulate planning and operations at key Contra Costa Water District facilities. Those facilities include:

- Los Vaqueros Reservoir capacity
- Delta intake capacities at Rock Slough, Old River, and Middle River (Victoria Canal)
- Old River Pipeline
- Target salinity level

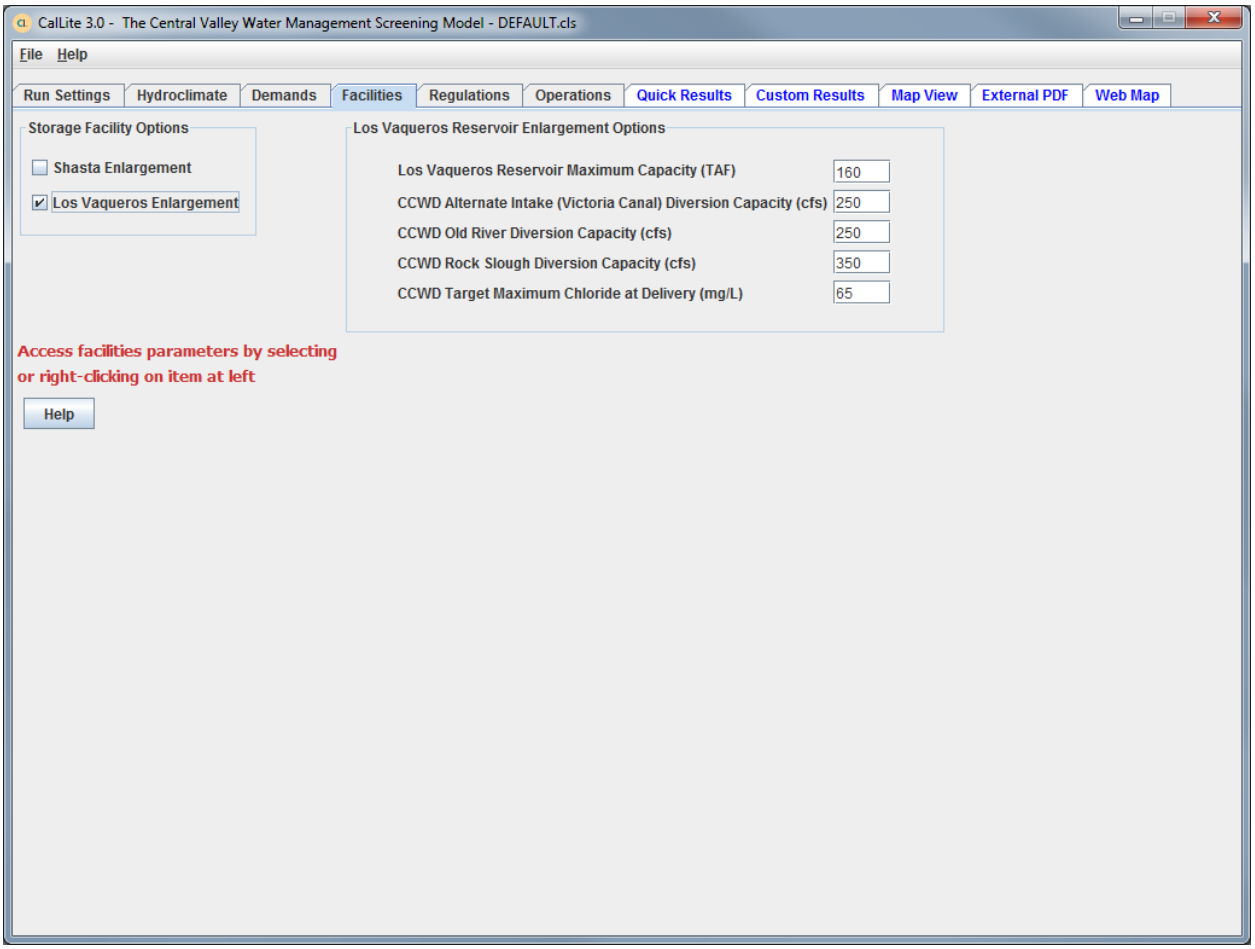


Figure 3-4. Facilities dashboard with options shown for Los Vaqueros enlargement.

3.5. Regulations

The Regulations dashboard allows the user to select different regulatory option. There are four panels on the Regulations dashboard for: D-1641/D-1485 regulations, Biological Opinion Reasonable and Prudent Alternative (RPAs), SJR Controls, and Other regulations.

3.5.1. Quick Select

The Quick Select box at the top of the dashboard gives users the option to select a *standard* run for one of the following regulatory environments: D-1485, D-1641, and D-1641 plus BO RPAs. Choosing one of these Quick Select options with automatically enable all the default regulations for that regulatory environment.

If a user would like to deviate from one of the standard regulatory environments, the User Defined Quick Select option must be selected. The GUI will store the set of options enabled prior to the selection of User Defined Quick Select. For example, if a user selects D-1641 Quick Select and then chooses User Defined Quick Select, the editable options will represent D-1641 regulations (i.e. X2, Roe Trigger, Export-Inflow, and Vernalis will be checked ON, while Salinity Standards at Antioch and Chipps will be checked OFF).

> ⚠ **WARNING:** Users must exercise discretion when setting user-defined standards. This feature is for advanced model users, since user-specified values may cause non-feasible operations, even if the model appears to complete successfully. Please check with modeling/operations experts to ensure that criteria for these inputs and resulting outputs remain reasonable.

Appendix C of the CalLite Reference Manual has a detailed description of all of the regulations on this dashboard.

3.5.2. D-1641/D-1485 Regulations Panel

This panel contains regulations described by State Water Resources Control Board Decisions 1641 (D-1641) and 1485 (D-1485). These regulations are summarized below and in more detail in Appendix C of the CalLite Reference Manual. Clicking the checkbox next to a regulation will activate it.

> ⚠ **WARNING:** D-1485 regulations are no longer operationally used in California. The option to run a scenario with D-1485 regulations is provided simply as a service to users.

For many of these standards, the specific D-1641 or D-1485 standard may be replaced with a user-defined standard. If this is desired, after turning on the regulation, click on the radio button for user-defined and enter desired values in the editable table (on the right half of the screen). The numbered months refer to water year months, so Oct = 1, Nov =2, etc.

The regulations on this panel are as follows:

Interior Delta Flows:

Delta Cross Channel (DCC) - This defines the numbers of days the DCC gates are open in each month. Operation of the DCC assists in transferring fresh water from the

Sacramento River south across the Delta. Operations depend on water quality, flood protection, and fish and wildlife requirements. The number of days open each month can be adjusted using the user-defined option.

> **WARNING:** When the user-defined radio button is selected, the Delta Cross Channel RPA (on the Biological Opinion RPAs panel) should be disabled.

River Flows:

Sacramento River at Rio Vista Minimum Flow - This defines the minimum flow requirement at Rio Vista, which vary by month and water year type. This standard can be adjusted using the user-defined option.

Trinity Minimum Flows – This defines the Trinity River minimum flow that was in place during the implementation of either the D-1485 or D-1641 standards. Note that these minimum flows are *not* considered part of the D-1485 or D-1641 regulation and are *not* defined in either of the regulatory documents.

The default for a D-1485 regulatory environment is lower minimum flows from the 340 TAF/yr Trinity minimum required flow based on the Trinity River Index. The default for a D-1641 regulatory environment is higher minimum flows from the 369-815 TAF/yr Trinity minimum required flow based on the Trinity River Index.

Users are not able to turn off the Trinity minimum flows altogether, so to access the available options (D-1641 or D-1485) for this checkbox, right click on the text for *Trinity Minimum Flows*.

Delta Outflows:

Minimum Net Delta Outflow - This defines the minimum outflow requirement through the Delta. The flow standard varies depending on month, water year type, and other criteria as specified in D-1641.

X2 Requirements - The X2 position is the distance (in kilometers) east of the Golden Gate Bridge where the salinity level is two ppt (parts per thousand) Chloride. The goal of this standard is to maintain the X2 position at or to the west of certain specified locations. Under D-1641, this standard is in place Feb-June and is enforced in different locations (Roe Island, Chipps Island, and Collinsville) for different parts of each month depending on certain criteria.

When the user-defined radio button is selected, the X2 standard can be turned on or off for each month, values can be set in kilometers by month and water year type, and both the Roe Trigger and the BO RPA Fall X2 standard should be disabled.

> **WARNING:** When the user-defined radio button is selected, both the Roe Trigger and the BO RPA Fall X2 standard should be disabled.

Roe Trigger- This trigger is a D-1641 regulation. Under D-1641 standards, X2 is required to be at or west of Roe Island for a certain number of days if the preceding month's X2 position was west of Roe. If the preceding month's X2 position was east of Roe, then the required number of days is automatically set to zero. If the trigger is not activated (checked on), the required number days west of Roe is always zero.

> ⚠ **WARNING:** Deactivate if user-defined radio button option is selected for X2 regulation (on the D-1641/D-1485 panel).

Export Restrictions:

Export-Inflow Ratio – This D-1641 standard limits the combined exports of CVP and SWP to a specific proportion of total Delta outflow. The standard varies by month and river flow levels. When the user-defined option is selected, this proportion (ratio) can be adjusted by month.

Vernalis (Vernalis D-1641 Criteria) – This standard limits the combined exports of CVP and SWP to the minimum of two different standards during the Apr 15-May 15 pulse period. The first standard is from D-1641, where exports are limited to the maximum of 1,500 cfs or San Joaquin River flow at Vernalis. The second standard is the VAMP (Vernalis Adaptive Management Plan) export cap, which varies depending on the VAMP pulse flows released during this same period. In certain situations it is possible for the user to have the VAMP export cap turned on while the VAMP pulse flows are turned off (either when using the dynamic San Joaquin module or when using a D-1485 run basis, which has no VAMP pulse flows). In these cases the VAMP export cap will be de-activated, since that cap is based on the pulse flow requirement, so cannot be accurately set without it. In these cases the D-1641 export cap will remain active.

Pumping Limits (Jones and Banks) – This limits pumping at Jones and Banks pumping plants according to the selected regulation. Under D-1641, Jones is limited to 4,600 and Banks is limited to 6,680. Under D-1485, Jones and Banks are additionally limited to 3,000 CFS in May and June and Banks is additionally limited to 4,600 in July. Users are not able to turn off the pumping limits altogether, so to access the available options (D-1641 or D-1485) for this checkbox, right click on the text for *Pumping Limits (Jones and Banks)*.

Salinity Standards:

CalLite includes the option to include salinity standards at: Emmaton and Jersey Point (for agriculture), Rock Slough (for Municipal and Industrial), and Collinsville (for fish and wildlife), and Antioch and Chipps (D-1485 additional standard locations). These standards vary depending on month and water year type.

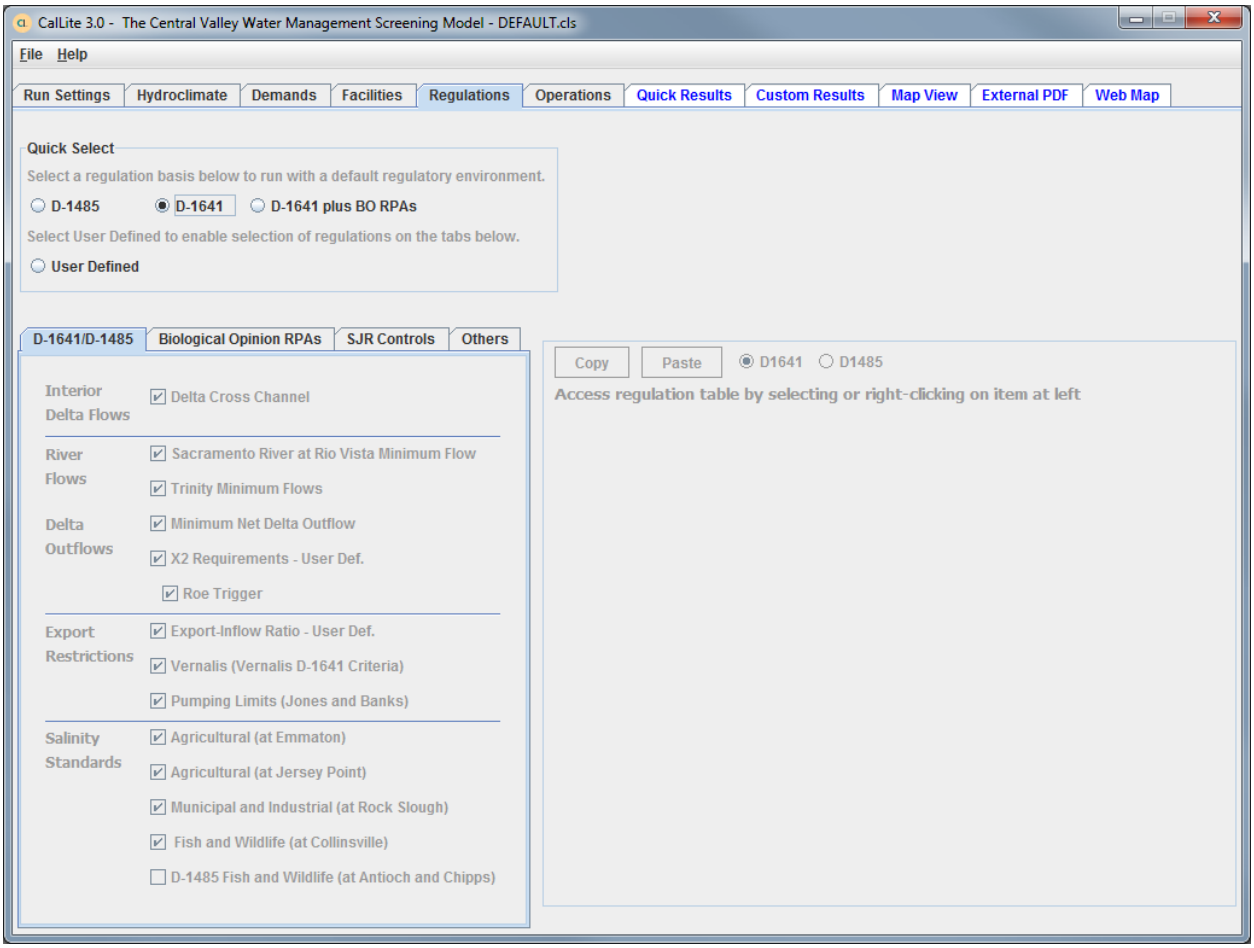


Figure 3-5. The Quick Select regulations box automatically enables the appropriate set of regulations for the selected regulatory environment.

3.5.3. Biological Opinion RPAs Panel

The standards listed on this panel implement Reasonable and Prudent Alternatives (RPAs) as described in the Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) biological opinions released in December 2008 and June 2009, respectively. See Appendix C in the CalLite Reference Manual for more detailed descriptions of these RPAs.

The RPAs on this panel are:

Old and Middle River (FWS RPA Actions 1-3) - This limits CVP and SWP exports so that flow in the Old and Middle River is no more negative than a specified standard during Dec-June. Depending on the time of year, along with the hydrologic and biological conditions, this standard can vary from -1,250 to -5,000 cfs.

⚠ **WARNING:** Deactivate if Old and Middle River regulation is selected on the Others panel *and* the corresponding user-defined radio button option is selected on that panel.

Fall X2 (FWS RPA Action 4) - This sets X2 standards for Sept-Nov, which are applied in wet and above normal water years. Since this RPA is active in different months than the D-1641 X2 standard, both can be applied in the same scenario.

> **WARNING:** Deactivate if D-14641 X2 regulation is selected on the D-1641/D-1485 panel *and* the corresponding user-defined radio button option is selected on that panel.

Clear Creek (NMFS RPA Action 1.1.1) - This sets minimum flow standards in Clear Creek.

Delta Cross Channel (NMFS RPA Action 4.1.2) - This defines the number of days the DCC gates are open in each month. DCC operations under this RPA are set so that the gates are never open for longer than required under the D-1641 DCC standard, and in some months the RPA may result in even fewer days open. Since this RPA was crafted as extra protection above and beyond the D-1641 standard, it will operate independently of the D-1641 DCC standard.

> **WARNING:** Deactivate if D-14641 Delta Cross Channel regulation is selected on the D-1641/D-1485 panel *and* the corresponding user-defined radio button option is selected on that panel.

San Joaquin River Inflow to Export Ratio (NMFS RPA Action 4.2.1) - This limits combined exports from the CVP and SWP to a fraction of the flow observed along the San Joaquin River at Vernalis.

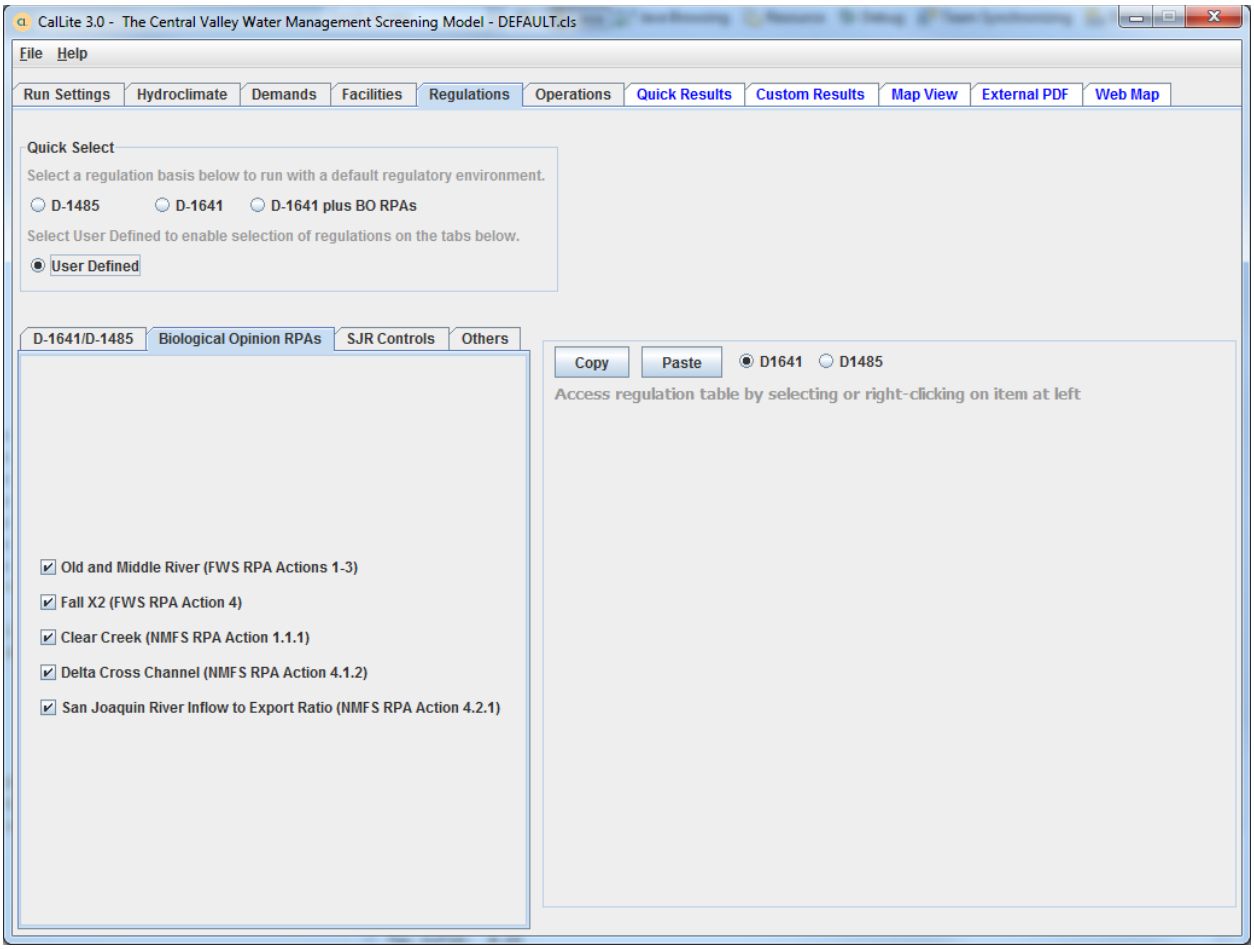


Figure 3-6. The Biological Opinion RPA panel.

3.5.4. SJR Controls Panel

The controls on this tab relate to operation of the dynamic San Joaquin module of CalLite. Checking the top checkbox will activate this module. If this checkbox is not checked, the flows on the San Joaquin at Vernalis (where it enters the Delta) will be represented as a fixed timeseries, and the other checkboxes will have no effect. The dynamic San Joaquin module allows for adjustment of certain regulations that apply to the San Joaquin basin, in particular to New Melones Reservoir on the Stanislaus River. Activating the appropriate checkbox will activate each of the regulations.

Note that regulations in the San Joaquin basin are currently under review. The two pulse period regulations listed below (VAMP and the 60-day pulse flow RPA) are not implemented in current operations in the San Joaquin basin, but are options in the model because new pulse period flow requirements have not been clearly defined.

The regulations on this tab are as follows:

Vernalis D-1641 baseflows- This activates the D-1641 flow requirements at Vernalis during February to June (excluding the April 15 - May 15 pulse period). These

requirements vary by water year type and whether X2 is located east or west of Chipps. Any additional water needed to meet these requirements above the flows required for other regulations is released from New Melones Reservoir, with a cap on releases in dry conditions.

Vernalis D-1641 salinity criteria- This activates the D-1641 salinity requirements at Vernalis, which are 0.7 Electrical Conductivity (EC) during April-August and 1.0 EC during September-March. Any additional water needed to meet these requirements above the flows required for other regulations is released from New Melones Reservoir, with a cap on releases in extremely dry conditions.

VAMP pulse flows (Apr 15-May 15)- This activates flow requirements at Vernalis during the April 15 - May 15 pulse period. These flow requirements vary depending on whether the model is run with Existing or Future Level of Development. For Future Level of Development, the flow requirements are based on the Vernalis Adaptive Management Program (VAMP) that was implemented from 1999-2011. Water is released to meet these requirements from multiple tributaries on a schedule defined in the San Joaquin River Agreement. For Existing Level of Development the flow requirements are based on the agreement between Reclamation and Merced Irrigation District which was implemented in 2012-2013.

Vernalis 60-day pulse flow RPA (NMFS Action 4.2.1)- This activates a 60-day pulse flow requirement at Vernalis during April and May, which varies by water year type. This requirement is in the NMFS Biological Opinion released in June 2009. Any additional water needed to meet this requirement above the flows required for other regulations is released from New Melones Reservoir, with a cap on releases in dry conditions.

Stanislaus flow RPA (NMFS Action 3.1.3)- This activates a fish flow requirement on the Stanislaus River which varies by water year type. This requirement is from the NMFS Biological Opinion released in June 2009.

San Joaquin River Restoration flows- This toggles the San Joaquin River Restoration flows between interim flows and full flows. Flow requirements vary by water year type. These flows are released from Friant Dam on the upper San Joaquin River, and are defined under the 2006 Settlement that led to the San Joaquin River Restoration Program. Interim flows are designed to allow for collection of data and research prior to implementation of full Restoration flows.

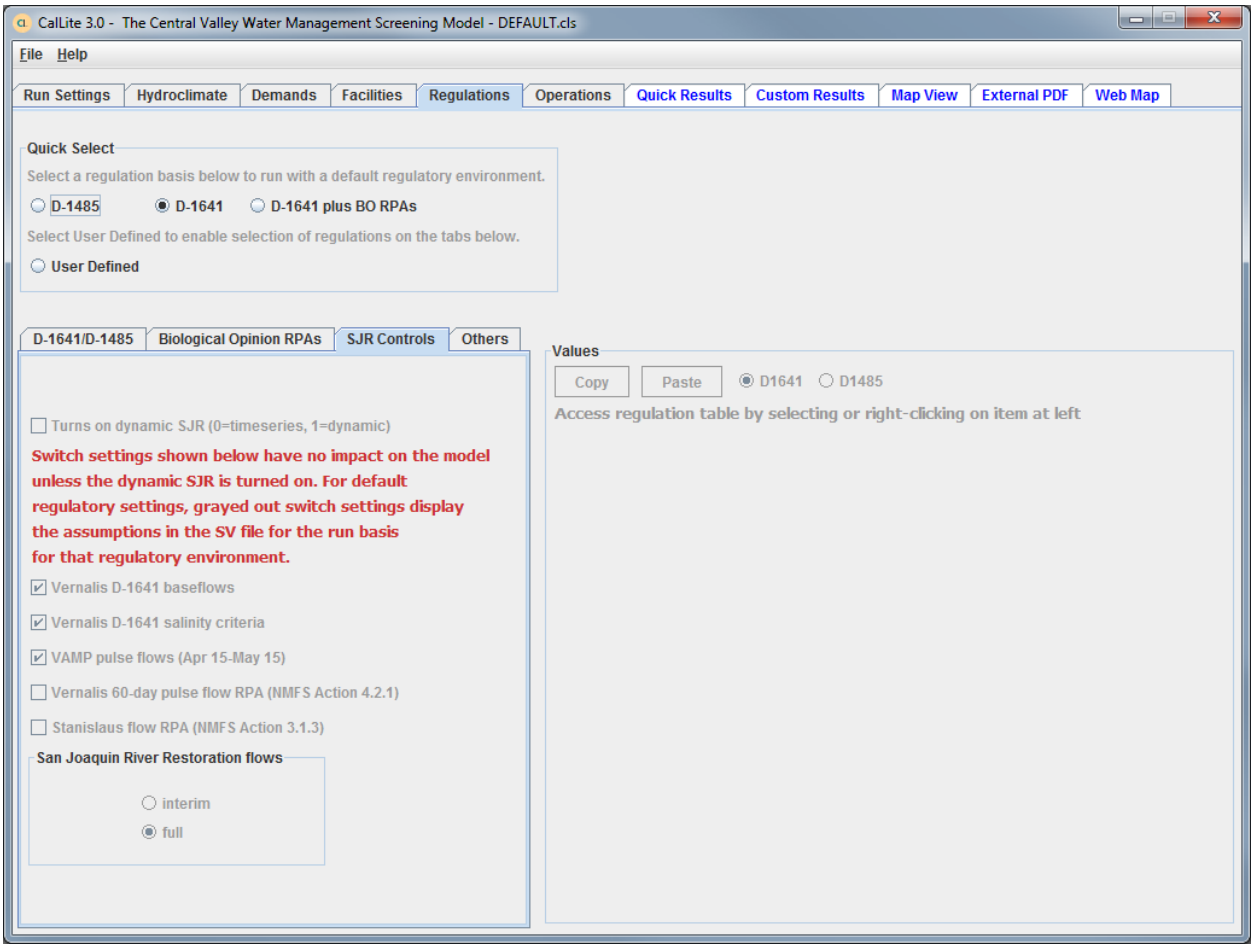


Figure 3-7. The SJR Controls panel.

3.5.5 Other Regulations Panel

This panel allows the user to activate three additional regulations and define values for them in the table on the right side of the screen. The month numbers in the user-defined tables refer to water year months (i.e. Oct=1, Nov=2, etc.)

The regulations available on the Other Regulations Panel are:

QWEST (San Joaquin River near Jersey Point). This is a minimum flow standard on the San Joaquin River near Jersey Point. The user can define values for this standard by month and water year type.

Old and Middle River. This limits CVP and SWP exports so that flow in the Old and Middle River (OMR) is no more negative than a specified standard during Dec-June. Standards can be specified by month and water year type.

> ⚠ **WARNING:** When the user-defined radio button is selected, the RPA OMR (on the Biological Opinion RPAs panel) standard should be disabled.

San Joaquin River Inflow to Export ratio with offset. This limits combined CVP and SWP exports to a cap computed based on San Joaquin River flow at Vernalis. The cap is computed as: offset + (multiplier × Vernalis). The offset and multiplier values can be specified by month and water year type.

> **WARNING:** When the user-defined radio button is selected, the RPA SJR Inflow to Export Ratio (on the Biological Opinion RPAs panel) standard should be disabled.

B2 Actions. These buttons implement actions from the Central Valley Project Improvement Act (CVPIA) Section 3406(b)(2) program (referred to as *B2*) to dedicate up to 800,000 acre-feet of CVP yield annually for fish and wildlife protection and habitat restoration. From the initial implementation of the B2 program, up to seven actions were modeled by CalLite. Recently introduced regulations have made Actions 2, 6 and 7 redundant. Consequently, these actions are no longer modeled and are not available as GUI selections. The available actions are:

Action 1: Upstream Minimum Flow Requirements
Action 3: VAMP Export Reduction (April 15 – May15)
Action 4: CVP VAMP Export Extension (May 16 – 31)
Action 5: CVP Export Ramping (June 1 – 30)

Fraction of Unimpaired Flow for Delta Criteria. In July 2010, the State Water Resources Control Board issued a report on Delta flow criteria. The user can activate those criteria in the model (for Delta outflow, the Sacramento River, and the San Joaquin River) and also specify different criteria if desired. *Note that unlike all of the other regulations on this dashboard, when this option is activated, this is a post-processing option, NOT a regulation. CalLite does not force flows at these locations to meet these criteria*. It only compares flows to the criteria and computes how much additional water would be needed to meet the criteria.

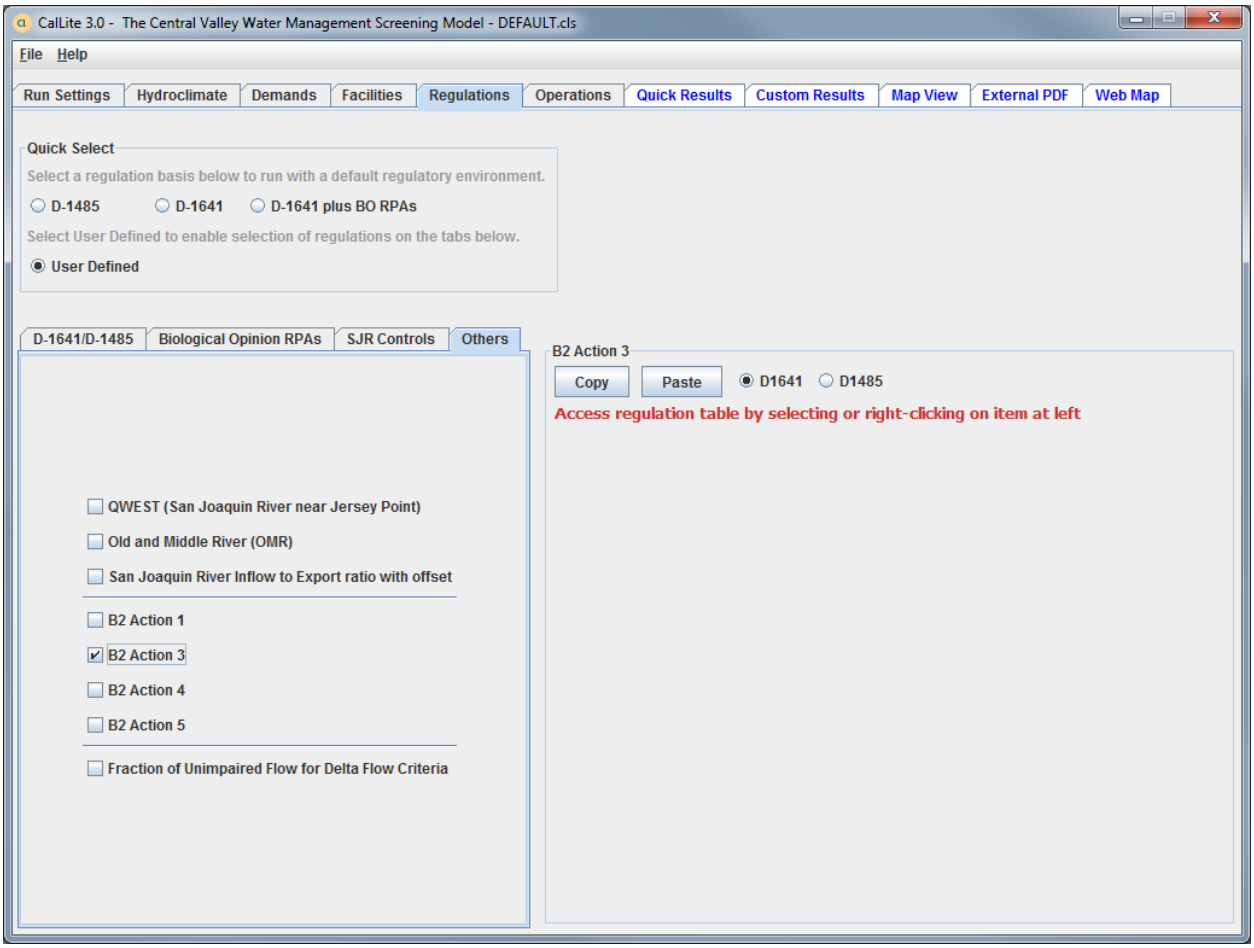


Figure 3-8. Other Regulations Panel.

3.6. Operations

The operations dashboard has options relating to CVP and SWP system operations, as follows:

CVP Operations and Facilities. The checkboxes here can be used to turn on or off three different wheeling operations: Payback Wheeling (D-1485), CVC Wheeling, and Joint Point of Diversion. The option is also available to turn on or off the Delta- Mendota Canal (DMC)/California Aqueduct Intertie. The Intertie project allows the DMC and California Aqueduct to share conveyance capacity, thus increasing export capacity.

For more detailed description of these operational facilities, see the Reference Manual.

CVP/SWP Allocation Methods. Here the user can choose between different CVP and SWP allocation methods. Currently, users have the option for allocation by either Water Supply Index/Delivery Index (WSI/DI) curves or by the Forecast Allocation Method (FAM).

WSI-DI Method

The WSI-DI method is the procedure currently used in CalSim II. This logic develops an allocation decision for system-wide CVP and SWP deliveries based on water in storage, forecasts of usable inflow, and storage carryover targets. The allocations for the CVP Water Right, Exchange, and Settlement contractors and SWP Feather River Service Area contractors are dependent on reservoir inflow criteria. South-of-Delta delivery allocations for the CVP are based on water in CVP San Luis storage plus projections of available water for export prior to low point. This is identical to the current procedure used in CalSim II.

Default WSI/DI curves for both CVP and SWP may be altered by clicking on the appropriate box and editing the values in the table on the right side of the screen. *The user should be aware that the WSI-DI curves should be edited with caution. They are carefully developed through iterative simulation of CalSim II, with a particular set of water supplies and demands.* More aggressive allocations may result in reservoir storage conditions that are not able to meet regulations through dry years. Relaxed allocations may result in storage levels that create higher flows in some months and unexpected modifications to Delta operations.


WARNING: Model results may differ from expected operation, so a careful analysis of the output results by an expert is always necessary.

FAM Method

FAM is developed based on the California Allocation Module (CAM). The model is developed by utilizing the multi-step optimization functions in WRIMS 2. FAM is coupled with the CalLite model by working as an additional cycle.

For more information about CalLite allocation methods, see Appendix G of the CalLite Reference Manual.

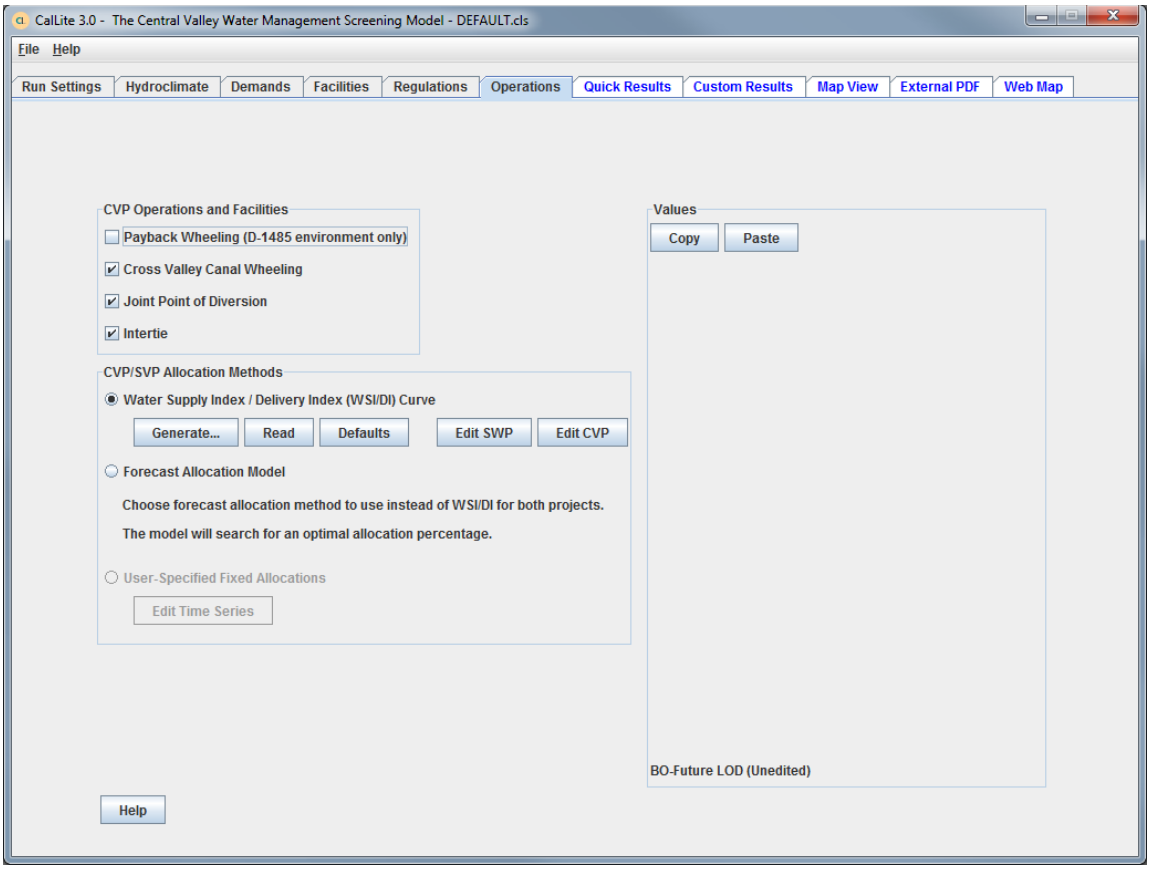


Figure 3-9. Operations control dashboard.

4. Results Dashboards

Here the user can view results for any available scenarios, using the Quick Results, Custom Results, Map View, External PDF, and Web Map dashboards.

4.1. Quick Results

Under the Quick Results dashboard, graphs and tables can be generated for numerous CalLite outputs, either for one scenario or for comparing multiple scenarios. The different sections on this dashboard are as follows:

Scenarios. Here the user can add or delete scenarios to determine which scenario results will be displayed. The number of scenarios and type of results to display (either for a single base scenario, a comparison of scenarios, or the difference between scenarios) can also be selected. The radio button next to each scenario name can be used to select which scenario to delete. For difference plots, the radio button sets which scenario to use as the basis for comparison when computing difference values.

Display. Options for displaying results:

-Start and end month and year.

-Flow data in either CFS or TAF/yr (i.e. thousand acre-feet per year). Variables other than flow have fixed units (TAF for storage, μmhos/cm for salinity). Note: μmhos is a unit of specific conductivity.

-Monthly time-series plot.

-Exceedance plots and Box and Whiskers plots. These plots can be shown for individual months, all monthly values, or annual totals. The annual total exceedance plots are only shown for flow variables and the units are always TAF.

-Table of monthly values. For flow variables, the annual total shown is always in TAF.

-Summary table. The summary table can show five different statistics (average, maximum, minimum, standard deviation, and median) computed from monthly and annual values, summarized by four different water year types, and for the three driest periods in 1922-2003. When summarizing data by water year type, the Sacramento Valley 40-30-30 Index, Feather Index, and SJR (San Joaquin Valley 60-20-20) Index use February as the first month of the water year; the Shasta Index uses March.

Report List. This section of the dashboard can be used to create reports based on user selections. Clicking the *Add To List* button, following the selection of a variable(s), will add the variable(s) to the list. The report will then include all variables that have been selected. In addition, the report

will reflect the user options within the Scenario and Display areas of the dashboard. Reports on the list can then be displayed (individually or all at once) and saved for later use. Lists can also be saved and reloaded using the *Save List* and Load List buttons, respectively.

Output selection. Double-clicking any of the variable names in the Report List section will display graphs and tables for that specific variable.

- *Storage+Flows* – standard output variables for flow, storage, and salinity
- *San Joaquin R.* – San Joaquin River terms for storage, flow, deliveries, and salinity
- *Shortages/Flow Obj.* – shortages in accretion/depletion (AD) terms for the North of Delta area, and comparisons of Delta outflow and Sacramento/San Joaquin River flows to the State Water Resources Control Board (SWRCB) Delta Flow Criteria
- *Water Mgt. Actions* – Los Vaqueros terms
- *Delivery Shortages* – SWP and CVP South of Delta delivery shortage terms

When graphs are displayed it is possible to zoom in by clicking and dragging the cursor to the lower right to create a box. Once zoomed in, the user can pan by holding down the left button and the Control key, and then moving the mouse. Right clicking in the graph area will bring up a menu that allows the user to edit properties of the graph; copy, save, and print the graph; zoom in, zoom out, and reset the plot to its original zoom; and copy the data used to create the graph into the clipboard for use in another application. In addition to the primary time-series, certain graphs also display secondary time-series (described in the legend).

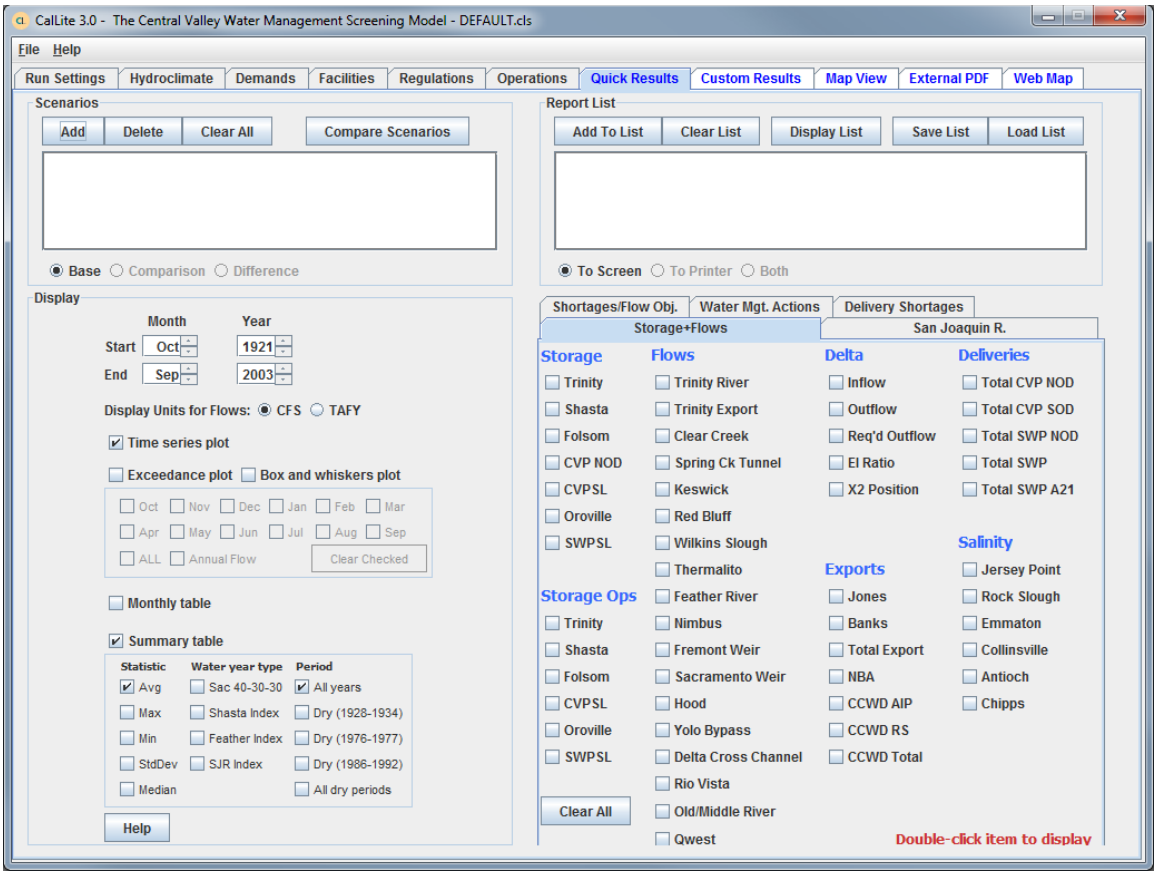


Figure 4-1. Quick Results dashboard.

4.2. Custom Results

The Custom Results Dashboard allows the user to filter and retrieve variables directly from the DV or SV file, including variables that cannot be selected through Quick Results or Map View. The filtered variables can be displayed in the same format as those brought up from Quick Results (i.e. Exceedance Plots, tables). This feature combines the broad range of post-processing features from Quick Results with the ability to bring up and analyze any variable in the DSS files. The user can view the data for these variables directly, or they may elect to create derived time-series (DTS) from them. DTS are created by combining two or more time-series with basic mathematical operators and may be custom-tailored to fit the needs of a specific project or investigation. These DTS can be saved and accessed at a later session.

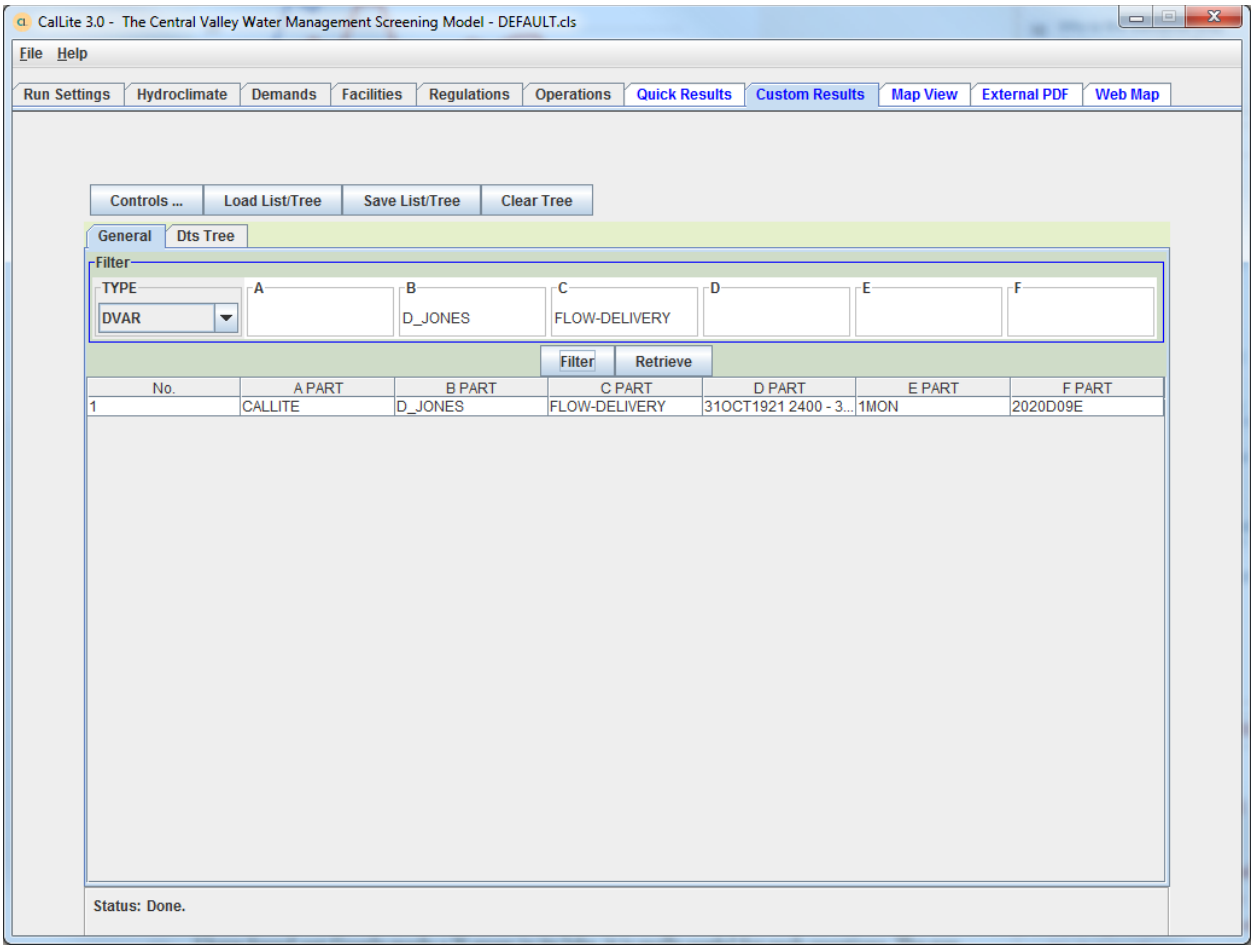


Figure 4-2. The Custom Results dashboard allows users to filter and retrieve any variable from the SV or DV file.

4.3. Map View

The Map View Dashboard allows users to view the CalLite study results by clicking on the arcs, nodes, and reservoirs in the CalLite schematic. Users can choose to view results from the standard schematic or from the mass balance schematic.

Note: *Data for the San Joaquin schematic will not be available unless the selected scenario was run with Dynamic SJR simulation turned on.*

The mass balance schematic aggregates schematic arcs into larger categories. These categories, represented by the red arrows, account for the major inflows, outflows, exports and net consumption within the Delta. Alongside the major flows are selectable elements for salinity stations (represented by yellow circles) and flow objectives (represented by blue circles). Clicking on the Salinity Station will display the salinity at that station along with its respective salinity standard. Similarly, selecting the blue circles will display the flow at that location with its respective flow objective.

Controls

To zoom in, hold the ctrl key and draw a box over the area to be enlarged. An alternative way to zoom in and out is to hold down shift key and right click simultaneously and then move the mouse up and down. To pan across the schematic, hold down the shift key and click/drag anywhere in the window. Click on *Controls* at any time to load a CalLite study, or change the format of the data output.

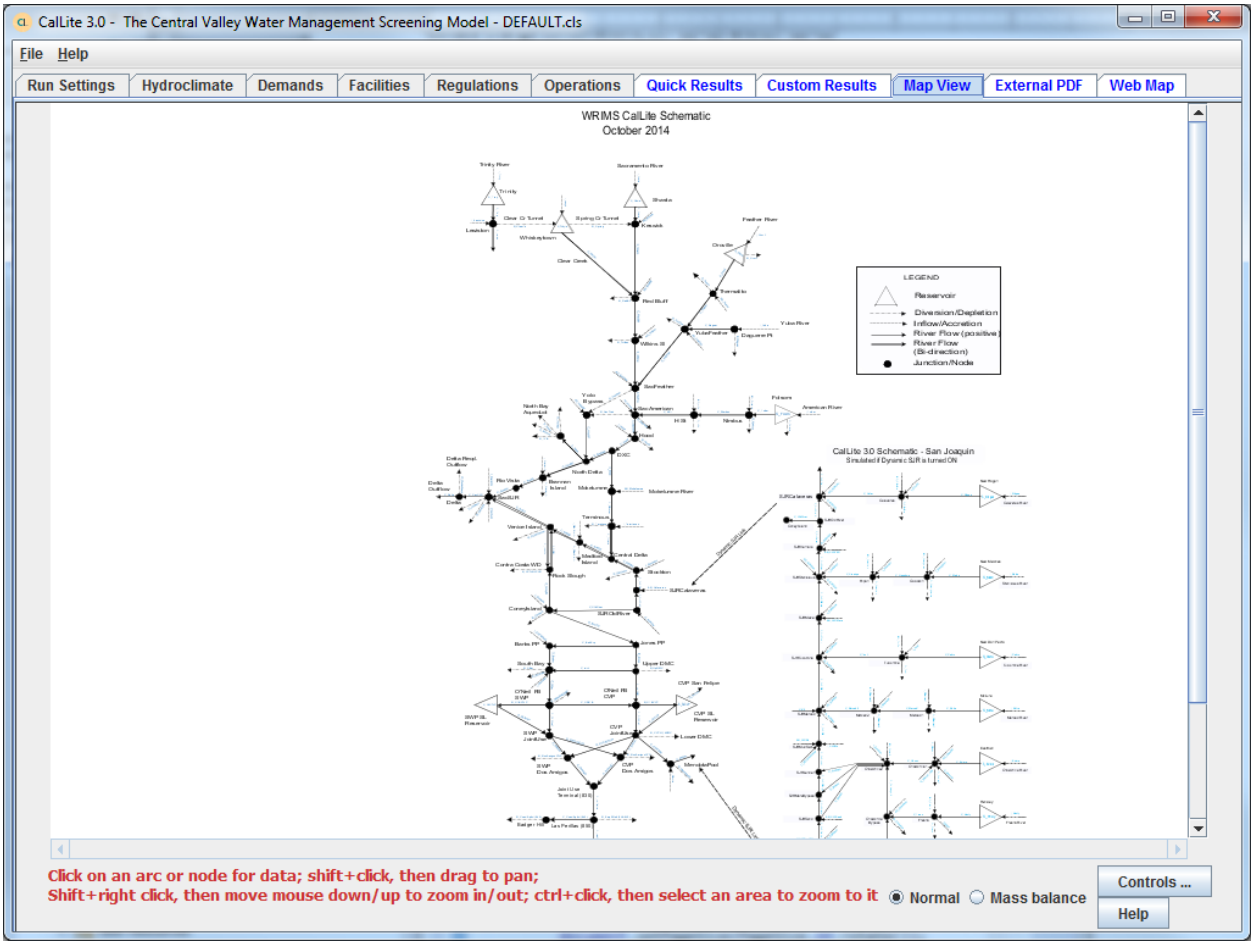


Figure 4-3. The schematic under Map View shows the system of the CalLite model. Click on the elements within the schematic to view data.

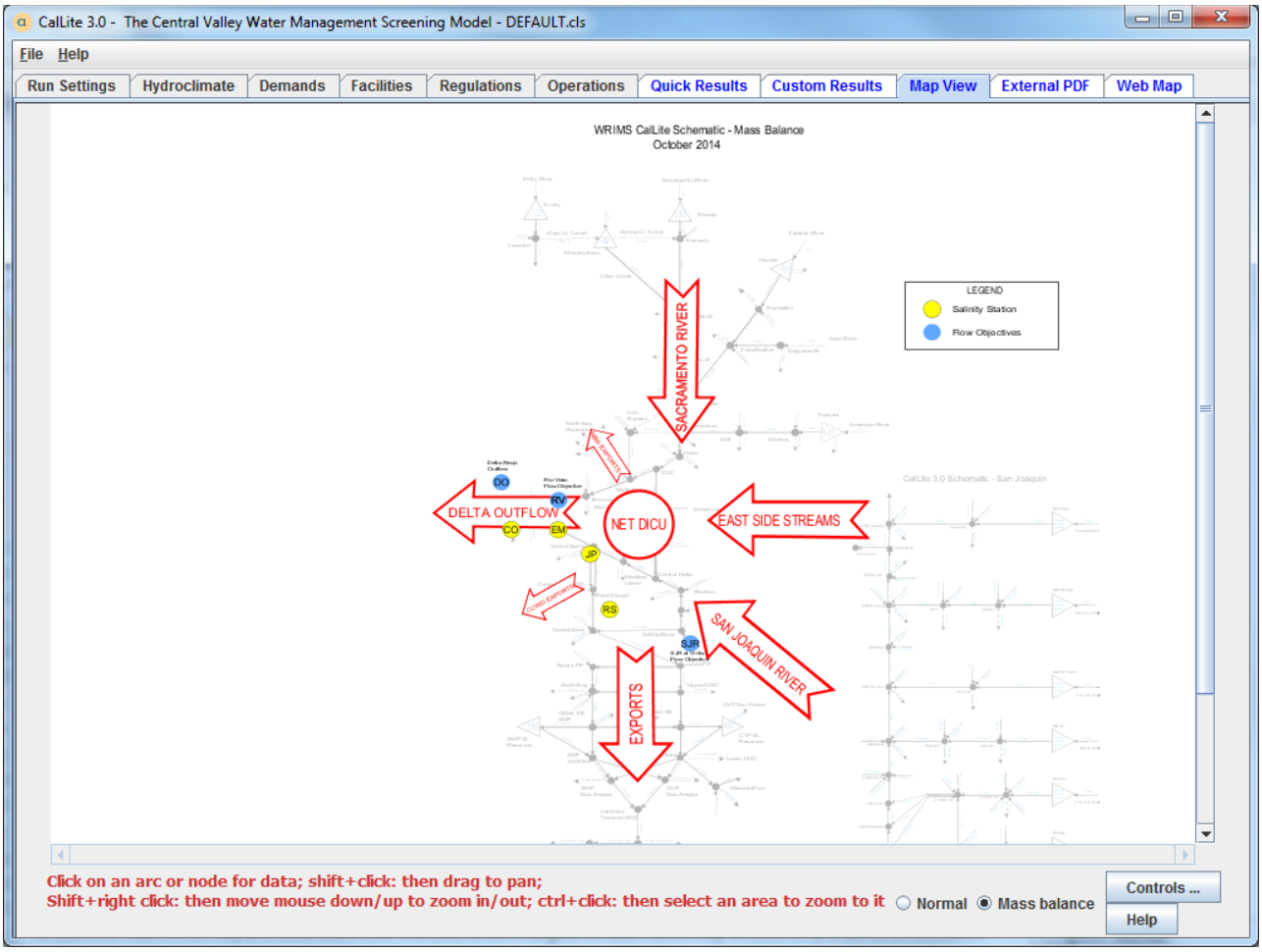


Figure 4-4. The Mass Balance schematic shows the inflows, outflows, exports and consumptive use of the Delta. Click on the elements within the schematic to view data.

4.4. External PDF

This dashboard allows the user to produce a standardized comparison or corroboration report comparing two CalLite scenarios, two CalSim scenarios, or between CalLite and CalSim scenarios.

The dashboard produces this report by calling one of the CalLite utilities, the CalLite report tool. The report shows storage in major reservoirs, flows at key river segments, CVP and SWP deliveries, and other scenario outputs.

In order to generate the report, use the Select File buttons to select a report template file (.inp file), two DSS output files, and a report output file name. Next, enter names for each of the two studies to be compared (defaults are set to CalLite 1 and CalLite 2), and finally hit the Generate Report button. Optional information such as notes, assumptions, and modeler name can also be added to the report.

CalLite-CalLite comparison:

The default report template file (callite_scenario_comparison.inp) will compare two CalLite studies.

CalSim-CalLite corroboration:

The report tool can also be used to compare CalLite results to CalSim results. To do this, the DSS Result File #1 must be set to the output DSS from a CalSim simulation, the DSS Result File #2 must be set to the output DSS from a CalLite simulation and the report template file must be set to calsim_callite_corroboration.inp.

CalSim-CalSim comparison:

Use the calsim_calsim_corroboration.inp report template file to compare two CalSim studies.

For more detailed description of the report tool, and instructions on how to edit the report template files, see Appendix J in the CalLite Reference Manual.

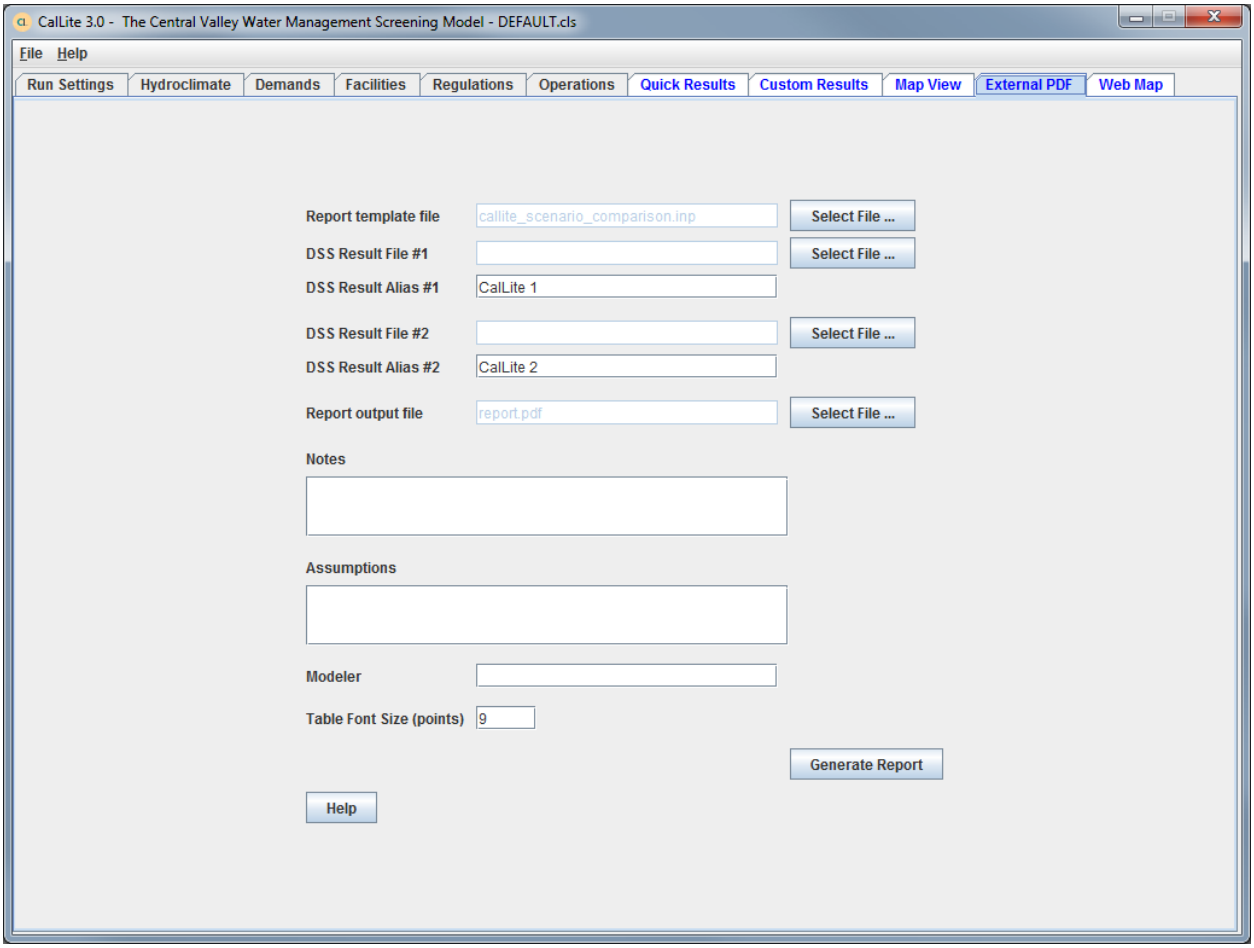


Figure 4-5. The External PDF dashboard automatically creates a standardized comparison or

corroboration reports based on two DV files.

4.5. Web Map

 This is a Beta version of the Web Map dashboard and not all the features are operational.

The Web Map dashboard contains an embedded internet browser which uses the Mozilla Firefox engine. This embedded browser displays the CalLite Google Map-based Geo-Schematic located at Google App Engine.

First time users will need to sign into the account with the email and password below:

Email:	CalLiteUser
Password:	callitewebapp

Please check the *Stay signed in* box in order to avoid having to sign in again in the future.

Note: If the user forgets the password, a security question will be used as an authenticator. The answer to the security question is simple and embedded in the question itself.

This browser displays the CalLite schematic overlaid on Google Maps. It allows users to move to different regions of the schematic by zooming in and out or dragging the map. When the user clicks on the dropdown menu *Region*, they can zoom to predefined regions such as Delta, Shasta Reservoir, and Oroville Reservoir.

When the user clicks on an arc (channel, delivery, AD term, or inflow) or a node (reservoir or river node), metadata will pop up on the map. If any scenarios have been added on the Quick Results dashboard, CalLite will display results for those scenarios in a pop-up window. Results will be displayed according to the current settings on the Quick Results dashboard. In other words, all graphs and tables currently selected will be displayed.

This dashboard with the embedded browser enables communications through the internet between data remotely located on Google Server (such as Google Map and the CalLite Schematic) and the data located on the users' computer (such as the CalLite output DSS data file). The following chart shows the mechanism of the integration of the CalLite GUI with this Google App Engine Web application. Run Basis

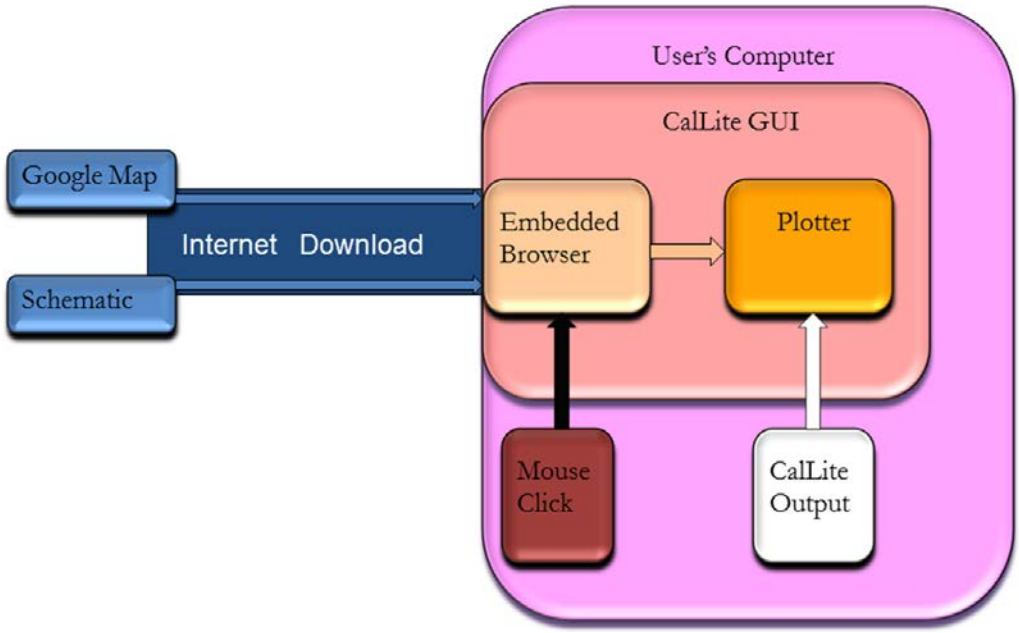


Figure 4-6. The CalLite schematic overlaid on Google Maps.

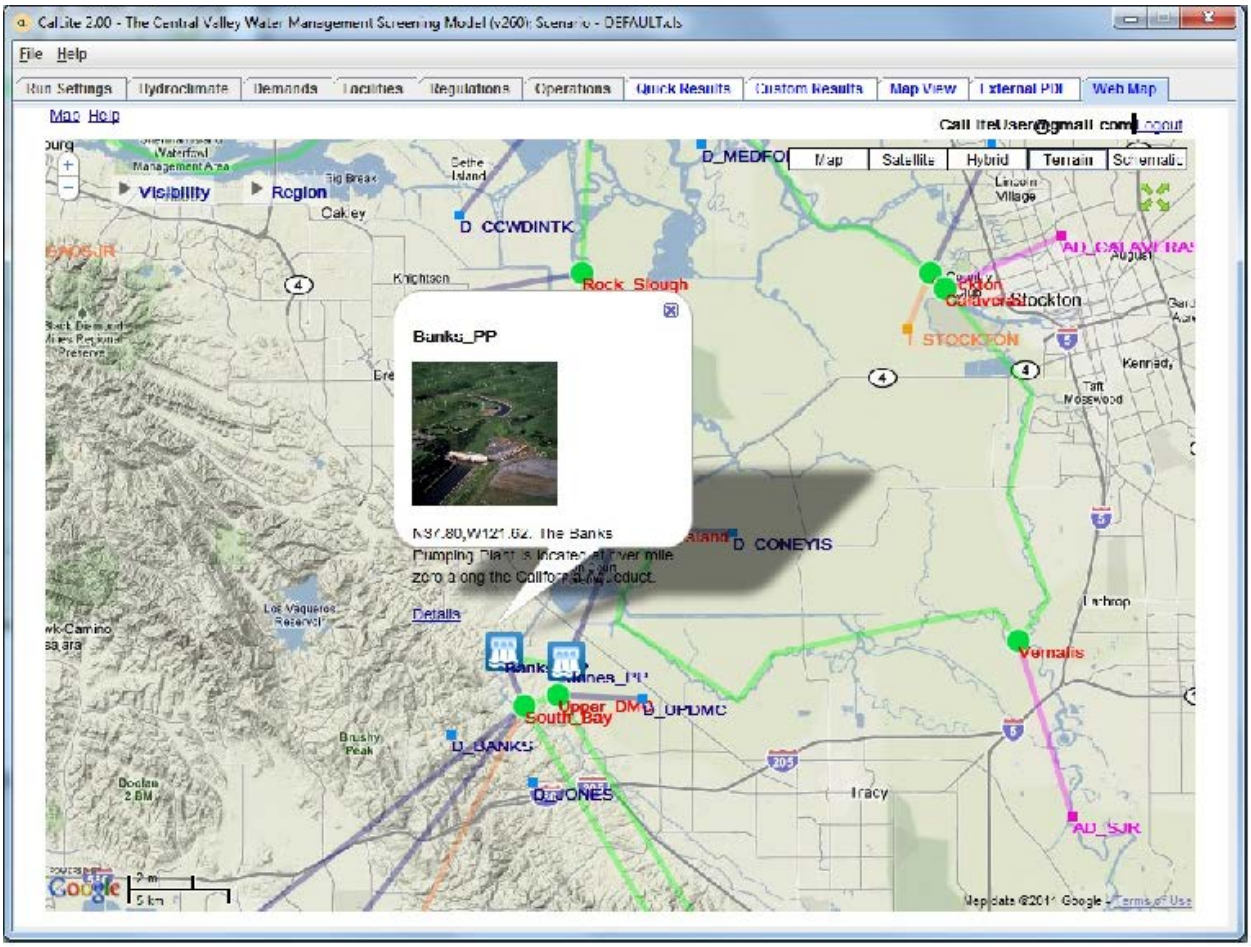


Figure 4-7. Web Map dashboard in CalLite.

5. Tutorial

5.1. Installation

The CalLite model is currently delivered in a single installer file. Installation consists of extracting all files in the archive to a file system location on a Windows XP, Vista, or Windows 7 computer. During installation, a CalLite3.00.exe icon is generated on the desktop. The software is started by double-clicking the icon. Alternatively, user can start the CalLite GUI from start>program>CalLite3.00>CalLite3.00. User can also start the CalLite GUI by double-clicking on the file *CalLiteGUI.exe* in the root directory of the extracted version (Figure 5-1).

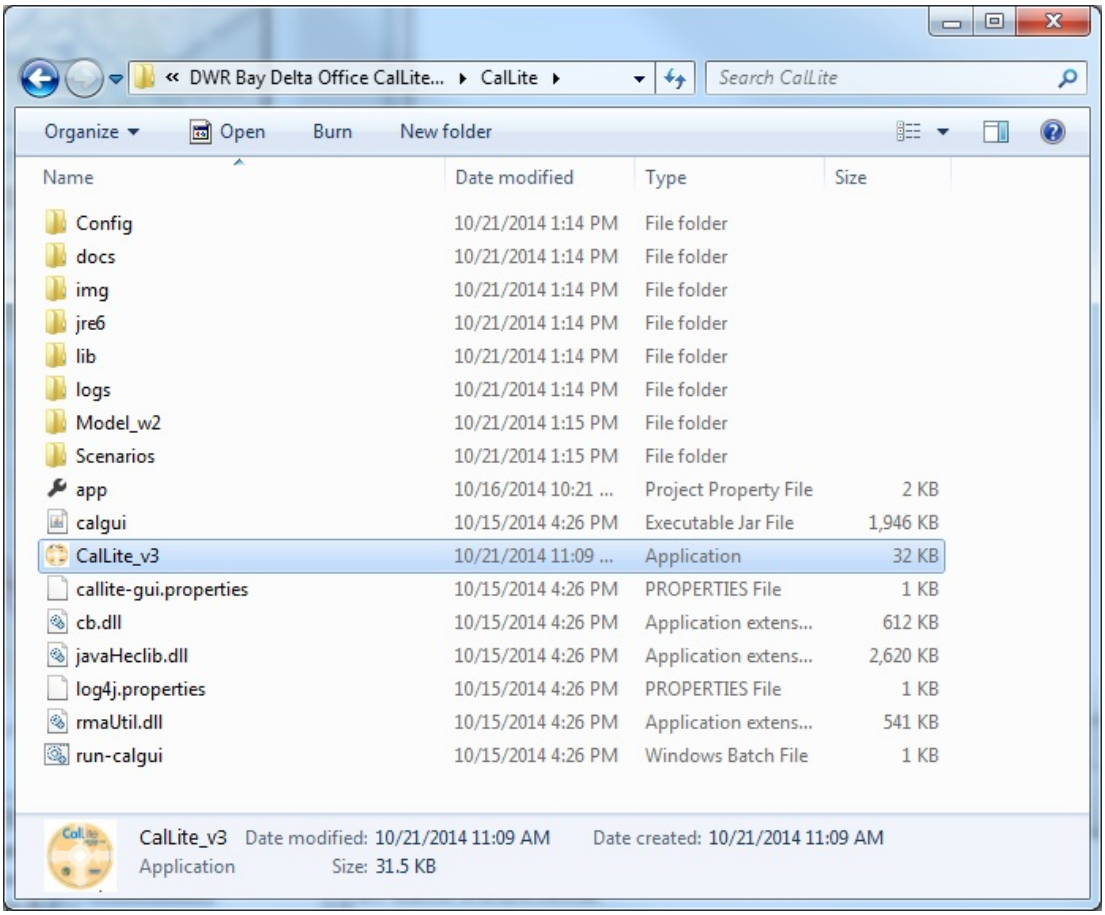


Figure 5-1. The CalLite GUI 3.00 package.

5.2. Tutorial Exercise

At startup, the Run Settings dashboard of the CalLite GUI is visible. The tabs with white backgrounds and blue letters relate to model results, while the remaining dashboards for model input and control have gray tabs and black letters. Figure 5-2 shows the Run Settings dashboard as well as the various tabs. The following sub-sections provide a simple example application of the CalLite model. For this example, no changes to the Run Settings dashboard will be pursued.

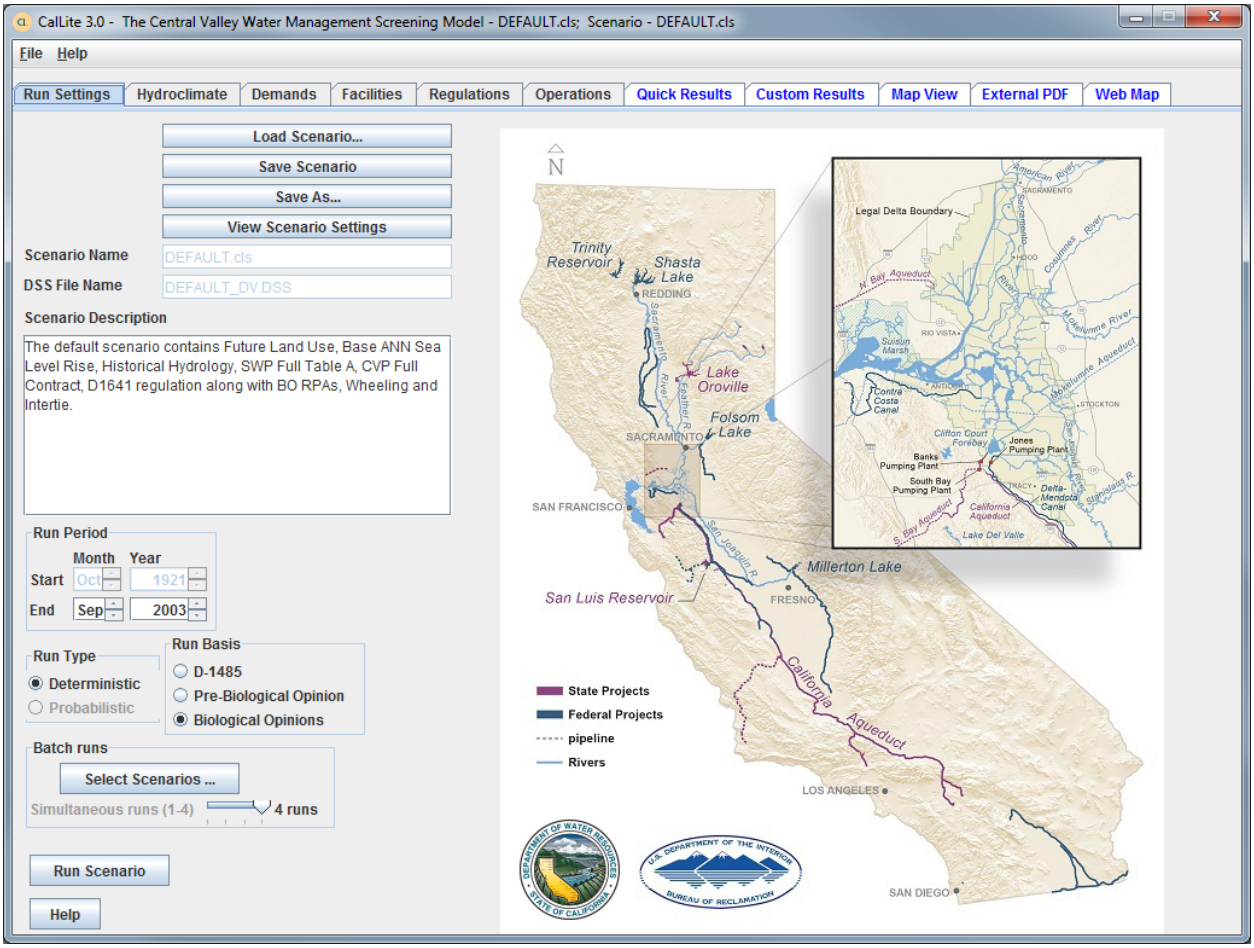


Figure 5-2. Run Settings dashboard in CalLite GUI.

5.2.1. Creating scenarios

The CalLite GUI automatically loads a default scenario when starting up. Moving through the different model input dashboards allows viewing of the various model settings. For this scenario, select the Base (Current Sea Level) and Future Level of development (set with option buttons on the Hydroclimate dashboard), assume Fixed demands (Full Table A for SWP and Full Contract for CVP, set with option buttons on the Demands dashboard), and apply only the D-1641 regulations by checking D-1641 in the Regulations dashboard under Quick Select. Figures 5-3, 5-4, and 5-5 show the Hydroclimate, Demands, and Regulations dashboards, respectively.

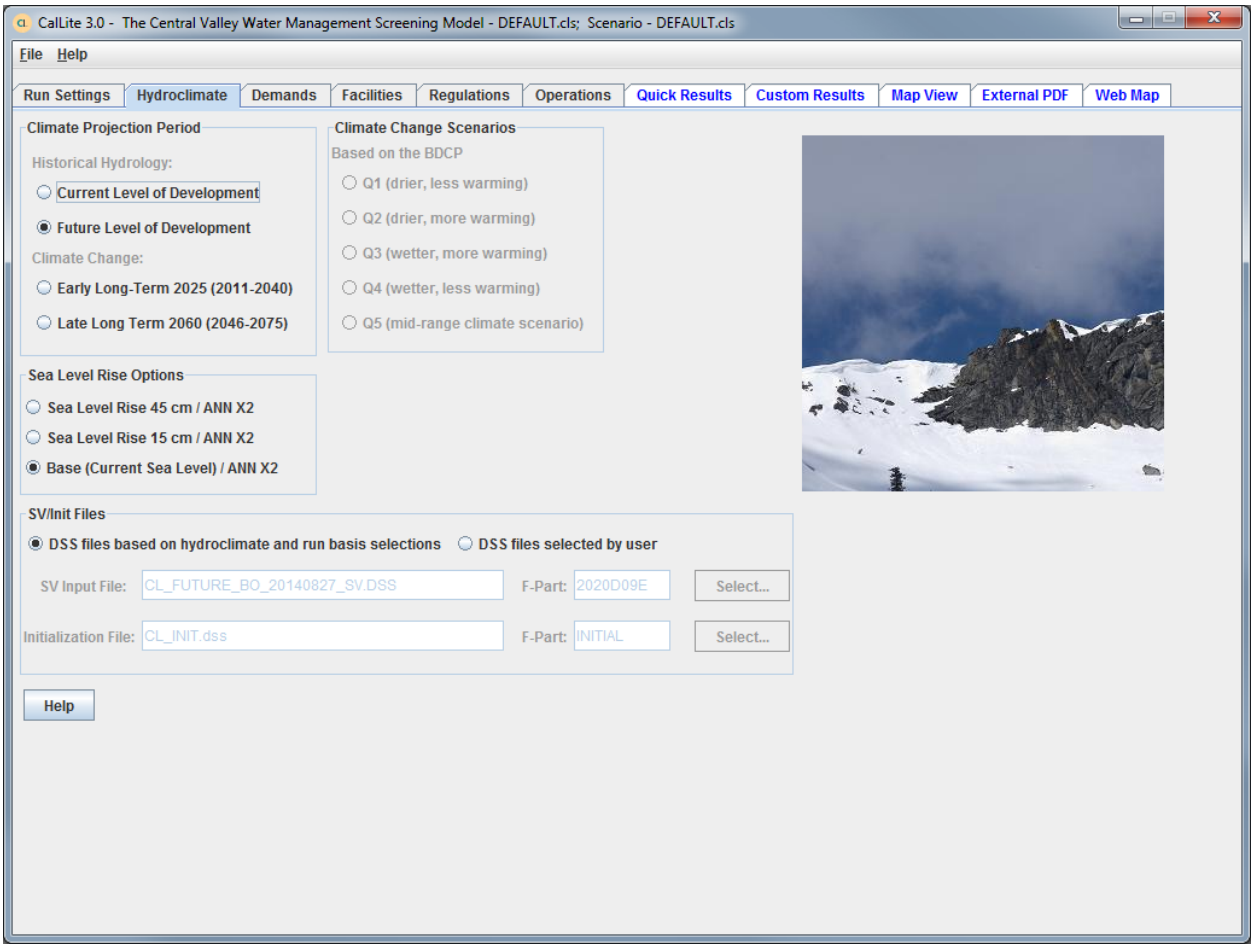


Figure 5-3. *Future Level of development* and *Base (Current Sea Level)* options are selected on Hydroclimate dashboard.

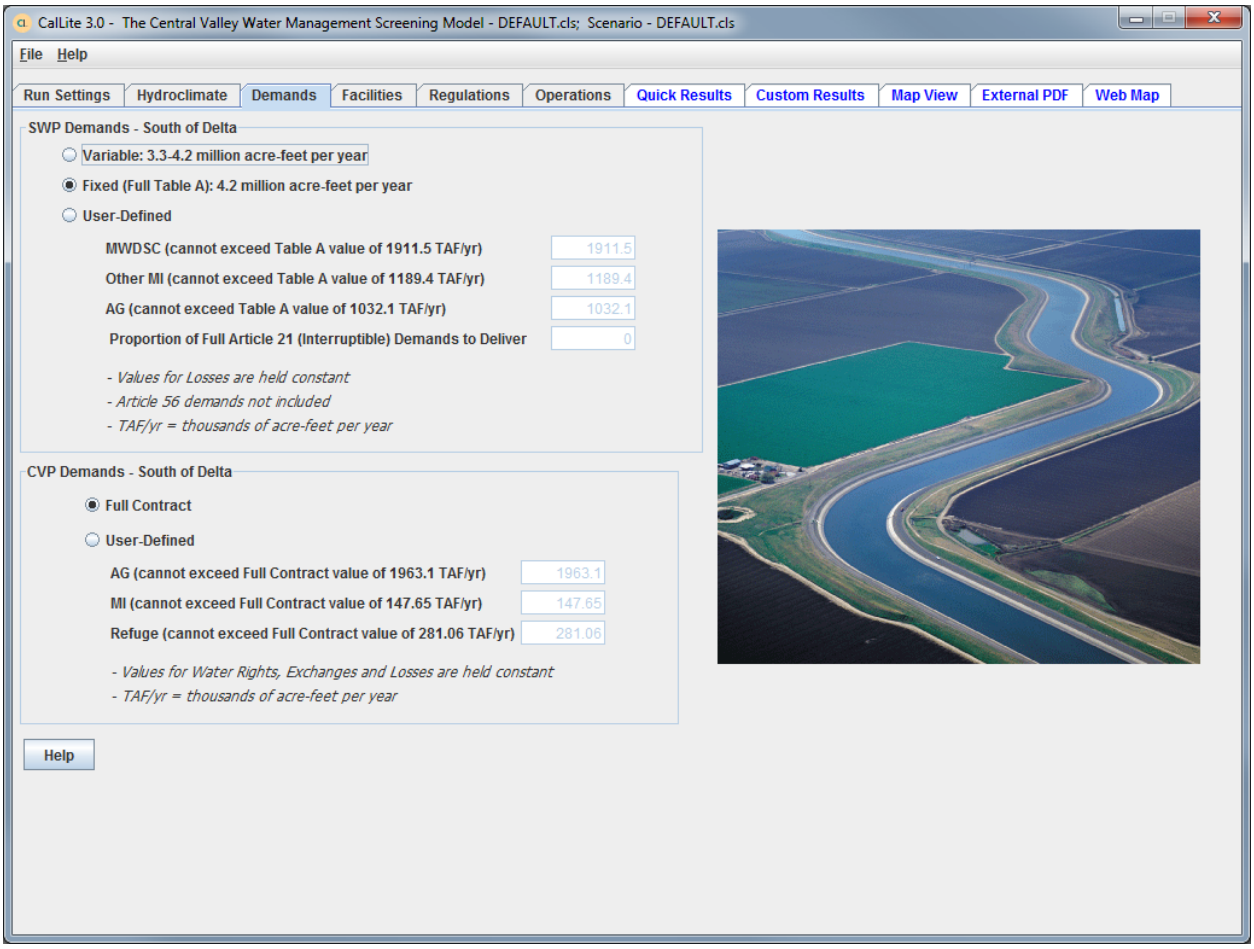


Figure 5-4. SWP demands to *Future* and CVP demands to *Full Contract* on Demands dashboard.

On the Regulations dashboard, numerical criteria associated with certain regulatory options are presented in an adjoining table. The user can change the values in those tables by checking the User Defined option. Default values for the tables can be restored by selecting one of the three predefined regulatory options under Quick Select. For this exercise, select D-1641.

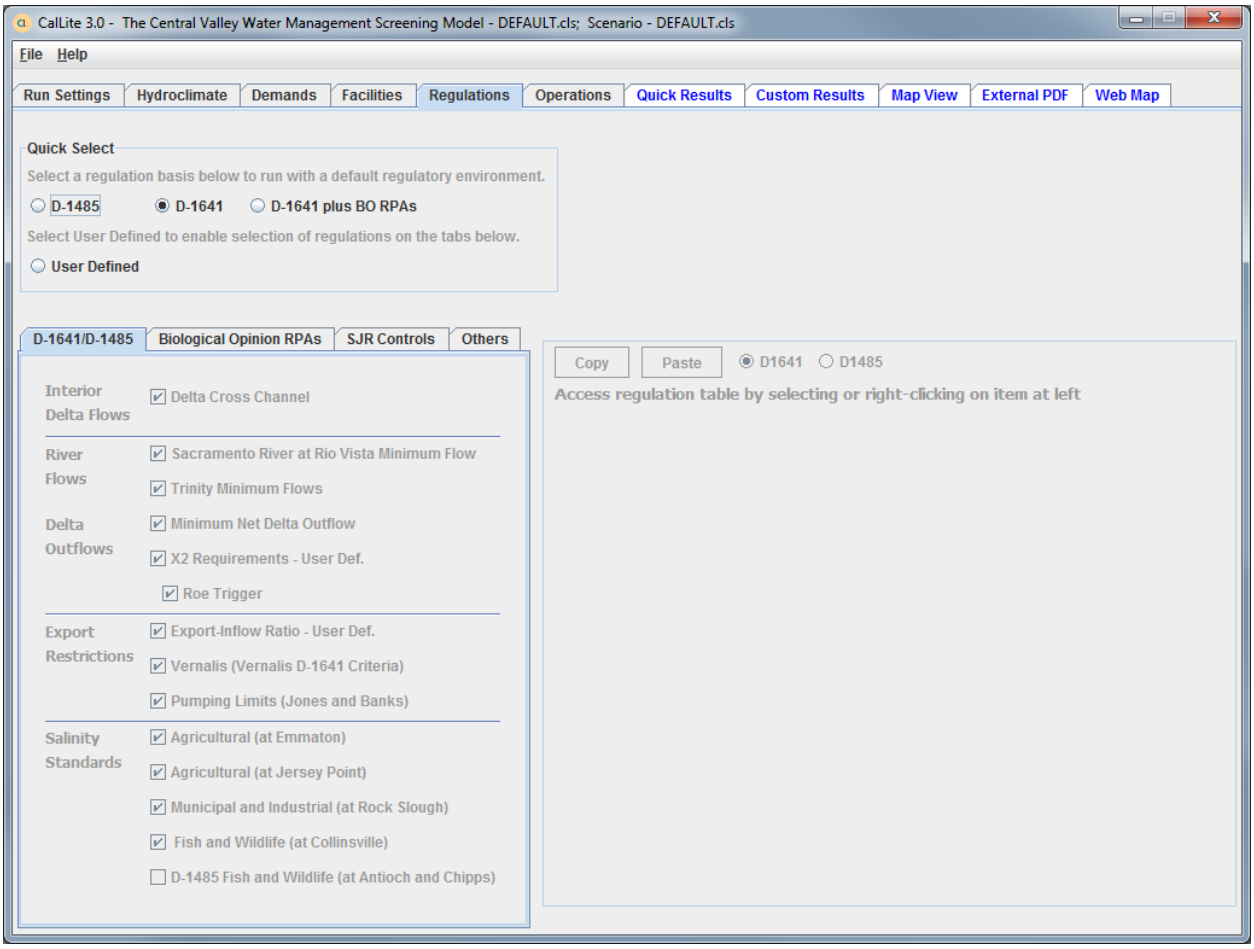


Figure 5-5. D-1641 regulation constraints are selected by checking D-1641 under Quick Select on the Regulations dashboard.

Save the scenario to a new file, this can be done by pressing the *Save As…* button on the Run Settings dashboard, or with the menu command *File | Save As…* (Figure 5-6).

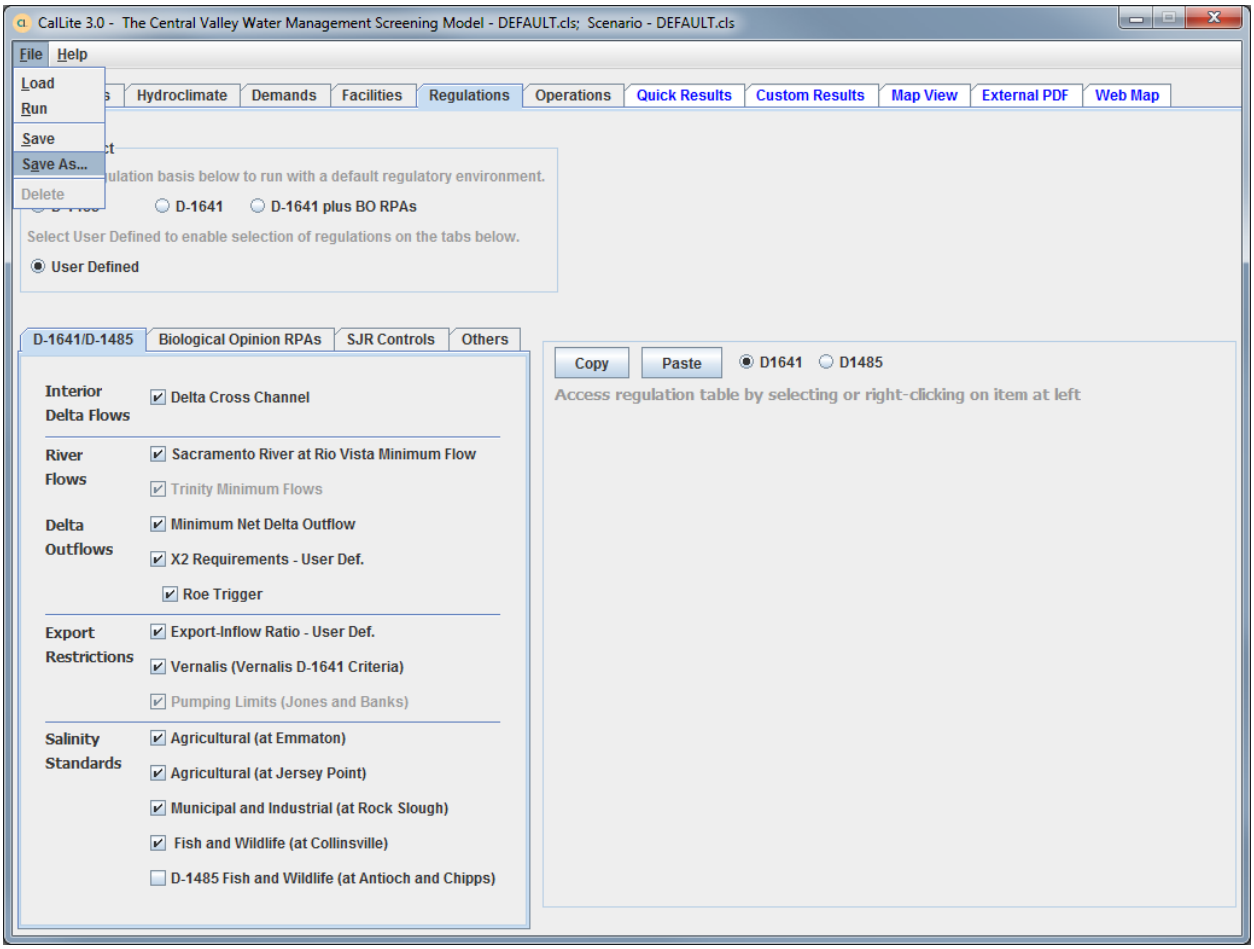


Figure 5-6. Preparing to save the scenario.

Type the descriptive scenario name, for example *Future_LOD_Future_Demand_D1641*, once the dialog box appears. The scenario setting will be stored in the Scenarios subdirectory in *Future_LOD_Future_Demand_D1641.CLS* and the model results will be placed in the file *Future_LOD_Future_Demand_D1641_DV.DSS* also in the Scenarios subdirectory. Figure 5-7 displays the Save dialog box.

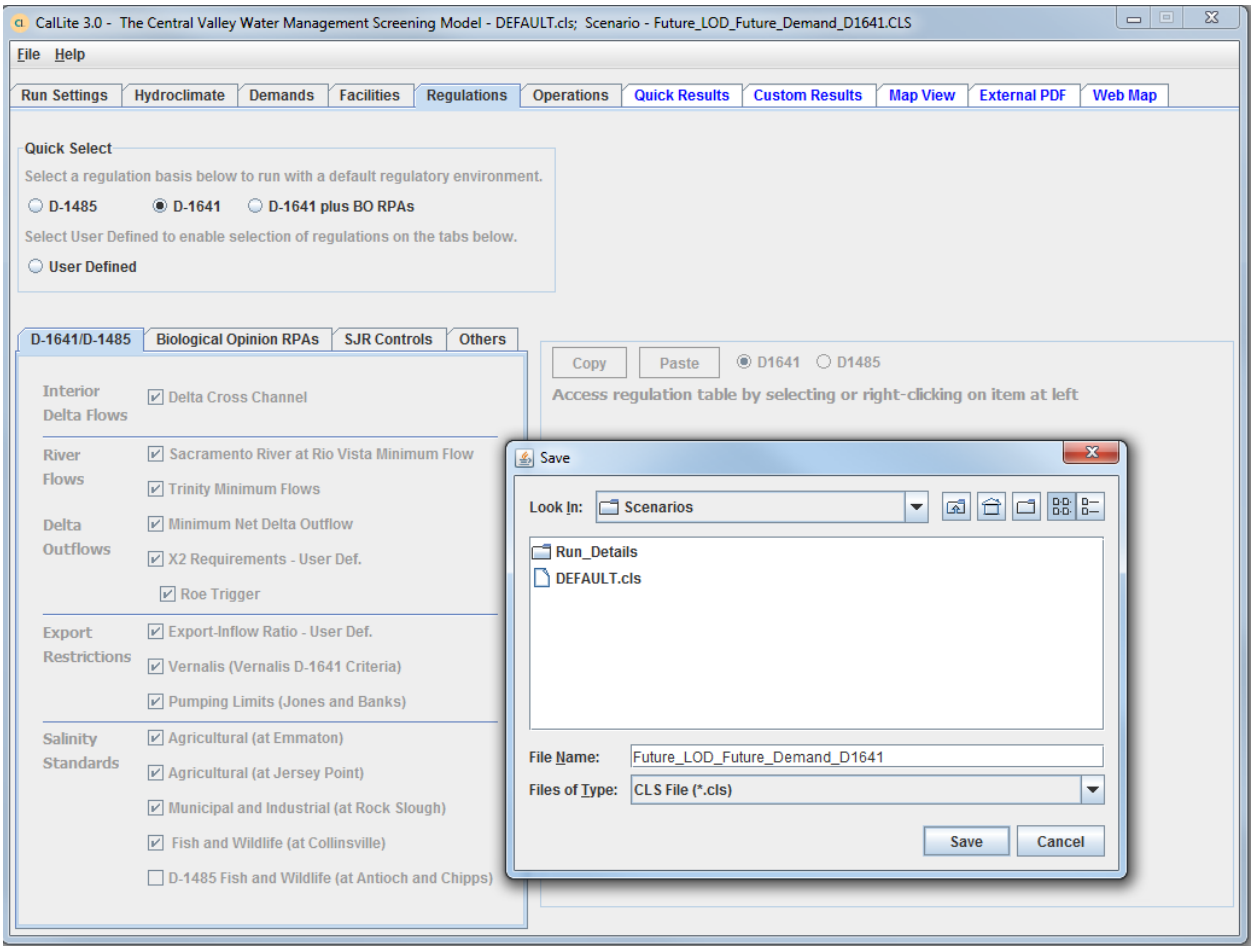


Figure 5-7. Saving the *Future_LOD_Future_Demand_D1641* scenario.

On the Run Settings dashboard, text in the Scenario Description box can be entered to describe the selections just made as shown in Figure 5-8. Simulate the model for the D-1641 scenario settings by either pressing *Run Scenario* on the Run Settings dashboard, or with the menu choice *File | Run*. The CalLite GUI creates a set of model input files in the Run directory based on the settings in the currently-loaded scenario and then executes the model. The Status Monitor window shows the progress of the simulation. It can be minimized, moved, or covered up. Figure 5-9 provides a screenshot of the GUI during simulation.

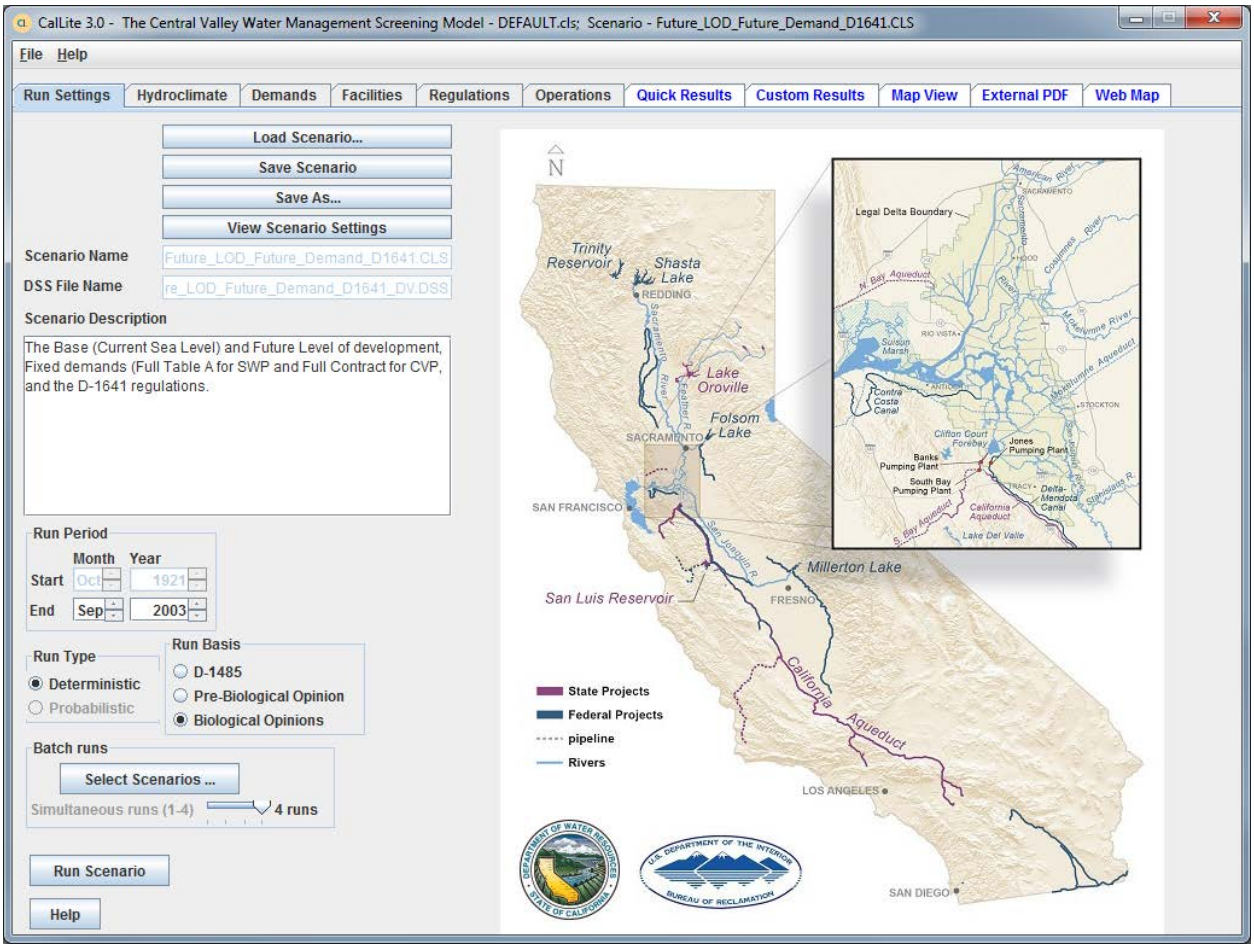


Figure 5-8. Text added to the Scenario Description box.

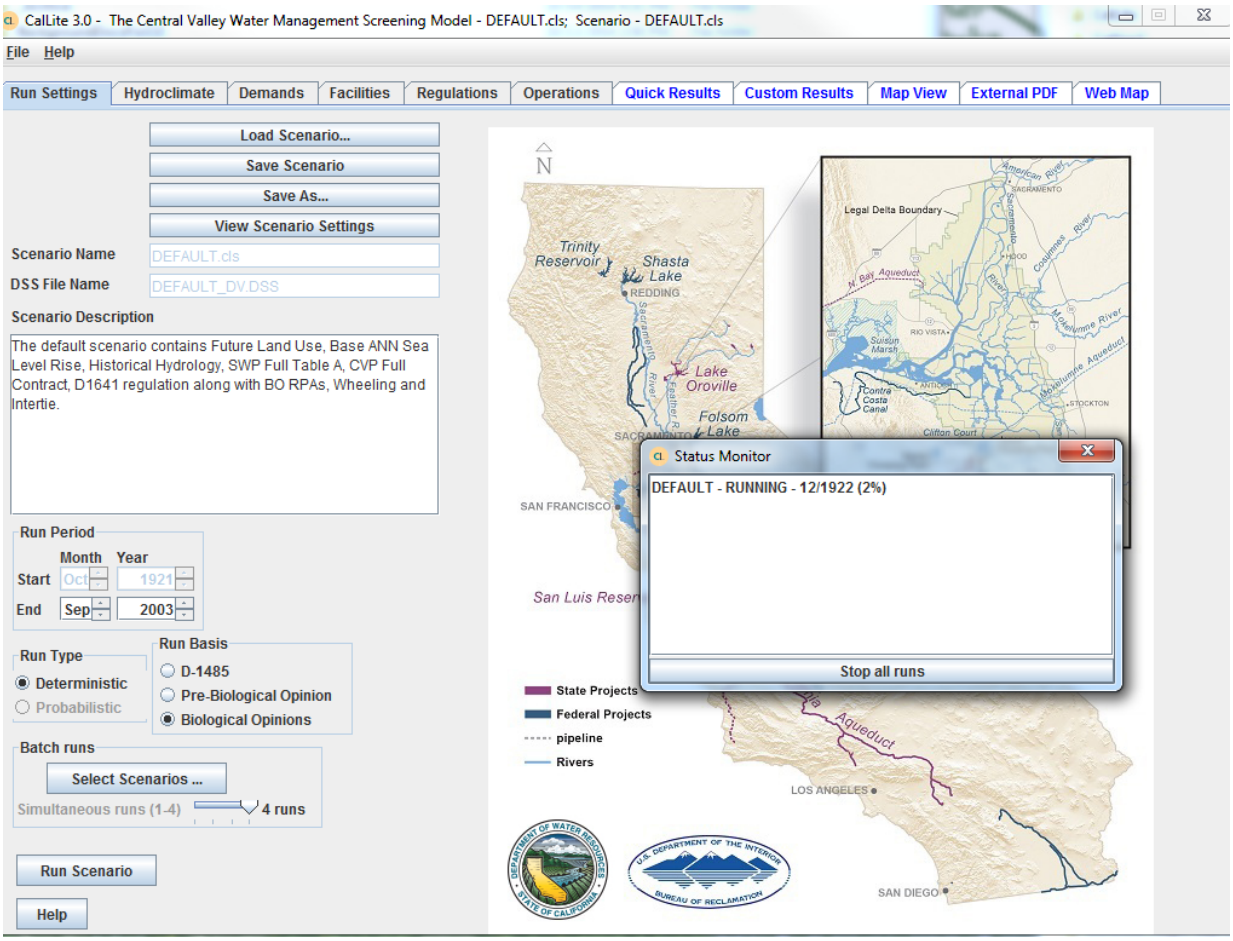


Figure 5-9. Model execution status is presented in the Status Monitor window.

Create a second scenario that adds the Biological Opinion regulatory constraints to the scenario on top of the D-1641 regulations. Do this by selecting the *D-1641 plus BO RPAs* from the *Quick Select* box in the Regulations dashboard. Once the change is done, the scenario can be saved as *Future_LOD_Future_Demand_D1641+BO.CLS*. Simulate the model to generate the *Future_LOD_Future_Demand_D1641+BO_DV.DSS* output file. Figure 5-10 shows the D-1641 plus Biological Opinion (BO) RPAs checked on.

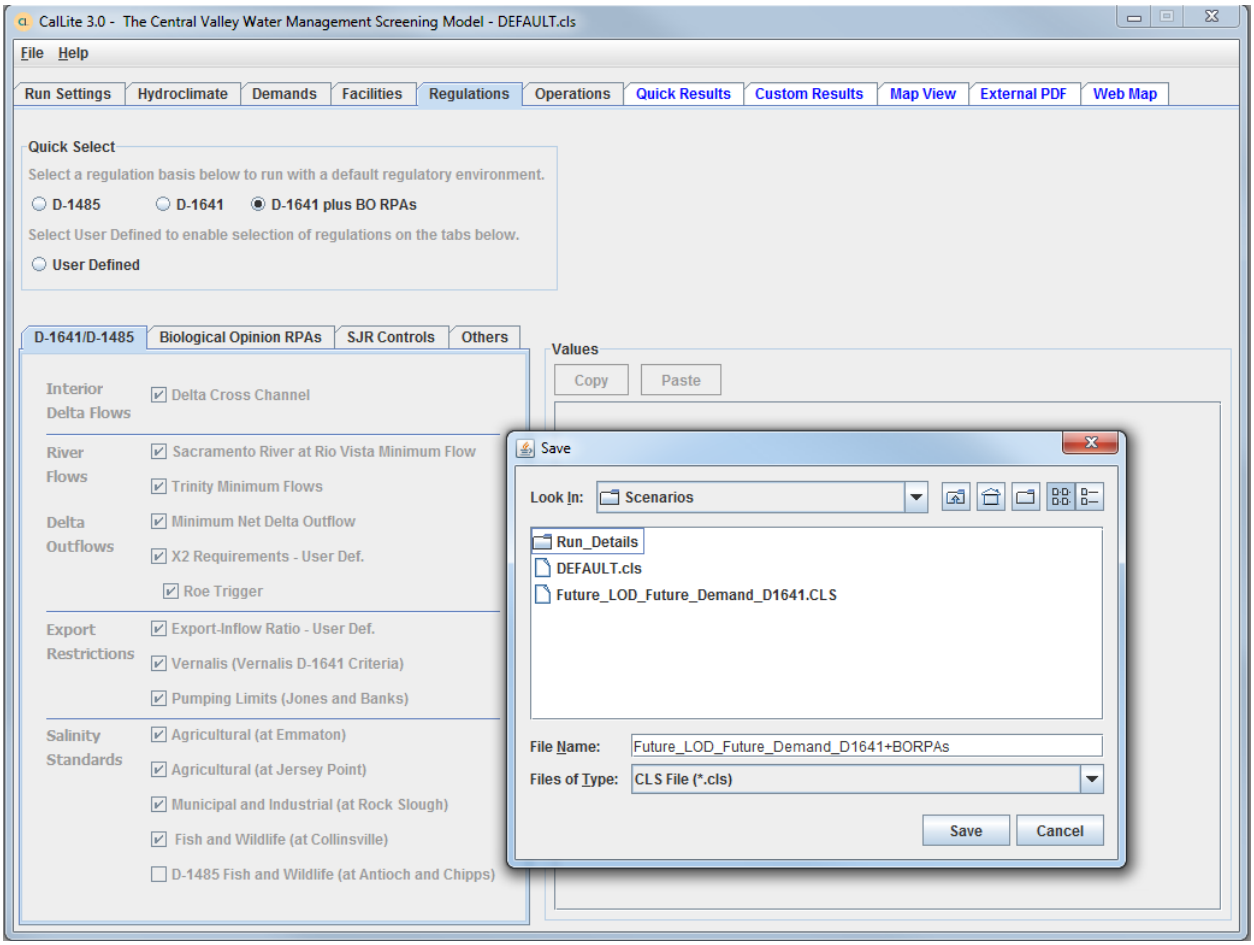


Figure 5-10. D-1641 plus Biological Opinion RPAs regulations are selected and the *Future_LOD_ Future_Demand_D1641+BORPAs* scenario is ready to save.

5.2.2. Viewing Results

There are now two sets of model results that can be used to demonstrate the display capabilities of the CalLite GUI. Start with loading the D-1641 results by moving to the Quick Results dashboard and clicking on the Add button in the Scenarios panel at the upper left. Select the file *Future_LOD_Future_Demand_D1641_DV.DSS*, which contains the model results for the D-1641-only scenario, then click on the Select button in the dialog. Figure 5-11 displays the opening of the scenario's DSS output file within the Quick Results dashboard.

Note: Since the open CalLite GUI was used to run the *Future_LOD_Future_Demand _D1641+BORPAs* scenario, the *Future_LOD_Future_Demand_D1641+BORPAs_DV.dss* output file already exists in the Scenarios box in the Quick Results dashboard as shown in Figure 5-11.

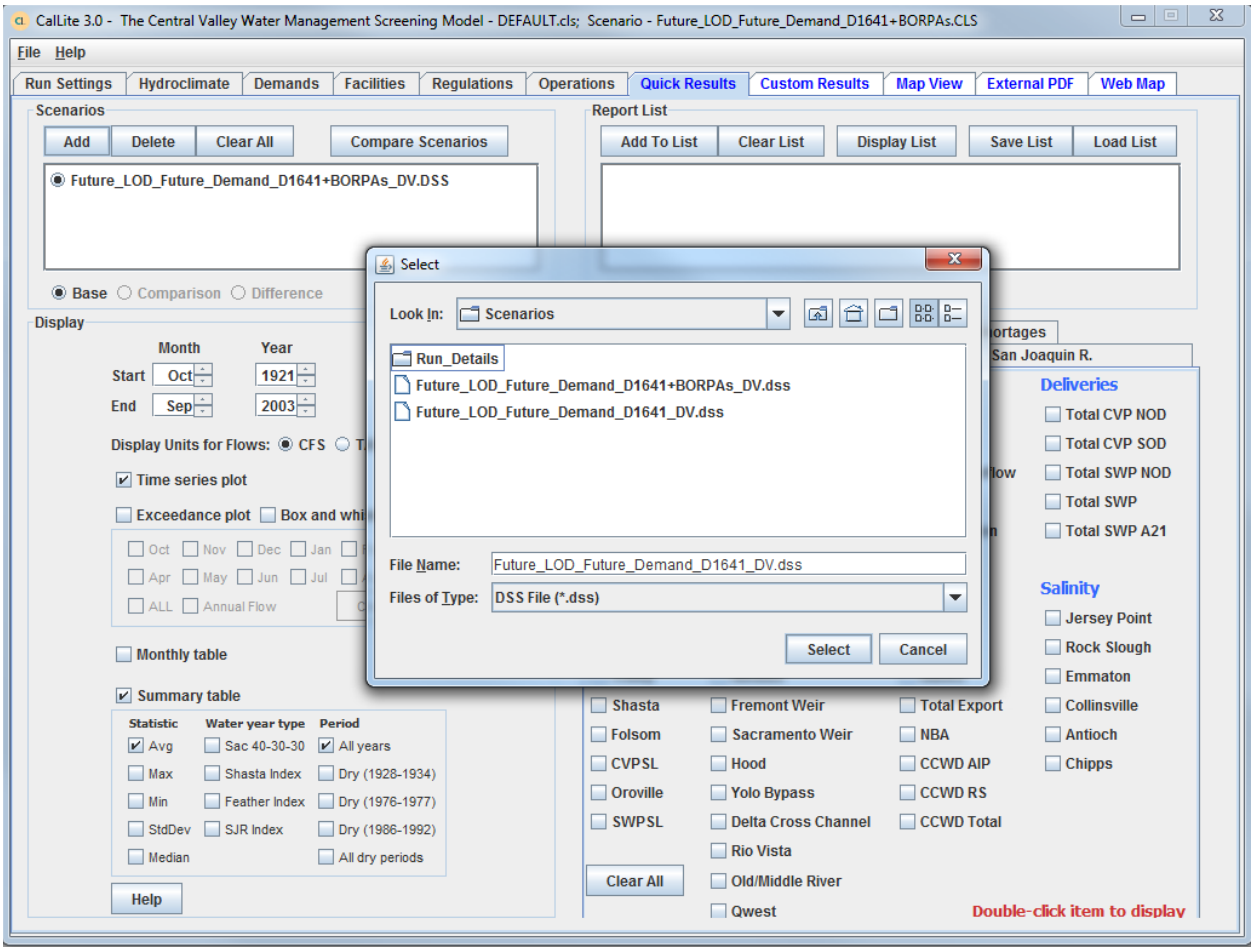


Figure 5-11. Loading scenario results in the Quick Results dashboard.

The loaded scenario is now shown in the list of scenarios with a select option button next to it. When a scenario output file in the list is selected, it will be used as the baseline scenario for *Comparison* and *Difference* options. It will also be the scenario deleted if one clicks on the Delete button.

As an exercise, create and execute a custom report that shows time-series and exceedance plots, as well as monthly tables and summary data for the Shasta storage:

- On the Quick Results dashboard, turn on the *Time-series plot*, *Exceedance plot* (selecting both October and All from the exceedance plot choices), Monthly table, and Summary table checkboxes in the Display panel.
- Turn on the Shasta checkbox in the *Storage+Flows* panel.
- Click the *Add to List* button to add this report to the list of reports (lists can be saved for future use and loaded back in).
- Click the *Display List* button to view the report.

The report components are presented in separate tabs of a single window; select a tab to see each component. Figure 5-12 displays the Quick Results dashboard. Figures 5-13 through 5-18 provide sample results.

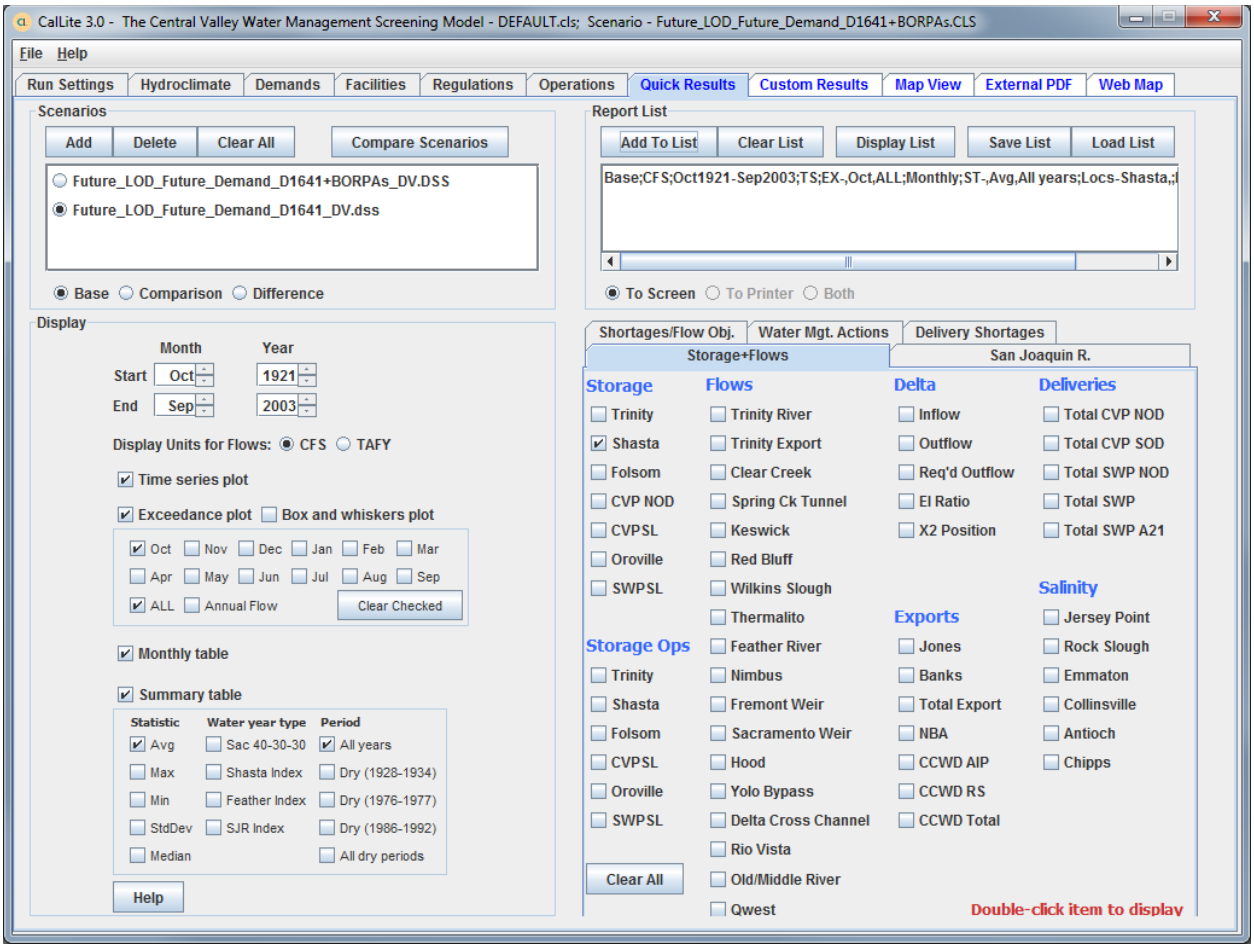


Figure 5-12. Turn on display choices and dataset to view report, and then add to list.

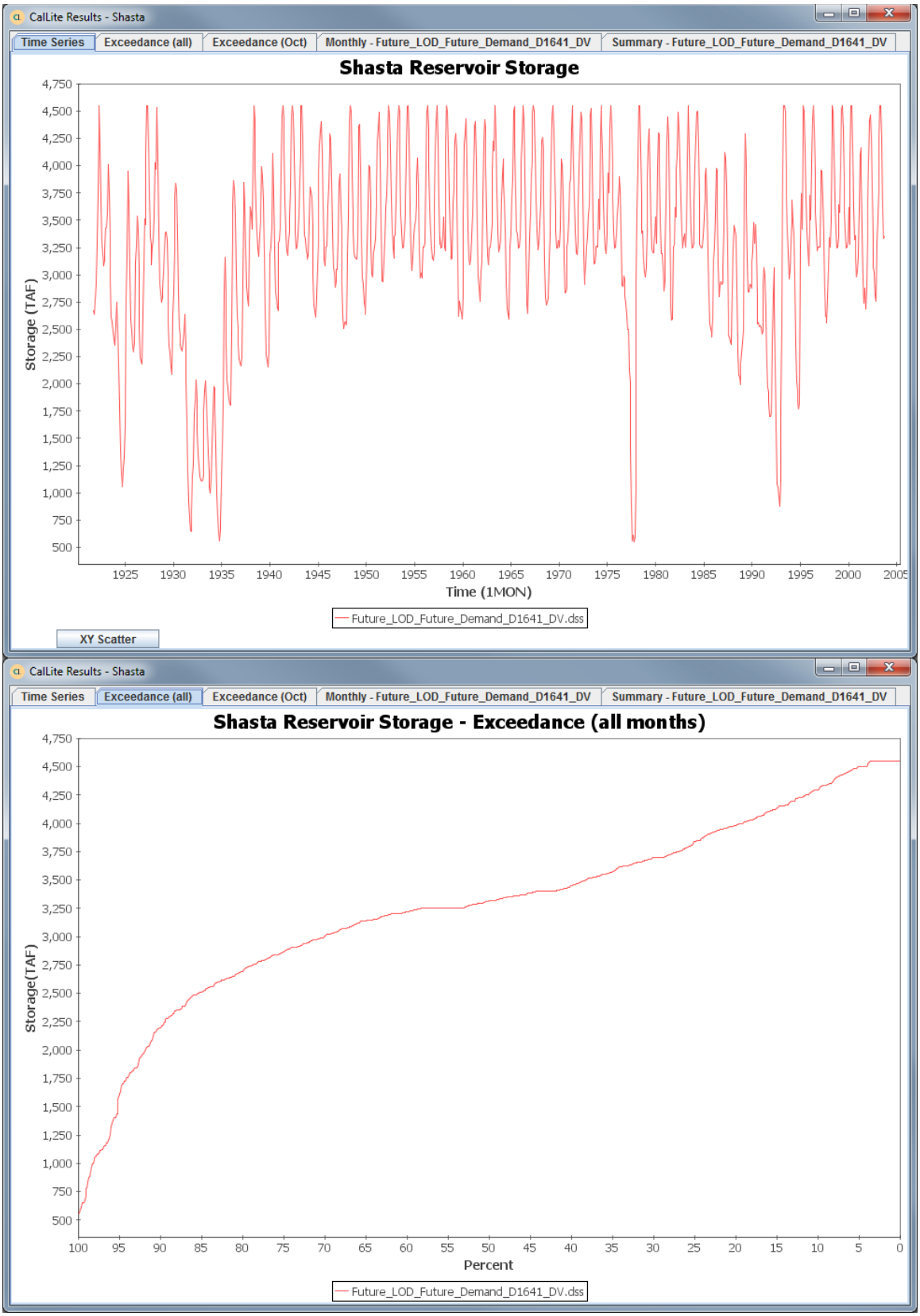


Figure 5-13. Time-series and exceedance chart reports generated by CalLite GUI.

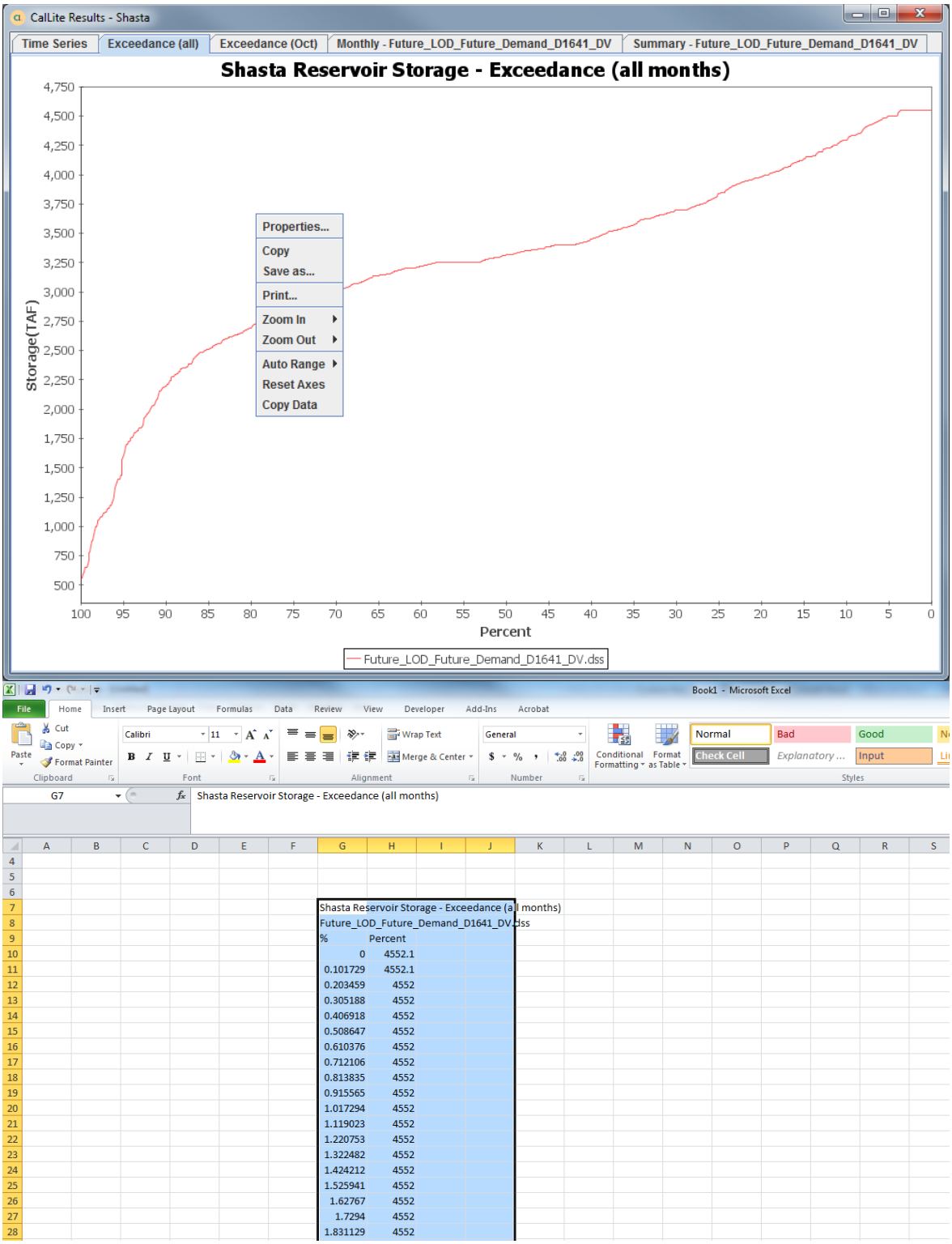


Figure 5-14. Right-clicking on a chart (top figure) displays functions including print and cut-and-paste options for supporting data into (e.g.) Excel (bottom figure). Charts can be copied as a bitmap with Ctrl+C.

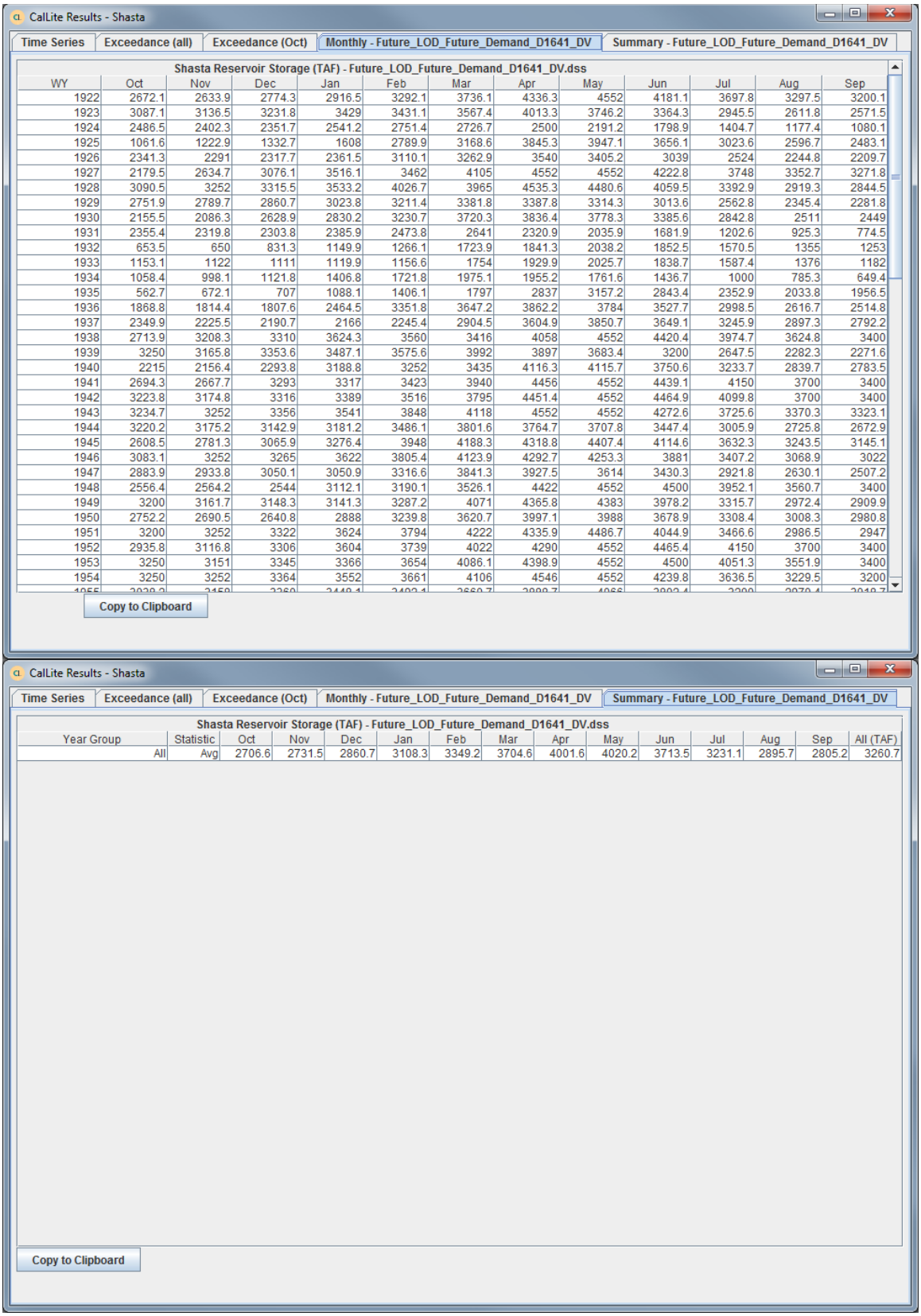


Figure 5-15. Monthly and summary table reports generated by CalLite GUI.

Selecting any parameter on the Storages+Flows, Shortages/Flow Objectives, or Water Management Actions subpanels and clicking on the Display List button will generate a report based on the current settings in the Display panel.

Close the CalLite results window from the previous step, deselect the Shasta option under Storage and select the *Trinity River* under Flows, then click on *Add To List* (Figure 5-16). Make sure the latest added result (i.e. Trinity River) in the Report List is selected, then click on the Display List button. This will bring up Trinity River flow results, which include a secondary time–series, in this case the minimum instream flow requirement (Figure 5-17). All charts support zooming (hold down the left mouse button and select the zoom area) and panning (hold down the left button and the Control key, then move the mouse) to better view the results. To zoom out, click and drag the cursor to the upper left. Tabular results are also available with an example provided in Figure 5-18.

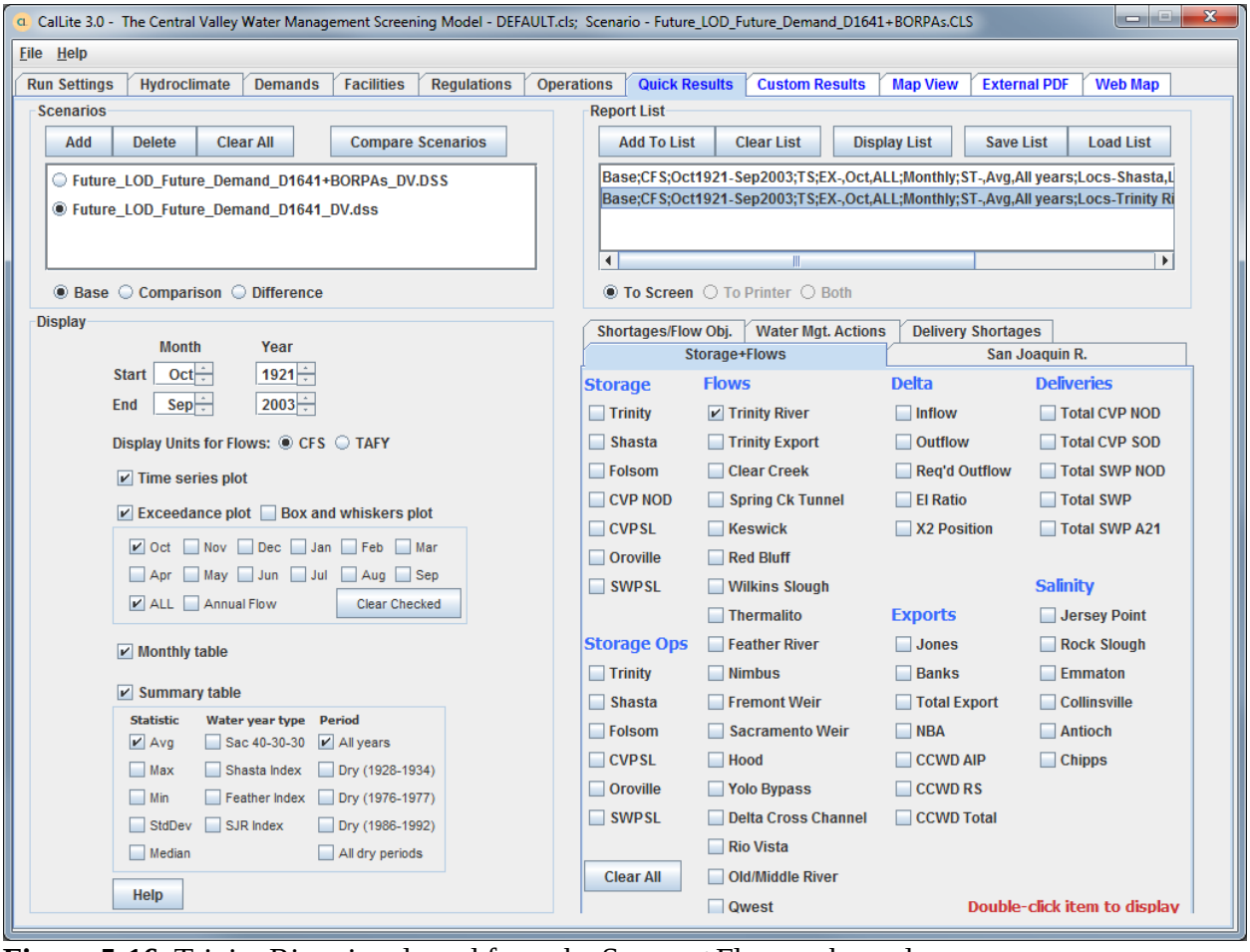


Figure 5-16. Trinity River is selected from the Storage+Flows subpanel.

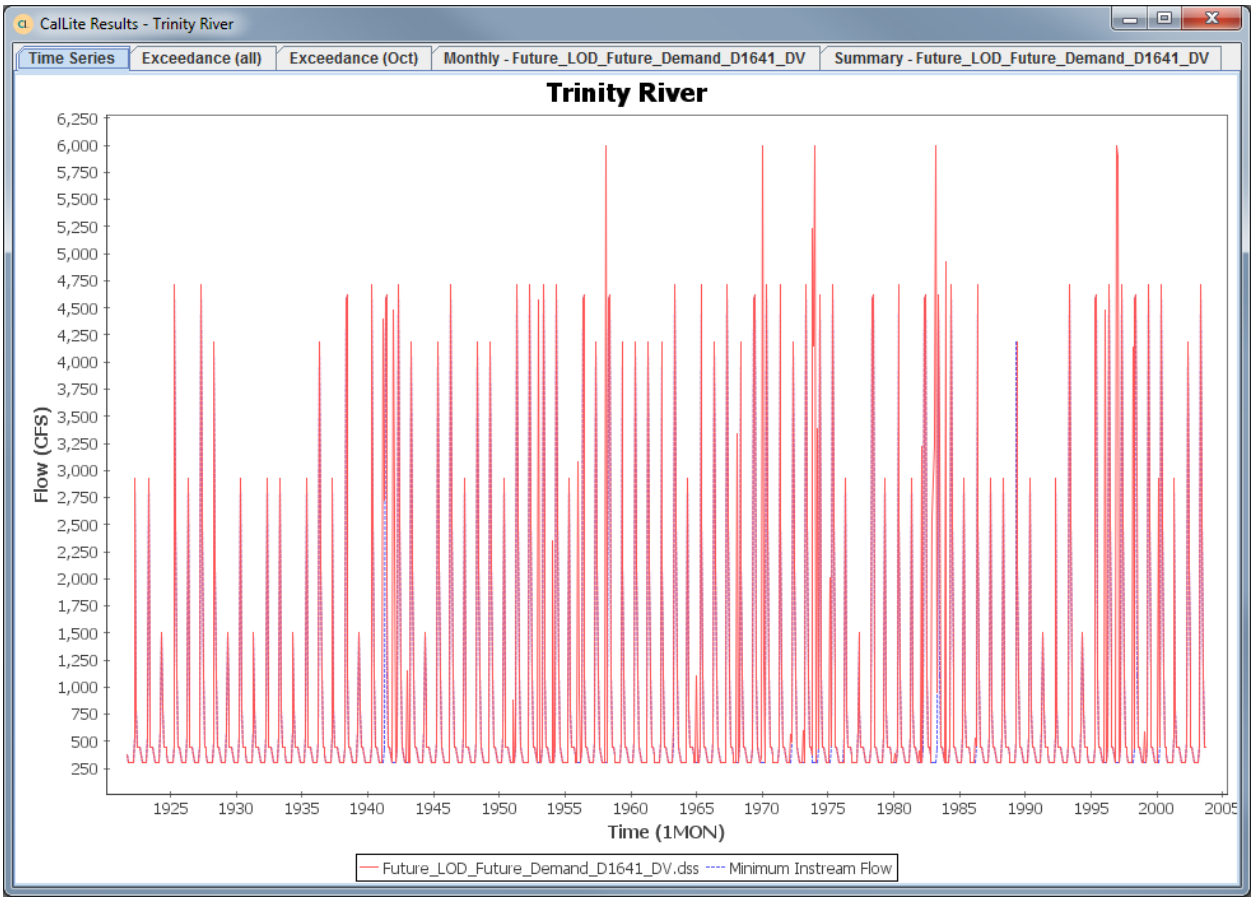
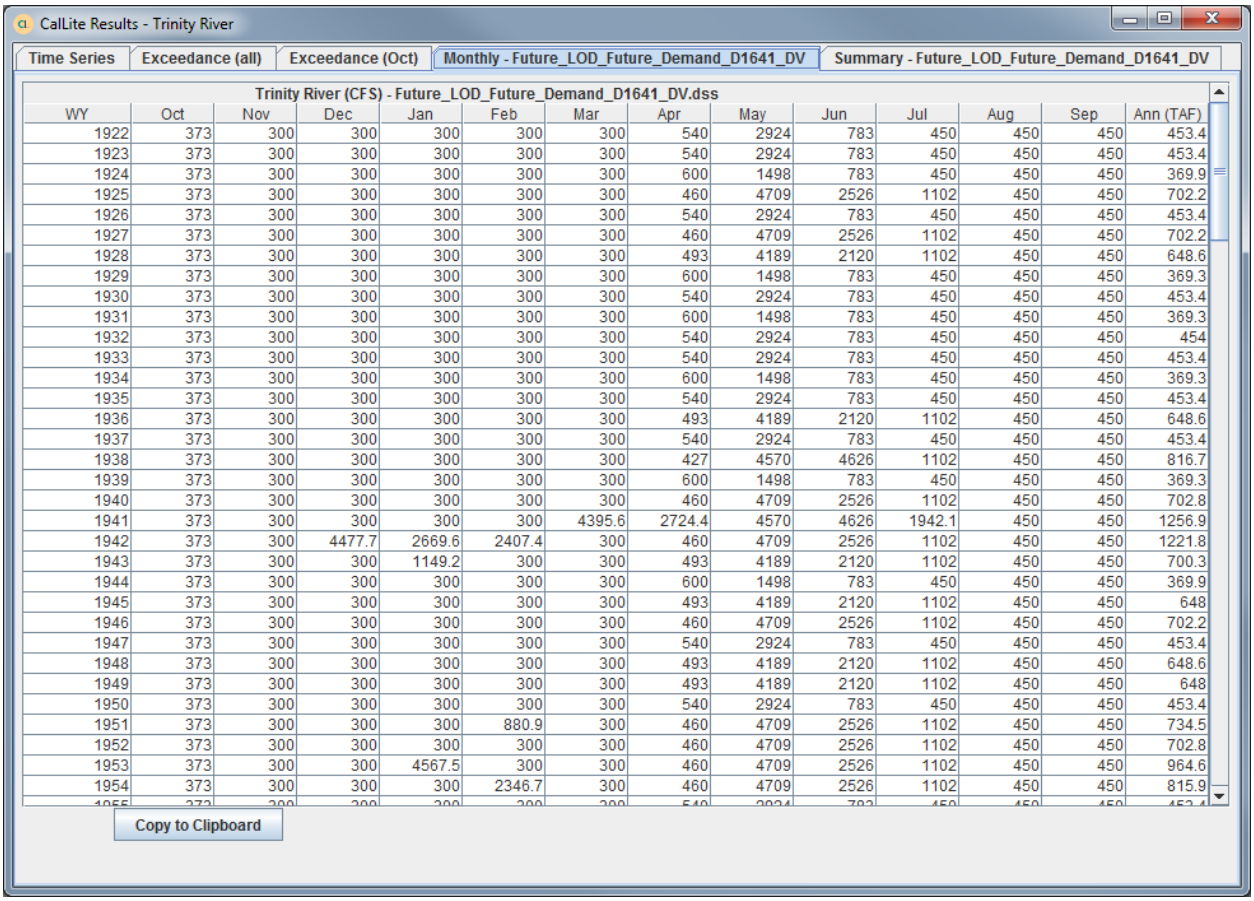


Figure 5-17. Trinity River flow time-series with minimum instream flow requirement as a secondary time-series (dashed blue line).



WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann (TAF)
1922	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1923	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1924	373	300	300	300	300	300	600	1498	783	450	450	450	369.9
1925	373	300	300	300	300	300	460	4709	2526	1102	450	450	702.2
1926	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1927	373	300	300	300	300	300	460	4709	2526	1102	450	450	702.2
1928	373	300	300	300	300	300	493	4189	2120	1102	450	450	648.6
1929	373	300	300	300	300	300	600	1498	783	450	450	450	369.3
1930	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1931	373	300	300	300	300	300	600	1498	783	450	450	450	369.3
1932	373	300	300	300	300	300	540	2924	783	450	450	450	454
1933	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1934	373	300	300	300	300	300	600	1498	783	450	450	450	369.3
1935	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1936	373	300	300	300	300	300	493	4189	2120	1102	450	450	648.6
1937	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1938	373	300	300	300	300	300	427	4570	4626	1102	450	450	816.7
1939	373	300	300	300	300	300	600	1498	783	450	450	450	369.3
1940	373	300	300	300	300	300	460	4709	2526	1102	450	450	702.8
1941	373	300	300	300	300	4395.6	2724.4	4570	4626	1942.1	450	450	1256.9
1942	373	300	4477.7	2669.6	2407.4	300	460	4709	2526	1102	450	450	1221.8
1943	373	300	300	1149.2	300	300	493	4189	2120	1102	450	450	700.3
1944	373	300	300	300	300	300	600	1498	783	450	450	450	369.9
1945	373	300	300	300	300	300	493	4189	2120	1102	450	450	648
1946	373	300	300	300	300	300	460	4709	2526	1102	450	450	702.2
1947	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1948	373	300	300	300	300	300	493	4189	2120	1102	450	450	648.6
1949	373	300	300	300	300	300	493	4189	2120	1102	450	450	648
1950	373	300	300	300	300	300	540	2924	783	450	450	450	453.4
1951	373	300	300	300	880.9	300	460	4709	2526	1102	450	450	734.5
1952	373	300	300	300	300	300	460	4709	2526	1102	450	450	702.8
1953	373	300	300	4567.5	300	300	460	4709	2526	1102	450	450	964.6
1954	373	300	300	300	2346.7	300	460	4709	2526	1102	450	450	815.9

Figure 5-18. Annual accumulations are calculated from monthly values for all flow results. In the monthly table, the annual accumulated flow is presented as an additional column.

Scenario results can be compared by using the Comparison option in the Scenarios panel. Follow the example steps below; see Figures 5-19 and 5-20 for menu options and result plots, respectively.

- Add the D-1641+BO scenario with the Add button (in case it is not already added);
- Change the selection from *Base* to *Comparison* in the Scenarios panel;
- In the Report List panel, click *Clear List* to remove the previous report(s);
- Click *Add to List* to add the new comparison report; and
- Click *Display List* to show all reports in the list.

Note: If the *Display List* button is clicked without adding the new comparison report, a *base* report that only shows information from the baseline simulation will be provided.

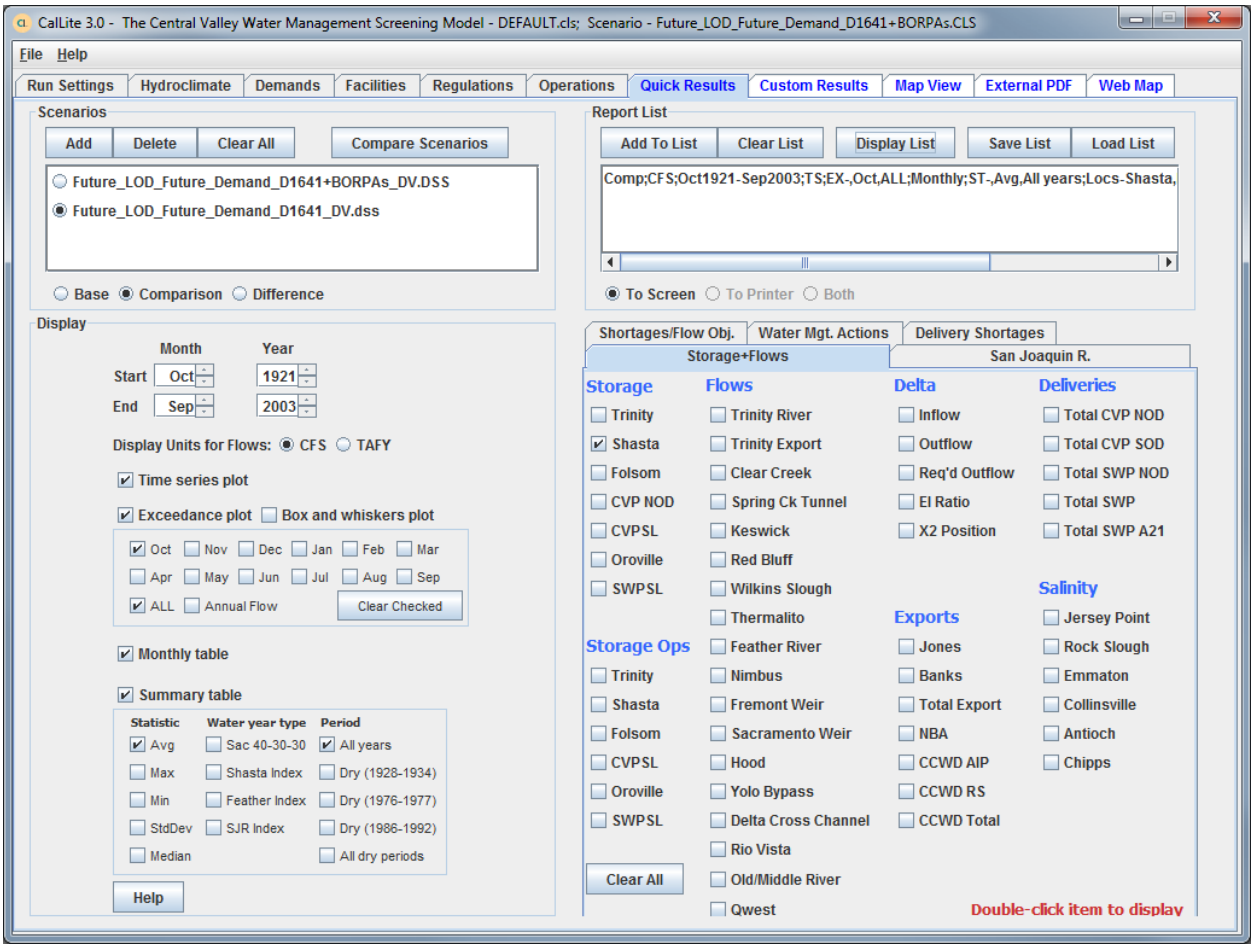


Figure 5-19. There are two scenarios in the Scenario list, with the D-1641 scenario selected as the base.

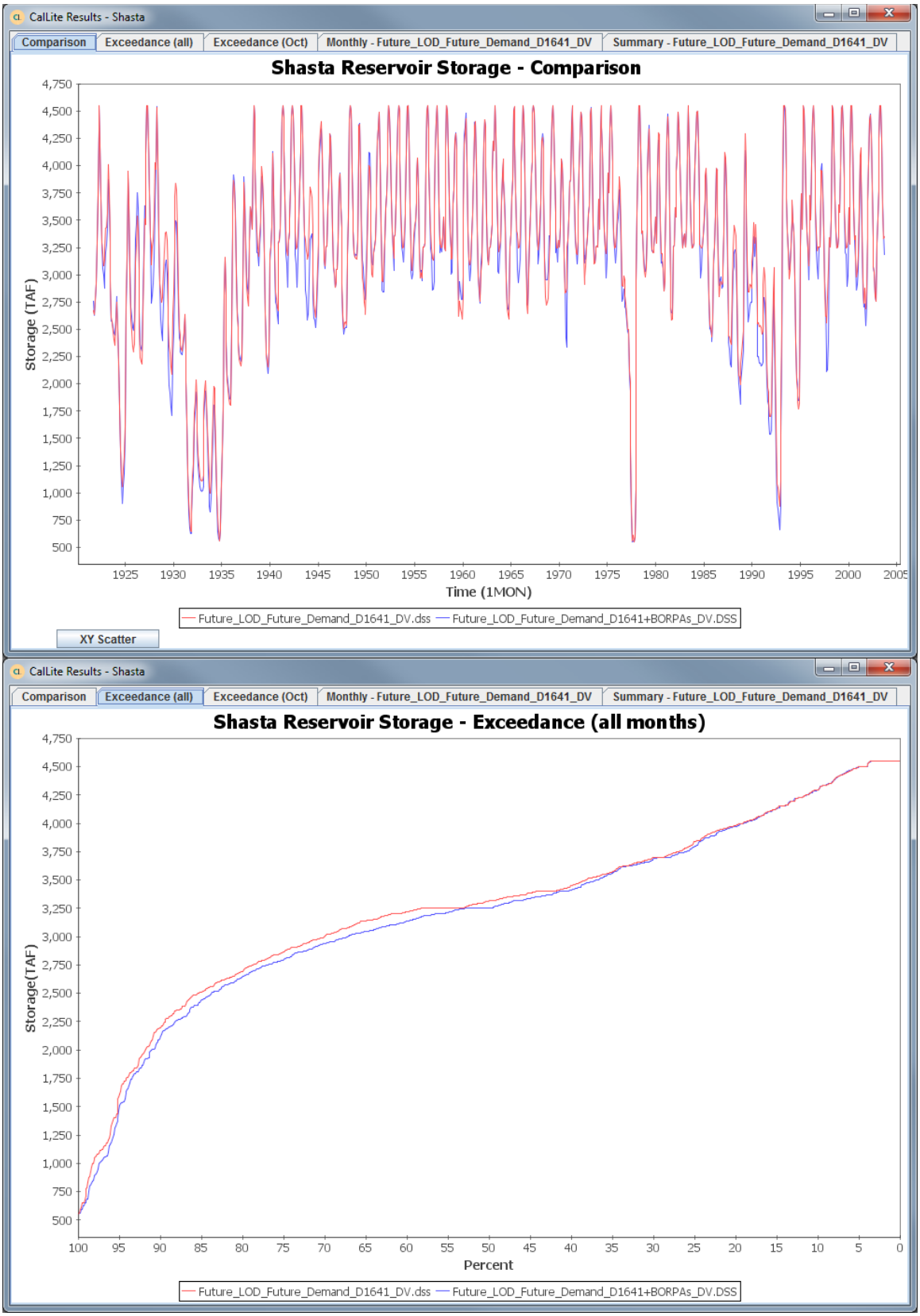


Figure 5-20. Comparison plots show results from multiple scenarios on the same charts.

The difference between scenarios can also be plotted and tabulated. For this example, change the selection from *Comparison* to *Difference* and right-click on the Shasta checkbox. See Figures 5-21 and 5-22 for menu options and report plots, respectively.

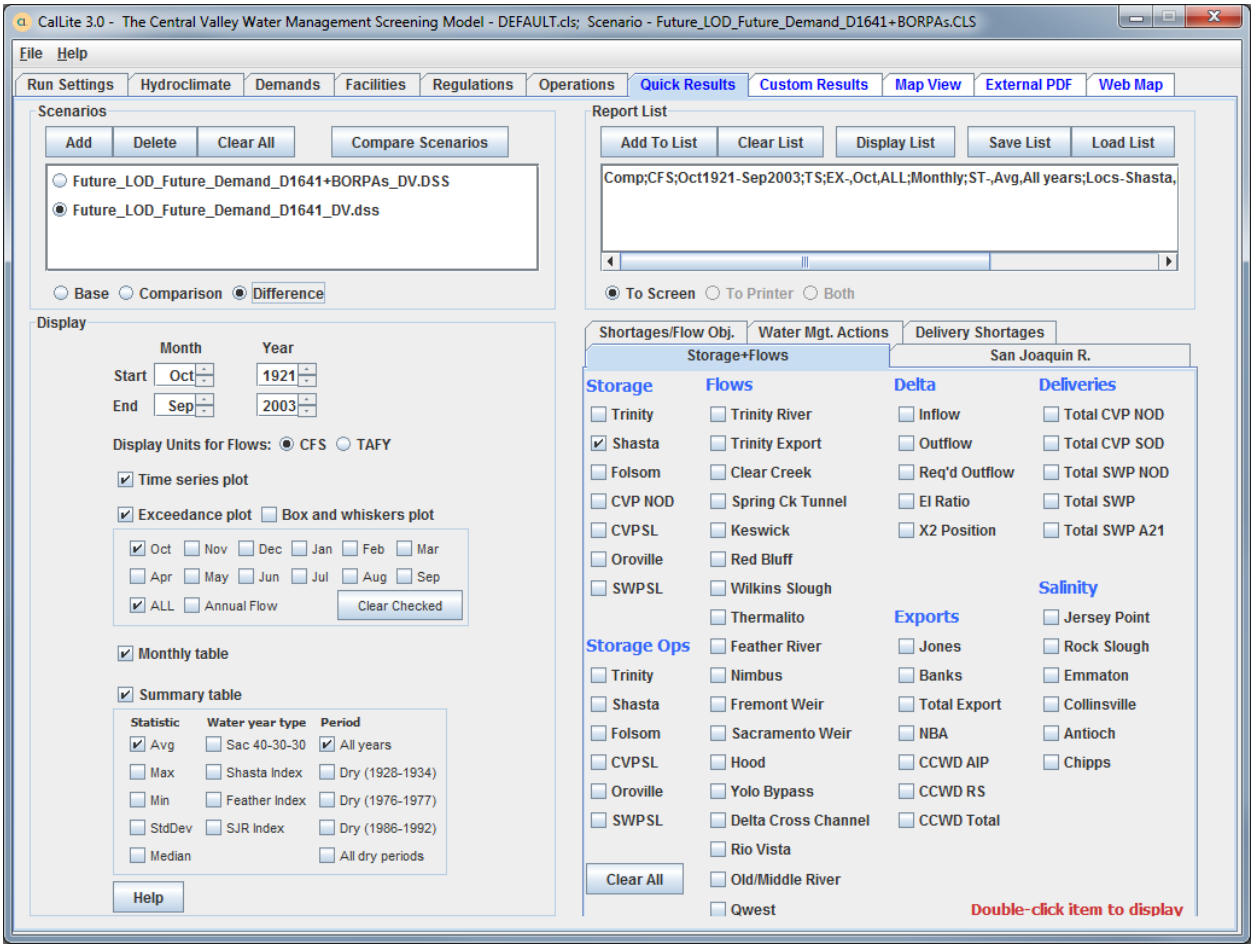


Figure 5-21. Quick Results dashboard prior to developing a difference report.

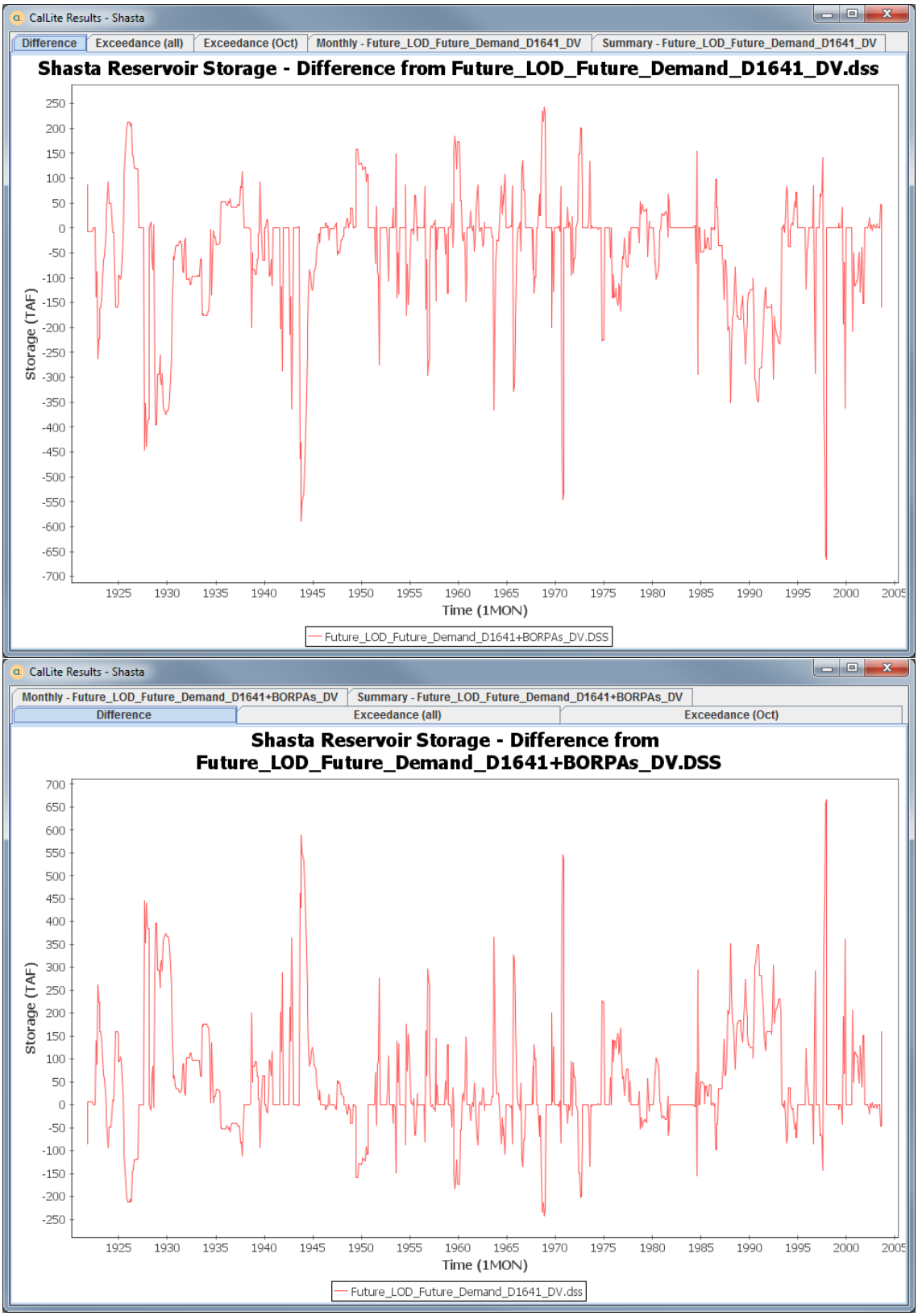


Figure 5-22. Difference charts for Shasta storage under two different scenarios.

Note: Difference charts will change when the base scenario is changed in the scenario list.

External report templates for generating convenient sets of tables and charts in PDF format are accessible from the External PDF dashboard. For this example use the D-1641 and D-1641+BORPAs scenario result files with the callite_scenario_comparison.inp template. Figures 5-23 and 5-24 provide an example of the PDF generation process and a report page sample.

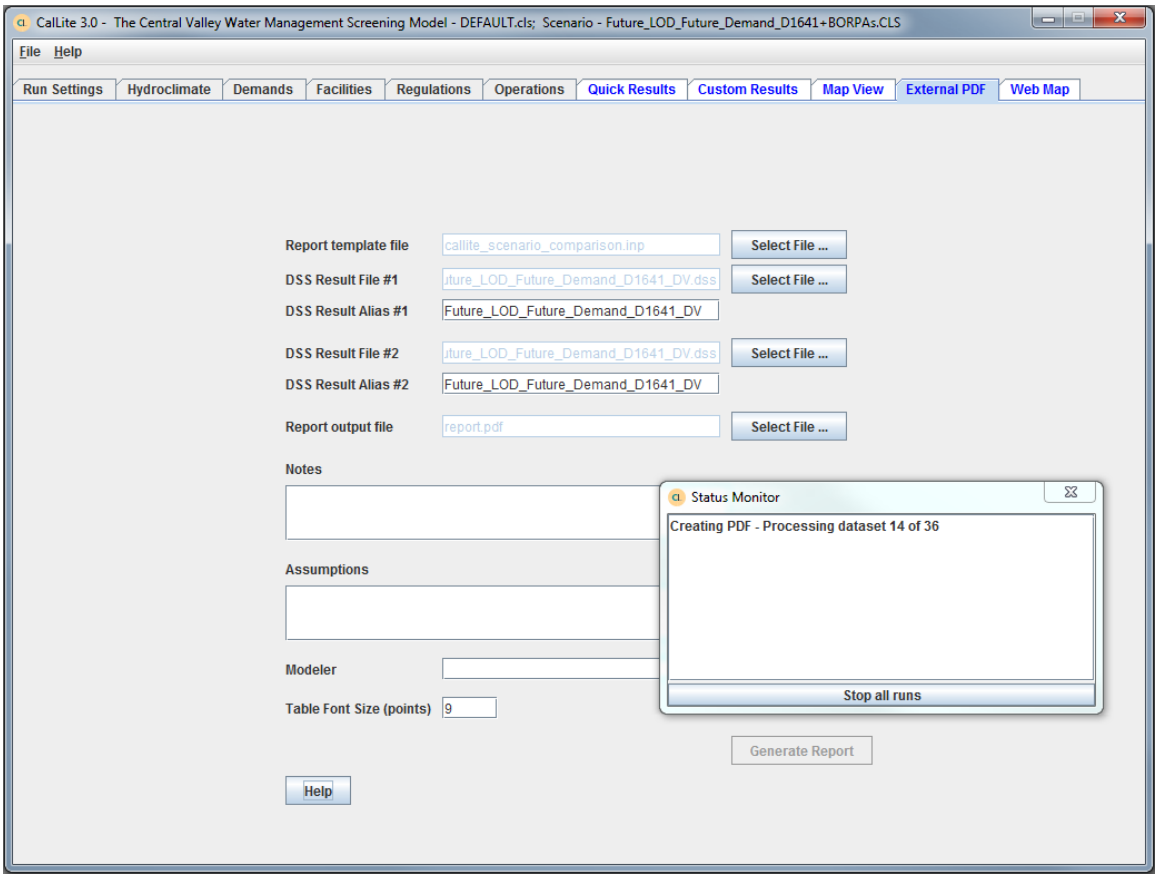
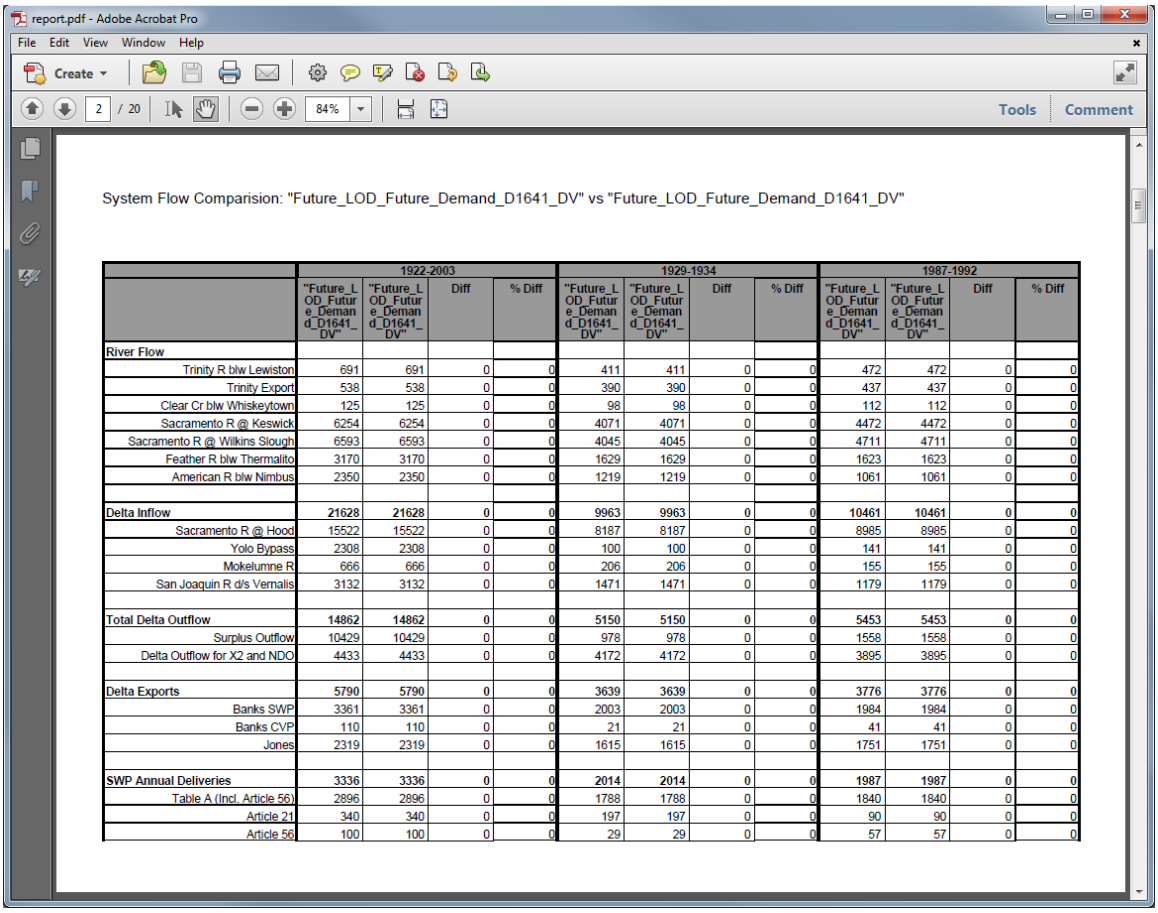


Figure 5-23. The CalLite GUI allows rapid generation of report-quality charts and tables from different sets of model results.



System Flow Comparision: "Future_LOD_Future_Demand_D1641_DV" vs "Future_LOD_Future_Demand_D1641_DV"

	1922-2003				1929-1934				1987-1992			
	"Future_LOD_Future_Demand_D1641_DV"	"Future_LOD_Future_Demand_D1641_DV"	Diff	% Diff	"Future_LOD_Future_Demand_D1641_DV"	"Future_LOD_Future_Demand_D1641_DV"	Diff	% Diff	"Future_LOD_Future_Demand_D1641_DV"	"Future_LOD_Future_Demand_D1641_DV"	Diff	% Diff
River Flow												
Trinity R blw Lewiston	691	691	0	0	411	411	0	0	472	472	0	0
Trinity Export	538	538	0	0	390	390	0	0	437	437	0	0
Clear Cr blw Whiskeytown	125	125	0	0	98	98	0	0	112	112	0	0
Sacramento R @ Keswick	6254	6254	0	0	4071	4071	0	0	4472	4472	0	0
Sacramento R @ Wilkins Slough	6593	6593	0	0	4045	4045	0	0	4711	4711	0	0
Feather R blw Thermalito	3170	3170	0	0	1629	1629	0	0	1623	1623	0	0
American R blw Nimbus	2350	2350	0	0	1219	1219	0	0	1061	1061	0	0
Delta Inflow	**21628**	**21628**	**0**	**0**	**9963**	**9963**	**0**	**0**	**10461**	**10461**	**0**	**0**
Sacramento R @ Hood	15522	15522	0	0	8187	8187	0	0	8985	8985	0	0
Yolo Bypass	2308	2308	0	0	100	100	0	0	141	141	0	0
Mokelumne R	666	666	0	0	206	206	0	0	155	155	0	0
San Joaquin R d/s Vernalis	3132	3132	0	0	1471	1471	0	0	1179	1179	0	0
Total Delta Outflow	**14862**	**14862**	**0**	**0**	**5150**	**5150**	**0**	**0**	**5453**	**5453**	**0**	**0**
Surplus Outflow	10429	10429	0	0	978	978	0	0	1558	1558	0	0
Delta Outflow for X2 and NDO	4433	4433	0	0	4172	4172	0	0	3895	3895	0	0
Delta Exports	**5790**	**5790**	**0**	**0**	**3639**	**3639**	**0**	**0**	**3776**	**3776**	**0**	**0**
Banks SWP	3361	3361	0	0	2003	2003	0	0	1984	1984	0	0
Banks CVP	110	110	0	0	21	21	0	0	41	41	0	0
Jones	2319	2319	0	0	1615	1615	0	0	1751	1751	0	0
SWP Annual Deliveries	**3336**	**3336**	**0**	**0**	**2014**	**2014**	**0**	**0**	**1987**	**1987**	**0**	**0**
Table A (Incl. Article 56)	2896	2896	0	0	1788	1788	0	0	1840	1840	0	0
Article 21	340	340	0	0	197	197	0	0	90	90	0	0
Article 56	100	100	0	0	29	29	0	0	57	57	0	0

Figure 5-24. A sample of a CalLite PDF Report Tool scenario comparison chart.

Reference

CalLite Reference Manual, Central Valley Water Management Screening Model (Version 3.00), California Department of Water Resources and United States Bureau of Reclamation, November 2014.

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