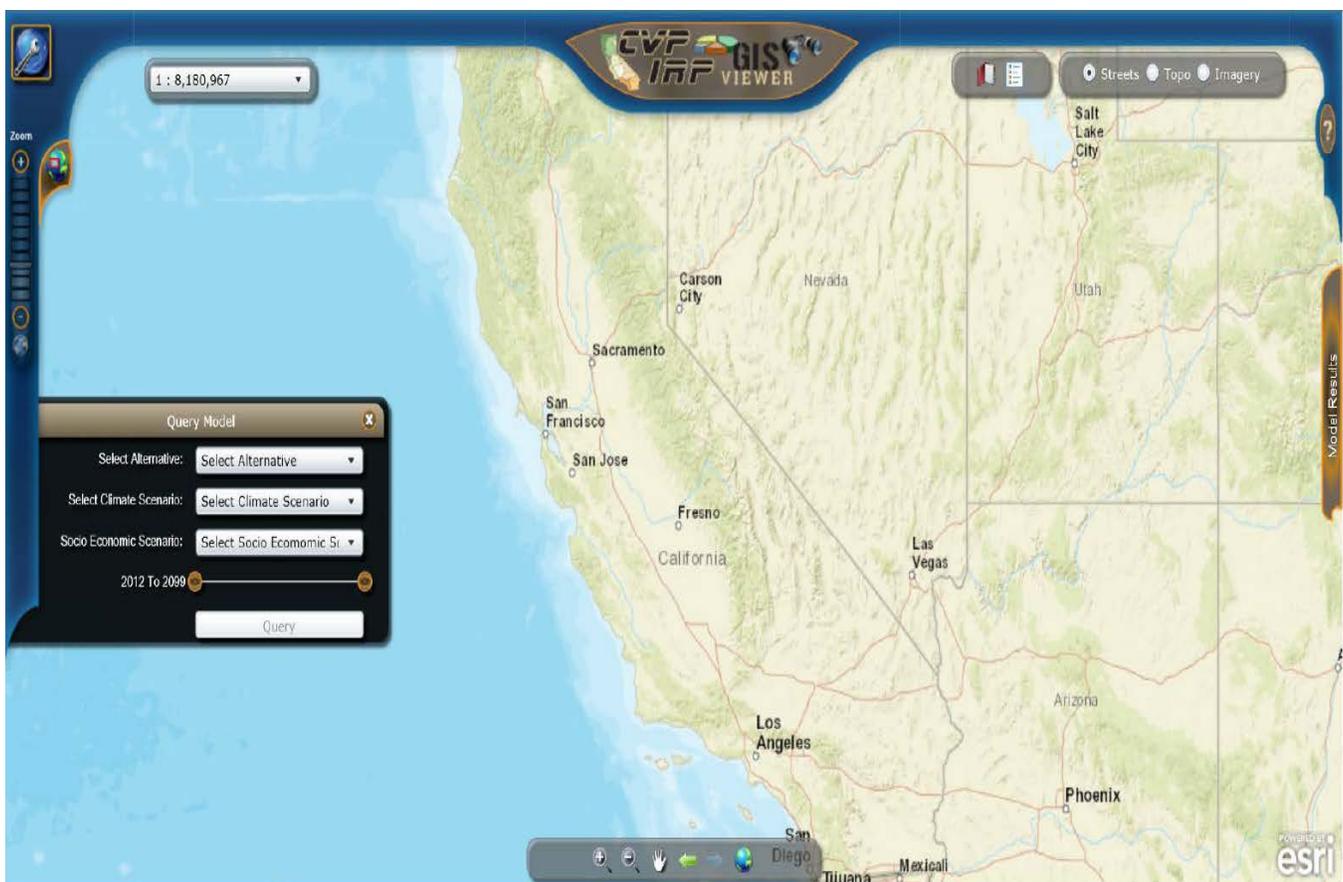


# RECLAMATION

*Managing Water in the West*

## West-wide Resource Assessment and Management Planning User's Platform

Research and Development Office  
Science and Technology Program  
Final Report ST-2017-1783-1



U.S. Department of the Interior  
Bureau of Reclamation  
Research and Development Office

June 2017



## **Mission Statements**

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.



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(Signature)



# Executive Summary

The West-wide Resource Assessment and Management Planning Users Platform (Ww RAMP UP) is intended to address the need to effectively communicate outcomes of water resource assessment and management planning studies. By providing a web based platform that offers access to downloadable data and analyses in a variety of formats including text, graphics and maps, its development will support the Reclamation's Open Water Data Initiative activities; encourage exploration of planning study results and facilitate group interactions in the context of decision making processes. The Ww RAMP UP will be designed to be a dynamic portal to which Reclamation's existing and future planning studies can be uploaded to the web platform.



# Contents

	<i>Page</i>
<b><i>Introduction</i></b> .....	<b>2</b>
<b><i>Description of the Application</i></b> .....	<b>2</b>
<b><i>Task Descriptions</i></b> .....	<b>10</b>
<b>Task 1. Initial Meeting and Project Setup Activities</b> .....	<b>10</b>
<b>Task 2. Front Page Design</b> .....	<b>11</b>
<b>Task 3. Setup Story Maps</b> .....	<b>11</b>
<b>Task 4. Study Comparison Scenario Viewer</b> .....	<b>11</b>
<b>Task 5. Study Uploading</b> .....	<b>12</b>
<b>Task 6. Open Data Study Downloading</b> .....	<b>12</b>
<b><i>Conclusions and Recommendations</i></b> .....	<b>13</b>
<b><i>References</i></b> .....	<b>13</b>

## List of Figures

<b><i>Figure 1. Basic Workflow Web Client Technologies of the Platform</i></b> .....	<b>3</b>
<b><i>Figure 2. Opening Page features from Reclamation’s SECURE Report website</i></b> ..	<b>3</b>
<b><i>Figure 3. Examples of Available Studies/Info page</i></b> .....	<b>4</b>
<b><i>Figure 4. Example of the Scenario Query tool menu</i></b> .....	<b>5</b>
<b><i>Figure 5. Example of Alternative Selections</i></b> .....	<b>6</b>
<b><i>Figure 6. Example of Hydroclimate Selections</i></b> .....	<b>6</b>
<b><i>Figure 7. Example of Socioeconomic Selection Menu</i></b> .....	<b>7</b>
<b><i>Figure 8. Examples of Graphic Outputs</i></b> .....	<b>8</b>
<b><i>Figure 9. Example of a time period analysis.</i></b> .....	<b>8</b>
<b><i>Figure 10. Envisioned Server Infrastructure</i></b> .....	<b>9</b>

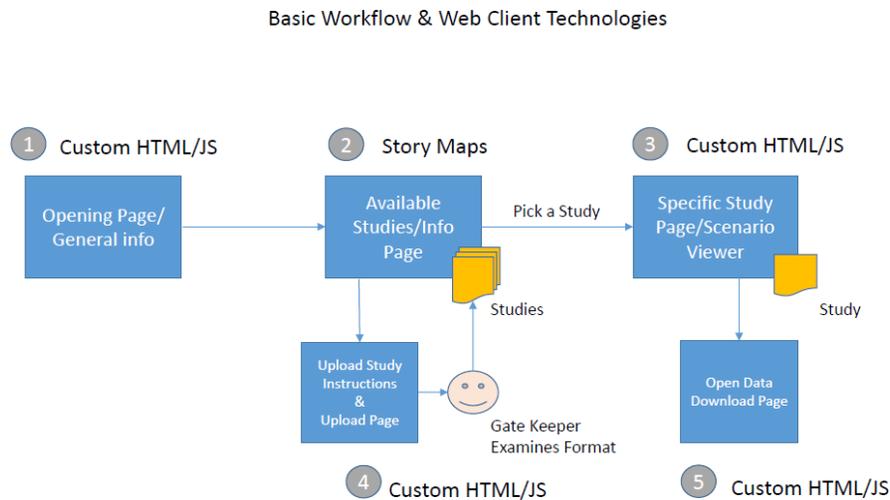
# Introduction

The West-wide Resource Assessment and Management Planning Users Platform (Ww RAMP UP) is intended to address the need to effectively communicate outcomes of water resource assessment and management planning studies. By providing a web based platform that offers access to downloadable data and analyses in a variety of formats including text, graphics and maps, its development will support the Reclamation's Open Water Data Initiative activities; encourage exploration of planning study results and facilitate group interactions in the context of decision making processes. The Ww RAMP UP will be designed to be a dynamic portal to which Reclamation's existing and future studies planning studies can be uploaded to the web platform.

The Ww RAMP UP platform will build on existing technology developed by the WaterSMART program for presentation of studies related to Reclamation's SECURE Water Act reports, Reclamation's Water Information System (RWIS), WaterSMART Data Visualization Tool and the Central Valley Project Integrated Resource Plan (CVPIRP) study.

## Description of the Application

The Ww RAMP UP platform workflow, web client technologies, data presentation and site management concepts



are presented in Figure 1.

Figure 1. Basic Workflow Web Client Technologies of the Platform

When users open the platform in a web browser, they will be presented with an Opening Page (Figure 1, Label 1) that provides general information about Reclamation’s mission, the purpose of the Ww RAMP UP website and how to access its functionality. The Opening Page can be a static custom HTML/Javascript (JS) page that will also explain the Ww RAMP UP application’s functionality. An example of what users might encounter on the Opening Page is shown on Figure 2 below.



Figure 2. Opening Page features from Reclamation’s SECURE Report website

Several notable features shown in Figure 2 include a capability to include text (left side of the figure), links to the other websites and reports (highlighted in blue), a navigation tool (extreme left) to select various studies and icons for video and sharing the page with others. An additional desirable feature to be added to the Opening Page will be a method to contact Reclamation and leave comments regarding the website and its content. The WaterSMART Data Visualization Tool provides additional examples of other format options which could be implemented in the application.

<http://usbr.maps.arcgis.com/apps/MapJournal/index.html?appid=043fe91887ac4ddc92a4c0f427e38ab0>.

Through the Opening Page, users will be directed to the Available Studies/Info page (Figure 1 Label 2) providing an interactive map illustrating the location of various studies. It is envisioned that an ESRI StoryMaps configurable technology

along with some custom HTML will be used for this page. A list of studies will also be presented to facilitate selecting a study. As shown on Figure 3, this page provides users with access to a catalogue of studies and types of information supported by the website.

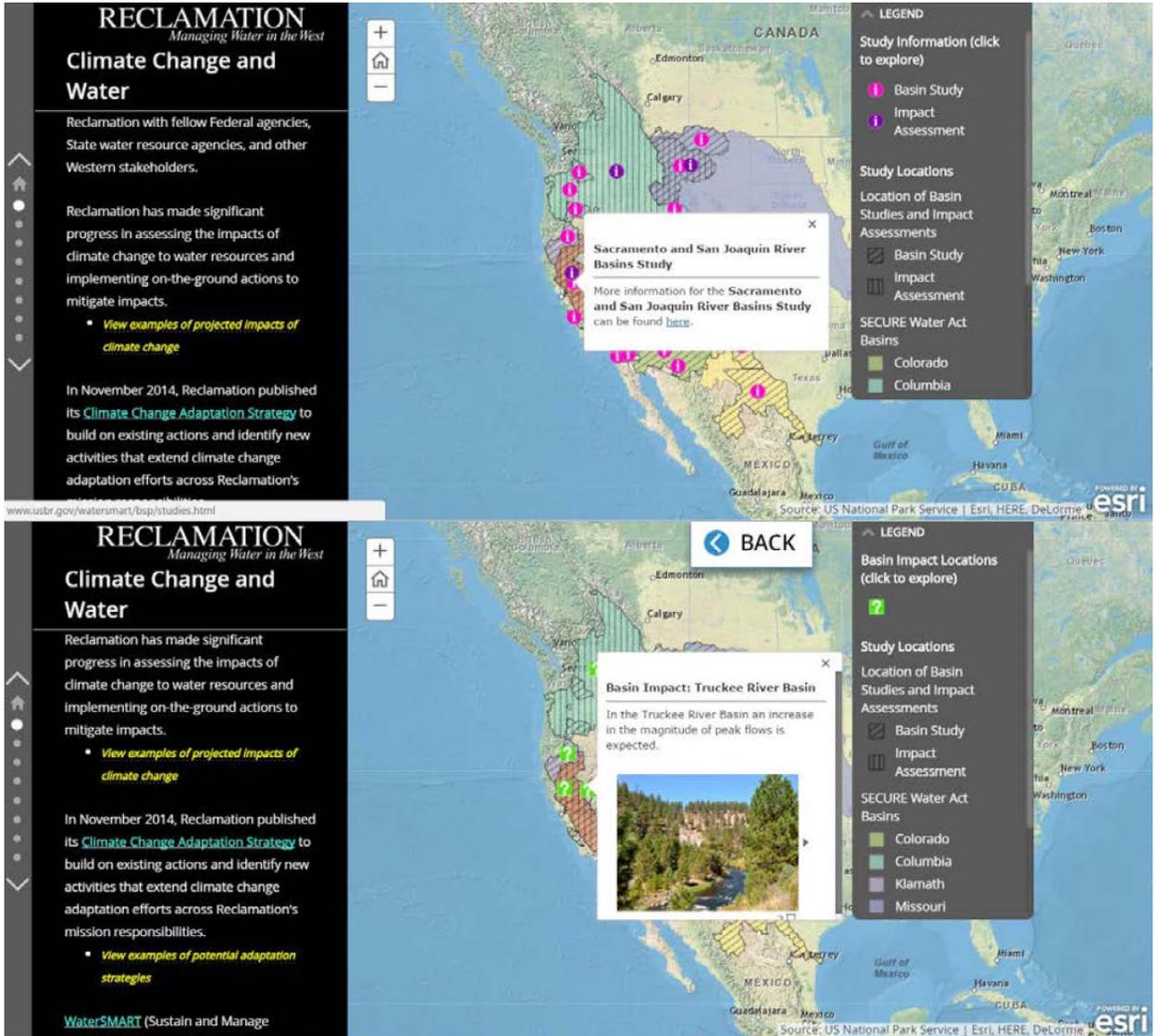


Figure 3. Examples of Available Studies/Info page

When a study is selected, the map will zoom to that study boundary on the map, and additional information specific to that study will be presented. The user will have the option to proceed to the “Scenario Comparison” page for that study, or simply explore general information on the study. Typically, planning studies such as WaterSMART Basin Studies, NEPA and Feasibility Studies involve evaluating

a variety of alternative scenarios to determine how benefits, costs and impacts to a variety of resource categories compare to each other. An example of the Scenario Viewer page from the CVP IRP study is presented on Figure 4 below. On the right side is a Model Results tab which allows the user to access model results and parameters. In the upper right corner, the user may select from various background maps, bookmarks and help functions.

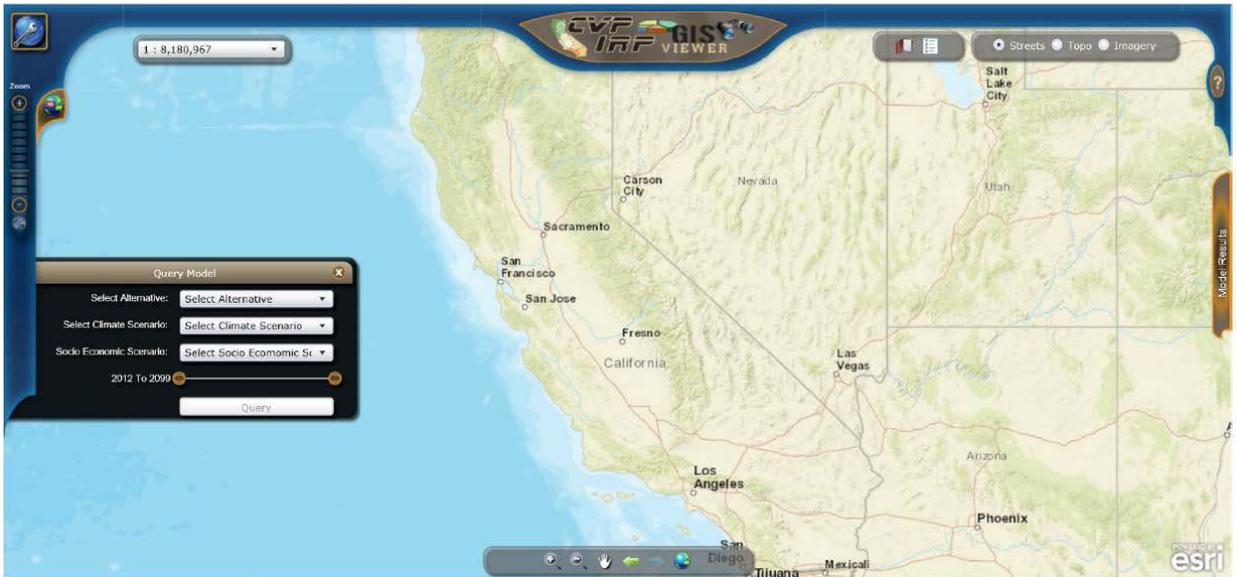


Figure 4. Example of the Scenario Query tool menu

A variety of user settings and display control tools are available (top left and bottom center). In this example, the Query Menu is used to present users with options to compare scenarios (left center of figure). The general procedure is to first select a proposed action alternative (baseline, alternative 1, alternative 2, ...). In Figure 5, an example of the Alternative Selection menu is shown. In this case, the alternatives are various portfolios of management actions.

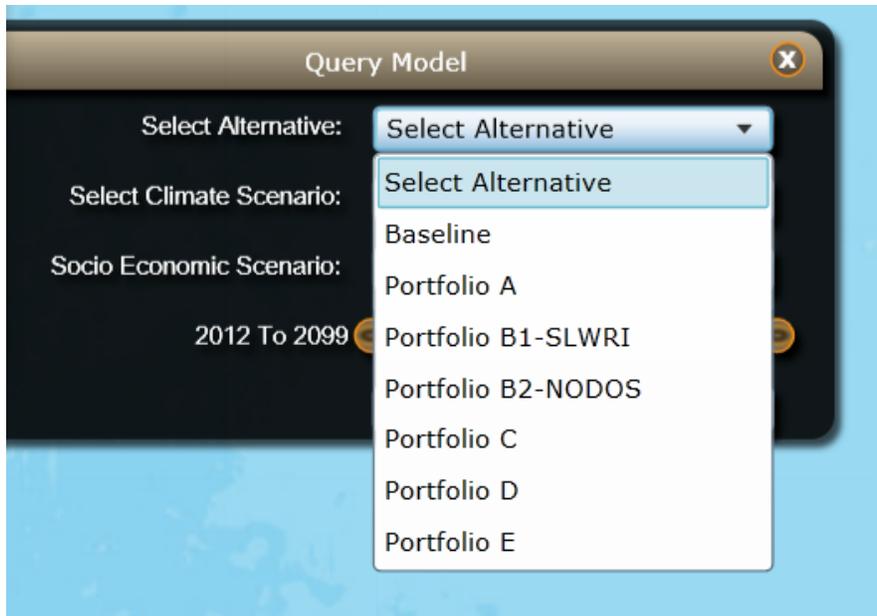


Figure 5. Example of Alternative Selections

Next, the user selects a hydroclimate scenario (historic, hot-dry, less warming-wet .....). On Figure 6, the hydroclimate scenarios are labeled no Climate Change, Q1 through Q5.

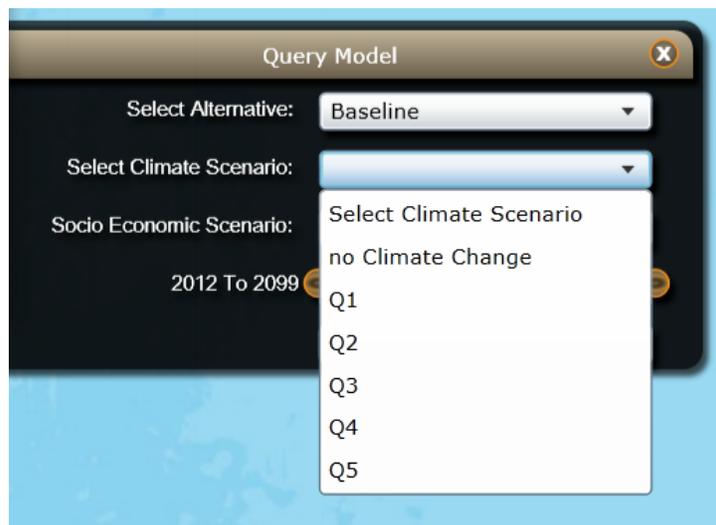


Figure 6. Example of Hydroclimate Selections

Then a socioeconomic scenario (Expansive Growth, Current Trends, ...) is selected (Figure 7).



Figure 7. Example of Socioeconomic Selection Menu

The application then allows for visualization of the query results (numeric and map-based) for the various locations and features which may be selected either on the map or in the Model Parameters Menu (left center). Graphics include bar and pie charts (Figure 8).

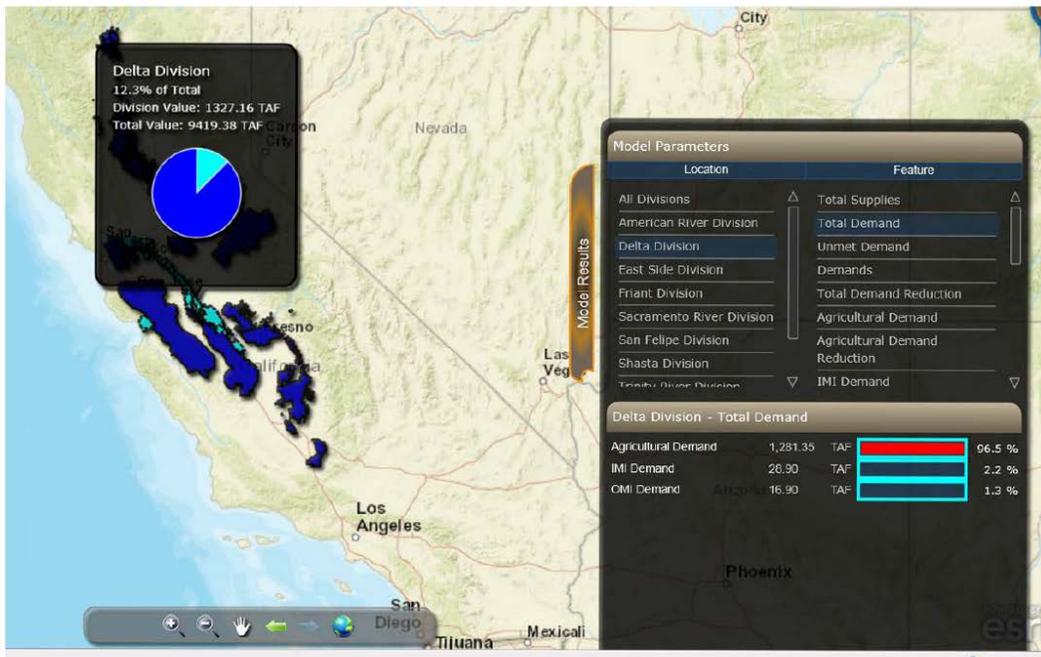


Figure 8. Examples of Graphic Outputs

Additionally, a particular time period can be specified, and time series for that range can be inspected (Figure 9).

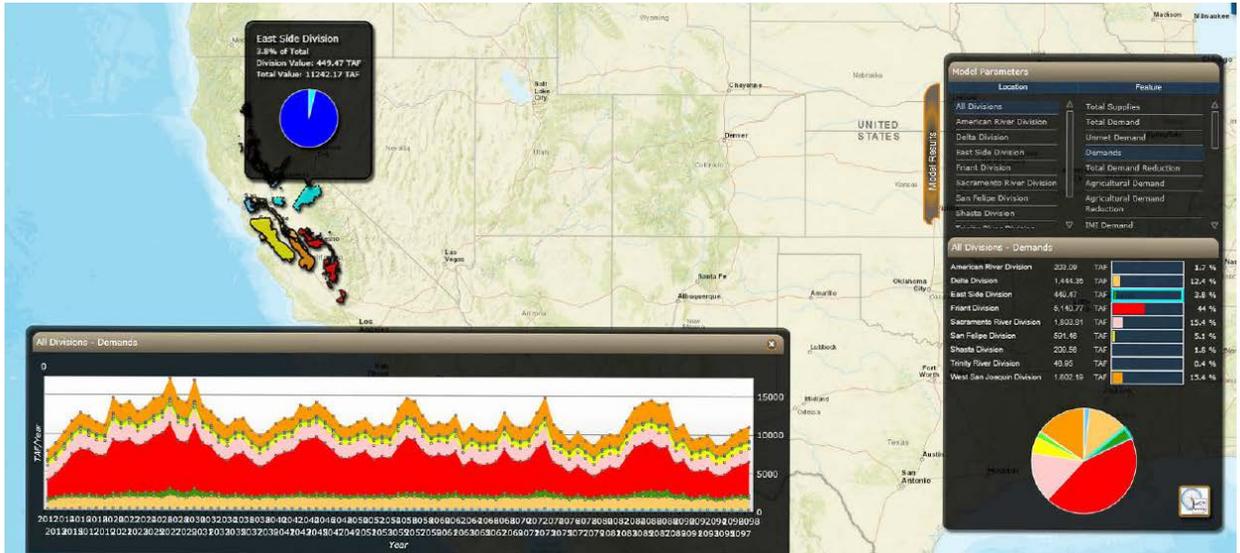


Figure 9. Example of a time period analysis.

This Scenario Comparison page will likely be developed as custom HTML/JS single page application (SPA). The mapping components used will be either the ESRI Javascript 3.x or 4.x api. Custom Web API's will be required if the study data is in a format other than ESRI tables.

Additional features that need to be added to the Ww RAMP UP platform include additional functionality to provide users with access to the model results in various formats (Figure 1, label 3). This page will be developed using custom HTML/JS, likely integrated with DOI's Open Data Portal. For a given scenario, a server side web API will be required to take input from the user, subsequently query and send the requested data to the client. Some coding will be required for the various download formats. Study results will be downloadable either directly from the application or through an Open Data Portal such as the Reclamation Water Information System (RWIS, <https://water.usbr.gov/index.php>).

An upload capability will be provided to Reclamation study project managers through the Upload page (Figure 1, label 4). The Upload Page will provide the user with information pertaining to the procedures and data formats required to upload a study to the system. When a user has prepared a study for upload, this page will facilitate the upload of the study and notify the 'gate keeper' that a study has been submitted for review and insertion into the application. The

gatekeeper will work with the user and data to ensure the requirements are met. This page will be a custom HTML/Javascript page to facilitate the upload workflow. A web API will be required on the server side to accept the data and place it in the appropriate location on the server. Some type of email notification will also be required.

The envisioned server infrastructure for the Ww RAMP UP application is shown on Figure 10.

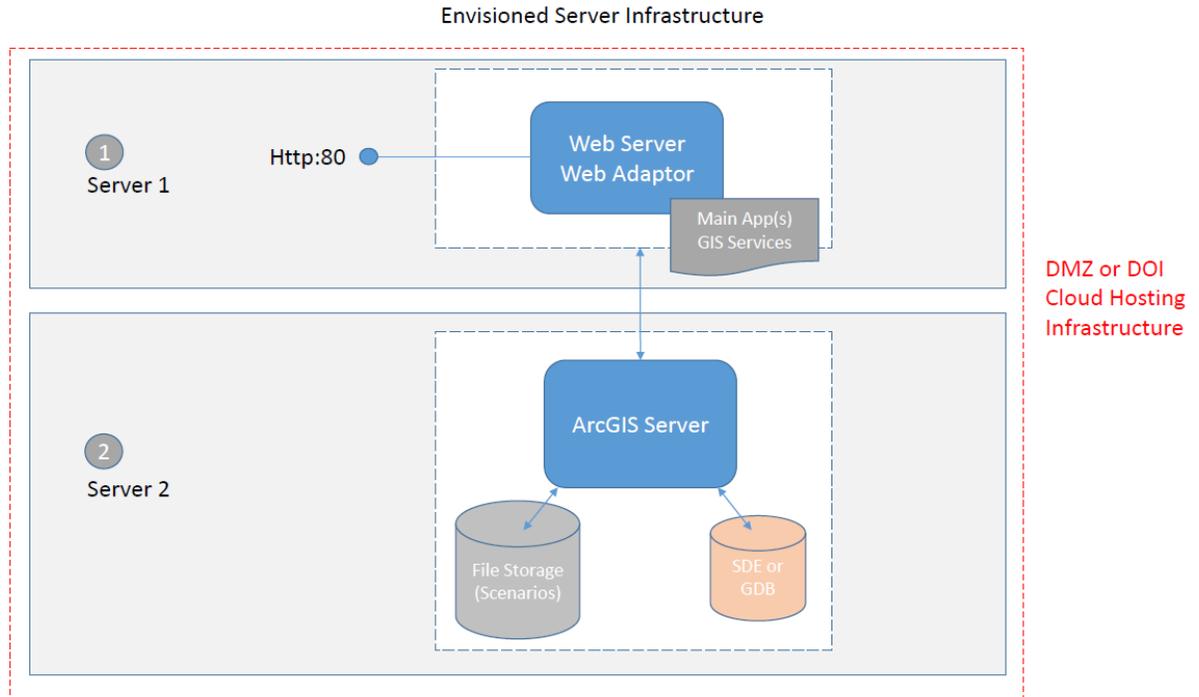


Figure 10. Envisioned Server Infrastructure

In theory, the entire application and data stack can be housed on one well-provisioned server. However, current recommendations from ESRI specify breaking out the concerns into an n-tier arrangement: a web server, an ArcGIS Server instance, and a database server. If this architecture is attainable or available by piggybacking on existing systems, then this n-tier approach can be used. Another common approach is using 2 servers as shown on Figure 10. This configuration includes a web server and a server that houses both the ArcGIS Server software and the database. Since this approach is simpler, it will be described here. However, migrating to a full 3 tier architecture would not be excessively difficult if circumstances warrant.

Since the core application will be public facing, the servers must reside in either (1) an agency DMZ or (2) a DOI cloud hosting infrastructure shown on Figure 10

as a red dashed line. Certain parts of the application may use the AGOL technology. For example, story maps could be served from the AGOL or an external portal instance in the DMZ or DOI cloud. The web server will be running IIS. It will have an ESRI Web Adaptor installed to route REST endpoint requests to the ArcGIS Server instance. A common configuration would include approximately 12RB RAM running 4 Cores with a minimum of C:\ 100GB and D:\ 50GB storage capacities. The GIS server will host the ArcGIS Server software, and be visible to the web server. It will likely be running SQL Server as a database, however it is possible to also use file-based geodatabases. Sufficient storage will be required to store the model scenarios. A possible configuration is 16RB RAM running 4 Cores with a minimum of C:\ 100GB and D:\ 50GB storage capacities.

## **Task Descriptions**

This section describes the activities needed to develop and deploy the Ww RAMP\_UP web portal. These project activities will be managed by Reclamation Principal Investor (PI) and may be accomplished by either Reclamation employees and/or consultants working for Reclamation under contract.

### **Task 1. Initial Meeting and Project Setup Activities**

An initial meeting between the Reclamation project manager (PM) and the application development team (ADT) will occur to review the Scope of Work and discuss the design for the Ww RAMP UP application. A detailed plan will be developed for the development and deployment of the application. This design plan will include a description of the Ww RAMP UP features and the Javascript framework(s) to be implemented. The setup activities will also evaluate and determine whether the application will be deployed by servers in the Reclamation DMZ or external DOI cloud servers. This activity will require the ADT to work with Reclamation's IT staff to acquire and deploy the appropriate server resources. Once complete, accounts and permissions for the ADT will be setup and the IIS will be configured.

### **Task 1. Deliverables and Schedule**

The deliverables for this task include the detailed design plan and a brief report documenting the acquired server resources, accounts, configuration of the IIS and java script frameworks to be used in the application development. It is estimated that this task may require about 10 days of labor over 1 month period. No cost estimate is made at this time.

## **Task 2. Front Page Design**

This task includes the conceptual design of the storyboards. The ADT will meet with the PM to present and discuss the storyboard designs. After making any necessary adjustments, the ADT will develop, test and debug the software.

## **Task 2. Deliverables and Schedule**

The deliverables for this task include the software code sets along with the completed Front Page. It is estimated that this task may require about 8 days of labor over 1 month period. No cost estimate is made at this time.

## **Task 3. Setup Story Maps**

This task includes establishing which resource assessment and management planning studies will be supported in the initial deployment of the Ww RAMP UP web portal. After consultation with PI and project sponsors, the ADT will acquire the designated studies and evaluate relevant reports and data sets. Geospatial data will be aggregated and published to the portal's ArcGIS server. The story maps will be configured and study content will be implemented in the web portal. The ADT will test the functionality of the application and debug to meet the design specifications.

## **Task 3. Deliverables and Schedule**

The deliverables for this task include the study GIS data sets and supported planning study information in functioning story maps. It is estimated that this task may require about 26 days of labor over 2 month period. No cost estimate is made at this time.

## **Task 4. Study Comparison Scenario Viewer**

This task includes an assessment of the functionality of the existing CVP IRP data viewer which uses outdated Silverlight technology in preparation for developing new code meeting the design plan specifications. Supported resource assessment and management planning information will be published to the ArcGIS and web portal servers. Setup of the required web APIs and databases will be performed. Storyboard conceptual designs will be developed. After consultation with PI and project sponsors, software implementing the storyboard conceptual designs will be developed, tested and debugged.

## **Task 4. Deliverables and Schedule**

The deliverables for this task include development and finalization of the approved conceptual designs, completion of the web APIs and the functioning scenario comparison viewer. The application code set will also be documented and provided to the PM. It is estimated that this task may require about 75 days of labor over 6 month period. No cost estimate is made at this time.

## **Task 5. Study Uploading**

This task includes developing storyboard conceptual designs for uploading resource assessment and management planning studies. Data schemas and a notification system for the uploading of data will also be developed. The role and functioning of the Ww RAMP UP gatekeeper(s) will be defined. After consultation with PI and project sponsors, application software development, testing and debugging will be performed.

## **Task 5. Deliverables and Schedule**

The deliverables for this task include finalization of the approved conceptual design for uploading data and the approved data schema. The gatekeeper role and notification system will be completed and documented. The functioning upload application along with its associated code set will be provided. It is estimated that this task may require about 25 of labor over 2 month period. No cost estimate is made at this time.

## **Task 6. Open Data Study Downloading**

This task includes making the Ww RAMP UP web portal study data available on Reclamations Open Data Portal. The PM along with the project sponsors and stakeholders will determine what data are to be available and in what formats. Study data will be organized and converted (if needed) to a format required by the Open Data Portal. Appropriate metadata will be assigned to GIS data layers and model results.

## **Task 6. Deliverables and Schedule**

The deliverables for this task include assessing and uploading of the resource assessment and management planning studies to the configured Open Data website. Appropriate metadata will be provided with the information. Required data formats will be made available. The Open Data site will be tested to ensure the various data download and download options are functioning properly. The time to complete this task is a function of the number of studies, required formats,

and the amount (granularity) of data that are to be published. It is estimated that this task may require about 24 days of labor over 2 month period. No cost estimate is made at this time.

## Conclusions and Recommendations

When implemented, the Ww RAMP UP will provide the capabilities to address the important need to effectively communicate outcomes of resource assessment and management studies by providing a tool that offers access to data and analyses on a web based platform. The Ww RAMP UP platform will build on existing technology to add new functionality that will support Reclamation's Open Water Data Initiative, Water Information System and WaterSMART Data Visualization Tool activities.

Therefore, it is recommended that this Scoping project be further developed and submitted as a research proposal to seek funding by the R&D program and other potential partners and stakeholders as a project to be conducted starting in FY 2018.

## References

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