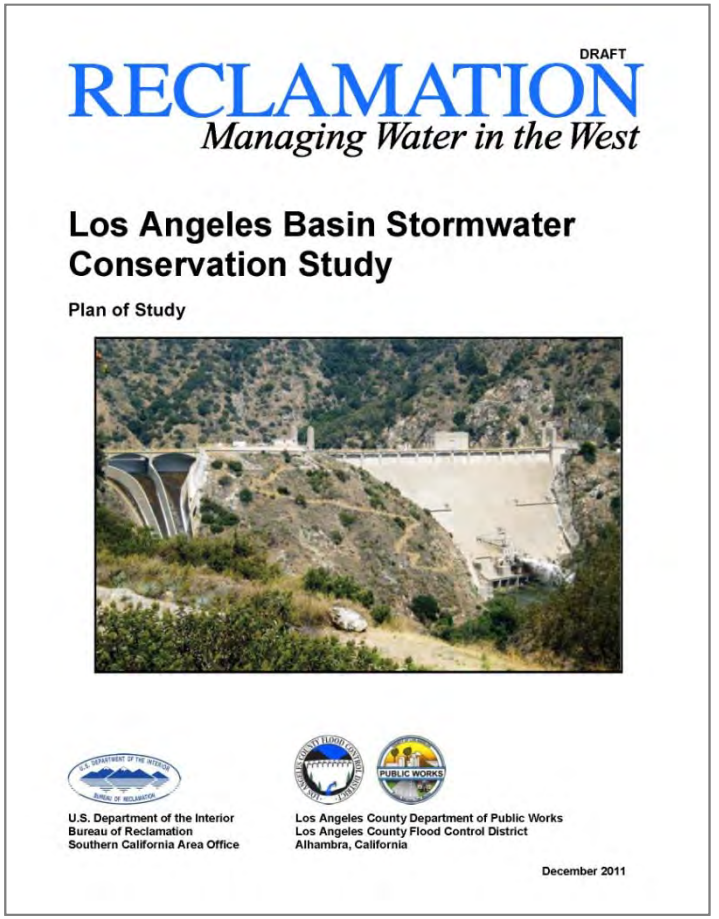
Los Angeles Basin Stormwater Conservation Study

Los Angeles County Flood Control District
U.S. Department of the Interior – Bureau Of Reclamation

KICKOFF MEETING
FEBRUARY 6, 2013

Meeting Objectives

- Overview of Study
- Update on Progress/Schedule
- Identify Opportunities for Stakeholder Participation



Study Overview

Partnership between:

- Los Angeles County Flood Control District
- U.S. Department of the Interior – Bureau of Reclamation

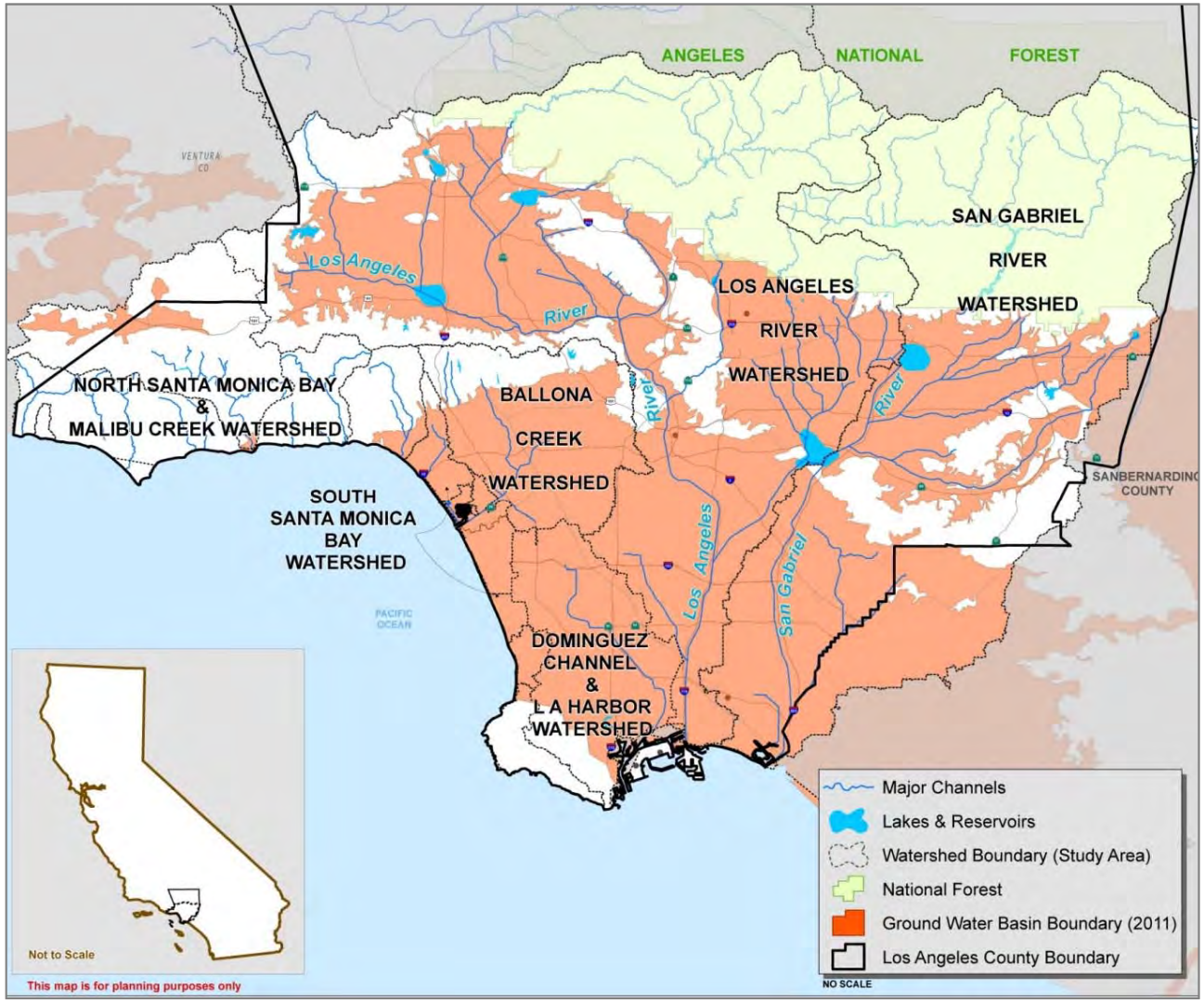
Basin Study Cost Estimate: $2.4 million

- Reclamation funding: $1 million
- LACFCD funding: $1,364,666
- Local Partners match: $59,960

Official Start Date – December 27, 2012

2.5 Years to Complete Study

Study Area


ANGELES NATIONAL FOREST
VENTURA CO
Los Angeles River
SAN GABRIEL RIVER WATERSHED
LOS ANGELES RIVER WATERSHED
NORTH SANTA MONICA BAY & MALIBU CREEK WATERSHED
BALLONA CREEK WATERSHED
SOUTH SANTA MONICA BAY WATERSHED
DOMINGUEZ CHANNEL & L A HARBOR WATERSHED
PACIFIC OCEAN
SAN BERNARDINO COUNTY
Los Angeles River
San Gabriel River
Not to Scale
This map is for planning purposes only
Major Channels
Lakes & Reservoirs
Watershed Boundary (Study Area)
National Forest
Ground Water Basin Boundary (2011)
Los Angeles County Boundary
NO SCALE

Study Objectives

LA Basin Study Objectives

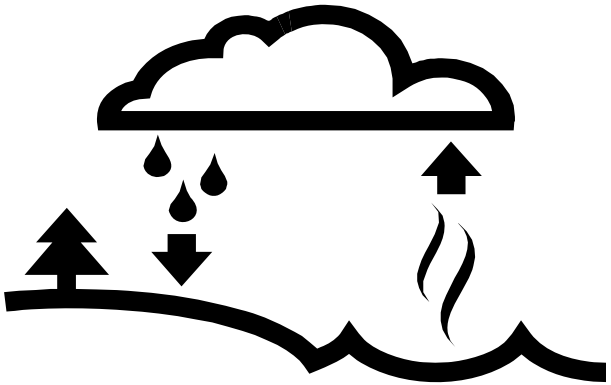
- Evaluate existing water conservation (capture/recharge) under future conditions
- Evaluate potential for new facilities and operational changes for increased capture and recharge to address future conditions

Methodology

- Detailed scientific, engineering & economic analyses
- Coordinating with existing & proposed planning efforts
- Developing partnerships
- Local stakeholder involvement
- Highly skilled technical team

Key Considerations

- **Account for projected climate change**
- **Population growth**



Similar Efforts

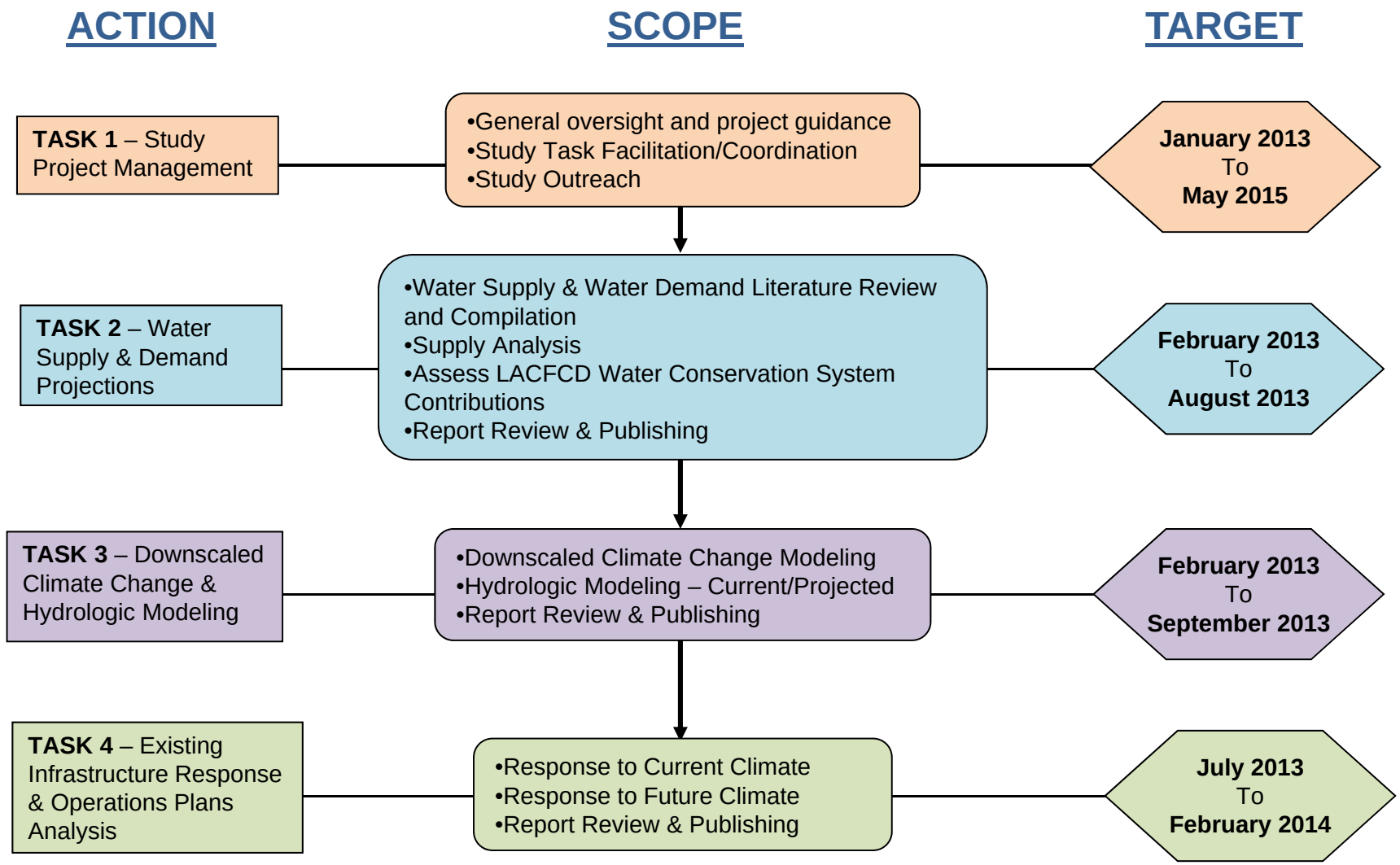
- **Colorado River Basin Water Supply & Demand Study**
  - Completed December 2012
  - http://www.usbr.gov/lc/region/programs/crbstudy.html
- **Santa Ana Watershed Basin Study**
  - In Progress
  - http://www.usbr.gov/lc/socal/basinstudies/OWOW.html

Study Outcome

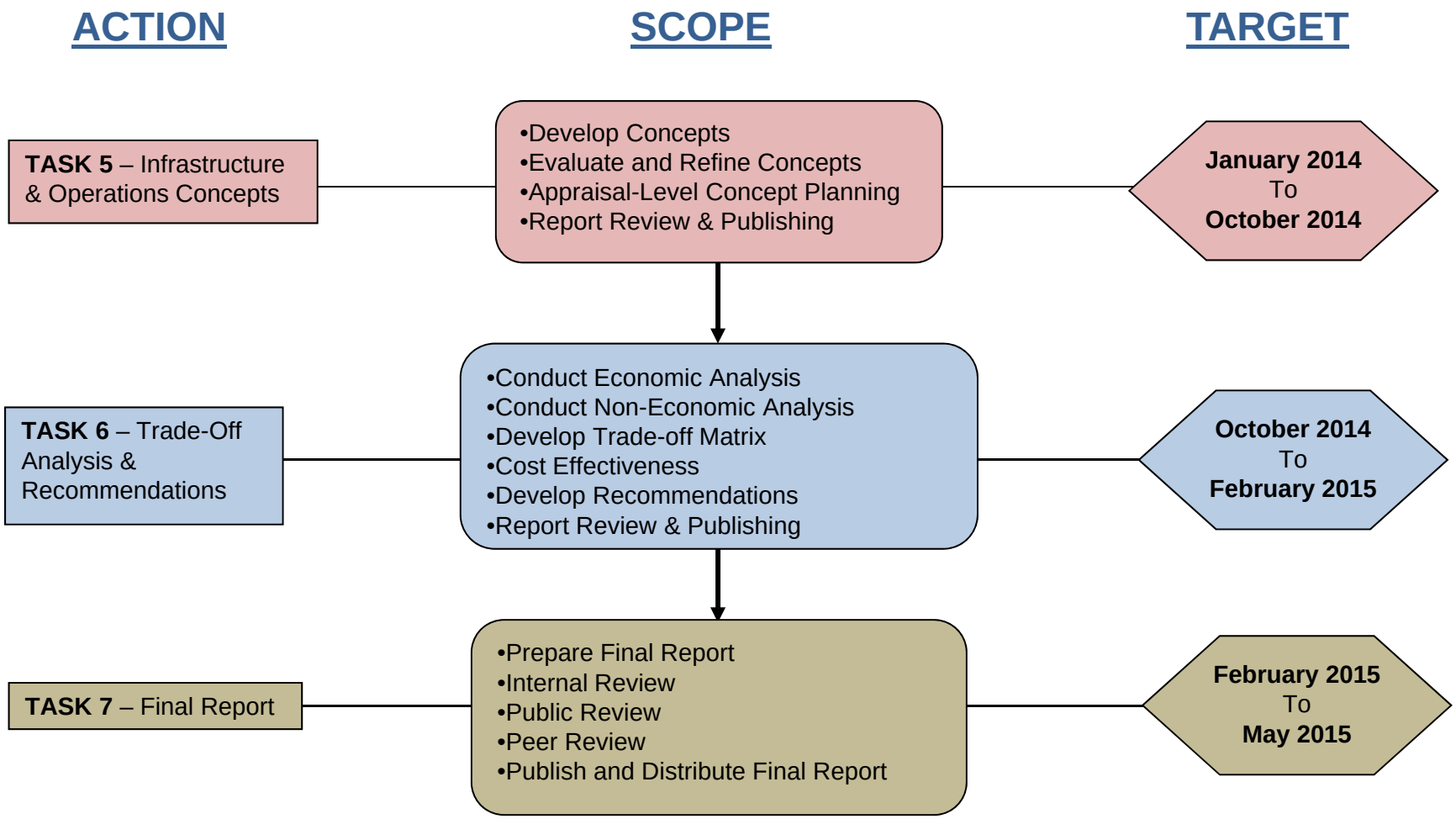
Planning Document

- Evaluates:
  - Existing water conservation under future conditions
  - Improvements (structural or operational) to existing facilities
  - Potential for new facilities
- Tool for future planning by LACFCD and other Basin Study partners

Study Schedule



Study Schedule



Task 3

Downscaled Climate Change Model

- Global data
- Refined for use at regional level
- Model Output

  - Time and space based precipitation & evaporation data

Hydrologic Model

- Watershed Management Modeling System (WMMS)
- Designed for the Los Angeles region
- Uses Climate Model Output
- Model Output

  - Time and space based runoff data (flow rates and volumes)

DELIVERABLE: Task 3 Report

RECLAMATION

Managing Water in the West

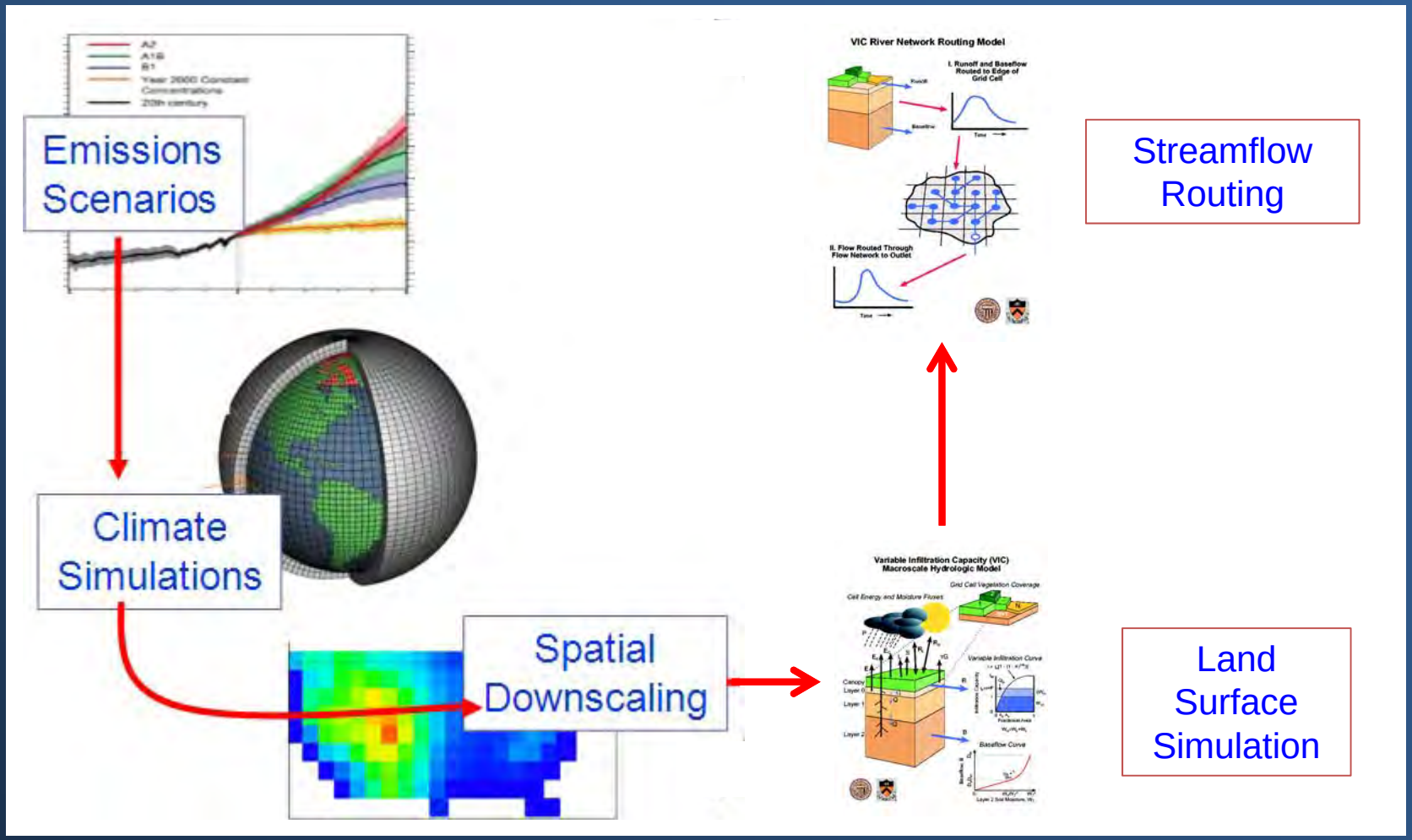
Los Angeles Basin Stormwater Conservation Study - Climate Change

February 6, 2013

Technical Services Center, Denver

U.S. Department of the Interior
Bureau of Reclamation

Downscaled BCSD-CMIP3 GCM Output and Hydrologic Modeling (Bias-Correction Spatial Disaggregation - Coupled Model Intercomparison Project Phase 3 General Circulation Model)



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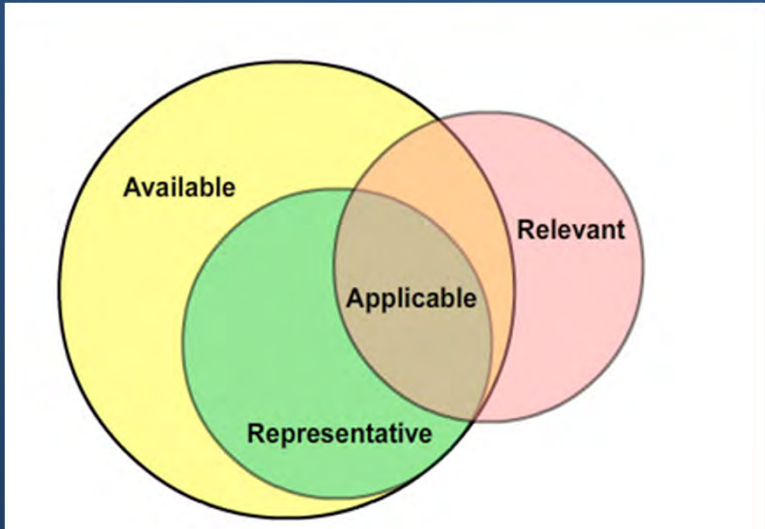
CMIP-5 (BCCA)

Coupled Model Intercomparison Project Phase 5, Bias-correction and constructed analogs



Source: Brekke and Barsugli

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Reporting

http://www.usbr.gov/climate

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Managing Water in the West

SECURE Water Act
Section 9503(c) – Reclamation
Climate Change and Water
2011

U.S. Department of the Interior
Policy and Administration
Bureau of Reclamation
Denver, Colorado

April 2011

Technical Report

RECLAMATION
Managing Water in the West

Technical Memorandum No. 86-68210-2011-01

West-Wide Climate Risk Assessments: Bias-Corrected and Spatially Downscaled Surface Water Projections

U.S. Department of the Interior
Bureau of Reclamation

March 2011

Report to Congress

RECLAMATION

Online Data Access

RECLAMATION USGS
Santa Clara University CLIMATE CENTRAL
SCRIPPS INSTITUTION OF OCEANOGRAPHY

Bias Corrected and Downscaled WCRP CMIP3 Climate and Hydrology Projections

This site is best viewed with Chrome (recommended) or Firefox. Some features are unavailable when using Internet Explorer. Requires JavaScript to be enabled.

Welcome | About | Tutorials | Projections: Subset Request | Projections: Complete Archives | Feedback | Links

Summary

This archive contains fine spatial-resolution translations of:

- climate projections over the contiguous United States (U.S.) developed using two downscaling techniques (monthly BCSD Figure 1, and daily BCCA Figure 2), and
- hydrologic projections over the western U.S. (roughly the western U.S. Figure 3) corresponding to the monthly BCSD climate projections.

Archive content is based on global climate projections from the World Climate Research Programme's (WCRP's) Coupled Model Intercomparison Project phase 3 (CMIP3) multi-model dataset, which was referenced in the Intergovernmental Panel on Climate Change Fourth Assessment Report. Please see the "About" page for information on projection development, including the methodology to perform climate model bias-correction and spatial downscaling.

Purpose

The archive is meant to provide access to climate and hydrologic projections at spatial and temporal scales more relevant to some of the watershed and basin-scale decisions facing water managers and planners dealing with climate change. Such access permits several types of analyses, including:

- assessment of local to regional climate projection uncertainty.
- assessment of potential climate change impacts on natural and social systems (e.g., watershed hydrology, ecosystems, water and energy demands).
- risk-based exploration of planning and policy responses framed by potential climate changes exemplified by these

Figure 1. BCSD CMIP3 Monthly Climate Analysis example - Median projected change in average-annual precipitation (cm/year), 2041-70 versus 1971-2000.

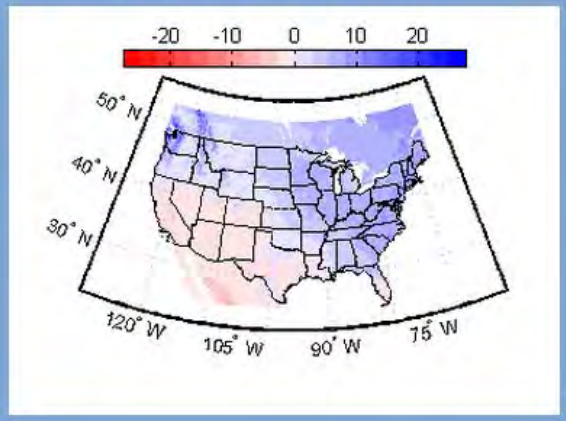
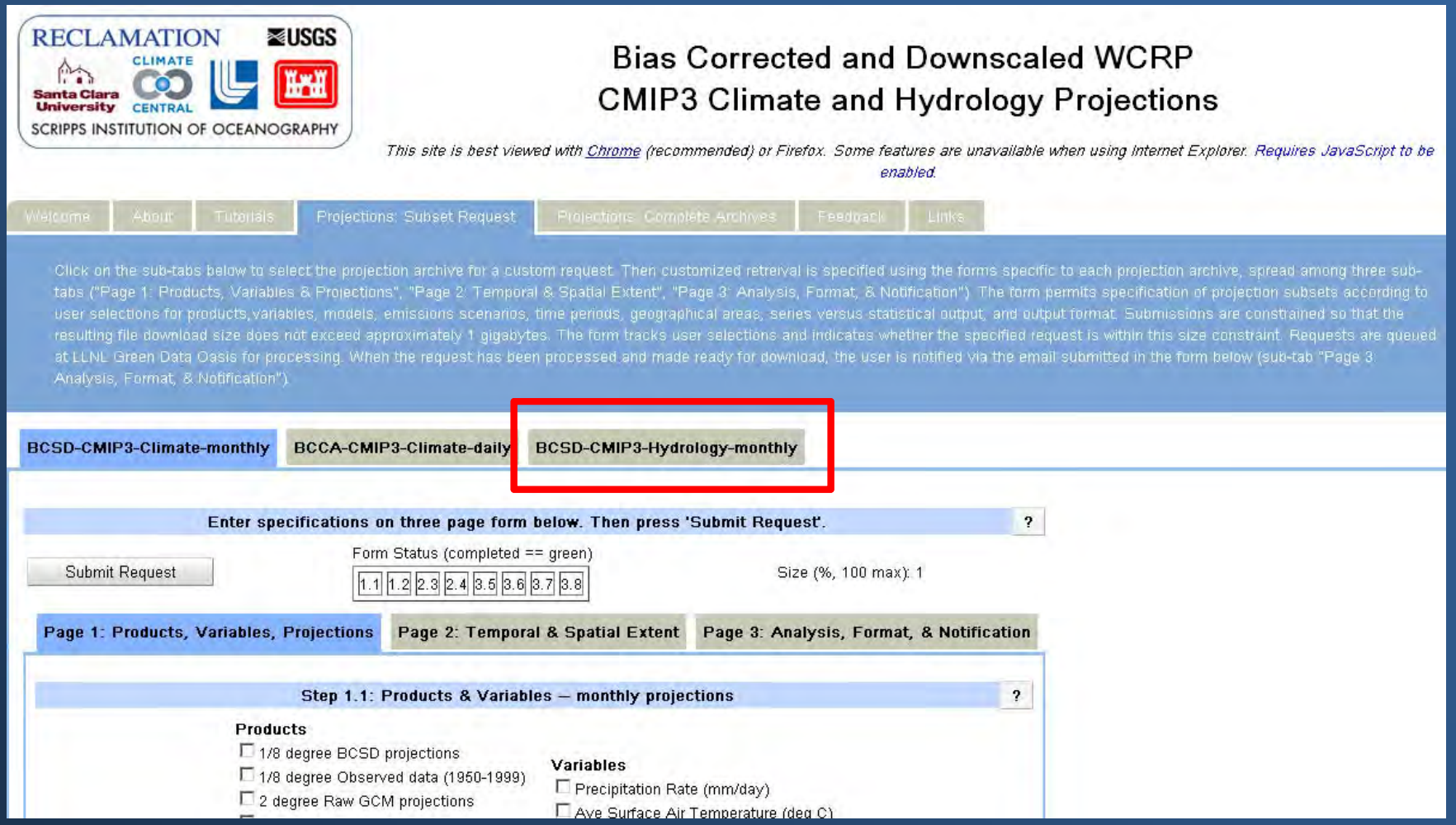


Figure 2. BCCA CMIP3 Daily Climate Analysis example –

http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections

Online Data Access



Online Data Access

Welcome | About | Tutorials | Projections: Subset Request | Projections: Complete Archives | Feedback | Links

Click on the sub-tabs below to select the projection archive for a custom request. Then customized retreival is specified using the forms specific to each projection archive, spread among three sub-tabs ("Page 1: Products, Variables & Projections", "Page 2: Temporal & Spatial Extent", "Page 3: Analysis, Format, & Notification"). The form permits specification of projection subsets according to user selections for products,variables, models, emissions scenarios, time periods, geographical areas, series versus statistical output, and output format. Submissions are constrained so that the resulting file download size does not exceed approximately 1 gigabytes. The form tracks user selections and indicates whether the specified request is within this size constraint. Requests are queued at LLNL Green Data Oasis for processing. When the request has been processed and made ready for download, the user is notified via the email submitted in the form below (sub-tab "Page 3: Analysis, Format, & Notification").

BCSD-CMIP3-Climate-monthly | BCCA-CMIP3-Climate-daily | BCSD-CMIP3-Hydrology-monthly

Enter specifications on three page form below. Then press 'Submit Request'. ?

Submit Request

Form Status (completed == green)

1.1 1.2 2.3 2.4 3.5 3.6 3.7 3.8

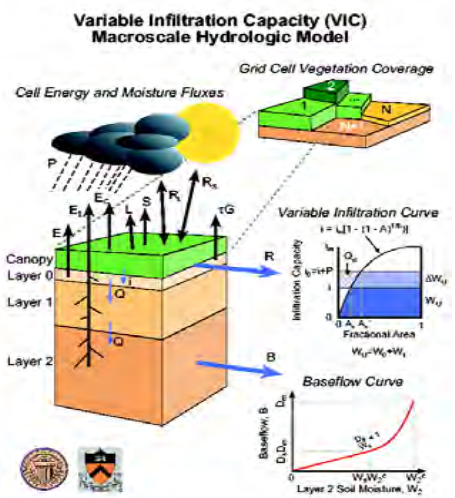
Size (%, 100 max): 1

Page 1: Products, Variables, Projections | **Page 2: Temporal & Spatial Extent** | **Page 3: Analysis, Format, & Notification**

Step 1.1: Variables – monthly projections ?

- ☐ Precipitation (mm/m)
- ☐ Maximum Air Temperature (deg C)
- ☐ Minimum Air Temperature (deg C)
- ☐ Wind Speed (m/s)
- ☐ Soil Moisture Content (mm – 1st day of month)
- ☐ Snow Water Equivalent (mm – 1st day of month)
- ☐ Total runoff (mm/m)
- ☐ Evapotranspiration - Actual (mm/m)
- ☐ Evapotranspiration - Potential, natural veg (mm/m)
- ☐ Evapotranspiration - Potential, open water (mm/m)
- ☐ Evapotranspiration - Potential, tall reference (mm/m)
- ☐ Snow Water Equivalent (mm – 1st day of month) ☐ Evapotranspiration - Potential, short refernece (mm/m)

Step 1.2: Emissions Scenarios, Climate Models and Runs ?



RECLAMATION

Objective
Climate Change Task

- Develop continuous hourly precipitation and evaporation time-series for the period 2011-2099 conditioned on applicable 21st century climate change information to support LACFCD's watershed management and modeling system (WMMS).

How will this be done!

Methodology - Definitions

- Historical period, 1986-1999 (14-years)
  - Observed historical: observed precipitation and temperature over 1986-1999 [County]
  - Simulated historical: climate model derived precipitation and temperature for the 1986-1999 period [Reclamation]

Methodology - Definitions

- Future period, 2011-2099 (89-years)

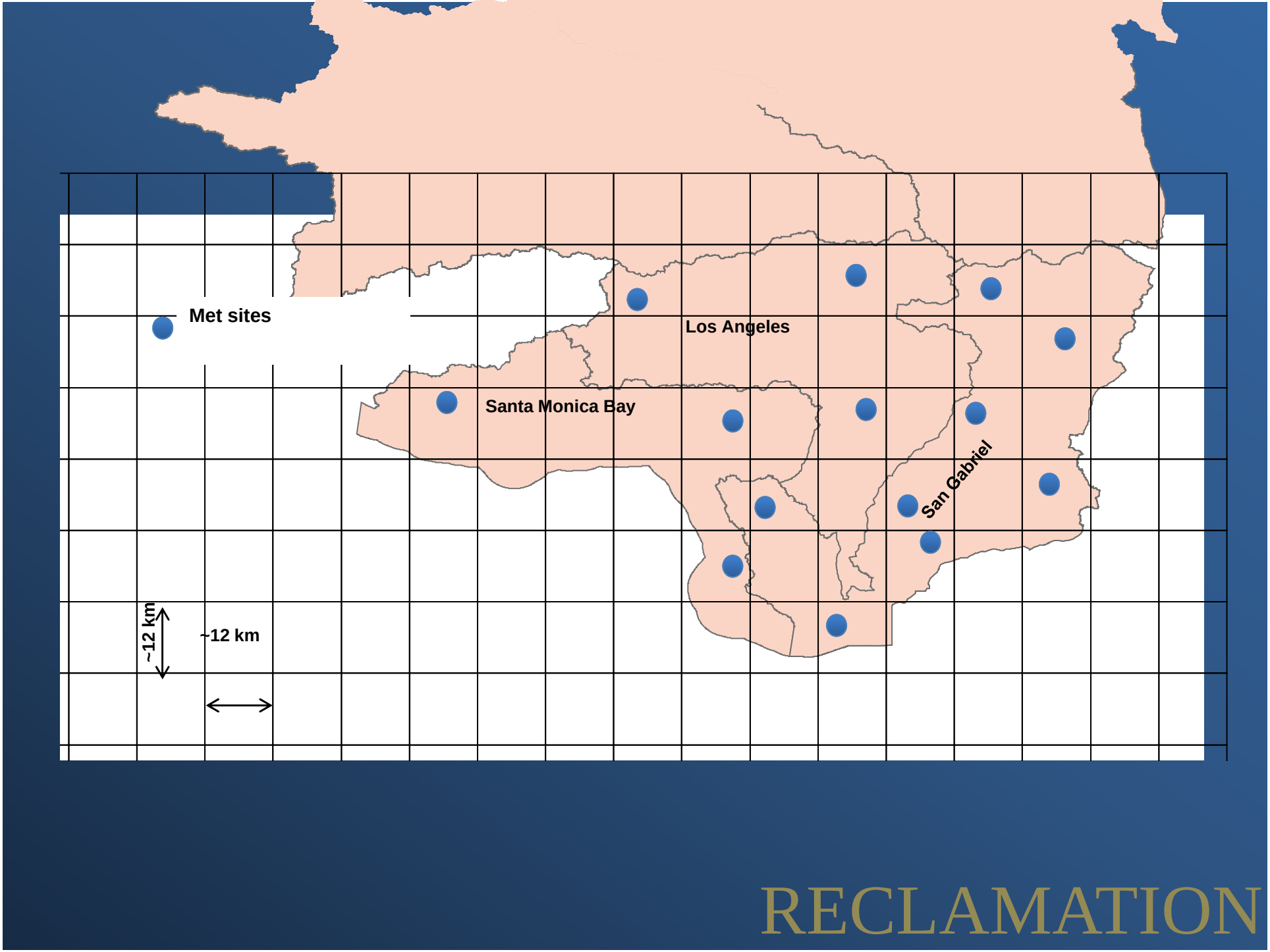
- Divided into six representative future periods
  1. 2011-2024 (14-years)
  2. 2025-2038 (14-years)
  3. 2039-2052 (14-years)
  4. 2053-2066 (14-years)
  5. 2067-2080 (14-years)
  6. 2081-2099 (19-years)

- Choice of 14-years, to be consistent with chosen historical period length of 14-years (1986-1999)

Methodology - Definitions

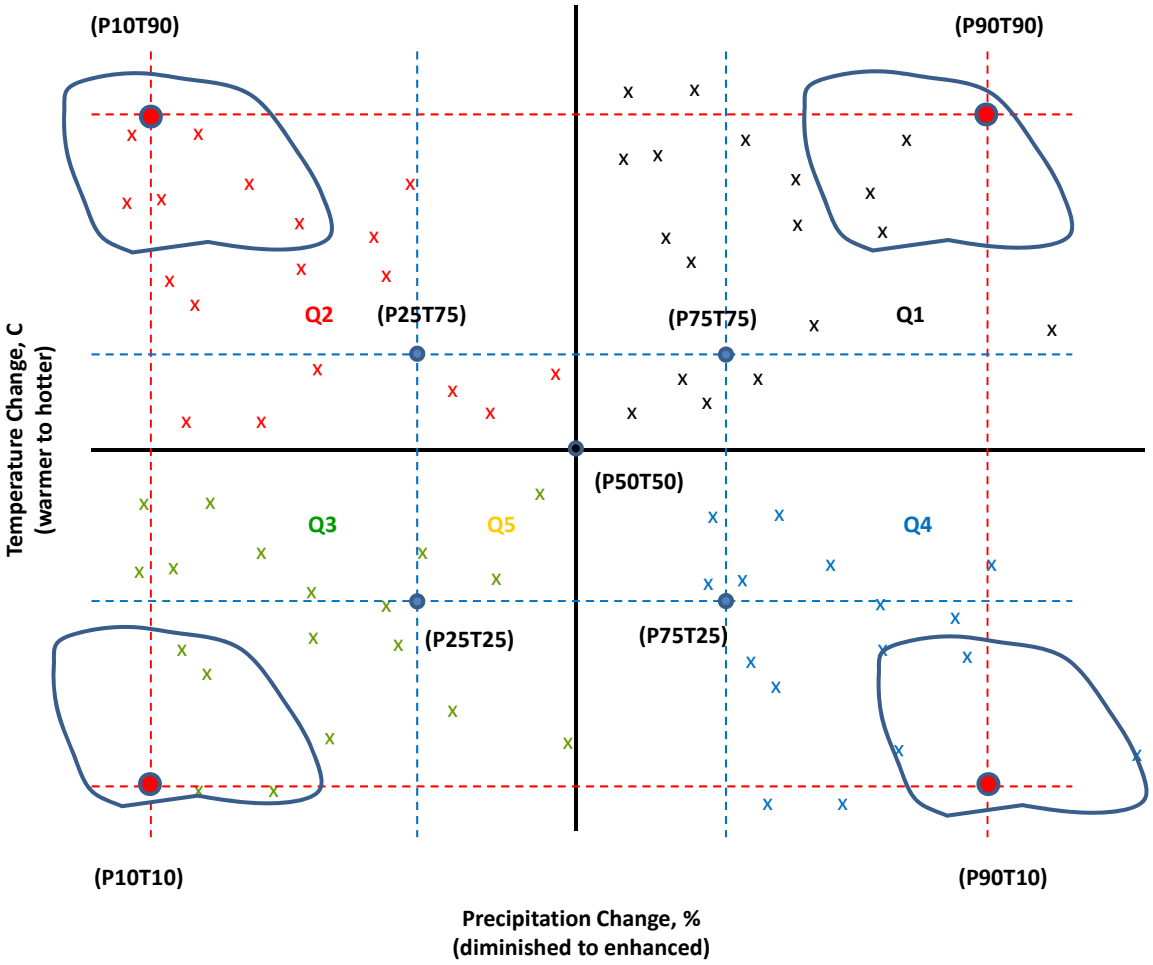
- Cool season (Sep-Apr) – September of previous year through April of next year

- For example for 2013 this would be September 2012 through April 2013



RECLAMATION

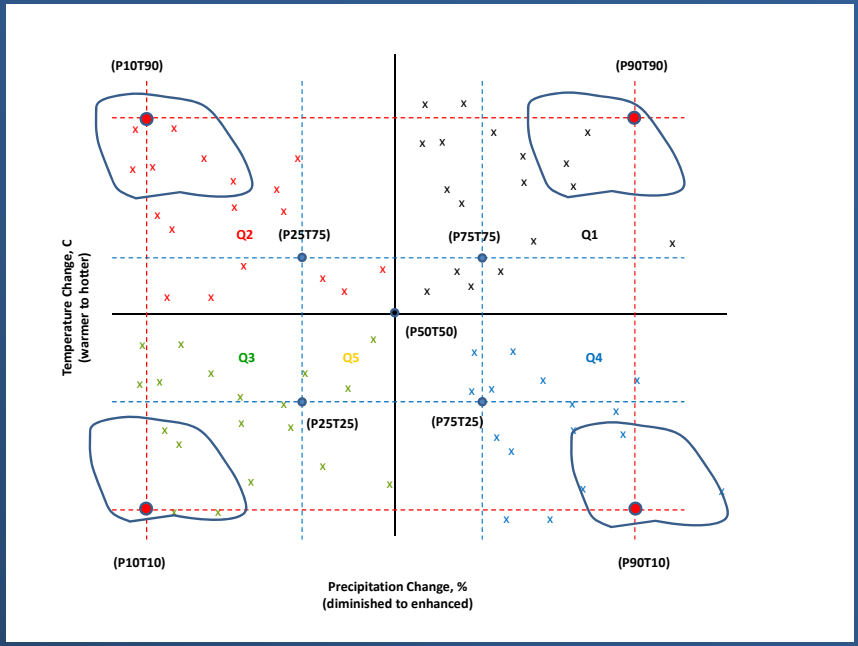
Projection Membership



RECLAMATION

Projection Membership

- Precipitation and Temperature Change
- Estimate change between the historical simulation (1986-1999) and each of the six future periods (2011-2024, 2025-2038, etc.) for each of the 112 climate projections

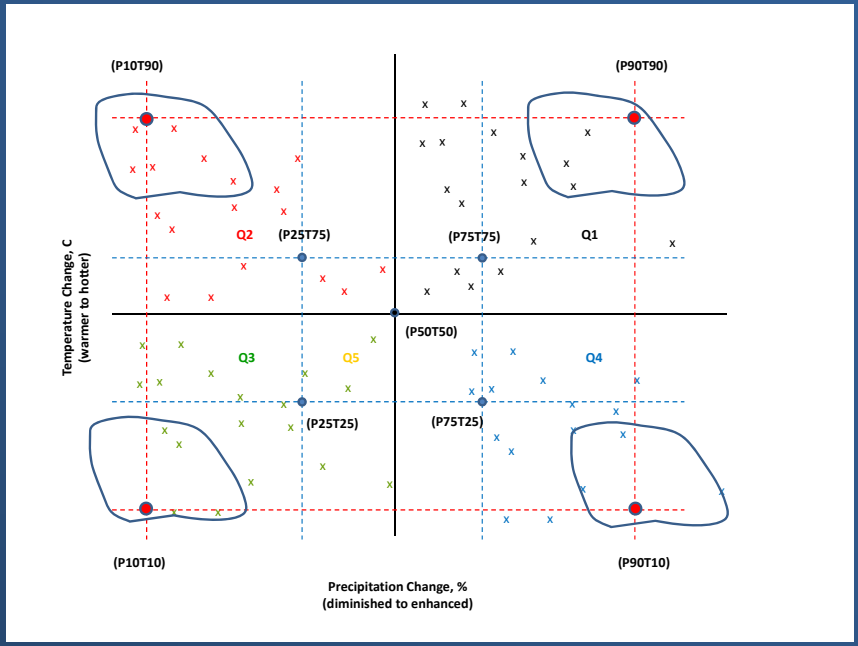


RECLAMATION

Projection Membership

(10 in each one, Expected to be somewhat different for each of the six future periods)

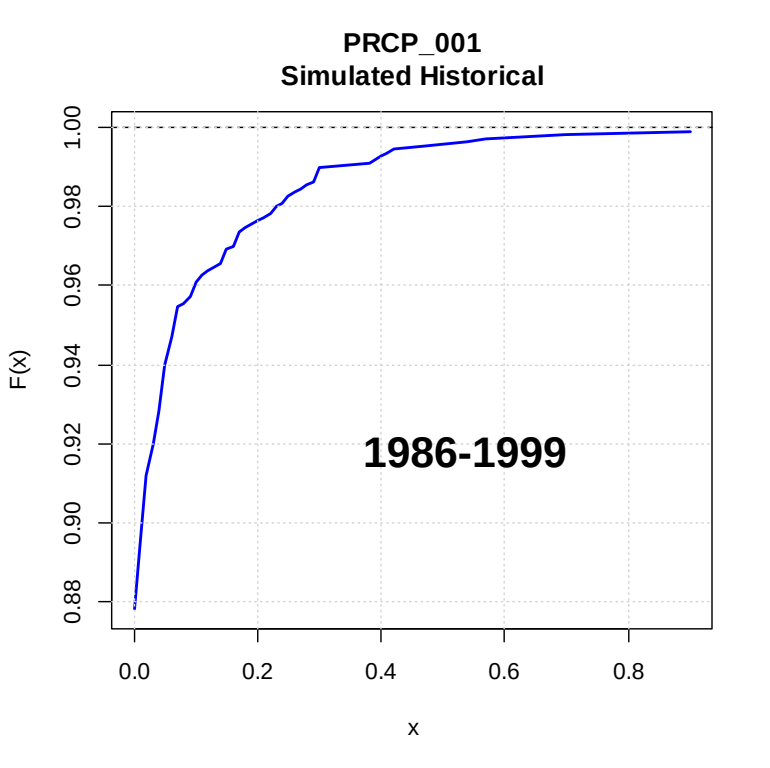
- Q1 - enhanced precipitation magnitude with hotter temperature (black x)
- Q2 - diminished precipitation magnitude with hotter temperature (red x)
- Q3 - diminished precipitation magnitude with warmer temperature (green x)
- Q4 - enhanced precipitation magnitude with warmer temperature (blue x)
- Q5 - central tendency (overlapping projections from Q1-Q4)

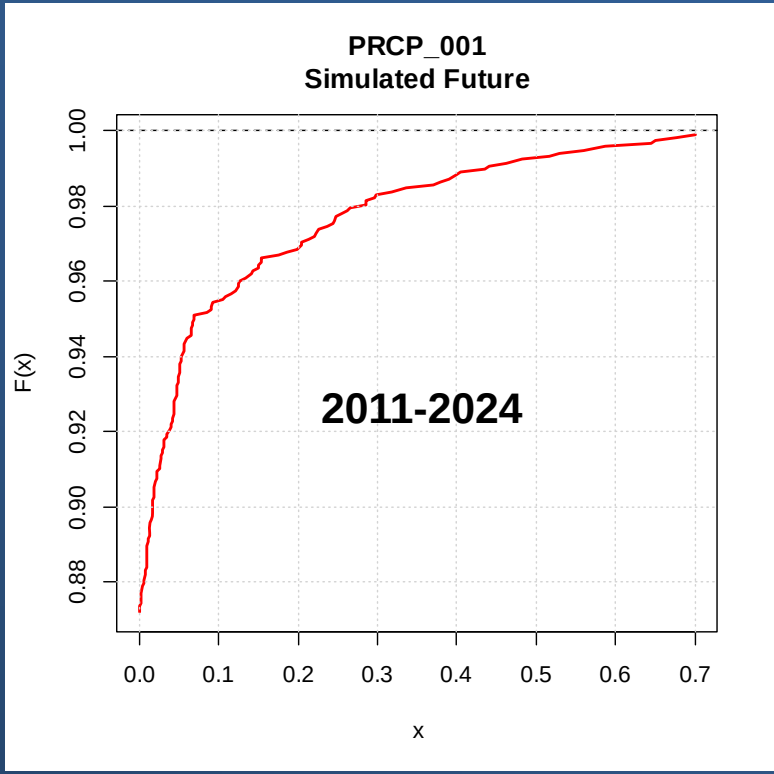


RECLAMATION

Climate Conditioned Weather Sequences

Example Precipitation (inch) CDFs for Julian day 1 (PRCP_001; Jan 1)

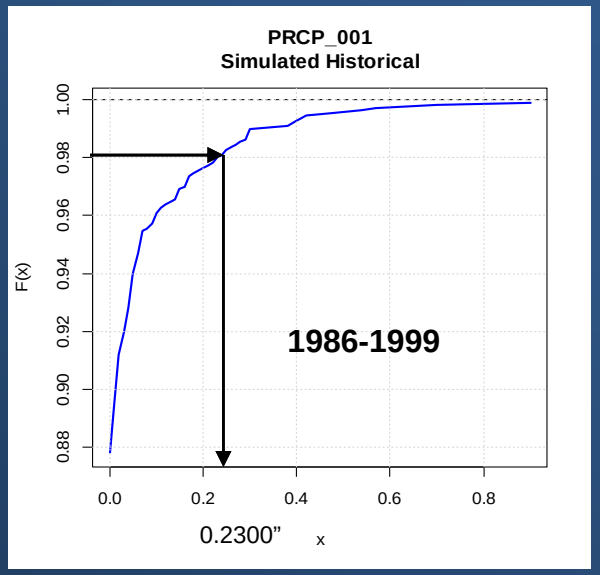


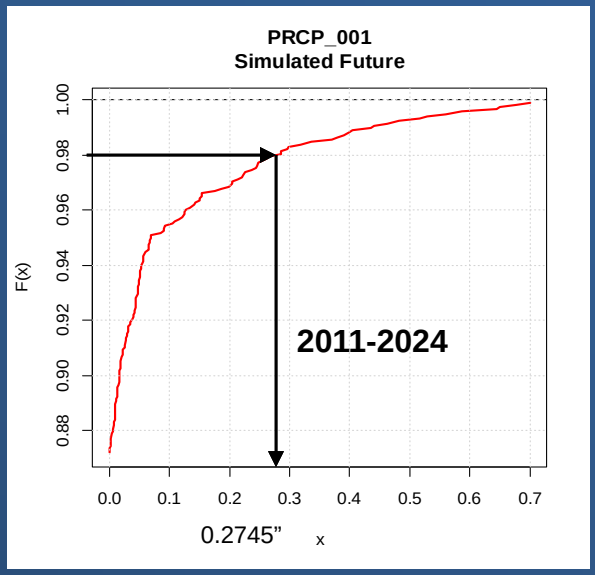


Estimate percentile specific change factors by comparing distributions Simulated Historical and Simulated Future

RECLAMATION

Climate Conditioned Weather Sequences





In this example, change factor for percentile 0.98 is,

100*(0.2745 – 0.2300) /0.2300 = 19.35%

Interpretation - for the Q1 scenario in the first future period (2011-2024), at the 0.98 percentile, precipitation is expected to increase by 19.35% from the historical period (1986-1999).

RECLAMATION

Climate Conditioned Weather Sequences

Future Period	Climate Scenario				
	Q1	Q2	Q3	Q4	Q5
2011-2024	{…}	{…}	{…}	{…}	{…}
2025-2038	{…}	{…}	{…}	{…}	{…}
2039-2052	{…}	{…}	{…}	{…}	{…}
2053-2066	{…}	{…}	{…}	{…}	{…}
2067-2080	{…}	{…}	{…}	{…}	{…}
2081-2099	{…}	{…}	{…}	{…}	{…}

- For example, the cell entry {…} corresponding to future period 2011-2024, and climate scenario Q1 (enhanced precipitation magnitude with hotter temperature) represents precipitation for 5113 days (e.g., Excel® formula, =DATE(2024,12,31)-DATE(2011,1,1)).
- Disaggregate daily precipitation based on historical hourly precipitation proportions.
- Complete 89-year sequence of daily (hence hourly) precipitation, for climate scenario Q1, the six future time-series will be concatenated into a single time-series that will represent this climate scenario.
- Repeat for other scenarios.

Evaporation Data

- Hargreaves-Samani (H-S) Reference ET data requirements (daily)
  - Maximum temperature
  - Minimum temperature
  - Precipitation

$$ET_{0,har} = 0.0023 \times 0.408 R_A \times (T_{av} + 17.8) \times TD^{0.5}$$

- Where,
  - R_A, extraterrestrial radiation (MJ/m^2/day)
  - T_{av}, average daily air temperature (°C)
  - TD, difference between mean daily maximum and minimum temperature (°C)
  - $ET_{0,har}$, reference ET (mm/day)

- Understand and account for ET bias estimated using the H-S equation – disaggregate to hourly

Deliverables

- Input datasets for the WMMS. This will consist of,
  - five future climate scenarios Q1-Q5 for CMIP-3 and five for CMIP-5
  - each consisting of 89-years of hourly precipitation and evaporation for precipitation gauge locations and evaporation sites across the Study Area.

- Precipitation frequency analysis for each of the precipitation gauge locations for each of the five climate scenarios (Q1-Q5) using the GEV-1 model to estimate the precipitation depth/intensity corresponding to 24-hr duration and 50-year return period under a changing climate.

RECLAMATION

Managing Water in the West

Climate Change
Questions?

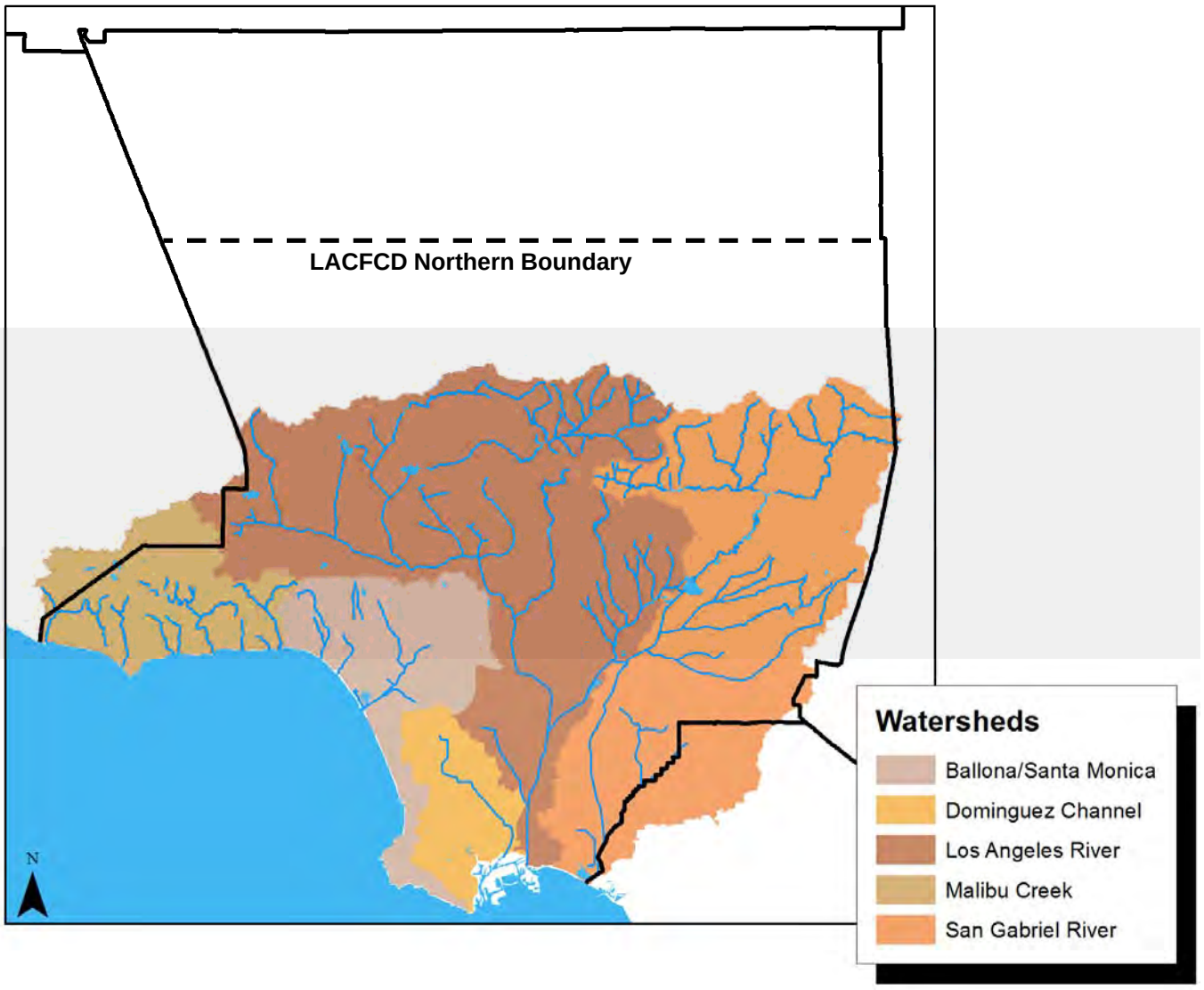

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT


COUNTY OF LOS ANGELES
PUBLIC WORKS
Public Service That Works

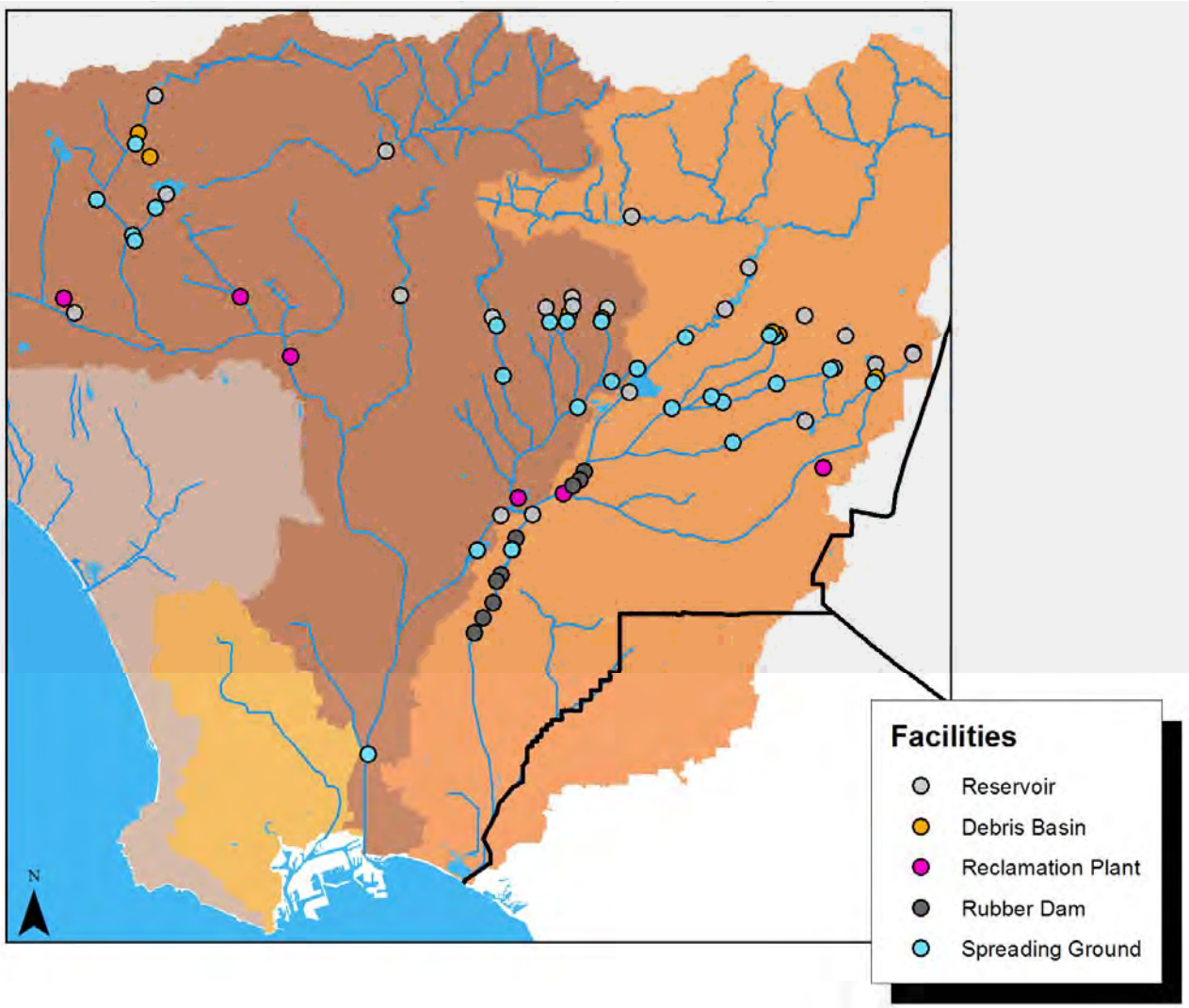
WMMS Overview

- Model Target Area
- Conservation System
- Weather Data
- WMMS Program
- Model Output
- General Model Accuracy

Model Target Area



Conservation System



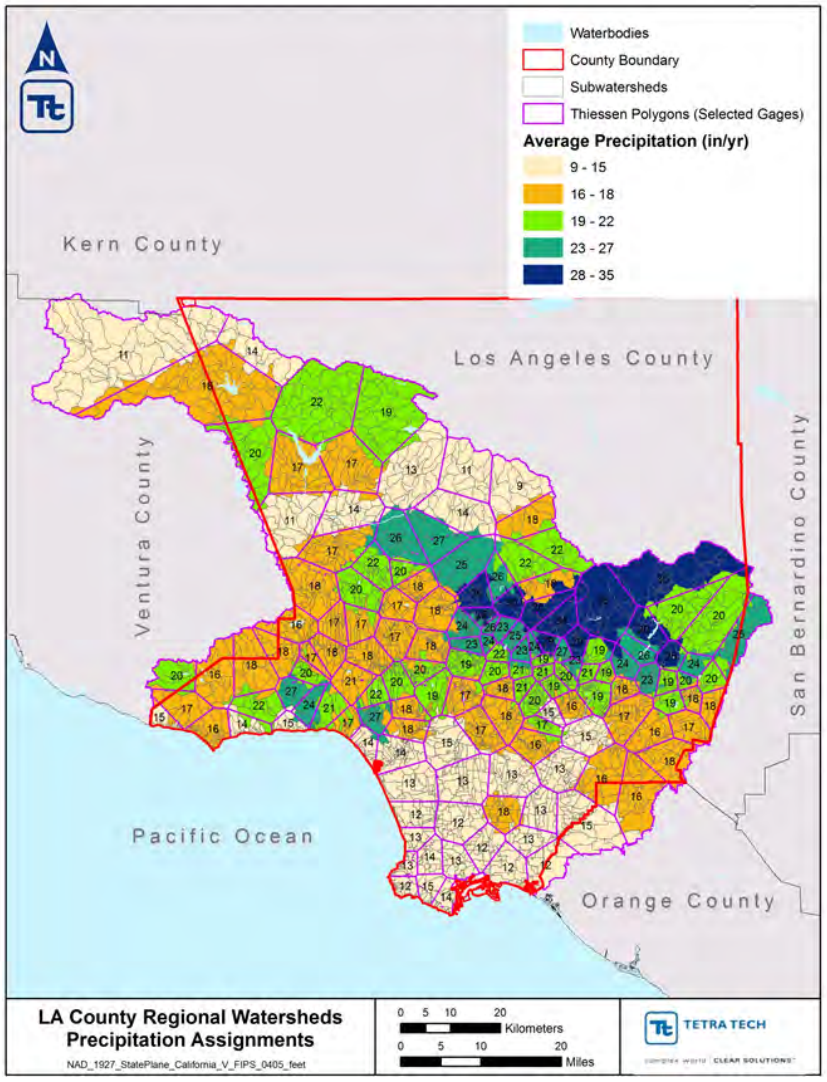
Weather Data

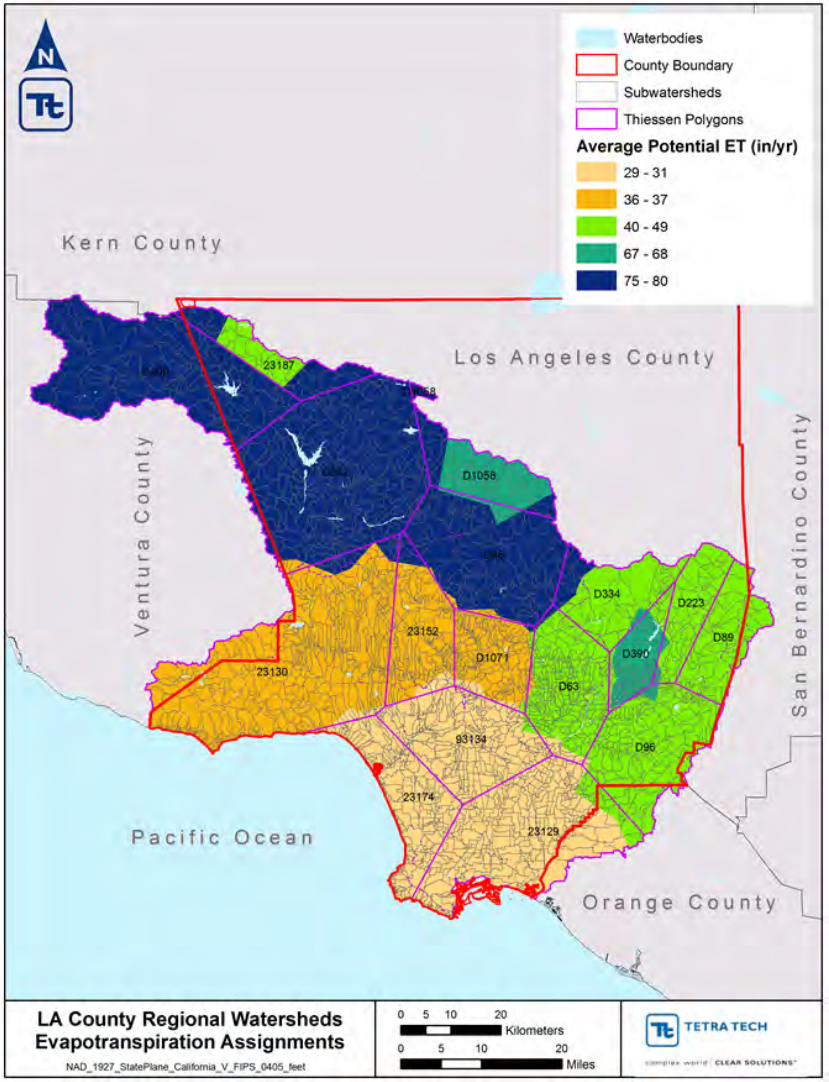
Weather Data

Precipitation & Evaporation Records (1986-2012)

- LACDPW – Water Resource Division Gauges
- California Climate Data Archive

Weather Data

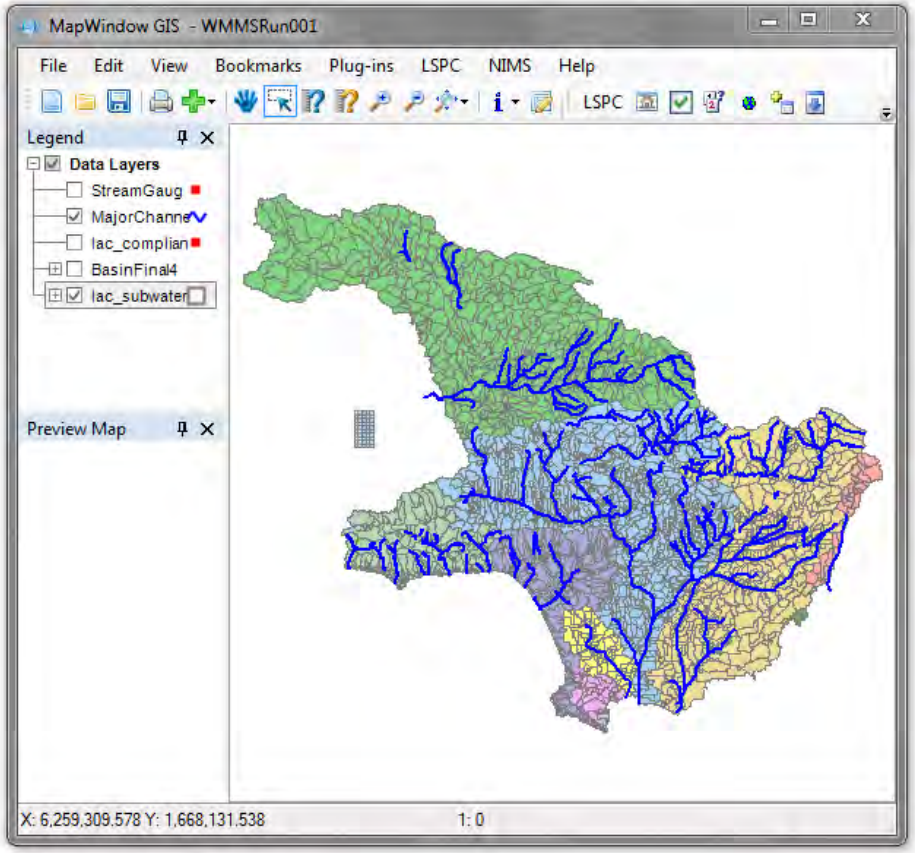




WMMS Program

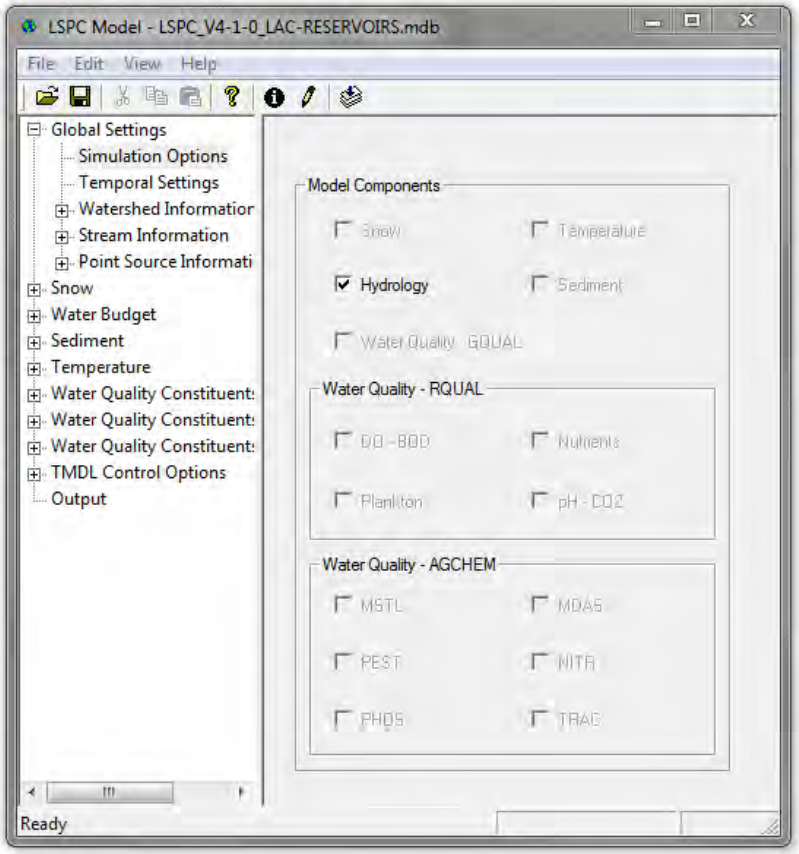
MapWindow

Free GIS Viewer, by ISU Geospatial Software Lab



LSPC

Loading Simulation Program, C++



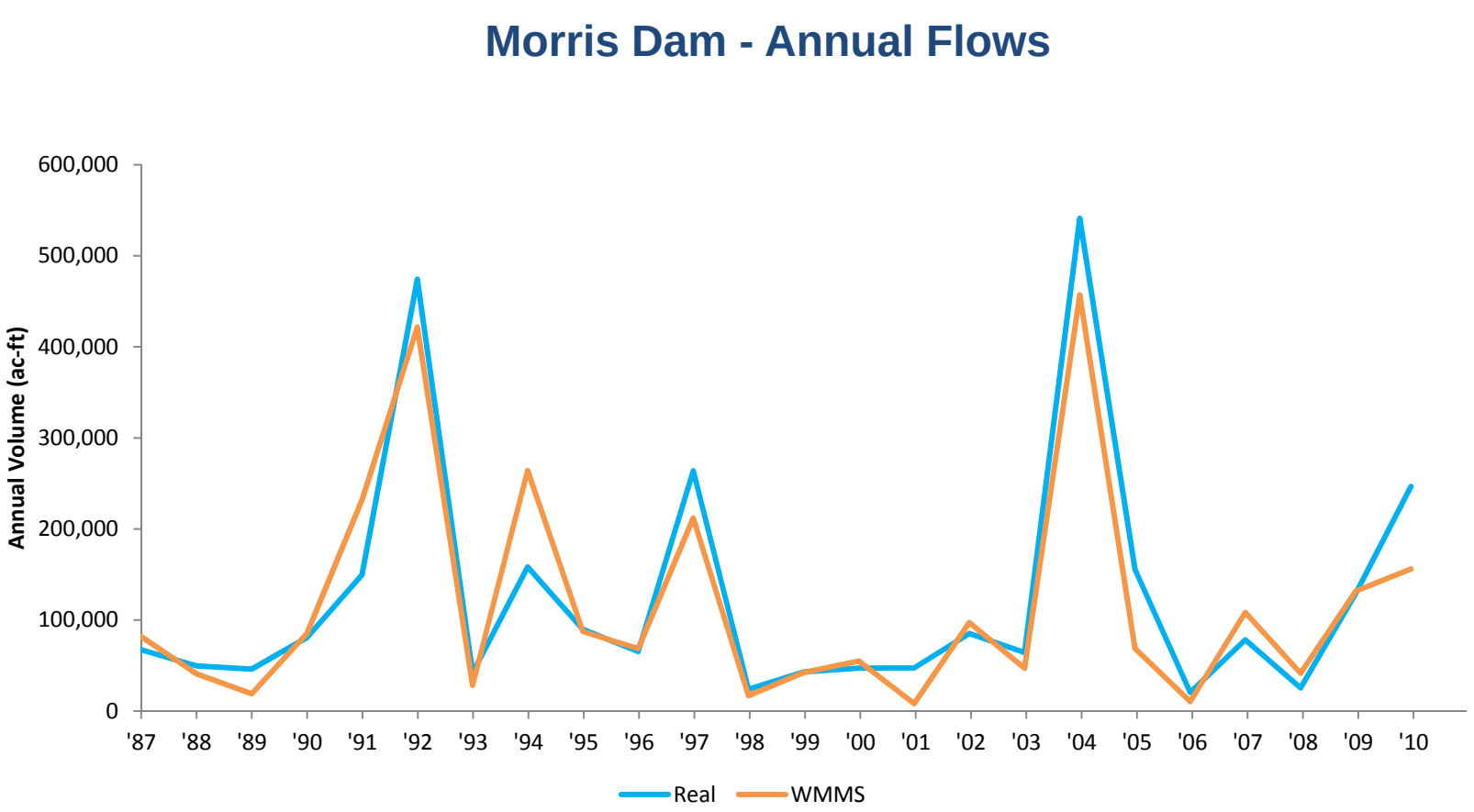
Model Outputs

Storage in Spreading Grounds & Reservoirs

Flows at any point

Model Accuracy

Model Accuracy

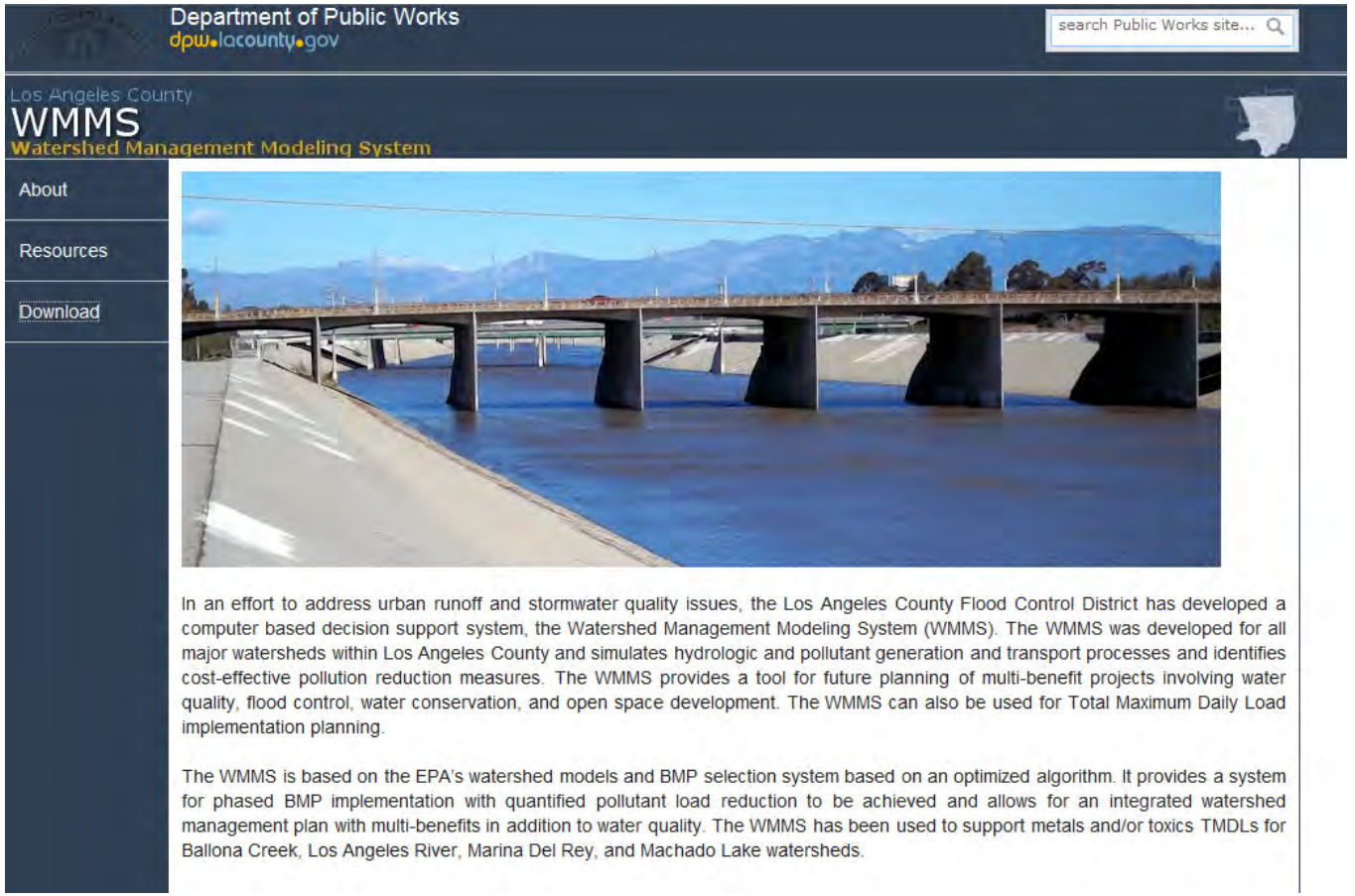


Model Accuracy

10-Year Annual Average Capture (ac-ft)

Spreading Facility	Real Capture	WMMS Capture
Santa Fe	44,000	46,600
San Gabriel Canyon	25,100	25,000
Hansen	16,100	15,800
Tujunga	11,700	11,500
Lopez	709	735

WMMS Download



http://dpw.lacounty.gov/wmd/wmms/

WMMS Q&A

Hydrologic Modeling Questions?

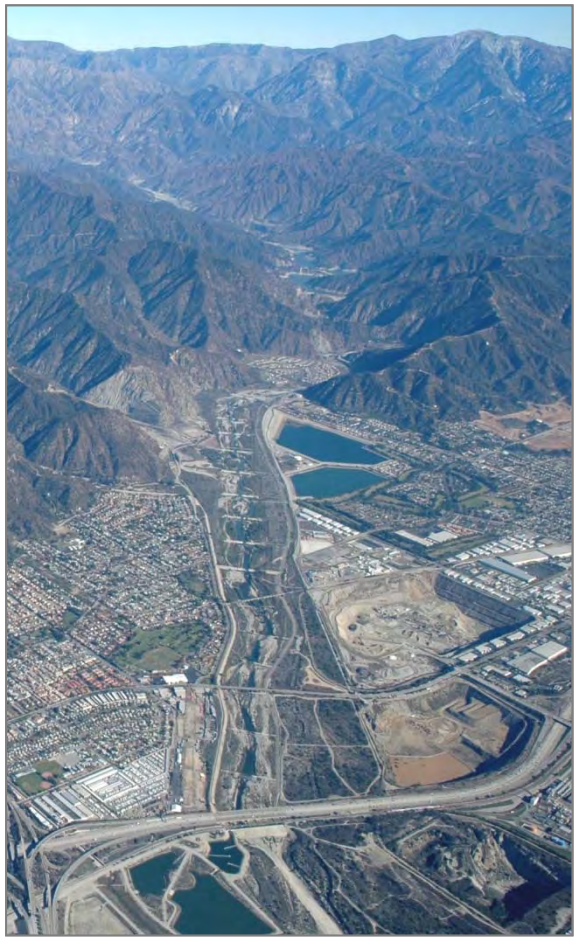
Stakeholder Involvement Opportunities

Stakeholder Technical Advisory Committee (STAC)

- Provide technical support and input
- Review reports and deliverables

Public Involvement

http://www.usbr.gov/lc/socal/basinstudies/LABasin.html



Next Steps

Perform Task 3

- Run Climate & Hydrologic Models
- Analyze runoff output data

STAC Meeting – Late Summer 2013

- Review Draft Task 3 Report
- Task 4 Scoping

Public Meeting – Fall 2013

Next Tasks

- Task 2 – Water Supply & Demand Projections
- Task 4 – Existing Infrastructure Response & Operations Plans Analysis

Questions?

Los Angeles Basin Stormwater Conservation Study

http://www.usbr.gov/lc/socal/basinstudies/LABasin.html

LACFCD Contact:

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Department of Public Works
Los Angeles County Flood Control District
Watershed Management Division
(626) 458-4370
lalexanderson@dpw.lacounty.gov

Reclamation Contact:

Amy Witherall, Water Resources Planner
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Bureau of Reclamation
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awitherall@usbr.gov