Appendix C. Statutory Requirements for SGMA

Statutory Requirements

Legislative/Regulatory Requirement	Legislative/Regulatory Section Reference	C&E Plan Section
Publish public notices and conduct public meetings when establishing a GSA, adopting or amending a GSP, or imposing or increasing a fee.	SGMA Sections 10723(b), 10728.4, and 10730(b)(1).	7.0
Maintain a list of, and communicate directly with, Interested Parties.	SGMA Sections 10723.4, 10730(b)(2), and 10723.8(a)	3.0/Appx F
Consider the interests of all beneficial uses and users of groundwater.	SGMA Section 10723.2	3.0/Appx F
Provide a written statement describing how Interested Parties may participate in plan development and implementation, as well as a list of Interested Parties, at the time of GSA formation.	SGMA Sections 10723.8(a) and 10727.8(a)	4.0
Encourage active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin.	SGMA Section 10727.8(a)	7.0
Understand that any federally recognized Indian Tribe may voluntarily agree to participate in the planning, financing, and management of groundwater basins – refer to DWR's Engagement with Tribal Governments Guidance Document for Tribal recommended communication procedures.	SGMA 10720.3(c)	7.0
Description of beneficial uses and users of groundwater in the basin	GSP Regulations §354.10	3.0/Appx F

List of public meetings at which the Plan was discussed or considered	GSP Regulations §354.10	Appendix D
Comments regarding the Plan received by the Agency and a summary of responses	GSP Regulations §354.10	N/A at time of publication
A communication section that includes the following (GSP Regulations §354.10):		
Explanation of the Agency's decision-making process	GSP Regulations §354.10	4.0
Identification of opportunities for public engagement and discussion of how public input and response will be used	GSP Regulations §354.10	7.0
Description of how the Agency encourages active involvement of diverse social, cultural, and economic elements of the population within the basin	GSP Regulations §354.10	7.0
The method the Agency will follow to inform the public about progress implementing the Plan, including the status of projects and actions	GSP Regulations §354.10	7.0

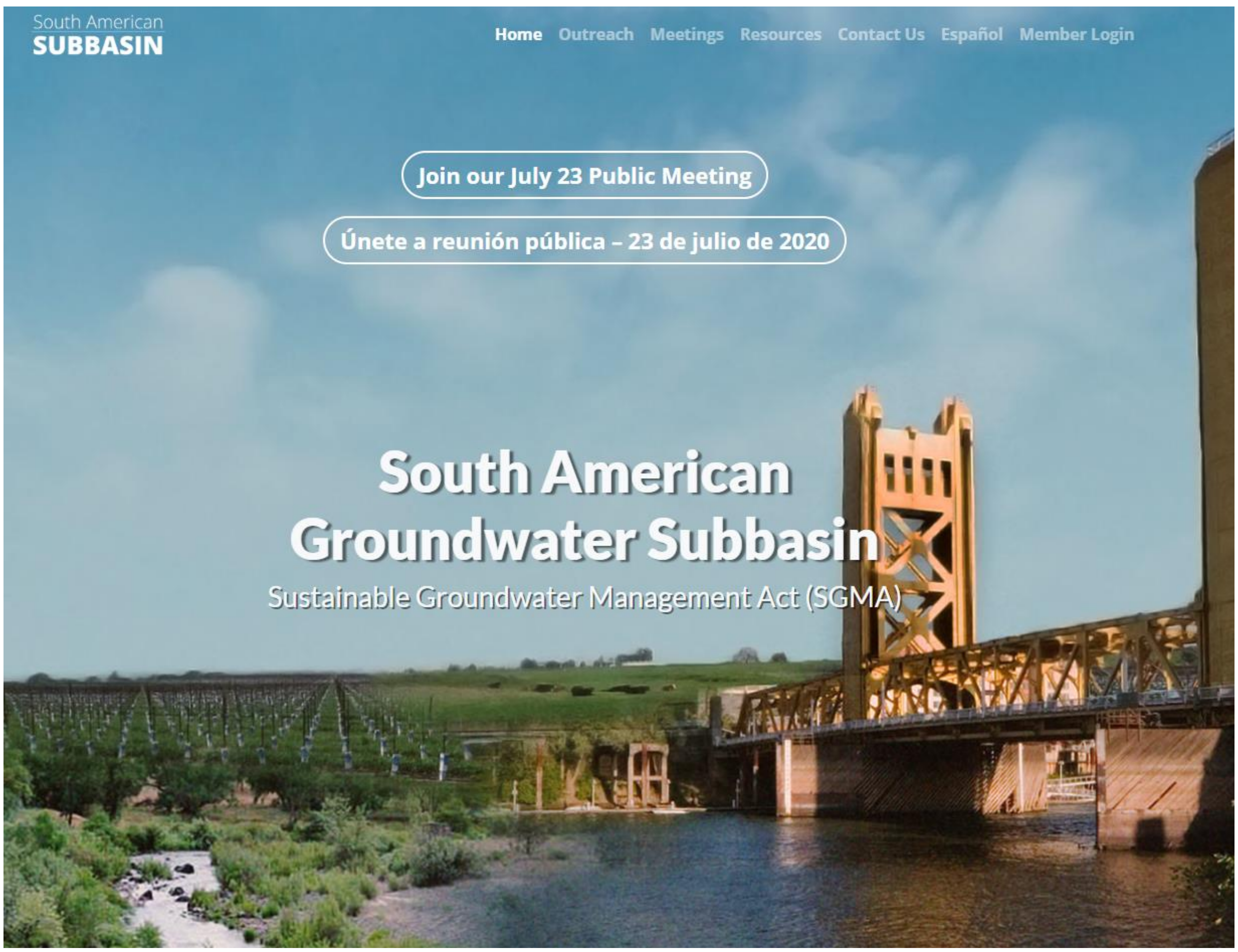
Appendix D. SASb Groundwater Website Portal

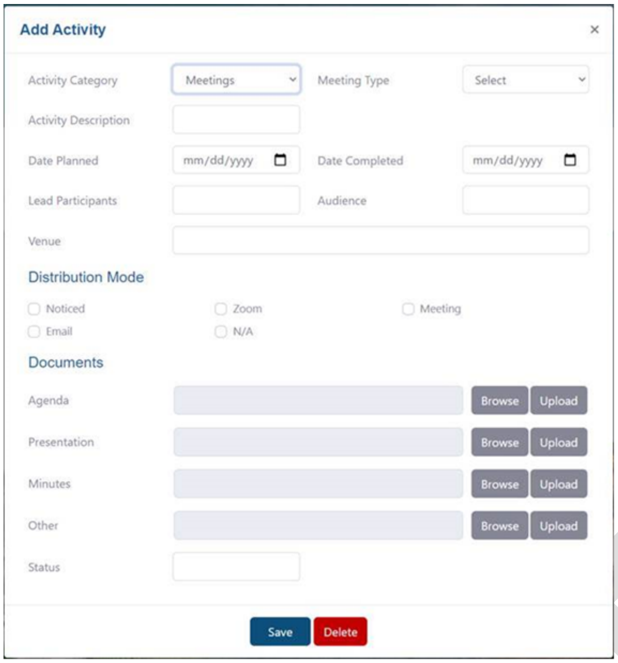
The SASb Website Portal (http://www.sasbgroundwater.org/contact-us.html) is a web-based outreach tool for SASb GSAs to post events and automatically inform Interested Parties about GSP development. Interested Parties can visit the website to register their email address to stay informed about upcoming activities.

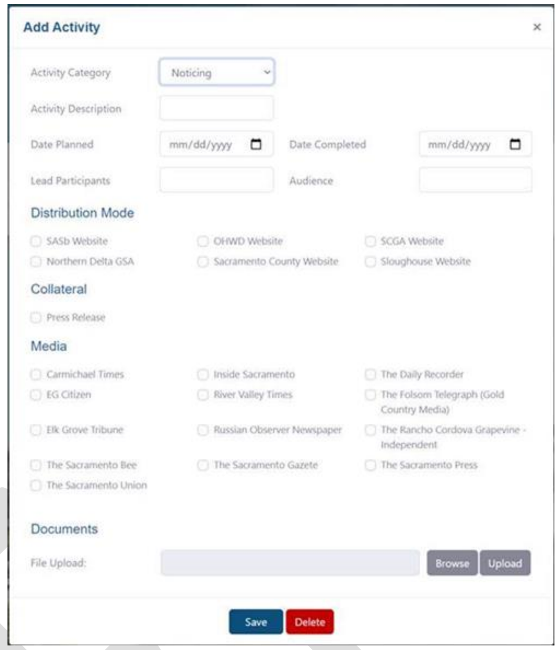
The SASb Website Portal serves as a repository for GSA information about SASb meetings, communications, and Interested Parties. It tracks outreach efforts by the GSAs; storing meeting attendance information as practical with COVID-19 teleconferencing limitations, logging targeted outreach, and hosting the Interested Parties list.

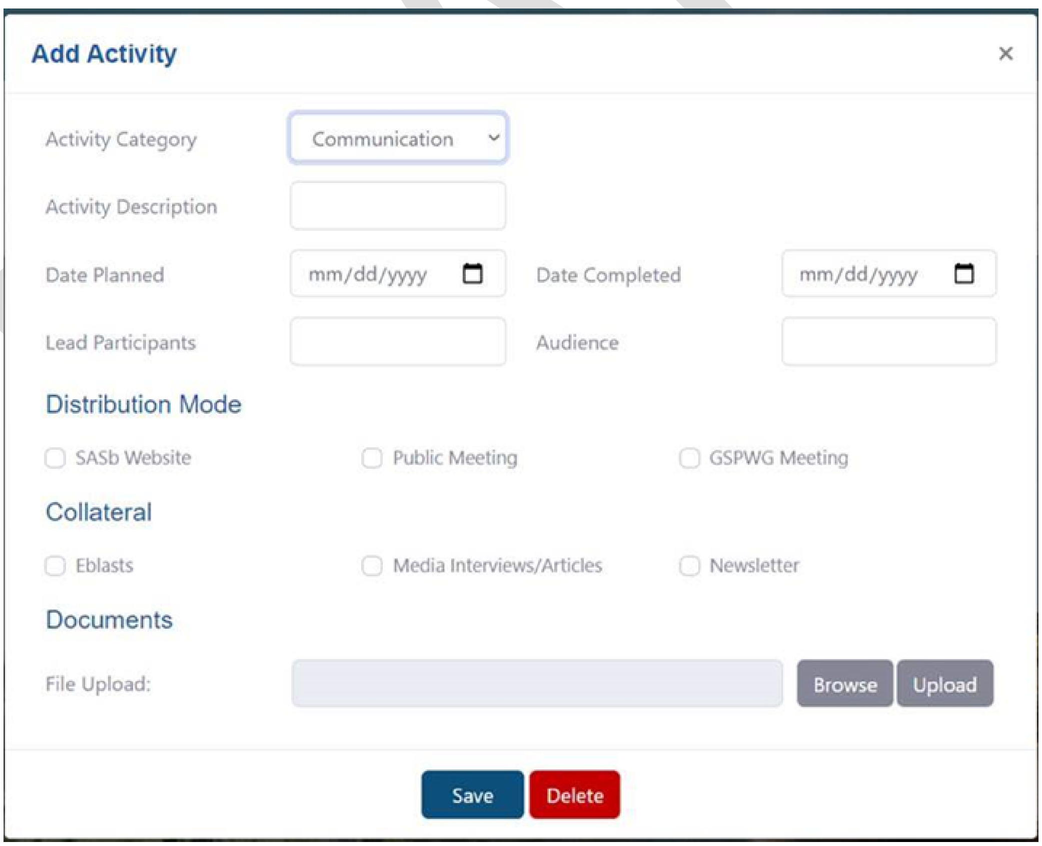
Tool administrators can generate reports about all GSP outreach activities. The reports include items such as attendance sheets, RSVPs, agendas, meeting summaries, handouts, and presentations.

SASbgroundwater.org Home Page, Contact Registration and Portal Pages

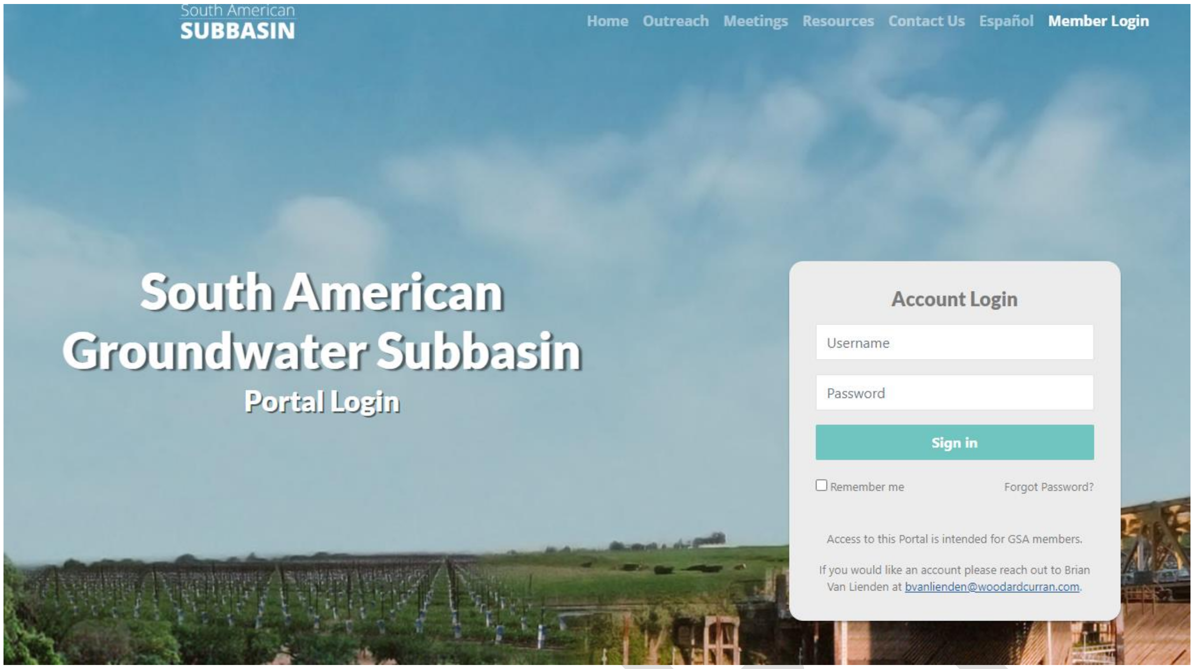


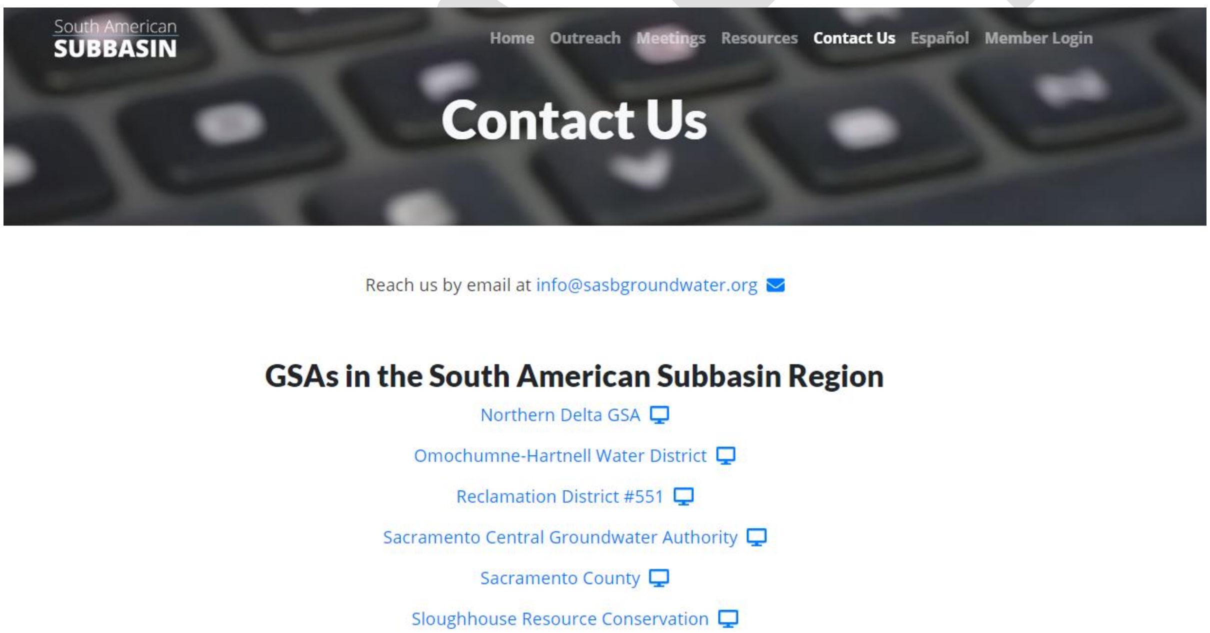

Add Activity
Activity Category
Meetings
Meeting Type
Select
Activity Description
Date Planned
mm/dd/yyyy
Date Completed
mm/dd/yyyy
Lead Participants
Audience
Venue
Distribution Mode
Noticed
Zoom
Meeting
Email
N/A
Documents
Agenda
Presentation
Minutes
Other
Browse
Upload
Status
Save
Delete


Add Activity
Activity Category
Noticing
Activity Description
Date Planned
mm/dd/yyyy
Date Completed
mm/dd/yyyy
Lead Participants
Audience
Distribution Mode
SASb Website
OHWD Website
SCGA Website
Northern Delta GSA
Sacramento County Website
Sloughouse Website
Collateral
Press Release
Media
Carmichael Times
Inside Sacramento
The Daily Recorder
EG Citizen
River Valley Times
The Folsom Telegraph (Gold Country Media)
Elk Grove Tribune
Russian Observer Newspaper
The Rancho Cordova Grapevine - Independent
The Sacramento Bee
The Sacramento Gazete
The Sacramento Press
The Sacramento Union
Documents
File Upload:
Browse
Upload
Save
Delete


Add Activity
Activity Category
Communication
Activity Description
Date Planned
mm/dd/yyyy
Date Completed
mm/dd/yyyy
Lead Participants
Audience
Distribution Mode
SASb Website
Public Meeting
GSPWG Meeting
Collateral
Eblasts
Media Interviews/Articles
Newsletter
Documents
File Upload:
Browse
Upload
Save
Delete

DRAFT


South American
SUBBASIN
Home
Outreach
Meetings
Resources
Contact Us
Español
Member Login
South American Groundwater Subbasin
Portal Login
Account Login
Username
Password
Sign in
Remember me
Forgot Password?
Access to this Portal is intended for GSA members.
If you would like an account please reach out to Brian Van Lienden at bvanlienden@woodardcurran.com.


South American
SUBBASIN
Home
Outreach
Meetings
Resources
Contact Us
Español
Member Login
Contact Us
Reach us by email at info@sasbgroundwater.org
GSAs in the South American Subbasin Region
Northern Delta GSA
Omochumne-Hartnell Water District
Reclamation District #551
Sacramento Central Groundwater Authority
Sacramento County
Sloughhouse Resource Conservation

Appendix E. Partnership Commitment

South American SUBBASIN

PARTNERING COMMITMENT + GUIDING PRINCIPLES
South American Subbasin (SASb) Groundwater Sustainability Plan Working Group
MAY 22, 2020

1.0 PURPOSE

These Principles for engagement and operation of the Groundwater Sustainability Plan (GSP) Working Group (Working Group) are intended to provide a framework of agreements among the members to work collaboratively, efficiently, and with the necessary dedication to promote the development, adoption and submission of a Sustainable Groundwater Management Act (SCGA) compliant GSP by the statutory deadline of January 31, 2022.

The Principles derive from and include by reference the *Memorandum of Understanding Establishing a South American Subbasin SGMA Working Group and Identifying Cost Share Provisions for GSP Development,* which is attached as Exhibit A.

2.0 GSP PARTIES

Following are the core parties responsible for delivering the SASb GSP:

Groundwater Sustainability Agencies' (GSAs) Boards of Directors

The five GSAs have respective Boards that have Working Group Members as assigned below.

Groundwater Sustainability Plan Working Group Membership

Northern Delta GSA – 1 member
- Erik Ringelberg, primary
- Chris Thomas, Alternate

Omochumne Hartnell Water District – 2 members
- Mike Wackman
- Mark Stretars
- Mark Wilson, Alternate

Sacramento Central Groundwater Authority (SCGA) – 7 members
- Todd Eising
- Paul Schubert
- Mark Madison
- Evan Jacobs
- Dave Ocenosak
- Ted Rauh
- Christine Thompson

Sacramento County – 1 member
- Linda Dorn
- Kerry Schmitz, Alternate

Sloughhouse Resource Conservation District – 1 member
- Austin Miller

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- Herb Garmes, Alternate

GSP Administrating Agency

Sacramento Central Groundwater Authority

- John Woodling, Interim Executive Director, SCGA
- Bob Gardner
- Jonathan Goetz
- Ramon Roybal

Consultants Team

Larry Walker Associates

- Tom Grovhoug
- Laura Foglia
- Stephen Maples
    - **SEI**
        - Marisa Escobar
    - **KJ**
        - Sachi Itagaki
        - Jennifer Lau Larsen

Woodard & Curran

- Ali Taghavi
- Brian Van Lieden
- Jim Blanke
    - **Strategy Driver**
        - Ellen Cross
    - **HDR**
        - Shawn Koorn
        - Jafar Faghih

3.0 RESPONSIBILITIES

The primary responsibilities of each party to the GSP Team are identified below.

Respective GSAs' Boards

Each respective Board for the five GSAs will be responsible for:

- Ensuring appropriate communication and engagement is executed per the approved Communication and Engagement (C&E) Plan on behalf of their GSAs.
- Accepting interim milestone approvals to meet the mandated schedule of the Final GSP.
- Being informed about the GSP by their designated Working Group Members listed above.
- Informing their respective Working Group Members with their insights, perspectives, and opinions.
- Ultimately adopting an acceptable final GSP to deliver for DWR review by January 2022.

Working Group

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The Working Group members shall be responsible for:

- Sharing feedback from their respective GSA's related to the GSP development.
- Making recommendations to their GSA regarding the consideration and adoption of the GSP.
- Providing or ensuring the provision of timely responses and supporting information related to GSP development to the Consultants, Working Group and Administrative Agency upon request in order to meet the state mandated GSP deadline.
- Performing and supporting appropriate and coordinated outreach to other stakeholders within the Basin.
- Ultimately delivering an acceptable GSP to all GSAs for adoption.

GSP Administrating Agency

SCGA Staff will be responsible for:

- Being the point of contact for the Working Group to coordinate with the Consultants.
- Overseeing the Consultants in the delivery of the GSP scope of work and budget per the contract.
- Ensuring grant obligations are met and reimbursements received.
- Delivering GSP priorities within the state mandated GSP schedule.

Consultants

Each member of the Consultant Team will be responsible for:

- Ensuring the delivery of the GSP Scope of Work on time and within the budget per the contract.

Collective Outreach and Engagement Responsibilities

To foster the consideration of the beneficial uses and users of groundwater in the subbasin, the Working Group members agree to the following:

- Parties are committed to an inclusive and transparent process that proactively seeks the engagement and input of potentially impacted parties as identified in SGMA. Parties will work to develop protocols for public engagement, both at public workshops and during regular Working Group meetings.
- Parties will work collectively to develop an agreed-upon outreach plan, but each GSA is responsible for helping to guide and implement efforts within their respective jurisdictions.
- Parties recognize the value in developing shared messages to ensure consistency; joint participation in outreach efforts is encouraged to foster consistency in message and concretely demonstrate the parties' coordinated effort.
- Parties recognize the need to conduct outreach in the near-term to better understand additional representation needs (e.g., environmental, tribal, riparian water users, overlying water users, disadvantaged communities (DACs) etc.) beyond the signatories to this agreement.

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4.0 DECISION MAKING

Pursuant to the MOU, the Working Group will seek to make decisions through consensus. In the absence of a consensus, participants of the Working Group may be called upon to cast votes. Recommendations of the Working Group provided to the GSAs shall include a report of the votes cast.

With respect to voting procedures:

- Each Member commits to make a genuine effort to achieve consensus. Consensus is the preferred method for reaching agreement; voting is a last resort.
- Members from the OHWD GSA and SCGA GSA may vote by proxy provided in writing to another member from their respective GSA.
- Members who are the sole representative of their GSA (representing SRCD GSA, Sacramento County GSA and North Delta GSA) should identify an alternate to attend the meetings of the Working Group and vote on their behalf if they are unavailable.

5.0 SUCCESS FACTORS + BARRIERS TO SUCCESS + MITIGATING

SUCCESS	BARRIERS TO SUCCESS	MITIGATION
GOVERNANCE		
• Everyone is heard with equal voice and full participation	• Voting with an even number of participants	• Build consensus through discussion to envision success
• Understand flexibility and local needs – different demands for each	• Individual GSA Boards must buy in – waiting until the end or not knowing what has gone into the decision making will be problematic	• WG members needs to be the Liaisons and Advocates between the WG and the GSA Boards (e.g. build on successful MOU process that built trust)
• Understand where public will engage, actively outreach and communicate with them	• Public Meetings and how will play in with meetings and Boards	• Resolve issues of public meetings for the Working Group • Lay out public meeting schedule in C&E Plan
• Need to express positions of respective Boards of GSAs	• Understand that these are not personal or agency positions/decisions of the individuals; rather the position of the respective	• Need to articulate the nuances and technical challenges to the Boards • The decision by respective Boards will need to be carried forth

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	GSA Boards	• Need to find consensus recommendations within the WG that can be carried to the Boards; but ultimately the Boards have the decision making authority. • Bring back the Boards' decisions and barriers to success • Have rigorous discussion with your respective Boards
• Working together to meet the schedule and any barriers to schedule	• Holding back information or barriers to success	• Possibly provide a Third Party outside of this group that is independent to help us if consensus process does not work
• Engage all interested parties / stakeholders including the public and electeds' early	• Dealing with mostly Staff vs Electeds on GSPWG – we may put together a good GSP but have uninformed participants that undermine the process.	• Need to make sure we bring the Electeds and other key stakeholders along and address concerns early (meet with them; educate them; same constituents)
STAKEHOLDERS		
• Getting Public Understanding	• Work with the public and provide a forum with the WG • Also provide a forum for the WG to work through issues before bringing to the public – we must work quickly and meaningfully while keeping the public informed and engaged at key milestones	• We should treat ourselves as an "ad hoc" – we need to build trust with the stakeholders and involve them in the GSP – need a mechanism so interested parties can "listen" through a mechanism so they know what is going on in the WG.
• Clearly state in the C&E Plan, how and when the public will be engaged	• Inconsistent messaging and engagement with the stakeholders	• Need to educate Public on how they will potentially benefit/be impacted and that we have a consistent

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		message while building the GSP and distributed by all the Boards to set the stage for acceptance.
• A well informed public and stakeholders understand the process and can provide input	• Not bringing all the stakeholders along and not being transparent or providing the ability for input	• Set up an independent webpage that includes the technical documents / presentations / next meetings for the public
• Coordinating with adjacent basins to ensure there are no conflicts in information, sustainable criteria or actions	• Interbasin relationships, information or conflicts are not resolved.	• Need to find ways to coordinate alignment with adjacent basins so there are not differing answers / e.g. outcomes to the sustainable criteria
• Keep DWR engaged on the GSP process and asking them to observe so they know why and how we came up with our GSP to prevent any future obstacles	• DWR is not involved	• Engage Chelsea and new Grant Administrator engaged from the start (N American Subbasin with a co-worker) • Keep the Grant Administrator engaged
• Engage stakeholders in existing processes as much as possible with integrated messaging with ongoing efforts	• Competing messaging • Oversaturating stakeholders with engagement and messaging • Confusing stakeholders	• Leverage Regional San and County Ag as they are doing significant outreach to the Farming and Ag communities within the Recycled Water area and messaging on recycled water
TECHNICAL		
• Understand the goals of the GSP and what we want to implement	• Pulling in information into the GSP that we do not need to meet DWR obligations	• Need to NOT set up new requirements that are not defensible • Take DWR guidance that they have available
• Create actions that are implementable and measurable	• An unmeasurable Plan (e.g. GDEs) – lots of unmeasurable actions/requirements – careful not to tie our hands if we cannot implement the GSP	• GSP will establish measurable metrics and develop a plan to monitor success

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• Need to build on work that has been completed within and adjacent to the Basin (basin boundary amendments)	• Starting from scratch	• Leverage all past work that is of value to expedite the GSP development
• Need to identify what we want in the GSP and what do we want the GSP to do – what will we implement and what is the objective to eliminate conflict going forward.	• Not knowing what we want to achieve, expanding beyond SGMA requirements/authorities, scope creep	Put in a mission, vision and Sustainability Goal related to the GSP so we accomplish what we want the Basin to do Understand the Alternative deficiencies to be addressed.
REGULATORY		
• Understand where GSP interfaces with land use	• How does land management authority work under GSP – without consideration of police powers for implementation	• Understand land use interface with GSP • Reconcile land use overlap (e.g. General Plans)
• Understand what regulatory impacts there are by SASb areas of concern	• Understand known groundwater contamination and remedial efforts and level of involvement of each GSA (e.g. Not in the N Delta GSA area)	• Need to address in GSP
SCHEDULE		
Need to get the job done and not let State take over	• Avoid State Water Board intervention	• Be responsive to the schedule – it matters
FUNDING		
• Ensure rate increases and funding mechanisms are coordinated	• Communicating rate changes ineffectively (218)	• Work with County aggressively to adopt a decision on 218 option or dual process to avoid confusion • Ensure HDR who is doing all the rates can coordinate the multiple processes.
COLLABORATION		
• Trustful, collaborative and transparent partnership	• Diminishing trust	• Continue the trust built from the MOU process to resolve the potential issues (Boundaries, governance,

7

		hard feelings) • Sloughhouse recent Board meeting reiterated the importance of trust and acknowledged it is growing and they are dedicated to the process • Create this as a "core value" and reinforce • Understand that trust and disagreement are not the same; so it is important that the GSP develops into something we can live with

6.0 GUIDING PRINCIPLES

Members agree to the following principles to inform and guide Working Group deliberations, foster constructive discussions, promote a clear and shared set of expectations, and encourage collaboration.

Support an Effective and Efficient Process

Rely on credible information. To foster effective dialogues, members agree to mutually support a transparent and inclusive process where parties commit to rely on credible data and clear criteria to inform decision-making and to draw on the advice of the Consultant Team selected to support its development of a GSP.

Craft a GSP that respects local jurisdictions while building subbasin-wide approach. Parties are committed to working together to develop an integrated and effective GSP, while respecting each GSA's interest and expertise to oversee implementation within its unique jurisdiction or distinct planning areas. Parties agree to move the GSP process forward through consensus to ensure GSP approval by all GSA Boards.

Build off existing structures, lessons learned and past work where practicable, to leverage past investments and make the best use of everyone's time and resources.

Build progress through incremental agreements. Participants will use preliminary agreements on issues as the basis for progress towards final agreement. The Working Group will revisit preliminary agreements when new information emerges and again when finalizing overall recommendations.

Dedicated Participation and Respectful Engagement

Commitment of Working Group members to practice and promote engaged preparation for and participation in scheduled meetings; timely response and input to communications and deliverables; and transparent and timely delivery of pertinent information.

Commitment to collaborate. All members agree to work together in a constructive manner to meet SGMA requirements based on a locally driven approach. No one is to benefit at the expense of others, and all parties agree to negotiate in good faith. Realize our collective teamwork is mandatory to move the GSP process forward and diversion from the process will put the GSP delivery at stake. Strive to reach consensus on positions of shared interest and proactively identify barriers for discussion and, where possible, resolution at the earliest opportunity.

Commitment of time. Strive to attend meetings consistently; we need everyone at the table throughout. Contribute your thoughts and share our time so everyone can participate.

Respect Others and the Process. Seek opportunities to share your perspectives and understand the perspectives of others; listen intently to what others are saying; be honest and fair, and as candid as possible. If you hear something you do not understand, ask questions to clarify. If you hear something you do not agree with, help people understand your concerns.

By signing below you acknowledge your intent to uphold the Partnering Agreement.

Agency Name: Sacramento Central Groundwater Authority

Ramon Roybal, SCGA Staff — 6/4/2020

(Name and Title) (Date)

Agency Name: Omochumne Hartnell Water District

Mike Wackman — 6/1/2020

Mike Wackman, General Manager

(Name and Title) (Date)

Agency Name: Strategy Driver, Inc.

EM Cross — June 3, 2020

(Name and Title) (Date)

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Agency Name: Norther Delta Groundwater Sustainability Agency

June 23, 2020

Erik Ringelberg – NDGSA Administrator

June 23, 2020

Chris Thomas – NDGSA Alternate

Agency Name: Woodard & Curran, Inc.

06/04/2020

(Name and Title) (Date)

Agency Name: Woodard & Curran, Inc.

06/03/2020

(Name and Title) (Date)

Agency Name: Sacramento Central Groundwater Authority / Golden State Water Co

Paul Schubert
General Manager

Paul T. Schubert
Digitally signed by Paul T. Schubert
Date: 2020.06.03 15:43:18 -07'00'

Agency Name: Larry Walker Associates

June 3, 2020

Thomas Grovhoug, Senior Executive

(Name and Title) (Date)

Agency Name: Sacramento County Groundwater Sustainability Agency

Linda Dorn, Environmental Program Manager — June 3, 2020

(Name and Title) — (Date)

Agency Name: SACRAMENTO CENTRAL GROUNDWATER AUTHORITY

THEADOR MCRAUH BOARD MEMBER — JUNE 2, 2020

(Name and Title) — (Date)

Agency Name: Sloughhouse Resource Conservation District

6-1-20

Austin Miller
District Staff

June 1, 2020

Agency Name: SCGA STAFF

JOHN WOODLING — 6/4/20

(Name and Title) — (Date)

Agency Name: Omochumne-Hartnell Water District

June 1, 2020

(Name and Title) — (Date)

Agency Name: Sloughhouse Resource Conservation District

Herb Garms
SRCD District Direc or

Date 6/23/20

Agency Name: Sac County Water Agency

6/23/20

(Name and Title) (Date)

Agency Name: Sacramento Central Groundwater Authority
Christine Thompson , Board of Directors

Public Agencies Self-Supplied June 4, 2020

(Name and Title) (Date)

Agency Name: California American Water

Evan Jacobs, Director of Regulatory Policy 6-5-20

Agency Name: Larry Walker Associates

Laura Foglia, Senior Engineer 06/03/2020

Agency Name: Florin Resource Conservation District/Elk Grove Water District

Mark J. Madison — June 5, 2020

Date

Agency Name: SACRAMENTO CENTRAL GROUNDWATER AUTHORITY

6/4/2020

SENIOR CIVIL ENGINEER (Date)

Agency Name: SACRAMENTO REGIONAL COUNTY SANITATION DISTRICT

6/2/20

(Name and Title) (Date)

DAVE OCENOSAK
PRINCIPAL ENGINEER

Agency Name: Sacramento Central Groundwater Authority

6/25/20

chairman

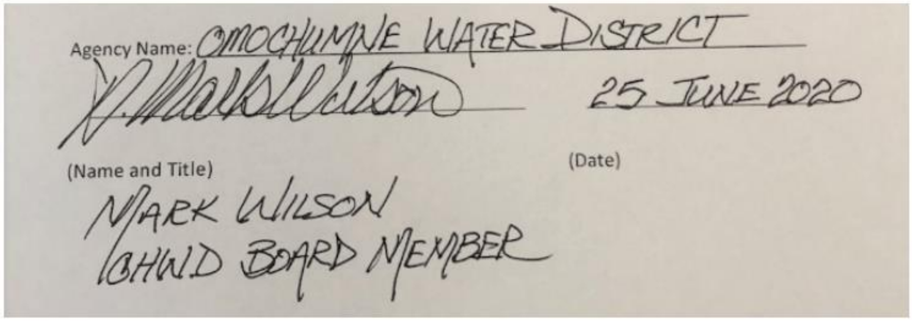
(Name and Title) (Date)

Agency Name: SCGA Staff

R. Gardner — 6/29/2020

(Name and Title) (Date)

BOB GARDNER P.E.
ASSOCIATE CIVIL ENGINEER



Agency Name: OMOCHUMNE WATER DISTRICT

25 JUNE 2020

(Name and Title) (Date)

MARK WILSON
OHWD BOARD MEMBER

Appendix F. Initial Interested Parties List

Pursuant to the California Water Code Section 10723.2, the SASb GSAs will consider the interest of all beneficial uses and users of groundwater when developing and implementing the SASb GSP.

The five SASb MOU GSAs developed lists of Interested Parties and submitted those lists to DWR at the time of GSA formation and augmented the list since that time. A compiled list of those submissions is provided below. This initial list, plus individuals who expressed interest in receiving updates about GSP development via the SASb website, will be imported into the website portal (presented in Appendix D) launched in July 2020. The SASb website portal will notify the Interested Parties list via email when GSP-related events are scheduled in the SASb. The list continues to grow as additional Interested Parties self-register or are otherwise identified.

Agency

- City of Elk Grove
- City of Folsom
- City of Rancho Cordova
- City of Sacramento
- Sacramento County
- Sacramento Central Groundwater Authority
- Florin Resource Conservation District/ Elk Grove Water District
- Lower Cosumnes Resource Conservation District
- Omochumne-Hartnell Water District
- Florin County Water District
- Rancho Murieta Community Services District
- Reclamation District 800
- Reclamation District 1002
- Sacramento County Water Agency
- Sacramento Regional County Sanitation District
- Sloughhouse Resource Conservation District
- Southgate Recreation and Park District

Water Corporations Regulated by PUC or a Mutual Water Company

- California-American Water Company
- Fruitridge Vista Water Company
- Golden State Water Company
- Tokay Park Water Company

Agricultural Users

- Agricultural landowners (individuals)_
- Wine Grape Growers Association
- Sacramento County Farm Bureau
- Southeast Sacramento County Agricultural Water Authority

Domestic Well Owners

- Individual rural residential/suburban landowners

Other Users

- East Lawn Cemetery
- Elk Grove Cosumnes Cemetery District
- St. Joseph's Catholic Cemetery
- Calvary Catholic Cemetery
- St. Mary's Catholic Cemetery
- Greater Sacramento Muslim Cemetery
- Sacramento Historic Cemetery
- Quiet Haven Memorial Park
- Sacramento Pet Cemetery
- Camellia Memorial Lawn
- Odd Fellows Lawn Cemetery
- Building Industry Association
- California Association of Resource Conservation Districts
- California State University, Sacramento

Public Water Systems

- El Dorado Mobile Home Park
- Sequoia Water Assoc
- Travel Lodge Mobile Home Park
- Cozy Villa MHP
- Tokay Park Water Co
- Holiday Mobile Village
- Twin Palms Motel
- El Dorado West MHP
- Plantation Mobile Home Park
- Freeport Marina Inc
- Laguna Village RV Park
- Westerner Mobile Home Park
- Locke Water Works Co
- Delta Crossing MHP

Golf Courses

- Valley Hi Country Club
- Bradshaw Ranch Golf Course
- Mather Golf Course
- Wildhawk Golf Course

Federal, State, Regional

- Department of Water Resources
- State Water Resources Control Board
- US Bureau of Reclamation
- US Fish and Wildlife Service
- California Fish and Wildlife Service
- Central Valley Regional Water Quality Board
- North Delta Water Agency
- Solano County Water Agency

- San Joaquin County Flood Control and Water Conservation District
- Yolo County Flood Control and Water Conservation District
- Regional Water Authority
- Sacramento Groundwater Authority

Local Land Use Planning Agencies/Adjacent GSAs

- City of Elk Grove
- City of Folsom
- City of Rancho Cordova
- City of Sacramento
- County of Sacramento

Environmental Users of Groundwater

- Various agencies on this list address environmental concerns related to groundwater and the SASb GSAs will work with them to consider and protect such interests, including but not limited to the additional organizations cited.
- Stone Lakes National Wildlife Refuge
- Sacramento Valley Conservancy
- The Nature Conservancy
- Cosumnes River Preserve
- Cosumnes Coalition
- Delta Meadows State Park

Tribal Governments

- Wilton Rancheria
- Buena Vista Rancheria Mewuk Indians
- Ione Band of Miwok Indians
- Nashville Enterprise Miwok-Maidu-Nishinam Tribes
- Shingle Springs Brand of Miwok Indians
- Tsi Akim Maidu
- United Auburn Indian Community of the Auburn Rancheria
- Colfax-Todds Valley Consolidated Tribe
- Yocha Dehe Wintun Nation

Disadvantaged Communities

- Environmental Justice Coalition for Water
- Florin Census-Designated Place (CDP) DAC
- Lemon Hill CDP DAC
- Parkway CDP DAC
- Fruitridge Pocket CDP DAC
- Freeport CDP DAC

Remediation Stakeholders

- Aerojet Rocketdyne
- Mather Airforce Base (Former)
- Sacramento Army Depot
- Sacramento County Refuse

Entities Monitoring and Reporting Groundwater in the Basin

- Various of the agencies and water companies listed above collect and report groundwater data including at the County and State level (CASGEM)
- Sacramento Central Groundwater Authority
- Sacramento County Water Agency

Appendix G. Disadvantaged Communities in the SASb

This appendix provides documentation for the contacts made by the Groundwater Sustainability Plan (GSP) Consultant Team in the South American Sub-basin (SASb) to assemble a list of Interested Parties from Disadvantaged Communities (DAC). Thee contacts were the first step in outreach to DACs to enable engagement and involvement in the SASb GSP development effort. The focus of the outreach is to DACs which are beneficial users of groundwater in the SASb, i.e. communities which rely on either individual domestic wells or small public water systems that use groundwater as a source of supply.

The following contacts were made:

DAC Organizations Contacted

Organization
Community Water Center
Sacramento County Environmental Management Department
Sacramento River Funding Area DAC Involvement Grant
American River Basin IRWM
Leadership Council for Justice and Accountability
California Rural Water Association
Center for Race, Poverty, and the Environment
Environmental Justice Coalition for Water
Sacramento County
Sacramento Water Forum

The following list of DAC areas in SASb was compiled using information from the DWR Water Tool, DAC Boundaries-Places, 2016. These areas overlap with the water supply entity jurisdictions that are shown in the maps below:

1. **Florin Census-designated Place (CDP) DAC**
    - Water District 1: Florin County Water District
    - Water District 2: Sacramento County Water District
    - Water District 3: City of Sacramento
    - Water District 4: California American Water Company
    - Water District 5: California American Water Company
    - Water District 6: California American Water Company
    - Water District 7: California American Water Company
2. **Parkway CDP DAC**
    - Water District 1: California American Water Company
    - Water District 2: City of Sacramento
3. **Lemon Hill CDP DAC**
    - Water District 1: California American Water Company
    - Water District 2: City of Sacramento
4. **Fruitridge Pocket CDP DAC**
    - Water District 1: California American Water Company

- Water District 2: City of Sacramento

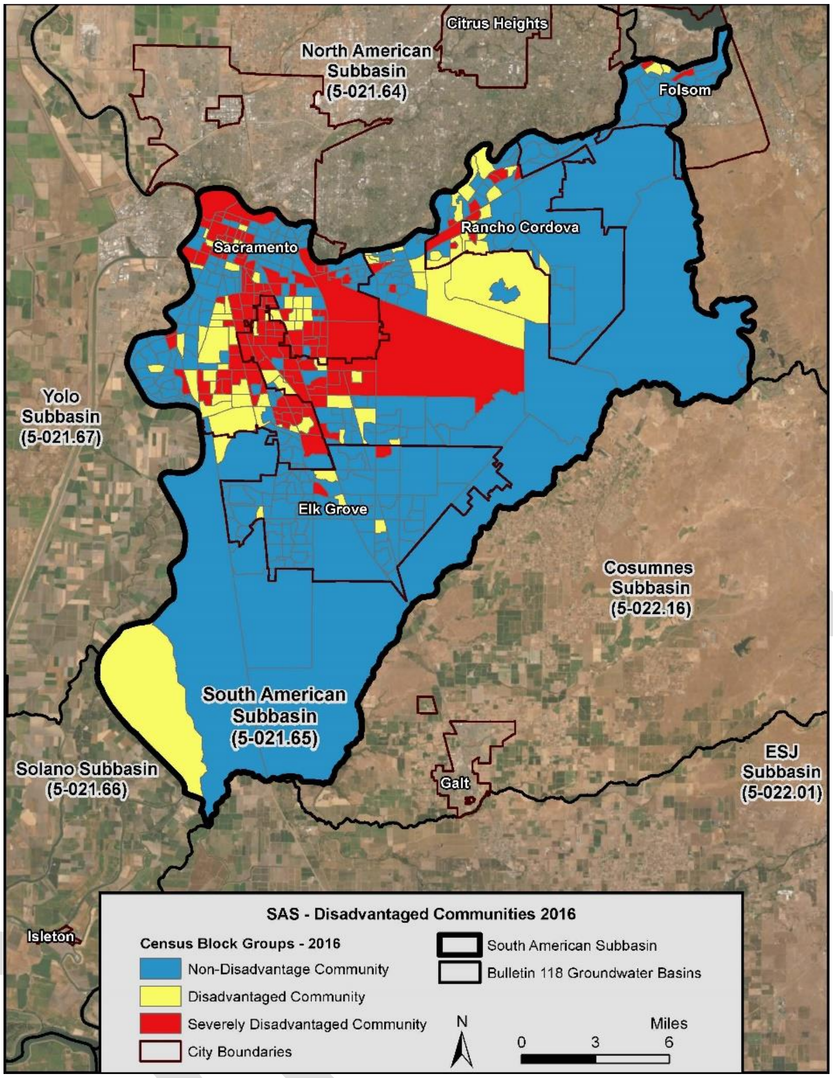
5. **Franklin CDP DAC**
   - Water District 1: Sacramento County Water District
6. **Freeport CDP DAC**
   - Water District 1: Appears to be between Rec District No 307 and North Delta Water Agency

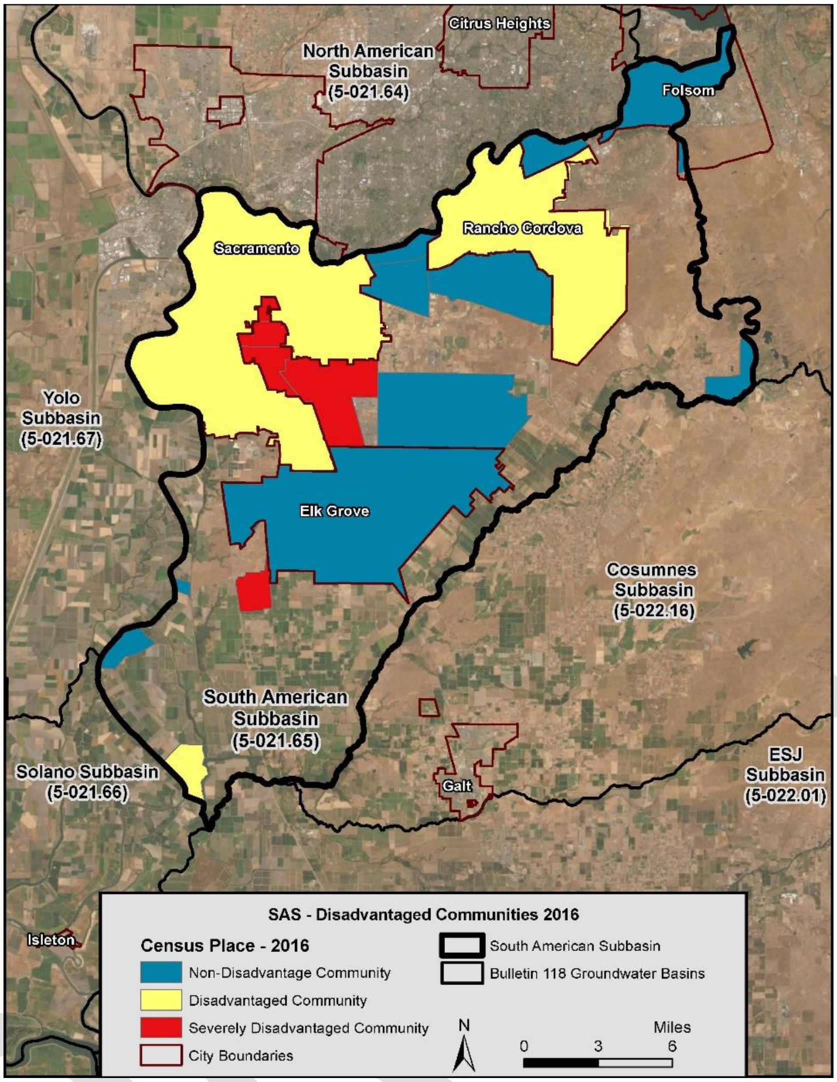
The 2018 American River Basin IRWMP Update shows the following Water Agencies also overlay these DAC Boundaries:

- Golden State Water Company
- California American Water Company
- Sacramento County Water Agency- Zone 41
- Tokay Park Water District

Three maps, depicted below, were prepared showing DACs in the SASb using information available from the DWR Water Tool, DAC Boundaries-Places, 2016. From the organizations above, a list of potentially Interested Parties was developed which will be used in outreach to DACs in accordance with the C&E Plan.

DACs in the SASb




Citrus Heights
North American Subbasin (5-021.64)
Folsom
Rancho Cordova
Sacramento
Yolo Subbasin (5-021.67)
Elk Grove
Cosumnes Subbasin (5-022.16)
South American Subbasin (5-021.65)
Solano Subbasin (5-021.66)
Galt
ESJ Subbasin (5-022.01)
Isleton
SAS - Disadvantaged Communities 2016
Census Place - 2016
Non-Disadvantage Community
Disadvantaged Community
Severely Disadvantaged Community
City Boundaries
South American Subbasin
Bulletin 118 Groundwater Basins
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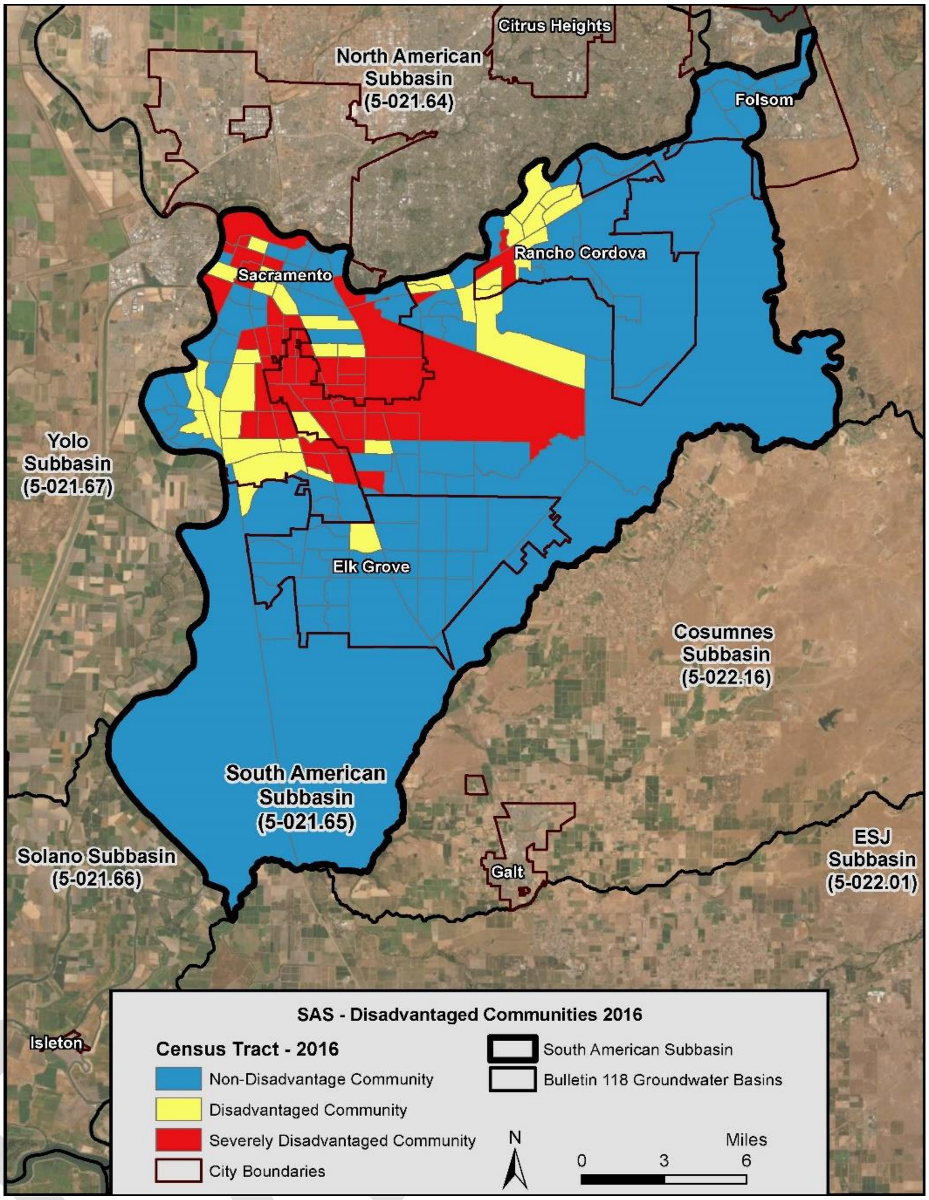
Citrus Heights
North American Subbasin (5-021.64)
Folsom
Rancho Cordova
Sacramento
Yolo Subbasin (5-021.67)
Elk Grove
Cosumnes Subbasin (5-022.16)
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Galt
ESJ Subbasin (5-022.01)
Isleton
SAS - Disadvantaged Communities 2016
Census Tract - 2016
Non-Disadvantage Community
Disadvantaged Community
Severely Disadvantaged Community
City Boundaries
South American Subbasin
Bulletin 118 Groundwater Basins
N
Miles
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Sacramento Central Groundwater Authority
Managing Groundwater Resources in Central Sacramento County

827 7th St, Rm 301
Sacramento, CA 95814

Tel: (916) 874-6851
Fax: (916) 874-5698
www.scgah2o.org

John Woodling
Interim Executive Director

July 13, 2020

To: DAC
xxxxx
xxxxx
xxxx, CA, 9xxxx

Subject: Notice of Intent to Prepare a Groundwater Sustainability Plan (GSP) in the South American Subbasin (SASb)

Dear Chairperson xxxxx,

On behalf of Groundwater Sustainability Agencies (GSAs) representing the South American Subbasin (SASb), we are writing to notify you that a Groundwater Sustainability Plan (GSP) for the SASb is under development as required by the Sustainable Groundwater Management Act (SGMA) (California Water Code Section 10720 et seq). The plan will be developed in accordance with SGMA regulations, in concert with local stakeholders and beneficial users of water in the SASb, and must be approved by the six GSA Boards and submitted to the California Department of Water Resources by January 31, 2022.

SASb GSAs

Northern Delta

Omochumne-Hartnell Water District (OHWD)

Sacramento Central Groundwater Authority (SCGA)

Sacramento County

Sloughhouse Resource Conservation District

Reclamation District 551

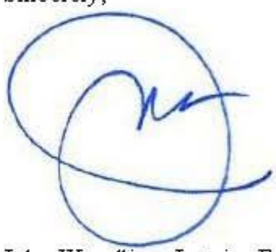
Water is vital to the economy, the environment, and the quality of life for all residents in Sacramento County. While this precious resource is visible every day in the American, Sacramento and Cosumnes Rivers, water that is underground is no less important, providing about half of the region's water supply. Groundwater in the South American Subbasin (SASb) serves the needs of cities, farms, businesses and tribes, and provides high quality drinking water to urban and rural residents, all while helping to sustain vital ecosystems. Your interest and input is essential to developing a plan to sustainably manage the SASb so our groundwater can satisfy your needs and all other needs in perpetuity.

A preliminary Communication and Engagement Plan for the development of the SASb GSP is being developed and will be available soon at www.sasbgroundwater.org. This plan will include a schedule of public meetings and other meetings that will take place during GSP preparation and describes the overall schedule for GSP preparation. The first public meeting (a remote meeting with web-based access) will occur on July 23, 2020 from 6 pm to 8 pm.

SGMA requires that special attention be given to outreach and engagement with disadvantaged communities potentially impacted by decisions made in the GSP development process. We are especially interested in connecting with individuals or communities who are served by domestic wells or small public water systems that operate wells.

If you wish to meet with the GSP Consultant Team members who are assisting in the development of the GSP, please notify the SASb Facilitator below and we will arrange a time for a meeting. To be included on the list of Interested Parties to receive further information on ways to meaningfully participate in the SASb GSP development process, please register at the following web address: sasbgroundwater.org and feel free to contact our Public Outreach Facilitator, Ellen Cross, with any questions or comments by email at crosse@strategydriver.com or by phone at (510) 316-9657.

Sincerely,



John Woodling, Interim Executive Director
Sacramento Central Groundwater Authority

cc: Groundwater Sustainability Plan Working Group
Ellen Cross, Strategy Driver, Inc.

Appendix H. Native American Tribal Governments in the SASb

Native American Tribal entities are included as part of the SASb outreach. The following list of Tribal Governments were contacted in advance of Public Meeting #1 scheduled for July 23, 2020.

- Wilton Rancheria
- Buena Vista Rancheria Mewuk Indians
- Ione Band of Miwok Indians
- Nashville Enterprise Miwok-Maidu-Nishinam Tribes
- Shingle Springs Brand of Miwok Indians
- Tsi Akim Maidu
- United Auburn Indian Community of the Auburn Rancheria
- Colfax-Todds Valley Consolidated Tribe
- Yocha Dehe Wintun Nation

Sacramento Central Groundwater Authority
Managing Groundwater Resources in Central Sacramento County

827 7th St, Rm 301
Sacramento, CA 95814

Tel: (916) 874-6851
Fax: (916) 874-5698
www.scgah2o.org

July 7, 2020

To: Tribal Nation
Chairperson
xxxxx
xxxx, CA, 9xxxx

Transmitted via email: xxxxxxx

Subject: Notice of Intent to Prepare a Groundwater Sustainability Plan (GSP) in the South American Subbasin (SASb)

Dear Chairperson xxxxx,

On behalf of Groundwater Sustainability Agencies (GSAs) representing the South American Subbasin (SASb), we are writing to notify you that a Groundwater Sustainability Plan (GSP) for the SASb is under development as required by the Sustainable Groundwater Management Act (SGMA) (California Water Code Section 10720 et seq). The plan will be developed in accordance with SGMA regulations, in concert with local stakeholders and beneficial users of water in the SASb, and must be approved by the six GSA Boards and submitted to the California Department of Water Resources by January 31, 2022.

SASb GSAs
Northern Delta
Omochumne-Hartnell Water District (OHWD)
Sacramento Central Groundwater Authority (SCGA)
Sacramento County
Sloughhouse Resource Conservation District
Reclamation District 551

Water is vital to the economy, the environment, and the quality of life for all residents in Sacramento County. While this precious resource is visible every day in the American, Sacramento and Cosumnes Rivers, water that is underground is no less important, providing about half of the region's water supply. Groundwater in the South American Subbasin (SASb) serves the needs of cities, farms, businesses and tribes, and provides high quality drinking water to urban and rural residents, all while helping to sustain vital ecosystems. Your interest and input is essential to developing a plan to sustainably manage the SASb so our groundwater can satisfy your needs and all other needs in perpetuity.

SGMA allows any federally recognized Indian tribe to voluntarily participate in the preparation or administration of a GSP. A federally recognized tribe's actions during participation will be based on the tribe's independent sovereign authority and not the authorities that SGMA provides to local agencies. Regardless of whether a tribe opts to coordinate their groundwater management with SGMA implementation, SGMA requires GSAs to consider the interests of all beneficial uses and users of groundwater, including tribes.

For more information on Tribal Government Engagement with GSAs, please see the Guidance Document on Sustainable Groundwater Management prepared by the California Department of Water Resources Sustainable Groundwater Management Program Tribal Advisory Group.

(https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/GuidanceDocumentforSustainableManagementofGroundwaterEngagementwithTribalGovernments_ay_19.pdf).

A preliminary Communication and Engagement Plan for the development of the SASb GSP is being developed and will be available soon at www.sasbgroundwater.org. This plan will include a schedule of public meetings and other meetings that will take place during GSP preparation and describes the overall schedule for GSP preparation. The first public meeting (a remote meeting with web-based access) will occur on July 23, 2020 from 6 pm to 8 pm.

To be included on the list of Interested Parties to receive further information on ways to meaningfully participate in the SASb GSP development process, please register at the following web address: sasbgroundwater.org. If you wish to meet with the GSP Consultant Team who are assisting in the development of the GSP, or have any questions or comments please contact our Public Outreach Facilitator, Ellen Cross by email at crosse@strategydriver.com or by phone at (510) 316-9657.

Sincerely,

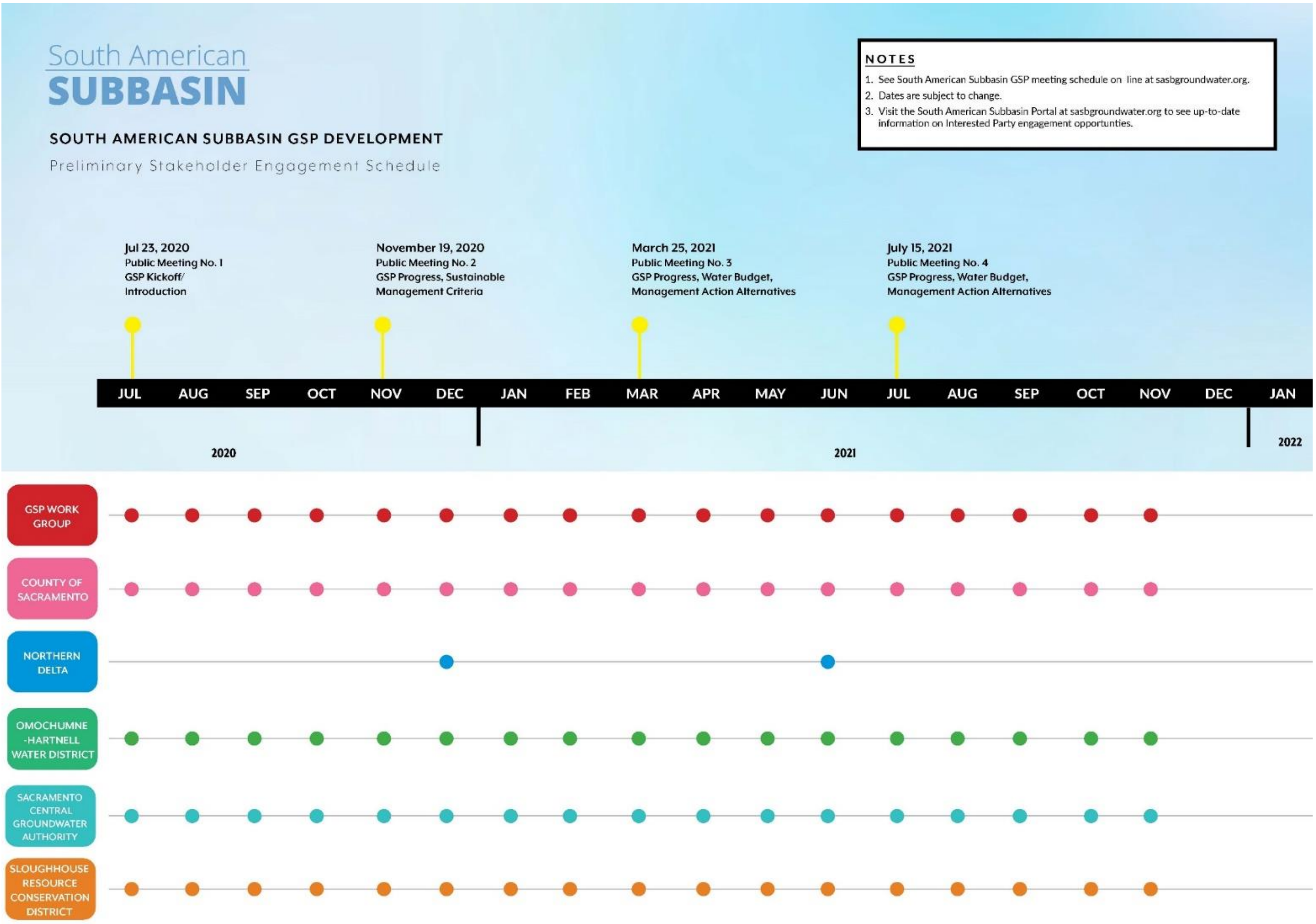
John Woodling, Interim Executive Director
Sacramento Central Groundwater Authority

cc: Groundwater Sustainability Plan Working Group
Ellen Cross, Strategy Driver, Inc.

Page **2** of **2**

Appendix I. Preliminary Engagement Schedule

Preliminary Engagement Schedule



Appendix J. Example Public Notice

SCGA

Date: July 6, 2020

Contact: Ramon Roybal (916) 874-6826, RoybalR@SacCounty.NET

https://scgah2o.saccounty.net/Pages/default.aspx

SOUTH AMERICAN SUBBASIN GROUNDWATER SUSTAINABILITY PLAN - PUBLIC WORKSHOP – July 23, 2020 – The South American Subbasin (SASb) Groundwater Sustainability Plan (GSP) Working Group, on behalf of five Groundwater Sustainability Agencies (GSAs), invites groundwater basin users and interested community members to attend a public workshop to initiate the development of a GSP for the SASb in accordance with the requirements of the Sustainable Groundwater Management Act (SGMA). The SASb is located in Sacramento County between the American and Cosumnes Rivers.

Why Groundwater Sustainability Matters?

Join us and learn about the condition and future health of your groundwater subbasin. Participate in the process to understand what needs to be done to protect the quality and availability of this valuable resource. Learn why maintaining a sustainable groundwater subbasin matters to the economy, environment, and quality of life of our urban and rural communities. We need your input - join us July 23rd!

The workshop will provide an opportunity to learn more about the following topics and provide initial input on:

- SGMA and the schedule for GSP development for the SASb
- Opportunities for public engagement in the decision-making process for the GSP
- Introduction to the SASb Groundwater Sustainability Agencies' (GSAs) Working Group
- Sustainability Goals and Sustainable Management Criteria

To indicate your interest and access the agendas and materials for the Public Meeting, please visit sasbgroundwater.org. Please note that during the development of the GSP, the GSAs also will hold their regular public Board Meetings, a schedule for which can be viewed at the website.

The GSP Working Group will host a public workshop on:

Thursday, July 23, 2020 from 6:00 pm to 8:00 pm

https://zoom.us/j/97062255197?pwd=dWwySGlNOWMwWmU1UCsyeGtlbWpoQT09

The public can call in at (669) 900 6833

Meeting ID: 970 6225 5197 Password: 936495

The GSPWG includes representation from five of the GSAs:

- Sacramento Central Groundwater Authority
- Northern Delta GSA
- Omochumne-Hartnell Water District
- Sacramento County
- Sloughhouse Resource Conservation District

Note: Pursuant to the Governor's Executive Order N-29-20 and given the state of emergency regarding the threat of COVID-19, the meeting will be held via teleconference.

- We encourage members and participants to join the meeting 10 minutes early. Note that we will use Zoom to share slides and other information during the meeting. Use the link above to join. If you have a microphone that you can use with your computer, it should be possible to both listen to, and participate in, the meeting through Zoom. If you do not have a microphone, or a headset with a microphone that plugs into your computer via USB port, you will need to call into the conference line to listen and comment, although you still should be able to view the meeting materials on Zoom. Please do not simultaneously use a microphone through Zoom and the telephone conference line. That combination results in audio problems for all participants.

Appendix K. Meeting Feedback Form

South American SUBBASIN

SASb Meeting Survey

SASb Meeting Survey

Please provide feedback to improve our communication and engagement process.

Name: ____

Contact: ____

Date: __________________________

Survey Questions

Survey Question	Please Select One
1) Information provided was useful and understandable?	Yes ☐ No ☐
2) Meeting noticing was timely, informative about location, and meeting topic(s)?	Yes ☐ No ☐
3) Opportunity to comment was provided?	Yes ☐ No ☐
4) Can we contact you regarding your survey to follow up?	Yes ☐ No ☐

Other SGMA topics and information of interest to you: ____

____

____

____

Other Suggestions on communication and engagement that would be helpful for the SGMA process:

____

____

____

____

____

____

Appendix L. Postcard Mailers

Postcards in English and Spanish sent to announce the SASb GSP Public Workshop

Appendix M. Interbasin Coordination under the Sustainable Groundwater Management Act

Agencies preparing a Groundwater Sustainability Plan (GSP) under SGMA are encouraged to work with other agencies in adjacent basins to facilitate exchange of technical information, assist with preparation of GSPs, coordinate basin boundary modifications, and conduct outreach to regional stakeholders.

Interbasin coordination is also important to ensure that implementation of a GSP will not adversely affect an adjacent basin's ability to implement is GSP or impede its ability to achieve its sustainability goal. GSAs may develop a voluntary Interbasin Agreement to establish compatible sustainability goals and understanding regarding the fundamental elements of each agency's GSP. Interbasin agreements should facilitate the exchange of technical information between agencies and include a process to resolve disputes concerning the interpretation of that information. (23 CCR § 357.2). A summary of elements to be included in an interbasin agreement is provided below.

Interbasin Coordination Agreement Checklist

	Interbasin Coordination Agreement Element	CA Code of Regulations
General Information		
☐	Identity of each basin participating in and covered by the terms of the agreement.	23 CCR § 357.2 (a)(1)
☐	A list of the Agencies or other public agencies or other entities with groundwater management responsibilities in each basin.	23 CCR § 357.2 (a)(2)
☐	A list of the Plans, Alternatives, or adjudicated areas in each basin.	23 CCR § 357.2 (a)(3)
Technical Information		
☐	An estimate of groundwater flow across basin boundaries, including consistent and coordinated data, methods and assumptions.	23 CCR § 357.2 (b)(1)
☐	An estimate of stream-aquifer interactions at boundaries.	23 CCR § 357.2 (b)(2)
☐	A common understanding of the geology and hydrology of the basins and the hydraulic connectivity as it applies to the Agency's determination of groundwater flow across basin boundaries and description of the different assumptions utilized by different Plans and how the Agencies reconciled those differences.	23 CCR § 357.2 (b)(3)
☐	Sustainable management criteria and a monitoring network that would confirm that no adverse impacts result from the implementation of the Plans of any party to the agreement. If minimum thresholds or measurable objectives differ substantially between basins, the agreement should specify how the Agencies will reconcile those differences and manage the basins to avoid undesirable results. The Agreement should identify the differences that the parties consider significant and include a plan and schedule to reduce uncertainties to collectively resolve those uncertainties and differences.	23 CCR § 357.2 (b)(4)
Conflict Resolution		
☐	A description of the process for identifying and resolving conflicts between Agencies that are parties to the agreement.	23 CCR § 357.2 (c)
Submission to DWR		
☐	Interbasin agreements submitted to the Department shall be posted on the Department's website.	23 CCR § 357.2 (d)

Appendix N. Media Contacts List

Press releases regarding GSP development public workshops are sent to the following media contacts.

Media Contacts

Newspaper Name	Website Link
Carmichael Times	http://carmichaeltimes.com/contact/index.php
EG Citizen	http://www.egcitizen.com/site/contact.html
Elk Grove Tribune	https://elkgrovetribune.com/contact/
Inside Sacramento	https://insidesacramento.com/events/
River Valley Times	https://www.mondotimes.com/1/world/us/5/8437/16348
Russian Observer Newspaper	https://www.russianamericanmedia.com/contact-us/
The Daily Recorder	https://www.dailyrecorder.news/home.cfm
The Folsom Telegraph (Gold Country Media)	https://goldcountrymedia.com/live-content/the-folsom-telegraph/ https://goldcountrymedia.com/live-content/contact/
The Rancho Cordova Grapevine-Independent	http://ranchocordovaindependent.com/contact/index.php
The Sacramento Bee	https://www.sacbee.com/customer-service/contact-us/#navlink=mi_footer
The Sacramento Gazette	https://www.sacgazette.com/
The Sacramento Observer	https://sacobserver.com/contact-us/
The Sacramento Press	https://sacramentopress.com/contact/
The Sacramento Union	https://sacunion.com/

South American
SUBBASIN

Appendix 1-E

Outreach Report (as of 10/21/2021)

Outreach report as of 10.12.2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
General GSP	Initial Notification of GSP Development for SASb	DWR SGMA Portal	SCGA staff	General Public	N/A	7/7/2020
General GSP	Initial Notification of GSP Development for SASb to County/Cities/CA PUC	USPS/Email	SCGA staff	Sacramento County BOS, Cities of Sacramento/Elk Grove/Folsom/Rancho Cordova, CA PUC	6	7/7/2020
General GSP	Noticing of SASb GSP Development to Tribal Representatives	USPS/Email	SCGA staff	Tribal contacts	14	7/9/2020
General GSP	Noticing of SASb GSP Development to DACs	USPS/Email	SCGA staff	DAC contacts	18	7/15/2020
General GSP	Additional Notification (to corrected address) to Locke Water Works as a DAC Regarding GSP Development	USPS	SCGA staff	Locke Water Works	1	7/22/2020
General GSP	Press Release via Sacramento County Public Information Office Announcing GSP Development	Sacramento County Public Information Office	C&E Coordinator	General Public	N/A	7/6/2020
General GSP	Availability of Public Draft - South American Subbasin Groundwater Sustainability Plan	SASb Email Distribution list/SASb website/USPS to Tribal contacts and DACs	SCGA staff	Interested Parties/Stakeholders/Tribal contacts/DACs	N/A	6/24/2021
General GSP	90-day notice of SASb GSP consideration for adoption by GSAs	Mailed via USPS and Email to County BOS/County Executive/City Councils and City Managers for Sacramento, Elk Grove, Folsom, and Rancho Cordova	SCGA staff	Municipal jurisdictions	N/A	9/3/2021
Sacramento Central Groundwater Authority (SCGA)	Discussion of GSP development schedule	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	10/9/2019
SCGA	Discussion of GSP development schedule	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	12/11/2019

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SCGA	Contract to develop GSP for SASb. GSP development schedule update	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	2/5/2020
SCGA	Contract to develop GSP for SASb. GSP development schedule update. Status report on MOU for development of SASb GSP.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	3/11/2020
SCGA	GSP development schedule update. Status report on MOU for development of SASb GSP. Report on C&E plan for SASb.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	4/8/2020
SCGA	GSP development schedule update. Adoption of MOU for development of SASb GSP.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	5/13/2020
SCGA	GSP development update. Status report of MOU for development of SASb GSP.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	7/8/2020
SCGA	GSP Working Group public kickoff meeting	Postcard sent via email and published in Farm Bureau newspaper mailed to members	Sacramento County Farm Bureau	Sacramento County Farm Bureau members	N/A	7/8/2020
SCGA	GSP Working Group public kickoff meeting	City of Rancho Cordova public website	City of Rancho Cordova	City of Rancho Cordova Interested Parties/Stakeholders/Public	N/A	7/9/2020
SCGA	SGMA/GSP requirements	City of Rancho Cordova department meeting	City of Rancho Cordova staff	City Rancho Cordova department heads and City Manager	N/A	7/10/2020
SCGA	GSP Working Group public kickoff meeting	Golden State Water Company email dist. list	Golden State Water Company staff	Golden State Water Company interested parties/customers	N/A	7/10/2020
SCGA	GSP Working Group public kickoff meeting	California American Water Company social media channels	California American Water Company staff	California American Water Company interested parties/customers	N/A	7/13/2020
SCGA	GSP Working Group public kickoff meeting	Elk Grove Water District website	Elk Grove Water District staff	Elk Grove Water District interested parties/customers	N/A	7/14/2020

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SCGA	Individual follow up with large Acreage Ag members within the basin to ensure attendance and awareness of 7/23/20 GSP public kickoff meeting	N/A	Sacramento County Farm Bureau staff	Sacramento County Farm Bureau members	N/A	7/15/2020
SCGA	SGMA/GSP update	City of Rancho Cordova "Monday Memo"	City of Rancho Cordova staff	Rancho Cordova City Council members	N/A	7/20/2020
SCGA	Reminder of July 23, 2020 SASb GSP public kickoff meeting.	social media event invites, posts and reminder email	Sacramento County Farm Bureau staff	Sacramento County Farm Bureau members	N/A	7/22/2020
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	8/12/2020
SCGA	Authorize The Interim Executive Director To Enter Into Amended Contracts With Larry Walker Associates And Woodard & Curran To Complete The Proposition 1 And Proposition 68 Grant Scopes Of Work For GSP Completion.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	9/3/2020
SCGA	Postcard Announcing GSP Working Group public meeting #2	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/Public	N/A	10/12/2020
SCGA	Announcement of Public Meeting #2 to SCGA Interested Party List	Email	SCGA staff	Interested Parties/Stakeholders	N/A	10/13/2020
SCGA	Promotion of Public Meeting #2	planned E-blasts & social media accounts	Sacramento County Farm Bureau staff	Sacramento County Farm Bureau members/ Interested Parties	N/A	10/14/20 10/28/20 11/5/2020
SCGA	GSP development update. Groundwater Sustainability Plan Consultant Contract Amendments	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	10/14/2020
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	12/9/2020
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	2/10/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SCGA	English and Spanish postcards announcing public meeting #3 to SCGA interested parties without email addresses	USPS	SCGA staff	Interested Parties	N/A	3/3/2021
SCGA	English and Spanish postcards announcing SASb GSPWG public meeting #3	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/public	N/A	3/4/2021
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	3/10/2021
SCGA	Noticed SASb Working Group public meeting.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	3/25/2021
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	4/14/2021
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	5/12/2021
SCGA	Notification of SASb WG Mtg #15	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/P	N/A	5/12/2021
SCGA	Notification of SASb WG Mtg #16	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/P	N/A	6/16/2021
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	6/22/2021
SCGA	Availability of public draft SASb GSP	Link to document on SCGA website homepage	SCGA staff	Interested Parties/Stakeholders/Public	N/A	6/23/2021
SCGA	Notification of availability of Public Draft SASb GSP	SCGA Email Dist. List	SCGA staff	Interested Parties/Stakeholders	N/A	6/24/2021
SCGA	English and Spanish postcards announcing SASb GSPWG public meeting #4	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/Public	N/A	6/28/2021
SCGA	English and Spanish postcards announcing public meeting #4 to SCGA interested parties without email addresses	USPS	SCGA staff	Interested Parties	N/A	6/28/2021
SCGA	Notification of SASb WG Mtg #17	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/Public	N/A	7/14/2021
SCGA	Noticed SASb Working Group public meeting.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	7/15/2021
SCGA	GSP development update. Vulnerable well protection program.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	8/11/2021
SCGA	Notification of SASb WG Mtg #18	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/Public	N/A	8/17/2021
SCGA	Notification of SASb WG Mtg #19	Posted to SCGA website	SCGA staff	Interested Parties/Stakeholders/Public	N/A	9/15/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SCGA	GSP development update.	SCGA Board Meeting	SCGA staff	Interested Parties/Stakeholders	N/A	10/13/2021
SCGA	GSP development updates.	Monthly presentations	SCGA Conservation Landowner Representative	Habitat 2020 and executive committee members of ECOS	N/A	January 2020-October 2021
Omochumne-Hartnell Water District (OHWD)	Mailing to all residences in the OHWD water district about the July 23, 2020 GSP development public meeting	USPS	OHWD staff	Stakeholders	N/A	7/9/2020
OHWD	Mailing to all residences in the OHWD GSA about the March 25, 2021 GSP development public meeting	USPS	OHWD staff	Stakeholders	N/A	3/11/2021
OHWD	Mailing to all residences in the OHWD GSA about the November 5, 2020 GSP development public meeting	USPS	OHWD staff	Stakeholders	N/A	10/24/2020
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	12/15/2020
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	1/19/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	2/16/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	3/16/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	4/20/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	5/18/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	6/15/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	7/20/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	8/17/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	9/21/2021
OHWD	SASb GSP development	OHWD Board Meeting	OHWD staff	Interested Parties/Stakeholders	N/A	10/19/2021
Sloughhouse Resource Conservation District (SRCD)	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	7/8/2020
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	8/12/2020
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	9/9/2020
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	10/14/2020
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	11/11/2020
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	12/9/2020
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	1/13/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	2/10/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	3/10/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	4/14/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	5/12/2021
SRCD	Ag. Res. Public Workshop Announcement	SRCD E-Mailing List	SRCD Staff	Interested Parties/Stakeholders	112	5/20/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	6/9/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	7/14/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	8/11/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	8/25/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	9/8/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	9/22/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	10/13/2021
SRCD	SASb GSP Development	SRCD Board Meeting	SRCD Staff	Interested Parties/Stakeholders	N/A	10/20/2021
County of Sacramento (County)	Adopt Sacramento County Groundwater Management Principles To Ensure Local Compliance With The Sustainable Groundwater Management Act Of 2014	Sacramento County Board of Supervisors	County staff	General Public	N/A	11/10/2015
County	Adopt Sacramento County Groundwater Management Principles To Ensure Local Compliance With The Sustainable Groundwater Management Act Of 2014 (Continued From November 10, 2015 Item No. 40)	Sacramento County Board of Supervisors	County staff	General Public	N/A	3/22/2016
County	Sustainable Groundwater Management Act Update	Sacramento County Board of Supervisors	County staff	General Public	N/A	4/5/2016
County	Update On Compliance With The Sustainable Groundwater Management Act In Sacramento County	Sacramento County Board of Supervisors	County staff	General Public	N/A	12/13/2016
County	Report Back On Implementation Of The Sustainable Groundwater Management Act And Funding Resources To Assist With Activities In The Sub-Basins (December 13 2016; Item 56)	Sacramento County Board of Supervisors	County staff	General Public	N/A	3/1/2017

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
County	Public Hearing To Consider Adopting A Resolution Accepting Groundwater Sustainability Agency Responsibility For Subbasin Areas Within Sacramento County Remaining Unmanaged On June 30, 2017	Sacramento County Board of Supervisors	County staff	General Public	N/A	4/11/2017
County	Accept GSA Responsibility For Overlap Areas In Sacramento County In The Event That The Alternative Submittal Is Withdrawn Or Denied	Sacramento County Board of Supervisors	County staff	General Public	N/A	9/26/2017
County	Update On Compliance With The Sustainable Groundwater Management Act	Sacramento County Board of Supervisors	County staff	General Public	N/A	12/17/2019
County	Update On Compliance With The Sustainable Groundwater Management Act	Sacramento County Board of Supervisors	County staff	General Public	N/A	10/20/2020
County	Postcard announcing 7/23/20 public meeting to all parcels in Sacramento County GSA area	USPS	County staff	Stakeholders	N/A	7/15/2020
South American Subbasin Working Group (SASb WG)	**SASb WG Mtg #1**: introductions, expectations, success factors, barriers to success, guiding principles and Partnering Commitment	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	5/15/2020

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #2**: Management / Governance, Overview of Draft Master Meeting Schedule, Continued Sustainability Goal discussions, Received updates on CoSANA Model and data needs, Requested data and information for incorporation in model, C&E Near Term Priorities	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	6/5/2020
SASb WG	**SASb WG Mtg #3**: Management / Governance, introductory information regarding Water Quality Sustainable Management Criteria (SMC) development process, a preliminary list of constituents of concern (COCs), available data for COCs in the SASb, options regarding SMC development, and input needed from the GSP WG, Discussed preparations for first Public meeting, Presented new SASb GSP (sasbgroundwater.org) website, Reminded GSPWG members of their obligation to disseminate materials for the first public meeting and convey information back to their respective GSA	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	6/26/2020
SASb WG	Website to inform public about GSP development	SASb Website	GSP consultant	General Public	N/A	7/1/2020
SASb WG	GSP Working Group public kickoff meeting	Press release via Sacramento County Public Information Office	Sacramento County Public Information Officer	General Public	N/A	7/6/2020

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	GSP Working Group public kickoff meeting	Sacramento County Go Delivery Email Bulletin	SCGA staff	Interested Parties	5,600	7/7/2020
SASb WG	Postcard Announcing GSPWG Public Kickoff/Website	USPS/Email/SASb Website	GSP consultant staff	Interested Parties/Stakeholders/DACs/Tribal Contacts/General public	N/A	7/7/2020
SASb WG	**SASb WG Mtg #4**: Discussed status of Reclamation District (RD) No. 551 participation in the GSP process, status of negotiations with Northern Delta GSA, Water Quality Sustainable Management Criteria (SMC) development, options regarding SMC development, reviewed monitoring network options, reviewed available information on domestic well densities in SASb, Discussed outreach efforts by GSPWG members to distribute notices for the public meeting. Discussed GSPWG member participation in public meeting, Reviewed functionality of sasbgroundwater.org website portal	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	7/17/2020
SASb WG	**Public Meeting #1**: Management / Governance, Communication & Engagement, Introduction to Groundwater Sustainability Plan, GSP Development Schedule, Overview of GSP Content	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	7/23/2020

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	SASb WG Mtg #5: Discussed Public's request to attend GSP Working Group Meetings, GSPWG decided to open meetings, Ag-Res Public Meeting scheduled from 6:00 pm to 7:30 pm on August 6th	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	8/3/2020
SASb WG	**SASb Ag-Res Public Meeting**: Public Meeting #1 (July 23rd) Follow Up - GSP Working Group Inclusion • Modeling Workshop • Other Topics raised during meeting Requested Ag-Res Topics • Groundwater Levels • Ag-Res as beneficial users and uses • Communications & Engagement with AgRes Interested Parties	GSP Working Group Meeting	Administrative/GSP consultant staff	Ag-res stakeholders/Interested Parties/subbasin stakeholders	N/A	8/6/2020
SASb WG	**SASb WG Mtg #6**: Discussed the fact that Reclamation District (RD) No. 551 has recently joined Northern Delta Groundwater Sustainability Agency (GSA) as an Associate member, climate change information, Hydrogeologic Conceptual Model, Surface Water Depletion, Discussed outcomes from the special Ag-Res meeting	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	8/21/2020

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #7**: schedule for production and review of draft GSP chapters, Inter-basin coordination meetings, Groundwater Conditions, development of the CoSANA model, climate change methodology, Surface Water Depletion, Groundwater Dependent Ecosystems	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	9/11/2020
SASb WG	GSP Working Group public meeting #2	Press release via Sacramento County Public Information Office	Sacramento County Public Information Officer	General Public	N/A	10/13/2020
SASb WG	GSP Working Group public meeting #2	Sacramento County Go Delivery Email Bulletin	SCGA staff	Interested Parties	5,650	10/13/2020
SASb WG	English and Spanish postcard Announcing GSP Working Group public meeting #2	USPS/Email/SASb Website	GSP consultant staff	Interested Parties/Stakeholders/DACs/Tribal Contacts/General public	N/A	10/13/2020
SASb WG	GSP Working Group public meeting #2	SASb Email dist. list	SCGA staff	Interested Parties	N/A	10/13/2020
SASb WG	SASb WG Mtg #8: need to integrate the efforts in the Cosumnes and SASb in addressing surface water depletions and Groundwater Dependent Ecosystems, CoSANA model, historic water budget and baseline assumptions, Monitoring Network for the Surface Water Depletion (SWD) and GDE sustainability indicators	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	10/16/2020

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**Public Meeting #2**: SGMA GSP Process, GSA Formation History, Decision Making - Roles & Responsibilities, GSP Schedule and status, CoSANA Mode, Ag-Res Water Budget, SGMA requirements for GSP, Entities with Land Use Authority in SASb, – Opportunities for Interactions with Land Use Agency Entities	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	11/5/2020
SASb WG	**SASb WG Mtg #9**: key decisions that will need to be made during the development of the GSP, projected water demands and sources of supply, Monitoring Network for groundwater levels, SMC for groundwater levels, Comments received from the public during the GSPWG meeting, Lisa Beutler of Stantec introduced to assist with public outreach elements of the C&E Plan.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	11/12/2020

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #10**: status of key decisions to be made during the development of the GSP, draft GSP review process, development of governance structure and plan for GSP implementation, CoSANA model baseline assumptions, presentation was provided regarding the analytical approach being used to assess the vulnerability of shallow wells to changes in groundwater level, screening process that has been used to determine candidate wells for inclusion in a proposed groundwater level monitoring network	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	12/11/2020
SASb WG	Notification of SASb WG Mtg #11	SASb Email dist. list	SCGA staff	Interested Parties/Stakeholders	N/A	1/13/2021
SASb WG	**SASb WG Mtg #11**: results of CoSANA modeling work to describe current and projected water budgets for the SASb, projects and management actions, analysis of interconnected surface waters (ISWs) and groundwater dependent ecosystems (GDEs) in the SASb.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	1/15/2021
SASb WG	Notification of SASb WG Mtg #12	SASb Email dist. list	SCGA staff	Interested Parties/Stakeholders	N/A	2/17/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #12**: proposed option for setting Sustainable Management Criteria (SMC) for groundwater (GW) levels, projects and management actions that will be considered in the GSP and in the development of scenarios to be modeled using the CoSANA model, CoSANA modeling work to describe the impact of several Demand Reduction scenarios, status report was provided on the technical studies being formed to identify and assess groundwater dependent ecosystems.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	2/19/2021
SASb WG	Announcement of GSP Working Public Meeting #3	Press release via Sacramento County Public Information Office	Sacramento County Public Information Officer	General Public	N/A	3/3/2021
SASb WG	Announcement of GSP Working Public Meeting #3	Sacramento County Go Delivery Email Bulletin	SCGA staff	Interested Parties	5,550	3/3/2021
SASb WG	GSP Working Group public meeting #3	SASb Email dist. list	SCGA staff	Interested Parties	N/A	3/2/2021
SASb WG	English and Spanish postcard Announcing GSP Working Group public meeting #3	USPS/Email/SASb Website	GSP consultant staff	Interested Parties/Stakeholders/DACs/Tribal Contacts/General public	N/A	3/3/2021
SASb WG	Notification of SASb WG Mtg #13	SASb Email dist. list	SCGA staff	Interested Parties/Stakeholders	N/A	3/17/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #13**: comments on Section 1 and Sections 2.1 and 2.2 of the draft GSP that were circulated in January, 2021, Projects and Management Actions, g Sustainable Management Criteria (SMC) for groundwater (GW) levels, e status of inter-basin coordination meetings with the groups that are now preparing GSPs for the Yolo, Solano, Cosumnes and North American subbasins	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	3/19/2021
SASb WG	GSP Working Group public meeting #3 - Reminder	SASb Email dist. list	SCGA staff	Interested Parties	N/A	3/22/2021
SASb WG	**Public Meeting #3**: Why the South American Subbasin (SASb) GSP Matters – SASb boundary – Sustainable Groundwater Management Act, Groundwater Sustainability Agency (GSA) Formation History, Decision Making - Roles & Responsibilities, GSP Schedule and status, Current and Projected Groundwater Conditions, Projects and Management Actions, Presentation on GSP Implementation - SGMA requirements, GSP Implementation Costs, Possible Agricultural-Residential (Ag-Res) survey, Upcoming special meetings: Farm Bureau and Ag-Res groups	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	3/25/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	Notification of SASb WG Mtg #14	SASb Email dist. list	SCGA staff	Interested Parties/Stakeholders	N/A	4/14/2021

SASb WG	**SASb WG Mtg #14**: GSP Master Meeting Schedule; proposed response to comments received from GSPWG members on Section 1 and Sections 2.1 and 2.2 of the draft GSP, status report was provided regarding the work by SCGA staff and facilitators from Stantec to develop a governance structure and cost sharing plan for GSP implementation, status report was also provided indicating that the consultant team was working on a structure for a shallow well protection program to be considered as a proposed element of the GSP; history and current status of the basin with regard to groundwater storage volumes and groundwater levels; presentation of future projected conditions; overview of the materials contained in the draft of Section 3 of the GSP; overview of the work that is ongoing by SCGA to set rates to cover GSP implementation costs; presentation on Harvest Water Project; GSA representatives were reminded to be documenting all communication and engagement activities that are occurring at their GSAs, including Board meetings.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	4/16/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	Notification of SASb WG Mtg #15	SASb Email dist. list	SCGA staff	Interested Parties/Stakeholders	N/A	5/12/2021

SASb WG	**SASb WG Mtg #15:** GSP Master Meeting Schedule; GSPWG members were reminded to provide comments on the draft of GSP Section 3; status report regarding the consultant team and SCGA staff efforts to develop a structure for a shallow/vulnerable well protection program to be considered as a proposed management action under the GSP; review of performed to date to assess future projected conditions, review of the status of modeling scenarios developed and run using the CoSANA model to assess the influence of planned Projects and Management Actions on future conditions of groundwater storage and level in the SASb; overview of the materials contained in the draft of Sections 4 and 5 of the GSP; summary of the GDE technical analysis; Harvest Water Project benefits and proposed measurable objectives and interim milestones as requested for incorporation into the GSP to reflect future improvements to groundwater levels in the project area and to help ensure that the Harvest Water project benefits will be maintained; GSA representatives were reminded to be documenting all GSP	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	5/14/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
	communication and engagement activities that are occurring at their GSAs, including Board meetings.					
SASb WG	Notification of SASb AG Res/ Vulnerable Well Owner Special Workshop	SASb Email dist. list	SCGA staff	Interested Parties/Stakeholders	N/A	5/20/2021
SASb WG	**SGMA & GSP 101, Subbasin Status, SASb - AG Res/ Shallow Well Owner Implications, Introduction**: Approaches for Maintaining Reliability, GSP Implementation & Fiscal Impacts & Next Steps	Ag-res/Vulnerable well owner Groundwater Sustainability Workshop	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	5/25/2021
SASb WG	Notification of SASb WG Mtg #16	SASb Email dist. list	SCGA staff	Interested Parties/Stakeholders	N/A	6/16/2021

SASb WG	**SASb WG Mtg #16**: GSP Master Meeting Schedule, proposed response to comments received from GSPWG members on Section 1 and Sections 2.1 and 2.2 of the draft GSP prior to the meeting, status report was also provided indicating that the consultant team was working on a structure for a shallow well protection program to be considered as a proposed element of the GSP, review the work performed to date to assess the history and current status of the basin with regard to groundwater storage volumes and groundwater levels, future projected conditions, overview of the materials contained in the draft of Section 3 of the GSP - Sustainable Management Criteria for groundwater levels, groundwater storage, stream depletion and groundwater quality, overview of the work that by SCGA to set rates to cover GSP implementation costs, e status of inter-basin coordination meetings with the groups that are now preparing GSPs for the Yolo, Solano, Cosumnes and North American subbasins, GSA representatives were reminded to be documenting all	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	6/18/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
	communication and engagement activities that are occurring at their GSAs, including Board meetings.					
SASb WG	Announcement of GSP Working Public Meeting #4	Sacramento County Go Delivery Email Bulletin	SCGA staff	Interested Parties	5,460	6/28/2021
SASb WG	GSP Working Group public meeting #4	SASb Email dist. list	SCGA staff	Interested Parties	N/A	6/28/2021
SASb WG	English and Spanish postcards announcing SASb GSPWG public meeting #4	USPS/Email/SASb Website	GSP consultant staff	Interested Parties/Stakeholders/DACs/Tribal Contacts/General public	N/A	6/28/2021
SASb WG	Announcement of GSP Working Public Meeting #4	Press release via Sacramento County Public Information Office	Sacramento County Public Information Officer	General Public	N/A	7/13/2021
SASb WG	Reminder announcement of GSP Working Public Meeting #4	Sacramento County Go Delivery Email Bulletin	SCGA staff	Interested Parties	5,460	7/13/2021
SASb WG	Reminder of GSP Working Group public meeting #4	SASb Email dist. list	SCGA staff	Interested Parties	N/A	7/13/2021
SASb WG	Posting of SASb WG Mtg #17	SASb Email dist. list	SCGA staff	Interested Parties	N/A	7/14/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**Public Meeting #4**: GSP Master Meeting Schedule, SGMA Overview - Groundwater Sustainability Agencies (GSAs) and GSPs, Medium Priority GSP Schedule, Sustainability Indicators; GSP – Highlights of Key Elements - CoSANA model, Water Budgets and GW Levels, PMAs – planned, Model scenarios – future conditions/climate change - basin is sustainable into the future, Shallow/vulnerable well analysis, Monitoring network – SMC; GSP Implementation by GSAs - Monitoring/reporting, 5-year GSP updates, Ongoing outreach and engagement, Coordination – other basins, land use entities, water supply entities, water bank, Vulnerable well protection – monitoring, mitigation, Fees; Questions, Comments and Discussion Related to GSP Section 5; Well Monitoring and Well Protection Concepts.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	7/15/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #17**: GSP Master Meeting Schedule, reminder that the draft GSP was released for public and GSPWG comment on June 18. Comment deadline was August 18 to allow the consultant team time to address comments in a final draft GSP; elements of a Shallow/Vulnerable Well Protection Program as a SASb GSP management action; re-visited the GSP implementation actions described in Section 5 of the draft GSP and asked that GSAs carefully consider those actions and associated costs; e development of a sustainable yield estimate; discussed in the ongoing inter-basin coordination meetings; GSA representatives were reminded to be documenting all GSP communication and engagement activities that are occurring at their GSAs, including Board meetings; review of topics covered and input received at the fourth SASb GSP public meeting held on July 15th	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	7/16/2021
SASb WG	Posting of SASb WG Mtg #18	SASb Email dist. list	SCGA staff	Interested Parties	N/A	8/17/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #18**: GSP Master Meeting Schedule, review of revised Section 4.7.1 in the draft GSP which describes the elements of a Shallow/Vulnerable Well Protection Program as a SASb GSP management action; summarized the major comments received to date on the draft GSP; development of the data management system; update on inter-basin coordination meetings; GSA representatives were reminded by Lisa Beutler to be documenting all GSP communication and engagement activities that are occurring at their GSAs, including Board meetings.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	8/20/2021
SASb WG	Posting of SASb WG Mtg #19	SASb Email dist. list	SCGA staff	Interested Parties	N/A	9/15/2021

Jurisdiction	Topics covered in outreach	Outreach Method	Presenter	Audience	#	Date
SASb WG	**SASb WG Mtg #19**: GSP Master Meeting Schedule, Post GSP Implementation, Governance Process –Status & Schedule, GSA Board meetings to consider GSP; GSP Implementation – Well Protection Program – comments received on revised text in Section 4; Major Comments received on Draft GSP – proposed responses; Inter-basin Coordination update; C&E Near Term Priorities – Outreach tracking by GSAs; Upcoming October 11 small group introductory meeting – volunteer monitoring network for Ag-Res wells.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	9/17/2021
SASb WG	Posting of SASb WG Mtg #20	SASb Email dist. list	SCGA staff	Interested Parties	N/A	10/13/2021
SASb WG	**SASb WG Mtg #20:** Post GSP Implementation Governance Process - Draft MOU content, Schedule; GSA Board meetings to consider/approve Final GSP – RD 551 check-in; Final GSP Production – Status Report; CoSANA Model report/appendix; Inter-basin Coordination update; C&E implementation - Outreach tracking by GSAs – Additions to Draft Table; Report back from October 11 small group introductory meeting – volunteer monitoring network for Ag-Res wells.	GSP Working Group Meeting	Administrative/GSP consultant staff	Interested Parties/Stakeholders	N/A	10/15/2021
				TOTAL	152	

Appendix 1-F

DWR Groundwater Sustainability Plan Elements Guide

Article 5.			Plan Contents for South American Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.			**Introduction to Plan Contents**					
			This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
SubArticle 1.			**Administrative Information**					
§ 354.2.			**Introduction to Administrative Information**					
			This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.4.			**General Information**					
			Each Plan shall include the following general information:					
(a)			An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin.	34:63	ES			
(b)			A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.	423:432	6.0			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
§ 354.6.			**Agency Information**					
			When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:					
(a)			The name and mailing address of the Agency.	70:74	1.4.1.1:1.4.1.6			
(b)			The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.	74:76	1.4.2.1:1.4.2.3			
(c)			The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.	74	1.4.2.1			
(d)			The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan.	76:77	1.4.3			
(e)			An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.	416:418,418:419	5.2,5.4		5-2	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.8, 10727.2, and 10733.2, Water Code.					
§ 354.8.			**Description of Plan Area**					
			Each Plan shall include a description of the geographic areas covered, including the following information:					
(a)			One or more maps of the basin that depict the following, as applicable:					

Article 5. **Plan Contents for South American Basin**

				GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.	84:88	2.1,2.1.1:2.1.2	2.1-1:2.1-3		1) Figure 2.1-1 shows the general SASb plan area. 2) Figure 2.1-2 shows the SASb subbasin and other adjacent basins. 3) Figure 2.1-3 shows the GSAs in the SASb.
	(2)		Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.	86,88	2.1.2.1	2.1-3		1) Figure 2.1-3 shows map of other Agencies within the basin.
	(3)		Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.	89,91,94	2.1.2.1, 2.1.2.3, 2.1.2.5	2.1-4, 2.1-6	2.1-2	1) Figure 2.1-6 shows Federal and State lands in the SASb. 2) Figure 2.1-4 shows cities and counties in the SASb. 3) Table 2.1-2 lists the municipal water purveyors of the SASb in year 2018.
	(4)		Existing land use designations and the identification of water use sector and water source type.	93:101, 259:266	2.1.2.6, 2.1.4, 2.4.2.1:2.4.2.2	2.1.6:2.1-8, 2.4-3:2.4-8	2.1-2, 2.1-5, 2.4-2:2.4-8	1) Figure 2.1-7 shows the agricultural land use designations. 2) Figure 2.1-8 shows land use by water use and water source type. 3) Figure 2.1-5 shows the regional watersheds. 4) Table 2.1-2 lists the municipal water purveyors of the SASb in year 2018.
	(5)		The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.	97:101	2.1.2.7	2.1-9:2.1-11		1) Figure 2.1-9 shows number/depth of DOMESTIC wells in SASb. 2) Figure 2.1-10 shows number/depth of PRODUCTION wells in SASb. 3) Fgure 2.1-11 shows number/depth of PUBLIC wells in SASb.
(b)			A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.	86:89	2.1, 2.1.1:2.1.2, 2.1.2.1	2.1-1:2.1-4		1) Figure 2.1-1 shows the general SASb plan area. 2) Figure 2-2 shows the SASb subbasin and other adjacent basins. 3) Figure 2-3 shows map of other Agencies within the basin. 4) Figure 2-4 shows cities and counties in the SASb.
(c)			Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.	101:151	2.1.4:2.1.12	2.1-12:2.1-28	2.1-5:2.1-23	
(d)			A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.	136:142	2.1.9			
(e)			A description of conjunctive use programs in the basin.	141,187:188,368:384	2.1.9.9, 2.3, 4.3:4.5	4-2:4-5	4-1	
(f)			A plain language description of the land use elements or topic categories of applicable general plans that includes the following:					
	(1)		A summary of general plans and other land use plans governing the basin.	142:143,407	2.1.10, 5.0		2.1-18:2.1-22	
	(2)		A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects	407	5.0			

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(3)		A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.	407	5.0			
	(4)		A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.	139	2.1.9.6			1) The Sacramento County Environmental Management Wells Program is responsible for authorizing the construction, modification, repair, inactivation, or destruction of wells in Sacramento County This has been amended to clarify that this is performed "via a permit and inspection process"
	(5)		To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.	N/A				No known impacts of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.
(g)			A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.	N/A				All plan elements are discussed in the GSP.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10720.3, 10727.2, 10727.4, 10733, and 10733.2, Water Code.					
§ 354.10.			**Notice and Communication**					
			Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:					
(a)			A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.	78:81	1.5.3,1.5.3.1:1.5.3.2		1-3	This information is addressed in section 1.5, where various means of communication such as public meetings, surveys, mail, emails, and public hearings were utilized to reach groups throughout the SASb.
(b)			A list of public meetings at which the Plan was discussed or considered by the Agency.	81, 746	1.5.3.2		1-4	1) Table 1-4 lists the individual GSA websites, meeting frequency, and meeting dates. 2) Appendix I-E
(c)			Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.	794				Appendix 1-G
(d)			A communication section of the Plan that includes the following:					
	(1)		An explanation of the Agency's decision-making process.	77:78	1.5.2			
	(2)		Identification of opportunities for public engagement and a discussion of how public input and response will be used.	78:81	1.5			
	(3)		A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.	78:81	1.5			
	(4)		The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.	78:81	1.5			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.8, 10728.4, and 10733.2, Water Code					
SubArticle 2.			**Basin Setting**					
§ 354.12.			**Introduction to Basin Setting**					

Article 5.			Plan Contents for South American Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
			This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.14.			**Hydrogeologic Conceptual Model**					
(a)			Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin.	153:187	2.2			
(b)			The hydrogeologic conceptual model shall be summarized in a written description that includes the following:					
	(1)		The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.	153	2.2.1			
	(2)		Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.	172:173	2.2.5.1			
	(3)		The definable bottom of the basin.	173	2.2.5.3			
	(4)		Principal aquifers and aquitards, including the following information:					
		(A)	Formation names, if defined.	173:174	2.2.6, 2.2.6.1:2.2.6.2			
		(B)	Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.	172:176	2.2.5:2.2.6			
		(C)	Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.	156:176	2.2.3:2.2.6			
		(D)	General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.	176	2.2.7			
		(E)	Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.	173:174, 97	2.2.6, 2.2.6.1:2.2.6.2, 2.1.2.7	2.1-9:2.1-11		1) Figure 2.1-9 shows number/depth of DOMESTIC wells in SASb. 2) Figure 2.1-10 shows number/depth of PRODUCTION wells in SASb. 3) Fgure 2.1-11 shows number/depth of PUBLIC wells in SASb.
	(5)		Identification of data gaps and uncertainty within the hydrogeologic conceptual model	184:187	2.2.9			
(c)			The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.	161:167	2.2.3.1	2.2-33:2.2-39		1) The cross sections derived from the CoSANA model layers are shown individually in Figures 2.2-33 to Figures 2.2-39.
(d)			Physical characteristics of the basin shall be represented on one or more maps that depict the following:					

Article 5.			Plan Contents for South American Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		Topographic information derived from the U.S. Geological Survey or another reliable source.	180	2.2.8.1	2.2-42		1) Figure 2.2-42 shows the SASb topography
	(2)		Surficial geology derived from a qualified map including the locations of cross-sections required by this Section.	162:163		2.2-34:2.2-35		1) Figure 2.2-6 shows cross section D-D'. 2) Figure 2.2-7 shows cross section H-H'.
	(3)		Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies.	185:186	2.2.8.4	2.2-45:2.2-46		1) Figure 2.2-45 shows soils of the SASb. 2) Figure 2.2-46 shows the hydrologic soil groups
	(4)		Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.	183	2.2.8.4	2.2-44		1) Figure 2.2-44 shows recharge areas, seeps, and springs
	(5)		Surface water bodies that are significant to the management of the basin.	181	2.2.8.2	2.2-43		1) Figure 2.2-43 shows SASb surface water bodies.
	(6)		The source and point of delivery for imported water supplies.	179	2.2.8			1) There are no imported water supplies
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10733, and 10733.2, Water Code.					
§ 354.16.			**Groundwater Conditions**					
			Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:					
(a)			Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:					
	(1)		Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.	209:217	2.3.1	2.3-19:2.3-26		1) Figures 2.3-19:2.3-24 show groundwater elevations for Fall 1977, Fall 1986, Fall 2005, and Fall 2015. 2) Figures 2.3-23:2.3-26 show seasonal groundwater contour maps for both elevation and depth to water for Fall 2019 and Spring 2019.
	(2)		Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.	197:207	2.3.1	2.3-6:2.3-18		1) Figure 2.3-6 shows location of wells with measured groundwater levels since 2018. 2) Figures 2.3-7:2.3-14 show hydrographs of groundwater levels from 1970 to 2020 in selected wells. 3) Figure 2.3-15 shows multiple completion wells. 4) Figures 2.3-16:2.3-20 show combined and cluster well hydrographs.
(b)			A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.	218	2.3.2	2.3-27		1) Figure 2.3-27 shows Groundwater Storage by Year, Water Year Type, and Cumulative Water Volume
(c)			Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.	218:219	2.3.3			1) Seawater intrusion is not considered to be a problem for the SASb.
(d)			Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.	219:233, 118:136	2.3.4, 2.1.8	2.3-28:2.3-38, 2.1-18		1) Figures 2.3-30:2.3-40 show data for nitrate, TDS, arsenic, hexavalent chromium, and PFAS 2) Figure 2.1.18 shows the known contaminant plumes known since 2008.
(e)			The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	234:236	2.3.5	2.3-39:2.3-40		1) land subsidence is not known to be a historically or currently significant in the SASb. Figures 2.3-39:2.3-40 show vertical displacement

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(f)			Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	236:238	2.3.6	2.3-45		1) Figure 2.3-45 shows seasonally averaged ISW depletion estimated by CoSANA at ISW designated reaches. The black line represents historical to near present-day conditions.
(g)			Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.	241:244	2.3.7	2.3-47		1) Figure 2.3-47 shows GDE likelihood classification of potential GDEs from 2005-2018.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, and 10733.2, Water Code.					
§ 354.18.			**Water Budget**					
(a)			Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.	245:274	2.4			
(b)			The water budget shall quantify the following, either through direct measurements or estimates based on data:					
	(1)		Total surface water entering and leaving a basin by water source type.	245:251	2.4.1	2.4-1		1) Figure 2.4-1 shows the sources of water entering and leaving the SASb
	(2)		Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.	245:251	2.4.1	2.4-1		1) Figure 2.4-1 shows the sources of water entering and leaving the SASb
	(3)		Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.	245:251	2.4.1	2.4-1		1) Figure 2.4-1 shows the sources of water entering and leaving the SASb
	(4)		The change in the annual volume of groundwater in storage between seasonal high conditions.	188:207, 259:263	2.3.1, 2.4.2.1	2.3-6:2.3-18	2.4-8	1) Figure 2.3-6 shows location of wells with measured groundwater levels since 2018. 2) Figures 2.3-7:2.3-14 show hydrographs of groundwater levels from 1970 to 2020 in selected wells. 3) Figure 2.3-15 shows multiple completion wells. 4) Figures 2.3-16:2.3-18 show combined and cluster well hydrographs. 1) Table 2.4-8 lists the groundwater storage and change in groundwater storage as a function of water year type (i.e., dry, wet, etc.)
	(5)		If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.	320:321	3.3.2			The basin has historically avoided overdraft.
	(6)		The water year type associated with the annual supply, demand, and change in groundwater stored.	266	2.4.2.1		2.4-8	1) Table 2.4-8 lists the groundwater storage and change in groundwater storage as a function of water year type (i.e., dry, wet, etc.)
	(7)		An estimate of sustainable yield for the basin.	274:279	2.5.2			
(c)			Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:					

Article 5.			Plan Contents for South American Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.	263:266	2.4.2.2	2.4-6:2.4-8		1) Figures 2.4-6:2.4-8 show the current inflows and outflows of the SASb for stream and canal systems, land surface system, and groundwater system.
	(2)		Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:					
		(A)	A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.	259:263	2.4.2.1	2.4-3:2.4-5		1) Figures 2.4-3:2.4-5 show the historical inflows, outflows, and water budget of the SASb for stream and canal systems, land surface system, and groundwater system.
		(B)	A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.	259:263	2.4.2.1	2.4-3:2.4-5		1) Figures 2.4-3:2.4-5 show the historical inflows, outflows, and water budget of the SASb for stream and canal systems, land surface system, and groundwater system.
		(C)	A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.	259:263	2.4.2.1		2.4-8	1) Table 2.4-8 shows that is an overall increase in groundwater storage averaged over 10 years.
	(3)		Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:					
		(A)	Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.	249:251, 267:273	2.4.1.3.3, 2.4.2.3, 2.4.2.4	2.4-9:2.4-14	2.4-1	1) Baseline conditions are summarized in Table 2.4-1. 2) Figures 2.4-9:2.4-11 show projected conditions for water resources without climate change impacts. 3) Figures 2.4-12:2.4-14 show projected conditions for water resources with climate change impacts.
		(B)	Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.	249:251, 267:273	2.4.1.3.3, 2.4.2.3, 2.4.2.4	2.4-9:2.4-14	2.4-1	1) Baseline conditions are summarized in Table 2.4-1. 2) Figures 2.4-9:2.4-11 show projected conditions for water resources without climate change impacts. 3) Figures 2.4-12:2.4-14 show projected conditions for water resources with climate change impacts.

Article 5.			Plan Contents for South American Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(C)	Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.	249:251, 267:273	2.4.1.3.3, 2.4.2.3, 2.4.2.4	2.4-9:2.4-14	2.4-1	1) Baseline conditions are summarized in Table 2.4-1. 2) Figures 2.4-9:2.4-11 show projected conditions for water resources without climate change impacts. 3) Figures 2.4-12:2.4-14 show projected conditions for water resources with climate change impacts.
(d)			The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:					
	(1)		Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.	267:273	2.4.2:2.4.2.1		2.4-5:2.4-7	1) Tables 2.4-2:2.4-4 shows the historical, current, and projected water budget (with and without climate change) considering all inflows and outflows of all water resources.
	(2)		Current water budget information for temperature, water year type, evapotranspiration, and land use.	251:255, 263:266	2.4.2, 2.4.2.2		2.4-5:2.4-7	1) Tables 2.4-2:2.4-4 shows the historical, current, and projected water budget (with and without climate change) considering all inflows and outflows of all water resources.
	(3)		Projected water budget information for population, population growth, climate change, and sea level rise.	251:255, 267:273	2.4.2, 2.4.2.3:2.4.2.5		2.4-5:2.4-7	1) Tables 2.4-2:2.4-4 shows the historical, current, and projected water budget (with and without climate change) considering all inflows and outflows of all water resources.
(e)			Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.	251:274	2.4.1:2.4.2			1) This section describes the assumptions associated with water budget projection using the best available information. Water budget projection was performed using the CoSANA model, a fully integrated surface and groundwater flow model that covers the entire South American Subbasin as well as the adjoining North American and Cosumes Subbasins
(f)			The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.	248:249	2.4.1.2			1) The CoSANA model, a fully integrated surface and groundwater flow model that covers the entire South American Subbasin as well as the adjoining North American and Cosumes Subbasins, was used to develop the water budget.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10727.6, 10729, and 10733.2, Water Code.					
§ 354.20.			**Management Areas**					
(a)			Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.	N/A				Currently no additional management areas are needed to facilitate plan implementation.

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(b)			A basin that includes one or more management areas shall describe the following in the Plan:					
	(1)		The reason for the creation of each management area.	N/A				Currently no additional management areas are needed to facilitate plan implementation.
	(2)		The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.	N/A				Currently no additional management areas are needed to facilitate plan implementation.
	(3)		The level of monitoring and analysis appropriate for each management area.	N/A				Currently no additional management areas are needed to facilitate plan implementation.
	(4)		An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.	N/A				Currently no additional management areas are needed to facilitate plan implementation.
(c)			If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.	N/A				Currently no additional management areas are needed to facilitate plan implementation.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
SubArticle 3.			**Sustainable Management Criteria**					
§ 354.22.			**Introduction to Sustainable Management Criteria**					
			This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.24.			**Sustainability Goal**					
			Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.	281:282	3.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10727, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.26.			**Undesirable Results**					
(a)			Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.	282:294	3.2			
(b)			The description of undesirable results shall include the following:					

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.	283:284, 287, 288:289, 291,293	3.2.1.1, 3.2.2.1, 3.2.3.2, 3.2.4.1, 3.2.5.1			
	(2)		The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.	284:285,287,288:289, 291:292,293:294	3.2.1.2, 3.2.2.2, 3.2.3.1, 3.2.4.2, 3.2.5.2			
	(3)		Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.	285:286, 287, 289, 291	3.2.1.3, 3.2.2.3, 3.2.3.3, 3.2.4.3, 3.2.5.3			
(c)			The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.	N/A				1) Minimum thresholds discussed in Section 3.3. 2) Criteria to define minimum thresholds defined sections 3.2.1.2, 3.2.2.2, 3.2.3.1, 3.2.4.2, 3.2.5.2.
(d)			An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.	280	3.0			1) Seawater intrusion does not apply to the SASb
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.28.			**Minimum Thresholds**					
(a)			Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.	294:325	3.3			
(b)			The description of minimum thresholds shall include the following:					
	(1)		The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.	294:325	3.3.1:3.3.5			
	(2)		The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.	294:325	3.3.1:3.3.5			
	(3)		How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.	294:317	3.3.1.1:3.3.1-2			
	(4)		How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	317, 321:323	3.3.1.3, 3.3.3			

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	(5)		How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.	294:325	3.3.1:3.3.5			
	(6)		How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.	317, 321:323	3.3.1.3, 3.3.3			
(c)			Minimum thresholds for each sustainability indicator shall be defined as follows:					
	(1)		Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:					
		(A)	The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.	297:315	3.3.1.2	3-1:3-6, 3-8, 3-11:3-12		1) Figure 3-1 shows MTs, MOs, and IMs at 8 example RMPs in the GSP groundwater elevation monitoring network. 2) Figure 3-2 shows Seasonal, 4 year running mean interpolated groundwater elevations in the South American Subbasin from spring 2005 to fall 2019. 3) Figure 3-3 shows Seasonal summary of interpolated groundwater elevations. 4) Figure 3-4 shows Groundwater elevation measured at all 37 RMPs in the Basin. 5) Figure 3-5 shows the impact of projected groundwater management and climate change on vulnerable wells. 6) Figure 3-6 shows impact of projected groundwater management and climate change on GDE areas. 7) Figure 3-8 shows impact of projected groundwater management and climate change on ISW reach length. 8) Figure 3-11 shows seasonally averaged ISW depletion estimated by CoSANA at ISW designed reaches.
		(B)	Potential effects on other sustainability indicators.	320:321, 323:324	3.3.2, 3.3.4			1) Groundwater level is directly related to groundwater storage and ISW depletion and be used as a proxy for these indicators.
	(2)		Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.	320:321	3.3.2	3-16		1) Figure 3-16 shows the impact of projected groundwater management and climate change on groundwater storage.
	(3)		Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:					
		(A)	Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.	N/A				1) Seawater intrusion does not apply to the SASb
		(B)	A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.	N/A				1) Seawater intrusion does not apply to the SASb

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	(4)		Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.	321:323	3.3.3		3-5	1) Maximum Threshold for Degraded Groundwater Quality is discussed instead of minimum threshold for degraded groundwater quality. 2) Table 3-5 shows Constituents of concern and the associated maximum thresholds. Maximum thresholds also include no more than 10% of wells exceeding the maximum threshold for concentration listed here.
	(5)		Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:					
		(A)	Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.	324:325	3.3.5			
		(B)	Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.	234:236	2.3.5	2.3-39: 2.3-40		1) Figure 2.3-41 shows land subsidence from data for 2005 - 2020 from single CGPS (Continuous Global Positioning System) station in the Subbasin (UNAVCO station #P274).
	(6)		Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:					
		(A)	The location, quantity, and timing of depletions of interconnected surface water.	307:312	3.3.1.2	3-7, 3-10:3-11	3-3	1) Figure 3-7 shows probable ISW and Probable Disconnected stream nodes. 2) Figure 3-10 shows probable ISW reaches by name, Probable Disconnected reaches, and GSAs in the Basin. 3) Figure 3-11 shows seasonally averaged ISW depletion estimated by CoSANA at ISW designated reaches. 4) Table 3-3 shows October - December simulated streamflow for the American, Cosumnes, and the Sacramento rivers under current conditions (baseline) and projected scenarios.
		(B)	A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.	248:249	2.4.1.2			1) The CoSANA model, a fully integrated surface and groundwater flow model that covers the entire South American Subbasin as well as the adjoining North American and Cosumes Subbasins, was used to develop the water budget.

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(d)			An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.	320:321,323:324	3.3.2, 3.3.4			1) Groundwater level is directly related to groundwater storage and ISW depletion and be used as a proxy for these indicators.
(e)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.	280	3.0			1) Seawater intrusion does not apply to the SASb
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10733, 10733.2, and 10733.8, Water Code.					
§ 354.30.			**Measurable Objectives**					
(a)			Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.	316, 325:334	3.3.1.3, 3.4		3-4, 3-6	1) Table 3-4 lists the IM, MO for groundwater level decline, storage, and ISW depletion. 2) Table 3-6 lists the MO's for degraded groundwater quality. 3) Seawater intrusion is not significant in the SASb. 4) Land is not significant in the SASb and the MO is to maintain current ground surface elevations.
(b)			Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.	316, 325:334	3.3.1.3, 3.4	3-17:3-21	3-4, 3-6	1) Table 3-4 lists the IM, MO for groundwater level decline, storage, and ISW depletion. 2) Table 3-6 lists the MO's for degraded groundwater quality. 3) Seawater intrusion is not significant in the SASb. 4) Land is not significant in the SASb and the MO is to maintain current ground surface elevations.
(c)			Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.	316	3.3.1.3		3-4	1) Table 3-4 lists the operational flexibility for groundwater level decline, storage, and ISW depletion. Operational flexibility is not applicable for groundwater quality, land subsidence, and seawater intrusion.
(d)			An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.	320:321,323:324	3.3.2, 3.3.4			1) Groundwater level is directly related to groundwater storage and ISW depletion and be used as a proxy for these indicators.
(e)			Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.	325:334, 411:413	3.4, 5.1.5			
(f)			Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.	N/A				1) There are no additonal plan elements to discuss
(g)			An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.	N/A				1) There are no MO's established that exceed the reasonable margin of operational flexibility.

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					
SubArticle 4.			**Monitoring Networks**					
§ 354.32.			**Introduction to Monitoring Networks**					
			This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.34.			**Monitoring Network**					
(a)			Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.	335:355	3.5.1:3.5.2	3-26:3-28		
(b)			Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:					
	(1)		Demonstrate progress toward achieving measurable objectives described in the Plan.	335:355	3.5.1:3.5.2			
	(2)		Monitor impacts to the beneficial uses or users of groundwater.	335:355	3.5.1:3.5.2			
	(3)		Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.	335:355	3.5.1:3.5.2			
	(4)		Quantify annual changes in water budget components.	335:355	3.5.1:3.5.2			
(c)			Each monitoring network shall be designed to accomplish the following for each sustainability indicator:					
	(1)		Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:					
		(A)	A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.	337:355	3.5.2	3-21:3-22		1) Figure 3-21 shows monitoring network for groundwater level, storage, and ISW depletion sustainability indicators. 2) Figure 3-22 shows Density of monitoring locations in the upper and lower zone of the principal aquifer.
		(B)	Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.	340	3.5.2	3-23		1) Figure 3-23 Monitoring frequency for representative monitoring points in the network for level, storage, and ISW depletion.
	(2)		Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.	320:321,323:324	3.3.2, 3.3.4			1) Groundwater level is directly related to groundwater storage and ISW depletion and be used as a proxy for these indicators.

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	(3)		Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.	280	3.0			1) Seawater intrusion does not apply to the SASb
	(4)		Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.	341:348	3.5.2	3-24:3-28	3-7:3-8	1) Figures 3-24:3-26 show the water quality monitoring wells in the upper and lower aquifer. 2) Tables 3-7:3-8 list information regarding the upper and lower aquifer layer water quality monitoring wells
	(5)		Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.	353:354	3.5.2			1) Subsidence is not a significant concern for the Subbasin
	(6)		Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:					
		(A)	Flow conditions including surface water discharge, surface water head, and baseflow contribution.	327:329,339:355	3.5.2	3-17:3-19, 3-23	3-9	1) Figures 3-17:3-19 show ISW monitoring locations. 2) Figure 3-23 shows monitoring frequency for representative monitoring points in the network for level, storage, and ISW depletion. 2) Table 3-9 lists stream gauge monitoring locations in the basin that collected 15 minute interval data.
		(B)	Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.	N/A				No rivers in the SASb have been shown to cease flowing.
		(C)	Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.	355	3.5.2		3-9	1) Table 3-9 lists stream gauge monitoring locations in the basin that collected 15 minute interval data.
		(D)	Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.	N/A				1) Groundwater level is used as a proxy for ISW depletion
(d)			The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area.	330	3.5.2	3-21		1) Figure 3-21 shows monitoring network for groundwater level, storage, and ISW depletion sustainability indicators covering 92% lateral coverage of the network. Groundwater level is used as a proxy for ISW depletion.
(e)			A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.	337:355	3.5.2			
(f)			The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:					
	(1)		Amount of current and projected groundwater use.	335:337	3.5.1			

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	(2)		Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.	340,345:348	3.5.2	3-23, 3-26:3-28	3-7, 3-8	1) Figure 3-22 shows the density of monitoring locations in the upper and lower zone of the principal aquifer for groundwater level and storage and ISW depletion. 2) Figures 3-25:3-26 show monitoring locations in the upper and lower zones for water quality.
	(3)		Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.	335:338	3.5.1			
	(4)		Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.	335:338	3.5.1			1) Wells with a historical record dating past 2005 were prioritized as monitoring candidates.
(g)			Each Plan shall describe the following information about the monitoring network:					
	(1)		Scientific rationale for the monitoring site selection process.	335:338	3.5.1	3-22		1) Figure 3-22 shows the general framework for monitoring site selection
	(2)		Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.	360	3.5.4			
	(3)		For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.	317, 322, 342	3.3.1.3, 3.3.3, 3.4.3		3-4, 3-5:3-6	1) Table 3-4 lists the MT, MO, and IM for groundwater level decline, storage, and ISW depletion. 2) Land subsidence and seawater intrusion are not significant in the subbasin. 3) Table 3-5 lists the MTs for water quality. 4) Table 3-6 shows the measurable objectives for nitrogen and specific conductivity at the selected wells within the Subbasin. 5) IMs are not applicable for water quality.
(h)			The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.	317, 330, 332, 340:341, 351:352	3.3.1.3, 3.4.3, 3.5.2	3-21, 3-23:3-24	3-4, 3-6:3-8	1) Figure 3-21 shows monitoring network for groundwater level and storage, and ISW depletion. 2) Figure 3-23 shows the monitoring frequency for groundwater level and storage, and ISW depletion. 3) Figure 3-24 shows the location of water quality monitoring wells. 4) Table 3-4 lists the monitoring wells used for groundwater level and storage, and ISW depletion. 5) Table 3-6 lists the wells for water quality monitoring. 6) Tables 3-7:3-8 lists the measurement history and frequency for water quality.
(i)			The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.	355:360	3.5.3			
(j)			An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.	N/A				1) Seawater intrusion does not apply to the SASb. 2) Land subsidence is not expected to be a signficiant concern to the SASb

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			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, 10728, 10733, 10733.2, and 10733.8, Water Code					
§ 354.36.			**Representative Monitoring**					
			Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:					
(a)			Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.	316, 341	3.3.1.3, 3.4.3		3-4, 3-6	1) Table 3-4 lists the RMPs groundwater level and storage, and ISW depletion. 2) Table 3-7 lists the RMPs for water quality.
(b)			(b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:					
	(1)		Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.	320:321, 323:324	3.3.2, 3.3.4			1) Groundwater level is directly related to groundwater storage and ISW depletion and be used as a proxy.
	(2)		Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.	316	3.3.1.3		3-4	1) Table 3-4 lists the operational flexibility for groundwater level decline, storage, and ISW depletion. Operational flexibility is not applicable for groundwater quality, land subsidence, and seawater intrusion.
(c)			The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.	335:337	3.5.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2 and 10733.2, Water Code					
§ 354.38.			**Assessment and Improvement of Monitoring Network**					
(a)			Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.	360:362	3.5.5			
(b)			Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.	316,337:355,347,352,360:362	3.3.1.3, 3.5.2, 3.5.5	3-27	3-4	1) Figure 3-27 shows the data gaps to be addressed for monitoring wells, stream gauges. 2) Table 3-4 shows monitoring wells with some historical data gaps
(c)			If the monitoring network contains data gaps, the Plan shall include a description of the following:					
	(1)		The location and reason for data gaps in the monitoring network.	316, 337:355, 347,352, 360:362	3.3.1.3, 3.5.2, 3.5.5	3-27	3-4	1) Figure 3-27 shows the data gaps to be addressed for monitoring wells, stream gauges. 2) Table 3-4 shows monitoring wells with some historical data gaps
	(2)		Local issues and circumstances that limit or prevent monitoring.	316,337:355,347,352,360:362	3.3.1.3, 3.5.2, 3.5.5	3-27	3-4	1) Figure 3-27 shows the data gaps to be addressed for monitoring wells, stream gauges. 2) Table 3-4 shows monitoring wells with some historical data gaps

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(d)			Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.	316,337:355, 347,352,360:362	3.3.1.3, 3.5.2, 3.5.5	3-27	3-4	1) Figure 3-27 shows the data gaps to be addressed for monitoring wells, stream gauges. 2) Table 3-4 shows monitoring wells with some historical data gaps
(e)			Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:					
	(1)		Minimum threshold exceedances.	316, 360:362	3.3.1.3, 3.5.5			In Development
	(2)		Highly variable spatial or temporal conditions.	316, 337:355,360:362	3.3.1.3, 3.5.2, 3.5.5	3-25, 3-26, 3-27, 3-28, 3-70	3-7, 3-8, 3-9	In Development
	(3)		Adverse impacts to beneficial uses and users of groundwater.	337:355	3.5.2	3-24		In Development
	(4)		The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.	316	3.3.1.3			In Development
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10728.2, 10733, 10733.2, and 10733.8, Water Code					
§ 354.40.			**Reporting Monitoring Data to the Department**					
			Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code.					
SubArticle 5.			**Projects and Management Actions**					
§ 354.42.			**Introduction to Projects and Management Actions**					
			This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.44.			**Projects and Management Actions**					
(a)			Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.	363:366	4.0			
(b)			Each Plan shall include a description of the projects and management actions that include the following:					
	(1)		A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:					

Article 5.			Plan Contents for South American Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(A)	A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.	365:368	4.2	4-1		Figure 4-1 shows the process of identifying, screening, evaluating, and selecting PMAs
		(B)	The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.	371, 375,379	4.4.1.2, 4.4.2.2, 4.4.3.2			
	(2)		If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.	320:321	3.3.2	3-16		The basin has historically avoided overdraft.
	(3)		A summary of the permitting and regulatory process required for each project and management action.	371, 375,379	4.4.1.3, 4.4.2.3, 4.4.3.3			
	(4)		The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.	371, 375,379	4.4.1.4, 4.4.2.4, 4.4.3.4			1) General status of all PMAs listed in Appendix 4-A
	(5)		An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.	371, 375,380	4.4.1.5, 4.4.2.5, 4.4.3.5			1) Additional project benefit information is listed in Appendix 4-B
	(6)		An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.	372,376,380	4.4.1.6, 4.4.2.6, 4.4.3.6			
	(7)		A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.	372,376,380	4.4.1.7, 4.4.2.7, 4.4.3.7			
	(8)		A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.	372,376,380:381, 413:415,416:417	4.4.1.8, 4.4.2.8, 4.4.3.8, 5.1.6, 5.2, 5.4, 5.5		5-1, 5-2	1) Table 5-2 lists the proposed funding mechanisms for proposed management actions 2)Table 5-2 lists a summary of the GSP implementation costs.
	(9)		A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.	372,376,381	4.4.1.9, 4.4.2.9, 4.4.3.9			
(c)			Projects and management actions shall be supported by best available information and best available science.	365:368	4.2		4-1	Figure 4-1 shows the process of identifying, screening, evaluating and selecting PMAs
(d)			An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.	365:368	4.2		4-1	Figure 4-1 shows the process of identifying, screening, evaluating and selecting PMAs
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					

South American
SUBBASIN

Appendix 1-G

Public Comment Log

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comment
1	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	General			The Department is writing to support ecosystem preservation in compliance with SGMA and its implementing regulations based on Department expertise and best available information and science. The Department recognizes and appreciates the effort of the GSAs to thoroughly and quantitatively consider all beneficial users of groundwater in the subbasin, and the draft GSP includes thoughtful analysis of modeled scenarios to evaluate the identified management criteria for undesirable results. However, the Department disagrees with the GSP's assessment of what impacts constitute an unreasonable impact for environmental users and believes the GSP could improve its methods for identifying environmental users of groundwater and establish more protective management criteria. Accordingly, the Department recommends that South American Subbasin GSAs address the following comments before submitting the GSP to the Department of Water Resources (DWR).	Comment noted.
2	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	General			In conclusion, the draft GSP thoughtfully discusses all beneficial uses and users of groundwater, provides detailed characterization of groundwater conditions in the basin, and incorporates robust modeling of future scenarios; however, the GSP can further refine its management criteria to better avoid potential impacts to GDEs and ISW, and provide additional detail for planned projects and management actions. The Department recommends that the South American Subbasin GSAs address the above comments before GSP submission to DWR to best prepare for the following regulatory criteria for plan evaluation: 1. The assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science. [23 CCR § 355.4(b)(1)] (See Comments #1, 2, 3, 4, 5) 2. The GSP does not identify reasonable measures and schedules to eliminate data gaps. [23 CCR § 355.4(b)(2)] (See Comment #6) 3. The interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have not been considered. [23 CCR § 355.4(b)(4)] (See Comments #1, 3, 4, 5) 4. The projects and management actions are not feasible and/or not likely to prevent undesirable results and ensure that the basin is operated within its sustainable yield. [23 CCR § 355.4(b)(5)] (See Comment #7)	Comment noted and addressed in other comment items.
3	Clean Water Action/Clean Water Fund Union of Concerned Scientists Audubon California Local Government Commission The Nature Conservancy	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan E.J. Remson & Melissa M. Rohde	8/10/2021	Overall	See attached letter for comments regarding specific attachments		Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be insufficient under SGMA. We highlight the following findings: 1. Beneficial uses and users are not sufficiently considered in GSP development. a. Human Right to Water considerations are not sufficiently incorporated. b. Public trust resources are not sufficiently considered. c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users are not sufficiently analyzed. 2. Climate change is not sufficiently considered. 3. Data gaps are not sufficiently identified and the GSP needs additional plans to eliminate them. 4. Projects and Management Actions do not sufficiently consider potential impacts or benefits to beneficial uses and users. Our specific comments related to the deficiencies of the South American Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in Attachment A. Please refer to the enclosed list of attachments for additional technical recommendations: Attachment A GSP Specific Comments Attachment B SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users	Specific comments addressed in other sections.
4	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			Conceptually, the GSPD includes two conservative assumptions that deserve clarification. First, regarding the projected impacts from pending climate change, the selection of the 'central tendency' climate forecast understates the impacts of climate change on future water supply and demand, which would have a negative impact on the SAS's sustainability. The GSPD should clearly describe the climate change study, its assumptions, and the arguments for and against using the central tendency forecast. Second, the GSPD does not include demand reduction as a Project and, therefore, does not reduce groundwater demand resulting from the associated water conservation and efficiency actions and programs that are expected to take place. These demand reducing programs should be described along with the logic for not including them in this GSP. The effect is to potentially overstate future groundwater pumping in the SAS. We urge that: 1) the GSPD include a more robust discussion of the climate change forecast, and 2) both climate assessment and demand reduction approaches be reassessed and included in a future GSP annual report to DWR or, at a minimum, in the 2025 GSP update.	Comment noted. Implementation of the GSP includes consideration of updates to the CoSANA model in light of changing conditions or additional data.

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comment
5	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			We are concerned about how GDEs are impacted by the Sustainable Management Criteria. We acknowledge that the GSPD presents a comprehensive assessment of both interconnected surface water (ISW) and Groundwater Dependent Ecosystems (GDE) based on current science. However, new information was presented recently (Lewis and Burgy 1964 study) to the GSP Working Group suggesting the root depth analysis used for GDEs should use a depth of 80 feet, not the 30 feet used in the GSPD. In addition, The Nature Conservancy (TNC) is about to publish a study indicating root depths for certain oak species are 25 meters. Also, a recent TNC study identifies the inability of oak woodlands to reproduce when ground water levels are too low. Therefore, a determination of appropriate root depths to maintain GDEs should be included as a priority Management Action in the final GSP.	This 80 ft metric concerns one paper from 1964 that studied injected isotope tracers (particles moving through the subsurface) in a fractured rock aquifer in hilly topography on (n = 15) trees. Results are specific to geology and do not hold for a relatively flat, alluvial, aquifer-aquitard system. Reproducible, recent results are needed for a system comparable to the SASb.
6	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			We are concerned about the measures being taken to protect GDEs. While we understand the rationale behind the three-year trigger for ISW, we believe another approach is necessary for the protection of GDEs. If groundwater levels fall below the root zone for three years before any action is taken, then the need for action has passed because the plants located in the area of concern will already be dead. We urge further work in this area and that the final document include more protective measures for GDEs; or if further study is needed, this be identified as a high priority Management Action.	The GSP identifies undesirable results for GDEs not when groundwater levels are below the root zone for 3 years, but rather, when the area of GDEs decreases below 44% (2012-2016 groundwater levels), or when the GDE "greenness" measured by satellites declines below historically observed values. In other words, GDEs won't shrink or dry out beyond what we've previously seen in the basin. Importantly, GDE area and greenness has improved since the past drought, indicating the ability to come back from those groundwater lows. Furthermore, projected management and climate change are expected to impact GDE area by -3 to +4 %, with a median impact slightly greater than 0, largely due to PMA near GDEs (Firgue 3-6).
7	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			Finally, with respect to communicating, we recommend that that monitoring data be presented to the public in a form that allows local property owners to track information from sampling events that are of immediate interest to them. We suggest that the GSAs incorporate telemetry into the well monitoring program so that results can be recorded on a real-time basis. This will allow for more frequent sampling if the need arises.	Section 3.5.3 summarizes the protocols for data collection and monitoring. Section 3.5. assesses and provides recommendations for improving the monitoring network, including installation of telemetry and data loggers, as well as protocols for data management. As part of the implementation of the GSP, the monitoring network will also be reassessed regularly for adequacy in tracking Subbasin conditions.
8	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			The Group 2 project list should be expanded to include a priority list of water purveyor projects that best contribute to the sustainable management of the basin. Water purveyors have a significant list of system connectivity, conjunctive use, and recharge projects. We recognize that the GSAs have no direct authority over any of these projects, but it is important to send a signal to the water purveyors and the public at large regarding which projects fit best with the management of the SAS and what completion priority each project has with respect to attaining subbasin sustainability.	Additional projects and management actions may be developed, discussed, and considered for inclusion into the GSP update by the GSAs as part of the implementation phase of the GSP.
9	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			Finally, we note the important insights made possible by research and monitoring that guides Project development so that both recharge and ecological value are increased. An example is the investment made by OHWD and SAFCA to work with research teams to fully understand the site characteristics and to identify all the opportunities for both principal aquifer recharge and flood protection, and ecological uplift. This information will enhance funding opportunities and support effective and responsible groundwater banking. We encourage SAS GSAs efforts to support individual GSA projects like this, and suggest including a thorough description of the many benefits of the project in the DGSP.	Additional projects and management actions may be developed, discussed, and considered for inclusion into the GSP update by the GSAs as part of the implementation phase of the GSP.
10	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			This Section also contains Management Action. We endorse the concept of a Shallow/ Vulnerable Well Protection Program and the Well Permit Coordination actions. The GSPD should specify responsibilities and timeframes for these Actions' development, funding, and implementation. Additionally, we recognize that the Shallow/Vulnerable Well Protection Program is still in the formative stage and offer these suggestions: The Program should focus on shallow wells (domestic and agricultural) that become dry resulting from MT exceedance, and should not apply to localized dry well conditions. We support efforts to engage the local agricultural and residential landowners in the development of the program. We suggest that the GSPD's initial focus include voluntary, private well owner data gathering and coordination. We recommend that the GSPD include enough information about the effort to support any subsequent funding opportunities from outside sources. The tie between shallow wells and conjunctive use/recharge should also be assessed as part of program development and implementation. Additionally, with enhanced private well owner monitoring, these well owners will have information they can use to carry out their own water conservation efforts.	Management actions are not all equally developed. The information provided is what was available at the time of the development of the GSP.
11	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			The GSPD's Management Actions section should be expanded to include specific lists of work, studies, and monitoring system improvements, including the responsible GSA(s). The same level of detail should be included in Management Action write-ups for the additional monitoring system improvements (including those we have recommended) noted as needed to be performed within the GSPD. The GSAs may find it difficult to plan and budget for these Actions unless they are called out in the final GSP that is approved by the GSAs. We believe the GSPD's Management Actions section should be expanded to include the following additional Management Actions: (see the next 2 rows)	Management actions are not all equally developed. The information provided is what was available at the time of the development of the GSP.

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comment
12	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			1) A Management Action should commission a climate impacts assessment that results in revised climate impact inputs for the five-year GSP update. This new climate impacts assessment should build upon the American River Basin Study used as the basis for the current GSPD analysis. The yet-to-be-published American River Basin Study is expected to include over 60 climate forecasts and the version that the GSPD uses is based on climate information and forecasts do not reflect the region's recent climate experience and the latest climate forecasts. Fortunately, the local agencies who helped fund the study have briefed the Water Forum and others on its findings and have indicated that the American River Basin Study does have climate data that is more reflective of current conditions and these newer forecasts. The study's project managers have advised that the study's forecasting models can be run with that information. Given the repeated references in the GSPD to the importance of the impacts of climate change on basin management, a new assessment should be conducted so that it is available in time for a future annual update to DWR or, by the latest, the next plan update in five years. To that end, the GSAs should reach out now to the other subbasin GSAs, RWA and the Water Forum to develop an agreement to perform that work so that it can be included in the region's three GSP updates. The same inputs should be used in the next round of UWMPs and by the RWA and Water Forum in their planning efforts. ECOS and RWA are members of the Water Forum and participate in the Water Forum 2 renegotiation process, which is committed to actions that lead to the Region's water supplies being able to best adapt to climate change. This includes how groundwater is a significant, sustainable resource for providing for our water needs - both for people and the environment. We believe that the Water Forum 2 process, and successor efforts, should help in the development of studies linking our water supply with future	Addition of these studies and analyses, including updates to the CoSANA model will be considered during the implementation phase of the GSP.
13	Environmental Council of Sacramento (ECOS)		6/18/2021	Overall			2) A Management Action should direct the GSAs to develop a policy and procedure for reviewing, formally commenting on, and approving (when appropriate) groundwater transfers, water banking activities including the accounting framework, and conjunctive use operations. The document should include GSA ongoing monitoring and management responsibilities in each area, and how costs for these activities are recovered. The policy and procedure should lay out how water banking and recharge programs will be implemented in the SAS including governance, water accounting, banking and recharge operations, and SAS banking premiums of water left in the SAS, over and above deposits, to adjust for natural storage loss, environmental premiums, and basin supply enhancement. Some Projects (Harvest Water Project and OHWD) are investments that enhance the subbasin's storage and provide multiple benefits for the subbasin. These efforts contribute to subbasin sustainability and the ability to utilize the subbasin for transfers, conjunctive use, and water banking. The policy and procedure should address how these types of Projects are able to participate in transfers, conjunctive use, and water banking operations, and/or other transactions that add value to their basin contributions.	Additional projects and management actions may be developed, discussed, and considered for inclusion into the GSP update by the GSAs as part of the implementation phase of the GSP.
14	Huhtamaki Foodservice, Inc.	Amy Steinfeld	8/17/2021	General			In 1963, Huhtamaki began production of groundwater from two water supply wells on the Property for overlying use in Huhtamaki's consumer products manufacturing operations From 1990 until 2005, the volume of water pumped by Huhtamaki ranged from 200,000 to 3.5 million gallons per day (MGD) or 220 to 3,900 acre-feet per year (AFY). In 2001, groundwater pumping ranged between 300,000 and 1.5 MGD (335 to 1,680 AFY). In 2002, at a time when its production process was using approximately 600,000 to 750,000 gallons per day (approximately 672 to 840 AFY), Huhtamaki was forced to temporarily pause all groundwater production after third-party groundwater pollution from operations on a neighboring property caused elevated levels of the contaminant tetrachloroethylene (PCE) in groundwater beneath the Property.2 During this interim period, Huhtamaki was forced to connect to the local municipal water system (California-American Water's (Cal-Am) Parkway System) as an interim water supply to replace groundwater supplies. Clean-up efforts are ongoing, and Huhtamaki intends to resume groundwater production from the Subbasin once groundwater quality conditions improve.	Comment noted
15	Sacramento Regional County Sanitation District (Regional San)	Terrie Mitchell	8/18/2021	General			We appreciate the GSP incorporating Harvest Water as a project and management action that contributes to the sustainability of the basin. Regional San is developing Harvest Water to provide a safe and reliable supply of tertiary-treated recycled water for agricultural uses, reducing the need for groundwater pumping in the region, supporting habitat protection and enhancement efforts, and providing near-term benefits to the Sacramento-San Joaquin Delta.	Comment noted.
16	Sacramento Regional County Sanitation District (Regional San)	Terrie Mitchell	8/18/2021	General			We believe Harvest Water is an exceptional opportunity to proactively restore and manage groundwater, while improving stream flows in the lower Cosumnes River, enhancing riparian habitats and wetlands, sustaining prime agricultural lands, and improving regional water supply reliability through conjunctive use. By delivering recycled water in-lieu of groundwater pumping, Harvest Water will increase groundwater storage by approximately 245,000 acre-feet within 10 years. This in-lieu recharge is expected to raise groundwater levels up to 35 feet in the center of the Harvest Water Program area, and 15 to 25 feet in other parts of the groundwater basin in the vicinity of the Program.	Comment noted.
17	Sacramento Regional County Sanitation District (Regional San)	Terrie Mitchell	8/18/2021	General			The GSP's measurable objectives for groundwater levels incorporate the estimated increases in groundwater levels in the vicinity of the Harvest Water Program. We believe this is not only appropriate, but vital to ensuring that the on-going management of groundwater in the basin supports the success of the Harvest Water Program. Regional San plans to continue our involvement in GSP development and implementation to ensure that Harvest Water benefits are realized in the form of elevated groundwater levels, protection of groundwater dependent ecosystems, and the related ecological benefits. We are available to provide additional information on the Harvest Water Program as needed and look forward to continuing our involvement as the GSP is adopted and implemented.	Comment noted.

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comment
18		Carl Werder	7/5/2021	Overall			General comment: Section 1 is currently 204 pages and more pages to be added. Other sections are less than 100 pages. Recommend dividing Section 1 into two parts or adding another section. Same for appendix 2-B, it is two big at 459 pages to be useful. May want to divide the basin into four or five areas of hydrographs.	Comment noted
19		Lynn Wheat Wheat91@yahoo.com	8/18/2021	General			As a 34 year resident of Elk Grove and active participant in local government, it was only after another community member began sharing information with me on SCGA meetings and the GSP, did I begin attending meetings and reading documents--and it was only after taking these steps did I begin to understand the importance in developing and implementing a plan. Were it not for the community member reaching out to me and discussing the GSP and meetings of the various GSA's would I have had any idea of the future of water in our area. This document suggested there has been extensive outreach. I believe the final GSP document needs to further elaborate on "extensive". Many in my community have no idea what will be required of them in the future and the cost burden of implementing the various projects. How have the members of the SCGA board been communicating to the general public they represent? I had requested the City of Elk Grove communicate with the residents in a manner which would peak curiosity; what will be required of the residents? Will residents be required to reduce use and carry the financial obligations of program implementation imposed by increasing fees, taxes and water bills? As a resident of Elk Grove, I pay taxes and fees to the City of Elk Grove, Elk Grove Water District, and Sacramento County Sanitation District. All are members of SCGA who contribute monies to support the functions of SCGA. There will be costs to implementing the programs and the costs should be clearly estimated and defined within the GSP. Who will cover the costs? How will the cost burden be distributed? Will there be equity in sharing the burden of the costs? What about "Unknown" costs of programs and facilities. "Costs of facilities and activities uncertain and will be developed as	Comment noted. See Section 1 and Appendix 1-E for summaries of public outreach and noticing. See Section 5 for discussion on implementation funding.
20		Lynn Wheat Wheat91@yahoo.com	8/18/2021	General			What will the quality of local groundwater be when GSP projects are implemented? Will there be significant changes to the quality of the water and treatment process? Will our groundwater become contaminated? What will be the estimated costs of treating the water to make it drinkable and meeting minimal State/EPA standards? The GSP needs to evaluate this and include it in the document. It is of no value to have water available that is more contaminated and harmful to the health and environment of the region and therefore unusable.	Comment noted. See Section 4. PMAs are in various levels of development, and details are provided as available. All projects will be required to obtain applicable state and federal environmental clearances as well as other permits as required.
21		Suman Singha, PhD	8/16/2021	General			It is heartening to learn that there is no significant aquifer drawdown in the SASb and future management should ensure long term sustainability.	Comment noted
22		Suman Singha, PhD	8/16/2021	General			It is equally heartening to learn that the contaminant plumes at Mather AFB, Aerojet and Kiefer Landfill are being closely monitored and that the remediation plans are working.	Comment noted
23		Suman Singha, PhD	8/16/2021	General			However, I do have a major concern that the CoSANA projections are based on past and current parameters. Given that climate change is a reality, I believe the model should also include a protracted/severe drought scenario that has the potential of occurring; especially when we consider the 20- and 50-year timelines for the plan.	Comment noted. Implementation of the GSP includes consideration of updates to the CoSANA model in light of changing conditions or additional data.
24		Suman Singha, PhD	8/16/2021	General			Although outside the scope of this report, I believe we need to start considering water as a finite and precious resource. Change in consumer behavior regarding water conservation and usage is going to be an important component of this. Part of this should include tiered pricing for water. Action on this is needed at all levels, else the scenario playing out in Mendocino will no longer be the exception but the rule.	Comment noted

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comments
1	Environmental Council of Sacramento (ECOS)		6/18/2021	Executive Summary			The Executive Summary (ES) does not adequately include the impacts and importance of climate change on SAS sustainability even though this information is found in the body of the GSPD. The ES focuses on the need for a plan to address human water needs, but the SGMA makes it clear that environmental groundwater needs must also be addressed. The ES also focuses on past plans and actions, and while these contribute to why we are engaged in a GSPD, the ES should focus on the future. Terms and concepts should be better defined, along with their relevance to groundwater assessments and planning. For example, "groundwater conditions", "conceptual model", and "water budget" need definitions/relevance narratives for the lay reader. Many readers may only read the ES, so it is important that the ES communicate effectively. Our specific comments on the GSPD's technical work, conclusions, and findings are discussed in the following section reviews.	Executive Summary has been modified, in part, to address comment. The detail requested is provided in later sections of the GSP (Sections 2,3,4 and 5).
2	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	Executive Summary	IX	129	Please revise the first sentence of the Kiefer Landfill Description, contained within Table ES-2, as follows: "The Kiefer Landfill is a 1,084-acre site with an active class III ~~300~~ 335-acre solid waste disposal site that is owned and operated by Sacramento County." Source info for revision: Page 2 of https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/sacramento/r5-2016-0013.pdf The number was adjusted upward by 30 acres to account for recently opened landfill Module M4.	Edit accepted
3	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	Executive Summary	IX	129	We would prefer that the last sentence of the Kiefer Landfill Description (within Table ES-2), which lists the number of monitoring wells, be removed, as these details are more properly provided in Section 2. If this sentence must be retained within the Executive Summary, then it should be revised as follows: "Currently, the monitoring network at Kiefer consists of ~~23~~ 65 monitoring wells." If the sentence is retained, the numbers of monitoring wells for the Mather and Aerojet sites (570 and 2000, respectively) should also be listed within this table. Source info for revision to number of wells: Page 10 of https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/sacramento/r5-2016-0013.pdf	Edit accepted

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comments
1	Huhtamaki Foodservice, Inc.	Amy Steinfeld	8/17/2021	Section 1.5.3.1			The Draft Plan list of SASb Beneficial Uses and Users (Section 1.5.3.1) does not include "commercial" or "industrial" uses of groundwater as beneficial uses within the Subbasin. Although the Draft Plan mentions these types of uses elsewhere and in the Sustainability Goal (see, e.g., Plan, § 3.1, App. 1-D), "commercial" and/or "industrial" uses should be added to this list. (See Wat. Code, §§ 10723.2, 10727.2(b)(2); Cal. Code Regs., tit 23, § 354.10(a).)	Water uses listed in 1-D have been added to 1.5.3.1
2	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/10/2021	Appendix 1D	69-71		Provide a map of tribal lands in the subbasin. The GSP states (p. 2-10): "The only tribal land that falls within the SASb is located south of Elk Grove near the intersection of Kammerer Road and Hwy 99." However no map, acreage, or population is provided.	Although we do not provide maps, acreage, or population counts, tribal governments and entities were contacted during engagement and outreach (detailed in Appendix 1D) and are involved in ongoing communication and outreach. Tribal groups involved in ongoing C&E include: Wilton Rancheria, Buena Vista Rancheria Mewuk Indians, Ione Band of Miwok Indians, Nashville Enterprise Miwok-Maidu-Nishinam Tribes, Shingle Springs Brand of Miwok Indians, Tsi Akim Maidu, United Auburn Indian Community of the Auburn Rancheria, Colfax-Todds Valley Consolidated Tribe, Yocha Dehe Wintun Nation.
3	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/12/2021				Provide the population of each identified DAC and include details on the population dependent on groundwater for their domestic water use.	Although we do not provide population counts of DACs, DAC groups were contacted during engagement and outreach (detailed in Appendix 1D) and are involved in ongoing communication and outreach. DAC-representative groups involved in ongoing C&E include: Environmental Justice Coalition for Water, Florin Census-Designated Place (CDP) DAC, Lemon Hill CDP DAC, Parkway CDP DAC, Fruitridge Pocket CDP DAC, Freeport CDP DAC. The GSP comprehensively evaluates impacts to domestic wells - which may be used by DACs - and finds them to be minimal (Appendix 3A).
4	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/16/2021	Appendix 1D			Describe efforts to engage with stakeholders during the GSP *implementation* phase in the Stakeholder Communication and Engagement Plan. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.	The GSAs are in the process of developing an implementation MOU that includes public engagement provisions. The GSAs will follow DWR guidance in stakeholder engagement during implementation (i.e., public notices and meetings before amending a GSP or prior to imposing or increasing a fee, and ongoing efforts to encourage active involvement).
5	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/17/2021	Appendix 1D			Describe efforts to consult and engage with tribes within the subbasin. Refer to the DWR guidance entitled Engagement with Tribal Governments for specifics on how to consult with tribes.	We received a list of potentially interested tribes after making a direct request to the Native American Heritage Commission. Contact was made with all of the listed tribes and those that indicated interest were added to the subbasin outreach lists. However, we will maintain ongoing communication with tribes following DWR guidance in stakeholder engagement during implementation.
6		Carl Werder	7/5/2021	Section 1			Section 1, -- This section offers nothing but a rehash of existing documentation concerning the GSP process, therefore no comment	Noted. No changes made.

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1	Ag/Res resident	Amelia Vankeuren	8/17/2021	2	102	1577	Section 2.2.7 Natural Water Quality Characterization only summarizes older groundwater quality data (pre-2016) in public supply wells, which tend to be deeper than shallow domestic wells. The summary in this section should also incorporate the more recent data downloaded from the GAMA Groundwater Information System Data Download in 2020 (as mentioned on page 2-142) as that would include shallow well information from the 2017 GAMA Sacramento-Metro Study Unit - Shallow Assessment.	The document was developed using the data that was available at the time it was written. More recent data can be reported in Annual Reports to be submitted after the GSP is completed.
2	Ag/Res resident	Amelia Vankeuren	8/17/2021	2	125	1938	The declining trend in groundwater levels in the eastern portion of the subbasin is highly concerning. "Not well understood" declines of 40 ft over 50 years are unacceptable, particularly as well 244 is relatively close to an area with a high concentrations of shallow domestic wells.	Comment noted. The text has been edited to clarify the discussion of groundwater elevations in this section.
3	Ag/Res resident	Amelia Vankeuren	8/17/2021	2	132	2019	The hydrographs for the 4 shallower wells show that the shallow aquifer groundwater elevation is generally 30 ft higher than the deeper aquifer wells, so there is a strong downward vertical gradient. The shift from an upward vertical gradient in other locations in the subbasin to the downward vertical gradient in Elk Grove suggests that the deeper aquifer is being heavily exploited in this location. Why is this downward gradient not mentioned in the summary of this section?	Comment noted. The text has been edited to clarify the discussion of groundwater elevations in this section.
4	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Plan Area and Basin Setting, 2.1.3 Description of Beneficial Uses and Users of Groundwater	page 2-19		1. Comment #1 Beneficial Uses and Users (Plan Area and Basin Setting, 2.1.3 Description of Beneficial Uses and Users of Groundwater, page 2-19): The GSP does not specifically identify environmental uses and users as beneficial users of groundwater in the subbasin. a. Issue: The GSP defines beneficial uses of groundwater in the subbasin as municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply. GSAs are required to consider all beneficial uses of groundwater, including environmental uses [Water Code 10723.2(e)]. b. Recommendation: The Department recommends revising the Section 2.1.3 description of beneficial uses and users to more accurately describe all groundwater users in the subbasin, similar to the more inclusive description of environmental beneficial users included in Section 1.5.3.1 (page 1-14).	Environmental uses has been added as a beneficial use.
5	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Plan Area and Basin Setting, 2.2 Hydrogeologic Conceptual Model, 2.4 Water Budget			2. Comment #2 CoSANA Model (Plan Area and Basin Setting, 2.2 Hydrogeologic Conceptual Model, 2.4 Water Budget): The GSP does not include sufficient detail on CoSANA model development. a. Issue: The GSP states that "The CoSANA model and model layers are described in detail in the Model Development technical memorandum" (page 2-78) and that "Additional information on the data and assumptions used to develop the CoSANA model is included as an appendix to the GSP" (page 2-172). However, neither of these documents are included with the draft GSP. b. Recommendation: The Department recommends the technical information referenced regarding CoSANA model development be included to facilitate careful review of the GSP.	The CoSANA model appendix has now been provided for review
6	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Plan Area and Basin Setting, 2.3.6 Interconnected Surface Water Systems, starting page 2-159			3. Comment #3 Interconnected Surface Waters (Plan Area and Basin Setting, 2.3.6 Interconnected Surface Water Systems, starting page 2-159): GSP identification of interconnected surface waters (ISW), defined by 23 CCR § 351(o) as surface water hydraulically connected "at any point" to the underlying aquifer, is based on a methodology that relies on a narrower definition of ISW than the definition included in the regulations and that risks misidentifying surface waters as disconnected. a. Issues: i. ISW Identification: The methodology for identifying a surface water reach as interconnected requires a majority of CoSANA stream nodes to be connected for a season in order to be considered ISW (line 2358, Appendix_3-C). However, this methodology applies a narrower definition of interconnected surface waters than 23 CCR § 351(o), which defines surface water as ISW if the surface water is hydraulically connected to groundwater "at any point." Therefore, surface water reaches that have connected nodes, regardless of whether those nodes represent a majority for a given season, meet the definition of interconnected surface water and should be evaluated accordingly in the GSP. Additionally, the GSP applies this ISW identification methodology inconsistently by identifying the Cosumnes River approximately between Deer Creek and Twin Cities Road as a data gap due to "sub-seasonal connection" (line 2366). The GSP does not discuss whether other surface waters throughout the basin were evaluated for sub-seasonal connections. 23 CCR § 351(o) does not require connection to last for the duration of a season for a reach to be interconnected. ii. Streamflow Depletion: The GSP states that increased streamflow will increase the hydraulic gradient and therefore increase ISW depletion (page 3-11, line 397).	(i) We agree with the reviewer that correctly classifying ISW is very important. For this reason, we conservatively include entire reaches when a majority of nodes are interconnected for at least 1 of 22 seasons evaluated in the historical record from 2005-2018 (Appendix 3-C, Figure 24). Unlike the reviewer suggests, this classification system actually leads to more surface water being considered ISW (compare subplots A and B in Figure 24) than if we only classified ISW at the nodal level. This increases ISW protection under SGMA because it includes portions of surface water that may actually be disconnected. We believe it reasonable that "interconnection" is an average state during a season and disagree with the reviewer that the scant evidence of sub-seasonal connection along the Cosumnes River between Deer Creek and Twin Cities Road should be considered "interconnection". Out of an abundance of caution we classify this section a "Data Gap" and seek to study whether the scant evidence of sub-seasonal connection in a small number of wells may be the result of air entrapment, perched aquifer dynamics, or another essential function that supports ISW. Bear in mind: groundwater conditions in this reach show persistent disconnection from 2005-2018. The GSP's decision to call this a Data Gap and to coordinate with environmental groups and the neighboring Cosumnes basin on studying this reach is taken out of an abundance of caution. Furthermore, scant evidence from high frequency 15-minute data suggests that a few days in the past 10 years groundwater levels sharply increased above river stage in the Cosumnes Data Gap. Notably, these groundwater level increases occur in wells more than a mile from the river - it is highly unlikely this these pulse events propagate to the river, and they may well represent air entrapment following floodplain inundation, or perched aquifer heads. This data is simply not available across all surface water reaches in the basin, nor is it necessary in locations
7	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Plan Area and Basin Setting, 2.3.6 Interconnected Surface Water Systems, starting page 2-159			b. Recommendations: i. ISW Identification: The Department recommends revising the methodology for identifying ISW so that surface water reaches that are connected at any node, regardless of whether the nodes reach the majority threshold or are connected for a full seasonal duration, are considered ISW. The reach of the Cosumnes River between Deer Creek and Twin Cities Road should be classified as ISW, rather than as a data gap. Additionally, the GSP should provide additional clarification on the sub-seasonal interconnection analysis and whether other surface water reaches in the subbasin similarly demonstrated short term interconnectedness. ii. Streamflow Depletion: The Department recommends clarifying that increased streamflow may increase the rate of stream water seeping from ISW into the underlying aquifer; but increased streamflow will not necessarily cause greater depletion of surface waters.	(i) As previously stated, we maintain that the methodology for classifying ISW is conservative and includes many more persistently disconnected surface water nodes with no strong evidence of connection as ISW because they exist on reaches where a majority of nodes experience at least 1 season of interconnection of out the 22 evaluated (Appendix 3-C, Figure 24). The reach of the Cosumnes River between Deer Creek and Twin Cities Road is persistently disconnected for all 22 seasons evaluated from 2005-2018. We include it as a Data Gap out of an abundance of caution and due to scant evidence from high frequency 15-minute data that suggests a few days in the past 10 years when groundwater levels sharply increased. Notably, these groundwater level increases occur in wells more than a mile from the river - it is highly unlikely this these pulse events propagate to the river, and they may well represent air entrapment following floodplain inundation, or perched aquifer heads. We maintain that this area is best classified as a Data Gap, and have plans for additional monitoring, interbasin coordination, and outreach to conclusively determine the location, timing, and magnitude of ISW (should data show that it exists) in this region. (ii) This point is well taken and the section has been clarified.

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8	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Plan Area and Basin Setting, 2.3.7 Groundwater Dependent Ecosystems, starting page 2-164			4. Comment #4 Groundwater Dependent Ecosystems (Plan Area and Basin Setting, 2.3.7 Groundwater Dependent Ecosystems, starting page 2-164): GDE identification, required by 23 CCR § 354.16(g), is based on methods that risk exclusion of ecosystems that may depend on groundwater. a. Issues: i. Depth to Groundwater: Methods applied to the Natural Communities Commonly Associated with Groundwater dataset to eliminate potential GDEs may exclude deep rooted vegetation. The GSP removes potential GDEs with a depth to groundwater greater than 30 feet; however, mature Valley Oak (Quercus lobata) can access groundwater up to 80 feet below the ground surface (Howard 1992, Lewis & Burgy, 1964). The use of a 30-foot threshold may incorrectly exclude Valley Oak communities within the subbasin from further consideration as a GDE. ii. Special Status Species: Though Appendix 3-B of the GSP references a compiled resource of GDE beneficial uses and users, the annotated list of species and their groundwater dependence (Appendix E to Appendix 3-B) has not been included for review with this draft GSP.	(i) The consultant team has reviewed the study in question (Lewis and Burgy, 1964) and does not find merit in the results. The study concerns an isotope-tracer study in a fractured rock aquifer in hilly topography using a small sample (n = 15) of trees. These results are highly specific to geology (i.e., isotope transport in fractured rock and alluvium are not at all comparable), and hydraulics (i.e., topographic driven flow patterns in mountainous regions are much different than those in relatively flat valley floors). Moreover, other literature reviewed by TNC suggest rooting depths of around 30 feet. The scientific de-merits outlined above give cause to not consider an 80 foot rooting depth parameter, and hence, we maintain the GDE study carried out the Freshwater Trust for the SASb (see technical Memo 3B (groundwater dependent ecosystems). (ii) This appendix is now included.
9	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Plan Area and Basin Setting, 2.3.7 Groundwater Dependent Ecosystems, starting page 2-164			b. Recommendations: i. Depth to Groundwater: The Department recommends the GSP update the methodology for GDE identification to reflect accurate maximum rooting depth specifically for Valley Oak communities. The Department recommends use of the NCAAG, field verification, and/or other local data to identify the locations of Valley Oak within the subbasin. For those areas, the GDE analysis should apply a threshold of 80 feet below the ground surface as the maximum potential depth at which the potential GDE could access groundwater. The Department accepts the use of a 30-foot threshold as sufficiently conservative for other potential GDEs within the subbasin that likely do not contain Valley Oak. ii. Special Status Species: The Department recommends including the list of GDE environmental users of groundwater within an appendix to the GSP.	(i-ii) addressed in the response to Comment No. 8.
10	Environmental Council of Sacramento (ECOS)	Ralph Propper & Robert Burness	6/18/2021	Section 2.5			We find the introductory materials to be duplicative of the material presented in Section 1 of the Draft GSP and do not materially contribute to the technical presentation of the South American Subbasin's (SASb) Sustainable Yield under SGMA. If there is reference to the former level of 273,000 AFY within this section of the GSP analysis, then a full technical analysis of why the basin sustainable level has changed from 273,000 AFY as late as last year to the new sustainable average level of 235,000 AFY should be included. One can only conclude that moving from a 20-year-old single value to a range that has a substantially lower midpoint, is the result of improved data and analysis carried out as part of the GSP process. In addition, there is an omission in the several paragraphs that discuss the uncertainties associated with the analysis underpinning the Sustainable Yield Estimate. These paragraphs neglect to mention the uncertainty posed by climate change. In our earlier comments on the draft GSP, we pointed out the importance of thoroughly documenting the climate change analysis that underpins the GSP analysis including the basis for the Sustainable Yield estimates.	The Background section was included because it provides context for how the GSP's sustainable yield estimate relates to previous Basin management. The remainder of the section provides a discussion of why the new value of 235,000 AFY is recommended.
11	Environmental Council of Sacramento (ECOS)	Ralph Propper & Robert Burness	6/18/2021	Section 2.5			We find that the materials meant to describe how the Sustainable Yield estimates were determined and why 235,000 AFY is the average sustainable yield, are not sufficiently explanatory for the lay person. The presentation needs to explain how the range of pumping was developed and, using one or more of the charts, identify what the points on these charts mean, and why and how the X and Y axis are developed. Also, if 0 change in groundwater storage is the desired point (as presented in figures 2.5.2(a & b) why is there no X and Y axis lining up on figure c and what is the significance of the negative value under the corresponding point of 235,000 AFY?	The section narrative has been revised to make more clear that the range of pumping shown by year type is meant to be descriptive of typical operational patterns and was not meant to be prescriptive.
12	Environmental Council of Sacramento (ECOS)	Ralph Propper & Robert Burness	6/18/2021	Section 2.5			We do not find a compelling analysis that determines why a range of pumping between 210,000 AFY and 270,000 AFY is acceptable. Also, there is no description of what "various year types" are, who determines them, and how are they factored into basin management. If this analysis is dependent on past years weather and hydraulic conditions projected forward, then an additional caution is warranted given that more recent conditions are tending to diverge from the past. It is not apparent from the analysis presented whether the SASb could withstand successive years like the past two continuing for another one or two years while being operated on the premise that 270,000 AFY can be withdrawn from the basin without Sustainable Yield consequences. More information is needed to put context around the "year types" and the GSAs' management responsibilities vis a vis the SASb's Sustainable Yield.	The section narrative has been revised to explain what is meant by year types (i.e. Sacramento River Index) and to make more clear that the range of pumping shown by year type is meant to be descriptive of typical operational patterns and was not meant to be prescriptive.
13	Environmental Council of Sacramento (ECOS)	Ralph Propper & Robert Burness	6/18/2021	Section 2.5			The document presents a table of annual pumping levels which it asserts, if adhered to, would ensure the SASb is managed so that its Sustainable Yield is maintained. However, there is no description of monitoring or management actions the GSAs will engage in to ensure that the SASb is not drawn down in such a fashion that its Sustainable Yield is negatively impacted. The GSP should include Management Actions to ensure that SASb pumping is managed not to exceed these pumping levels. In addition, there is no base line calculation for the storage level in 2015. It seems obvious that this value is needed so that the Sustainable Yield can be monitored and managed. There is five years of known data that can be used to develop and track the SASb's Sustainable Yield.	The pumping levels by water year are reflective of an average of 235,000 AFY, and are meant to provide guidelines for operational flexibility to implement water supply projects and to manage year-to-year weather variability. Under projected conditions with the PMAs, there is not a projection of overdraft in the SASb. However, additional adaptive management strategies can be used to maintain long-term sustainability of the basin. These do not necessarily need to be explicitly included in the GSP.
14	Environmental Council of Sacramento (ECOS)	Ralph Propper & Robert Burness	6/18/2021	Section 2.5			We believe that Management Actions are needed in at least two areas. First, there is a need to manage data and annually report the amount of annual pumping and how that volume relates to the SASb's sustainability including the Sustainable Yield. This work also needs to include coordination with the Water Forum, The Regional Water Authority, and the Bureau of Reclamation regarding forecasts of current and future "water years". This coordination will allow the GSAs to better understand if any management actions (e. g. possible pumping restrictions or demand management actions) are needed to maintain basin sustainability.	The pumping levels by water year are reflective of an average of 235,000 AFY, and are meant to provide guidelines for operational flexibility to implement water supply projects and to manage year-to-year weather variability. Under projected conditions with the PMAs, there is not a projection of overdraft in the SASb. However, additional adaptive management strategies can be used to maintain long-term sustainability of the basin. These do not necessarily need to be explicitly included in the GSP.

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15	Environmental Council of Sacramento (ECOS)	Ralph Propper & Robert Burness	6/18/2021	Section 2.5			A second Management Action includes the establishment of agreements with the water purveyors who plan to utilize the basin's groundwater for conjunctive use so that their pumping levels are consistent with figure 2.5-3. Agreements that match pumping levels with "water years" will assist the GSAs in exercising their responsibilities under SGMA. Similar agreements will be needed with those purveyors and others who carry out water banking operations.	The pumping levels by water year are reflective of an average of 235,000 AFY, and are meant to provide guidelines for operational flexibility to implement water supply projects and to manage year-to-year weather variability. Under projected conditions with the PMAs, there is not a projection of overdraft in the SASb. However, additional adaptive management strategies can be used to maintain long-term sustainability of the basin. These do not necessarily need to be explicitly included in the GSP.
16	Environmental Council of Sacramento (ECOS)		6/18/2021	Section 2			Section 2 also discusses water purveyor supply and demand numbers. The GSPD provides information from published 2015 Urban Water Management Plans (UWMP). The water purveyors subsequently published their 2020 UWMPs. These plans include updated information including actual supply and demand numbers for 2020, as well as forecasts for future water demand based on current local land use plans. The base numbers for 2020 are actual water supply and demand for that year and will not change so these 2020 UWMP numbers should be included in the final GSP. Understanding future groundwater demand is a critical component in the subbasin's water budget and in assuring management actions will have the desired effects in achieving SAS sustainability. Additionally, including 2020 supply and demand numbers as benchmarks improves the accuracy of assessments conducted to determine the effectiveness of purveyor demand reduction programs. Also, the next five-year GSP update should be based on 2025 UWMP demand numbers and programs. Therefore, the GSAs should engage in GSP planning and coordination for the next five-year update to ensure the latest water purveyor numbers are provided in advance of the draft and included in the final 2025 GSP update.	Table 2.1-23 has been updated to included data from the 2020 UWMPs
17	Environmental Council of Sacramento (ECOS)		6/18/2021	Section 2			Section 2 encompasses a compendium of information about the SAS. While we understand that the existing monitoring well system depends on existing wells and monitoring programs of the GSAs and other organizations, we urge those deficiencies noted in the system be corrected and that plans be developed, and resources set aside to further the coverage of both the shallow and deep portions of the primary aquifer. In addition, time and experience may necessitate additional monitoring associated with ISW and GDE protection. Finally, the existing monitoring system needs to be assessed to determine if it is sufficient to monitor future groundwater banking operations. If additional wells and monitoring are needed, their installation, operation and maintenance costs should be incorporated within the water banking program and borne by its participants.	Section 3.5.3 summarizes the protocols for data collection and monitoring. Section 3.5. assesses and provides recommendations for improving the monitoring network, including installation of telemetry and data loggers, as well as protocols for data management. As part of the implementation of the GSP, the monitoring network will also be reassessed regularly for adequacy in tracking Subbasin conditions.
18	Huhtamaki Foodservice, Inc.	Amy Steinfeld	8/17/2021	Section 2.4			The Water Budget (Section 2.4) should account for Huhtamaki's historical and projected groundwater use within the Subbasin. This section does not present granular detail about groundwater use by commercial and industrial users, but rather estimates urban water demand based on 2015 Urban Water Management Plans (UWMPs) and agricultural demand through land use mapping. (See Plan, §§ 2.4.1.3.1, 2.4.1.3.2, 2.4.1.3.3.) Accordingly, the Water Budget may not capture large-scale commercial and industrial users, such as Huhtamaki, unless those users are accounted for within the UWMPs.3 As described above, Huhtamaki holds an overlying right to the Subbasin, has previously pumped groundwater from the Subbasin, and plans to resume groundwater pumping when the quality of its water is satisfactory. We thus recommend that the Final Plan assess the groundwater production of commercial and industrial users that may not be included in the UWMPs and incorporate this production into the Water Budget and other sections of the Plan.	The water budgets included in CoSANA reflect the data that was available at the time the model was developed. Updates can be considered for the 2025 GSP Update.
19	Huhtamaki Foodservice, Inc.	Amy Steinfeld	8/17/2021	Section 2.4.3 Section 5.4 Section 2.1.6			The Draft Plan indicates that three sections are missing: (1) Sustainability Yield Estimate (Section 2.4.3); (2) Funding Sources and Mechanism (Section 5.4); and (3) Interconnected Surface Water Monitoring (Section 2.1.6). The public and stakeholders must have the opportunity to review and comment on these sections prior to approval of the Final Plan by the groundwater sustainability agencies. (Cal. Code Regs., tit 23, § 355.4(b)(10); Plan, App. 1-D, p. 16.) Because these are fundamental sections of the Plan, we request that these sections be posted for review and comment as soon as possible.	These sections have now been provided for review
20	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3.1	2-51	628	Please revise as follows: "Currently, the monitoring network at Kiefer consists of ~~23~~ 65 monitoring wells." Source info for revision: Page 10 of https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/sacramento/r5-2016-0013.pdf	Change has been made
21	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3.1	2-51	630	Please revise as follows: "The infiltration basin pilot study was successfull~~y~~, and the County ~~is currently awaiting~~ has received approval for permanent use" Source info for revision: https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2015-0012_noas/r5-2015-0012-062.pdf	Change has been made
22	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3.2	2-51	638	Please revise quantities (AFY) in Table 2.1-16, Kiefer Groundwater Pumping, as follows: 2010 1,099; 2011 1,142; 2012 391; 2013 518; 2014 507; 2015 460; 2016 380; 2017 475; 2018 599; 2019 650; Average 622. Source info for revision: Spreadsheet data previously supplied to Woodard & Curran for CoSANA model on 6/11/2020	Change has been made
23	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.5	2-53	678	Please revise quantity (AFY) in Table 2.1-17 for Kiefer to 622 AFY. Source info for revision: See Line No. 638 comment above.	Change has been made
24	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18	2-36	346	Please revise the estimated Remediation Water Use for Kiefer Landfill to 612 AF/year for the 2018 Water Year. Source info for revision: Spreadsheet data previously supplied to Woodard & Curran for CoSANA model on 6/11/2020	Change has been made

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25	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3	2-49	590-592	Please revise these lines to reflect the most recent regulatory orders, as follows: "The CVRWQCB carries out Kiefer Landfill remediation under WDR Order ~~R5-2007~~ R5-2016-0013. Additional information can be found here: https://www.waterboards.ca.gov/centralvalley/board_decisions/~~tentative orders/0708/kiefer/kiefer-wdr.~~adopted_orders/sacramento/r5-2016-0013.pdf"	Change has been made
26	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3	2-49	593	Please revise this line as follows: "The Kiefer Landfill is a 1,084-acre site with an active class III ~~300~~ 335-acre solid waste disposal site..." Source info for revision: See Page 2, Finding No. 6 of https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/sacramento/r5-2016-0013.pdf The number was adjusted upward by 30 acres to account for recently opened landfill Module M4.	Change has been made
27	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3	2-49	603	Please revise this sentence as follows: "Sacramento County was issued a ~~tentative order~~Order No. 89-207 to install a network of monitoring wells." Source info for revision: CVRWQCB Order No. 89-207, copy available upon request. Please also note that Tentative Orders are not issued and not enforceable.	Change has been made
28	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3.1	2-51	618	Please revise the sentence that is fully contained on this line as follows: "Approximately ~~375,000~~ 650,000 gallons of water are treated each day." Source info for revision: last sentence of 3rd paragraph of Page 2 of: https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2015-0012_noas/r5-2015-0012-062.pdf ("The Discharger proposes an average and maximum discharge to the infiltration basin at approximately 450 and 900 gpm, respectively, which are flows expected from the groundwater extraction and treatment system.")	Change has been made
29	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3.1	2-51	619	Please revise "rate of 1,000 gallons per minute" to "rate of up to 1,000 gallons per minute" Reason: Please see revisions to historical pumping rates which follow below (Line 638 comments), which show that the 1000 gpm level is rarely attained.	Change has been made
30	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.3.3	2-52	642-648	These figures appear to have been extracted from a 2009 report. In 2015 (the last time that these figures were estimated), the numbers for VOCs remaining in Zone A were 90 pounds and for Zone B were 13 pounds. The 2015 annual report is available on Geotracker (see Section 10.7 for total VOC mass estimates). Also, in line 648, "2000" should be replaced with "1995", as 1995 is the reference year for the groundwater cleanup that is used in all reports and orders.	Change has been made
31	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	2.18.4	2-52	665-667	There are about ten other landfills listed on Geotracker (https://geotracker.waterboards.ca.gov) that overlay the SASb. Two of these (28th Street and L & D Landfills) are in corrective action.	The list has been updated
32	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/13/2021	Figure 2.3-46 and throughout Section 3			While the GSP clearly identifies data gaps and their locations, we recommend that the GSP considers any segments with data gaps as *potential* ISWs and clearly marks them as such on maps provided in the GSP.	No action is taken.
33	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/25/2021	Section 2			Provide more information regarding the selection of the American River Basin Study and the methods through which climate change is incorporated, since this is a different method than the use of climate change factors suggested by DWR.	This rationale has been clarified and improved in the text.
34	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/26/2021	Section 2			Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.	This change is not taken, but the rationale for selecting the central tendency has been made more clear.

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35	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/27/2021	Section 2			Calculate sustainable yield based on the projected water budget with climate change incorporated.	The sustainable yield estimate utilizes the climate change scenarios that were analyzed for the GSP, along with the other modeling scenarios. The data does not indicate that climate change will significantly change the basin sustainable yield.
36	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/28/2021	Section 2			Incorporate climate change scenarios into projects and management actions.	We agree this is important, and evaluate a scenario that includes both climate change and PMAs.
37		Carl Werder	7/5/2021	Section 2	Page 135	Figure 2.3-18	Page 135 of 204, Figure 2.3-18., This hydrograph of wells 262 and 263 shows a steady decline in the groundwater table as a result of over pumping for remediation efforts and over reliance of groundwater in the Vineyard area. This decline must be clearly addressed as the current drop in the water table is not sustainable. Action needs to be clearly stated in this document as to how this decline will be stopped prior to any reporting to DWR. And how soon projects will be up and running to rectify this ongoing problem.	The proposed projects and timing of implementation are described in Section 4
38		Carl Werder	7/5/2021	Section 2	Page 33	line 212	Page 33 of 204, line 212., Recommend adding internet location for DWR so that the reader of this document can obtain additional information concerning their individual wells.	This has been added
39		Carl Werder	7/5/2021	Section 2	Page 60	line 678, Table 2.1-17	Page 60 of 204, line 678, Table 2.1-17., This table uses an average but fails to show how many years to determine this average? Also, since this document shows numbers in Table 2.1-13 for 2018 why add additional numbers. It would be best to stay with either a year or a specified average throughout this GSP.	The table is a roll-up of the previous 3 tables that show the average from 2010-2019.
40		Carl Werder	7/5/2021	Section 2	Page 36	line 242, Table 2.1-10	Page 36 of 204, line 242, Table 2.1-10., Each of these SCGA well locations are shown in hydrograph format so as to show how some areas have declining water tables and others that have improved water tables. The problems with this draft document is that on pages 35 and 36 there is no reference to Appendix 2-B Hydrographs and the hydrographs in Appendix 2-B do not show either the Local Designation or State Well Number. In fact there are 459 hydrographs in appendix 2-B numbered in order. This appendix needs to be divided up into groups so as to allow the reader of this document to find a specific well. This seems to me to be a case of putting out so much information (459 hydrographs) and poor referencing of hydrographs so that the declining well locations are buried.	The well locations for the hydrographs in Appendix 2-B are shown on Figure 2.3-6. It will also be available in an easy-to access format in the Subbasin Data Management System.
41		Carl Werder	7/5/2021	Section 2	Page 203	Line 2936	Page 203 of 204, Line 2936., Very disappointed that this section has yet to be completed. This is the real meat of this section one. Everything else in this section one is just a repeat of existing documents providing nothing new to the reader. Please forward this section to me via email as soon as it becomes available.	Section has now been made available for review
42		Carl Werder	7/5/2021	Section 2	Page 43	line 346, Table 2.1-13	Page 43 of 204, line 346, Table 2.1-13., This table for 2018 shows a total remediation groundwater extraction of 34,322 AF/yr and Aerojet alone extracting 26,075 AF/yr. However, on page 189 of 204, Table 2.4-7, remediation amount is only 21,000 AF/yr over a period of nine years and yet it goes up over a period from 1970. This makes no sense and appears to be deflecting the fact that remediation efforts contribute to reducing recharging of the groundwater in the Vineyard area.	The numbers have been checked and updated
43		Carl Werder	7/5/2021	Section 2	Page 59	line 607	Page 59 of 204, line 607., The words “small decline” are subjective and the word ‘small’ should be deleted as this is an opinion with no bases in fact.	This sentence has been removed
44		Carl Werder	7/5/2021	Section 2	Page 60	line 705 and 706	Page 60 of 204, line 705 and 706., The yield number of 273,000 AF/yr is a negotiated settlement amount that has no bases in fact. This was pointed out by DWR in their rejection of the SCGA Alternative. Therefore, I recommend that any reference to this number be deleted from this GSP.	The yield amount from the Water Forum Agreement is provided for historical context
45		Carl Werder	7/5/2021	Section 2	Page 14	line 78, Table 2.1-2	Section 2. – Page 14 of 204, line 78, Table 2.1-2., Why is this document using 2018 Water Year and not 2019 or a better picture of distributed water would be a three year average.	2018 was the last year where all data was available at the time the document was developed
46		Suman Singha, PhD	8/16/2021	Section 2	2-194	2908	I believe the word should be “with” not “without”	Change has been made
47		Suman Singha, PhD	8/16/2021	Section 2		Table 2.1-7 and Figure 2.1-12	Table 2.1-7 CDEC Flow Stations in SASb lists 4 active and 1 inactive sensor. The corresponding Figure 2.1-12 lists 5 active and 3 inactive sensors; with one active sensor being outside the SASb.	Thin shown the Section 3.2

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1	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	20	566	Allowing the minimum threshold at some representative monitoring points to be set lower than the 2015 low is unacceptable. Model simulations of projected conditions with climate change and PMA should not be allowed to serve as the minimum threshold. The purpose of SGMA is to ensure sustainability of the subbasin. If projected conditions with climate change and PMA result in groundwater levels lower than the 2015 low, then additional management actions must be taken in order to raise groundwater levels to at least the level of the 2015 low. It is unacceptable and disingenuous just lower the minimum threshold so that existing PMA are sufficient to not exceed the minimum threshold.	The reviewer's opinion is that SMC should not be set lower than the 2015 groundwater level. SGMA requires GSAs to evaluate the impact of SMC on beneficial users of groundwater. There is no one "historical" water year that guarantees the avoidance of impacts to beneficial users, and it is incorrect that significant and undesirable results are avoided if groundwater levels fall below those recorded in an arbitrary year. SGMA requires quantitative assessments of the impacts to beneficial users observed at MTs (evidenced by comment letters to Paso Robles and Cayuma GSPs). Thus, this plan acknowledges that the environment, domestic users, agricultural users, industrial users, and municipal users all require groundwater. Then, it sets MTs at levels that avoid significant and unreasonable impacts to these users of groundwater. The plan forecasts the avoidance of impacts to beneficial users (summarized in Section 3.3.1.2, and in technical Appendices 3A, 3B, and 3C).
2	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	7	109	Localized undesirable results such as this would likely not exceed the sustainable management criterion of 25% of representative monitoring wells being below the minimum threshold for three consecutive years. How will beneficial users be protected from localized undesirable results?	Our analyses suggest that even if 100% of wells reach MTs, significant and unreasonable impacts to wells are avoided. However, in an abundance of caution, the GSP advances a well protection program in Section 4.7.1 and a budget item in Section 5 to provide coordination, monitoring, outreach, a well census, and rehabilitation funds. Annual reporting and ongoing monitoring efforts, coupled with the well protection program will protect well users from localized undesirable results.
3	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	8	151	Wells that are currently functioning and become impacted due to lowering of groundater levels must be included in this count even if the wells are not listed in the DWR Well Completion Report database (as is the case for many older domestic wells). That is, even if a well is not listed on the DWR Well Completion Report database, if it is impacted it will be considered as contributing to the undesirable result threshold.	The GSP will always use the "best available information", which at this time is the DWR WCR database. As the well census yields more accurate well location information, these data will be used.
4	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	27	661	Both the 31 or 40 year retirement age for wells is inappropriate. My own domestic well is 47 years old and still functions quite well. Most of the other homes in my Ag/Res area were also built in the 1970s and still have original functioning wells. By assuming that older wells are not active, functional wells are being inappropriately removed from the domestic well count.	We thank the reviewer for this comment. Well impact analyses were re-run using a 50 year retirement age and found an additional 6 wells were impacted, and the count of active wells increased to about 1300 (compared to around 400-800). Thus, forecasted well impact appear insensitive to well retirement age. Importantly, these results to not change the definition of significant and unreasonable impacts to wells occurring at 5% of impacted wells. We keep the text as-is because using lower well retirement age results in a more conservative count of wells required to reach 5%. If a larger retirement age is used for GSP planning purposes - as the reviewer suggests - then the number of wells required to trigger a significant and unreasonable impact is also increased (5% of 1300 wells is 65 wells, but 5% of 400 wells is only 20 wells). Thus, using a larger retirement age in the GSP planning process may make it difficult to more rapidly respond to a well impact situation should it occur. Moreover, we point out that the reviewer's well is one sample. Retirement ages of 31 and 40 years are suggested by peer-reviewed literature that use thousands of samples (Gailey et al., 2019; Pauloo et al., 2020), and which are more appropriate until better data is uncovered in the well census.
5	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	27	654	The DWR Well Completion Report database that provides the basis for the number of active domestic wells is woefully incomplete, particularly for older wells (prior to 1990). My 1974 fully functioning domestic well is not included in the database, nor are many of my neighbors' wells. I live in a section of Elk Grove that is specifically zoned for Ag/Res small parcels and each residence has its own well, but many of these wells are not shown on the database. I've heard that Sacramento County well records prior to 1990 are a mess and not digitized, so weren't included in the database. In order to get a better count of active domestic wells and a more representative depth estimate of those wells, a well census should be conducted.	We fully agree with the reviewer and a well census is already proposed as part of the well protection program (Section 4.7.1). This effort will begin during the first year of SGMA implementation.
6	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	27	general	If 2-3% of domestic wells are impacted, the number of domestic wells impacted will be much higher than the 7 estimated by the climate change + PMA simulation. This is due to the incomplete nature of the DWR Well Completion Report database. The database is missing many older wells (pre-1990) that are still functioning, so the number of active domestic wells is undercounted. Also, newer wells tend to be drilled deeper than the older wells were, so the depth of domestic wells appear deeper and thus less vulnerable than they actually are.	This is not necessarily true. If older wells are indeed missing from the DWR WCR database, these wells are more likely to be shallower due to their age, and thus inactive anyway. As presented in working group meeting 10 (December 11, 2020), average domestic well depth in the SASb increased by a factor of 3 between 1940 and 2020. Nonetheless, the WCR represents our best available information on well construction and we must use it. In an abundance of caution, and acknowledging potential limitations in the data, a well census is planned, alongside a well protection program that involves monitoring, coordination, and rehabilitation funds.
7	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	27	675	Well rehabilitation costs is estimated based on the number of wells that will need to be deepened due to the water level declining to below 30 feet above the bottom of the well. However, there may be many more wells that are impacted due to the water level falling below the minimum level above the pump. These wells will need to have their pump lowered in order to maintain productivity. Lowering the pump is substantially cheaper than deepening a well, but may be much more common and thus contribute substantially to the cost of the program. It must be made clear that lowering of pumps in impacted wells is also covered in the Shallow/Vulnerable Well Protection Program	"Pump lowering" is now mentioned in the identified line. The authors wish to make it known that "well rehabilitation" and "well impacts" are used throughout the plan instead of "well replacement" and "well failure" to account for exactly the kind of lower-cost rehabilitation to impacted wells that the reviewer points out.
8	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	27	677	This cost is likely a gross underestimate because 1) it ignores the cost of lowering pumps which may be much more commonly needed than deepening wells, and 2) the number of wells that may be impacted is underestimated due to the fact that the DWR Well Completion Report database only includes a fraction of active wells and is skewed younger and deeper than the actual active well population.	(1) The model referenced by Pauloo et al (2021), EKI (2020) and Gailey (2019) actually does internalize the cost of pump lowering and well deepening. (2) Impacted well counts increase by about 6 when using a 50 year retirement ages, and thus costs are not substantially different than those reported in the GSP. Importantly, uncertainty and potential missing data that inform these models should be recognized. The GSP acknowledges this in the form of a well protection program with coordination, monitoring, a well census, and a well rehabilitation fund to mitigate impacts caused by unsustainable groundwater use.

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9	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	27	681	Estimated well impacts and associated rehabilitation costs were shared during public meetings, but the public response and feedback has not been properly addressed. During public meetings, Ag/Res residents brought up the incomplete nature of the DWR Well Completion Report database and the inappropriate 31-40 year old retiremet age for domestic wells, but neither of those issues were addressed.	Concerns about the retirement age parameter have been addressed in additional analysis that suggests only minimal additions to impacted well count that are still on the order of 1% of wells impacted. We elect to keep well retirement ages as-is so that the count of wells impacted to trigger undesirable results stays low (5% of 1300 wells is 65 wells, but 5% of 400 wells is only 20 wells). Section 4.7.1 details a well protection plan which includes a management action of improving well data in the region. This will drive more accurate well impact models. At the same time, a well rehabilitation fund will be built up to protect well users from unintended impacts.
10	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	31	745	Again, allowing the minimum threshold to be set lower than the 2015 low is unacceptable. Model simulations of projected conditions with climate change and PMA should not be allowed to serve as the minimum threshold. The purpose of SGMA is to ensure sustainability of the subbasin. If projected conditions with climate change and PMA result in conditions worse than the 2015 low, then additional management actions must be taken. It is unacceptable and disingenuous just lower the minimum threshold so that existing PMA are sufficient to not exceed the minimum threshold.	The reviewer's opinion is that SMC should not be set lower than the 2015 groundwater level. SGMA requires GSAs to evaluate the impact of SMC on beneficial users of groundwater. There is no one "historical" water year that guarantees the avoidance of impacts to beneficial users, and it is incorrect that significant and undesirable results are avoided if groundwater levels fall below those recorded in an arbitrary year. SGMA requires quantitative assessments of the impacts to beneficial users observed at MTs (evidenced by comment letters to Paso Robles and Cayuma GSPs). Thus, this plan acknowledges that the environment, domestic users, agricultural users, industrial users, and municipal users all require groundwater. Then, it sets MTs at levels that avoid significant and unreasonable impacts to these users of groundwater. The plan forecasts the avoidance of impacts to beneficial users (summarized in Section 3.3.1.2, and in technical Appendices 3A, 3B, and 3C).
11	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	81	1610	Rather than using "best professional judgement" to ensure that groundwater samples are representative of ambient groundwater, sampler collectors should use standard protocol from USGS National Field Manual for the Collection of Water-Quality Data, which specifies allowable fluctuation in pH, temperature, electrical conductivity, turbidity, etc.	Thank you for the recommendation, the recommended change has been incorporated.
12	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	65	1362	Public supply wells tend to be deeper than domestic wells. Will groundwater quality measurements from these wells actually be representative of groundwater quality in domestic wells? Most domestic well users do not monitor groundwater quality on a regular basis, but could be the first affected by water quality changes. Some domestic well owners (like myself) might be willing to allow regular sampling from our wells in order to get better spatial and depth coverage for monitoring efforts.	Two water quality monitoring networks are proposed for the basin: an upper aquifer network, and a lower aquifer network. A combination of municipal and monitoring wells of various depths will be utilized for these networks. In short, the deeper public supply wells will be used to characterize the lower zone, and the shallower monitoring and domestic wells will monitor the upper zone. As shown in Table 3-7, 11 wells have been selected to monitor the upper aquifer zone, and 10 wells have been selected to monitor the lower aquifer zone. This equates to roughly 36% of the upper aquifer layer being monitored (Figure 3-25), and roughly 47% of the lower aquifer layer being monitored (Figure 3-26). It is noted that these coverages are only estimates, as there is no official guidance on the required number of wells to monitor a basin of this size and pumping rate. Additionally, the monitored coverage will be increased in the future with wells incorporated to fill spatial data gaps, as well as existing wells within Regional San's Harvest Water Project. So, although deeper public supply wells may not necessarily be representative of shallower domestic wells, the proposed monitoring network contains an adequate assortment of well depths, sufficiently characterizes basin conditions, and is capable of being upgraded if spatial gaps are determined. Thank you for the interest in volunteering your well. Private wells were considered, but the team is hesitant to include these wells in the network as the data will be part of public, long-term record, and the goal is for these locations to be monitored 40+ years.
13	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	60	1306	The monitoring network only achieves 92% spatial coverage when combining data from both aquifers. The upper aquifer only has 70% spatial coverage and the lower aquifer only 50% coverage. There is a large spatial gap, particularly in the upper aquifer, near the center of the subbasin to the north and south of Elk Grove. Additional wells should be added to the monitoring network in those locations to fill the spatial data gap. These locations are particularly important to monitor due to the high density of domestic wells in the rural estates of Elk Grove.	The RMP network for groundwater level includes 45 wells which is nearly triple the amount required by DWR for a basin of the acreage and pumping capacity of the SASb (n = 16). The SASb has one principal aquifer (Section 2) with shallow and deep zones. Monitoring networks are designed to follow the zones of production from this principal aquifer. We maintain that together, the monitoring network is sufficient and representative.
14	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	66	1388	The water quality monitoring network should also include wells with a history of arsenic measurement. Figure 2.3-36 showed many shallow wells with arsenic exceeding the EPA MCL. Changes in groundwater levels and flow directions due to groundwater management could mobilize arsenic into other shallow wells such as those used for domestic purposes. Even if arsenic is naturally occurring and being mobilized from sediments, changes in groundwater flow and chemistry (i.e., changes in oxidation-reduction potential) could mobilize arsenic into the water.	While we agree that water quality monitoring should be conducted for arsenic, the historical assortment of constituents monitored at wells within the basin makes inclusion of wells monitored for arsenic, as well as TDS and N, hard to include in the network. Therefore, efforts will be made to ensure wells have historical record of arsenic measurements, but this cannot be guaranteed.
15	Ag/Res resident	Amelia Vankeuren	8/17/2021	3	68	Figure 3-24	There are huge spatial gaps in the groundwater quality monitoring network. This is highly concerning given the concentration of domestic wells in the upper aquifer. Most domestic well users do not measure groundwater quality except when buying or selling a house, so changes in water quality in this aquifer (e.g., increases in nitrate or arsenic) could go undetected for years and cause significant health impacts.	Monitoring coverage of the shallow aquifer is planned to be expanded in the near future. Wells from Aerojet's network in the northern portion of the Subbasin, and wells located within Regional San's Harvest Water Project area in the southern portion of the Subbasin, will be added to expand coverage. The northwestern portion of the Subbasin covers urban areas with no known issues related to nitrate or TDS, and therefore no expansion is planned for that region at this time. As shown in Table 3-7, 11 wells have been selected to monitor the upper aquifer zone, and 10 wells have been selected to monitor the lower aquifer zone. This equates to roughly 36% of the upper aquifer layer being monitored (Figure 3-25), and roughly 47% of the lower aquifer layer being monitored (Figure 3-26). It is noted that these coverages are only estimates, as there is no official guidance on the required number of wells to monitor a basin of this size and pumping rate.
16	Ag/Res resident	Amelia Vankeuren	8/17/2021	Appendix 3-A	18	Figure 7	The projected conditions with PMA and climate change result in a decline of groundwater levels to 15 ft below the Fall 2015 low along a north-south oriented line at the center of the subbasin. This amount of decline is unacceptable, particularly given the high concentration of domestic wells that fall in that zone of groundwater level depletion near Elk Grove. While it appears that most domestic wells were still functioning during the 2012-2016 drought, an additional decline of 15 ft may impact many domestic wells in that area and require well rehabilitation in the form of pump lowering or well deepening. Additional PMA should be planned in order to prevent the projected groundwater level declines in the center of the subbasin.	Our modeling suggests that even in this situation, an additional 15 feet of decline in this area is unlikely to impact wells to a significant and unreasonable degree (see Figure 15 in this appendix). PMA are developed around a well protection program to fund rehabilitation, to run a volunteer monitoring program, to coordinate with local community members, and to fill data gaps to better model well impacts.

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17	Ag/Res resident	Amelia Vankeuren	8/17/2021	Appendix 3-A	25	Figure 13	The range of domestic well total completed depths determined from the DWR Well Completion Report database is likely deeper the actual range of depths in active domestic wells. The database is incomplete, particularly for wells installed prior to 1990, many of which are still in use in rural communities that were built in the 1970s and 1980s like those near Elk Grove. The older wells that are not listed on the database tend to be shallower than the newer wells that are listed. The Greater Sheldon Rural Estates Homeowners Association has been collecting well information from its members and has found that there may be significantly more wells in the more vulnerable 150-200 ft depth range than Figure 13 suggests.	As part of the well protection program and ongoing annual reporting and monitoring, the GSP will incorporate the best available information into the SGMA planning process, which can include the well information collected by GSREHA. Until then, this plan uses the best available information.
18	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Sustainable Management Criteria; 3.3.1, 3.4.1 Groundwater Levels and 3.3.4, 3.4.4 Depletions of Interconnected Surface Water			5. Comment #5 Sustainable Management Criteria (Sustainable Management Criteria; 3.3.1, 3.4.1 Groundwater Levels and 3.3.4, 3.4.4 Depletions of Interconnected Surface Water): Groundwater level and interconnected surface water sustainable management criteria (SMC) may not protect against undesirable results for fish and wildlife beneficial uses and users of groundwater and interconnected surface waters. a. Issues: i. Minimum Thresholds: Minimum thresholds (MTs) for groundwater levels, and by proxy, for depletions of interconnected surface water, are not likely to prevent undesirable results for environmental beneficial uses and users of groundwater and interconnected surface water. The GSP assumes that conditions that have previously occurred in the basin did not lead to significant and unreasonable impacts to beneficial users of groundwater, relying on a circa 2015 baseline. At this baseline, which occurred towards the end of an extended period of dry from 2012 to 2016 (including two back-to-back Sacramento Valley critically dry water years in 2014 and 2015), wherein groundwater extraction increased to replace more than 70% of lost agricultural water supplies (Lund 2018), it is probable that vegetated and aquatic GDEs were experiencing adverse impacts due to combined groundwater depletion and reduced surface water availability. These adverse impacts included stressed or dying riparian vegetation, poor instream habitat availability, and increased water temperatures (DFW 2019). The GSP contends that only groundwater conditions that worsen beyond historic lows would constitute an undesirable result. However, GSPs must first evaluate potential adverse impacts to beneficial uses and users and determine at what groundwater levels those impacts would occur, and then set minimum thresholds accordingly. Defaulting to the post-2015 low groundwater level as minimum thresholds because similar	The comment contends that ISW and GDEs may have experienced significant and unreasonable impacts during the period circa 2015, but does not state or quantify what those impacts were. Without this information, it is difficult to assess the validity of this claim. Moreover, in contrast to what the reviewer states, MTs in this plan do not default to post-2015 lows, but rather are based on projected groundwater level change due to water use, projects and management actions, and climate change. Next, impacts to beneficial users are at these projected groundwater levels were assessed and found to be below ranges defined as significant and unreasonable by the GSAs. Avoiding impacts to beneficial users is at the core of this GSP, and we refer the reviewer to technical appendices 3A-3C, which detail the methods and results for impacts to wells, ISW, and GDEs. To summarize results here: quantified impacts to beneficial users were less than limits that the working group defined as significant and unreasonable. For instance, in the worst case scenario evaluated ("climate change with no PMA") domestic wells impacted by 1-2%. MTs are in fact set higher than these levels (i.e., at the scenario "climate change with PMA"), leading to even less well impact. Furthermore, at projected MTs, ISW reach length is may decline by 2.6% relative to 2015 conditions, and late fall baseflow to streams - important for spawning migration and habitat - will stay roughly the same, and may increase depending on the severity of climate change in the basin. Finally, GDE area is estimated to change by -3% to + 4% depending on the impacts of climate change, meaning that a low severity scenario actually leads to an increase in GDE area over the SGMA management horizon. Therefore, we maintain that the SMC set herein protect beneficial users of groundwater to quantifiable degrees and do not classify as "significant and unreasonable".
19	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Sustainable Management Criteria; 3.3.1, 3.4.1 Groundwater Levels and 3.3.4, 3.4.4 Depletions of Interconnected Surface Water			ii. Undesirable Results: The GSP metrics for declaring an undesirable result for the chronic lowering of groundwater, and by proxy, the depletion of interconnected surface water, may not sufficiently protect environmental beneficial users of groundwater. The GSP requires 25% of representative monitoring wells in the subbasin to fall below their MTs for three consecutive years before identifying an undesirable result to GDEs or ISW. While environmental users are adapted to sustain short-term lowering of groundwater levels during dry periods, environmental users may not be able to sustain extended periods of reduced groundwater access that would result from allowing groundwater levels to fall to historic lows for three consecutive years. The scenarios analyzed in the GSP showed that climate change impacts are likely to be most acutely felt by interconnected surface waters and GDEs that rely on shallower groundwater (line 559). By the time an undesirable result is declared, and management actions are triggered in response to the undesirable result, environmental users will have already experienced significant stress and potentially irreversible mortality.	As described in comment 18, in a theoretical and unlikely worst-case scenario in which all MTs are simultaneously reached across the entire basin was used to estimate impacts to ISW, GDE, and wells. Results suggest that these impacts are minimal and below thresholds determined by the GSAs as significant and unreasonable. Moreover, actual impacts would be even less if 25% of RMPs reach their MTs (versus the 100% of RMPs that we stress-tested our SMC against). To be clear, MTs have been carefully set and iteratively defined with respect to analyses of impacts to beneficial users such that they avoid "significant and unreasonable impacts", not "all impacts whatsoever".
20	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Sustainable Management Criteria; 3.3.1, 3.4.1 Groundwater Levels and 3.3.4, 3.4.4 Depletions of Interconnected Surface Water			b. Recommendations: i. Minimum Thresholds: The Department recommends the GSP reselect minimum thresholds that would better protect environmental uses and users of groundwater, rather than defaulting to the historical low groundwater levels for the subbasin. ii. Undesirable Results: The Department recommends the GSP reconsider the 3-year duration of groundwater levels below MTs required to constitute an undesirable result, recognizing that extended durations of groundwater inaccessibility for environmental users will likely lead to adverse impacts that cannot be easily reversed when groundwater levels recover. At a minimum, the Department recommends identifying physical triggers (e.g., declining Normalized Difference Vegetation Index (NDVI) signals) and associated management actions (e.g., demand reduction) to mitigate localized patterns of lowering groundwater or depleted ISW that can be implemented before the third consecutive year of MT exceedances. These interim action triggers will help preempt irreversible losses and undesirable results, instead of waiting for three years before deciding a trend is unacceptable. Protective MT criteria and/or interim action triggers are particularly important if anticipated supply augmentation PMAs are not implemented in a timely or predictable manner (see Comment #6).	These comments are well taken. (i) MTs are not, as the reviewer states, set to historic lows, but rather based on a simulation of our best-available information of forecasted groundwater pumping, PMAs, and climate change. In some locations, MTs are lower than historic lows, and in other locations, MTs are higher than historic lows. Importantly, across all scenarios tested, significant and undesirable results are avoided if 100% of RMPs reach their MTs, thus 255 of RMPs reaching MTs is conservative. (ii) In the abundance of caution, we have already implemented what the reviewer recommends in this second bullet point. We direct the reviewer to table 3-2, which lists criteria for GDE area and GDE NDVI set at historical minima, that when reached trigger the identification of significant and undesirable results for GDEs. These findings are elaborated upon in Technical Appendix 3B (Freshwater Trust, 2020), and importantly allow the identification of unprecedented impacts to GDEs even if RMPs do not register the identification of undesirable results.

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21	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Sustainable Management Criteria, 3.3 Minimum Thresholds, 3.4 Measurable Objectives and Interim Milestones, 3.5 Assessment and Improvement of the Monitoring Network			Comment #6 Monitoring Networks (Sustainable Management Criteria, 3.3 Minimum Thresholds, 3.4 Measurable Objectives and Interim Milestones, 3.5 Assessment and Improvement of the Monitoring Network): The GSP is inconsistent in identifying data gaps and plans for improvement of the monitoring network. a. Issue: i. Shallow Groundwater Monitoring: Existing shallow groundwater monitoring wells may not be sufficient to characterize groundwater level trends as they relate to potential GDEs within the subbasin. The GSP identified the need for additional shallow groundwater data near both surface waters and natural communities commonly associated with groundwater (2.2.9, line 1738); while the GSP later discusses plans to install paired monitoring wells and stream gauges (3.5.5, line 1735), there is no further discussion of the plan to collect additional shallow groundwater data near GDEs. ii. Representative Monitoring Points: While Table 3-4 (page 3-36) includes the geographic coordinates of the representative monitoring points (RMP), the points are not explicitly identified on any of the maps that display the RMP thresholds. iii. Groundwater Elevation Mapping: The maps in Section 3 that display groundwater levels of minimum thresholds (Figures 3-13 and 3-17; beginning on page 3-37) and measurable objectives (Figures 3-15 and 3-18) utilize elevations above mean sea level. Without a reference to the ground surface elevation, it is difficult to determine the depth of groundwater levels below ground surface and evaluate potential impacts to groundwater dependent ecosystems and interconnected surface water.	We are confused by the reviewer's comment, because all of the items that are reportedly missing are in fact present in the public draft of the GSP. First, we maintain that the RMP network is sufficient, that data gaps are consistently identified, and that plans for improvement of the groundwater level network are clearly outlined (Section 3.3.1.3, Figure 3-28), described in Section 4 (PMAs), and budgeted for in Section 5. (i) Shallow monitoring wells adequately cover GDE areas in the basin (compare Figures 3-23, 3-24 with Figure 3-7). There are no plans to collect additional shallow groundwater measurements near GDEs because enough are present. In fact, the 45 RMPs is nearly triple DWR recommendations for a basin of this size and pumping (n = 16). Finally, the additional monitoring alluded to in the comment for ISW is a separate issue: to better understand surface and groundwater interactions near ISW data gaps. Given the co-location of ISW and GDEs, these monitoring networks will also aid in GDE monitoring. (ii) The point is well taken, and Figure 3-14 now shows RMP ids and locations. (iii) The point is well taken and RMP MOs and MTs are now shown with as elevation and depth to groundwater in Figures 3-15, 3-17, 3-19, and 3-20. Moreover, Figure 3-5 now shows all hydrographs as depth to groundwater.
22	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Sustainable Management Criteria, 3.3 Minimum Thresholds, 3.4 Measurable Objectives and Interim Milestones, 3.5 Assessment and Improvement of the Monitoring Network			iv. ISW Data Gaps: The GSP states "reaches of the Cosumnes River approximately between Deer Creek and Twin Cities Rd. … are considered a data gap for planning purposes, and more research and inter-basin coordination is needed to determine the nature of surface groundwater interactions in this region. It is expected that by the next plan update (2027), a revised determination of ISW in this area will be developed" (page 3-29). The GSP describes how other data gaps, such as the lack of well perforation data, "will be addressed in future fieldwork during the GSP implementation period" (page 3-55). The GSP proposes that "additional stream gage and continuous monitoring will be installed in the area" to address the data gaps (page 3-79); however, the proposed monitoring network (displayed in Figure 3-21 on page 3-58) does not include any indicators for interconnected surface water near the stretch of the Cosumnes River that has been identified as a data gap. In particular, the two representative monitoring points closest to this area are proposed to only monitor groundwater level and groundwater storage, but not ISW. v. ISW Monitoring: Figure 3-21 (page 3-58) identifies interconnected surface waters in the far northeast portion of the subbasin. However, the representative monitoring points closest to these interconnected surface waters are proposed only to monitor groundwater level and groundwater storage, but not ISW.	(iv) As detailed in the ISW technical memo (Appendix 3C), and as emphasized in "Addressing Regional Surface Water Depletions in California: A PROPOSED APPROACH FOR COMPLIANCE WITH THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT" (EDF, 2018) groundwater monitoring locations should be sufficiently spaced away from ISW to avoid near-stream hydraulic influences in the groundwater level signal. To serve as an adequate monitoring point for ISW depletion, a monitoring well should represent changes in the expanding cone of depression that will eventually surpass the well's location and propagate to the steam, thereby capturing a portion of its streamflow. Thus, we disagree with the reviewer that points proximal to streams should be included based on their proximity alone, and refer them to Figure 34 of Technical Appendix 3C and EDF (2018). Our analysis suggests selecting monitoring wells between 3000 and 9000 feet from streams, consistent with EDF (2018) recommendations to position wells beyond 2000 feet from streams: "To indicate incipient streamflow depletion, therefore, water-level measurements in this zone, which for purposes here is estimated to be between 0 and 2000 feet for most Central Valley conditions, are not useful. (p. 8)". The two wells the reviewer suggests should monitor for ISW are in fact too close to the stream to be useful, but the one that we select is sufficiently spaced, and hence, used as an ISW RMP. Furthermore, we maintain that existing and planned monitoring in the Cosumnes River ISW data gap is sufficient. Paired, continuous, 15 minute groundwater level and streamflow data are collected at the upper and lower end of the Cosumnes River data gap, with plans to install an additional stream gage (Figure 3-29). (v) Please refer to the response above in (iv).
23	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Sustainable Management Criteria, 3.3 Minimum Thresholds, 3.4 Measurable Objectives and Interim Milestones, 3.5 Assessment and Improvement of the Monitoring Network			b. Recommendation: i. Shallow Groundwater Monitoring: Consistent with the GSP's acknowledgement of the need for additional shallow groundwater monitoring, the Department recommends the GSAs propose a specific plan for installing a discrete number of additional shallow groundwater monitoring wells near GDEs. The Department recommends using the list of GDE-associated beneficial users (not available for review, see Comment #3(ii)) to identify locations of GDE communities within the subbasin that are most likely to support special status species. GDEs that support special status species, or that are most vulnerable to reduced access to lowered groundwater levels (e.g., have limited surface water supply), should be prioritized for siting additional shallow groundwater monitoring wells. ii. Representative Monitoring Points: The Department recommends providing an identification number to each RMP listed in Table 3-4 and including a map identifying the location of each of the RMPs. iii. Groundwater Elevation Mapping: The Department recommends including ground surface elevation and groundwater depth below ground surface for the included maps. iv. ISW Data Gaps: The Department recommends that the GSP include specific gage and monitoring well plans and locations to address the data gap on the Cosumnes River. v. ISW Monitoring: The Department recommends that all interconnected surface waters are adequately monitored.	(i) RMPs that monitor shallow groundwater conditions (Figure 3-23 and 3-24) overlap with GDEs (3-6). Moreover, a robust plan to monitor changes in GDE area and NDVI are in place and we are confident in the GSP's ability to protect these beneficial users of groundwater. (ii) This comment has been addressed with a revised Table 3-4 and Figure 3-13. (iii) This has been addressed in Figures 3-15, 3-17, 3-19, and 3-20. (iv) This is already addressed in Section 3.5 (Figure 3-29) with commensurate PMAs in Section 4 and budget in Section 5. (v) In addition to groundwater level monitoring at carefully selected shallow aquifer monitoring wells, in an abundance of caution, the GSP also monitors for changes in the late fall spawning migration exceedance flow, and the ISW reach length. The Department's concerns are heard, and all efforts are being made to protect ISW.
69	Environmental Council of Sacramento (ECOS)		6/18/2021	Section 3			Section 3 effectively communicates the analysis done to comply with the requirements of SGMA and we concur with the proposed Sustainability Goal. However, we are concerned about the use of 2015 storage and water levels as the triggers in the Sustainable Management Criteria. The document implies that we can drop below 2015 levels for three consecutive years before any action is taken. However, under this approach, the GSPD does not comply with the SGMA provisions that direct conditions not to worsen below the 2015 base year. A more prudent approach would be to set the trigger levels higher so that action can be taken when water and storage levels initially reach the 2015 mark. The result of analysis presented in the GSPD makes it possible to adjust the Minimum Thresholds to levels that would require action when the actual 2015 values are reached.	In contrast to what the reviewer states, MTs are not all below 2015 levels. In fact, some are above 2015 levels, some are near 2015 levels, and some are below (Figure 3-4 and 3-5 in Section 3, and Figure 21 in the ISW technical Appendix). MTs are allowed to decline below 2015 levels, provided the avoidance of significant and unreasonable impacts to beneficial users of groundwater, which we demonstrate in three technical appendices to Section 3 and summarize in the Section 3 (see Section 3.3.1.2). Finally, we do not set trigger thresholds as the reviewer states at 2015 storage and levels. In fact, we do not set triggers at all. Rather, we use the identification of undesirable results as triggers for action and rely on PMAs to address them. Furthermore, the monitoring network and SMC tracking ensures continuous awareness of groundwater conditions in the basin, and GSAs will coordinate actions to address negative trends in the basin if and when they emerge as identified by the monitoring network, the SMC, and the onus of responsibility to continually evaluate groundwater conditions for annual reports and plan updates.

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24	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	3.4.3	3-51	1119	Regarding Table 3-6, L10008601447-MW-13 is a background well for Elk Grove Landfill and currently exceeds the Measurable Objective for Specific Conductivity. As this well is offsite and upgradient of the landfill and does not exceed any Water Quality Protection Standards for the landfill as specified by the CVRWQCB, achievement of the MOs would require action on the part of private landowners (Hilltop Cemetery) and public districts (Cosumnes CSD) and these other parties may wish to dispute or comment on the MOs, which are well below maximum thresholds. Without such input, the MO for Specific Conductivity should be increased to at least 580 umhos/cm, the current level of the Water Quality Protection Standard, and above the current Specific Conductivity of 538 umhos/cm. See Geotracker for further info.	This comment is well received and highlights the fact that MOs for specific wells must be reviewed at this time.
25	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	3.4.3	3-51	1119	Regarding Table 3-6, L10007396297-MW-40B is a downgradient well for Kiefer Landfill and this well currently exceeds the Measurable Objective for Specific Conductivity. However, this well does not exceed any Water Quality Protection Standards for the landfill, the Specific Conductivity is well below maximum thresholds, and no corrective action has been indicated for this location by the CVRWQCB, other than VOC treatment by air stripping (which does not reduce Specific Conductivity). Therefore, the Measurable Objective for Specific Conductivity for this well should be increased to at least the level of the Water Quality Protection Standard, which is set by statistical analysis of background wells and has varied between 480 and 512 umhos/cm in recent years. See latest monitoring reports on Geotracker for further info.	This comment is well received and highlights the fact that MOs for specific wells must be reviewed at this time.
26	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	3.5.2	3-71	Table 3-8	Please change GSA for Well ID L10007396297-MW-40B from OHWD to SCGA. Reference: SCGA MOU dated 5/13/2020 removing Kiefer Landfill from OHWD GSA.	Change incorporated.
27	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	Appendix 3-D	NA	Table A-1	Please change GSA for all Kiefer Landfill wells from OHWD to SCGA. Reference: SCGA MOU dated 5/13/2020 removing Kiefer Landfill from OHWD GSA.	Change incorporated.
28	Sacramento County Department of Waste Management & Recycling	Mike Koza	8/17/2021	Appendix 3-D	NA	Table A-1	Well depth to upper limit of screened interval for Kiefer Landfill well L10007396297-MW-38B is incorrect. Please use well depth to screen of 170 feet, as reported in Appendix B of 2020 annual monitoring report on Geotracker.	Change incorporated.
29	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			Issue 1: The number of functioning domestic wells The 5400 acres within the city of Elk Grove zoned Agricultural Residential, a fifth of its land area, at present contain over 1,200 occupied residences, all of them dependent for water on roughly the same number of domestic wells. This may be the principal dense concentration of domestic wells in the SCGA area, and perhaps one of the largest in the South American subbasin. Virtually all these wells are fully functioning and currently supply their associated residences with adequate water. The dramatic growth of this area, including in planned developments, dates back to at least the 1970s and 80s. Hundreds of wells over 30 or 40 years old, with some over 50, are maintained by their owners and are without visible deterioration.	The number of assumed active wells in our modeling efforts is controlled by an assumed "retirement age" parameter, which we have evaluated at 50 years in response to these comments. This raises the number of assumed active wells to around 1300, in line with the reviewer's suggestion. However, the true retirement age is likely to be lower than 50 years, consistent with the reviewer's claim that the DWR WCR database undercounts wells (thus a larger retirement age is required in order to increase the active well count to 1300). Well impact analyses re-run using a 50 year retirement age found an additional 6 wells were impacted, and the count of active wells increased to about 1300 (compared to around 400-800). Thus, forecasted well impact appear insensitive to well retirement age. Importantly, these results to not change the definition of significant and unreasonable impacts to wells occurring at 5% of impacted wells. We keep the text as-is because using lower well retirement age results in a more conservative count of wells required to reach 5%. If a larger retirement age is used for GSP planning purposes - as the reviewer seems to imply - then the number of wells required to trigger a significant and unreasonable impact is also increased (5% of 1300 wells is 65 wells, but 5% of 400 wells is only 20 wells). Thus, using a larger retirement age in the GSP planning process may make it difficult to more rapidly respond to a well impact situation should it occur. Moreover, we point out that retirement ages of 31 and 40 years are suggested by peer-reviewed literature that use thousands of samples (Gailey et al., 2019; Pauloo et al., 2020), and which are more appropriate until better data is uncovered in the planned well census (Sections 4.7.1 and 5).
30	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			(Issue 1 continued) The area water table and geological formations have been so stable that competently constructed wells have faced few threats. Well and pump purveyors serving our area say that residential well failures are rare. The Ag-Res area is subject to both City of Elk Grove and Sacramento County governance, plus community vigilance from CC&Rs and our two long active neighborhood associations established to monitor and defend the quality of rural life. This is not an environment in which a rash of well failures would go unnoticed. All observable evidence suggests that our domestic wells of all ages are generally performing adequately; we see no evidence to the contrary.	Our modeling is consistent with what the reviewer notes. Wells have no record of being impacted during recent historical lows (i.e., 2012-2016, DWR, MyDryWaterSupply), and our analysis of well impacts using peer-reviewed methods (Gailey et al., 2019; Paulo et al., 2020) suggests the avoidance of significant and unreasonable impacts. It is the intent of the well protection program in the GSP (Section 4.7.1) to not let well impacts go unnoticed. This is achieved by a volunteer monitoring program, coordination with a well advisory group, a well census, and a rehabilitation fund.
31	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			(Issue 1 continued) It is therefore with some surprise and puzzlement that we find in the recently released SASb draft Groundwater Sustainability Plan, particularly in Appendix 3-A, the suggestion that residential wells should be attributed an expected functional lifetime of something around 30 or 40 years, with the implication being that older wells should not be counted as viable or provided protection. If applied to Elk Grove, that policy could exclude hundreds of obviously functioning wells unproblematically providing water to their residences. Obviously, nobody knows the actual life span of our Elk Grove rural area domestic wells, since virtually all, including some several decades old, are still functioning and have not yet begun to peter out. There is no evidence on which to base a life expectancy estimate until we begin to see a failure pattern that has yet to appear. The only logical policy at this time is to accept the valid presence of all domestic wells in the Elk Grove rural residential area for both identification and protection. This will considerably raise what we understand to be the current SASb estimate of only around 700 eligible wells in the entire subbasin---only two thirds the number we observe just within the city limits of Elk Grove alone.	The reviewer is mistaken that the 30-40 year old retirement age parameter discredits older wells from being protected. The GSP at this time makes no distinction as to what wells are protected, but rather, creates a broad well protection program (Section 4.7.1) that includes among other provisions, a well rehabilitation fund. As the reviewer notes, no one knows the actual life span of a domestic well in the Elk Grove rural area. Retirement ages of 31 and 40 are used to address uncertainty in this parameter while still using the best available information (Pauloo et al., 2020; Gialey et al., 2019). A well census is designed as part of the well protection program to improve understanding of wells. Moreover, a well impact model was re-run with a retirement age parameter of 50 years, which brings the active well count closer to 1400, and increases well impacts by only 6 wells. As stated before, the 1% impact ratio is constant, but we elect to maintain retirement ages as-is in Section 3 and Appendix 3-A because a lower active well count results in a lower trigger threshold in terms of the count of impacted wells required to identify an undesirable result (5% of 1400 wells is 65 wells, but 5% of 400 wells is 20 wells). We hope that this conservative management threshold, coupled with the well protection program, gives the review confidence in the GSP.

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32	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			(Issue 1 continued) Curious about how the Subbasin working group could have come up with an estimate so obviously at odds with observable fact in our Elk Grove rural area, we consulted one of the main databases they cite---a website of well completion reports maintained by DWR. An initial look at the site suggests to us that the data it contains are so incomplete and so biased toward new wells that these data probably are worse than useless. Given the lack of credible evidence supporting any imputed average well life span in our Elk Grove rural area, plus strong prima facie evidence that virtually all wells of all ages, over 1,100 in number, are still working acceptably, we request that every well serving an occupied residence be counted as functional. There simply is no empirical justification for doing otherwise. The burden of proof is clearly on those who would impose a well lifespan criterion.	We have investigated the DWR WCR database and actually find the opposite. Please review slide 11 in Working Group presentation # 10 (December 11, 2020). The distribution of well completion dates shows no systematic bias towards well completion date. In fact, more older wells are represented compared to new wells. This makes sense because WCRs need to be tabulated and entered into the database, so we expect some lag time for new wells to enter the system. We disagree with the reviewer's comment that these data are "worse than useless" and instead offer that although limited, they are the "best available information" at the time of GSP writing. It is infeasible for the GSP to collect information on all domestic wells at the present moment, but the GSP takes management actions (Section 4.7.1) to improve well completion data through a well census during the first year of plan implementation. In an abundance of caution, the GSP also provides monitoring, coordination, and a rehabilitation fund.
33	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			Issue 2: Minimum Threshold The draft GSP proposes setting a subbasin-wide minimum threshold groundwater level equivalent to the groundwater level in the fall of 2015, a year of severe drought. That level is not the same everywhere relative to current groundwater levels, this year also being a severe drought year. We have not found a recorded 2015 groundwater level for the Elk Grove rural residential area, but anecdotal evidence from well and pump purveyors and other observers suggests that the groundwater level in 2015 was so close to the current ground level in 2021 that the difference is negligible. In the absence of solid evidence of a substantial difference, we propose that the groundwater level as measured in fall of 2021--under effects from the current drought---be adopted as the official recognized minimum threshold pertaining to the Elk Grove rural residential area. It is important to have a solid beginning point measurement, for the Elk Grove rural residential area is projected (Appendix 3-A, p. 17) to suffer some of the subbasin's most pronounced groundwater level decline (15 feet) even after accounting for project and management actions to retain water.	Groundwater level trends may be highly localized and influenced by a variety of hydrogeologic factors, however, the reviewer's claim that 2015 levels are close to 2021 levels at the scale of Elk Grove, or at a regional scale are inaccurate. Groundwater level data from the DWR, SCGA, OHWD, and UCD strongly suggest that, on average, levels were around 12 feet lower comparing 2019 and 2021 (slides 33-34, Working Group presentation #10, December 11, 2020). Moreover, setting MTs at present day levels, which may avoid significant and unreasonable impacts to domestic well users, would certainly cause significant and unreasonable impacts to municipal users of water - the GSP must avoid impacts to all beneficial users of groundwater as per the stated Sustainability Goal (Section 3.1). Thus, this GSP models impacts to domestic wells assuming all MTs are reached and finds a low impact proportion of around 1-2%, irrespective of well retirement age. Nonetheless, in the abundance of caution, please refer to the well protection program (Section 4.7.1).
34	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			One of the reasons for this especially severe decline is that the Elk Grove rural residential area does not substantially benefit from any such project or management action now planned. Nor are there any announced intentions to reinforce the especially impacted aquifers in this area. Hence, some of SCGA's, and the subbasin's, greatest groundwater table decline is projected to occur precisely at the location of its largest and most dense collection of shallow domestic wells, with no remedial action at the spot even considered. This is a recipe for looming disaster, and one practical means to help prevent it is to designate a minimum threshold for this area no deeper than the current water table at the time the GSP is proposed.	The reviewer's claim that Elk Grove does not benefit from planned PMAs is inaccurate. The Harvest Water and regional conjunctive use programs collectively are modeled to increase the groundwater level by around 6-12 feet in the Elk Grove area (technical Appendix 3A, Figure 8) compared to projected groundwater conditions without PMAs.
35	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			Issue 3: Well monitoring The large cluster of domestic wells and variety of conditions in the Elk Grove rural residential area suggest a need for denser well monitoring than is currently being considered for the subbasin as a whole. It is generally agreed between our associations and the technical working group advising the draft GSP that such enhanced monitoring will be useful, and that it must be conducted through organized community effort in communication with SCGA and perhaps whatever team is working across the subbasin. Because of the specificity of our area of interest---the designated rural residential area established within the city limits of Elk Grove---we have decided to organize under our auspices an independent community well monitoring project within and limited to the Elk Grove rural residential area, of course maintaining communication and cooperation with SCGA and related technical staff as appropriate.	We cannot agree more with the reviewer that local-scale well monitoring is needed, and in fact the GSP supports an even more dense monitoring effort through a volunteer monitoring network (compared to the RMP network) and coordination with a well advisory committee that can relate this information to the GSAs (Section 4.7.1).
36	Sheldon Community Association Greater Sheldon Road Estates Homeowners Association	William Myers Shirley Peters	7/21/2021	Appendix 3-A			Issue 4: Well protection program We request that any GSP adopted by SCGA and submitted for approval to DWR include the guarantee of a well protection program that deepens or replaces free of cost to owners all domestic wells within the Elk Grove rural residential area in which groundwater levels are judged in danger of sinking to levels less than 30 feet above the bottom of the existing well. Since at the time of this writing all known domestic wells in this area are functioning adequately with proper groundwater access, and since it is unlikely that the net water use of domestic well owners as a group surpasses the total rainfall they typically receive on their Ag Res acreage in a season, and since future conditions of groundwater availability and quality are likely to reflect management policies, practices and decisions taken by SCGA, that agency should from the date its GSP enters into force be responsible for maintaining full access of each and every Elk Grove rural residential area well to a sufficient groundwater supply. Well owners are responsible for maintaining well structure and equipment in good repair.	Precipitation as a benchmark for de minimis extraction is ill advised: groundwater inputs are not - as the reviewer suggests - controlled directly by precipitation, but rather, net deep percolation from imported and diverted surface water and runoff, and subsurface interflow. The metric that this GSP adopts quantifies the proportion of wells impacted (5%) after which significant and unreasonable impacts are identified, with no restriction on using the well rehabilitation fund (Section 4.7.1) prior to the identification of such results.
37	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/10/2021	Appendix 1D	69-71		Provide a map of tribal lands in the subbasin. The GSP states (p. 2-10): "The only tribal land that falls within the SASb is located south of Elk Grove near the intersection of Kammerer Road and Hwy 99." However no map, acreage, or population is provided.	Although we do not provide maps, acreage, or population counts, tribal governments and entities were contacted during engagement and outreach (detailed in Appendix 1D) and are involved in ongoing communication and outreach. Tribal groups involved in ongoing C&E include: Wilton Rancheria, Buena Vista Rancheria Mewuk Indians, Ione Band of Miwok Indians, Nashville Enterprise Miwok-Maidu-Nishinam Tribes, Shingle Springs Brand of Miwok Indians, Tsi Akim Maidu, United Auburn Indian Community of the Auburn Rancheria, Colfax-Todds Valley Consolidated Tribe, Yocha Dehe Wintun Nation.

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38	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/11/2021				Include a map showing domestic well locations and average well depth across the subbasin.	These are present in Technical Appendix 3C (Figures 10, 13, 14).
39	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/12/2021				Provide the population of each identified DAC and include details on the population dependent on groundwater for their domestic water use.	Although we do not provide population counts of DACs, DAC groups were contacted during engagement and outreach (detailed in Appendix 1D) and are involved in ongoing communication and outreach. DAC-representative groups involved in ongoing C&E include: Environmental Justice Coalition for Water, Florin Census-Designated Place (CDP) DAC, Lemon Hill CDP DAC, Parkway CDP DAC, Fruitridge Pocket CDP DAC, Freeport CDP DAC. The GSP comprehensively evaluates impacts to domestic wells - which may be used by DACs - and finds them to be minimal (Appendix 3A).
40	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/13/2021	Figure 2.3-46 and throughout Section 3			While the GSP clearly identifies data gaps and their locations, we recommend that the GSP considers any segments with data gaps as *potential* ISWs and clearly marks them as such on maps provided in the GSP.	No action is taken.
41	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/14/2021				The GSP states that a complete list of special status species is presented in Appendix E of the GSP, but this was not included in the public review draft. We recommend that the GSP includes a clear description of the fauna (e.g., birds, fish, amphibians) and flora (e.g., plants) that are dependent on GDEs within the GDE section of the GSP (see Attachment C of this letter for a list of freshwater species located in the South American subbasin). Also note any threatened or endangered species.	This will be included on the website ASAP and we will coordinate with the Freshwater Trust to see to this.
42	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/15/2021				Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (Quercus lobata). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30 feet threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater.	The consultant team has reviewed the study in question (Lewis and Burgy, 1964) and does not find merit in the results. The study concerns an isotope-tracer study in a fractured rock aquifer in hilly topography using a small sample (n = 15) of trees. These results are highly specific to geology (i.e., isotope transport in fractured rock and alluvium are not at all comparable), and hydraulics (i.e., topographic driven flow patterns in mountainous regions are much different than those in relatively flat valley floors). Moreover, other literature reviewed by TNC suggest rooting depths of around 30 feet. The scientific de-merits outlined above give cause to not consider an 80 foot rooting depth parameter, and hence, we maintain the GDE study carried out the Freshwater Trust for the SASb (see technical Memo 3B (groundwater dependent ecosystems).
43	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/16/2021	Appendix 1D			Describe efforts to engage with stakeholders during the GSP *implementation* phase in the Stakeholder Communication and Engagement Plan. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.	The GSAs are in the process of developing an implementation MOU that includes public engagement provisions. The GSAs will follow DWR guidance in stakeholder engagement during implementation (i.e., public notices and meetings before amending a GSP or prior to imposing or increasing a fee, and ongoing efforts to encourage active involvement).

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44	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/17/2021	Appendix 1D			Describe efforts to consult and engage with tribes within the subbasin. Refer to the DWR guidance entitled Engagement with Tribal Governments for specifics on how to consult with tribes.	We received a list of potentially interested tribes after making a direct request to the Native American Heritage Commission. Contact was made with all of the listed tribes and those that indicated interest were added to the subbasin outreach lists. However, we will maintain ongoing communication with tribes following DWR guidance in stakeholder engagement during implementation.
45	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/18/2021	Section 3			Describe direct and indirect impacts on DACs and tribes when defining undesirable results for chronic lowering of groundwater levels.	Undesirable results are defined with respect to domestic, industrial, agricultural, municipal, and environmental users. DACs are already considered by inclusion in these user groups (particularly domestic users).
46	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/19/2021	Section 3			Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and tribes.	Analysis of reaching 100% of MTs at all RMPs suggest the avoidance of significant and undesirable results to domestic wells. Thus impacts to all user groups - which include DACs - are already considered.
47	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/20/2021	Section 3			Describe direct and indirect impacts on DACs and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider domestic water users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."	Undesirable results are defined with respect to domestic, industrial, agricultural, municipal, and environmental users. DACs are already considered by inclusion in these user groups (particularly domestic users).
48	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/21/2021	Section 3			Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and tribes.	Groundwater quality MTs suggest the avoidance of significant and undesirable results for all users. Thus impacts to all user groups - which include DACs - are already considered.
49	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/22/2021	Sections 2 and 3			Section 2.3.4 (Groundwater quality) discusses TDS, however Section 3.3.3 (Maximum threshold for degraded groundwater quality) discusses specific conductivity. Choose one measurement to describe salinity and use it consistently throughout the GSP.	The groundwater quality section (Section 2.3.4) uses analysis of Total Dissolved Solids (TDS), as opposed to specific conductivity, to evaluate salinity levels in the Subbasin as this data is historically abundant for the subbasin. Section 3.3.3 (Maximum threshold for degraded groundwater quality) discusses specific conductivity, as opposed to TDS, for the reason that specific conductivity can be measured with an in-situ probe, while TDS requires laboratory results. This ease of measurement will enable easier collection of salinity data for the subbasin moving forward. We understand that disconnect arises with use of the different methods, but feel that the historic analysis available through TDS data, and the future ease of measurements available through probe measurements of specific conductivity, outweigh any potential disconnect.

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50	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/23/2021	Section 3			The plan only sets minimum thresholds and measurable objectives for nitrates and specific conductivity. The GSP should set SMC for the additional COCs in the subbasin (arsenic, iron, and manganese) and ensure they align with drinking water standards.	Analysis of the available data for arsenic, iron, and manganese does show that exceedances of these constituents occur throughout the Subbasin. Arsenic is different from iron and manganese for the reason that there are public health risks associated with elevated arsenic concentrations, as opposed to the aesthetic considerations that arise due to elevated concentrations of iron and manganese. Further analysis of elevated concentrations of these constituents reveals that exceedances of the Maximum Contaminant Level (MCL), and Secondary Maximum Contaminant Levels (SMCLs) occur within regions that are served water by Municipal Community Water Systems (this analysis will be presented in an upcoming draft). The monitoring and treatment of these constituents should be sufficient to protect the beneficial users of groundwater. As part of the updated GSP Draft, it is not proposed that SMC be set for these constituents, but instead proposed that the three constituents be included in the two monitoring networks proposed by the GSP (the GSP Water Quality Monitoring Network, and the Community Monitoring Effort). This monitoring data will then be evaluated, and if deemed necessary, SMC will be set in the next GSP update in 2027.
51	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/24/2021	Section 3			When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results9 in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds can be determined.	See Technical Appendix 3B and Section 3's Table 3-2 (The Freshwater Trust, 2020). GDE area and NDVI declining below historical observed levels are used as quantitative metrics to define when significant and unreasonable impacts occur.
52	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/25/2021	Section 2			Provide more information regarding the selection of the American River Basin Study and the methods through which climate change is incorporated, since this is a different method than the use of climate change factors suggested by DWR.	This rationale has been clarified and improved in the text.
53	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/26/2021	Section 2			Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.	This change is not taken, but the rationale for selecting the central tendency has been made more clear.
54	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/27/2021	Section 2			Calculate sustainable yield based on the projected water budget with climate change incorporated.	The sustainable yield estimate utilizes the climate change scenarios that were analyzed for the GSP, along with the other modeling scenarios. The data does not indicate that climate change will significantly change the basin sustainable yield.
55	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/28/2021	Section 2			Incorporate climate change scenarios into projects and management actions.	We agree this is important, and evaluate a scenario that includes both climate change and PMAs.

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56	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/29/2021	Section 3			Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, and tribal areas to clearly identify potentially impacted areas. Ensure that existing and proposed representative monitoring sites adequately cover DAC, domestic well, and tribal portions of the subbasin.	We provide both maps of monitoring well locations (Section 3.3.1.3) and DACs (Appendix 1D, page 69). Analysis of reaching 100% of MTs at all RMPs suggest the avoidance of significant and undesirable results to domestic wells. Thus impacts to all user groups - which include DACs - are already considered.
57	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/30/2021	Section 3			Provide specific steps to fill data gaps relating to representative monitoring sites that lack historical data or well screen information for wells on private lands.	A management action to fill the described data gaps has been provided in Section 4 and a budgetary item has been provided in Section 5.
58	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/31/2021	Section 3			Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. The GSP (Appendix 3-B) describes GDE analyses using NDVI. Describe more fully if NDVI will be used to assess impacts to GDEs during the GSP implementation phase.	Groundwater level monitoring and NDVI monitoring will occur throughout the implementation period.
59	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	9/1/2021	Section 4			For DACs, include a discussion of whether potential impacts to water quality from projects and management actions could occur. For example, groundwater recharge projects can have potential negative impacts to water quality which could cause undesirable results to drinking water beneficial users. Ensure that appropriate monitoring and mitigation aspects are included in the project development plans for recharge projects. Refer to Appendix B for drinking water well impact mitigation guidance.	The project proponents for each project included in the GSP will be responsible for monitoring water quality effects of their projects and for mitigating any potential impacts. These aspects will be addressed as the projects are implemented.
60	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	9/2/2021	Section 4			Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.	Currently planned PMA substantially improve groundwater elevations (Appendix 3A, Figure 8) and avoid undesirable results. PMA also include regional conjunctive use, which incorporate climate and water delivery uncertainties.
61	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/11/2021				Include a map showing domestic well locations and average well depth across the subbasin.	These are present in Technical Appendix 3C (Figures 10, 13, 14).

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62	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/14/2021				The GSP states that a complete list of special status species is presented in Appendix E of the GSP, but this was not included in the public review draft. We recommend that the GSP includes a clear description of the fauna (e.g., birds, fish, amphibians) and flora (e.g., plants) that are dependent on GDEs within the GDE section of the GSP (see Attachment C of this letter for a list of freshwater species located in the South American subbasin). Also note any threatened or endangered species.	This will be included on the website ASAP and we will coordinate with the Freshwater Trust to see to this.
63	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/15/2021				Refer to Attachment B for more information on TNC's plant rooting depth database. Deeper thresholds are necessary for plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (Quercus lobata). We recommend that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30 feet threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater.	The consultant team has reviewed the study in question (Lewis and Burgy, 1964) and does not find merit in the results. The study concerns an isotope-tracer study in a fractured rock aquifer in hilly topography using a small sample (n = 15) of trees. These results are highly specific to geology (i.e., isotope transport in fractured rock and alluvium are not at all comparable), and hydraulics (i.e., topographic driven flow patterns in mountainous regions are much different than those in relatively flat valley floors). Moreover, other literature reviewed by TNC suggest rooting depths of around 30 feet. The scientific de-merits outlined above give cause to not consider an 80 foot rooting depth parameter, and hence, we maintain the GDE study carried out the Freshwater Trust for the SASb (see technical Memo 3B (groundwater dependent ecosystems).
64	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/18/2021	Section 3			Describe direct and indirect impacts on DACs and tribes when defining undesirable results for chronic lowering of groundwater levels.	Undesirable results are defined with respect to domestic, industrial, agricultural, municipal, and environmental users. DACs are already considered by inclusion in these user groups (particularly domestic users).
65	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/19/2021	Section 3			Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and tribes.	Analysis of reaching 100% of MTs at all RMPs suggest the avoidance of significant and undesirable results to domestic wells. Thus impacts to all user groups - which include DACs - are already considered.
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69	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/23/2021	Section 3			The plan only sets minimum thresholds and measurable objectives for nitrates and specific conductivity. The GSP should set SMC for the additional COCs in the subbasin (arsenic, iron, and manganese) and ensure they align with drinking water standards.	Analysis of the available data for arsenic, iron, and manganese does show that exceedances of these constituents occur throughout the Subbasin. Arsenic is different from iron and manganese for the reason that there are public health risks associated with elevated arsenic concentrations, as opposed to the aesthetic considerations that arise due to elevated concentrations of iron and manganese. Further analysis of elevated concentrations of these constituents reveals that exceedances of the Maximum Contaminant Level (MCL), and Secondary Maximum Contaminant Levels (SMCLs) occur within regions that are served water by Municipal Community Water Systems (this analysis will be presented in an upcoming draft). The monitoring and treatment of these constituents should be sufficient to protect the beneficial users of groundwater. As part of the updated GSP Draft, it is not proposed that SMC be set for these constituents, but instead proposed that the three constituents be included in the two monitoring networks proposed by the GSP (the GSP Water Quality Monitoring Network, and the Community Monitoring Effort). This monitoring data will then be evaluated, and if deemed necessary, SMC will be set in the next GSP update in 2027.
70	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/24/2021	Section 3			When defining undesirable results for chronic lowering of groundwater levels and depletions of interconnected surface waters, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by groundwater conditions in the subbasin. Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results9 in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds can be determined.	See Technical Appendix 3B and Section 3's Table 3-2 (The Freshwater Trust, 2020). GDE area and NDVI declining below historical observed levels are used as quantitative metrics to define when significant and unreasonable impacts occur.
71	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/29/2021	Section 3			Provide maps that overlay monitoring well locations with the locations of DACs, domestic wells, and tribal areas to clearly identify potentially impacted areas. Ensure that existing and proposed representative monitoring sites adequately cover DAC, domestic well, and tribal portions of the subbasin.	We provide both maps of monitoring well locations (Section 3.3.1.3) and DACs (Appendix 1D, page 69). Analysis of reaching 100% of MTs at all RMPs suggest the avoidance of significant and undesirable results to domestic wells. Thus impacts to all user groups - which include DACs - are already considered.
72	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/30/2021	Section 3			Provide specific steps to fill data gaps relating to representative monitoring sites that lack historical data or well screen information for wells on private lands.	A management action to fill the described data gaps has been provided in Section 4 and a budgetary item has been provided in Section 5.
73	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	8/31/2021	Section 3			Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin. The GSP (Appendix 3-B) describes GDE analyses using NDVI. Describe more fully if NDVI will be used to assess impacts to GDEs during the GSP implementation phase.	Groundwater level monitoring and NDVI monitoring will occur throughout the implementation period.
74		Carl Werder	7/5/2021	Section 3	Page 7	Lines 104 and 105	Section 3 – Page 7 of 85, Lines 104 and 105., This sentence should include remediation as a major use of groundwater in the basin since they extract approximately 30,000 AF/yr.	We see the reviewer's perspective, but technically remediated groundwater is either returned to the groundwater system (and hence not consumed), or consumed for one of the already mentioned uses including agricultural, domestic, industrial, and municipal categories. Thus, we keep the text as-is.

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comment
75		Carl Werder	7/5/2021	Section 3	Page 14	Line 363	Page 14 of 85, Line 363., Introduction of a new project called "Harvest Water Project '' without any explanation of what this is or maybe I missed it? Need to refer reader to Section 4.4.1 at this location.	This comment is well taken, and the requested cross-reference has been made.
76		Carl Werder	7/5/2021	Section 3	Page 32	Line 791, Table 3-3	Page 32 of 85, Line 791, Table 3-3., The 50th percentile column has figures carried out to the hundredths while all other columns are not. Recommend dropping the decimal point figures in this column.	This comment is also well taken, and the requested rounding has been made.
77		Carl Werder	7/5/2021	Section 3	Page 40	Line 852, Table 3-4	Page 40, Line 852, Table 3-4., It is assumed that the 'Well ID' in this table is DWR's, but again it would be better to add SCGA's numbers to locate the hydrograph that goes with the information in the table.	This comment suggests using the shorter, more easily-readable well IDs associated with SCGA well IDs in the SMC table. Unfortunately, not all DWR state well IDs are also SCGA wells. Hence, we revise the entire ordering to be consistent with a direction (south to north) and a more easily readable scheme ("RMP_number"). See updated Figures 3-4 and 3-5.

Comment No.	Commenting Organization	Comment By	Date of Comment	Section/ Appendix #	PDF Page Number	PDF Line Number or Figure Number	Comment	Response to Comment
1	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	4.4.1			8. Comment #8 Water Storage Investment Program, Harvest Water Project: The Department's dedicated Water Storage Investment Program (WSIP) staff have completed additional review of the GSP's inclusion of the Harvest Water Project as a PMA and provide the following comments for GSA consideration. a. Background: In July 2018, the Sacramento Regional County Sanitation District (Regional San) received a maximum conditional eligibility determination of $287.5 million from the California Water Commission for the public benefits to be provided by the Harvest Water Program. The California Water Commission is administering funds dedicated by Proposition 1 through the WSIP for public benefits associated with water storage projects. The Department is the administering agency for public ecosystem benefits. As required by regulations, to receive funding, the Department will be contracting with Regional San for administration of Harvest Water's proposed ecosystem benefits to riparian, wetland, Greater sandhill crane, and vernal pool habitats, as well as increased Cosumnes River flows. More specifically, three of Harvest Water's proposed public ecosystem benefits are dependent upon increasing groundwater levels: enhancement of riparian habitat, enhancement of wetland habitat, and increased flows in the Cosumnes River to support fall-run Chinook salmon. The implementation of the GSP and the resultant groundwater levels in the subbasin will influence Harvest Water's ability to increase groundwater levels within their project area to elevations necessary for these public ecosystem benefits. The WSIP contract between the Department and Regional San will constitute a long-term commitment by the Harvest Water Program to administer public ecosystem benefits for the life of the project, estimated during the WSIP application process to be 84 years.	See response to comment No. 3
2	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	4.4.1			b. Issues: i. Groundwater Levels: The GSP states the Harvest Water project is expected to restore "depleted groundwater levels up to 35 feet within 15 years" (page 4-8) but elsewhere states "model simulations indicate groundwater levels will increase upwards of 25 feet in the main recharge zone" (page 3-44). The GSP also notes that the measurable objectives for eight of the representative monitoring points "within or near the Harvest Water recharge project" are increased to reflect "an aspirational goal of increasing groundwater levels in the southern SASb" (page 3-44). ii. Measurement Frequency: The GSP states "All wells will collect at least biannual measurements… Wells in or adjacent to the Harvest Water Recharge management zone will collect monthly measurements" (page 3-57). However, Figure 3-23 (page 3-60) indicates that most of the RMPs near the Harvest Water program area will be monitored biannually (indicated by the green dots) while other areas will be monitored on a 15-minute frequency. This mapping leaves the reader to guess which of these "biannual" RMPs will be monitored on a monthly frequency. iii. Model Assumptions: The GSP describes only limited assumptions utilized to model the Harvest Water project (page 4-21).	See response to comment No. 3
3	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	4.4.1			c. Recommendations: i. Groundwater Levels: The GSP should clarify expected groundwater levels in the Harvest Water program area and their relation to minimum thresholds and measurable objectives. Further, the GSP should explicitly describe how GSP implementation will meet these aspirational goals, which will support Harvest Water's groundwater elevation targets. ii. Measurement Frequency: For the sake of clarity, the GSP should indicate which RMPs will be monitored more frequently than biannually. iii. Model Assumptions: Due to the importance of this project in the subbasin, the GSP should more thoroughly describe the inputs and assumptions utilized when modeling Harvest Water. Specific topics on which the GSP should elaborate include: 1. The locations of in-lieu recharge and winter application recharge. 2. The total volume of water delivered to the subbasin. Specifically, the volume of the in-lieu net recharge (22,500 Acre Feet per Year [AFY]) and the winter application (8,750 AFY) do not correctly sum to the total delivery volume (41,250 AFY). 3. Restrictions to delivery of recycled water imposed by the 2019 Wastewater Change Petition. 4. Project ramp-up timing (i.e., as the project ramps up delivery volumes from startup to full operation).	i. The description of expected benefits described in Section 4.4 comes from available documentation for the Harvest Water Project, and may differ from the results of modeling simulated for the GSP due to differences in project or baseline assumptions. Refinements of groundwater level benefits for the project will be developed by the Harvest Water program going forward. ii. We apologize for the confusion. The RMP network (Figure 3-23) shows biannual well monitoring within and near Harvest Water; these wells will be monitored biannually as part of the GSP for comparison to SMC and assessment of the avoidance of significant and unreasonable impacts to beneficial users. Importantly, monthly monitoring is not necessary or required for GSP purposes in the South American Subbasin. However, the Harvest Water Program may incorporate additional monitoring wells and may incorporate higher frequency monitoring, to the extent necessary to support the needs of that program. The GSAs have coordinated with Regional San on the Harvest Water Program during GSP development and anticipate future data sharing so that data collected under the Harvest Water Program can be incorporated into analyses for GSP purposes, to the extent relevant. iii. The information provided is sufficient for purposes of describing the model simulation performed for the GSP. For more detailed assumptions regarding potential project parameters and operations, please refer to documentation developed by the Harvest Water program.

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4	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Project and Management Actions (PMA); 4.6 Results of Model Scenarios; starting page 4-20		page 4-20	7. Comment #7 Project and Management Actions (Project and Management Actions (PMA); 4.6 Results of Model Scenarios; starting page 4-20): Projects and management actions that would support demand management in the subbasin lack specificity. a. Issue: The modeled project and management action scenarios presented in the GSP include two demand management scenarios that would involve reductions in both urban and agricultural water use (Table 4-3). Though the GSP provides detailed explanations for the three supply augmentation scenarios included in the PMA modeling, similar specificity is not provided for demand reduction scenarios. The GSP states that 2020 urban water management plans, developed by water supply agencies within the subbasin, are anticipated to lead to increased conservation and encourage demand management scenarios (line 786). However, as water management plan specifics are not provided, it is unclear whether it is reasonable for the GSP to assume that these plans will be able to collectively meet the demand reductions modeled in Scenario 1 and 2, or when and how they would be implemented within the subbasin. PMA Scenario 5, which includes implementation of the Harvest Water, Omochumne-Hartnell Water District (OHWD) Recharge, and Regional Conjunctive Use projects (Table 4-4, Scenario 5) results in an annual net storage change deficit of 100 acre-feet per year with climate change. Should any of the three projects encounter delays or result in less than the projected benefit to groundwater storage volumes, annual subbasin storage deficits could increase significantly. Only six of the 172 potential projects and management actions presented in Appendix 4-A are categorized as demand management; the lack of specificity for how and when these demand reduction actions would be implemented within the subbasin could delay implementation and undermine the subbasin's ability to achieve sustainability goals, particularly if the expected	See response to Comment 23 for Section 3. If, in the future, the need for demand management arises, the GSA may consider demand management as a management action under a revised GSP.
5	California Department of Fish and Wildlife	Kevin Thomas	8/17/2021	Project and Management Actions (PMA); 4.6 Results of Model Scenarios; starting page 4-20		page 4-20	b. Recommendation: The Department recommends detailing when and how demand reduction projects and management actions would be implemented to meet the targets outlined in Scenarios 1 and 2. Add specific measures that would lead to initiation of demand reduction actions should planned projects within the basin fail to provide the necessary benefit to groundwater levels in the subbasin.	Failure to meet SMC and avoid undesirable results could lead to further exploration of demand management and/or implementation of additional recharge projects as an element of the GSP. These triggering mechanisms will be evaluated annually and considered in 5-year updates to the GSP. Best available information does not indicate that such actions will be necessary.
6	Community Member	Suzanne Pecci (916) 893-3139 slpecci@aol.com	8/18/2021	Section 4			Section 4. Projects and Management Action, 4.1 History and Context 8. Regional Water Reliablity Plan prepared for Regional Water Authority— 2019 Neither a discussion of the RWA Reliability Plan nor an overview of the general concepts of water banking were provided in the Public Outreach and Engagement Meetings or workshops conducted by SCGA or OHWD . It is my understanding water banking is an overarching goal in the SASb for both SCGA, and OHWD. There is the potential to partcipate in a regional water bank in the SASb facilitated by staffing of SCGA by SGA and RWA which is currently under consideration.. In my opinion there was suffficient time and opportunity for the public to be informed about water banking in the SASb, but the conversation seem to get stuck on SGMA 101 The public requires an overview of water banking before GSP adoption.	Regional water banking discussions are ongoing among key players in the North Amercian and South Amercian subbasins. A complete public process will occur as those plans become more detailed. Discussions of water banking were described in GSPWG meetings and are described in Section 4 and Appendix 4-A. Text has been added to Section 4 to provide greater clarity regarding the management action in the GSP which calls for action by the GSAs to work with the parties involved in regional water banking discussion to develop a regional water bank and associated accounting system. This measure was widely supported by GSPWG members and public participants in public meetings.
7	Community Member	Suzanne Pecci (916) 893-3139 slpecci@aol.com	8/18/2021	Section 4.2			4.2 Projects and Managements Actions under SGMA. In my understanding, recycled water projects, recharge projects,conjunctive use and water banking are the basis for achieving sustainability in the SASb . Water quality implications of these innovative new concepts and projects were not appropriately disclosed to the large community of shallow well owners whose wells could potentially be impacted by poor water quality resulting from implementing these projects. Recently, in attempting to compare recent water tests results from our private well to wells locations similar to my ag res parcel, directly adjacent to agriculture, I found there were no monitoring wells in the SASb monitoring network or the GAMA network with which I could compare results. A monitoring network, of shallow wells including water quality monitoring is a data gap in the GSP that needs to be addressed. Exisiting water moniitoring data, including water quality data needs to be readily accessible to owners of shallow wells. GSAs that are participating in groundwater level monitoring and/or water quality monitoring programs through the State Water Board, DWR or any County or State Agency must be be required as Public Agencies to be transparent and share their data with the public by making it readily accessible to the public on their websites. An good example is the UC Davis Well Monitoring project in OHWD. Water quality should be as an element of the shallow well monitoring network PMA with wells located in a variety of areas throughout the rural area in the SASb. Shallow monitoring wells should be included in GSP annual reports and the five year update of the GSP as the data is gathered and quantified and made available for inclusion.	Modifications were made to Section 4 to describe the activities associated with a well protection program in greater detail, including additional data collection for groundwater levels and groundwater quality in shallow wells in the SASb. A volunteer monitoring network is described in Section 4 as a vehicle for implementation of such data collection activities.
8	Community Member	Suzanne Pecci (916) 893-3139 slpecci@aol.com	8/18/2021	Section 4.4.1			4.4.1 Harvest Water Harvest Water is an innovative and costly recycled water project, in my opinion, designed for agriulture and enviornmental interests with targeted outreach to specific participants and potential participants in the Harvest Water program. There is no evidence of significant outreach to the general public by the public agencies involved since 2011 to the present as the design and construction phases begin. An overview of Harvest Water Program by Regional San introduced the project to the General Public in the last few Public Enegagement and Outreach Meetings, There are lots of moving parts to the project and the public has not been made aware of the entire scope tof he Harvest Water Program and financing for the project.	The Harvest Water project has moved forward over the past decade with broad-based support among State and local agencies and stakeholders. A public engagement program has been conducted for Harvest Water, including development and adoption of a program-level and project-level EIR conforming to CEQA requirements by Sacramento REgional County Sanittion Distrct (Regional San). REsponsbility for continued public outreach and engagement rests with Regional San as he implementing agency for Harvest Water.

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9	Community Member	Suzanne Pecci (916) 893-3139 slpecci@aol.com	8/18/2021	Section 4.4.3			Section 4.4.3 Regional Conjunctive Use Program 4.4.3.8 Estimated Cost and Funding Funding of these highly innovative concepts and innovative technologies planned for the SASb carry big price tags for construction,operated and ongoing maintenance. Transparency has been lacking from GSAs planning and developing these projects and more detailed information is required in this GSP for public review and comment. Public/Private Partnerships as potential funding mechanisms for development and operation of many of these projects in the planning stages has not been discussed in Public Outreach and Engaagement meetings . It is my opinion Public/private partnerships are required o be addressed as a matter of The Public Trust.	The regional conjunctive use project described in the GSP and modeled using the CoSANA model will be implemented by the individual entities described in Section 4 of the GSP. These entities have performed similar projects over the past several decades and will be responsible for following applicable regulatory requirements, meeting public outreach requirements and acquiring funding for continued implementation of conjunctive use projects in the SASb. GSAs will communicate and coordinate with these water supply agencies, as described in the GSP, but will not bear the direct burden of implementation.
10	Community Member	Suzanne Pecci (916) 893-3139 slpecci@aol.com	8/18/2021	Section 4.4			4.4 Near Term Projects Additional detail and nformation needs to be provided in the GSP for public review and comment which would include proposed funding sources. For instance the Interconnection between the City of Folsom and Omochumne-Hartnell Water District at the Folsom South Canal Project. The public should be provided more than a few words about this project which a review of public records and LAFCo documents in, my opinion, indicate proposed construction and operation of a direct potable reuse recycled water facility in OHWD. At least those of us in the district should know about this project.	Prior to implementation of specific elements of the regional conjunctive use project, the implementing agencies (in this case, the City of Folsom and OHWD) will need to fulfill all regulatory, CEQA and public notification requirements. Some of these projects are at the concept level where additional detail is unavailable. In general, detailed descriptions of the elements of the regional conjunctive use project are beyond the scope of the GSP.
11	Community Member	Suzanne Pecci (916) 893-3139 slpecci@aol.com	8/18/2021	Section 4.7			Section 4.7 Management Actions 4.7.1 Shallow/vulnerable Well Protection Program There is a large ag res presence in the SASb dependent on private individual shallow wells as their sole source of drinking water. Through Public Outreach and Engagement SCGA successfully reached a large number of these irural residents who expressed their great interest in having a Shallow Well Protection Program. There have beenn numerous presentations at Public Engagement Meetings, Ag res Workshops and at a recent SCGA Board meeting to articulate the many decisions and considerations that have to be addressed in developing a Well Potection plan, including the lack of funding. There has been no decision by the GSAs in the SASb to move forward with at Well protection Plan for the ag res wells owners. I understand in order to be funded in the GSP, there has to be an identified Project . I suggest this section of the GSP be amended to include: a formal decision by SCGA and the affected GSAs in the SASb supporting development of a Well Protection Plan Framework; a Project framework be developed for inclusion in the current GSP that includes application for grant funding currently available from DWR and a request for technical support and funding from DWR for development of a Pilot Well Protection Plan for the SASb.	As noted by the commenter, significant time and energy has been spent in GSPWG and public meetings to discuss inclusion of a well protection program in the GSP. The result of those discussions is captured in Section 4 of the GSP, where a commitment to implement a mangement action and the process to develop and a framework for the program is described at a level of detail acceptable to members of the GSPWG.
12	Environmental Council of Sacramento (ECOS)		6/18/2021	Section 4			Section 4 provides complete discussions of the Projects contemplated as part of the GSP. However, we believe that water purveyor and Agriculture demand reduction should be added. The GSPD discusses a 10% demand reduction programs for water purveyors and Agriculture. While time may not be sufficient to redo the analysis to incorporate these programs, they should be described in the GSPD and included in the next GSP five-year update as Group 1 and 2 projects.	See response to Comment No. 69 for Section 3. Demand reduction is anticipated to occur in the future through actions by others, but has not been assumed in Scenarios 4 and 5 described in Section 4. Since demand reduction is planned to occur through the implementation of UWMPs by urban water purveyors in the SASb, the results described in Scenarios 4 and 5 are conservative estimates of future conditions.
13	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	9/1/2021	Section 4			For DACs, include a discussion of whether potential impacts to water quality from projects and management actions could occur. For example, groundwater recharge projects can have potential negative impacts to water quality which could cause undesirable results to drinking water beneficial users. Ensure that appropriate monitoring and mitigation aspects are included in the project development plans for recharge projects. Refer to Appendix B for drinking water well impact mitigation guidance.	The project proponents for each project included in the GSP will be responsible for monitoring water quality effects of their projects and for mitigating any potential impacts. These aspects will be addressed as the projects are implemented.
14	The Nature Conservancy Audubon California Local Government Commission Union of Concerned Scientists Clean Water Action	Ngodoo Atume J. Pablo Ortiz-Partida, Ph.D. Samantha Arthur Danielle V. Dolan EJ Remson Melissa M. Rohde	9/2/2021	Section 4			Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.	Currently planned PMA substantially improve groundwater elevations (Appendix 3A, Figure 8) and avoid undesirable results. PMA also include regional conjunctive use, which incorporate climate and water delivery uncertainties.
15		Carl Werder	7/5/2021	Section 4	Page 6	Line 64	Section 4 – Page 6 of 44, Line 64., Again the 273,000 AF is a red flag. By using the words, "development of a sustainable yield value of 273,000 AF" makes it sound as though this number was based on some criteria. It was not, it was simply negotiated between parties such as developers and environmental folks. Recommend deleting this part of the sentence.	Information pertaining to the development and utilization of the existing sustainable yield estimate is a matter of record. A new sustainable yield figure has been developed for the SASb based on consideration of the SMC described in Section 3. The basis for this estimate and the methodology used in its derivation is described in Section 2.
16		Carl Werder	7/5/2021	Section 4	Page 6	Lines 66 and 67	Page 6 of 44, Lines 66 and 67., It should also be pointed out that the 2006 Groundwater Management Plan has in it action plans if the criteria is exceeded and in 15 years not once has any of these actions been taken.	As required by SGMA, the GSP for the SASb clearly outlines the SMC and monitoring network that will be implemented to ensure that undesirable results do not occur. The GSP outlines the process that will be used to address problems that may arise in the attainment of SMC at representative monitoring points in the SASb. Past performance in implementing the 2006 GMP is not indicative of future actions taken by GSA under this GSP.

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17		Lynn Wheat Wheat91@yahoo.com	8/18/2021	4.4.1			Will the new urban areas be using recycled water for domestic use? Will this project be adding additional future drinking water for the region? Is this in the conceptual stage? I have presented this question at SCGA meetings and what I heard is that SCGA is not a land use agency. How can there be coordination between land use agencies and SCGA if the GSP is not based on updated General Plans of the cities and counties? How can this be a transparent process when the agencies involved in serving Elk Grove are not coordinating meetings to reach out to the ratepayers in a meaningful understandable way? Ratepayers are Stakeholders and have not been identified as such in the draft GSP. However, ratepayers have been identified as a financial source for the funding of projects.	Section 4.4.1 provides a description of the Harvest Water Project, which is in the design phase. The recycled water will be provided for agricultural uses. Regional San is in the process of fulfilling all permitting requirements for the construction and operation of the Harvest Water. As described in Section 5.1.4, implementation of the GSP includes coordinating activities with other GSAs and other entities such as those with land use jurisdiction, and the GSAs will need to develop governance and communication processes to support these activities.

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1	Community Member	Suzanne Pecci	8/18/2021	Section 5			Section 5 Plan Implementation The governace structure for the 5 GSAs in the SAsb has not been successfully negotiated after 6 years of meetings, 2x2s, ad hoc committees., MOUs… At this point in time when the 60 day period of public review is closied the GSP is missing a governance agreement, a funding structure, a framework for managment and coordination for shared projects ,as well as funding plans for individual GSAs for public review and comment, Section 5 —Plan Implementation is reliant on these agreements between the 5 GSP. The public requires a public review and comment period on these essential agreements. Finally, a few comments on the August 17, 2021 OHWD Board Meeting Agenda item 7 .Expansion —a public discussion of OHWD possibly pursuing in the coming months an expansion of its GSA boundaries through DWR —annexation of thousands of acres of agricultural land currently in SCGA territory going through the LAFCo process in the next few months, including CEQA, —-a transfer of assessments and fees recently levied by SCGA for the area —and the removal of the Ag Director position from the SCGA Board ——-all being done in conjunction with the review and response to the GSP draft comments,approval and adoption of the current GSP and DWR final plan submittal by the end of January 2022 —and OHWD pursuing these actions at this time seems a distraction and, in my opinion, jeopordizes tthe SASb GSP process that is at a critical juncture. The discussion of 22,000 - 33,000 acres being added to OHWD, and even the idea of crossing into San Joaquin County adds a whole new dimension to "Local Control." There was an OHWD comment that 'this expansion could make us very powerful ' leads me to question SGMA's intent with respect to Local Control. and was the intent really to facilitate power and not to facilitate public	Discussions among the GSAs in the SASb regarding the governance structure and funding contributios for GSP implementation have been ongoing for most of 2021. The MOU developed by the GSAs will be submitted to DWR with the GSP.
2	Environmental Council of Sacramento (ECOS)		6/18/2021	Section 5			Section 5 needs to be strengthened with the additional Projects and Actions we recommend. If the GSP does not include the full list of Projects and Actions that need to be accomplished, then those left off the Plan's published list will likely not be addressed.	This comment was addressed in response to comments on Section 4, where projects and management actions were thoroughly described.
3	Huhtamaki Foodservice, Inc.	Amy Steinfeld	8/17/2021	Section 2.4.3 Section 5.4 Section 2.1.6			The Draft Plan indicates that three sections are missing: (1) Sustainability Yield Estimate (Section 2.4.3); (2) Funding Sources and Mechanism (Section 5.4); and (3) Interconnected Surface Water Monitoring (Section 2.1.6). The public and stakeholders must have the opportunity to review and comment on these sections prior to approval of the Final Plan by the groundwater sustainability agencies. (Cal. Code Regs., tit 23, § 355.4(b)(10); Plan, App. 1-D, p. 16.) Because these are fundamental sections of the Plan, we request that these sections be posted for review and comment as soon as possible.	The draft Section 2 subsection describing the sustainable yield estimate was posted on the SASb website for public review in September 1, 2021. The draft section was discussed and refined at publicly accessible GSPWG meetings in August and September, 2021. The final GSP includes this publicly vetted subsection. The other sections noted by the commenter are included in the final GSP and will be considered in the public process for GSP approval by each of the GSA Boards.
4		Lynn Wheat Wheat91@yahoo.com	8/18/2021	5.1.6			5.1.6 Projects are group 1, group 2 and group 3. What are the projects under each grouping? Understandably the Projects are further discussed in another area of the document. How about listing the projects in the Executive Summary? Projects in group 3 are supplemental and in a "conceptual stage". What are the concepts being contemplated? A description of the "conceptual stage" lends transparency to this document. Funding by the individual entities and sponsors should be included.	The breakdown of projects into categories 1, 2 and 3 is described in Section 4 of the final GSP.
5		Lynn Wheat Wheat91@yahoo.com	8/18/2021	5.1.7			5.1.7 Continuation of education, outreach and engagement should and needs to include property owners and ratepayers.	The GSP acknowledges and supports the need for ongoing outreach to property owners and stakeholders after approval of the GSP. A budget estimate is provided for continued outreeach by GSAs in Section 5.
6		Lynn Wheat	8/18/2021	5.2.2			5.2.2 Needs to include the costs for each GSA. The GSP should be able to give an estimate of the "unknown" costs for the potential projects or infrastructure need. This needs to be a transparent process with the financial obligations defined. Harvest Water Project is still seeking an additional $100 million in funding. An area within the Harvest Water Project will be urbanized under Elk Grove City's general plan and will not remain Agricultural. This needs to be discussed in the GSP as I understand Harvest Water is to bring recycled water to area farmers easing groundwater pumping.	Estimates for costs to be incurred by GSAs in their normal conduct of business and estimates for costs to be shared by the GSAs in implementing the GSP are included in Section 5. Apportionment of these costs to each GSA is being addressed in the GSP implementation MOU being developed by the GSAs. Distribution of individual GSP costs to landowners and groundwater users in each GSA will be determined by each GSA. This information is not available for inclusion in the GSP.

Appendix 2-A

Divisions of Geologic Time – Major Chronostratigraphic and Geochronologic Units (US Geological Survey, March 2007)

USGS
science for a changing world

Divisions of Geologic Time—Major Chronostratigraphic and Geochronologic Units

Introduction.—Effective communication in the geosciences requires consistent uses of stratigraphic nomenclature, especially divisions of geologic time. A geologic time scale is composed of standard stratigraphic divisions based on rock sequences and calibrated in years (Harland and others, 1982). Over the years, the development of new dating methods and refinement of previous ones have stimulated revisions to geologic time scales.

Since the mid-1990s, geologists from the U.S. Geological Survey (USGS), State geological surveys, academia, and other organizations have sought a consistent time scale to be used in communicating ages of geologic units in the United States. Many international debates have occurred over names and boundaries of units, and various time scales have been used by the geoscience community.

New time scale.—Since the publication by the USGS of the 7th edition of "Suggestions to Authors" (STA7; Hansen, 1991), no other time scale has been officially endorsed by the USGS. For consistency purposes, the USGS Geologic Names Committee (GNC; see box for members) and the Association of American State Geologists (AASG) developed **Divisions of Geologic Time** (fig. 1). The **Divisions of Geologic Time** is based on the time scale in STA7 (Hansen, 1991, p. 59) and updates it with the unit names and boundary age estimates ratified by the International Commission on Stratigraphy (ICS). Scientists should note that other published time scales may be used, provided that these are specified and referenced (for example, Palmer, 1983; Harland and others, 1990; Haq and Eysinga, 1998; Gradstein and others, 2004). Advances in stratigraphy and geochronology require that any time scale be periodically updated. Therefore, the **Divisions of Geologic Time** is dynamic and will be modified as needed to include accepted changes of unit names and boundary age estimates.

The **Divisions of Geologic Time** shows the major chronostratigraphic (position) and geochronologic (time) units; that is, eonothem/eon to series/epoch divisions. Workers should refer to the ICS time scale (Ogg, 2004) for stage/age terms. Most systems of the Paleozoic and Mesozoic are subdivided into series utilizing the terms "Lower," "Middle," and "Upper." The geochronologic counterpart terms for subdivisions of periods are "Early," "Middle," and "Late." The international geoscience community is applying names to these subdivisions based on stratigraphic sections at specific localities worldwide. All series/epochs of the Silurian and Permian have been named. Although the usage of these names is preferred, "lower/early," "middle," and "upper/late" are still acceptable as informal units (lowercase) for these two systems/periods. Also the Upper Cambrian has been named "Furongian" in the ICS time scale. However, the GNC will not recognize this name and include it in the **Divisions of Geologic Time** until all series/epochs of the Cambrian are named.

Cenozoic.—There has been much controversy related to subdivisions of the Cenozoic, particularly regarding retention or rank of the terms "Tertiary" and "Quaternary." Although some stratigraphers have suggested that these terms be abandoned, the issue remains unresolved. If the terms are retained, there will need to be agreement on the status of the Quaternary as a system/period or subsystem/subperiod. Another controversial issue is the position of the base of the Quaternary; is it at the base of the Pleistocene or within the upper Pliocene? These positions have age estimates of 1.8 Ma and 2.6 Ma, respectively (see box for age terms). Until a decision is made on the subdivisions of the Cenozoic, the **Divisions of Geologic Time** will follow the general structure of the time scale in STA7 (Hansen, 1991) in accepting the use of the terms "Tertiary" and "Quaternary" and the equivalence of the bases of the Quaternary and Pleistocene. The map symbols "T" (Tertiary) and "Q" (Quaternary) have been used on geologic maps for more than a century and are widely used today.

Precambrian.—For many years, the term "Precambrian" was used for the division of time older than the Phanerozoic. For consistency with the time scale in STA7 (Hansen, 1991), the term "Precambrian" is considered to be informal and without specific stratigraphic rank (although it is capitalized).

Map colors.—Geologic maps utilize color schemes based on standards that are related to the time scale. Two different schemes are used, one by the Commission for the Geologic Map of the World (CGMW) and another by the USGS. Colors typically shown on USGS geologic maps have been used in a standard fashion since the late 1800s and recently have been published in the digital cartographic standard for geologic map symbolization (Federal Geographic Data Committee, Geologic Data Subcommittee, 2006). The GNC decided in 2006 that the USGS colors should be used for large-scale and regional geologic maps of the United States. For international maps or small-scale maps (for instance, 1:5 million) of the United States or North America, the GNC recommends the use of the international colors. Specifications for the USGS colors are in Federal Geographic Data Committee, Geologic Data Subcommittee (2006), and those for the CGMW colors are in Gradstein and others (2004).

Acknowledgments.—This Fact Sheet benefited from thoughtful reviews by John Repetski (USGS) and Donald E. Owen (Lamar University, Beaumont, Tex., and North American Commission on Stratigraphic Nomenclature).

By U.S. Geological Survey Geologic Names Committee

Members of the Geologic Names Committee of the U.S. Geological Survey, 2006

Randall C. Orndorff (chair), Nancy Stamm (recording secretary), Steven Craigg, Terry D'Erchia, Lucy Edwards, David Fullerton, Bonnie Murchey, Leslie Ruppert, David Soller (all of the USGS), and Berry (Nick) Tew, Jr. (State Geologist of Alabama).

Age Terms

The age of a stratigraphic unit or the time of a geologic event may be expressed in years before present (before A.D. 1950). The "North American Stratigraphic Code" (North American Commission on Stratigraphic Nomenclature, 2005) recommends abbreviations for ages in SI (International System of Units) prefixes coupled with "a" for annum: ka for kilo-annum, 10^3 years; Ma for mega-annum, 10^6 years; and Ga for giga-annum, 10^9 years. Duration of time should be expressed in millions of years (m.y.). For example, deposition began at 85 Ma and continued for 2 m.y.

References Cited

Federal Geographic Data Committee, Geologic Data Subcommittee, 2006, FGDC digital cartographic standard for geologic map symbolization: Federal Geographic Data Committee Document Number FGDC–STD–013–2006, 290 p., 2 pls., available online at http://ngmdb.usgs.gov/fgdc_gds/.

Gradstein, Felix, Ogg, James, and Smith Alan, eds., 2004, A geologic time scale 2004: Cambridge, U.K., Cambridge University Press, 589 p., 1 pl.

Hansen, W.R., ed., 1991, Suggestions to authors of the reports of the United States Geological Survey, seventh edition [STA7]: Reston, Va., U.S. Geological Survey, 289 p. (Also available online at http://www.nwrc.usgs.gov/lib/lib_sta.htm.)

Haq, B.U., and Eysinga, F.W.B., van, eds., 1998, Geological time table (5th ed.): Amsterdam, Elsevier, 1 sheet.

Harland, W.B., Armstrong, R.L. Cox, A.V., Craig, L.E., Smith, A.G., and Smith, D.G., 1990, A geologic time scale, 1989: Cambridge, U.K., Cambridge University Press, 263 p.

Harland, W.B., Cox, A.V., Llewellyn, P.G., Picton, C.A.G., Smith A.G., and Walters, R.W., 1982, A geologic time scale: Cambridge, U.K., Cambridge University Press, 131 p.

North American Commission on Stratigraphic Nomenclature, 2005, North American stratigraphic code: American Association of Petroleum Geologists Bulletin, v. 89, no. 11, p. 1547–1591. (Also available online at http://ngmdb.usgs.gov/Info/NACSN/Code2/code2.html.)

Ogg, James, comp., 2004, Overview of global boundary stratotype sections and points (GSSPs): International Commission on Stratigraphy, available online at http://www.stratigraphy.org/gssp.htm.

Palmer, A.R., comp., 1983, The Decade of North American Geology [DNAG] 1983 geologic time scale: Geology, v. 11, no. 9, p. 503–504.

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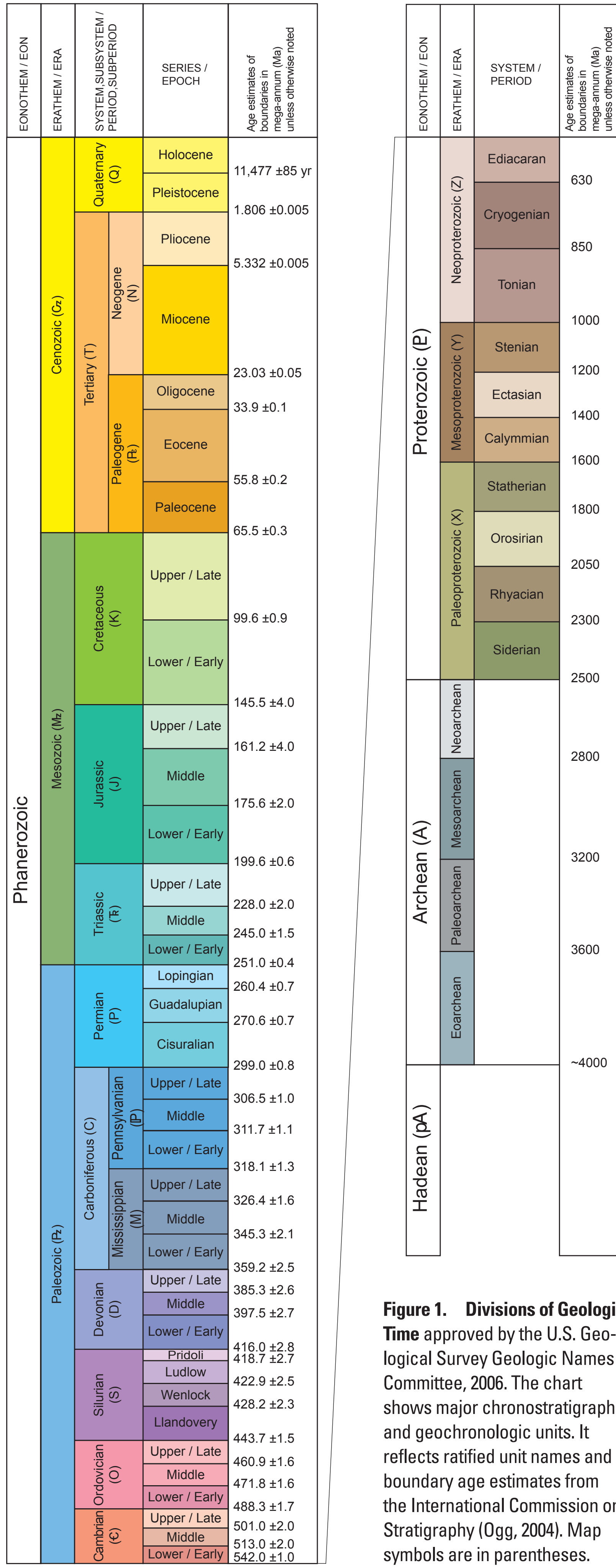


Figure 1. Divisions of Geologic Time approved by the U.S. Geological Survey Geologic Names Committee, 2006. The chart shows major chronostratigraphic and geochronologic units. It reflects ratified unit names and boundary age estimates from the International Commission on Stratigraphy (Ogg, 2004). Map symbols are in parentheses.

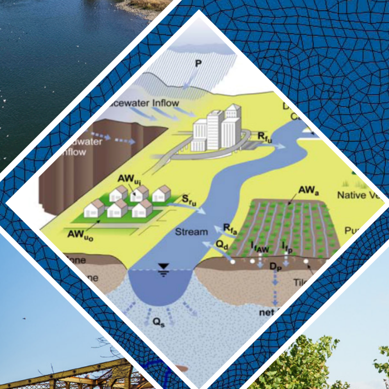
Appendix 2-B

CoSANA: An Integrated Water Resources Model of the Cosumnes, South American, and North American Groundwater Subbasins

CoSANA

An Integrated Water Resources Model of the Cosumnes, South American, and North American Groundwater Subbasins

NOVEMBER 2021



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COSANA:

AN INTEGRATED WATER RESOURCES MODEL OF THE COSUMNES, SOUTH AMERICAN, AND NORTH AMERICAN GROUNDWATER SUBBASINS

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ABBREVIATIONS

2070CT	2070 Central Tendency
2070HD	2070 Hot and Dry
AFY	acre-feet per year
ARBS	American River Basin Study
ASR	aquifer storage and recovery
ASTM	American Standard Testing Method
AWMP	Agricultural Water Management Plan
C2VSimFG	California Central Valley Groundwater-Surface Water Simulation Model
Cal Am	California American Water Company
CalSIMETAW	California Simulation of Evapotranspiration of Applied Water
CASGEM	California Statewide Groundwater Elevation Monitoring
CDEC	California Data Exchange Center
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CoSANA	Cosumnes-South American-North American Integrated Water Resources Model
CoSb	Cosumnes Subbasin
CSD	Community Services District
CWD	community water district
DEM	digital elevation model
DWR	California Department of Water Resources
ESJ	Eastern San Joaquin Groundwater Subbasin
ET	evapotranspiration
ET_o	reference ET
ET_c	crop coefficient
GSA	groundwater sustainability agency
GSP	groundwater sustainability plan
GWMP	City of Sacramento’s 2017 Groundwater Master Plan
ID	irrigation district; identifier
IDC	IWFM Demand Calculator
IGSM	Integrated Groundwater and Surface Water Model
IWFM	Integrated Water Flow Model
JVID	Jackson Valley Irrigation District
METRIC	Mapping Evapotranspiration at High Resolution with Internalized Calibration
NASb	North American Subbasin
NRCS	Natural Resource Conservation Service
PCWA	Placer County Water Agency
PRISM	Precipitation-Elevation Regressions on Independent Slopes Model
Reclamation	United States Bureau of Reclamation
RMCSD	Rancho Murieta Community Services District
RMSE	root mean square error
RWA	Regional Water Authority
SacIWRM	Sacramento Area Integrated Water Resources Model
SAFCA	Sacramento Area Flood Control Agency
SASb	South American Subbasin
SCGA	Sacramento Central Groundwater Authority
SCWA	Sacramento County Water Agency
SGA	Sacramento Groundwater Authority
SGMA	Sustainable Groundwater Management Act

SMUD	Sacramento Municipal Utility District
SSCAWA	Southeast Sacramento County Agricultural Water Authority
SSURGO	Soil Survey Geographic Database
STATSGO2	Digital General Soil Map of the United States
SVSim	Sacramento Valley Groundwater-Surface Water Simulation Model
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WA	water agency
WC	water company
WD	water district
WDL	Water Data Library
WY	water year
YGM	Yuba Groundwater Model

ACKNOWLEDGEMENTS

The Cosumnes-South American-North American Integrated Water Resources Model (CoSANA) was developed in a collaborative effort with representatives of the North American Subbasin (NASb), South American Subbasin (SASb), and the Cosumnes Subbasin (CoSb). This collaborative approach spanning three subbasins improves the ability for local water managers and stakeholders to use CoSANA to for a range of regional planning efforts.

Funding of the CoSANA model was also a collaborative effort, with contributions from the Sacramento Groundwater Authority (SGA), Regional Water Authority (RWA), Sacramento Central Groundwater Authority (SCGA), Sacramento Area Flood Control District (SAFCA), and Southeast Sacramento County Agricultural Water Authority (SSCAWA). Contributions from SGA, SSCAWA, Sacramento Water Forum, Sacramento County, and the seven groundwater sustainability agencies (GSAs) represented by the Cosumnes Subbasin Sustainable Groundwater Management Act (SGMA) Working Group supported by grants from the California Department of Water Resources' Proposition 1, Round 2 Sustainable Groundwater Planning Grant Program

A technical committee consisting of working groups from each of the three subbasins provided technical support and quality assurance throughout the model development. Working groups included agencies and consultant teams representing the NASb, SASb, and CoSb with knowledge of the area. Participation by representatives of regional water agencies and GSA representatives, including SGA, RWA, SCGA, SAFCA, SSCAWA and the Sacramento Water Forum, allowed for incorporation of information related to stakeholders within those organizations and beyond. Further progress was shared at meetings associated with development of groundwater sustainability plans (GSPs) to gain additional input and information.

Model development was led by RWA and supported by input and efforts of many entities and their consultants, including:

- RWA/SGA
  - Rob Swartz
  - Monica Garcia
- SCGA
  - John Woodling
  - Ramon Roybal
  - Bob Gardner
- The Sacramento Water Forum
  - Tom Gohring
- SAFCA
  - Gary Bardini
- Department of Water Resources
  - Can Dogrul
  - Tyler Hatch
  - Tariq Kadir
- Each GSA within the North American, South American, and Cosumnes Subbasins and their representatives
- Many other water purveyor and remediation site representatives that provided information to better simulate their areas and operations.

Woodard & Curran was the lead consultant for development of the CoSANA model with substantial assistance from stakeholders, subbasin representatives, and their consultants. The Woodard & Curran project team included:

- Ali Taghavi
- Jim Blanke
- Sebastien Poore
- Sara Miller
- Sevim Onsoy
- Brian Van Lienden
- Sercan Ceyhan
- Mesut Cayar

Other consultants who contributed to the model development included:

- EKI Environment and Water
    - John Fio
    - Dave Leighton
    - Christina Lucero
- GEI Consultants
    - Jonathan Goetz
    - Richard Shatz
- Larry Walker Associates
    - Laura Foglia
    - Rich Pauloo
- MBK Engineers
    - Lee Bergfeld
    - Angela Bezzone
    - Kyle Knutson

The CoSANA team is grateful for the many entities that provided assistance or data to characterize the groundwater and surface water systems in the greater Sacramento region, including many urban water purveyors, agricultural entities, environmental groups, GSA representatives, managers of contamination remediation operations, project proponents, private domestic and rural residential well owners. The team is also appreciative of the California Department of Water Resources for their assistance in implementing the CoSANA model on the Integrated Water Flow Model (IWFM) platform.

EXECUTIVE SUMMARY

CoSANA, the Cosumnes-South American-North American, Integrated Water Resources Model, is a regional integrated water resources model developed as an upgrade and enhancement of the existing Sacramento Area Integrated Water Resources Model (SacIWRM). The enhanced integrated groundwater and surface water simulation capabilities afforded by CoSANA are intended to assist in a broad range of water management activities in the Sacramento Region. CoSANA is built on the Integrated Water Flow Model (IWFM) framework, which is specifically designated in Sustainable Groundwater Management Act (SGMA) Groundwater Sustainability Plans (GSP) regulations as being supported by the California Department of Water Resources for water budget development within GSPs. The model is developed with specific features to support development of sustainable groundwater management strategies and policies and compliance with SGMA, as well as to support the planning and implementation of regional conjunctive use and water banking efforts and other water management activities.

> ***CoSANA at a Glance***
>
> **Model area**: North American, South American, and Cosumnes Groundwater Subbasins
>
> **Modeling Platform**: IWFM
>
> **Layering**: 5 layers representing major formations to the base of fresh water
>
> **Elements**: 24,171 elements with an average element area of 37 acres
>
> **Stream system**: 27 simulated streams with 51 reaches
>
> **Land Use:** 24 land use types, including 20 agricultural crops
>
> **Water Supply:** Surface water, groundwater, and recycled water supply to agricultural and urban water purveyors
>
> **Remediation Pumping:** Groundwater extraction and cleanup at 4 remediation sites
>
> **Hydrologic period**: Water Years 1970-2019 on a monthly time step

Stakeholder participation was a key component in the development of CoSANA, which enabled the model development team to work in a collaborative and transparent environment and to obtain the local data necessary to develop a detailed model, gain input and insight from those most knowledgeable about the subbasins, and to gain stakeholder buy-in, which is necessary for broad regional acceptance. Outreach activities included coordination with representatives of regional water agencies and groundwater sustainability agencies, including the Regional Water Authority, Sacramento Groundwater Authority, Sacramento Central Groundwater Authority, Sacramento Area Flood Control Agency, Southeast Sacramento County Agricultural Water Authority, and the Sacramento Water Forum. Further, progress was shared at meetings associated with development of GSPs for each of the three subbasins to gain additional input and information.

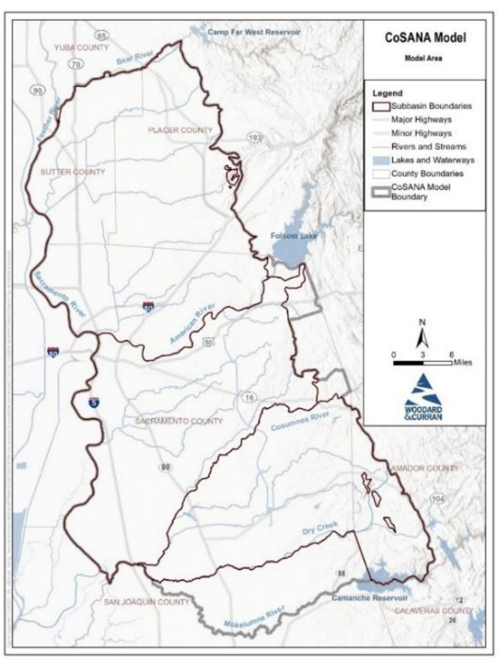


Figure ES-1: Model Area

ES.1 Model Area

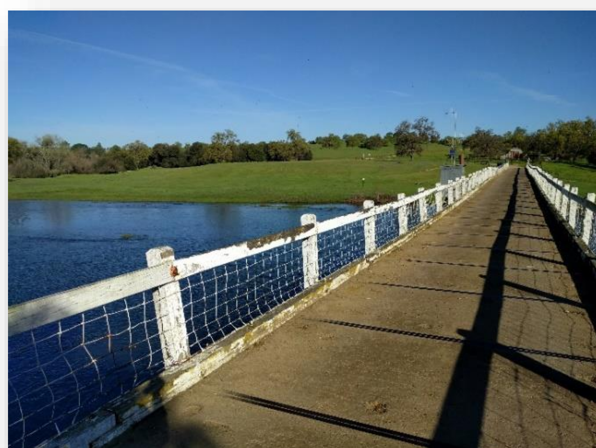
The model area covers nearly 900,000 acres (approximately 1,400 square miles) and is bounded in the north by the Bear River, in the south by the Mokelumne River, in the west by the Sacramento River, and in the east by the Sierra Nevada foothills. This area includes the entirety of the North American, South American, and Cosumnes Groundwater Subbasins. Portions of the Eastern San Joaquin Subbasin are included for consistency with past efforts but are not updated or calibrated to the same level as the North American, South American, and Cosumnes Subbasins. The physical model boundaries are shown in Figure ES-1.

CoSANA performs calculations related to water flow by breaking down the model area into smaller areas both horizontally and with depth. This is known as discretization. Smaller areas and more layers allow for more detailed modeling, but optimal discretization is found by weighing these benefits against limitations of data availability and computational power. The CoSANA model grid contains 24,171 finite elements and 22,274 nodes with an average element area of 37 acres. The overall node spacing is 1,170 feet on average with a maximum of 2,210 feet and a minimum of 300 feet. Smaller node spacing is present near streams and near areas of significant groundwater contamination, where more accurate calculations are called for. The subsurface is characterized by five model layers representing the different geologic conditions from the ground surface to the shallower of the bedrock or base of fresh water. These layers represent:

- Layer 1: Recent alluvium and the Riverbank Formation
- Layer 2: Laguna Formation
- Layer 3 Mehrten Formation
- Layer 4: Valley Springs Formation
- Layer 5: Ione Formation

The development of CoSANA included collection and compilation of a broad range of data related to land use, water use, hydrologic conditions, and hydrogeologic conditions, including:

- Geologic stratification
- Aquifer parameters
- Stream configuration
- Stream flows
- Small watersheds
- Precipitation
- Land use
- Evapotranspiration
- Soil properties
- Population
- Per capita water use
- Groundwater pumping
- Groundwater levels
- Surface water deliveries
- Boundary conditions
- Initial conditions



These and other datasets were developed based on local data, state databases, and federal databases and provided as input to CoSANA, on a monthly time step.

ES.2 Historical Simulation and Model Calibration

The CoSANA model simulates historical conditions in the basin for the period of water years 1970 through 2018 (October 1, 1969 through September 30, 2018). While the modeling time period begins in water year 1970, consistent with the SacIWRM, the focus of this modeling effort was water years 1990 – 2018, which includes substantially more refined data than the earlier years. Water years 1990 – 1994 are used as a warm-up period for the model, and water years 1995-2018 are used for model calibration. Additionally, the entire period of water year 1970-2018 is then used to perform a verification of the model performance over longer hydrologic period.

The simulation of historical conditions is intended to both help better understand and quantify the groundwater flow system and to calibrate the overall groundwater model. The calibration process involves comparison of simulated and observed data combined with adjustments to certain parameters. Data related to groundwater levels, streamflows, and water budgets were incorporated into the calibration process. Parameter adjustments were made within certain tolerance ranges that are reflective of the uncertainties associated with each parameter. The calibration process included both manual calibration by reviewing results and making appropriate adjustments as needed to reflect the long-term trends and short-term seasonal changes in observed data. Additionally, the PEST software package was employed to refine the calibration results by adjusting the soil, aquifer, and stream parameters within a reasonable range and distribution to achieve a better match between observed and simulated data. In this manner, the model is able to improve estimates for parameters lacking comprehensive data, such as agricultural groundwater production or certain aquifer parameters, resulting in better overall model performance.

ES.3 Baseline Simulations

Baseline simulations were developed to represent a set of pre-established hydrologic, land and water use, water demand, water supply, and basin operational conditions. In addition to providing valuable information on the groundwater flow system, these baselines can be implemented to evaluate effects of particular projects or management actions. The baselines incorporate 50 years of hydrology (water years 1970 – 2019) to meet SGMA requirements and to provide climatic variability necessary to assess future projects and management actions. Baseline simulations were developed for four different conditions:

- **Current Conditions:** The CoSANA Current Conditions Baseline (CCBL) is a representation of long-term average conditions assuming that a recent level of development and water demand persists over a long-term period of hydrologic conditions.
- **Projected Conditions:** The CoSANA Projected Conditions Baseline (PCBL) is a representation of the projected land and water use conditions of 2040, applied to the same long-term hydrologic conditions. Projected conditions are generally based on information from land use agencies and from Urban Water Management Plans or other planning documents from water purveyors.
- **Projected Conditions with Climate Change:** The CoSANA Projected Conditions Baseline with Climate Change (PCBL with Climate Change) shares many of the same inputs as the PCBL, but with additional factors to incorporate potential climate change conditions. Climate change conditions are represented through incorporation of information on 2070 Central Tendency (2070CT) conditions as documented by the US Bureau of Reclamation in the American River Basin Study (ARBS). In addition to the 2070CT, sensitivity of the model results and groundwater levels and storage was evaluated using a 2070 Hot and Dry (2070HD) climate scenario from the ARBS.

ES.4 Simulated Groundwater Conditions

Groundwater conditions associated with the historical simulation and the baseline simulations are presented in the report as contour maps, hydrographs, and water budgets. A summary-level groundwater budget for the three groundwater subbasins in the model area is presented in Table ES-1, below. This groundwater budget shows positive change in storage for the historical conditions, Current Conditions Baseline, and Projected Conditions Baseline, and a negative change in storage for the Projected Conditions with Climate Change Baseline (based on 2070CT). Generally, positive change in storage is associated with rising groundwater levels as the system seeks a new equilibrium with the surface water system and surrounding subbasins, while negative change in storage is associated with declining groundwater levels.

Table ES-1: Groundwater Budgets for the Combined North American, South American, and Cosumnes Subbasins

Model Version	Pumping (AFY)	Deep Percolation (AFY)	Gain from Stream (AFY)	Recharge from Canals (AFY)	Boundary Flows (AFY)	Subsurface Inflow (AFY)	Change in Storage (AFY)
Historical (1995–2018)	667,460	428,359	206,837	18,335	7,003*	11,302	26,702
CCBL	643,595	413,447	188,397	16,758	33,656	8,147	16,768
PCBL	685,501	396,714	230,109	16,402	36,561	8,726	2,969
PCBL+ Climate Change	726,028	377,207	261,089	16,427	40,481	11,378	-19,486

Note: all values presented in acre-feet per year (AFY)

CoSANA provides substantial detail that can allow for disaggregating these results spatially and temporally. For instance, as shown in Table ES-2, the North American Subbasin shows the most positive change in storage and the Cosumnes Subbasin shows the most negative change in storage, with values for the South American Subbasin in the middle. Similar differences exist within the subbasins as well, with areas receiving surface water and/or using little groundwater having generally more positive change in storage and groundwater levels and areas using more groundwater and/or receiving little surface water having generally more negative change in storage and groundwater levels. Groundwater conditions and model output are complex, and substantial detail is presented in the main report.

Table ES-2: Estimates of Average Change in Groundwater Storage by Subbasin

Model Version	North American Subbasin (AFY)	South American Subbasin (AFY)	Cosumnes Subbasin (AFY)	Total (AFY)
Historical (1995–2018)	26,661	5,551	-5,510	26,702
CCBL	14,843	2,158	-233	16,768
PCBL	5,390	-1,128	-1,293	2,969
PCBL+ Climate Change	-3,502	-6,222	-9,762	-19,486

ES.5 Recommendations

Like the SacIWRM before it, the CoSANA model is intended to be a living model, with refinements and updates occurring over time to meet the changing needs of the region and to incorporate the latest conditions, data, and modeling platforms. During the development of the model, several items were identified for future refinements to improve the capability of CoSANA to be a long-term defensible and reliable water resources model for the area, as listed below with additional detail in the main report.

- Continue collaboration and engagement with local GSAs, water purveyors, groundwater users, and water managers
- Collaborate with DWR
- Develop a model update schedule
- Enhance representation of variability of potential evapotranspiration
- Map Soil Survey Geographic Database (SSURGO) rootzone parameters directly to CoSANA
- Refine surface water deliveries in the North American and South American Subbasins
- Improve inflow estimates for tributary streams
- Improve return flow routing within IFWM and CoSANA
- Improve data and simulation of Auburn Ravine flows
- Develop improved rating tables for major streams
- Improve simulation of complex water systems
- Improve data for Mather AFB remediation operations
- Improve model information and data sets on the eastern areas

ES.6 Summary

The CoSANA model is built upon the previous SacIWRM by migrating to the IWFM platform, providing finer resolution spatially and with depth, and by refining and extending the data incorporated into the model. CoSANA provides a robust, comprehensive, defensible model for assessing water resources conditions in the Sacramento Region through integrated modeling of land surface, groundwater, and surface water conditions using detailed local and regional data and the most widely accepted modeling platform. This includes simulation under historical, current, projected, and projected with climate change conditions. The tool is well calibrated and ready to be used in various water supply and management studies and is flexible enough to be updated and refined to meet future needs of the region, including implementation of sustainable groundwater management strategies, regional water accounting and allocation frameworks, evaluation of well protection plans and programs, and regional conjunctive use and projects assessments, including the regional water bank.

1. INTRODUCTION

The North American, South American, and Cosumnes Groundwater Subbasins are simulated under a unified model to provide a regional integrated water resources model suitable for a variety of regional water management needs. With a comprehensive long-term hydrologic period, robust and accurate water supply and use data for urban water purveyors, land use and cropping patterns based on the latest statewide and regional land use surveys, geologic and hydrogeologic information based on the statewide numerical and texture models, and surface water hydrologic data, The Cosumnes-South American-North American Integrated Water Resource Model, or CoSANA, is a comprehensive integrated water resources model to serve the North and South American and Cosumnes groundwater subbasins. CoSANA incorporates all relevant data from the Sacramento Area Integrated Water Resources Model (SacIWRM).

1.1 Goals of Model Development

The primary goal of development of CoSANA is to have a robust, technically sound, publicly accepted analytical computer tool that simulates the details of the integrated land surface system; stream and river system; and groundwater hydrologic and hydrogeologic system in the model area for use in regional water management.

This goal represents continuation of successful use of the SacIWRM, which was implemented for numerous diverse water management efforts over three decades. Updating, refining, and modernizing SacIWRM into the new state-of-the-art CoSANA platform has a goal of providing a technical and analytical tool through conducting the work in a collaborative and open environment to gain regional acceptance in the water community of the greater Sacramento region. Together, the tool and regional acceptance can allow for a broad, regional, consistent modeling approach that can provide defensible, robust, consistent results in a more efficient manner.

While CoSANA is intended to assist in a broad range of water management activities in the area, the model is developed with specific features to support development of sustainable groundwater management strategies and policies and compliance with the Sustainable Groundwater Management Act (SGMA), as well as to support the planning and implementation of regional conjunctive use and water banking efforts.

CoSANA is used for the development of the groundwater sustainability plans (GSPs) for North American Subbasin (NASb), South American Subbasin (SASb), and Cosumnes Subbasin (CoSb), including work related to:

- Hydrogeologic conceptual model
- Sustainable management criteria
- Water budgets and sustainable yield
- Monitoring networks
- Projects and management actions to achieve sustainability
- Outreach, reporting, and ongoing analysis

CoSANA is also intended to support work associated with a Sacramento regional water bank, including:

- Identification of benefits and impacts
- Water bank accounting
- Quantification of losses
- Integration with surface water reservoir operations models
- FloodMAR opportunities assessment and design
- Outreach, reporting, and ongoing analysis

CoSANA is developed to support analysis of a broad range of regional water management efforts.

1.2 Cosumnes, South American, and North American Subbasins

CoSANA simulates the North American (5-021.64), South American (5-021.65), and Cosumnes (5-022.16) Groundwater Subbasins, along with a small portion of the Eastern San Joaquin (ESJ) (5-022.01) Groundwater Subbasin. The focus of the model is the NASb, SASb, and CoSb subbasins, with less detail provided for the ESJ Subbasin. Figure 1-1 shows the model domain and the boundaries of the associated subbasins. Portions outside of the groundwater subbasins were included in the model area to avoid breaking up larger urban areas, including the City of Folsom and Rancho Murieta Community Services District (RMCSD). The model area includes portions of Amador, Placer, Sacramento, San Joaquin, and Sutter Counties. The CoSANA model domain is similar to the SacIWRM model domain, with some differences due to changes in groundwater subbasin boundaries.

NASb and SASb are categorized as high priority groundwater subbasins and CoSb is categorized as a medium priority groundwater subbasin under the California Statewide Groundwater Elevation Monitoring (CASGEM) program. None of these three subbasins are identified by the California Department of Water Resources (DWR) as critically overdrafted. As such, groundwater sustainability agencies (GSAs) in these three subbasins must develop GSPs by January 31, 2022 that detail how each subbasin will be managed in a sustainable manner by 2042. CoSANA is developed to assist in that process.

Table 1-1 lists 17 GSAs covering the NASb, SASb, and CoSb Subbasins. The GSAs include the major urban water purveyors, agricultural water purveyors, or other agencies which supply water or have land use authority within the subbasin. The water purveyors are shown in Figure 1-2 and the GSAs are shown in Figure 1-3.

Table 1-1: Groundwater Sustainability Agencies by Subbasin

Subbasin	GSA
North American Subbasin	Reclamation District 1001
	Sacramento Groundwater Authority
	South Sutter Water District
	Sutter County
	West Placer County
South American Subbasin	Sacramento County
	Northern Delta
	Omochumne-Hartnell Water District
	Sacramento Central Groundwater Authority
	Sloughhouse Resource Conservation District
Cosumnes Subbasin	Amador County Groundwater Management Authority
	City of Galt
	Clay Irrigation District
	Galt Irrigation District
	Omochumne-Hartnell Water District
	Sacramento County
	Sloughhouse Resource Conservation District

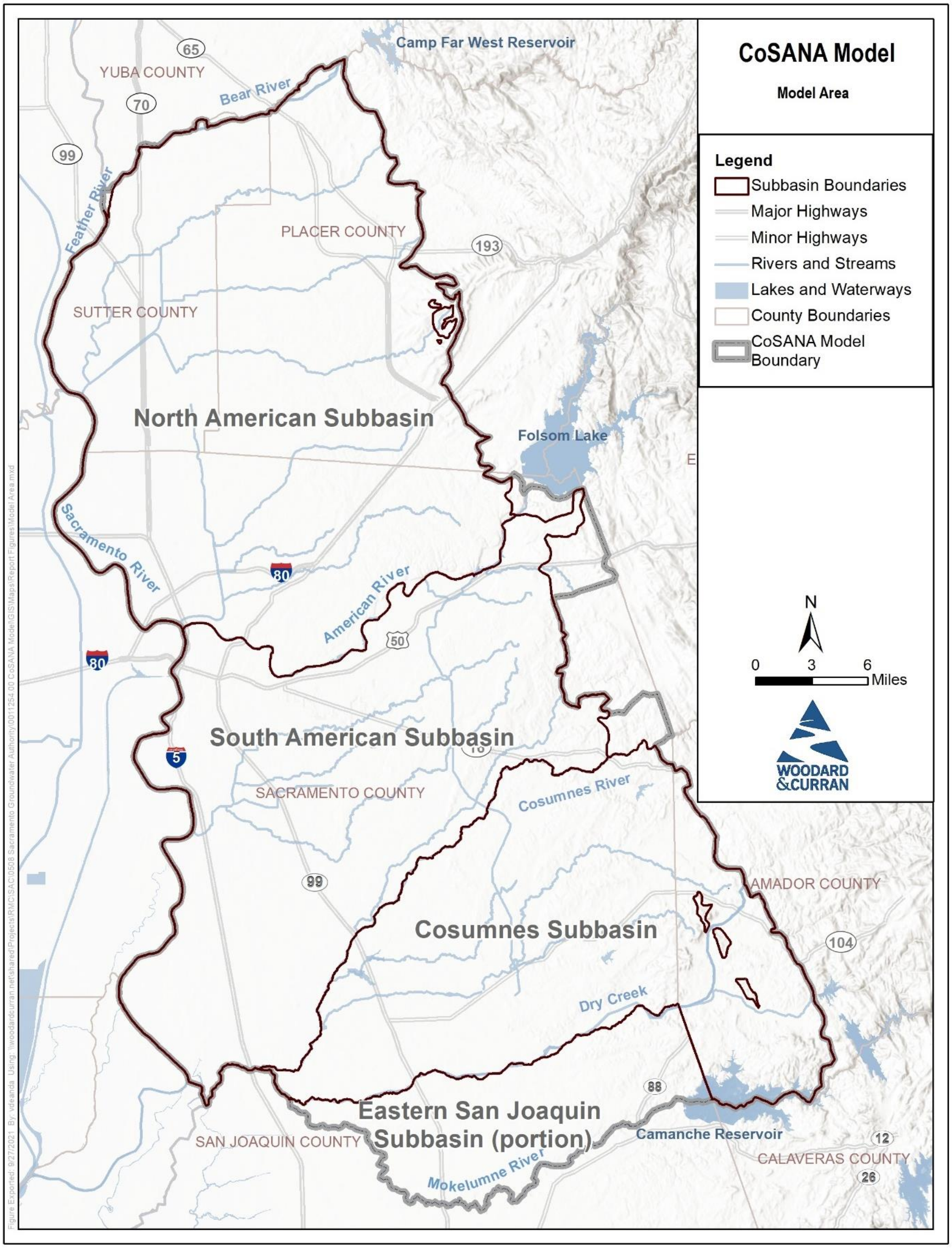


Figure 1-1: Model Area and Groundwater Subbasin Boundaries

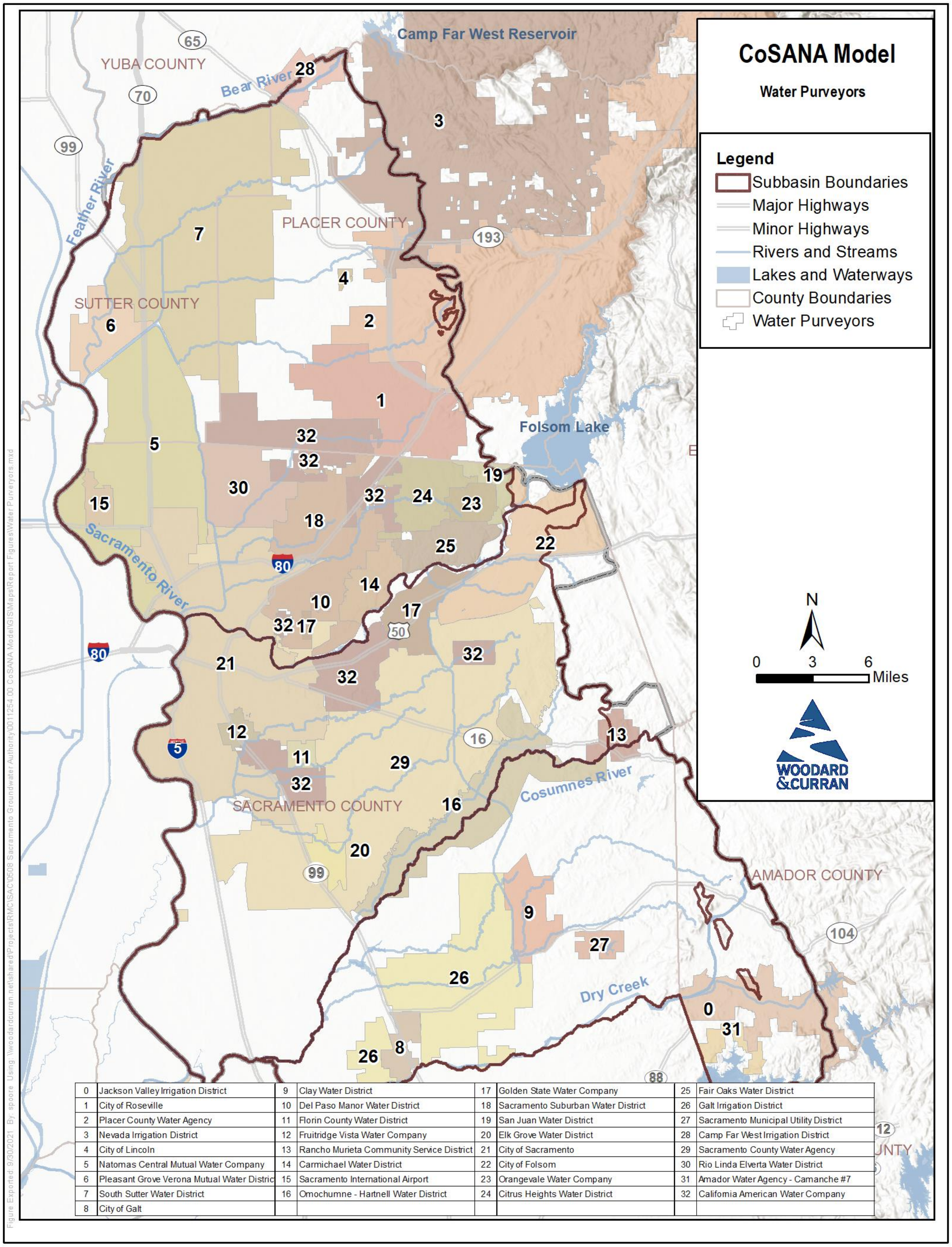


Figure 1-2: Major Water Purveyors

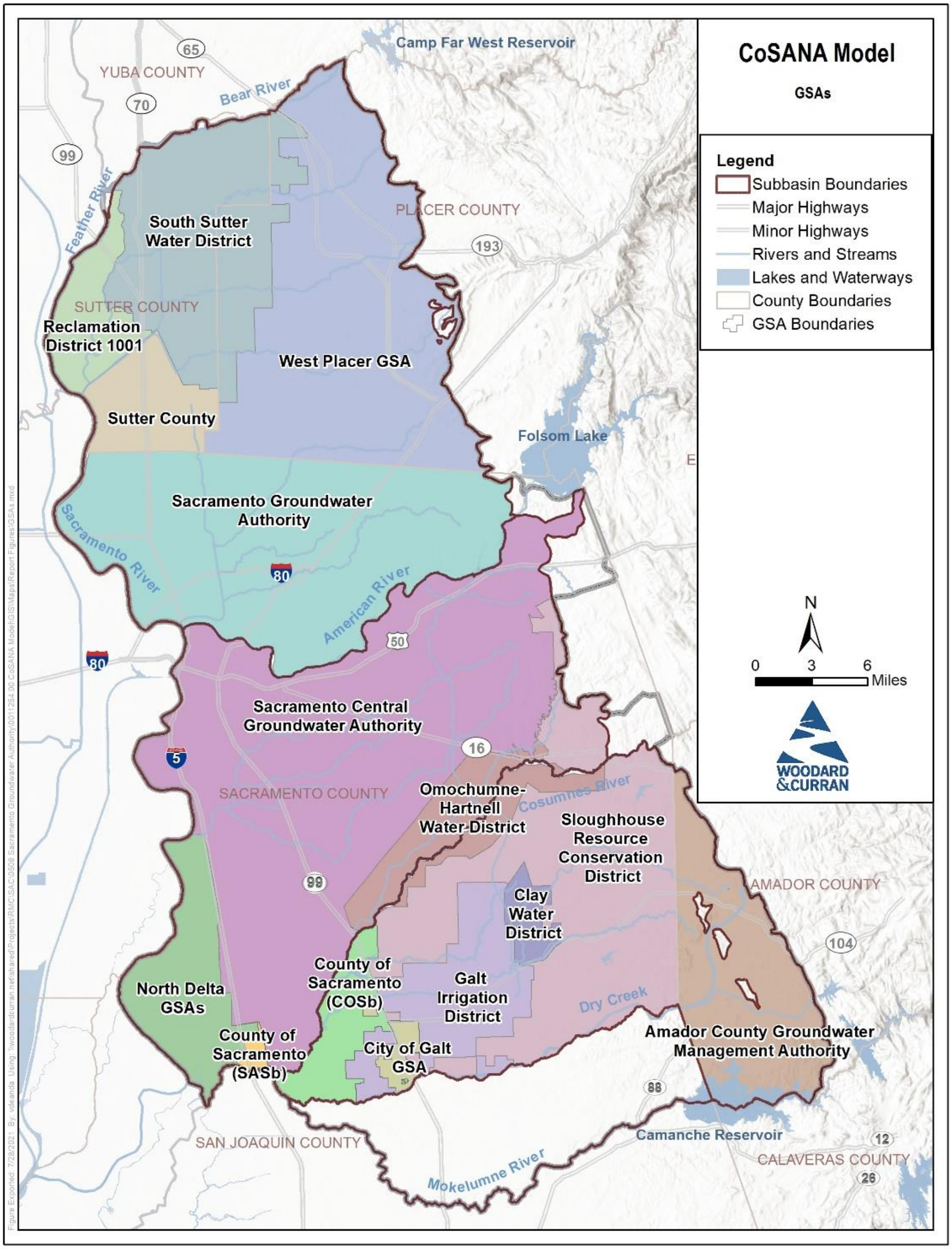


Figure 1-3: Groundwater Sustainability Agencies

1.3 Collaborative and Open Environment

Model development was conducted in a collaborative and open environment and was coordinated with various entities representing the three groundwater subbasins, including Sacramento Groundwater Authority (SGA), Sacramento Central Groundwater Authority (SCGA), Sacramento Area Flood Control Agency (SAFCA), Sacramento County, Regional Water Authority (RWA), the Sacramento Water Forum, the Cosumnes Subbasin SGMA Working Group (referred to as the "Working Group"), GSAs, and associated consultants.

The development of CoSANA took place in an open and transparent process and in a collaborative environment, with regular meetings between technical and working group members discussing model technical specifics and sharing model data, assumptions, data analysis and development, calibration approach and process, as well as interim and final results. The modeling team additionally met with local agencies individually to review model data and gather additional information to support refining model and data assumptions during model development.

Participation by representatives of regional water agencies and GSA representatives, including SGA, RWA, SCGA, SAFCA, Southeast Sacramento County Agricultural Water Authority (SSCAWA), the Sacramento Water Forum, and the Cosumnes Subbasin Working Group allowed for incorporation of information related to stakeholders within those organizations and associated subbasins. Further, progress was shared at meetings associated with development of GSPs for each of the three subbasins to gain additional input and information. These presentations provided details on the goals and progress of CoSANA development and also served as a method to request information and data from stakeholders.

In addition to coordination activities during development of the CoSANA model, the completed model was compared to models in the surrounding subbasins to assess consistency. The assessment focused primarily on subsurface flows, although other components, including stream seepage, were also reviewed. The assessment included meetings with modeling representatives from surrounding subbasins, including the Yolo, Yuba, and Solano Subbasins. Subsurface flows were found to be similar in magnitude, although in some cases in opposite directions. These differences were not considered substantial enough to impact the ability to use model results for management purposes within the GSP. This is due to the relatively small differences in comparison to other components of the groundwater budget and due to the calibrated nature of the models, where small differences in subsurface flows may be balanced out by similar differences in other calibrated components of the model. Coordination is expected to continue in the future, where information gained by recent modeling in the various subbasins can be incorporated into future refinements of CoSANA and the neighboring models to reduce the differences and improve model performance.

1.4 Model Platform and Historical Modeling of the Region

SacIWRM and predecessor models have been used to simulate and analyze the North American, South American, and Cosumnes Subbasins since 1992. The models have contributed to many regional and local studies, including supporting the Water Forum Agreement and implementation of groundwater management plans (Table 1-2). SacIWRM was developed based on the Integrated Groundwater and Surface Water Model (IGSM) code, developed in the early 1990s by DWR and the United States Bureau of Reclamation (Reclamation) to simulate Central Valley operations. SacIWRM underwent six major upgrades since first being developed, with the last major update to the northern portion of the model in 2007 and to the central portion in 2016. SacIWRM includes data from 1970 through 2011 and is still in active use for various projects.

CoSANA is developed by porting and refining the data from the older model SacIWRM into the newer DWR code that replaced IGSM in the early 2000s, called Integrated Water Flow Model (IWFM). IWFM is an open-source, finite element simulation code that supports triangular and quadrilateral elements (Dogrul et al., 2017a). It is specifically designated in the GSP regulations as being supported by DWR for water budget development within GSPs. It is also the code used for DWR's California Central Valley Groundwater-Surface Water Simulation Model (C2VSimFG), which supports SGMA activities throughout the Central Valley at the regional scale (Brush et al., 2013; DWR, 2020). The IWFM Demand Calculator (IDC) is the stand-alone root zone component of IWFM that simulates land surface and root zone flow processes (Dogrul et al., 2017b). It calculates agricultural and urban water demands using inputs including climate conditions, soil parameters, and land use types and distribution. It can be run separately or combined with IWFM. IDC was run combined with IWFM, and data development and results in this documentation are included as part of overall IWFM datasets and results.

The model area covers 888,548 acres and is bounded in the north by the Bear River, in the south by the Mokelumne River, in the west by the Sacramento River, and in the east by the Sierra Nevada foothills. The physical model boundaries are shown in Figure 1-1.

Table 1-2: SacIWRM History and Application

Year	Study
1992	City-wide Model
1993	County-wide Model
1996	American River Water Resources Investigation
1996	Northridge Conjunctive Use Study
1996	Rio Linda Water Supply Analysis
1996	Hydrology Update
1996	Water Forum- Basin Yield
1999	Sunrise Douglas Water Supply Analysis
1999	Zone 40 (North Vineyard Well Field)
2000	American River Basin Cooperating Agencies Studies
2002	Aerojet Surface Water Discharge Permit
2004	Zone 40 Water Supply Master Plan Update
2005	Natomas Central Mutual Water Company Impacts Assessment
2005	Rio Del Oro Impacts Study
2007	Sutter Measure M Impact Study
2007	Sun Creek Development
2008	Model Comprehensive Update
2009	SCGA Well Protection Program
2009	Cosumnes River Hydrologic Study
2010	RWA Water Accounting Framework
2011	The Nature Conservancy (TNC) Reservoir Re-Operation Study
2012	South County Recycled Water Feasibility Study
2012	TNC Conjunctive Use Study
2012	TNC/California Water Foundation Central Valley Hydrologic Study
2014	TNC Groundwater Banking Feasibility
2015	SCGA Biennial Groundwater Management Plan Report
2016	Sacramento Regional County Sanitation District Climate Change Assessment & Environmental Impact Report Support
2017	Harvest Water, Water Storage Investment Program, City of Sacramento Groundwater Master Plan
2018	Dynamic linkage with the Yolo IGSM
2020	Grandpark Specific Plan Development

1.5 Report Organization

The remainder of this report is organized as follows:

- Chapter 1 is this introductory chapter.
- Chapter 2 describes the historical model development, including the design of the model grid, layering, and input data for the root zone, groundwater, surface water, and land surface modules.
- Chapter 3 describes model input data for water supply and demand. Assumptions associated with agricultural and urban water use are described in this chapter.
- Chapter 4 describes the methodology used for the calibration of model parameters. Final parameters used in the model are provided along with model results and comparisons to observed data. This chapter also includes a sensitivity analysis of model results with perturbed input parameters.
- Chapter 5 describes the baseline conditions. The Current Conditions Baseline (including the input data for water supply and demand and the model results), Projected Conditions Baseline (including the land use, water supply and demand data used and the model results), and Projected Conditions with Climate Change Baseline (including the hydrologic data used and the model results) are described in this chapter.
- Chapter 6 presents a summary of the report and provides recommendations for future activities.
- Chapter 7 presents a list of references used in this report.

2. MODEL DEVELOPMENT

This section presents the source and analysis of input data used in the development of CoSANA. This includes spatial and temporal information for hydrologic, hydrogeologic, water use, water supply, and operations data sets included in the model, as well as physical settings, parameters, and assumptions.

2.1 Model Input Data

IWFM model files and corresponding major data sources used in the development of CoSANA are presented in Table 2-1 along with the report sections where the model data and data sources are described.

Table 2-1: CoSANA Input Data

Major Data Category	Minor Data Category	Data Source	Report Section
Hydrogeological Data	Geologic Stratification	Local information	2.10
	Aquifer Parameters	USGS texture model	4.5.3
Stream Data	Stream Configuration	C2VSim SVSim SacIWRM Local information	2.4
	Stream Inflow	USGS & CDEC stream gages Local information	2.4
	Calibration Gages	USGS & CDEC stream gages	4.2.3
Hydrological Data	Precipitation	PRISM & CalSIMETAW	2.6
Agricultural Water Demand	Land Use	DWR county surveys CropScape DWR statewide mapping Local information	2.7
	Evapotranspiration	C2VSim METRIC Local information	2.8
	Soil Properties	SSURGO STATSGO2	2.9
Urban Water Demand	Population	U.S. Census Bureau tract data	3.3.1
	Per Capita Water Use	Local information California Water Plan	3.2
Water Supply	Groundwater Pumping	Local information SacIWRM	3.1.2
	Surface Water Deliveries	Local information SacIWRM	3.1.1
Other	Boundary Conditions	C2VSim Local information	2.12
	Initial Conditions	Water Data Library	2.13
	Small Watersheds	C2VSim	2.11
	Calibration Wells	DWR Local information	4.2.2

Abbreviations: C2VSim: California Central Valley Groundwater-Surface Water Simulation Model; CalSIMETAW: California Simulation of Evapotranspiration of Applied Water; CDEC: California Data Exchange Center; DWR: California Department of Water Resources; METRIC: Mapping Evapotranspiration at High Resolution with Internalized Calibration; SacIWRM: Sacramento Integrated Water Resources Mode; PRISM: Precipitation-Elevation Regressions on Independent Slopes Model; SSURGO: Soil Survey Geographic Database; STATSGO2:Digital General Soil Map of the United States; SVSim: Sacramento Valley Groundwater-Surface Water Simulation Model; USGS: United States Geological Survey

2.2 Simulation Period and Temporal Discretization

The CoSANA model simulates the historical conditions in the basin for the period of water years (WY) 1970 through 2018 (October 1, 1969 through September 30, 2018). Monthly data was used as model input, and the model simulation uses a monthly time step. Model output can be reported on a monthly or annual time increment, as needed.

Model data development efforts were divided into two periods, as follows:

- WY 1970-1989 – The data for this period is primarily mapped over from SacIWRM. As such, CoSANA inherits the spatial and temporal resolution of SacIWRM. As much of the source data for land use, water use, and water supply are not readily available in digital form, the mapped data from SacIWRM was used without substantial refinement. However, the hydrologic data sets, including rainfall and streamflows, are refined based on the latest sources of data.
- WY 1990-2018 – The data for this period is much more refined, as digital source data are used in development of the model input data. Additionally, the groundwater level and streamflow observation data are available in a more consistent quality and format. Therefore, this period is used for the WY 1995-2018 model calibration period, plus a WY 1990-1994 warm up period. Further discussion on calibration period selection is provided in the model calibration section of the report.

Beyond the two time periods, the entirely of the WY 1970-2018 period is used for verification of consistency of model simulation, long-term water budgets, long-term trends in groundwater levels and stream-aquifer interaction, and long-term trends in the groundwater storage changes. WY 2019 is added to the baselines to achieve 50 years of hydrology as required by SGMA (see Section 5).

2.3 Model Grid and Subregions

A model grid provides a discrete geographic representation of the physical, hydrologic, hydrogeologic, jurisdictional, land use, water use, and water supply features at a small enough size to support the basis for robust mathematical representation of the features and the inter-relationship between various components of the system.

A grid network was developed for the CoSANA model, based on principles of finite element numerical analysis, to reflect hydrological, hydrogeological, physical, jurisdictional, and operational conditions in the groundwater subbasins represented in CoSANA. The finite element grid for CoSANA was developed using Aquaveo's GMS-Groundwater Modeling System software with spatial processing using Esri's ArcGIS. The grid includes quadrilateral and triangular elements based on selected input lines and control points. Features included in the development of the model grid are shown in Figure 2-1 and include:

- Streams
- GSA boundaries
- Water purveyor boundaries
- County boundaries
- Areas of groundwater contamination
- Geological features
- Model grids in neighboring subbasins

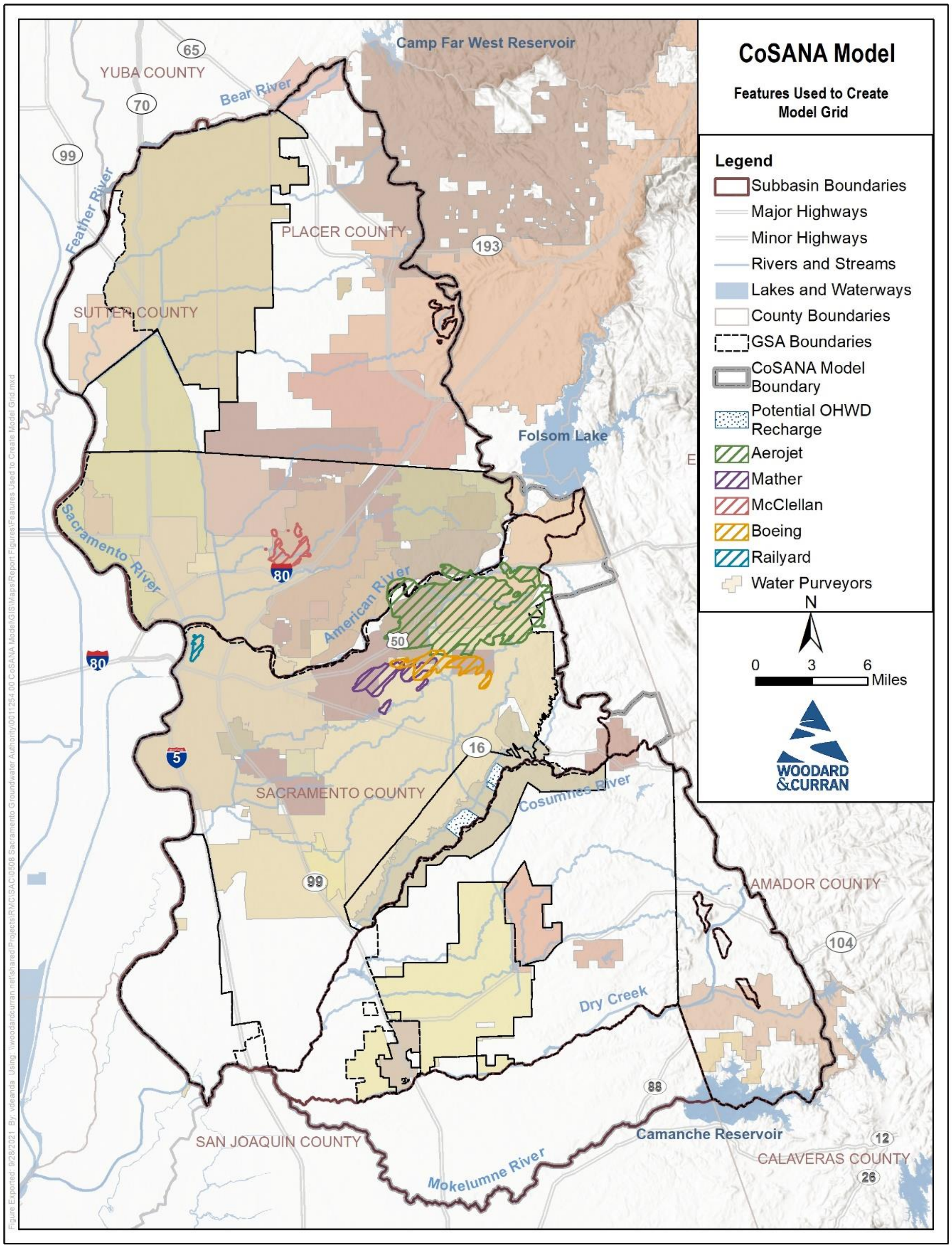


Figure 2-1: Features Used to Create Model Grid

The CoSANA model grid contains 24,171 elements and 22,274 nodes with an average element area of 37 acres (Figure 2-2). The node discretization interval for most features was set at 2,000 feet with more refined spacing in specific areas, such as near streams (described below) and areas of significant groundwater contamination (1,000 feet spacing for the Mather, Aerojet, and McClellan areas). The overall node spacing was 1,170 feet on average with a maximum of 2,210 feet and a minimum of 300 feet.

Streams in the model domain were separated into three tiers, described further in Section 2.4. The first two tiers are simulated in the model. Tier 3 streams are minor streams that are included in the model grid for drainage routes but are not directly modeled in CoSANA.

Border model nodes were aligned with the model grids for the Yuba Groundwater Model (YGM), which is directly adjacent and also uses the IWFM platform, to improve the potential for future direct interaction with this model (Figure 2-3). Node spacing along other boundaries for other neighboring models, including the Yolo and Eastern San Joaquin models were used as guidelines, however, CoSANA provides smaller node spacing along these boundaries compared to the neighboring models. There was no direct coordination on node spacing along the boundaries bordering the Solano or Sutter Subbasins.

The southern boundary of CoSANA is the Mokelumne River, which provides coverage for the Cosumnes Subbasin and a portion of the Eastern San Joaquin Subbasin, as well as a hydrologic boundary. The Cosumnes Subbasin is covered by both CoSANA and the Eastern San Joaquin Subbasin model (Eastern San Joaquin Water Resources Model). Generally, the CoSANA model has limited focus on the Eastern San Joaquin Subbasin, and the Eastern San Joaquin model has limited focus on the Cosumnes Subbasin. The CoSANA node spacing is refined along the Mokelumne River and the data and information in CoSANA's representation of the Cosumnes Subbasin is refined by the Cosumnes Subbasin GSAs and consultants. The Cosumnes Subbasin GSAs used CoSANA in development of their GSP.

The model elements are grouped into 87 model subregions (Figure 2-4) that are used to organize input data and to report standard model water budget output. Subregions were delineated using boundaries of cities, water agencies, GSAs, subbasins, and counties. A listing of model subregions, including the associated subbasin and the number of model elements they contain, is provided in Table 2-2.

Table 2-2: CoSANA Subregions

Subregion Number	Subregion Name	Groundwater Subbasin	Number of Elements
1	Camp Far West ID	North American	142
2	Sutter Co. 1	North American	12
3	South Sutter WD GSA	North American	1296
4	Placer County WA	North American	997
5	Nevada ID	North American	161
6	Lincoln	North American	235
7	RD1001	North American	359
8	Pleasant Grove Verona MWC	North American	162
9	Sutter Co. 2	North American	60
10	Natomas MWC (Sutter Co.)	North American	252
11	Sutter Co. 3	North American	76
12	Roseville SOI	North American	42
13	City of Roseville	North American	478
14	Cal Am (West Placer)	North American	166
15	Natomas MWC (Sacramento Co.)	North American	423

Subregion Number	Subregion Name	Groundwater Subbasin	Number of Elements
16	Sacramento International Airport	North American	48
17	Metro Air Park	North American	26
18	Sac Co. 1	North American	63
19	Sac Co. 2	North American	27
20	Sac County WA (Northgate 880)	North American	13
21	Rio Linda Elverta	North American	221
22	Sac Co. 3	North American	16
23	Cal Am (Antelope)	North American	55
24	Cal Am (Lincoln Oaks)	North American	92
25	Citrus Heights WD	North American	171
26	San Juan WD (Placer Co.)	North American	29
27	San Juan WD (Sacramento Co.)	North American	88
28	Orange Vale WC	North American	73
29	Lake Natoma/Mississippi Bar	North American	116
30	Fair Oaks WD	North American	354
31	Carmichael WD	North American	297
32	Sacramento Suburban WD (North)	North American	471
33	Sacramento Suburban WD (South)	North American	293
34	Del Paso Manor WD	North American	18
35	Golden State WC Arden	North American	21
36	Cal Am (Arden)	North American	27
37	Sac County WA (Arden Park Vista)	North American	76
38	City of Sacramento (North)	North American	777
39	City of Sacramento (South)	South American	1212
40	Cal Am (Suburban Rosemont)	South American	410
41	Sac Co. 4	South American	33
42	Golden State WC (Cordova)	South American	548
43	Sac Co. 5	South American	111
44	City of Folsom	South American (partial)	869
45	Cal Am (Security Park)	South American	76
46	Fruitridge Vista WC	South American	46
47	Florin County WD	South American	31
48	Cal Am (Parkway)	South American	98
49	Sac Co. 6	South American	104
50	Sac County WA (North/Central)	South American	1451
51	Sac County WA (South)	South American	240
52	Elk Grove WD (Service Area 2 - Intertie)	South American	97
53	Elk Grove WD (Service Area 1 - GW)	South American	62
54	Cosumnes River West	South American	734
55	RD744	South American	76
56	Franklin Drainage District	South American	197

Subregion Number	Subregion Name	Groundwater Subbasin	Number of Elements
57	RD813	South American	70
58	RD755	South American	22
59	RD1002	South American	94
60	RD551	South American	272
61	RD369	South American	36
62	RD2110	South American	88
63	Sac Co. 7	South American	54
64	Rancho Murieta (North)	South American (partial)	244
65	Sloughhouse RCD (North)	South American	422
66	OHWD (South American Subbasin)	South American	990
67	OHWD (Cosumnes Subbasin)	Cosumnes	601
68	Rancho Murieta (South)	Cosumnes	87
69	Sloughhouse RCD (East)	Cosumnes	1219
70	Wilton	Cosumnes	255
71	Sloughhouse RCD (West)	Cosumnes	254
72	Galt ID (East)	Cosumnes	615
73	Clay WD	Cosumnes	125
74	Clay	Cosumnes	67
75	SMUD Rancho Seco	Cosumnes	50
76	Cosumnes River South	Cosumnes	308
77	Galt ID (West)	Cosumnes	78
78	Sac Co. 8	Cosumnes	408
79	City of Galt	Cosumnes	86
80	Sloughhouse RCD (South)	Cosumnes	35
81	Amador Co. 1	Cosumnes	443
82	Ione	Cosumnes	44
83	Jackson ID	Cosumnes	213
84	Camanche	Cosumnes	355
85	Amador County WA	Cosumnes	57
86	Mokelumne	Eastern San Joaquin	1944
87	City of Galt WWTP	Cosumnes	7

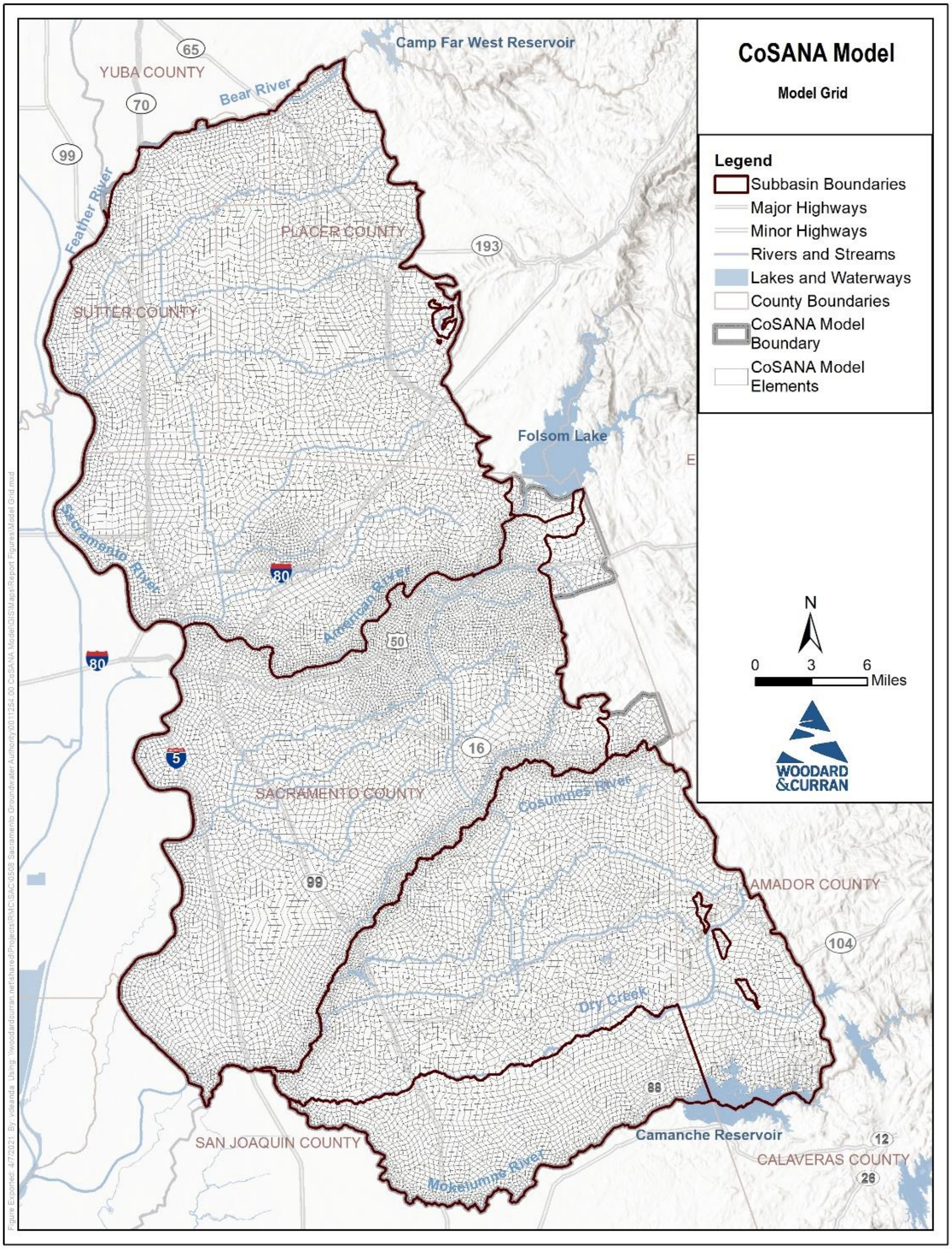


Figure 2-2: CoSANA Model Grid

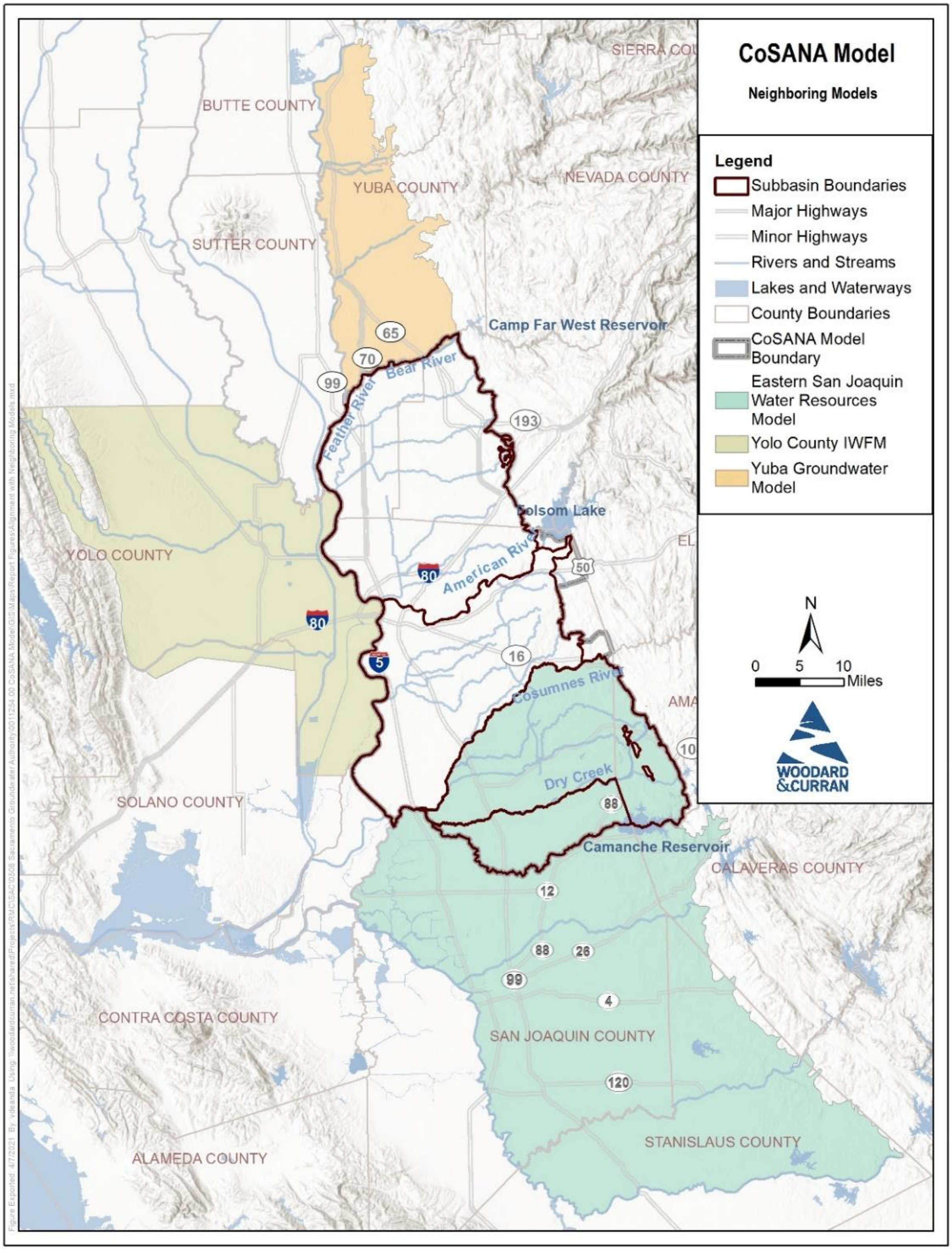


Figure 2-3: Alignment with Neighboring Model Grids

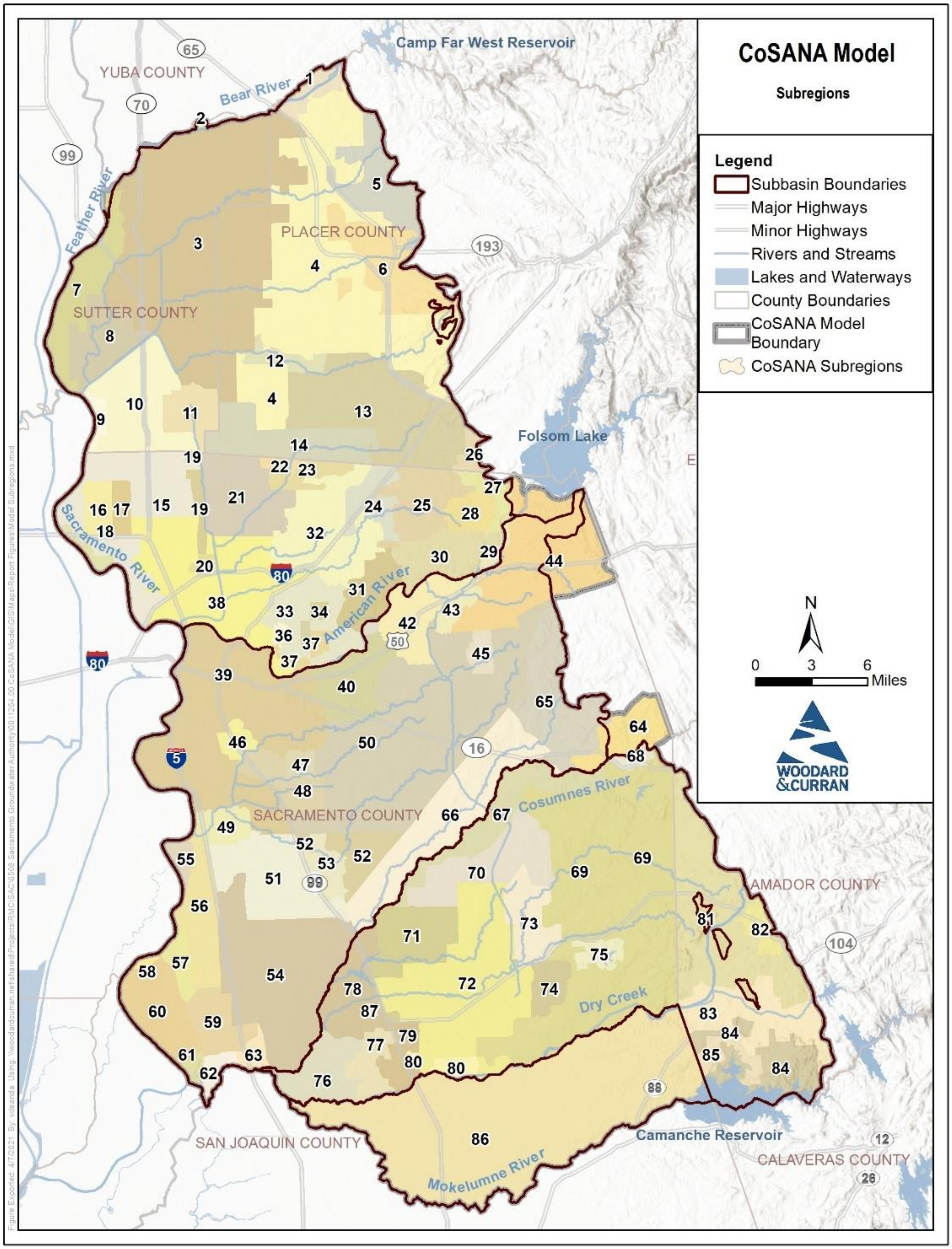


Figure 2-4: CoSANA Subregions

2.4 Stream Configuration and Inflow

Model hydrology is represented by 51 modeled stream reaches representing 27 streams, rivers, and canals, which are largely defined to start and/or end at confluences. Streams in the model domain are separated into three tiers, as shown in Table 2-3 and Figure 2-5. The discretization interval for stream node spacing and buffers included around the streams to transition from the finer to coarser node spacing vary based on the tier, as follows:

- Tier 1 includes major streams and were discretized to 750 feet (Cosumnes and American Rivers) or 1,000 feet (Sacramento, Feather, Bear, and Mokelumne Rivers). The fine level of discretization allows for better representation of surface water-groundwater interaction. A buffer, the distance within which the finer discretization is applied, of 5,280 feet (1 mile) was applied.
- Tier 2 represents important streams with standard feature discretization intervals (largely 2,000 feet). Exceptions included Deer Creek with discretization of 1,250 feet and a 2,640 feet (0.5 mile) buffer and Folsom South Canal with discretization of 1,500 feet and a 5,280 feet (1 mile) buffer.
- Tier 3 includes minor streams and drainages, and were not simulated as streams, but included for drainage routes (discussed further in section 2.5). Discretization for these streams was standard (largely 2,000 feet). While these hydrologic features represent drainage and conveyance water courses in the model, they are not directly used as simulated streams in the model due to lack of sufficient information such as channel geometry and streamflow records.

The streams and creeks are represented in the model by 2,388 stream nodes. The number of stream nodes and their refined resolution provide an increased level of accuracy when depicting stream-groundwater interaction. Physical channel characteristics, including the stream invert elevation, channel width, and stream flow rating tables, were obtained from the closest C2VSimFG stream nodes, SacIWRM, and United States Geological Survey (USGS) digital elevation models (DEM).

Time series of stream inflow data is available from 7 USGS gaging stations, additionally several tier 2 streams in the NASb use inflows developed by MBK Engineers or model derived flows from C2VSimFG or YGM. Table 2-4 presents stream input data and Figure 2-6 shows available stream gage locations.

Table 2-3: CoSANA Streams and Tiers

Stream	Groundwater Subbasin	Stream Tier
American River	North American	1
Arcade Creek	North American	2
Auburn Ravine	North American	2
Bear River	North American	1
Cross Canal	North American	2
Curry Creek	North American	3
Dry Creek	North American	2
East Side Canal	North American	2
Feather River	North American	1
Magpie Creek	North American	2
Natomas East Drain	North American	2
Ping Slough	North American	3
Pleasant Grove Creek	North American	2
Racoon Creek	North American	2
Sacramento River	North American	1
South Branch Pleasant Grove Creek	North American	3
Alder Creek	South American	2
American River	South American	1
Beacon Creek	South American	2
Buffalo Creek	South American	2
Cosumnes River	South American	1
Deer Creek	South American	2
Elder Creek	South American	2
Folsom South Canal	South American	2
Laguna Creek	South American	2
Morrison Creek	South American	2
Sacramento River	South American	1
Arkansas Creek	Cosumnes	3
Badger Creek	Cosumnes	2
Brown’s Creek	Cosumnes	3
Cosumnes River	Cosumnes	1
Deadman Gulch	Cosumnes	3
Dry Creek	Cosumnes	2
Folsom South Canal	Cosumnes	2
Griffith Creek	Cosumnes	3
Hadselville Creek	Cosumnes	2
Jackson Creek	Cosumnes	2
Laguna Creek	Cosumnes	2
Mokelumne River	Cosumnes	1
North Fork Badger Creek	Cosumnes	3
Rolling Draw	Cosumnes	3
Skunk Creek	Cosumnes	3
Sutter Creek	Cosumnes	3
Willow Creek	Cosumnes	3
Windmill Draw	Cosumnes	3

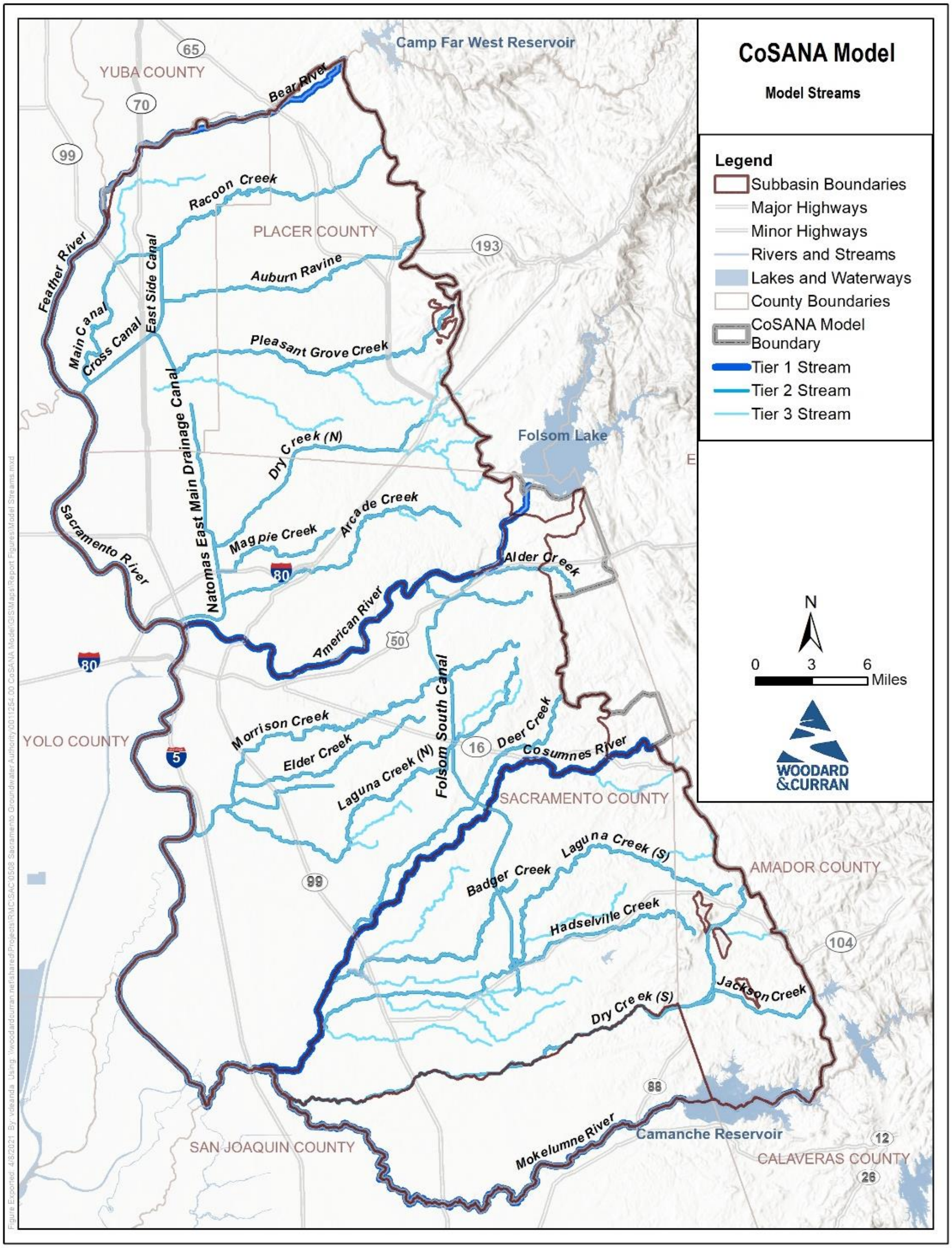


Figure 2-5: CoSANA Streams

Table 2-4: Stream Inflows

Stream	Stream Node	Source	Gage Name	Period of Record (WY)	Average Annual Streamflow (acre-feet)
Sacramento River	155	USGS	Sacramento River near Verona (USGS Gage 11425500)	1929 - 2021	14,461,848
American River	734	USGS	American River at Fair Oaks (USGS Gage 11446500)	1904 - 2021	2,745,469
Cosumnes River	1490	USGS	Cosumnes River at Michigan Bar (USGS Gage 11335000)	1907 - 2021	396,807
Mokelumne River	2080	USGS	Mokelumne River below Camanche Dam (USGS Gage 11323500)	1905 - 2020	568,754
Bear River	1	USGS	Bear River near Wheatland (USGS Gage 11424000)	1928 - 2021	325,546
Raccoon Creek	158	MBK Engineers	Raccoon Creek	1976 - 2018	28,848
Auburn Ravine	248	MBK Engineers	Auburn Ravine	1976 - 2018	19,353
Pleasant Grove Creek	301	MBK Engineers	Pleasant Grove Creek	1976 - 2018	28,827
Dry Creek[1]	502	MBK Engineers	Dry Creek (North American Subbasin)	1976 - 2018	35,944
Feather River	86	YGM	Feather River	1987 - 2015	5,314,464
Dry Creek[1]	1911	C2VSimFG	Dry Creek (Cosumnes Subbasin)	1970 - 2015	30,020
Jackson Creek	1936	JVID	Jackson Creek below Lake Amador Dam	1980 – 2009, 2017 – 2019	7,198
Morrison Creek	1024	USGS	Morrison Cr near Sacramento	1997 - 2017	15,158
Laguna Creek (SASb)	1169	USGS	Laguna Cr. near Elk Grove	1995 - 2018	8,336

C2VSimFG = California Central Valley Groundwater-Surface Water Simulation Fine Grid Model
JVID = Jackson Valley Irrigation District
USGS = United States Geological Survey
YGM = Yuba Groundwater Model
[1] There are two distinct streams named “Dry Creek” within the model domain: one in the North American Subbasin, and one in the Cosumnes Subbasin

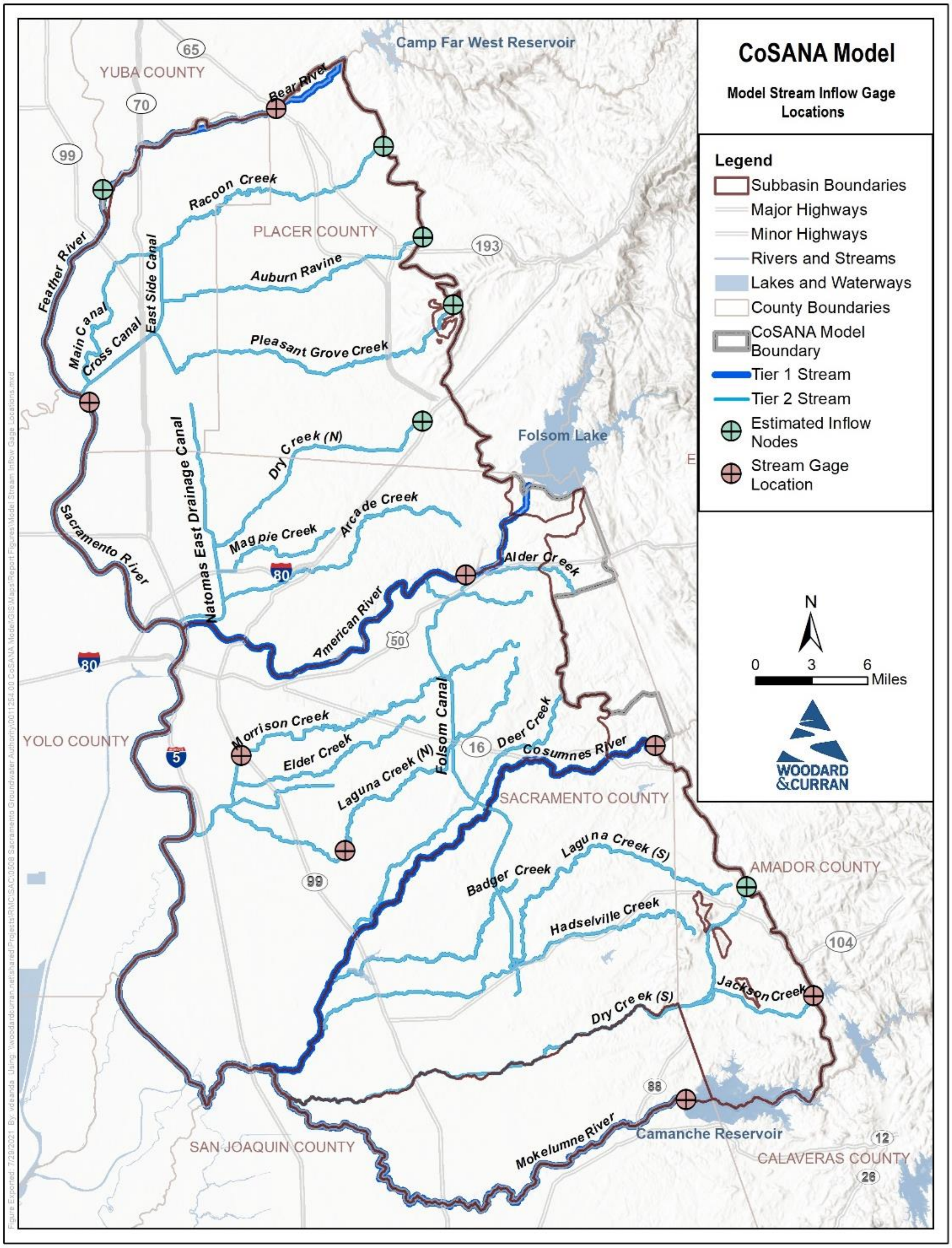


Figure 2-6: CoSANA Stream Inflow Gage Locations

2.5 Surface Drainage Pattern

Surface water drainage (e.g., runoff from rainfall and excess applied water) for each model element is assigned to a stream node representing where the drainage ultimately flows to. These drainage patterns were delineated using the USGS Watershed Boundary Dataset for 12-digit hydrologic units, also called subwatersheds. Each 12-digit hydrologic unit located within the model boundaries was associated with the model stream node it ultimately drained into through both visual analysis as well as information provided on the subwatersheds. Elements falling within the hydrologic units were assigned to the model stream node indicating the ultimate surface water drainage direction. Additional refinement was done along the Cosumnes River to simulate where agricultural return flow would return to the stream with more precision. A total of 62 unique stream nodes receive surface water drainage in CoSANA from 58 subwatersheds. Figure 2-7 shows these stream nodes and the subwatersheds mapped to the model elements.

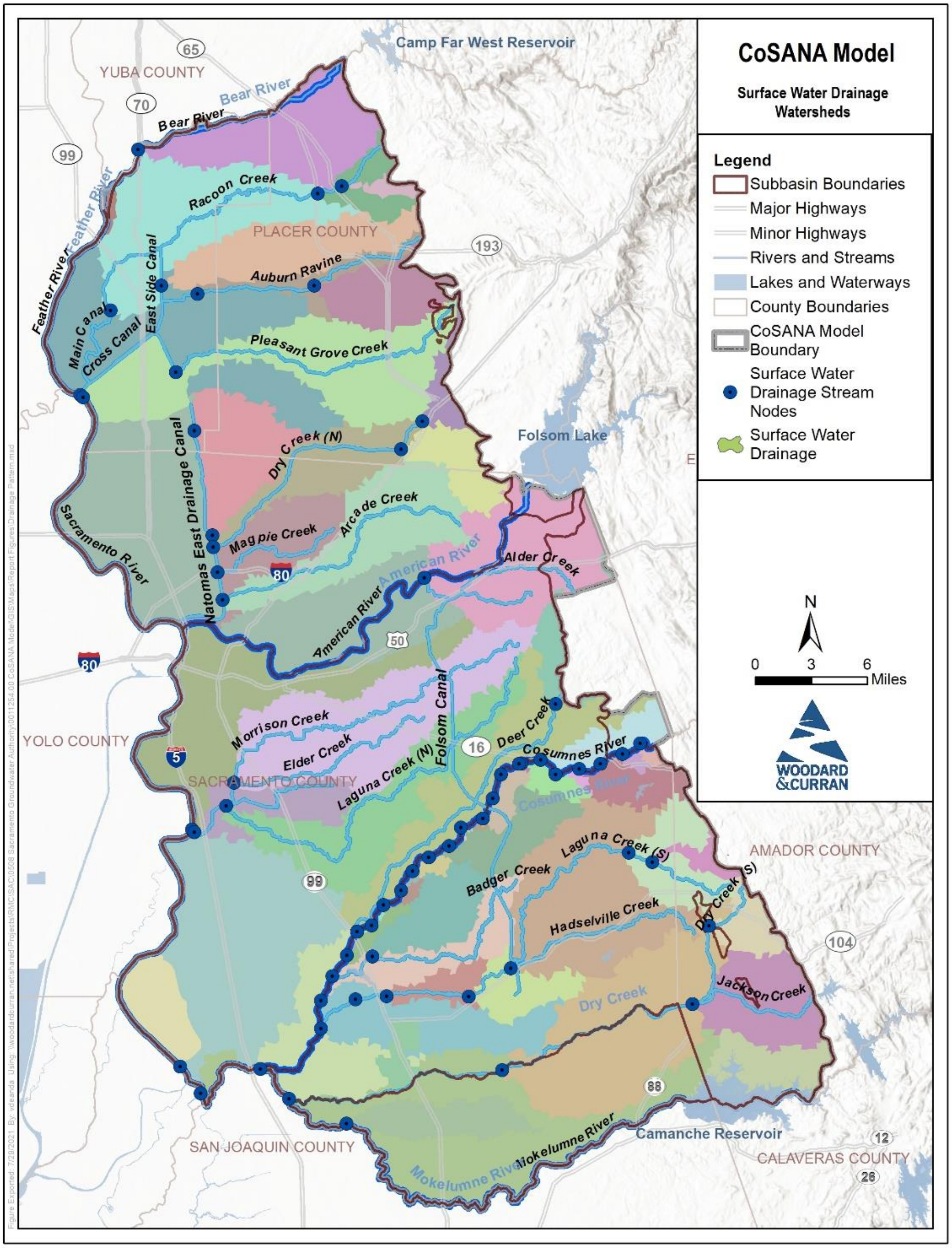


Figure 2-7: CoSANA Drainage Network

2.6 Precipitation

Rainfall data for the model area was derived from the PRISM (Precipitation-Elevation Regressions on Independent Slopes Model) database used in the DWR's CALSIMETAW (California Simulation of Evapotranspiration of Applied Water) model. The database contains daily precipitation data from October 1, 1921, to September 30, 2018, on an 800-meter grid throughout the model area. CoSANA has monthly rainfall data defined for every model element in order to preserve the spatial distribution of the monthly rainfall. Each of the model elements was mapped to the nearest PRISM reference node and the resulting average annual precipitation is shown in Figure 2-8.

Figure 2-9 shows the annual rainfall in the model area and the cumulative departure from mean, which is an indication of long-term rainfall trends in the area. For the 1995-2018 calibration period, the minimum precipitation was in 2007 with 11.0 inches, while the maximum occurred in 1998 with 34.4 inches, the average annual precipitation over this period was 20.1 inches. Based on the Sacramento Valley Water Year Index, there were 3 critical, 5 dry, 5 below normal, 3 above normal, and 8 wet years.

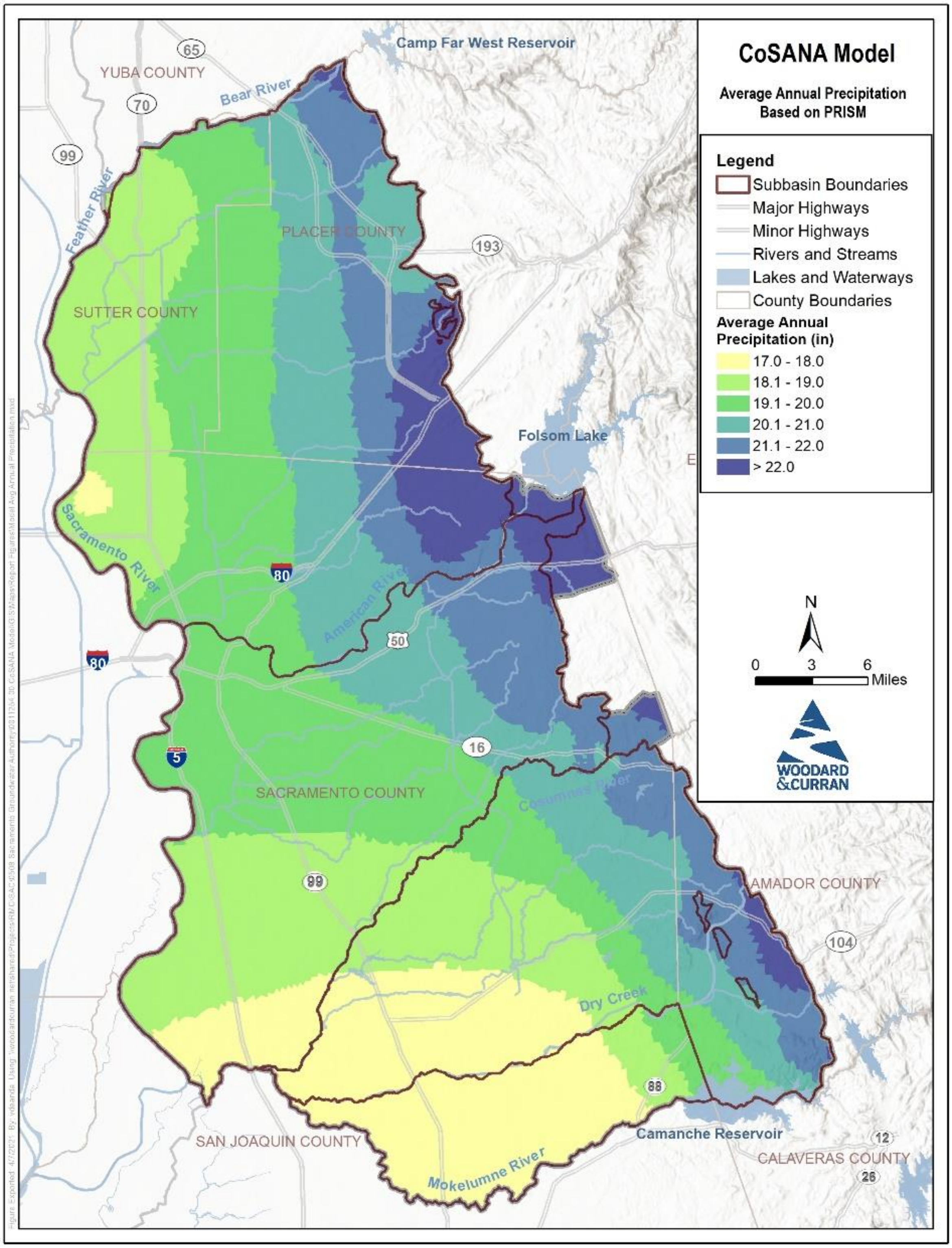


Figure 2-8: CoSANA Average Annual Precipitation

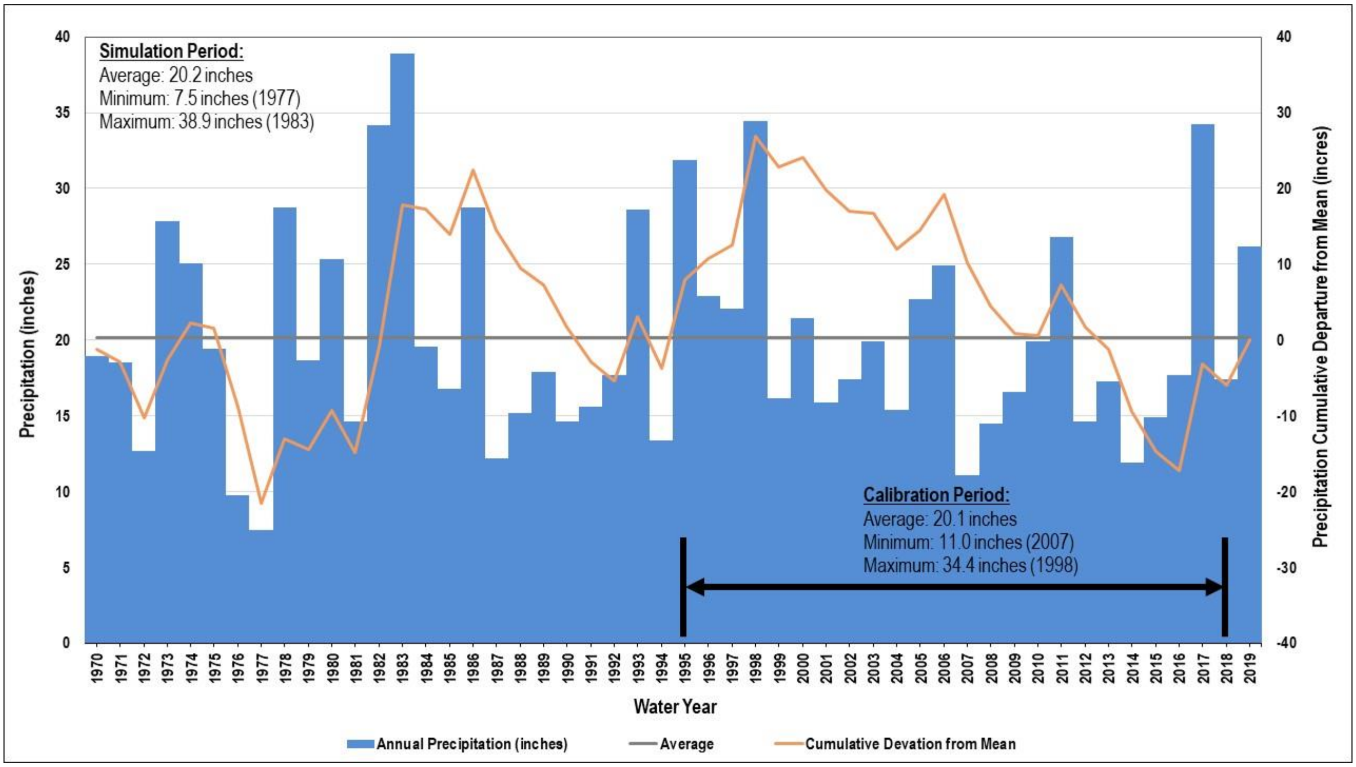


Figure 2-9: CoSANA Average Annual Precipitation with Statistics

2.7 Land Use and Cropping Patterns

Land use and cropping patterns are major data sets that drive the estimation of water demand for agricultural water use as well as rainfall runoff and deep percolation conditions throughout the model area. Land use surveys were used to map the agricultural crops into 4 general land use types and 20 irrigated crop categories, consistent with C2VSimFG, and as shown in Table 2-5. The digital land use surveys were mapped to each of the model elements, so as each model element contains all information to estimate the agricultural, native, and riparian water demand on a monthly time step. All irrigated crop categories except for rice are simulated as non-ponded crops, meaning they are grown without standing water. Rice is simulated as both no decomposition and flooded decomposition to represent the current understanding of local rice growing practices. Assumptions of rice decomposition practices were based on local information and estimated as proportion of rice acreage each year that underwent no decomposition or flooded decomposition. This information aligns with rice practices simulated in other models, including the Yuba Groundwater Model and C2VSimFG. Table 2-5 lists the land use categories. The crop categories are nearly identical to those in C2VSimFG, the only difference being CoSANA has one category of tomatoes, whereas C2VSimFG has two.

Table 2-5: Land Use Categories

Land Use Type	Model Category
Irrigated Crops	Grain
	Cotton
	Sugar Beets
	Corn
	Dry Beans
	Safflower
	Other Field Crops
	Alfalfa
	Pasture
	Tomato
	Cucurbits
	Onions & Garlic
	Potatoes
	Other Truck Crops
	Almonds & Pistachios
	Other Deciduous
	Citrus & Subtropical
	Vineyards
	Idle
	Rice
Other Land Use	Urban Landscape Water Surface Riparian Vegetation Native Vegetation

Spatial land use data were used to specify land use types and crop acreages for each model element for each year. The three major reference sources include DWR county land use surveys, DWR Statewide Crop Mapping, and CropScape. As crop categories were not consistent across all the land use data sources, individual mappings matched up each crop type to the appropriate model land use category. These data were available for different years for different counties. To approximate the land use across the entire model area, digital land use coverages were created from multiple datasets covering different years. These three snapshot years of land use coverage are assumed to represent conditions for 1995, 2005, and 2015 using data from a year close to that snapshot year (see Table 2-6). Linear interpolation was used represent land use for years between snapshot years. As no land use data for 2005 was available for Amador and San Joaquin Counties, land use in elements in those areas was linearly interpolated between 1995 and 2015.

Table 2-6: Sources of Data for Land Use Coverages

Data Source	Coverage Area	Year
1995 Land Use Coverage		
DWR Land Use Survey	Sutter County	1998
DWR Land Use Survey	Placer County	1994
DWR Land Use Survey	Sacramento County	1993
DWR Land Use Survey	San Joaquin County	1996
DWR Land Use Survey	Amador County	1997
2005 Land Use Coverage		
DWR Land Use Survey	Sutter County	2004
Local Information	Placer County	2009
DWR Land Use Survey	Sacramento County	2000
2015 Land Use Coverage		
DWR Statewide Crop Mapping	Sutter and Placer Counties (except for urban in Placer County)	2014
CropScape	Urban extent for Roseville-Lincoln	2015
DWR Land Use Survey	Sacramento County	2015
DWR Statewide Crop Mapping	San Joaquin and Amador Counties	2014

Land use development methodologies differed between DWR county land use surveys and DWR statewide crop mapping for 2014. Because the 2014 survey focused only on irrigated and urban areas, areas such as roads or strips between fields or buildings were assumed to be undeveloped or unirrigated land. This created issues in interpolation where longstanding rice fields would be shown as growing smaller and developed urban footprints were decreasing in acreage. In order to preserve the accuracy and refinement of the 2014 dataset, a reduction of 5% was applied to land use acreages developed from DWR county surveys assumed to represent 1995 and 2005. This 5% was estimated based on analysis of differences in estimated crop acreages for parcels known to be cultivated in both 1995 and 2015. Additionally, interpolation in dense urban areas was adjusted to have urban acreage remain the same or increase over time, to avoid erroneous reductions in urban land due to survey methodologies. Further refinement was also performed in the Elk Grove area to more accurately capture the timing of some of the large-scale agricultural-to-urban land use conversions in that area.

Refinement was also performed to capture drought-period fallowing. Growers indicated they fallowed fields in areas of Sutter and Placer Counties during 2014 in response to drought; these same fields were mostly returned to crops after the drought. The 2014 statewide survey categories for these idle plots were overwritten with 2016 and 2017 CropScape data to better reflect the total crop acreage in Sutter and Placer Counties for interpolation purposes. The idled acreage was added back in for the year 2014 after interpolation between the compositive areas was performed.

Figure 2-10, Figure 2-11, and Figure 2-12 show the spatial distribution of the land use coverages for CoSANA for 1995, 2005, and 2015. Figure 2-13 through Figure 2-16 show the annual cropping patterns for the entire CoSANA and individual subbasins.

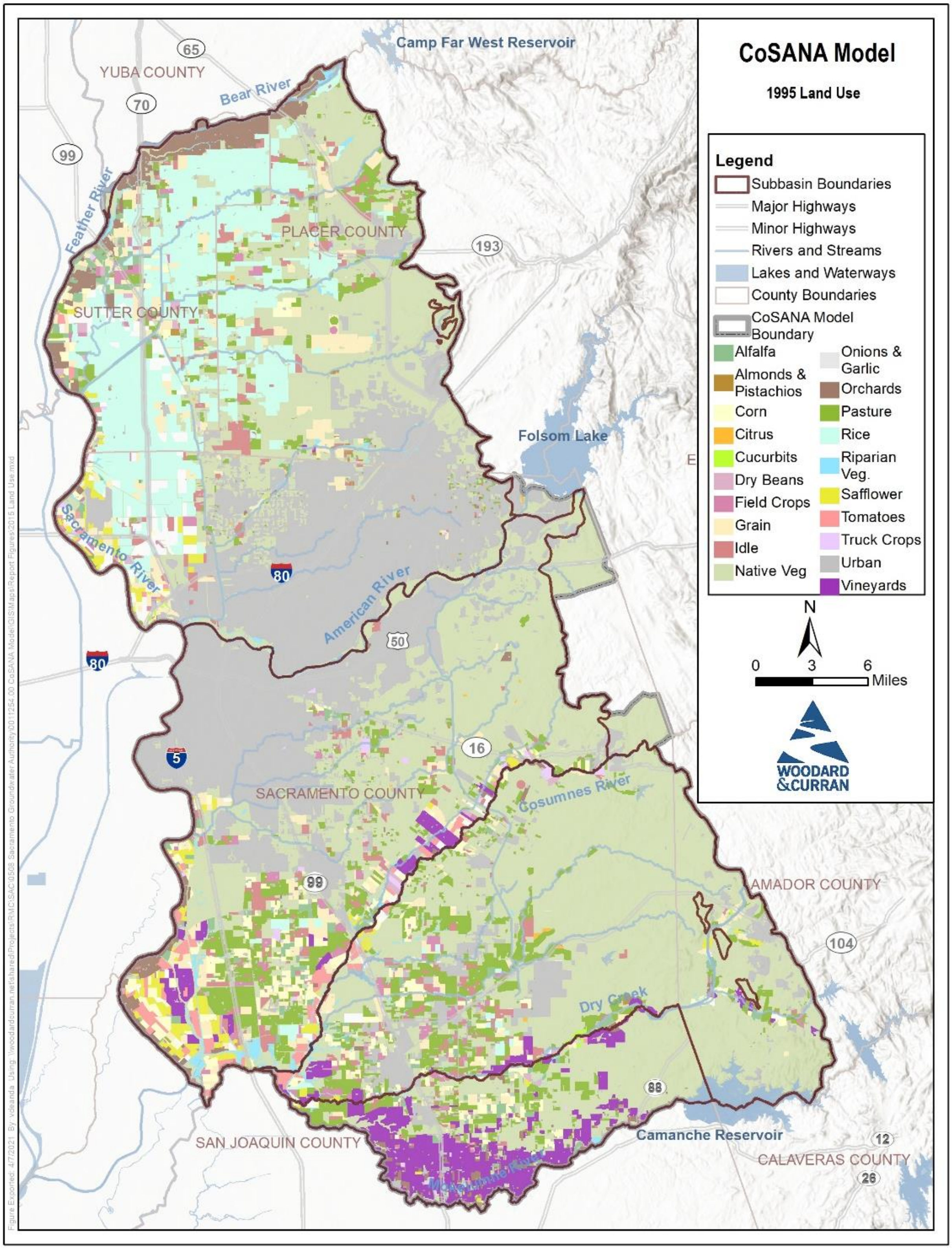


Figure 2-10: 1995 Land Use Coverage

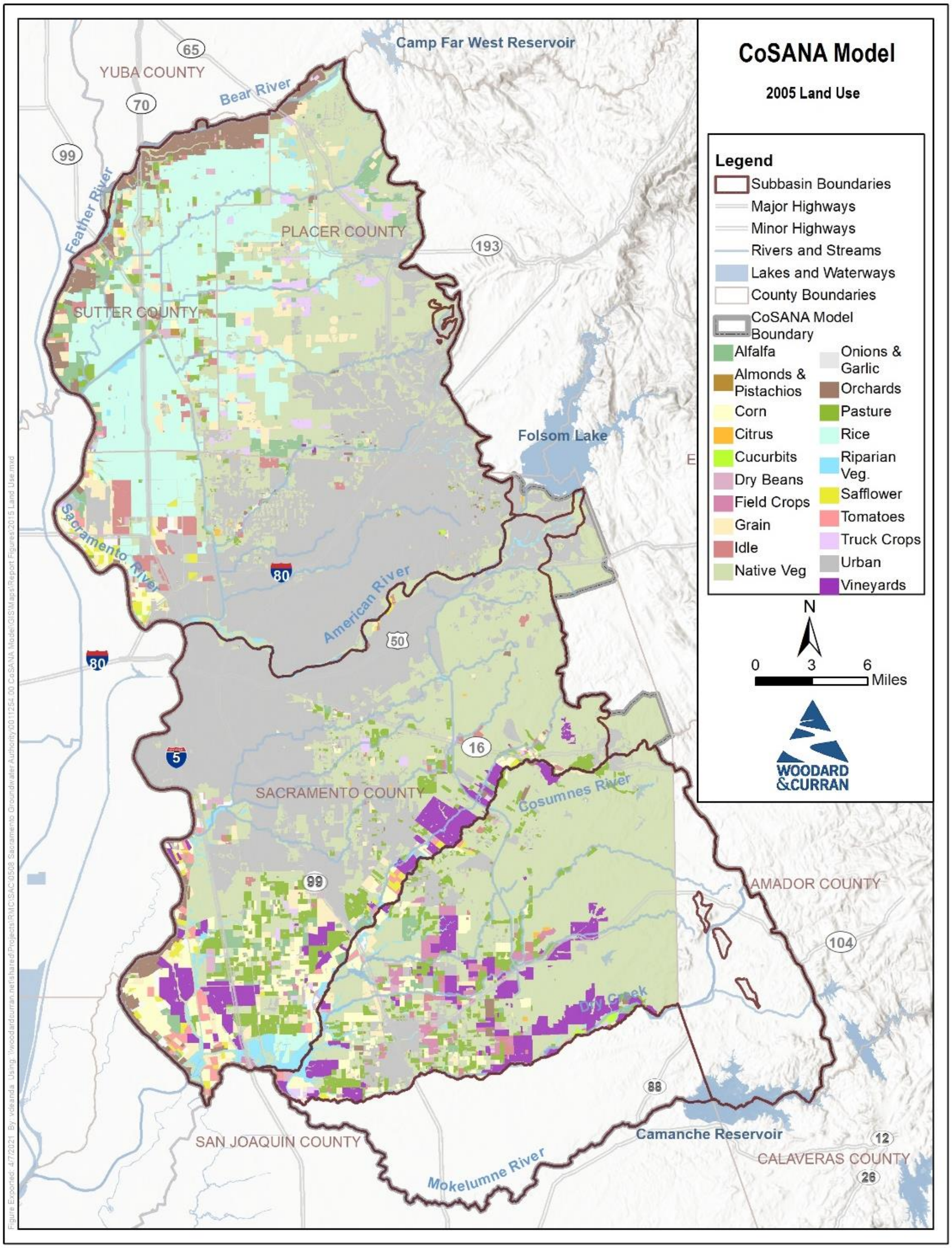


Figure 2-11: 2005 Land Use Coverage

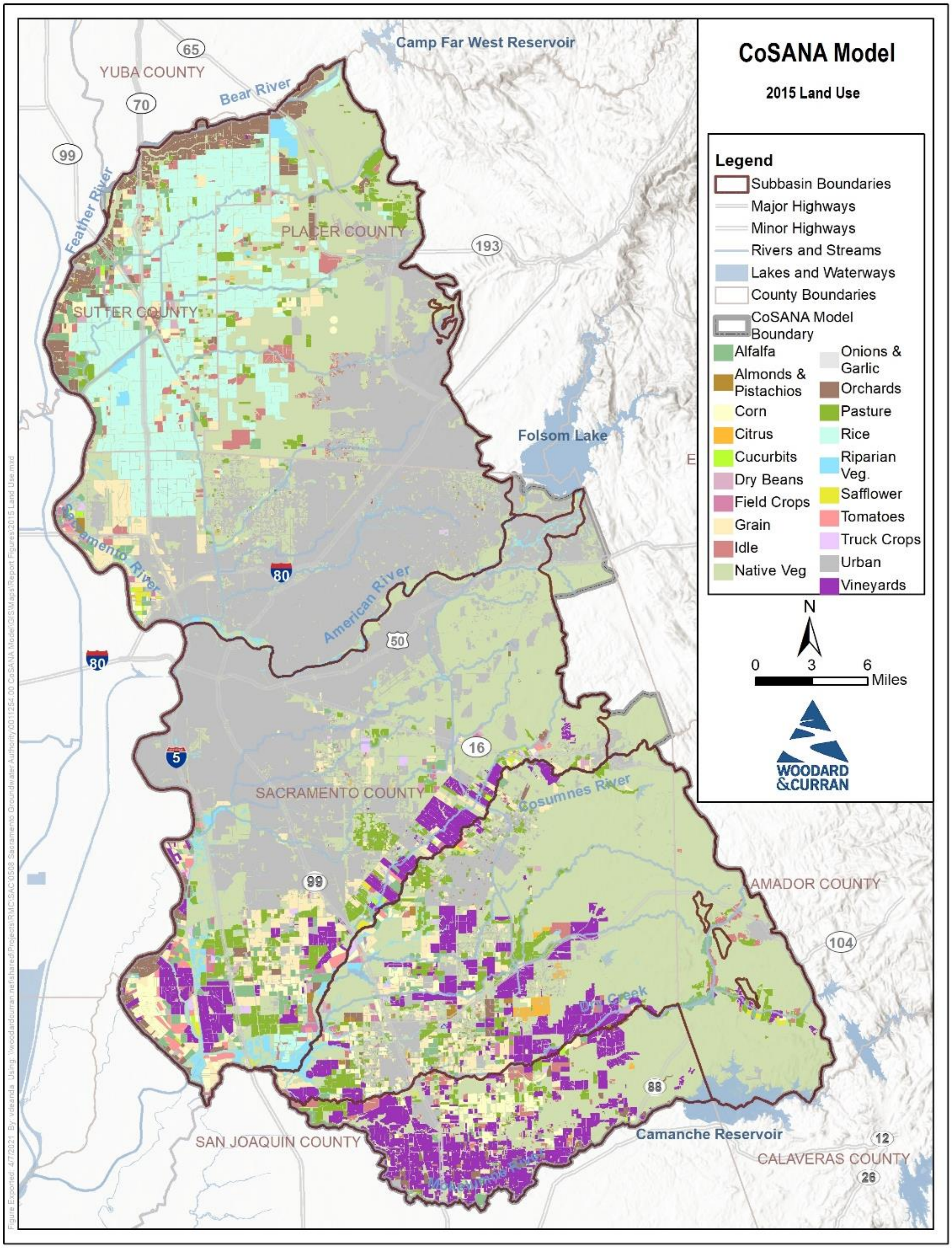


Figure 2-12: 2015 Land Use Coverage

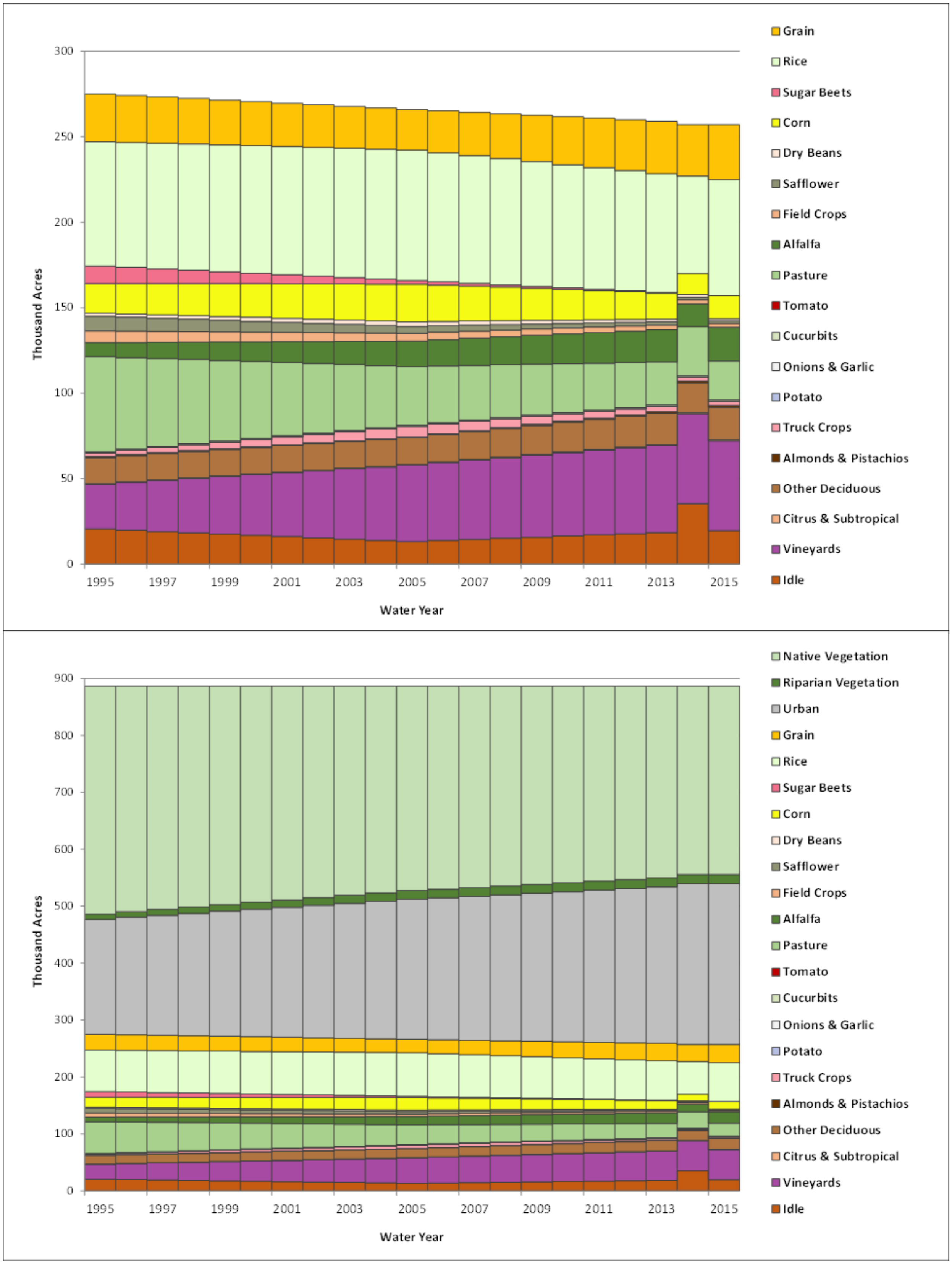


Figure 2-13: Annual Land Use for CoSANA

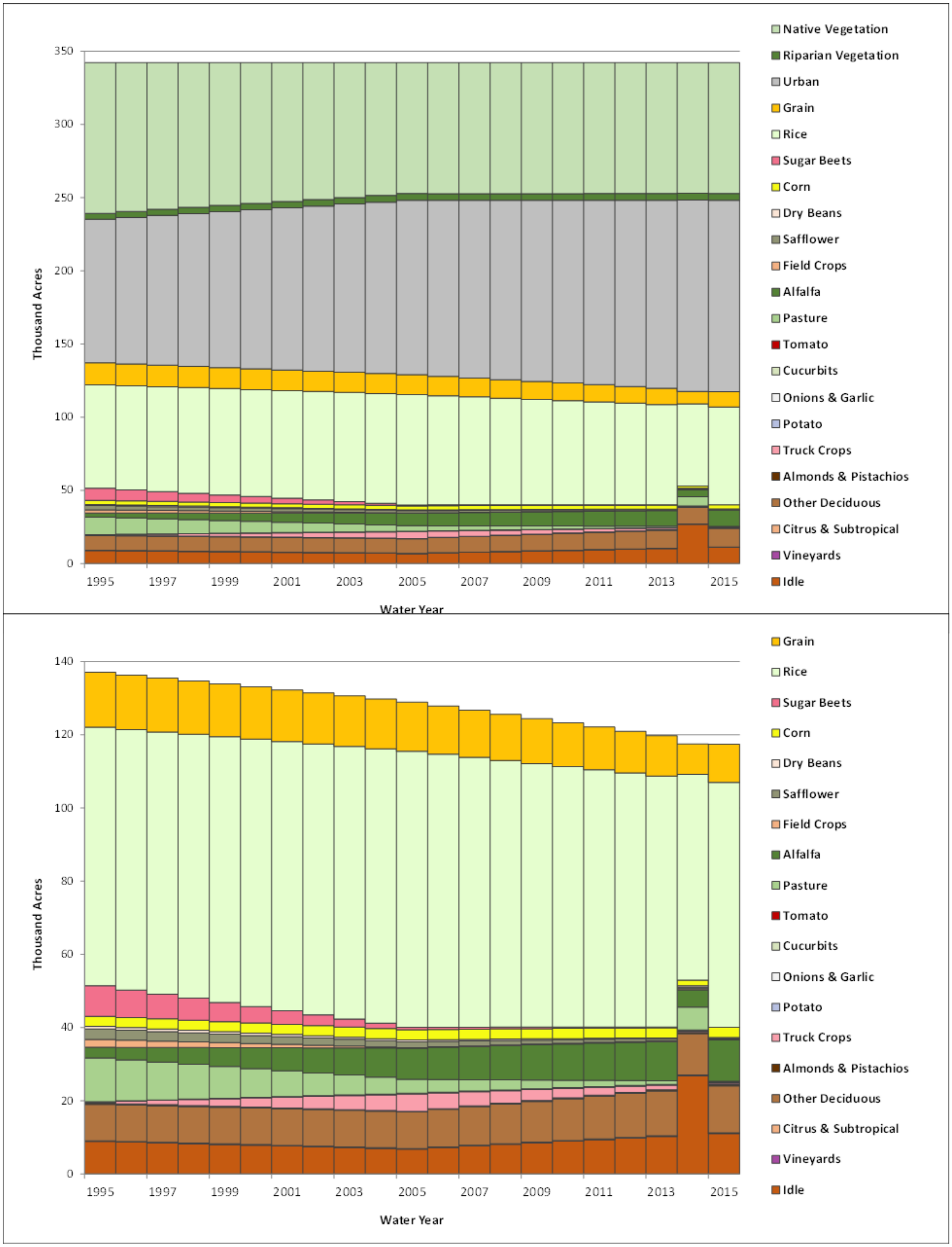


Figure 2-14: Annual Land Use for North American Subbasin

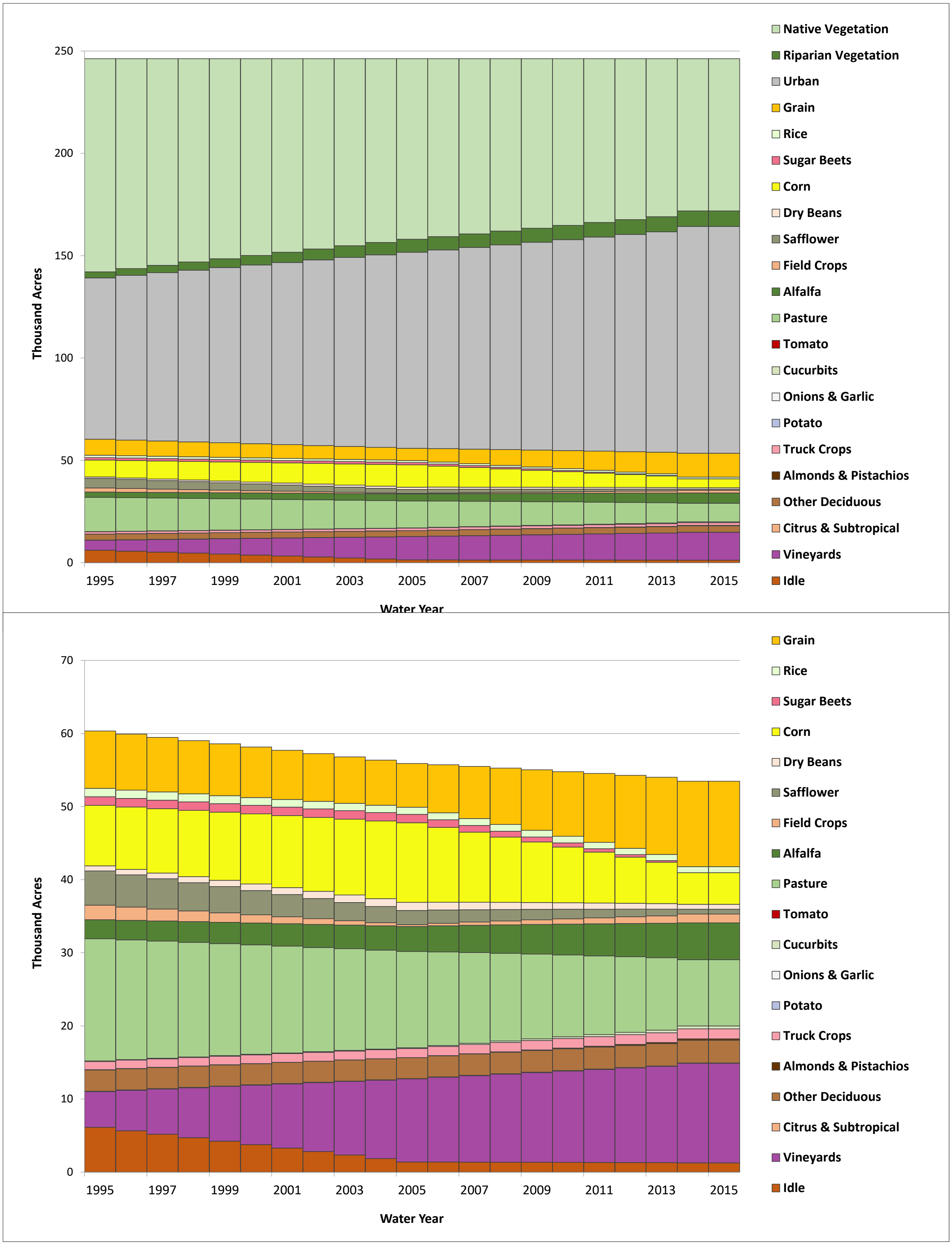


Figure 2-15: Annual Land Use for South American Subbasin

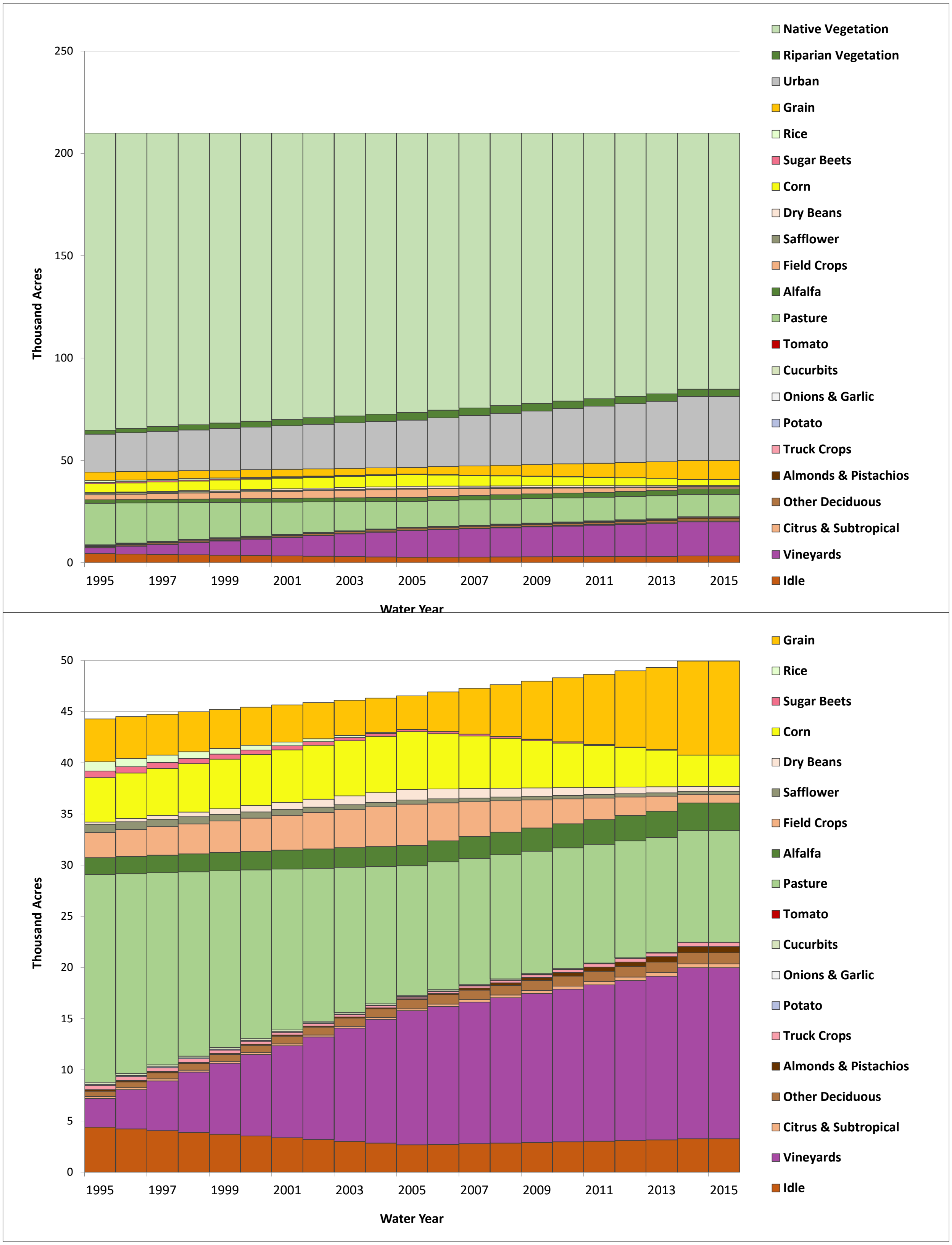


Figure 2-16: Annual Land Use for Cosumnes Subbasin

Land use trends in the North American Subbasin for 1995 through 2015 show decreases in total and irrigated agricultural acreage, with about 137,900 irrigated acres in 1995 and about 117,700 acres in 2015. During this same period, urban area increases from about 98,000 acres to about 130,800 acres. The increased urban area is due to both conversion of agricultural lands to urban areas, as well as conversion of native vegetation areas to urban. Most of the urban growth occurs in the Placer County area of the subbasin. In terms of irrigated acreages, decreases are observed in grain, rice, sugar beets, safflower, other field crops, and alfalfa/pasture. These decreases are due to urbanization and grower crop choices. The only irrigated crop showing substantial increases in acreage are orchards.

Land use trends in the South American Subbasin for 1995 through 2015 show decreases in total and irrigated agricultural acreage, with about 65,000 irrigated acres in 1995 and about 55,800 acres in 2015. During this same period, urban area increases from about 78,800 acres to about 110,800 acres. Increased urban area is due to both conversion of agricultural lands to urban areas, as well as conversion of native vegetation areas to urban. Most urban growth is observed to occur in the Elk Grove and Rancho Cordova areas. In terms of irrigated acreage, decreases are observed in corn, safflower, alfalfa/pasture, and tomatoes. These decreases are due to urbanization and grower crop choices. The largest increases in agricultural acreage are seen with the growth of grain and vineyards.

Land use trends in the Cosumnes Subbasin for 1995 through 2015 show increases in total and irrigated agricultural acreage, with about 45,200 irrigated acres in 1995 and about 50,200 acres in 2015. During this same period, urban area increases from about 18,500 acres to about 31,300 acres. Both urban and agricultural growth occur largely as a result of conversion of native vegetation areas. The majority of urban growth occurs as rural residential development in the Wilton area. In terms of irrigated acreage, decreases are observed in field crops (sugar beets, corn, safflower, and other field crops), and alfalfa/pasture. These decreases are due to urbanization and grower crop choices. Increases are observed in grain and permanent crops such as orchards and vineyards.

2.8 Evapotranspiration

Evapotranspiration (ET) is an important factor in demand estimation for crops and native vegetation. Every CoSANA land use type and crop category, as well as the small-stream watersheds, are assigned monthly values for the entire simulation period, which provides the monthly and annual hydrologic variability in ET estimates for the period of simulation.

The starting ET values through September 2015 were derived from C2VSimFG values for the C2VSimFG Subregion 7, which represents the NASb and was chosen as being most representative of the agricultural practices of the greater Sacramento region as modeled in CoSANA. Additional modifications were made during model calibration to the rice ET based on local information. Also, grain, vineyards, field crops, and safflower ET was updated using typical year monthly crop evapotranspiration information developed by the Irrigation Training and Research Center (ITRC) at California Polytechnic State University, San Luis Obispo by DWR's CIMIS (California Irrigation Management Information System) Zone. CIMIS zones represent areas with similar long-term average reference ET (ET_o) values, there are in total 18 zones to represent ET variability across California (https://cimis.water.ca.gov/App_Themes/images/ etozonemap.jpg). CoSANA uses average data for both Zone 12 and Zone 14.

To extend this data to 2018, ET_o data were downloaded for CIMIS station 131 (Fair Oaks). Monthly crop coefficient (ET_c) data for the extended period were estimated using the ratio of ET_o between annual data and the 2015 data.

Of 20 agricultural land uses in CoSANA, 7 crop types account for nearly 95% of irrigated cropland (for the 2015 land use survey). The monthly ET requirements of these crops are shown in Figure 2-17, Figure 2-18, and Figure 2-19, as well as for urban, riparian vegetation, and native vegetation land use types. Annual ET demands for the major land use types are 19.0 inches/year for grain, 29.7 inches/year for corn, 47.6 inches/year for alfalfa, 49.8 inches/year for pasture, 45.6 inches/year for orchards, 30.4 inches/year for vineyards, 32.3 inches/year for rice, 42.9 inches/year for urban, 18.2 inches/year for native vegetation, and 63.4 inches/year for riparian vegetation.

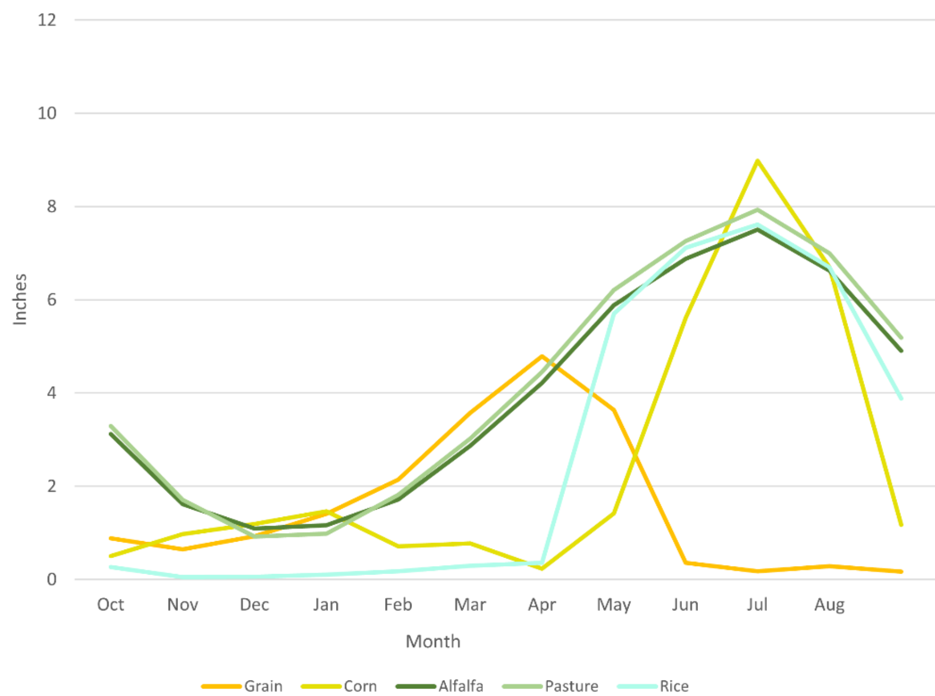


Figure 2-17: Average Monthly Evapotranspiration by Land Use Type, Major Field and Row Crops

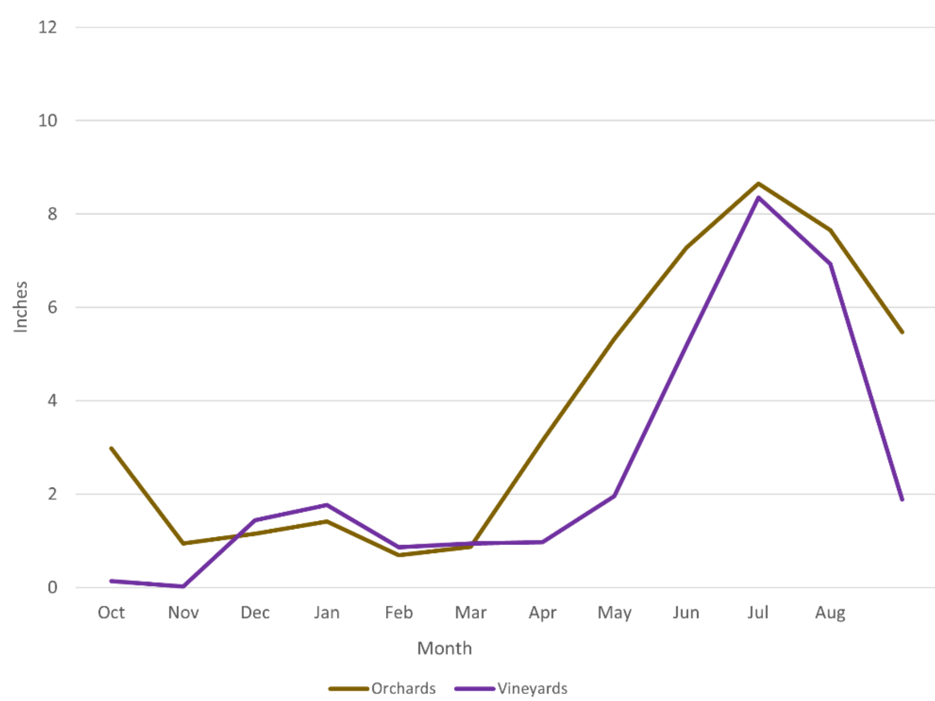


Figure 2-18: Average Monthly Evapotranspiration by Land Use Type, Orchards and Vineyards

Figure 2-19: Average Monthly Evapotranspiration by Land Use Type, Urban, Native, and Riparian

2.9 Root Zone Soil Parameters

The soil properties specified in CoSANA are field capacity, wilting point, total porosity, saturated hydraulic conductivity, and pore size distribution index. The soil properties are used to calculate rainfall runoff and infiltration through the soil zone for each model element. Data from C2VSimFG was used to populate the five soil properties for each model element. The soil parameters were modified during the calibration process; the final soil parameter values and their spatial distributions are discussed and shown in figures in Section 0.

Model elements are also associated with the four hydrologic soil groups according to their runoff potential and infiltration characteristics. CoSANA elements with their corresponding hydrologic soil group are shown in Figure 2-20. The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS; USDA NRCS, 2007) defines these hydrological soil groups as follows:

- Soils in Group A have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam, or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
- Soils in Group B have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

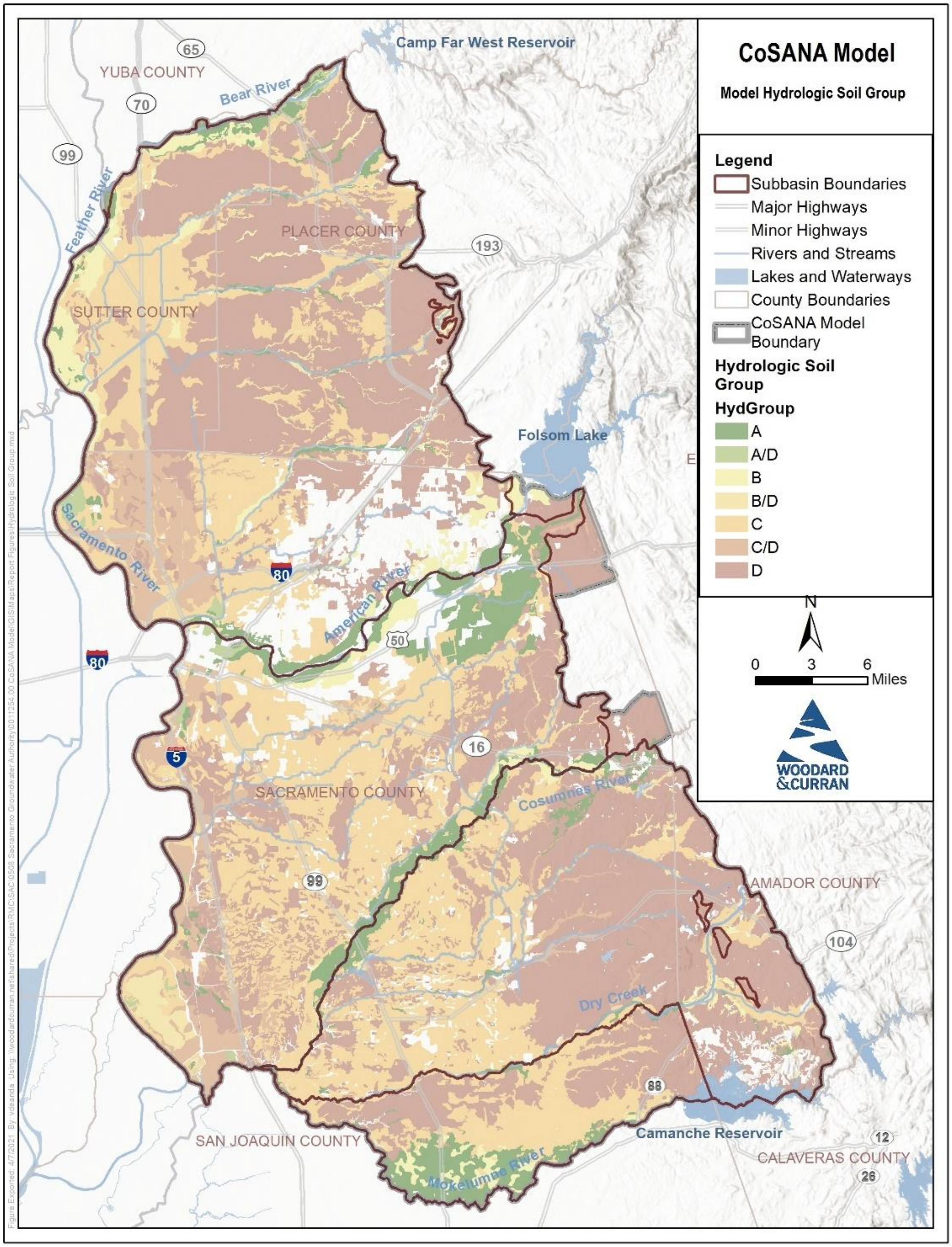


Figure 2-20: USDA Hydrologic Soil Groups

- Soils in Group C have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
- Soils in Group D have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential.

2.10 Geologic Structure and Model Layering

The following section highlights development and refinement of CoSANA stratigraphy.

2.10.1 Model Layer Development and Approach

Layering for a groundwater model is guided by many factors, several of which are described as follows:

- Hydrostratigraphy of the study area. The thickness and extent of model layers and the overall extent and depth of the model was developed based on available geologic and hydrogeologic reports, including available maps and cross-sections, to reflect the physical system being simulated. Information from neighboring subbasins was also considered for consistency with the modeling efforts in those areas.
- Stream-aquifer interaction. CoSANA will support the investigation of stream-aquifer interaction in the modeled subbasins, notably for the American, Sacramento, and Cosumnes Rivers. This requires a realistic and accurate representation of the aquifer, pumping volumes, and pumping locations and a grid that is discretized sufficiently fine horizontally and vertically. Representing the recent alluvium and Riverbank Formation as a separate layer provided a finer vertical discretization underneath and around the streams.
- Available information on screen/perforation depths for monitoring and production wells. If available, information on the vertical distribution of pumping is used to layer the model such that it corresponds to the depths at which those stresses occur. At present, there is limited information on the vertical distribution of well screens and perforations in the study area, particularly for private agricultural and domestic wells. Furthermore, many wells in the area were constructed with long sections of perforation or open boring, making it difficult to determine the elevations of greatest groundwater production.
- Importance of vertical gradients and the availability of vertically distributed head data. There are several multi-completion monitoring wells installed in the study area. At the most there are only five completions in an individual well cluster. Vertical discretization beyond that level would require estimation of parameters that control vertical movement of water (e.g., vertical hydraulic conductivity) that could not be evaluated by comparison of simulated and observed data.
- Model run time. All other considerations being equal, model run times will increase with the number of layers that are used. Run time was identified as an important consideration early in the planning process for CoSANA due to the benefits seen from faster model run time for SacIWRM. The ability to perform many model runs quickly is a desired outcome in the model development, particularly when iterative modeling scenarios are performed.

The selection of the number of layers and their elevations requires balancing these factors and the overall objectives of the project.

2.10.2 Model Layer Definition

The subsurface is characterized in CoSANA by five model layers representing the different geology from the ground surface to the shallower of bedrock or the base of fresh water. The ground surface elevation, the upper boundary of the topmost layer, is based on the USGS DEM at a resolution of 30 meters. Descriptions of each of the model layers are listed below, from top to bottom. DWR's Bulletin 118-3 (1974) and data from the Western Placer County Groundwater Management Plan (Roseville, City of, et al., 2007) provided cross sections that were used to support development of all layers, while surficial geology maps (California Geological Survey 2009, 2011) were used primarily to support the extent of layers at the surface. Figures 23-27 show the extent and thickness of each model layer as described below.

- Layer 1 represents the recent alluvium and Riverbank Formation. Layer 1 is up to 188 feet thick and is generally constrained to be at least 30 feet thick. This layer was developed using California Geological Survey (2009; 2011), DWR's Bulletin 118-3 (1974), and data from the Western Placer County Groundwater Management Plan (Roseville, City of, et al., 2007) (Figure 2-21).
- Layer 2 corresponds to the Laguna Formation. Layer 2 is up to 502 feet thick and is generally constrained to be at least 50 feet thick (Figure 2-22).
- Layer 3 corresponds to the Mehrten Formation. Layer 3 is up to 1,487 feet thick and is generally constrained to be at least 50 feet thick (Figure 2-23).
- Layer 4 corresponds to the Valley Springs Formation. Layer 4 is up to 824 feet thick and is generally constrained to be at least 50 feet thick (Figure 2-24). The bottom of the Valley Springs Formation was supported by the work of Page (1974) in addition to the sources described earlier.
- Layer 5 corresponds to the portion of the Ione Formation that is above the base of fresh groundwater. Base of fresh water is defined based on Berkstresser (1973) and represents the depth where electrical conductivity is approximately 3,000 microsiemens per centimeter. Very few borings penetrate far below the base of freshwater, and it is expected that very little pumping occurs from this depth. Layer 5 is up to 795 feet thick and is generally constrained to be at least 50 feet thick (Figure 2-25).

A set of cross-sections were developed to show model stratigraphy in various locations and are presented as an overview map and 12 cross sections in Figure 2-26 through Figure 2-38.

Within each model layer, CoSANA aquifer parameters were estimated based on the texture dataset of the Sacramento Valley (DWR, 2018a). Aquifer parameters assigned to pilot point locations covering the model domain were distributed to model nodes using the sediment-based texture information to provide the spatial variability of parameters.

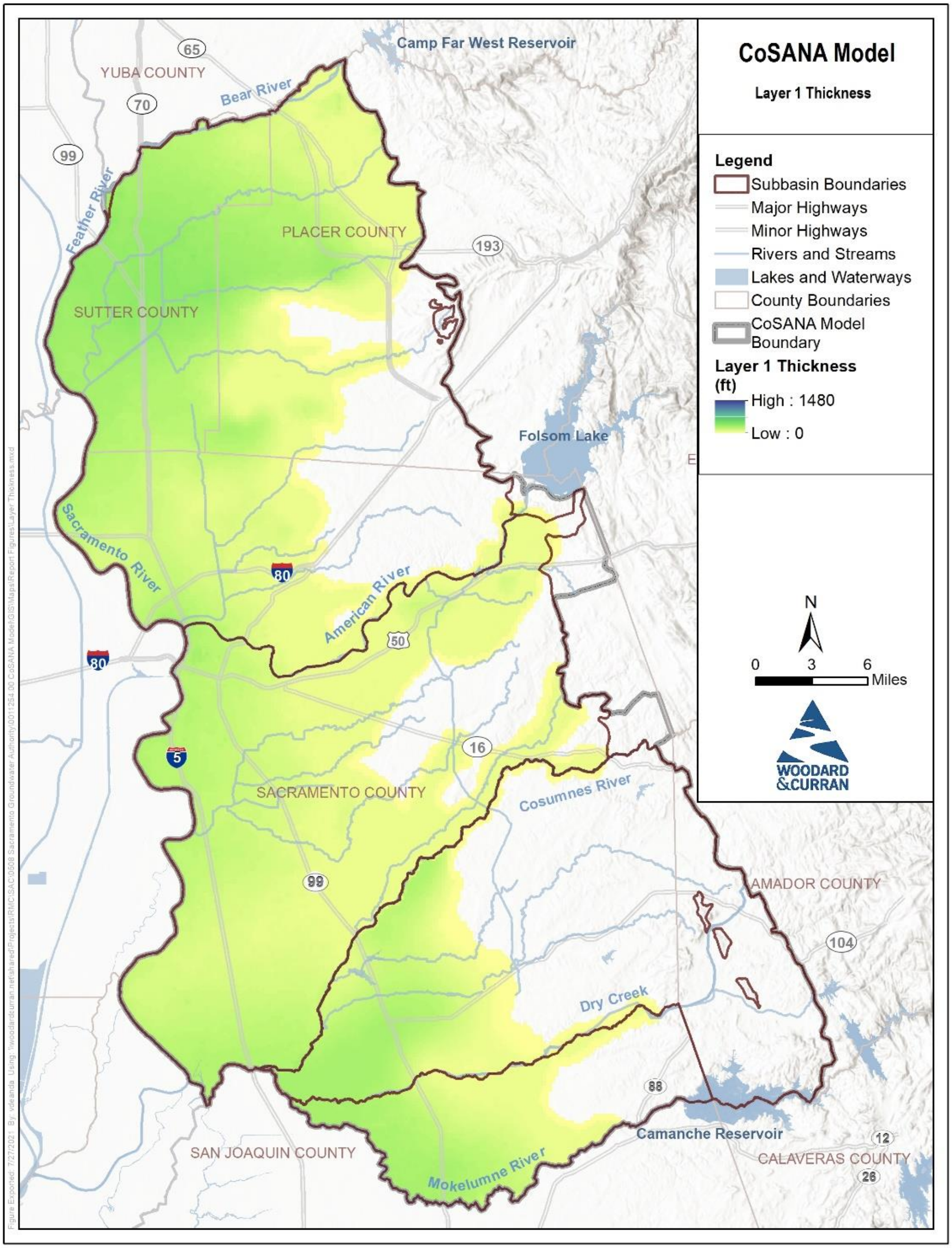


Figure 2-21: Thickness of Layer 1

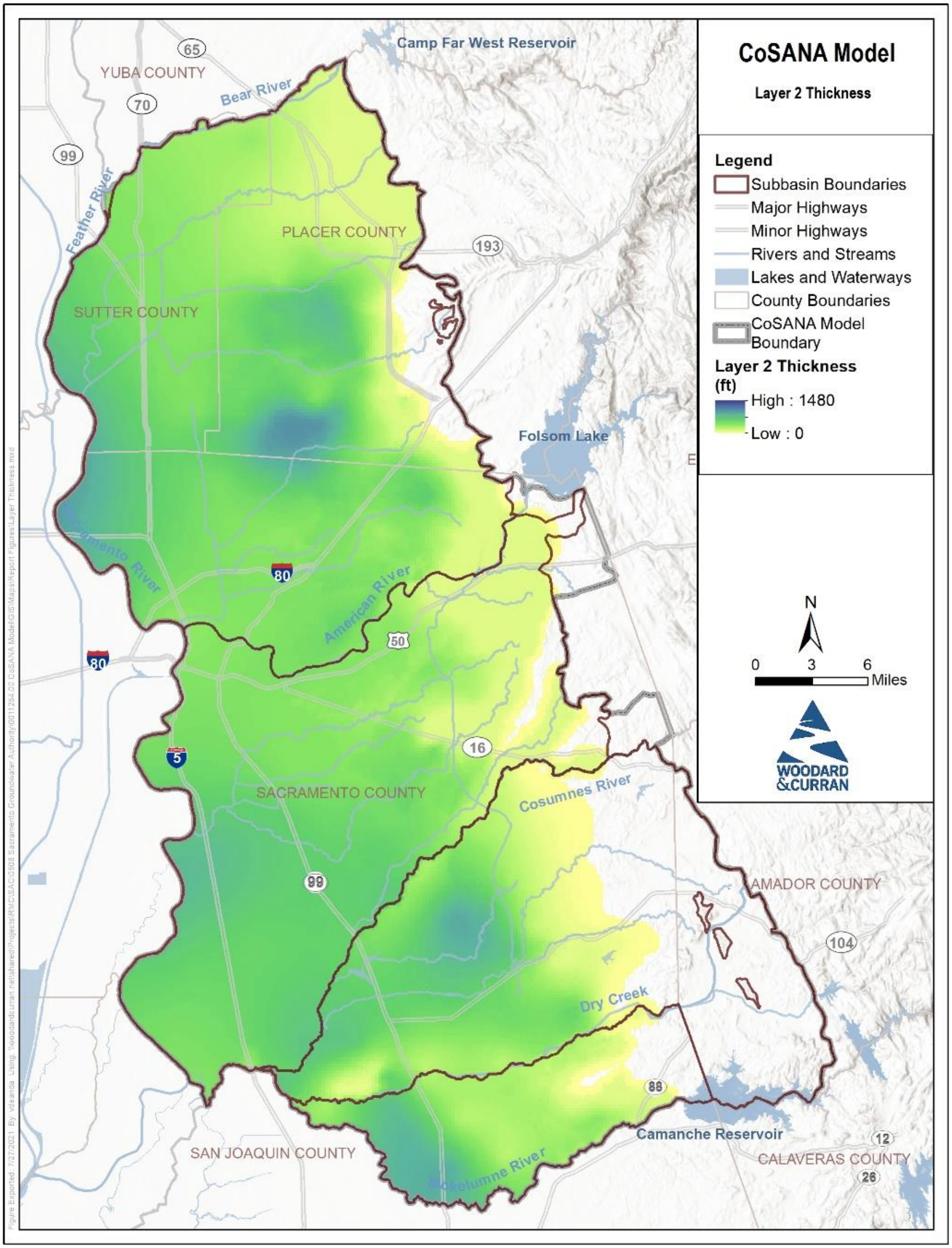


Figure 2-22: Thickness of Layer 2

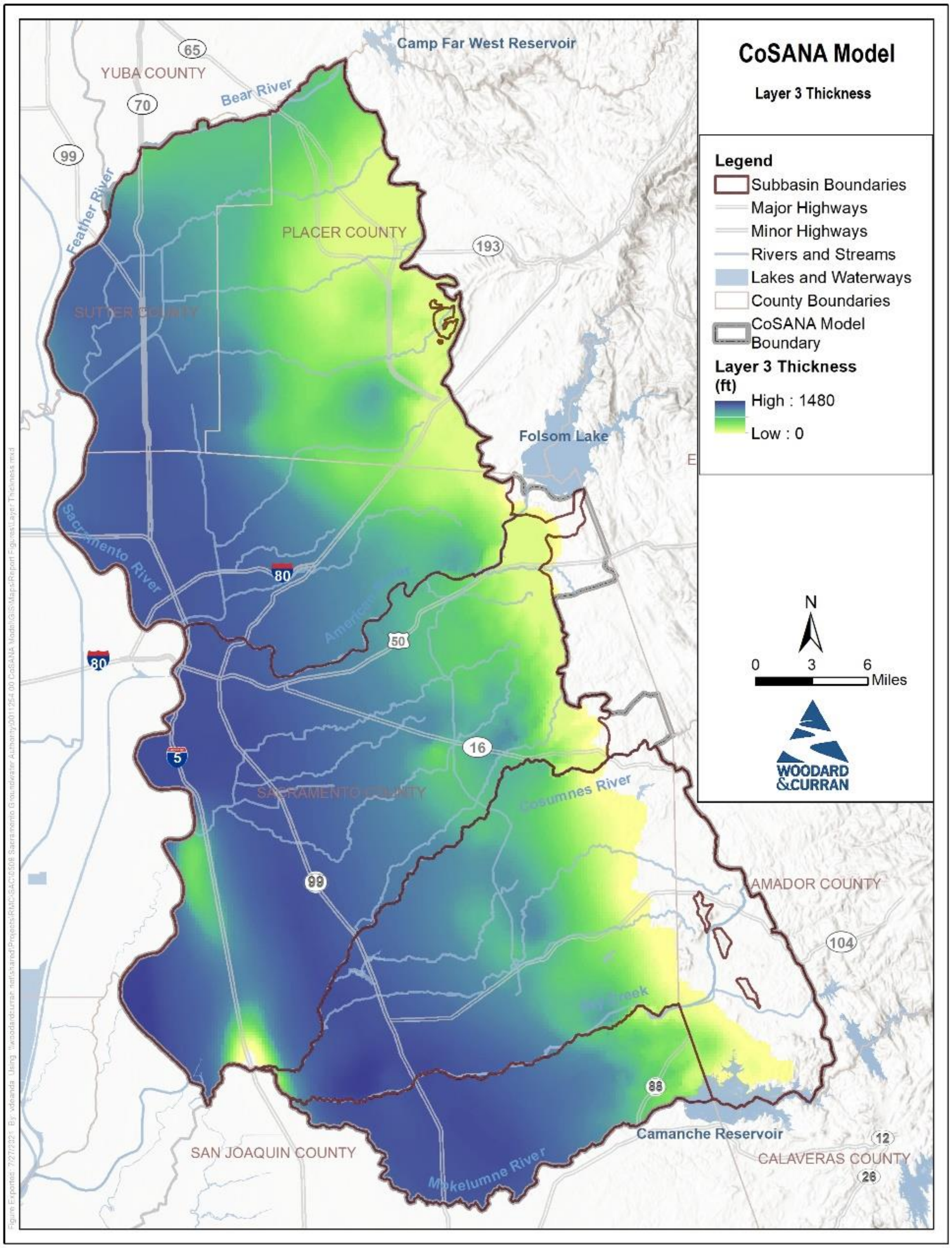


Figure 2-23: Thickness of Layer 3

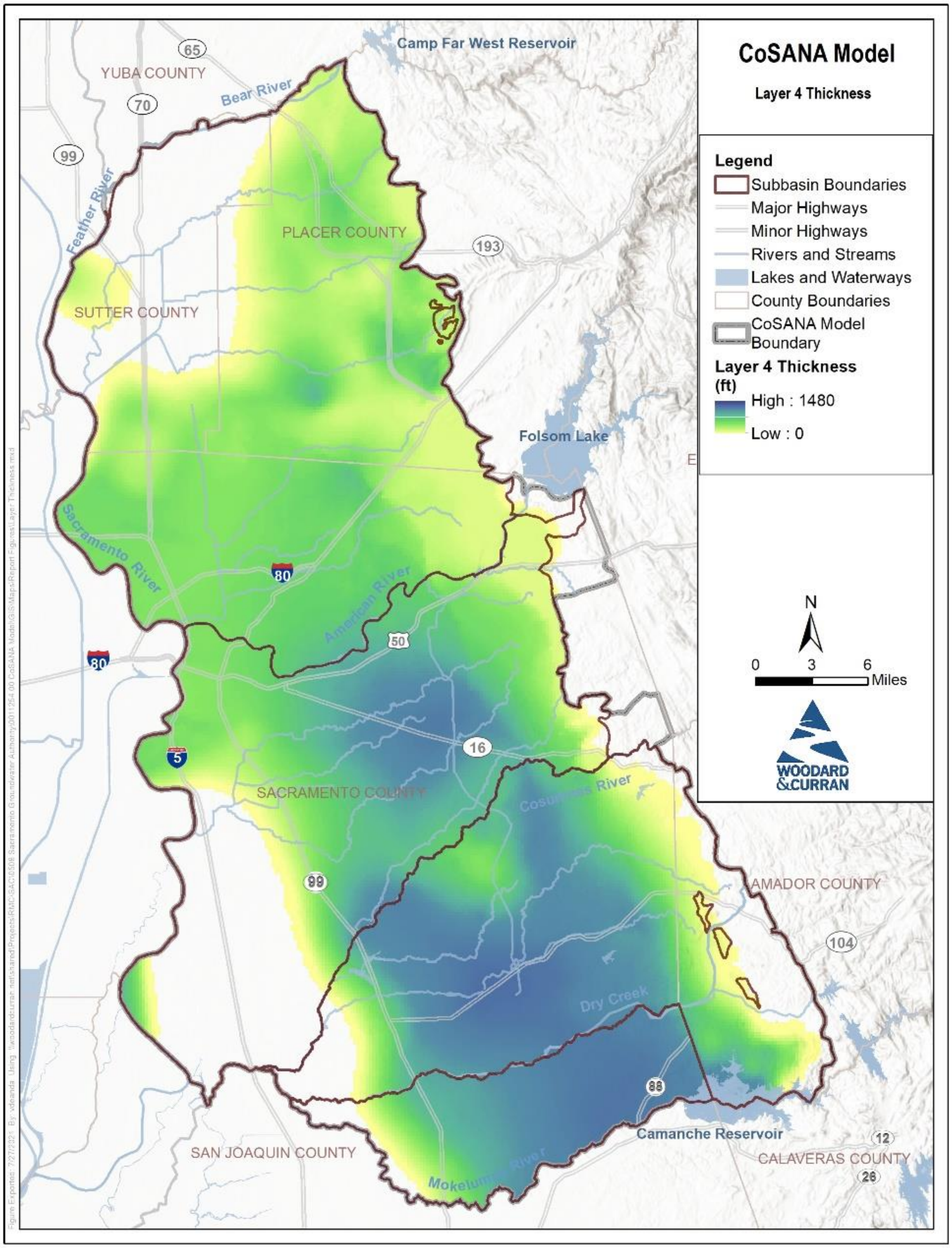


Figure 2-24: Thickness of Layer 4

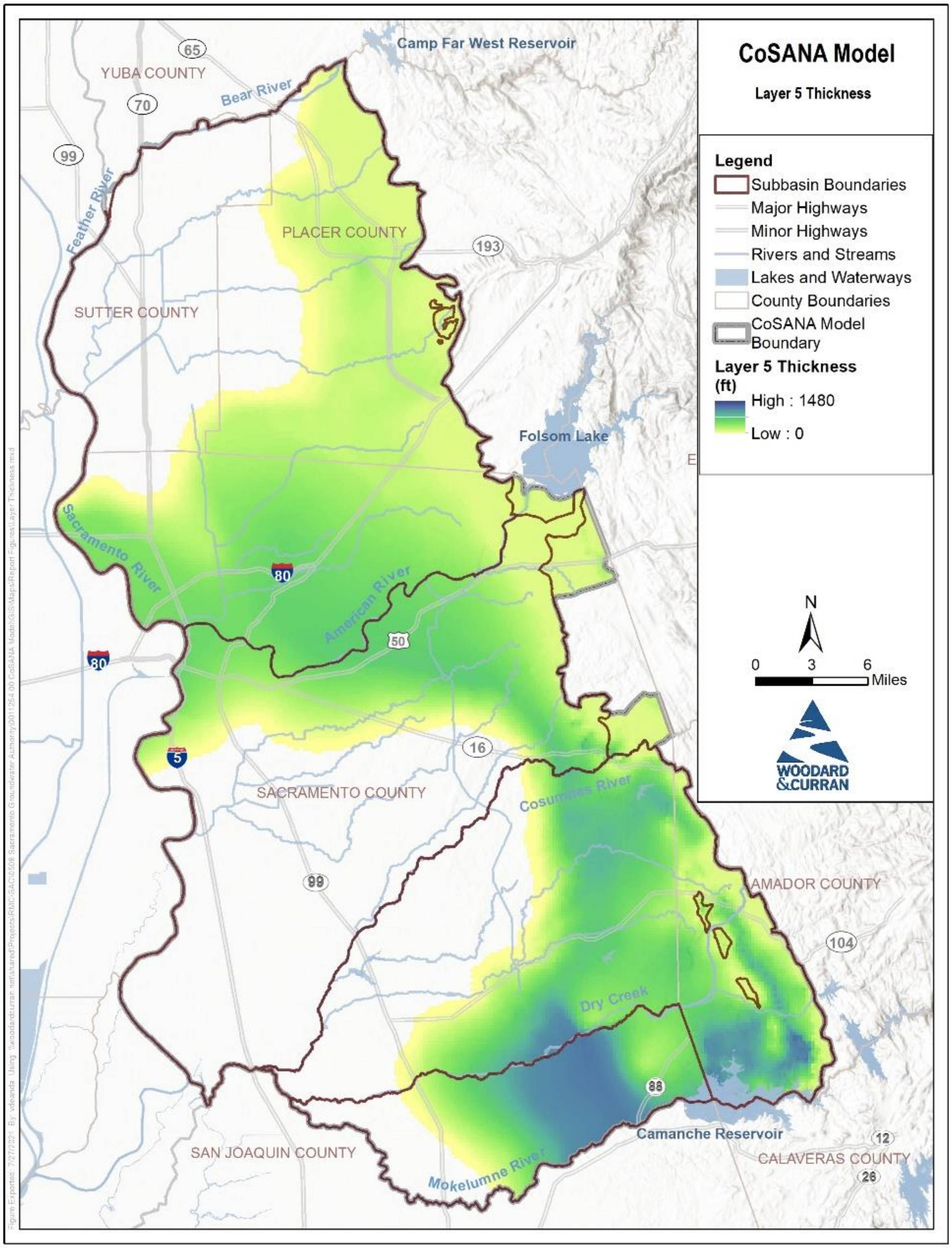


Figure 2-25: Thickness of Layer 5

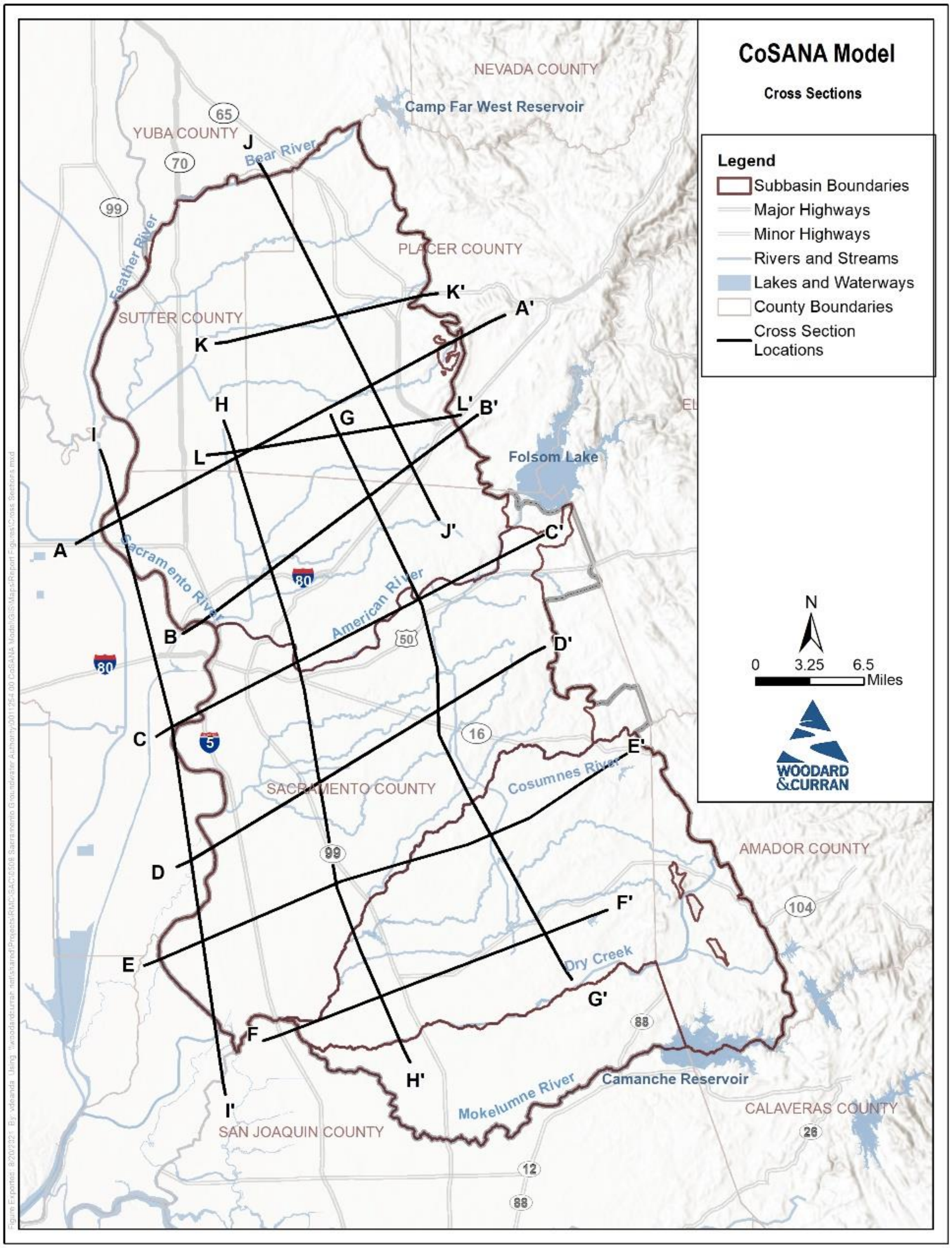


Figure 2-26: CoSANA Cross Sections

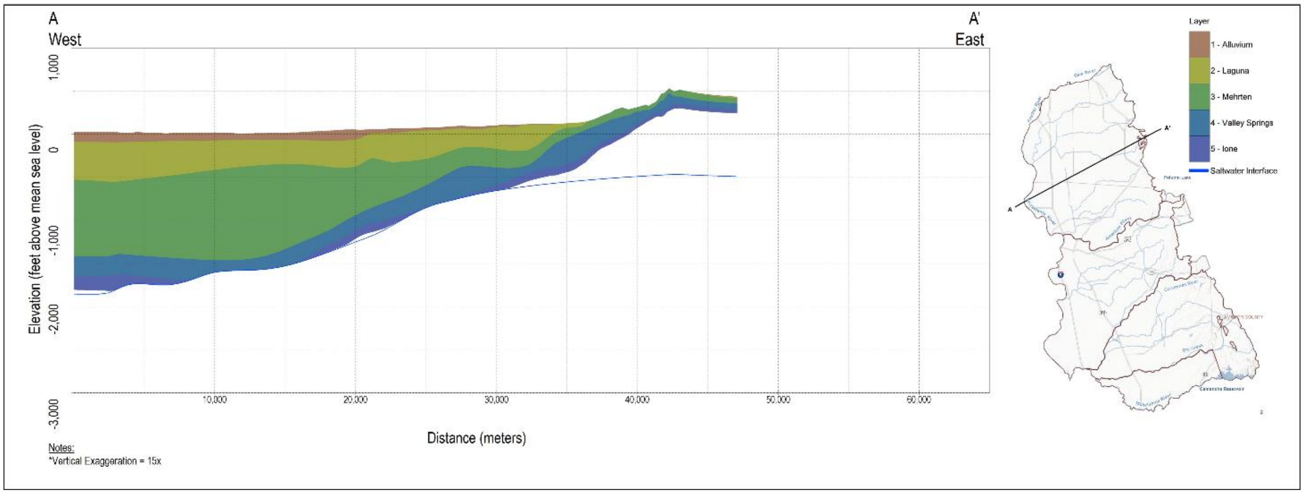


Figure 2-27: CoSANA Cross Section A-A'

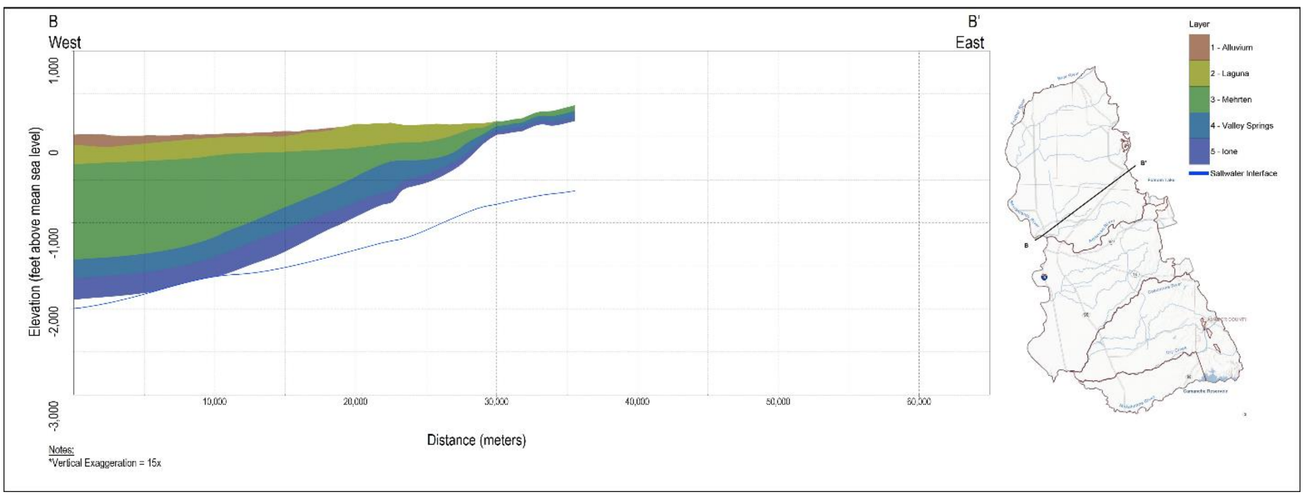


Figure 2-28: CoSANA Cross Section B-B'

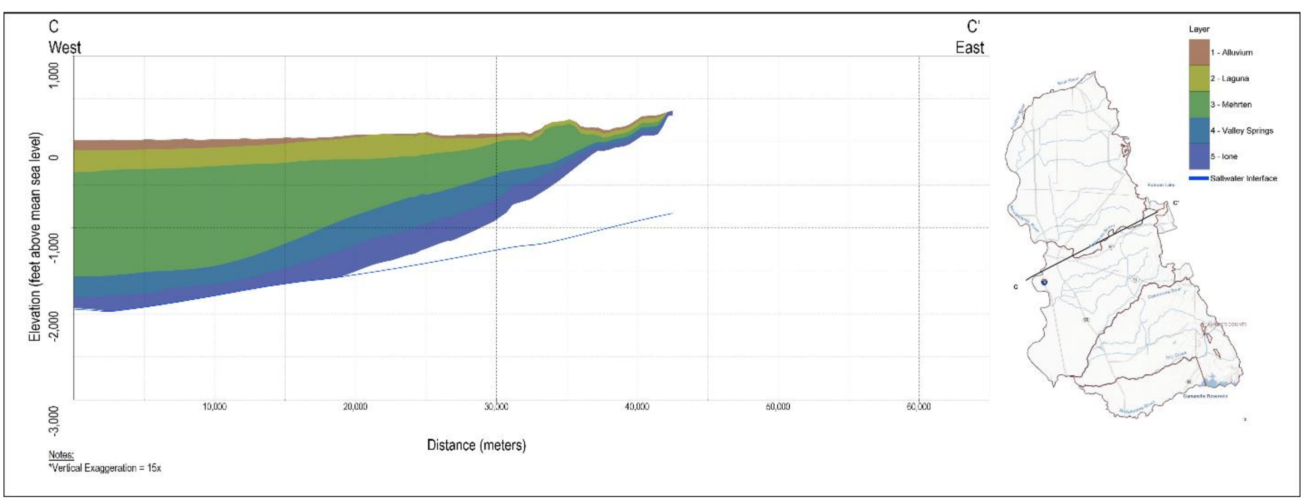


Figure 2-29: CoSANA Cross Section C-C'

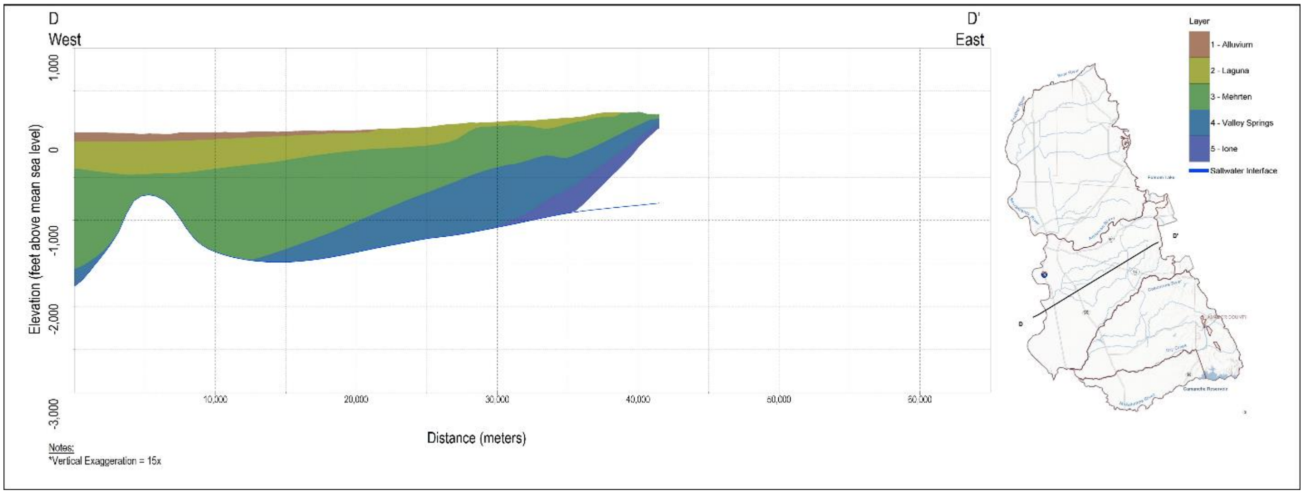


Figure 2-30: CoSANA Cross Section D-D'

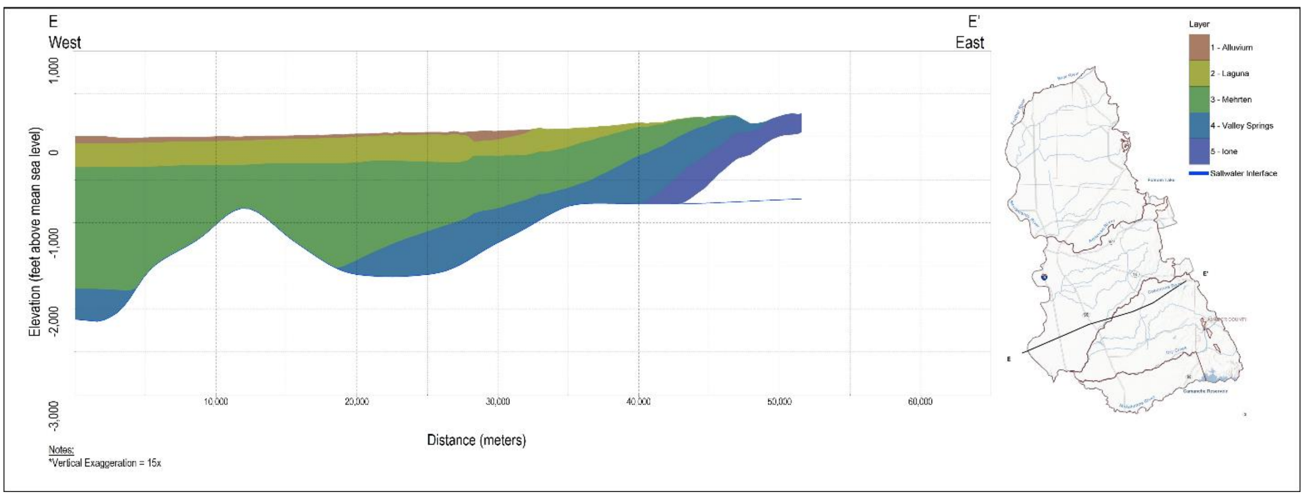


Figure 2-31: CoSANA Cross Section E-E'

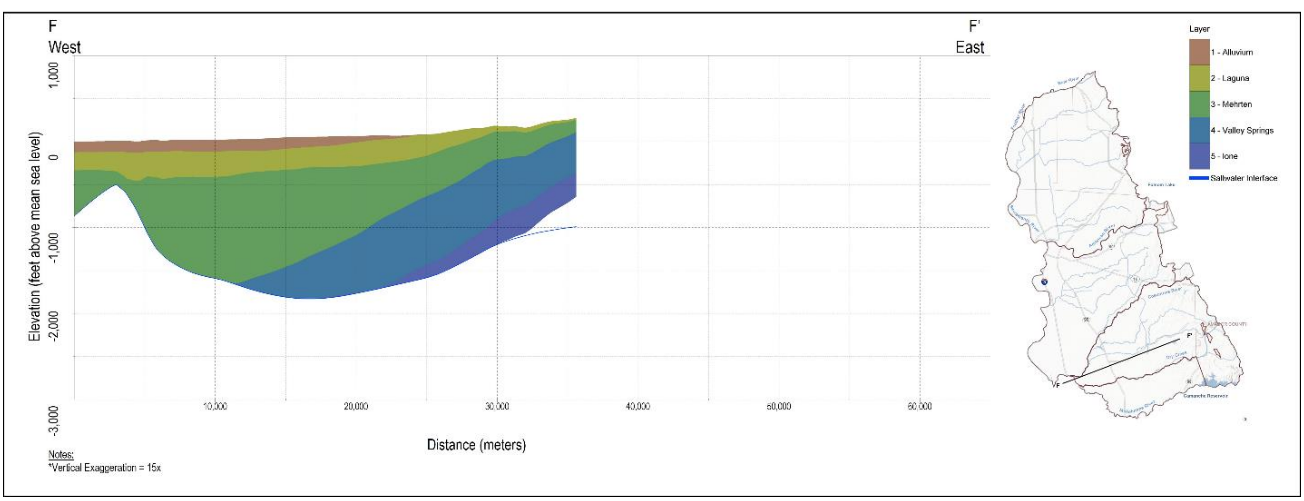


Figure 2-32: CoSANA Cross Section F-F'

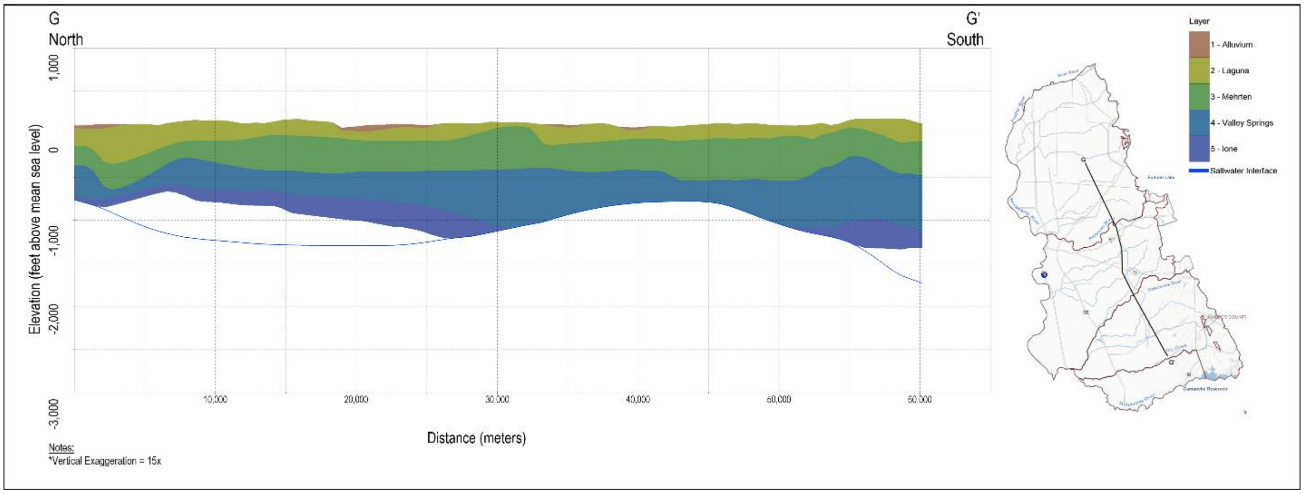


Figure 2-33: CoSANA Cross Section G-G'

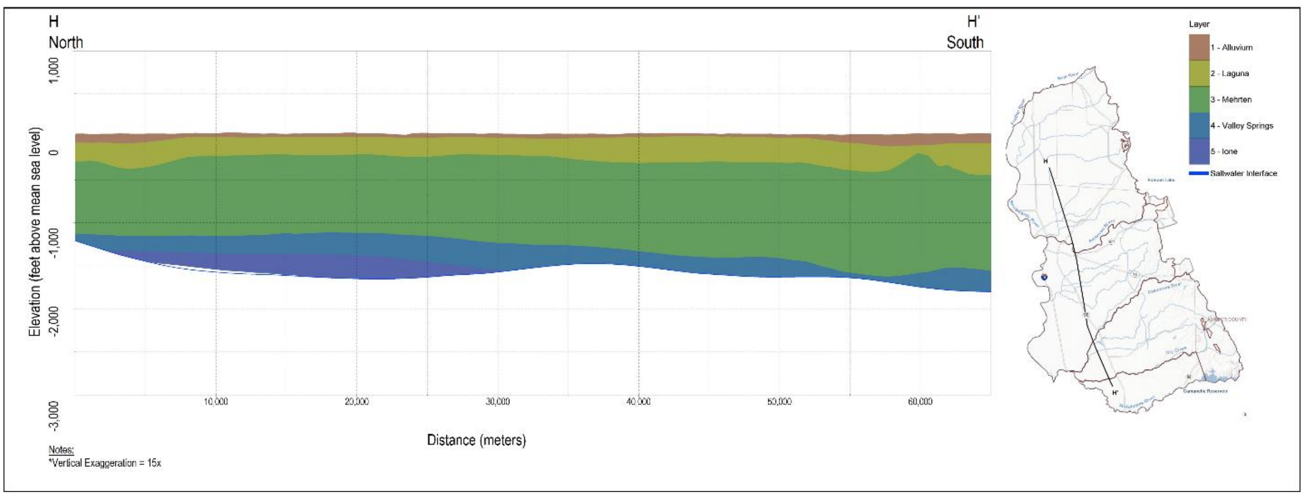


Figure 2-34: CoSANA Cross Section H-H'

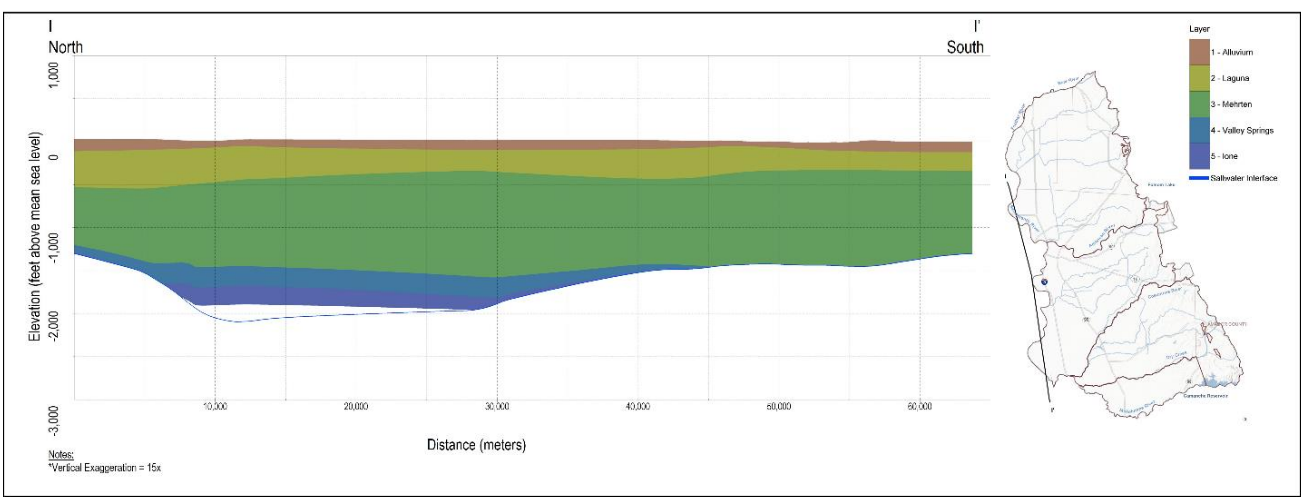


Figure 2-35: CoSANA Cross Section I-I'

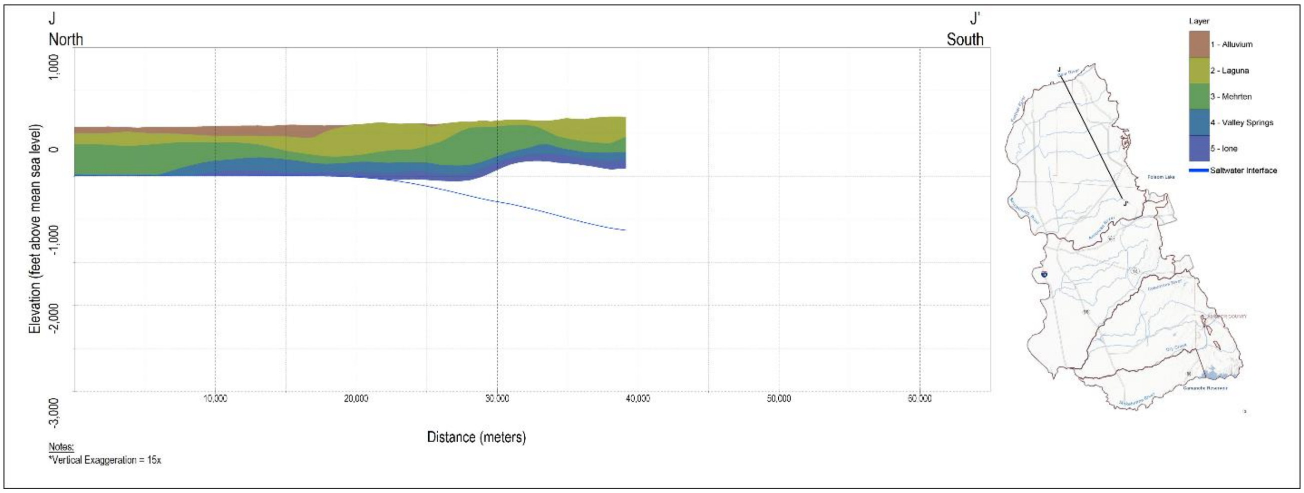


Figure 2-36: CoSANA Cross Section J-J'

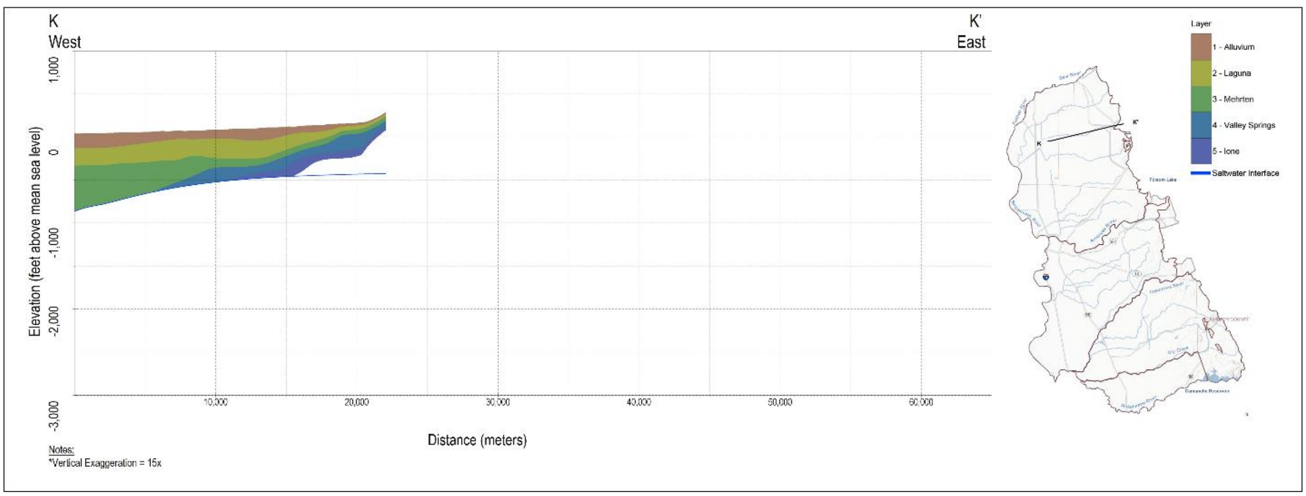


Figure 2-37: CoSANA Cross Section K-K'

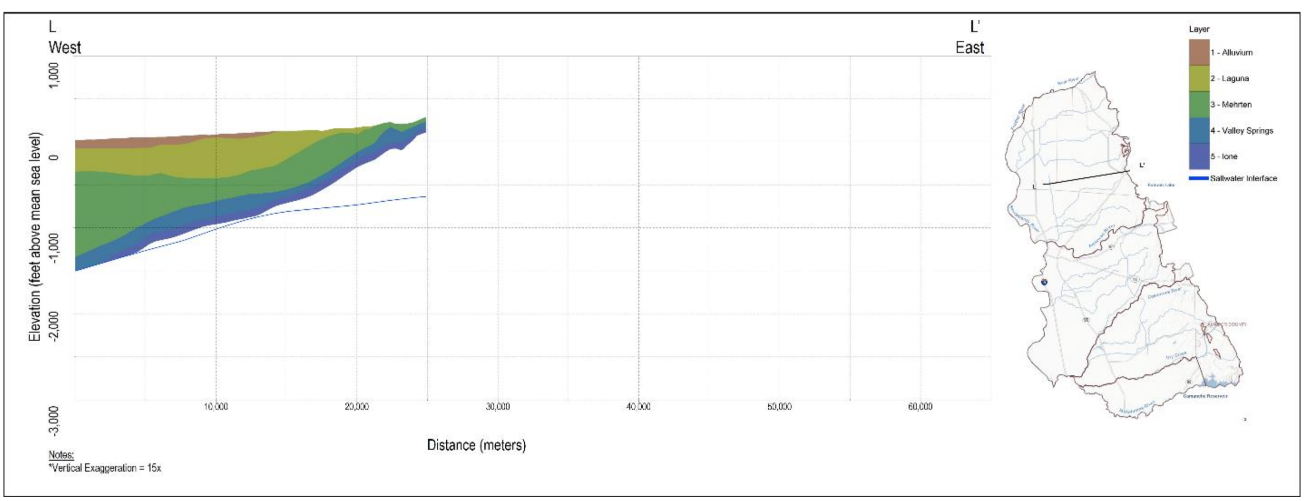


Figure 2-38: CoSANA Cross Section L-L'

2.11 Tributary Watersheds

The inflow from the eastern boundary of the model (i.e., Sierra Nevada foothills) originates from tributary watersheds, including both gaged and ungaged watersheds. The simulation of runoff and inflows from the gaged watersheds (i.e., stream inflows into the model) was discussed in Section 2.4. The simulation of surface and subsurface flows from the ungaged watersheds is explained in this section.

CoSANA simulates the ungaged eastern inflow using 32 small watersheds (Figure 2-39), based on the latest version of C2VSimFG. Flow from ungaged small watersheds is estimated based on precipitation rates and characteristics assigned to each identified ungaged watershed, again based on parameters from C2VSimFG. A portion of flow from the small watershed enters the model area as surface runoff and flows to simulated streams. The remaining small watershed flow contributes as subsurface boundary flow to the groundwater system.

All subsurface inflows from these small watersheds are routed to model Layer 5 along specified groundwater nodes, with a defined maximum percolation rate at each node. Excess flows that do not infiltrate to groundwater enter the simulated streams at specified locations, delineated using the USGS Watershed Boundary Dataset (HUC12 watersheds).

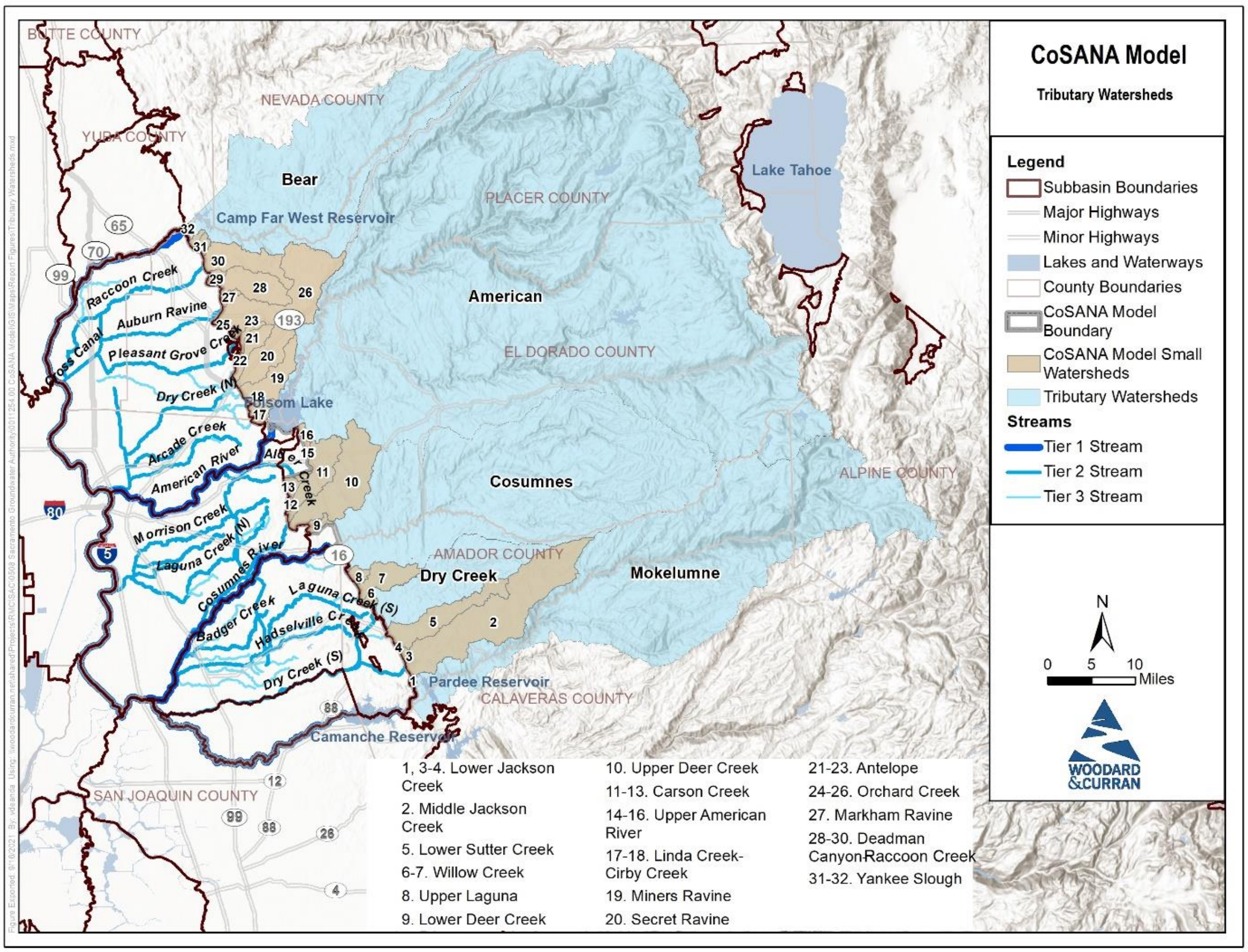


Figure 2-39: Tributary Watersheds

2.12 Boundary Conditions

Boundary conditions define the subsurface inflows for the northern, western, and southern borders of the model. The following boundary conditions are set in CoSANA:

2.12.1 General Head

Time-series general-head boundary conditions representing groundwater levels outside of the model area were defined for all active layers for 713 boundary nodes on the northern, western, and southern limits (i.e., along Bear River, Sacramento River, and Mokelumne River). General head boundary conditions, for each model node that it is defined, use a defined conductance and a reference groundwater level time series at a location outside the model domain with a known distance. The conductance values at the boundary condition nodes were calculated from the horizontal hydraulic conductivity, distance to the reference point, layer thickness, and the length of the boundary section represented by each node.

Groundwater level time-series data at a distance of approximately 3,000 feet from the boundary were extracted from the C2VSimFG model. The extracted values were compared with observed groundwater elevations from DWR's Water Data Library (WDL) and modified to better fit the observed elevations by trend and bias correction while protecting the spatial variation provided by C2VSimFG.

2.12.2 Small Watersheds

As discussed in the previous section, subsurface inflows and surface runoff contributions along the eastern boundary of model are represented using small watersheds.

2.12.3 Constrained Head

Additional boundary conditions were defined to simulate known water elevations for Camanche Reservoir. Seepage from Camanche Reservoir was represented by constrained head boundary conditions for the uppermost layer of the 228 groundwater nodes representing the reservoir elevations.

2.13 Initial Conditions

Groundwater heads for each model node and each layer at the beginning of the calibration simulation (October 1, 1989) were developed using DWR's WDL database. Over 815 wells with data were analyzed for use in building the initial groundwater heads. Due to the availability of data in different wells, a hierarchy of data was used to compile sufficient coverage over the model domain for development of initial conditions:

- Fall 1989 (August through October) where available
- Extended Fall 1989 (July through November)
- Surrounding years data, averaged (Fall 1988 or Fall 1990)
- Surrounding two years data, averaged (Fall 1987 or Fall 1991)
- Other timeframes were selected by examining hydrographs and groundwater level trends
- Where all above unavailable outside of the model boundary, depth to water was extrapolated

Observation data were interpolated to develop a raster representing initial groundwater levels over the model domain. Due to the lack of construction information for many of the WDL monitoring locations, the groundwater heads described above are used for all layers. The model "warm up" period from WY1989 to WY1994 allows the model time to equilibrate the groundwater conditions to smooth any issues that might arise from lack of data or erroneous data. The initial conditions for CoSANA representing October 1, 1989 are shown in Figure 2-40.

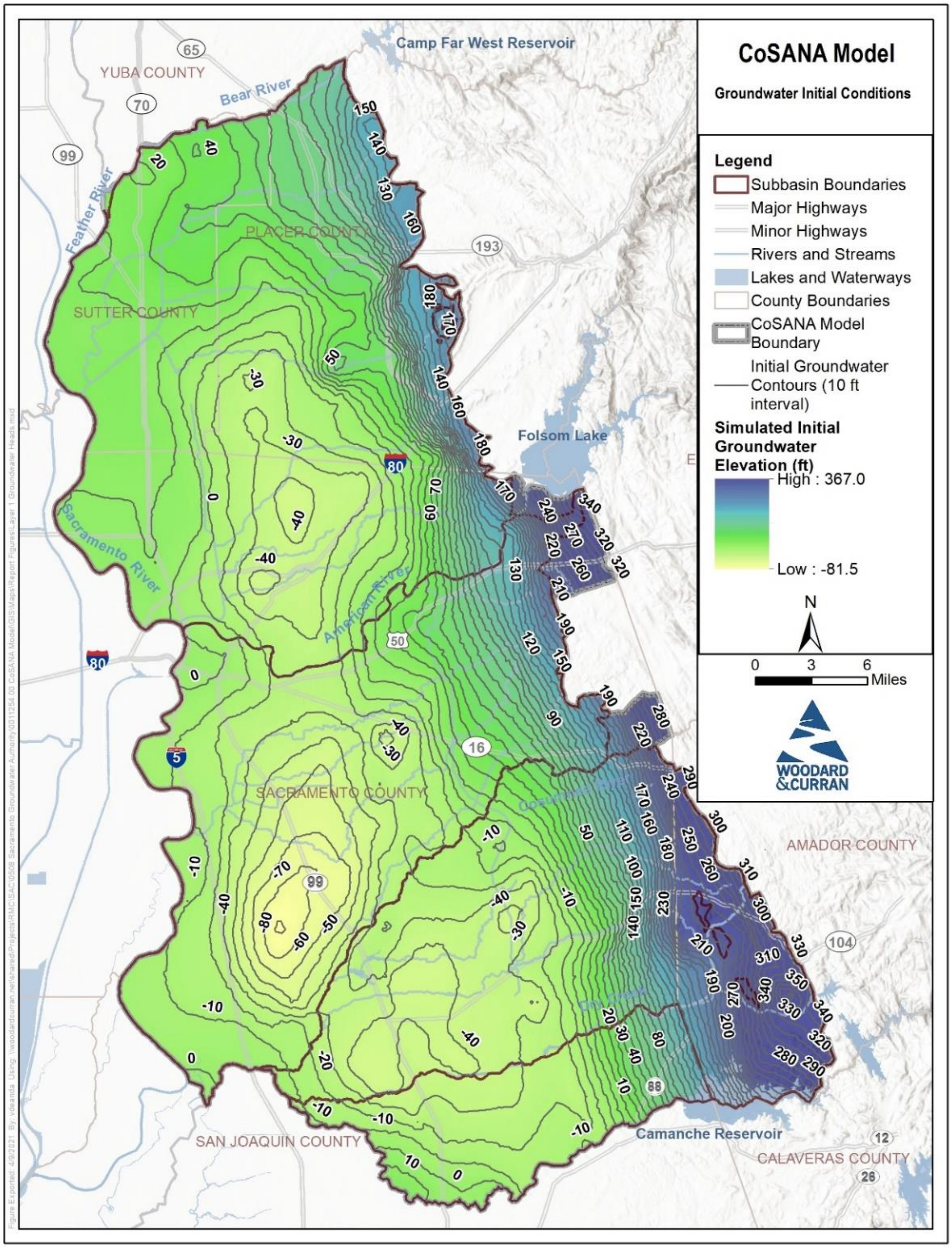


Figure 2-40: Initial Conditions, Groundwater Heads, Fall 1989

3. WATER SUPPLY AND DEMAND DATA

The following sections describe the data and methodology for developing CoSANA water demand and supply input data. Typically, agricultural and urban supplies are specified in IWFM's groundwater pumping and surface water diversion data, and agricultural and urban demands are calculated using the IWFM IDC. In the case of CoSANA, the urban demands for historical period were provided for each one of the urban water purveyors and were input in the model directly.

3.1 Water Supply

Both the agricultural demands estimated by IDC and the urban demands are primarily met through the IWFM representation of surface water diversions and groundwater pumping. Other sources of water simulated in IWFM to meet demand include recycled water, remediated (reuse) water, precipitation, and existing moisture in the soil.

3.1.1 Surface Water Supply

Historical surface water diversions for the simulation period were compiled from a combination of sources discussed in more detail in Sections 3.2 and 3.3, including gage data, water rights reports, Urban Water Management Plans (UWMPs), Agricultural Water Management Plans (AWMPs), and other sources. Some diversions were estimated based on historical demands. A summary of diversions simulated in the model is provided in Appendix A, along with the actual percentage of diverted water that is delivered after the delivery losses are accounted for. Delivery losses comprise recoverable losses (i.e., seepage along delivery and unlined canals) and non-recoverable losses (i.e., evaporation from canals).

Many diversions provide water across two or more model subregions, so deliveries are assigned to a group of elements representing the delivery area, rather than a subregion. Diversions are either assigned to a stream node near the point of diversion or they are treated as imports if the point of diversion is outside model area. Figure 3-1 to Figure 3-3 show schematic diagrams of the surface water delivery system simulated in CoSANA.

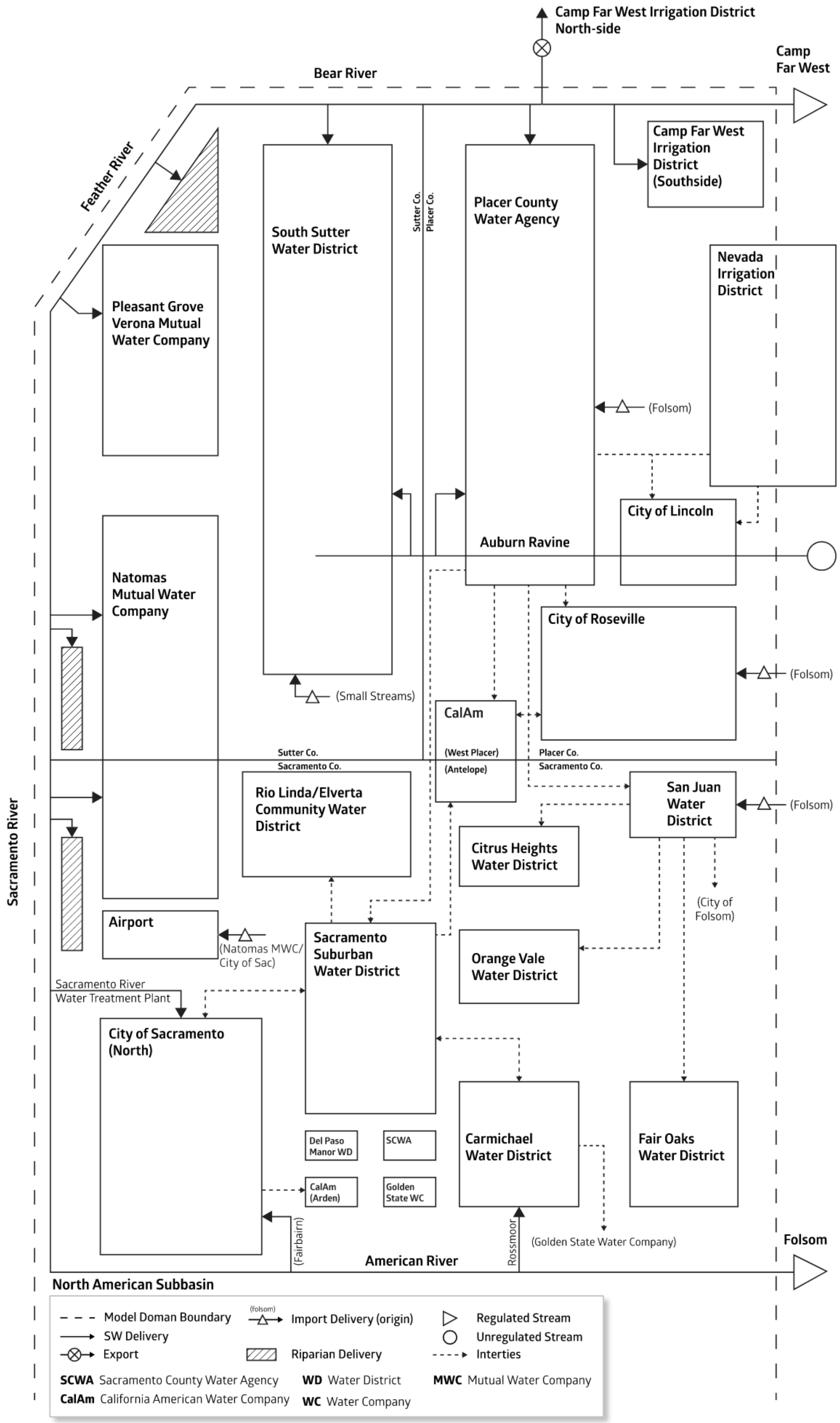


Figure 3-1: CoSANA NASb Surface Water Delivery Schematic

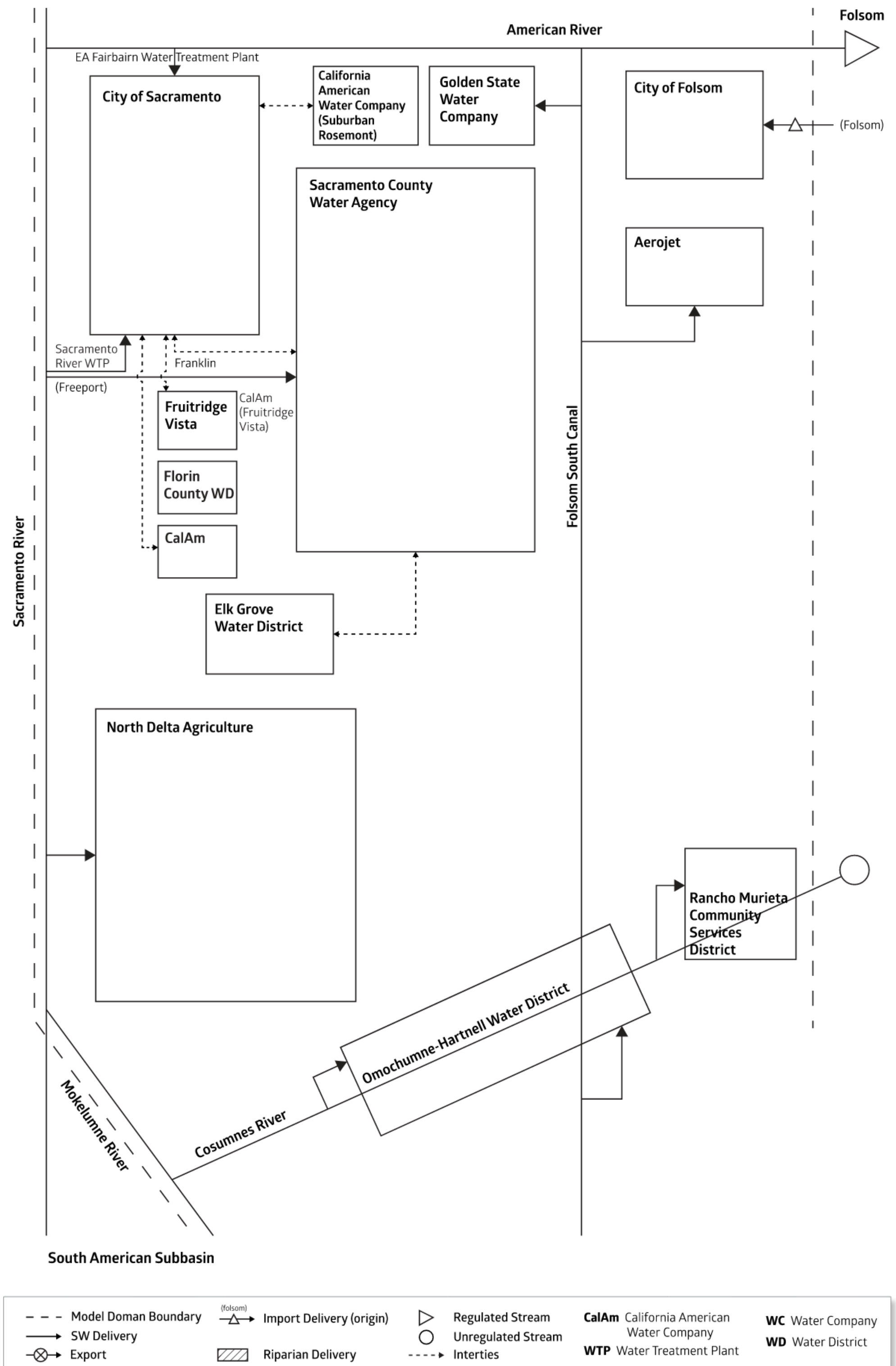


Figure 3-2: CoSANA SASb Surface Water Delivery Schematic

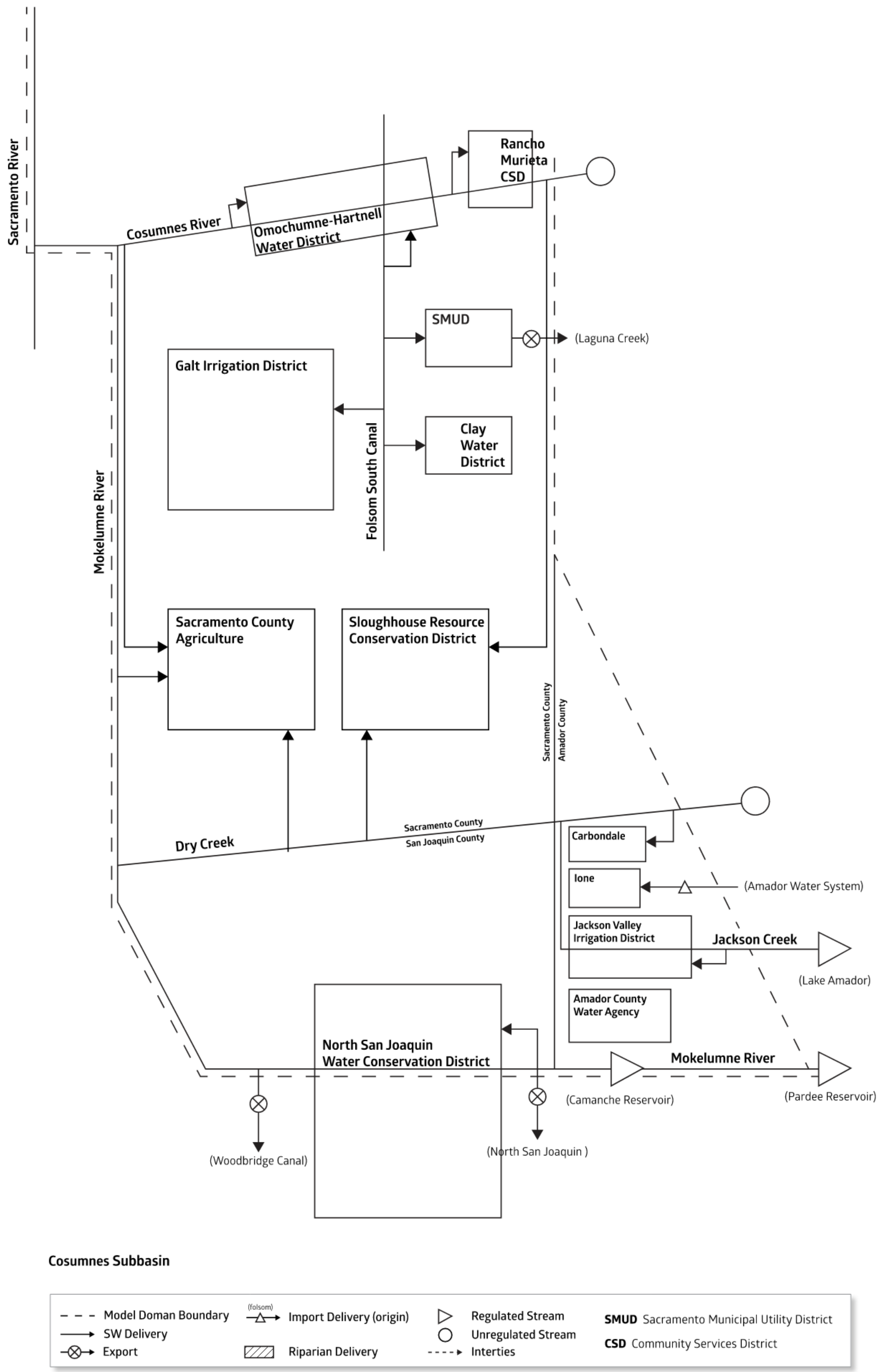


Figure 3-3: CoSANA CoSb Surface Water Delivery Schematic

3.1.2 Groundwater Pumping

Groundwater pumping within CoSANA is separated into pumping by wells and pumping by elements. The former largely includes agency-operated wells that deliver groundwater to a public water supply system, as well as groundwater contamination remediation operations where data are available by well. The latter includes estimated agricultural and domestic (including rural residential) groundwater pumping.

Where available, pumping data are specified on a monthly basis throughout the historical simulation period. Data provided typically included well locations, total depth, screen perforation depth, use (agricultural, urban, or remediation) and historical monthly pumping records. Agricultural and rural residential pumping volumes are not typically known and were estimated by the model to meet demands not satisfied through other sources (e.g., well pumping and surface water deliveries.)

3.2 Urban Water Demand and Supply

Urban demands are provided by the urban water purveyors for the historical model period. The monthly urban demands are directly inputted into the model for each urban purveyor.

It was assumed that an annual average of 60% of urban water is used indoors and 40% is used outdoors. CoSANA uses monthly fractions for indoor and outdoor use, with the majority of urban water demand due to indoor activities from November through March and up to 60% of urban water used outdoors for the remainder of the year. Assumed monthly fractions for City of Galt indoor and outdoor use were adjusted to better match those reported by the City of Galt.

Table 3-1 lists the number of wells by type and purveyor included in CoSANA. Figure 3-4 shows the locations of the urban pumping wells in CoSANA, including those shown in Table 3-1 and some additional smaller users including Sacramento International Airport, fish farms, and others.

Table 3-1: Summary of CoSANA Well Pumping by Urban Purveyor

Purveyor	Number of Municipal Pumping Wells	Average Annual Municipal Pumping (WY 1995-2018, acre-feet)
California American Water Company	135	39,666
Cal Am (formerly Fruitridge Vista WC)	20	4,220
Camanche Village (Amador County WA)	6	258
Carmichael WD	17	4,025
Citrus Heights WD	14	987
City of Galt	25	4,716
City of Lincoln	5	717
City of Roseville	6	18
City of Sacramento	68	20,427
Del Paso Manor WD	10	1,536
Elk Grove WD	17	5,144
Fair Oaks WD	12	1,262
Florin County WA	10	2,624
Golden State WC	33	9,897
Orange Vale WC	2	0
Rio Linda Elverta CWD	13	2,990
Sacramento County WA	118	27,510
Sacramento Suburban WD	119	29,905
Total Average Annual Pumping (acre-feet)		155,902

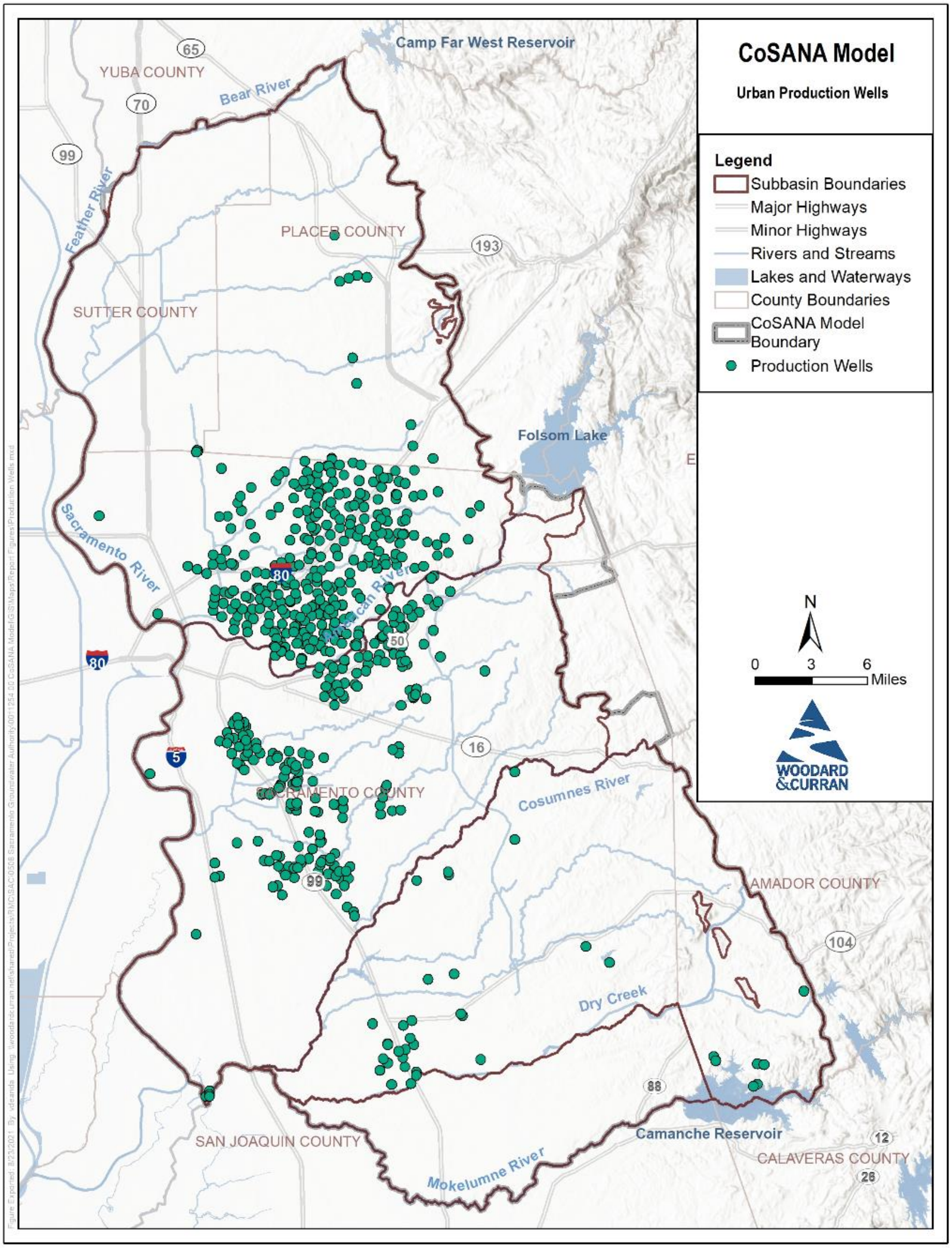


Figure 3-4: Locations of Urban Groundwater Production Wells

The following sections provide a brief description of water supplies for each of the urban water purveyors in each Subbasin.

3.2.1 North American Subbasin

This section briefly describes the urban demand and supply assumptions used in the historical CoSANA for the purveyors within the NASb. Averages presented are for the calibration period, WY 1995-2018. RWA (M. Garcia, personal communication, August 29, 2019) provided data for many of the individual entities listed below.

3.2.1.1 California American Water Company (Antelope)

California American Water Company (Cal Am) Antelope receives an average of 170 acre-feet per year (AFY) of surface water supplied via an intertie with Sacramento Suburban Water District (WD). Groundwater supply meets remaining demand with an average of 5,621 AFY. Data sources include SacIWRM (to 2004), RWA (service area data including surface water diversions for 2011 onwards), and Cal Am (well-by-well pumping data for 2004-2018).

3.2.1.2 California American Water Company (Arden)

Cal Am Arden is primarily supplied by groundwater, an average of 2,830 AFY, with approximately 2 AFY being met by surface water supplied by the City of Sacramento. Data sources include SacIWRM (to 2004), RWA (service area data including surface water diversions for 2011 onwards), and Cal Am (well-by-well pumping data for 2004-2018).

3.2.1.3 California American Water Company (Lincoln Oaks)

Cal Am Lincoln Oaks receives an average of 245 AFY of surface water supplied via an intertie with Sacramento Suburban WD. Groundwater supply meets remaining demand, with an average of 8,869 AFY. Data sources include SacIWRM (to 2004), RWA (service area data including surface water diversions for 2011 onwards), and Cal Am (well-by-well pumping data for 2004-2018).

3.2.1.4 California American Water Company (West Placer)

Cal Am West Placer service area supply includes 725 AFY of surface water sourced from Placer County Water Agency (PCWA). RWA provided data for 2011-2018. Data prior to 2011 is estimated based on annual data provided by GEI Consultants (R. Shatz, personal communication, March 5, 2020).

3.2.1.5 Carmichael Water District

Carmichael WD uses an average 7,155 AFY of surface water from the American River and 4,080 AFY of groundwater from district wells. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.6 Citrus Heights Water District

Citrus Heights WD supply includes 16,015 AFY of surface water sourced from San Juan WD and 952 AFY of groundwater from district wells. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.7 Del Paso Manor Water District

Supply for Del Paso Manor WD is met entirely by groundwater pumping from district wells and averages 1,549 AFY. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.8 Fair Oaks Water District

Fair Oaks WD supplies include an average of 11,145 AFY of surface water received from San Juan WD and 1,183 AFY of groundwater from district wells. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.9 Golden State Water Company (Arden)

Golden State Water Company (WC) Arden supply includes an average of 1,169 AFY of groundwater pumping from district wells. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.10 City of Lincoln

On average, 6,218 AFY of the City of Lincoln's water supply comes from surface water supplied by PCWA and Nevada Irrigation District. The remaining 739 AFY of supply is provided by groundwater production from city wells. Data for 2008-2018 was provided by the City of Lincoln. Data for 2005 to 2008 is estimated based on annual data from the City of Lincoln UWMPs (2010, 2015). Data prior to 2005 is from SacIWRM

3.2.1.11 Orange Vale Water Company

Orange Vale WC on average receives 4,191 AFY of surface water sourced from San Juan WD. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.12 Placer County Water Agency (City of Rocklin Retail Service Area)

PCWA serves the City of Rocklin for retail customers. Remaining portions of PCWA's service area within the model are served by other retail water purveyors or are self-supplied by groundwater. Supply to the City of Rocklin is on average 4,578 AFY, based on data from PCWA (R. Cox, personal communication, July 17, 2019) for WY 2016-2018. All demand is assumed to be met by surface water. Lacking other data sources, data from 2016 was used for previous years.

3.2.1.13 Rio Linda / Elverta Community Water District

Rio Linda/Elverta CWD is primarily supplied by groundwater pumping, averaging 3,010 AFY. The remaining 5 AFY is from surface water sourced from an intertie with the City of Sacramento. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.14 City of Roseville

The City of Roseville receives, on average, 27,943 AFY of surface water sourced from Folsom Reservoir, with the remaining 126 AFY of supply met by groundwater pumping from city wells. Data were provided by the City of Roseville for 1986-2018. Gaps in data existed for 1999-2000 and 2008-2009; these were filled by interpolating data from surrounding years. Data prior to 1986 is from SacIWRM. Data from the City of Roseville also included details on groundwater injection as part of the city's aquifer storage and recovery program.

3.2.1.15 Sacramento Suburban Water District

Sacramento Suburban WD supply mix includes 32,396 AFY of groundwater production from district wells and 10,024 AFY from surface water sourced via intertie with PCWA and the City of Sacramento. Data sources include SacIWRM (to 2004), and RWA (after 2004).

3.2.1.16 City of Sacramento

The City of Sacramento receives on average 97,488 AFY of surface water from their water treatment plants on the American and Sacramento Rivers. Remaining demand is met by groundwater production from city wells that averages 20,225 AFY. This demand is spread across both the NASb and the SASb. Data sources include SacIWRM (to 2004), and RWA (after 2004).

3.2.1.17 Sacramento International Airport

The Sacramento International Airport receives on average 175 AFY from the City of Sacramento (based on data from RWA). Remaining demand of 968 AFY is assumed to be met by groundwater (based on SacIWRM demand).

3.2.1.18 San Juan Water District

San Juan WD average supply is estimated to be 5,196 AFY within the model area and is met entirely by surface water from Folsom Lake. This is based on retail data for the district supplied by RWA (after 2004) and assumes that 37% of the districts retail service area is within the CoSANA boundary. Data prior to 2004 is based on SacIWRM.

3.2.1.19 Sacramento County Water Agency (Arden Park Vista)

Demand for the Sacramento County Water Agency (SCWA) Arden Park Vista service area averages 3,911 AFY and is met entirely by groundwater pumping from district wells. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.1.20 Sacramento County Water Agency (Northgate)

Supply for the SCWA Northgate service area averages 940 AFY and is met entirely by groundwater pumping from district wells. Data sources include SacIWRM (to 2004) and RWA (after 2004).

3.2.2 South American Subbasin

This section briefly describes the urban demand and supply assumptions used in the historical CoSANA for the purveyors located within the SASb.

3.2.2.1 California American Water Company (Fruitridge - formerly Fruitridge Vista Water Company)

Cal Am Fruitridge Vista is serviced almost entirely by groundwater production from Cal Am wells. Some small surface water transfers are reported, which average to 1 AFY. Data sources include SacIWRM (to 2011), HydroDMS (2012-2013), and SCGA (2014-2018).

3.2.2.2 California American Water Company (Parkway)

Cal Am Parkway receives on average 592 AFY of surface water delivered via an intertie with the City of Sacramento; the remaining 10,699 AFY is supplied from groundwater production from Cal Am wells. Data sources include SacIWRM (to 2011), RWA (service area data including surface water diversions for 2011 onwards), and Cal Am (well-by-well pumping data for 2004-2018).

3.2.2.3 California American Water Company (Security Park)

Cal Am Security Park averages 31 AFY demand, met by groundwater production from Cal Am wells. Data sources include SacIWRM (to 2011), RWA (service area level data including surface water diversions for 2011 onwards), and Cal Am (well-by-well pumping data for 2004-2018).

3.2.2.4 California American Water Company (Suburban Rosemont)

Cal Am Suburban Rosemont receives on average 110 AFY of surface water delivered via an intertie with the City of Sacramento, with the remaining 12,296 AFY supplied from groundwater production from Cal Am wells. Data sources include SacIWRM (to 2011), RWA (service area level data including surface water diversions for 2011 onwards), and Cal Am (well-by-well pumping data for 2004-2018).

3.2.2.5 Elk Grove Water District (Service Area 1)

Supply for Elk Grove WD Service Area 1 averages 5,189 AFY and is met by groundwater production from district wells. Data sources include SacIWRM (to 2009) and Elk Grove Water District (after 2009).

3.2.2.6 Florin County Water District

Florin County WD supply averages 2,623 AFY, entirely sourced by groundwater production from district wells. Data is from SacIWRM. Actual production values are not known for this area, and demand is estimated.

3.2.2.7 City of Folsom

The City of Folsom has an average demand of 20,451 AFY, with 100% of its supply coming from surface water diverted from Folsom Lake. Data sources include SacIWRM (to 2011) and RWA (after 2011).

3.2.2.8 Golden State Water Company (Cordova)

Golden State WC Cordova receives on average 6,287 AFY of surface water, primarily from water diverted from the American River via the Folsom South Canal. The remaining 8,977 AFY of demand is met by groundwater production from Golden State wells. Data sources include SacIWRM (to 2011) and RWA (after 2011).

3.2.2.9 Rancho Murieta Community Service District

Rancho Murieta CSD supply averages to 1,833 AFY, which is fully met by surface water diverted from the Cosumnes River. This is based on data on the number of service connections and water use from the 2006 Rancho Murieta Community Services District Integrated Water Master Plan and the 2010 Update.

3.2.2.10 City of Sacramento

(See North American Subbasin)

3.2.2.11 Sacramento County Water Agency (Hood)

SCWA Hood service area has an average demand of 47 AFY which is supplied by groundwater production from agency wells. Data sources include SacIWRM (to 2011) and RWA (after 2011).

3.2.2.12 Sacramento County Water Agency (Laguna Vineyard)

SCWA Laguna Vineyard service area (including Elk Grove WD Service Area 2) has an average supply mix of 17,340 AFY of groundwater production from agency wells, 3,314 AFY of surface water primarily sourced from the Sacramento River, and 232 AFY of recycled water. Data sources include SacIWRM (to 2011), HydroDMS (2012-2013), and SCGA (2014-2018).

3.2.2.13 Sacramento County Water Agency (Mather)

SCWA Mather service area average supply mix that includes 3,958 AFY of groundwater production from agency wells, and 233 AFY surface water primarily sourced from the Sacramento River via the Vineyard Surface Water Treatment Plant. Data sources include SacIWRM (to 2011), HydroDMS (2012-2013), and SCGA (2014-2018).

3.2.3 Cosumnes Subbasin

This section briefly describes the urban demand and supply assumptions used in the historical CoSANA for the purveyors located within the CoSb.

3.2.3.1 Amador County Water Agency (Camanche Village)

Amador County WA Camanche Village service area has an average supply of 257 AFY which is met 100% by groundwater production from agency wells. Data sources include monthly pumpage from four Camanche wells and two Camanche north shore wells, as reported by Amador County Water Agency (G. Mancebo, personal communication, April 29, 2019).

3.2.3.2 Amador County Water Agency (Ione)

Amador County WA supply to the City of Ione averages 2,130 AFY which is entirely surface water. Ione supply was estimated from reported wastewater treatment plant flows and population. Data sources include treated wastewater flows from Amador Water Agency (B. Cook, personal communication, December 9, 2019) and population data from the California Department of Finance.

3.2.3.3 City of Galt

The City of Galt has an average supply of 4,737 AFY, which comes entirely from groundwater production from municipal wells. Data sources include monthly pumpage from a total of 18 wells, as reported by the City of Galt (M. Clarkson, personal communication, March 22, 2019).

3.2.3.4 Rancho Murieta Community Service District

(see South American Subbasin section)

3.2.4 Fish Farms

The 2011 South Basin Groundwater Management Plan reported that there is approximately 11,000 AFY pumping to supply water to fish farms in the Cosumnes Subbasin. This annual pumping estimate was allocated to six fish farms based on the relative area of each fish farm and the annual pumping rate was converted to monthly rates in proportion to monthly ET_o rates. Inspection of aerial photos in Google Earth was used to determine when each fish farms was developed and when pumping from each fish farm was likely to have begun.

3.2.5 Galt Wastewater Treatment Plant Effluent

All effluent and stormwater from the City of Galt is routed to the wastewater treatment plant, where it is ultimately either released to Skunk Creek (tributary of Laguna Creek) or used for irrigation of surrounding fields. The 2011 South Basin Groundwater Management Plan (South Area Water Council, 2011) reported that the City of Galt applies an average of approximately 700 AFY to fields for irrigation. The wastewater treatment plant came online in 1983. As such, a variable monthly application rate based on an assumed monthly supply requirement was specified for 1983 through 2019.

3.3 Agricultural Water Demand and Supply

Agricultural water demand is the amount of irrigation water that is required to satisfy the crop evapotranspiration requirement and to meet other irrigation practices. IDC is designed to estimate the agricultural water demand for each model element through consumptive use methodology. IDC dynamically calculates crop demand at each model time step based on factors including crop type, crop evapotranspiration, rainfall, hydrologic soil type, and irrigation practices. The IDC calculations rely on model input data for historical crop acreage, irrigation practices (e.g., return and reuse fractions, irrigation period), soil moisture requirements, effective rainfall (the portion of rainfall available for crop consumptive use), crop evapotranspiration, and localized soil parameters. These data were compiled, analyzed, synthesized, and processed for input in CoSANA.

Precipitation, land use, evapotranspiration, and soil properties are discussed in the relevant sections in Chapter 2. The irrigation period, using data from C2VSimFG, defines irrigation as either on or off for each crop and for each month of the model simulation period. Most trees are assumed irrigated from April through October, vineyards from April through November, most field crops from May through September, and most truck crops from April through September. Crops with irrigation assumed year-round include citrus and subtropical trees, irrigated pasture, and alfalfa. Fractions to represent return flow (i.e., irrigation flow following the model drainage pattern discussed in Section 2.5) and reuse (i.e., the fraction of applied irrigation water to be reused for irrigation) are based on data from C2VSimFG. All non-ponded CoSANA agricultural lands are assigned a 5% return flow and 1% reuse factor. Rice during the growing season is assigned an average 13% return flow and an average 9% reuse factor, with variability depending on the month of the year. Riceland when flooded for decomposition in the non-growing season is assigned an average 9% return flow and an average 6% reuse factor, also with variability depending on the month of the year. Urban landscape areas are assumed to have 0% return flow and 0% reuse.

3.3.1 Rural-Residential Pumping

Private groundwater pumping quantities on an individual well basis are largely unknown; therefore, private rural-residential pumping in CoSANA is estimated by IWFM on an element basis. Water demands at each relevant element are used to calculate pumping necessary to meet the urban demand estimated by IDC after water purveyor pumping and surface water has been distributed.

The perforation interval, which dictates the layers a simulated well extracts water from, were assigned separately to the domestic (i.e., rural residential) and agricultural wells. Rural residential wells used a statistical analysis of perforation interval developed for C2VSimFG. Perforation interval data were compiled by DWR using data from the CASGEM and Online System for Well Completion Reports databases. Simulated perforation intervals were assigned as the 5th and 95th percentiles of the well perforation interval data for each township/range block.

Demand for rural residential areas, or areas outside of those supplied by a public water system, was based on estimated population and water consumption outside of areas supplied by a public water system. To estimate demand in these areas, the areas themselves were isolated spatially by removing all areas served by a public water system. Population density for the rural residential areas is developed based on census tract data, and estimated per capita water use is developed for a typical household based on information from the California Water Plan (DWR, 2018b).

For the rural-residential area within the CoSb, outdoor water use was estimated from per-parcel water demand and approximate total number of rural-residential parcels. The estimated average per-parcel outdoor water demand is 2.5 AFY based on a detailed inspection of land use for 10 random parcels. Visual inspection of Google Earth aerial photographs identified approximately 3,200 rural-residential parcels, resulting in an average annual outdoor water use of 8,000 AFY. All indoor water use was assumed to return to the subsurface through septic systems and was therefore not explicitly modeled.

3.3.2 Agricultural Pumping

Private groundwater pumping volumes, location, and pumping depth for agricultural water supplies are largely unknown, though aggregate estimates for private pumping are often included in planning documents (e.g., AWMPs, groundwater management plans). Therefore, agricultural pumping in CoSANA is estimated by IWFM on an element basis. Water demand at each relevant element is used to calculate any additional pumping necessary to meet the agricultural demand estimated by IDC after public water system pumping and surface water has been distributed.

3.3.3 Agricultural Groundwater Substitution Transfers

CoSANA includes 55 agricultural groundwater substitution transfer pumping wells, shown in Figure 3-5. All agricultural groundwater substitution transfer pumping operations occur in the NASb and include Pleasant Grove Verona MWC (PGVMWC) and Natomas MWC (NMWC). South Sutter WD also operates a transfer program that is similar in many respects to a groundwater substitution transfer. Transfer pumping volumes are known for PGVMWC and NMWC on a well-by-well basis. The volume of groundwater pumped is assumed to be applied to meet agricultural demand in the respective service areas. South Sutter WD transfer wells and pumping volumes are not known, but it is assumed that a reduction in surface water deliveries to the service area creates increased pumping demand, resulting in transfer pumping operations. A summary of agricultural transfer pumping wells in CoSANA is shown in Table 3-2.

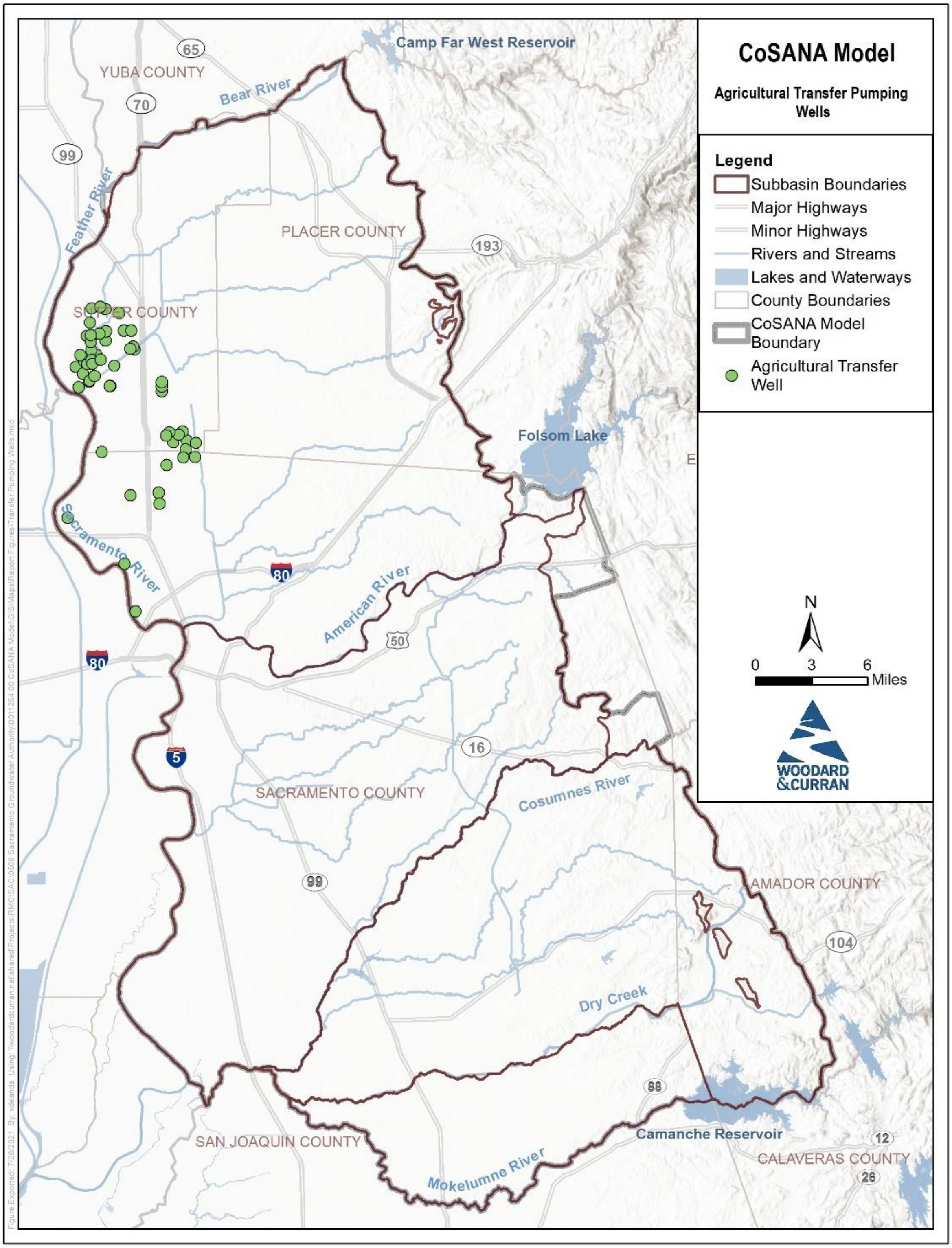


Figure 3-5: Locations of Agricultural Groundwater Substitution Transfer Pumping Wells

Table 3-2: Summary of Agricultural Groundwater Substitution Transfer Pumping

Agency	Number of Groundwater Transfer Pumping Wells	Number of Simulated Transfer Years	Average Annual Pumping in a Transfer Year WY 1995-2018, (acre-feet)
Pleasant Grove Verona MWC	30	6	7,668
Natomas MWC	25	4	8,412
Total Average Annual Pumping (acre-feet)			16,080

3.4 Remediation Pumping

CoSANA includes 344 remediation wells (Figure 3-6) simulating remediation operations for Aerojet/IRCTS, McClellan AFB, Mather AFB, and Kiefer landfill. Data for Aerojet and IRCTS operations were provided by Aerojet (personal communication, J. Fourie, January 16, 2020); McClellan AFB remediations data were provided by McClellan AFB (G. Yuki, personal communication, October 23, 2020) and AECOM (P. Graff, personal communication, October 10, 2020); Mather AFB data were developed based on annual reports; data for Kiefer Landfill operations were provided by Sacramento County (M. Koza, personal communication, June 11, 2020). Remediation pumping volumes by entity are shown in Table 3-3. An annual summary of remediation pumping volumes by extraction entity is provided in Appendix B. Further, annual simulated pumping volumes for the major remediation efforts in the CoSANA model area are summarized by subregion in the land and water use budgets in Appendix C.

Table 3-3: Summary of CoSANA Remediation Operations:

Remediation Area (Subbasin)	Number of Groundwater Remediation Pumping Wells	Average Annual Remediation Pumping (WY 1995-2018, acre-feet)
Aerojet/IRCTS (NASb)	15	1,970
Aerojet/IRCTS (SASb)	190	19,703
Kiefer Landfill (SASb)	15	969
Mather AFB (SASb)	4	207
McClellan AFB (NASb)	113	1,899
Total Average Annual Pumping (acre-feet)		24,748

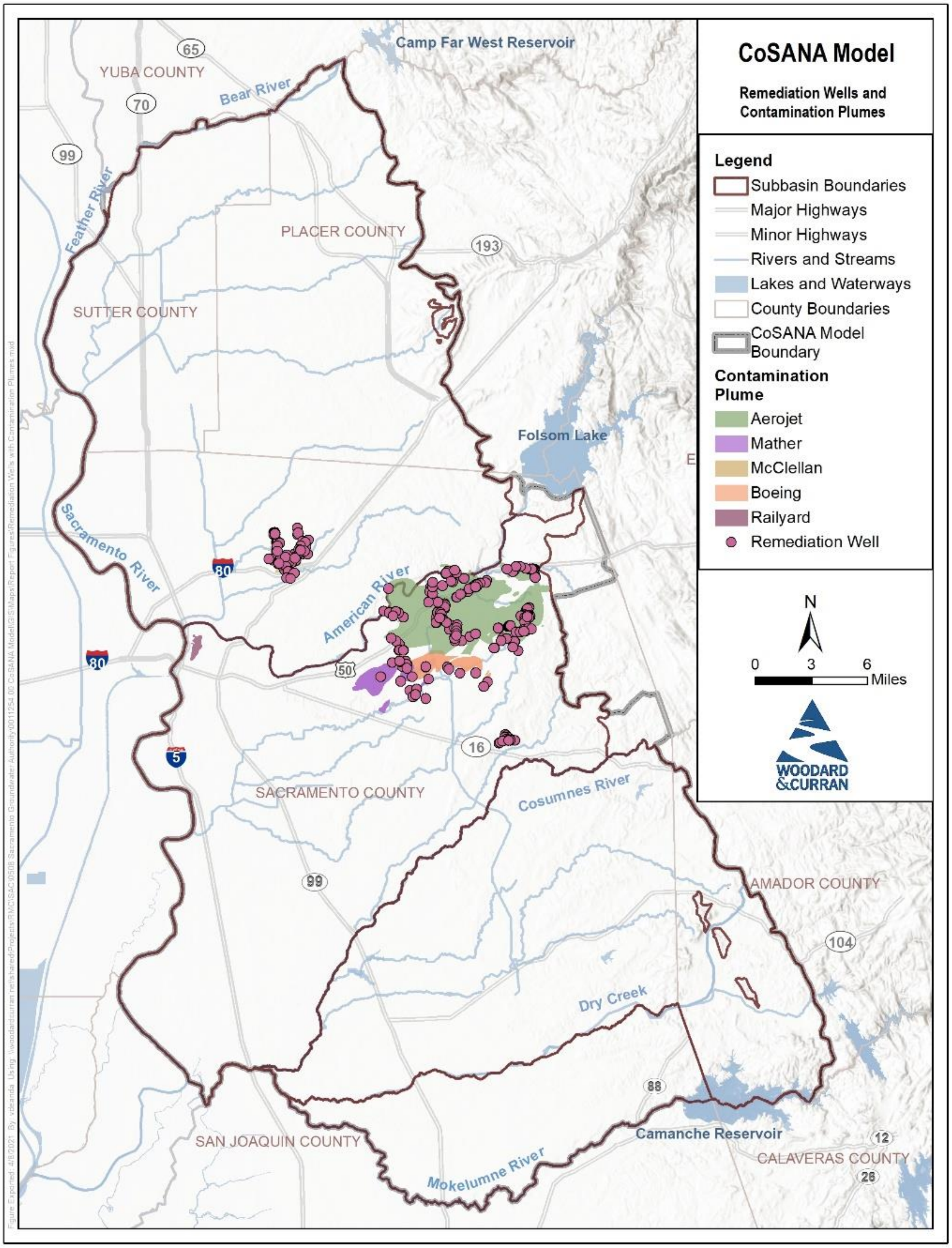


Figure 3-6: Locations of Remediation Pumping Wells

4. MODEL CALIBRATION AND SENSITIVITY ANALYSIS

CoSANA model is an integrated water resources model developed to simulate the integrated nature of the various components of the hydrologic system. Model calibration is an important part of model development, performed to meet the following objectives:

- Develop water budgets that properly represent various geographic scales, including the subbasin, GSA, and subregion scales, at both monthly and annual time scales,
- Represent the regional distribution of groundwater conditions, as well as the seasonal and long-term trends in groundwater levels at target calibration wells,
- Represent appropriate level of stream-aquifer interaction by simulating the modeled streams in such a way that the monthly and long-term streamflows at specific gaging stations properly represent the observed stream flow or stream stage data,
- Properly represent the interbasin flows across the boundaries internal to the CoSANA between the three subbasins modeled, as well as those between the neighboring subbasins outside the model area, in specific, Yuba, Yolo, Solano, and Eastern San Joaquin Subbasins.

Due to the complexities of calibrating an integrated water resources model, a hybrid approach for calibration was utilized to perform a manual calibration on initial water budgets and regional groundwater conditions and an automated calibration using PEST (Doherty, 2015) to achieve a refinement of the calibrated parameters that would result in a more accurate simulation. This calibration approach and process is similar to that used for calibration of the Central Valley's C2VSimFG, with special focus and attention to the regional and local data sets and information.

4.1 Calibration Goals

The goals of model calibration are to:

1. Represent the physical understanding of the model parameters within a range of reported values
2. Obtain a reasonable representation of water budgets for each of the hydrologic systems modeled (i.e., land and water use, stream flow, and groundwater budgets)
3. Achieve a reasonable general pattern of groundwater levels and flow directions
4. Optimize the agreement between simulated results and observed values for short-term seasonal and long-term trends in groundwater levels at selected calibration well
5. Optimize the agreement between simulated results and observed streamflow hydrographs or stream stage gages at selected gaging stations.

These goals are achieved through careful review of model input data and adjustments to model parameters. The model results also provide insight to key components of the groundwater basin including historical recharge, subsurface flows, gains/losses from/to streams and changes in groundwater storage.

CoSANA was calibrated to local data and knowledge, surface water flows, groundwater levels, and groundwater contours. The sources used include local knowledge (mainly gathered during the GSP Working Groups meetings), AWMPs, UWMPs, other local planning efforts, observed groundwater levels and associated contours, and observed streamflow data.

Due to uncertainty in the initial conditions, a “warm up” period is included to allow groundwater levels to stabilize. As previously noted, CoSANA includes data starting in October 1969 (WY 1970). To reduce run time, the model used for the historical calibration begins in October 1989 (WY 1990). The CoSANA calibration period begins after a five-year warm up period, in October 1994, and ends in September 2018; thus, the full period for model calibration is WY 1995 through 2018 (24 years).

4.2 Calibration Process

The calibration process is conducted as shown in Figure 4-1 and as described in the following subsections.

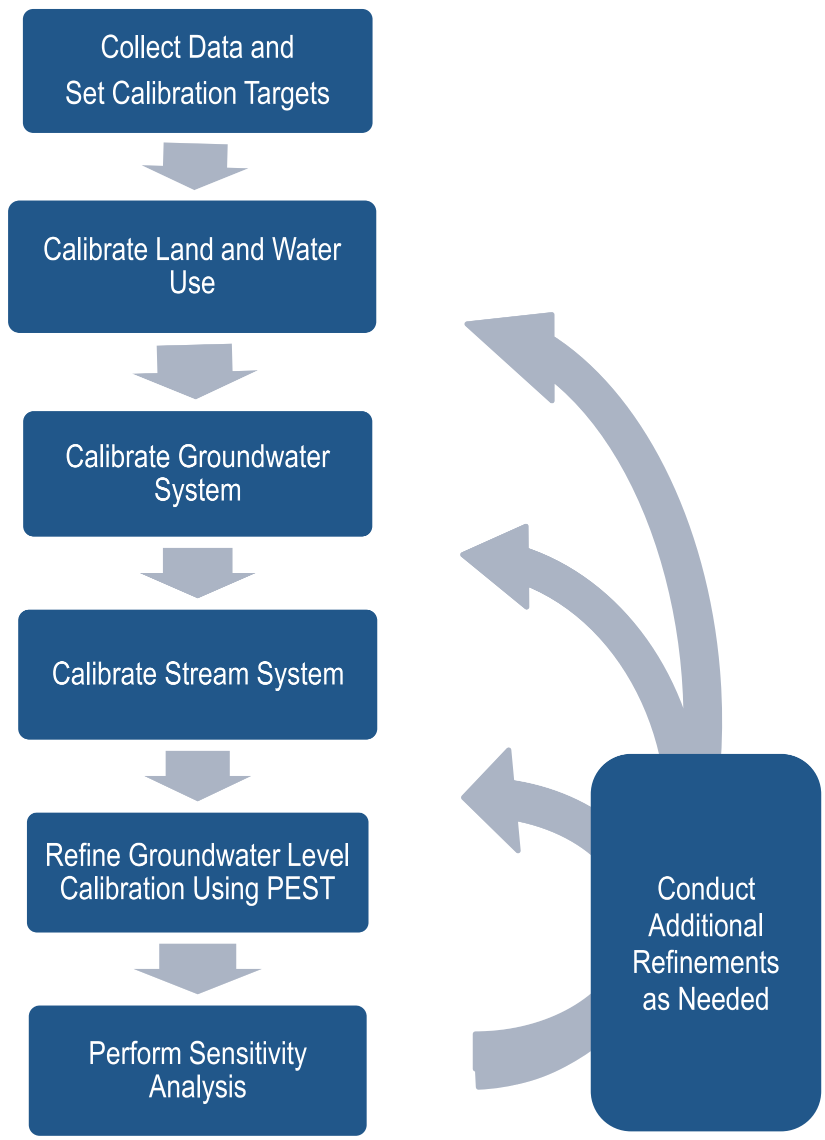


Figure 4-1: CoSANA Calibration Process

4.2.1 Water Budget Calibration

Water budgets are calibrated to improve the accuracy of the representation of the hydrologic characteristics of the groundwater basin. A water budget balances supplies, demands, and any subsequent change in storage occurring within that specific portion of the hydrologic cycle. IWFM automatically outputs budgets at the subregion scale for processes involving groundwater, the surface layer, streams, the root zone, small watersheds, and the unsaturated zone. IWFM can output budgets down to a single element or any specific grouping of elements.

During this step of the calibration process, model results are reviewed and summarized into monthly and annual (by water year) budgets. The primary budgets reviewed for calibration are the groundwater budget and the land and water use budget. Other budgets, notably the stream budget (see Appendix D), are also reviewed as part of the calibration process. After extensive budget analysis, key model datasets and parameters are adjusted, particularly groundwater aquifer parameters, to better match local budgets from local agricultural water purveyors and local planning efforts. The CoSANA water budget results are summarized in the following sections.

4.2.1.1 Land and Water Use Budget

The land and water use budget represents the balance of the IDC-calculated water demands with the water supplied and includes two different versions, agricultural and urban. Both the agricultural and urban versions include the same components that make up the water balance:

- Demands:
  - Demand (either agricultural or urban)
  - Surplus (if applicable)
- Supplies:
  - Groundwater pumping
  - Surface water deliveries (including recycled water deliveries)
  - Shortage (if applicable)

As part of the calibration of the land and water use budget, root zone parameters are adjusted as needed to achieve reasonable estimates of agricultural demand and to develop the components of a balanced root zone budget. IDC calibration serves as the foundation of the IWFM calibration for agricultural areas, as demand estimated often translates directly to groundwater pumping, which is the primary stress on the groundwater system. To adjust agricultural demand, element-level root zone parameters, particularly the soil hydraulic conductivity and the pore size distribution index, were adjusted in accordance with the hydrologic soil group and subregion. Spatial representation of these calibrated parameters is shown in Figure 4-2 through Figure 4-6. The IDC model was calibrated to achieve an irrigation efficiency of approximately 68% to 72%, consistent with agricultural water use values reported by irrigation districts in their AWMPs, as well as data from DWR's California Agricultural Water Use Model and California Water Plan.

The average annual water demand and supply mix used to meet the demand is summarized in Table 4-1. The average annual simulated land and water use budgets for the calibration period are presented in Figure 4-7 through Figure 4-14, showing the agricultural and urban demands and supplies in CoSANA both model wide and by subbasin. Additional detail on the Land and Water Use budget is included in Appendix C.

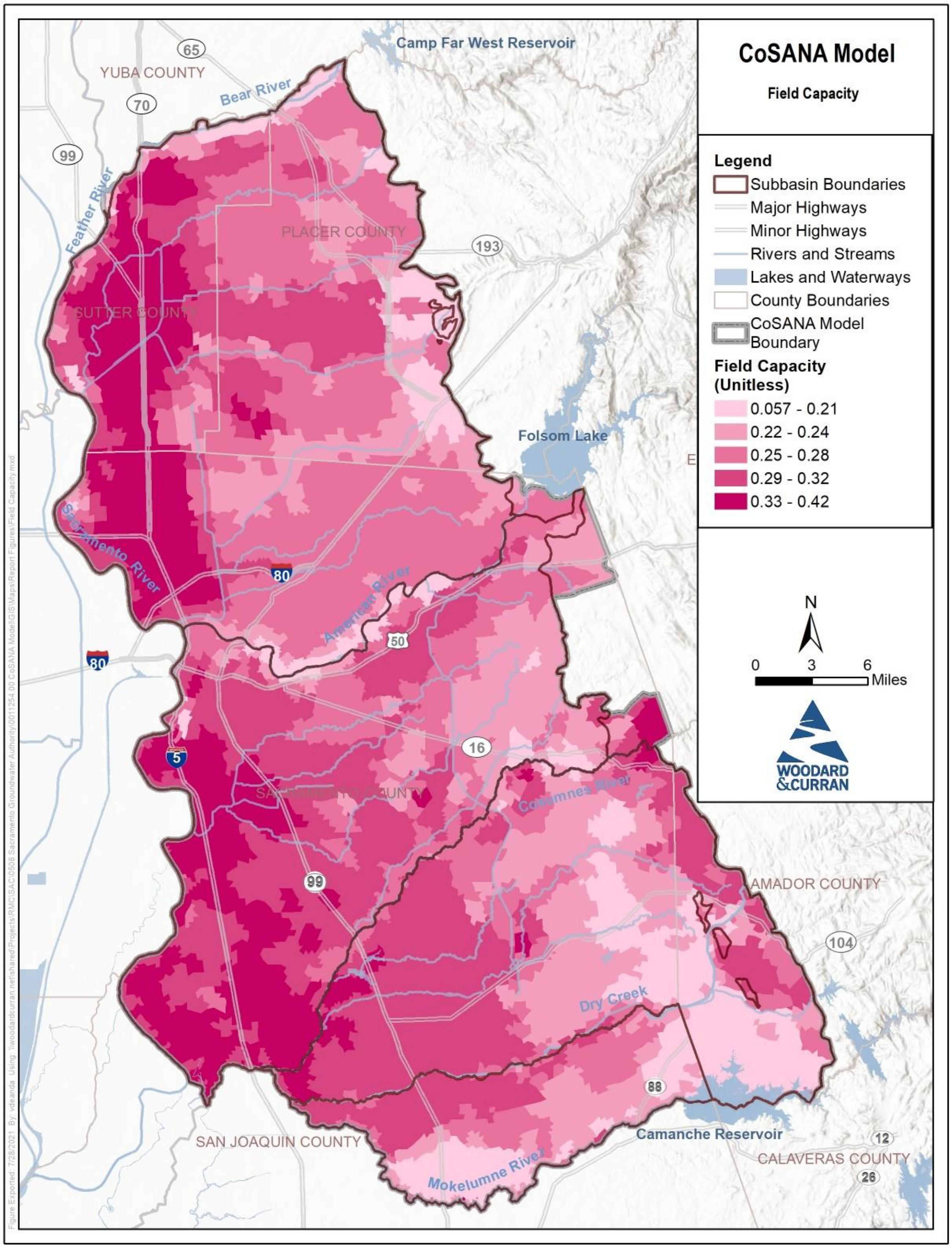


Figure 4-2: CoSANA Field Capacity

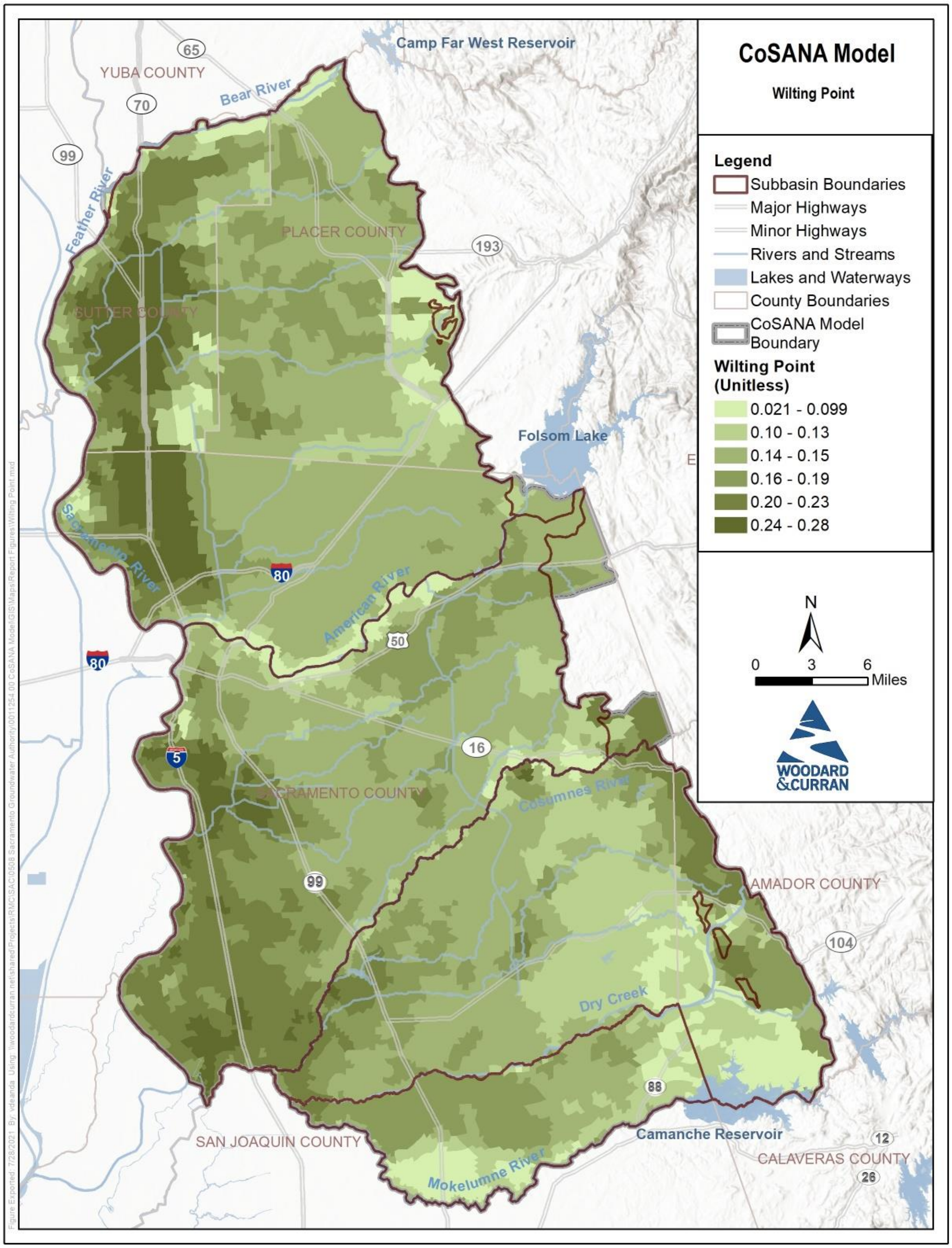


Figure 4-3: CoSANA Wilting Point

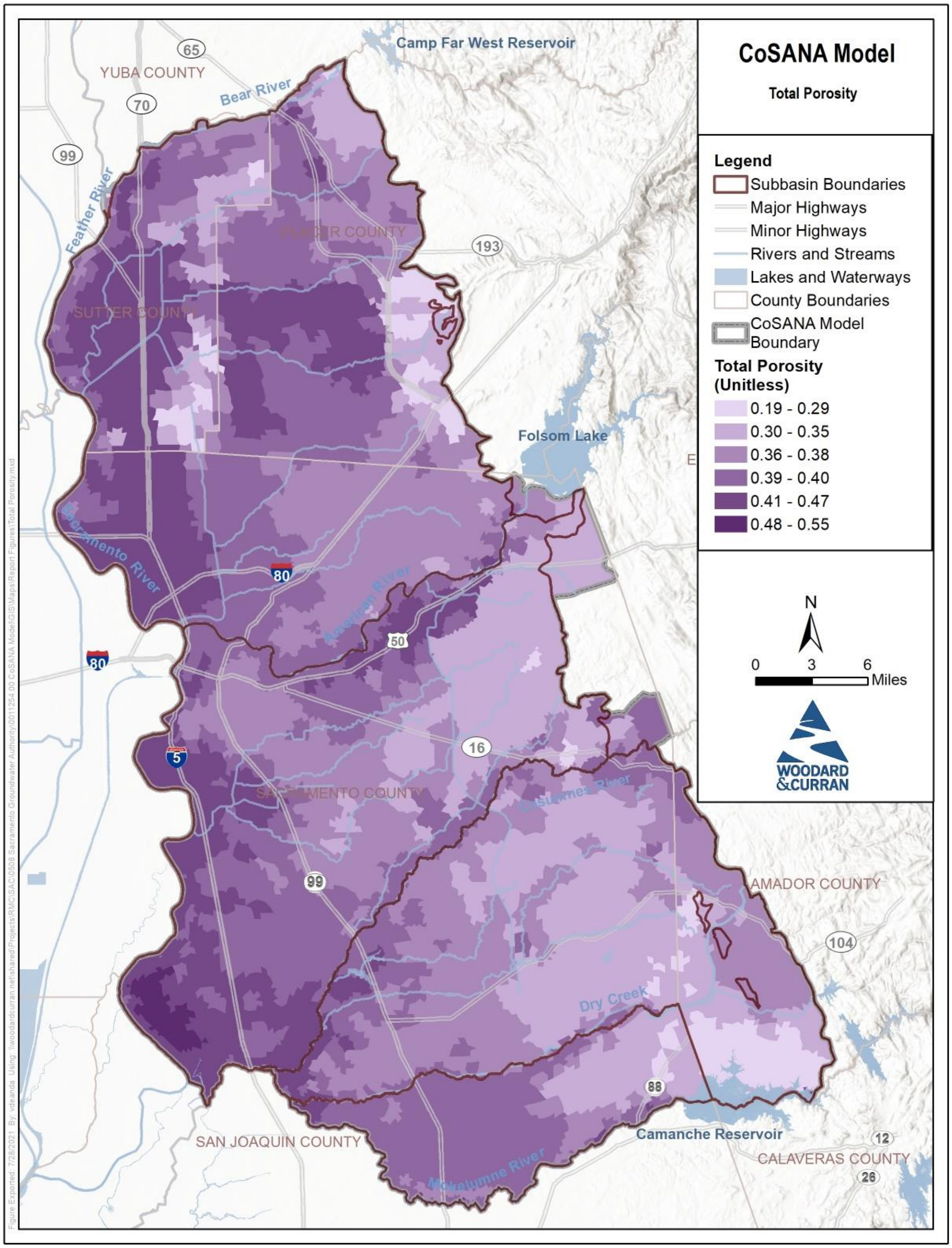


Figure 4-4: CoSANA Total Porosity

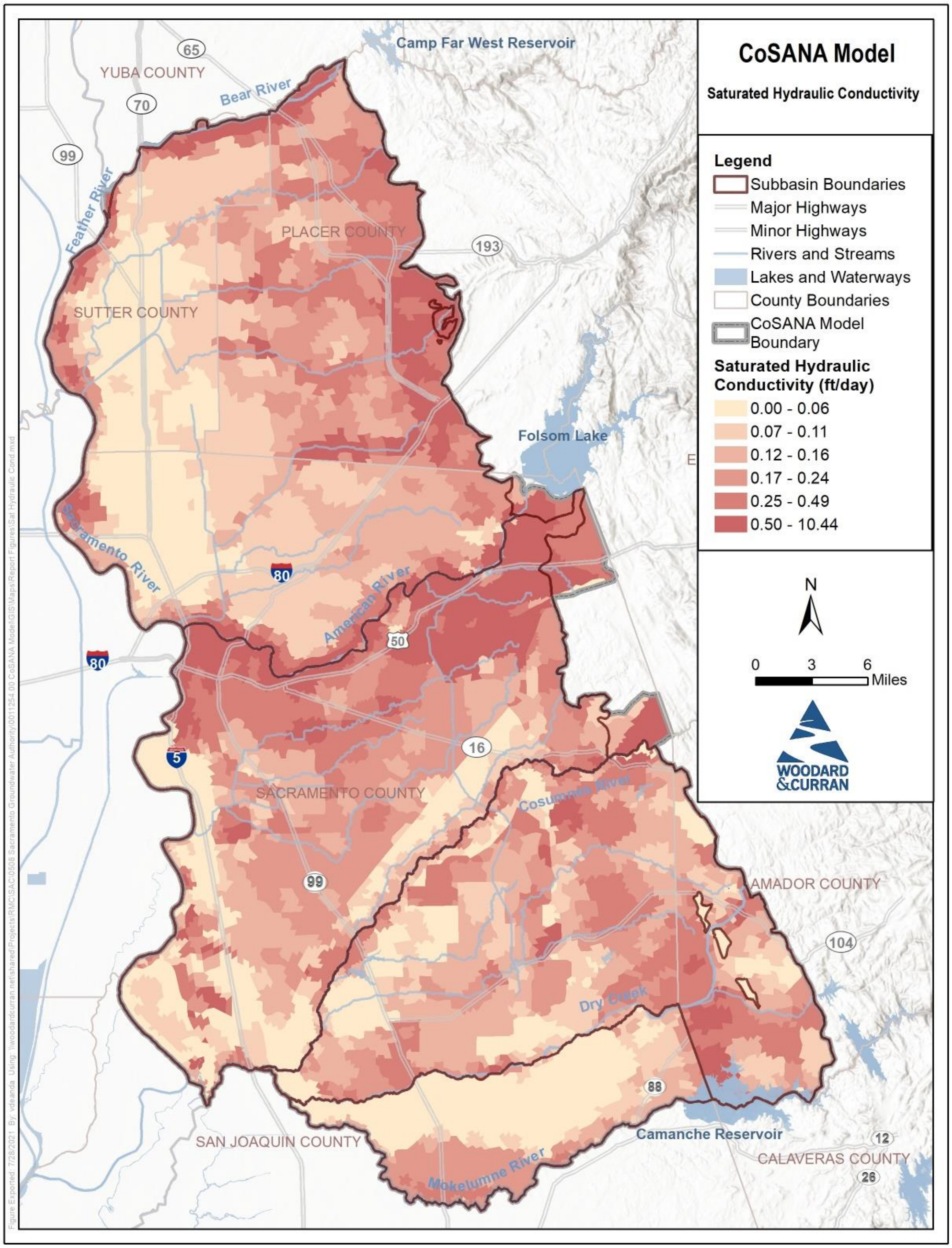


Figure 4-5: CoSANA Saturated Soil Hydraulic Conductivity

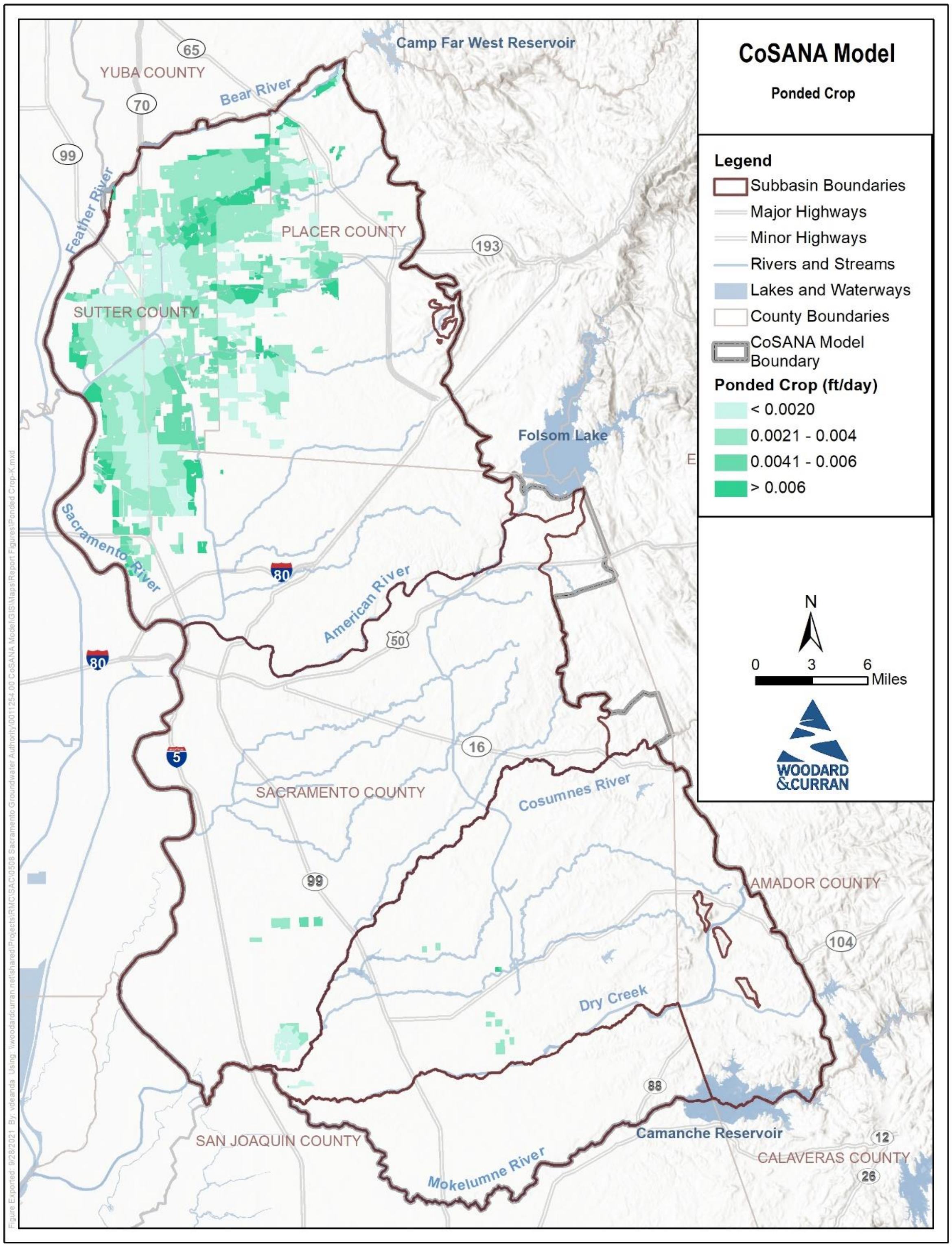
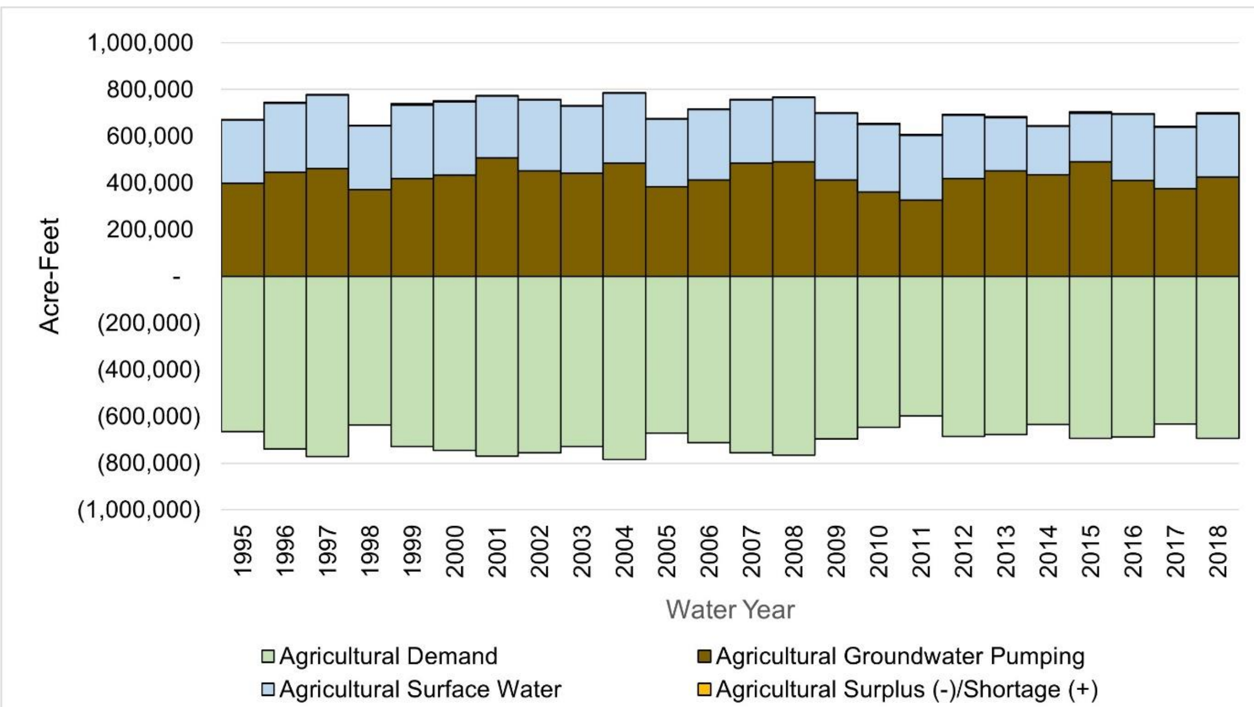


Figure 4-6: CoSANA Ponded Crop Saturated Soil Hydraulic Conductivity

Table 4-1: Land and Water Use Budget Demand and Supply Mix
(Average Annual for the Period WY 1995-2018)

Subbasin	Ag. Demand (AFY)	Ag. Ground-water Use (AFY)	Ag Surface Water Deliveries (AFY)	Urban Demand (AFY)	Urban Ground-water Use (AFY)	Urban Surface Water Deliveries (AFY)	Urban Recycled Water (AFY)	Remediation Pumping (AFY)
NASb	410,136	205,563	207,225	215,951	91,263	124,687	0	3,869
SASb	160,694	116,397	44,667	182,760	93,515	89,324	232	20,879
CoSb	132,690	107,167	25,576	26,861	22,881	2,417	0	0
Total	**703,520**	**429,127**	**277,468**	**425,572**	**207,659**	**216,428**	**232**	**24,748**

Note: Small differences exist between total supplies and total demands. These shortages and surpluses are delivered and applied regardless of the demand specified in the model. Surpluses tend to result in deep percolation. Remediation pumping is not considered part of demand in the L&WU budget but is shown for information purposes. CoSANA total is a summation of the three subbasins (NASb, SASb, and CoSb) and excludes areas in the Eastern San Joaquin subbasin and areas outside of B118 subbasins.



Note: This figure is a summation of NASb, SASb, and CoSb values and excludes areas outside of these subbasins

Figure 4-7: CoSANA Agricultural Land and Water Use Budget

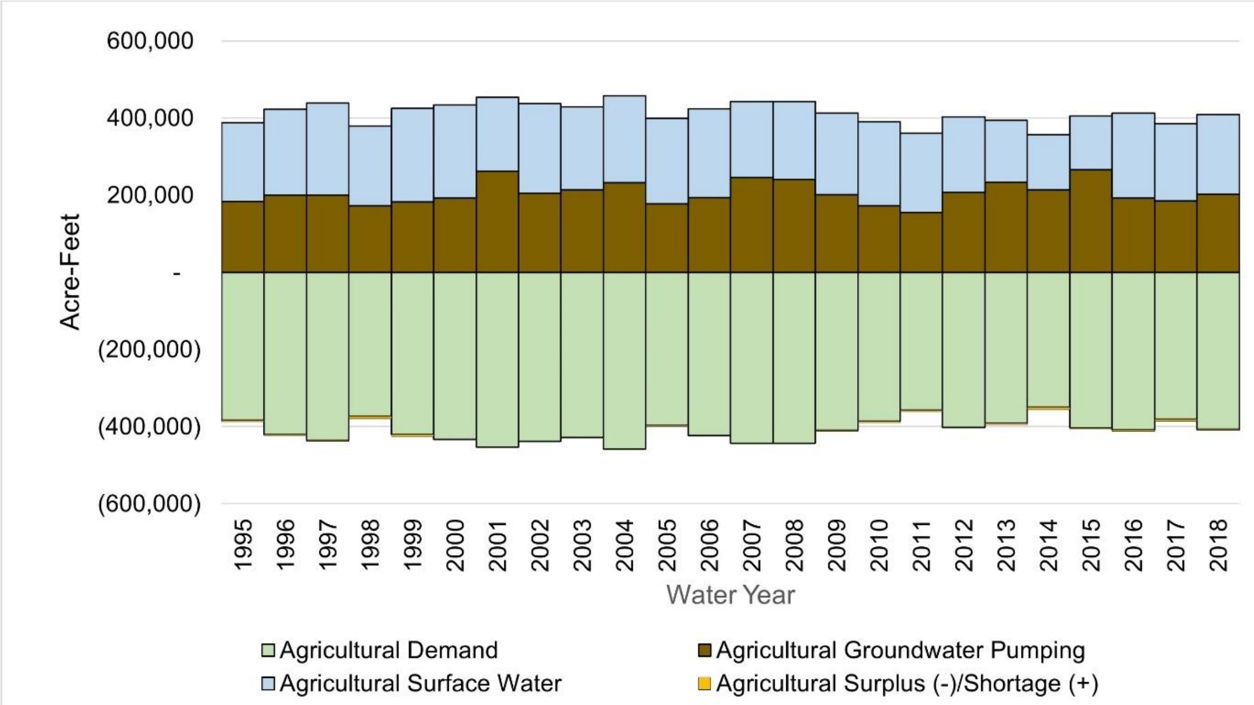


Figure 4-8: NASb Agricultural Land and Water Use Budget

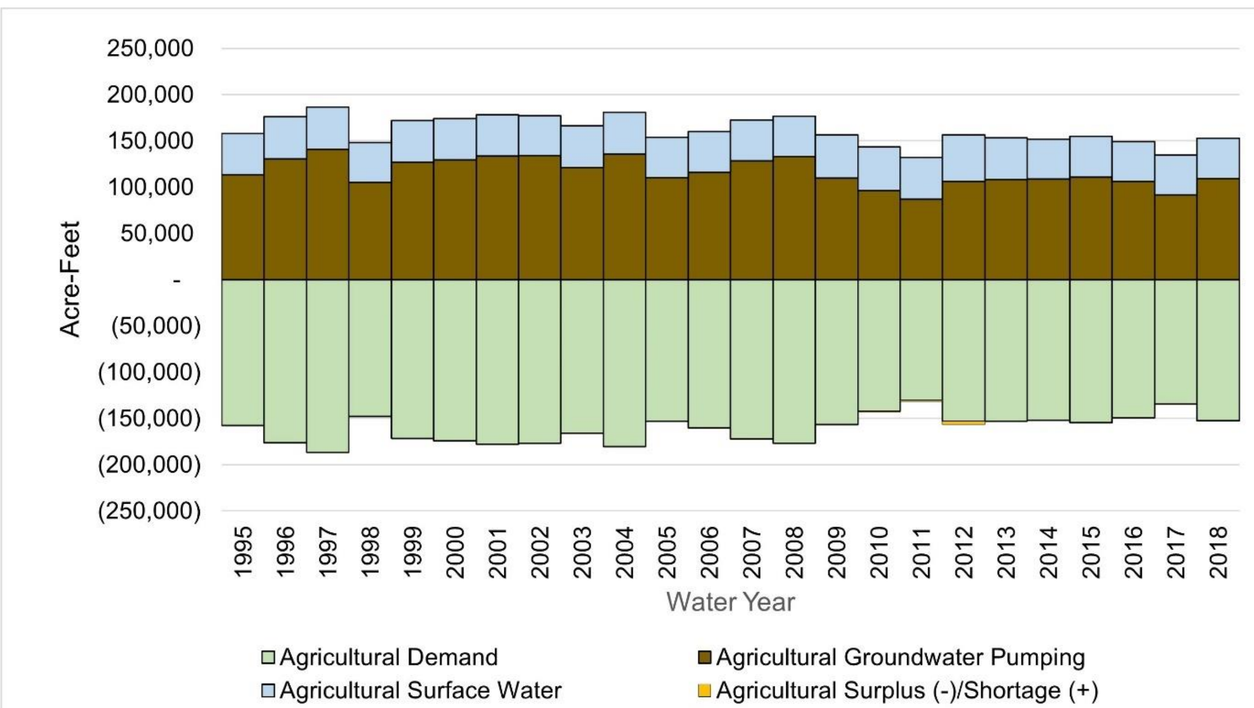


Figure 4-9: SASb Agricultural Land and Water Use Budget

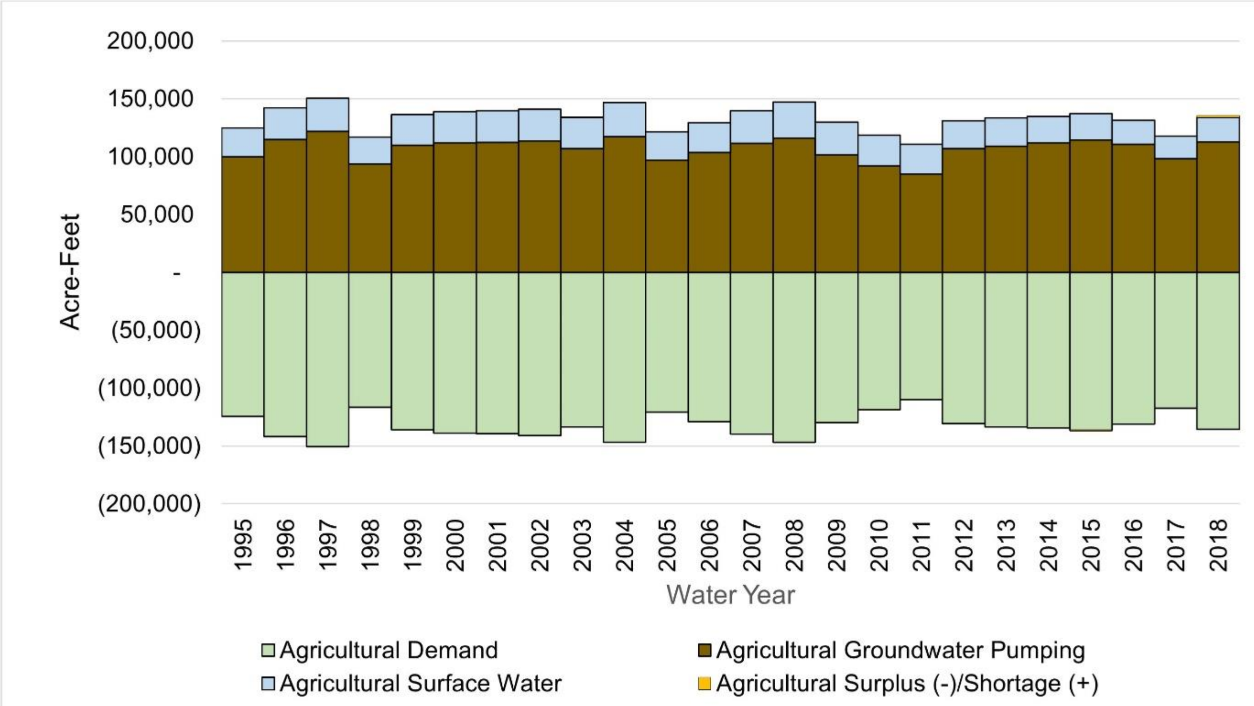
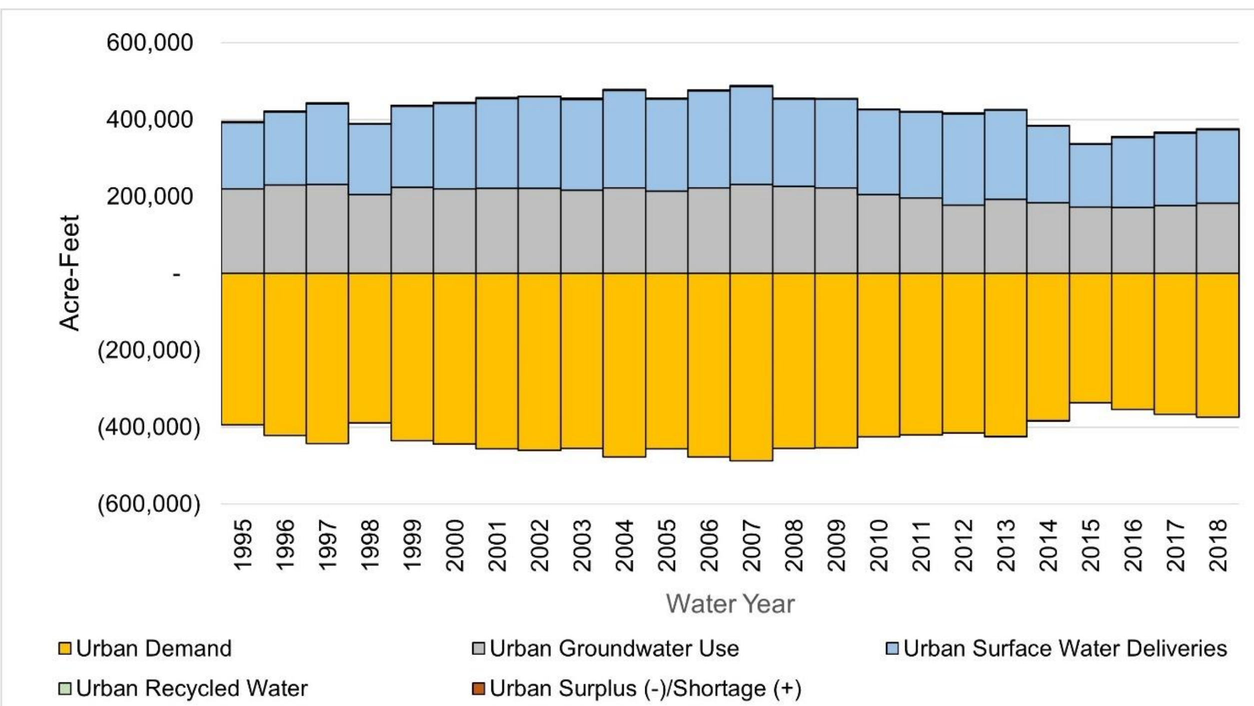


Figure 4-10: CoSb Agricultural Land and Water Use Budget



Note: This figure is a summation of NASb, SASb, and CoSb values and excludes areas outside of these subbasins

Figure 4-11: CoSANA Model Urban Land and Water Use Budget

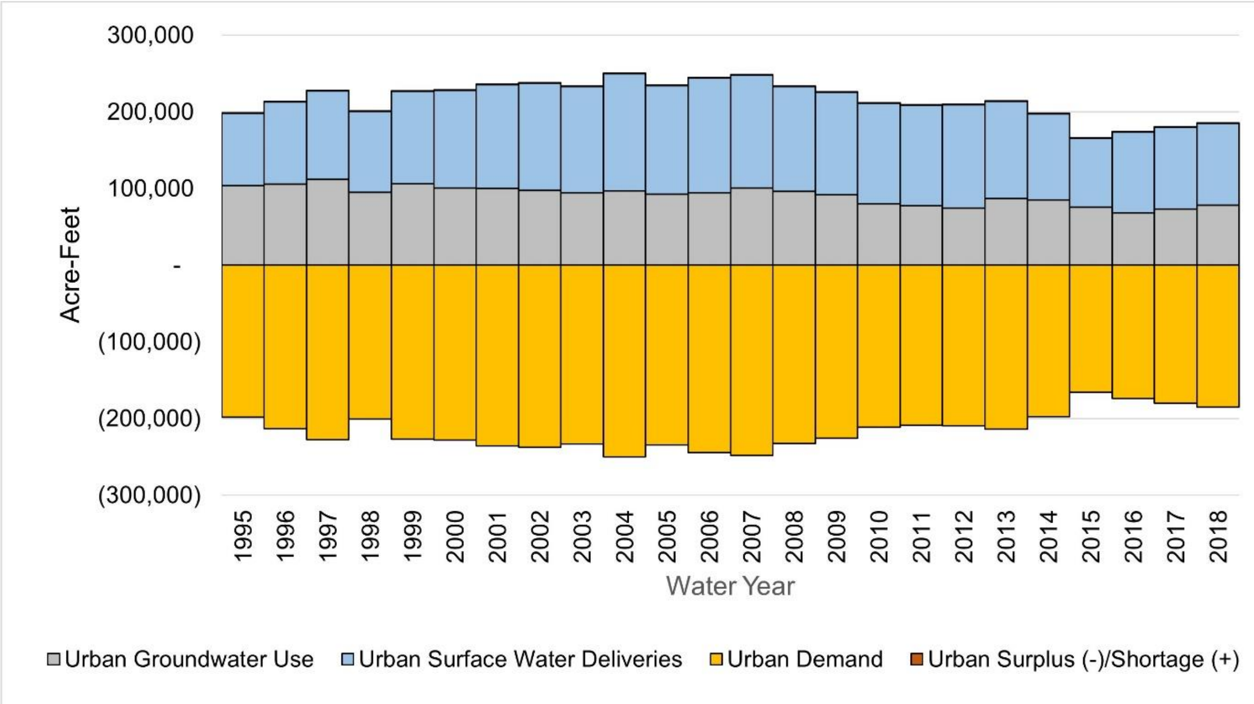


Figure 4-12: NASb Urban Land and Water Use Budget

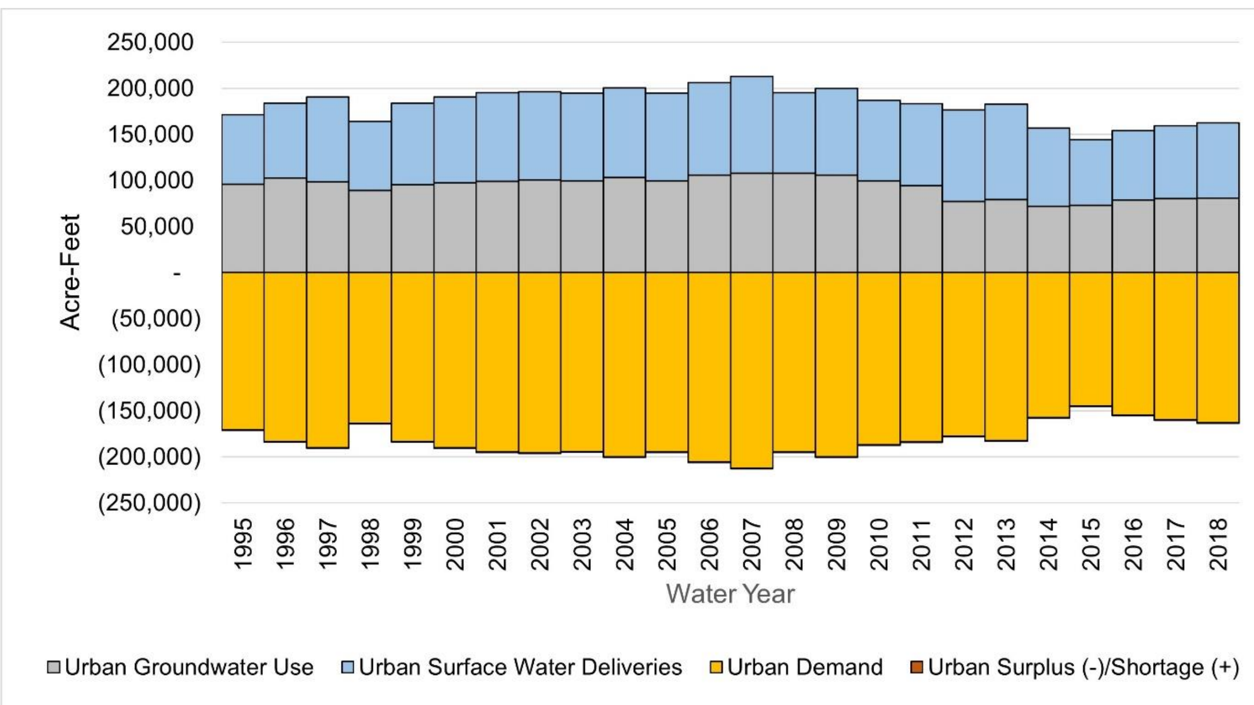
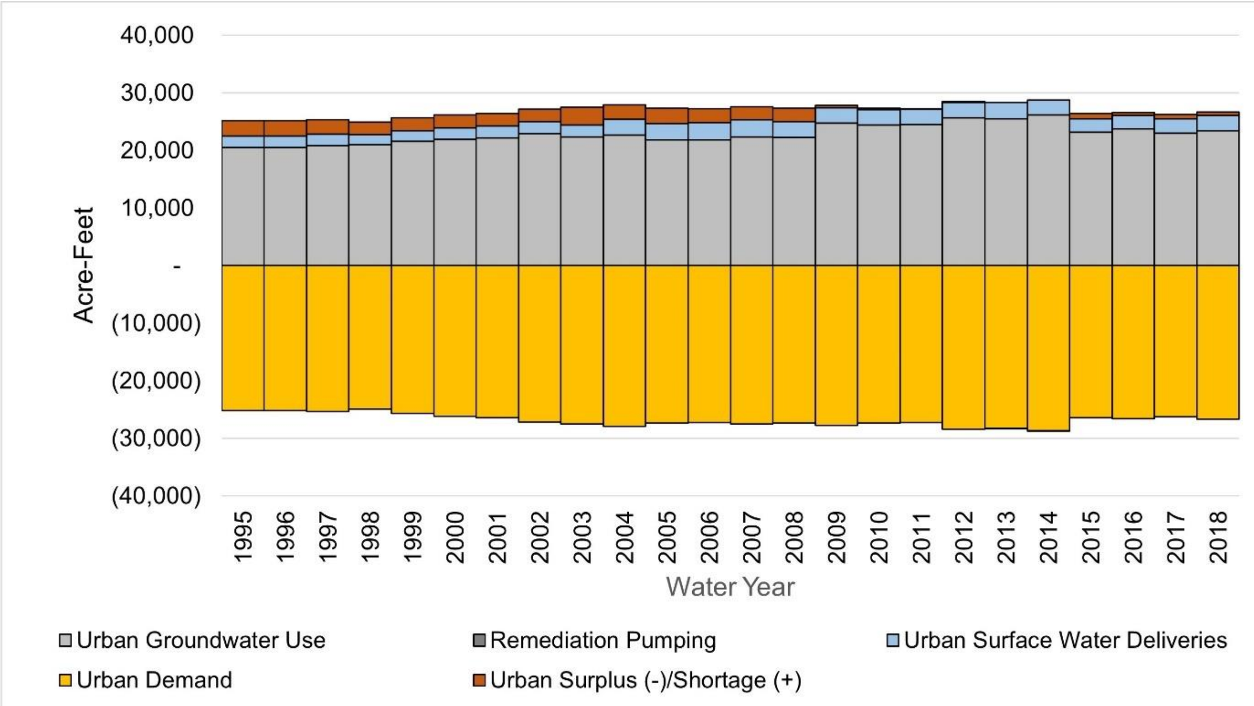


Figure 4-13: SASb Urban Land and Water Use Budget



Note: Urban groundwater use is specified in the CoSb model input data set. The model-calculated surplus/shortage in urban demand is therefore not utilized to calculate the CoSb groundwater budget.

Figure 4-14: CoSb Urban Land and Water Use Budget

4.2.1.2 Groundwater Budget

The groundwater budget quantifies inflows and outflows from the groundwater system. The primary components of the groundwater budget, corresponding to the major hydrologic processes affecting groundwater flow in the model area, are:

- Inflows:
  - Deep percolation (from rainfall and irrigation applied water)
  - Gain from stream (recharge due to stream seepage)
  - Recharge (from other sources such as irrigation canal seepage and recharge ponds)
  - Boundary inflow (from outside the model area)
  - Net subsurface inflow (from adjacent subregions)
- Outflows:
  - Groundwater pumping
  - Loss to stream (outflow to streams and rivers)
  - Boundary outflow (to outside the model area)
  - Subsurface outflow (to adjacent subregions)
- Change in groundwater storage (positive indicates withdrawal from groundwater storage, and negative indicates contribution to groundwater storage)

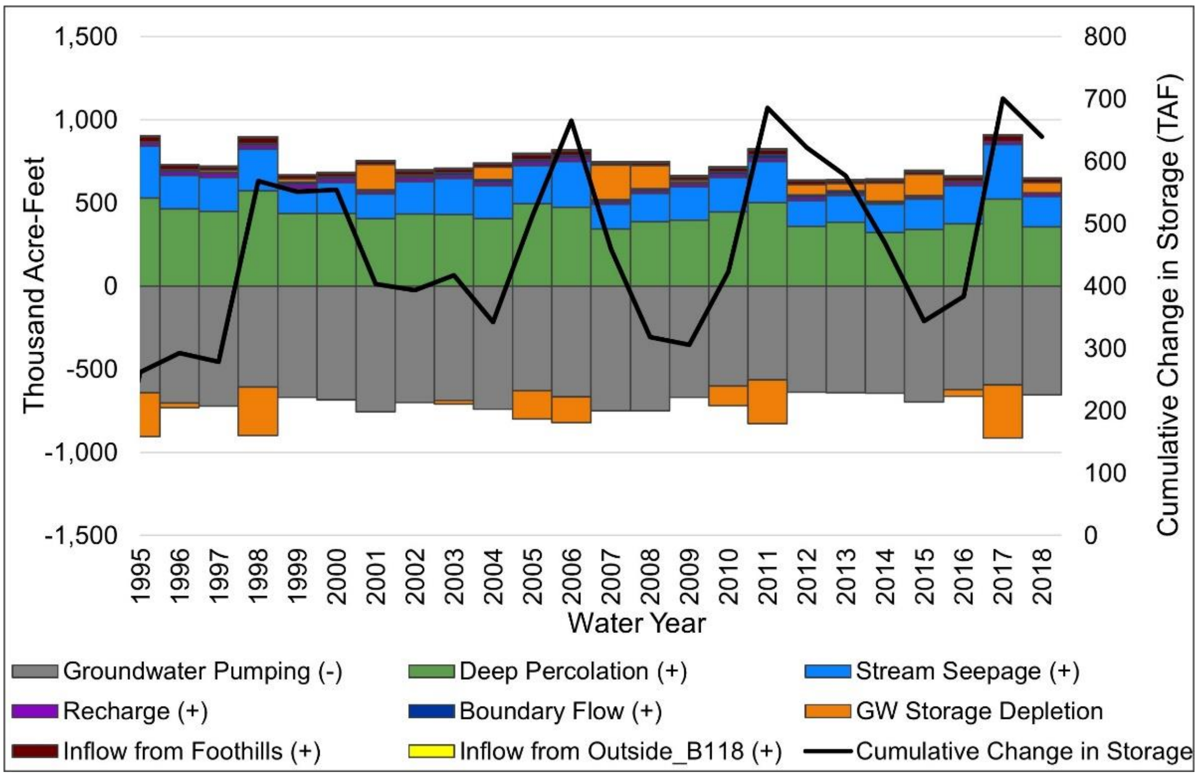
The groundwater budgets, including cumulative change in storage, are summarized in Table 4-2 and shown in Figure 4-15 through Figure 4-18 for three subbasins combined and for the NASb, SASb, and CoSb, respectively. Though results vary area to area, the primary sources of groundwater inflows are deep percolation and interaction with the model streams.

Subregion-level budgets are provided in Appendix E.

Table 4-2: Summary of CoSANA Groundwater Budget
(Average Annual for the Period WY 1995-2018)

Subbasin	Pumping (AFY)	Deep Percolation (AFY)	Gain from Stream (AFY)	Recharge from Canals (AFY)	Subsurface Inflow (AFY)	Boundary Flows (AFY)	Change in Storage (AFY)
NASb	315,794	189,988	85,907	18,320	18,220	30,019	26,661
SASb	221,618	130,317	101,953	15	-8,884	3,769	5,551
CoSb	130,048	108,054	18,977	0	-2,333	-162	-5,510
Total	**667,460**	**428,359**	**206,837**	**18,335**	**7,003***	**11,302**	**26,702**

Note: CoSANA total is a summation of NASb, SASb, and CoSb values and excludes areas outside of these subbasins.
* The model-wide subsurface inflow value includes subsurface flows to and from areas outside of the combined NASb, SASb, and CoSb area.



Note: This figure is a summation of NASb, SASb, and CoSb values and excludes areas outside of these subbasins

Figure 4-15: CoSANA Groundwater Budget

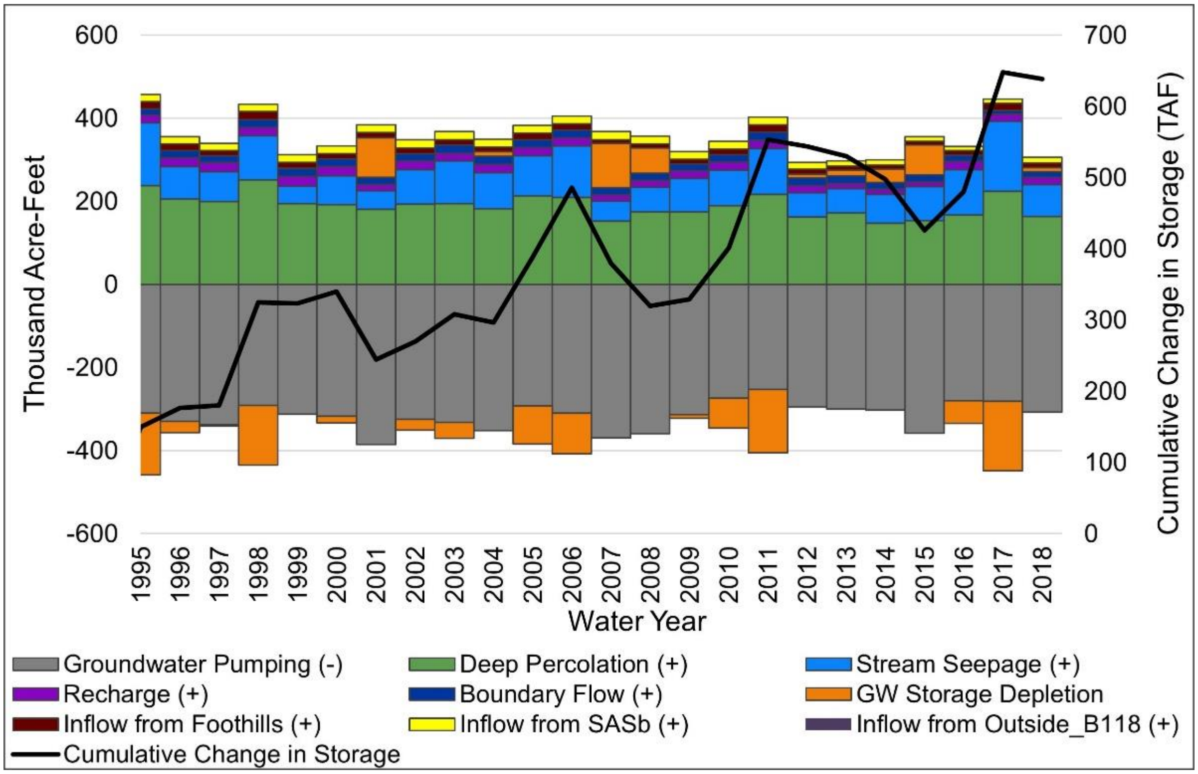


Figure 4-16: NASb Groundwater Budget

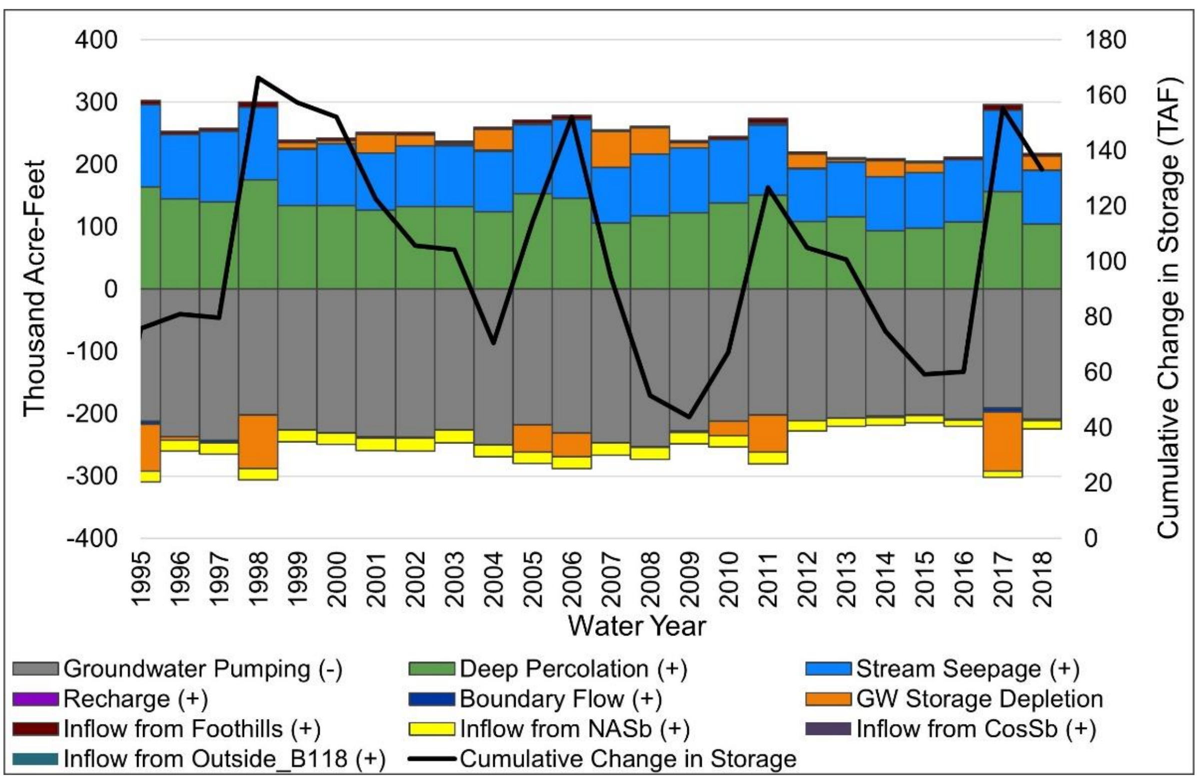


Figure 4-17: SASb Groundwater Budget

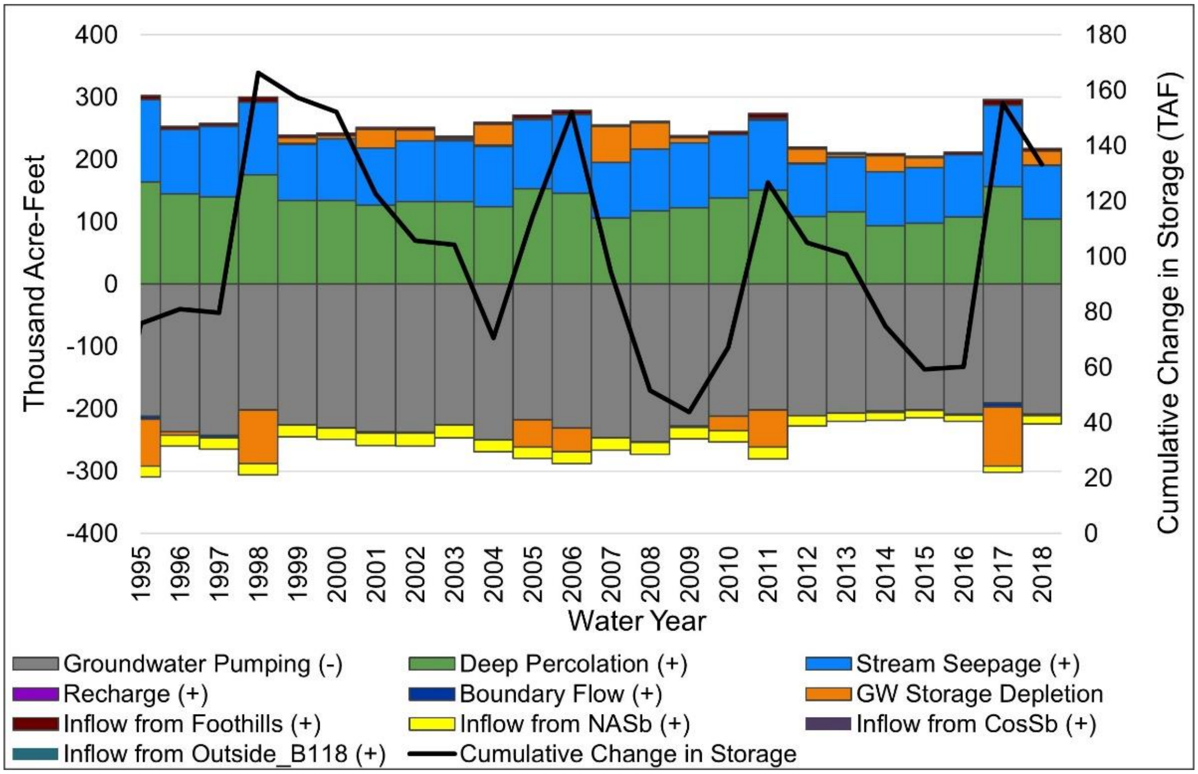


Figure 4-18: CoSb Groundwater Budget

4.2.2 Groundwater Level Calibration

Groundwater levels are calibrated to achieve acceptable agreement between the simulated and observed values (in this case, groundwater levels at the calibration wells). Within CoSANA, over 1,600 wells were evaluated for developing groundwater observation locations (calibration wells) to allow CoSANA's calibration at both a regional and local scale. Data for these wells were obtained from DWR's CASGEM program, DWR's Water Data Library, and local monitoring data from Aerojet, Elk Grove Water District, The Nature Conservancy, and the University of California - Davis. The calibration wells were selected based on their period of record, availability of observation data, spatial distribution across the model, representative nature of the data, and trends of nearby wells. After a review of the available observation data, a working set of 761 wells was selected to be used for the calibration process.

The groundwater level calibration process included both manual refinements to the model as well as automated calibration using the PEST software package. The set of 761 wells with associated observations was used to perform PEST calibration. Of the identified 761 wells, a refined subset of 403 wells that are considered representative of the long-term conditions of groundwater levels both at a local and regional scale were selected for analysis in each PEST run. The location and number of observations for the full set of 761 wells are shown in Figure 4-19, the period of record for each of these wells is shown in Figure 4-20. Maps showing the locations of each of the 403 wells in the subset and calibration hydrographs are shown in Appendix F.

With the observation data identified, a preliminary manual calibration was performed to adjust the water budgets, primarily the land and water use budgets and the small watershed budgets, to have a reasonable starting point for calibrating the aquifer parameters. Simulated groundwater levels are calibrated to observed levels through adjustments to hydrogeologic parameters or aquifer parameters including hydraulic conductivity, specific storage, and specific yield (discussed in Section 4.4). Input datasets were also refined where the calibration process identified issues. The goal of groundwater level calibration is to achieve the maximum agreement between simulated and observed groundwater elevations at calibration wells while maintaining reasonable values for aquifer parameters.

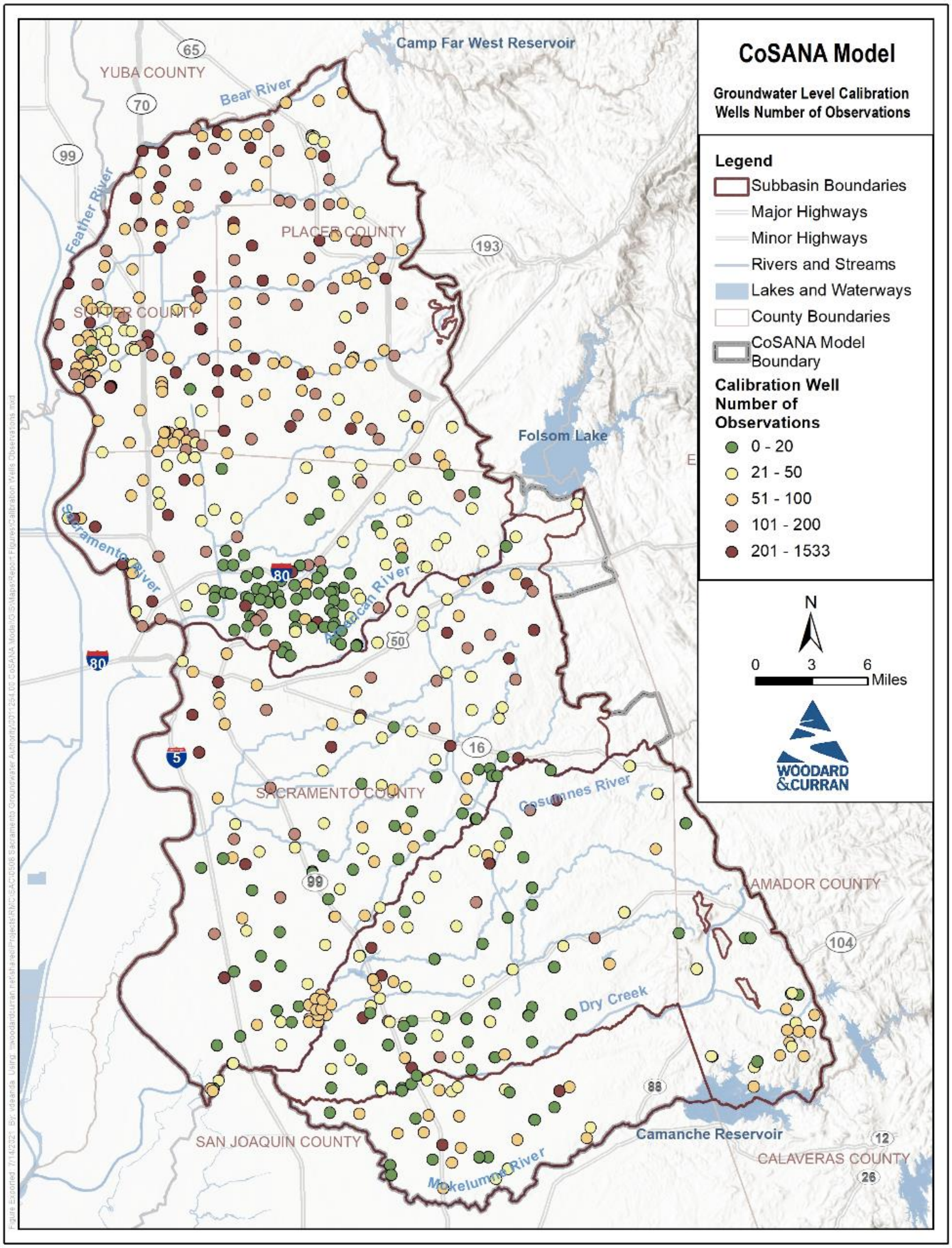


Figure 4-19: Number of Observations for Calibration Wells

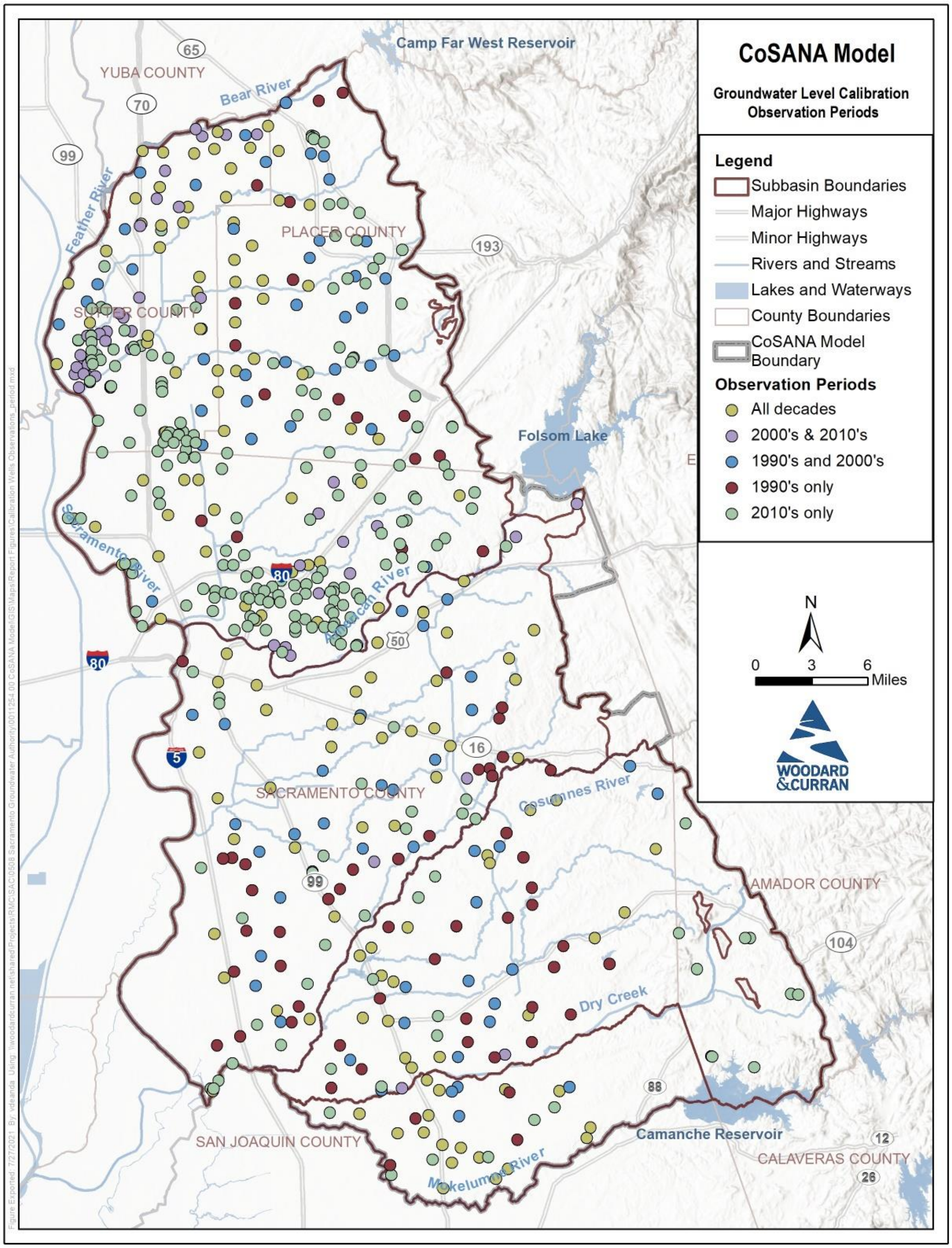


Figure 4-20: Period of Record for Calibration Wells

The automated parameter estimation tool, PEST, was used to assist in refinement of aquifer parameters to improve model calibration. PEST-assisted calibration is performed to interact with CoSANA via input and output files and iteratively modifies parameter values to reduce an objective function representative of the model residual error. These modifications are made within identified bounds of reasonable values for each parameter. PEST-assisted calibration focused on the aquifer parameters such as horizontal and vertical conductivities and storage parameters.

Between PEST-assisted calibration iterations, the modeling team revisited the land system and small watershed budgets and made manual adjustments where needed, until calibration goals were met.

Simulated groundwater level contours and observed values for calibration wells are shown in Figure 4-21, Figure 4-22, and Figure 4-23 for spring 1998, fall 2015, and fall 2018, respectively. Simulated groundwater level hydrographs and observations for selected wells (locations shown in Figure 4-24) are shown in Figure 4-25 through Figure 4-49. Simulated values represent the layers screened at that well, except for 7223 and 7224 which do not have screened interval information.

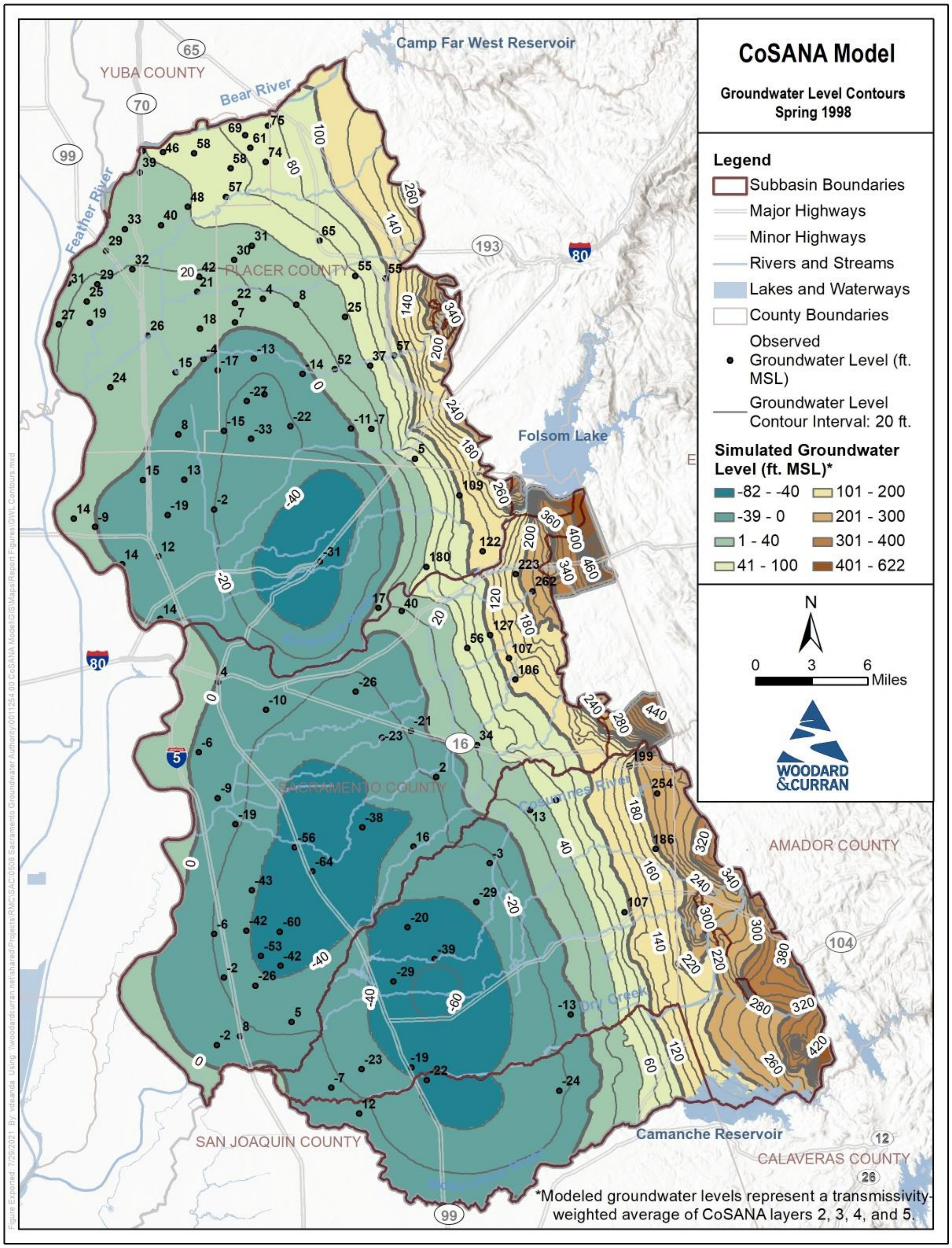


Figure 4-21: CoSANA Groundwater Level Contours – Spring 1998 (End of Wet Period)

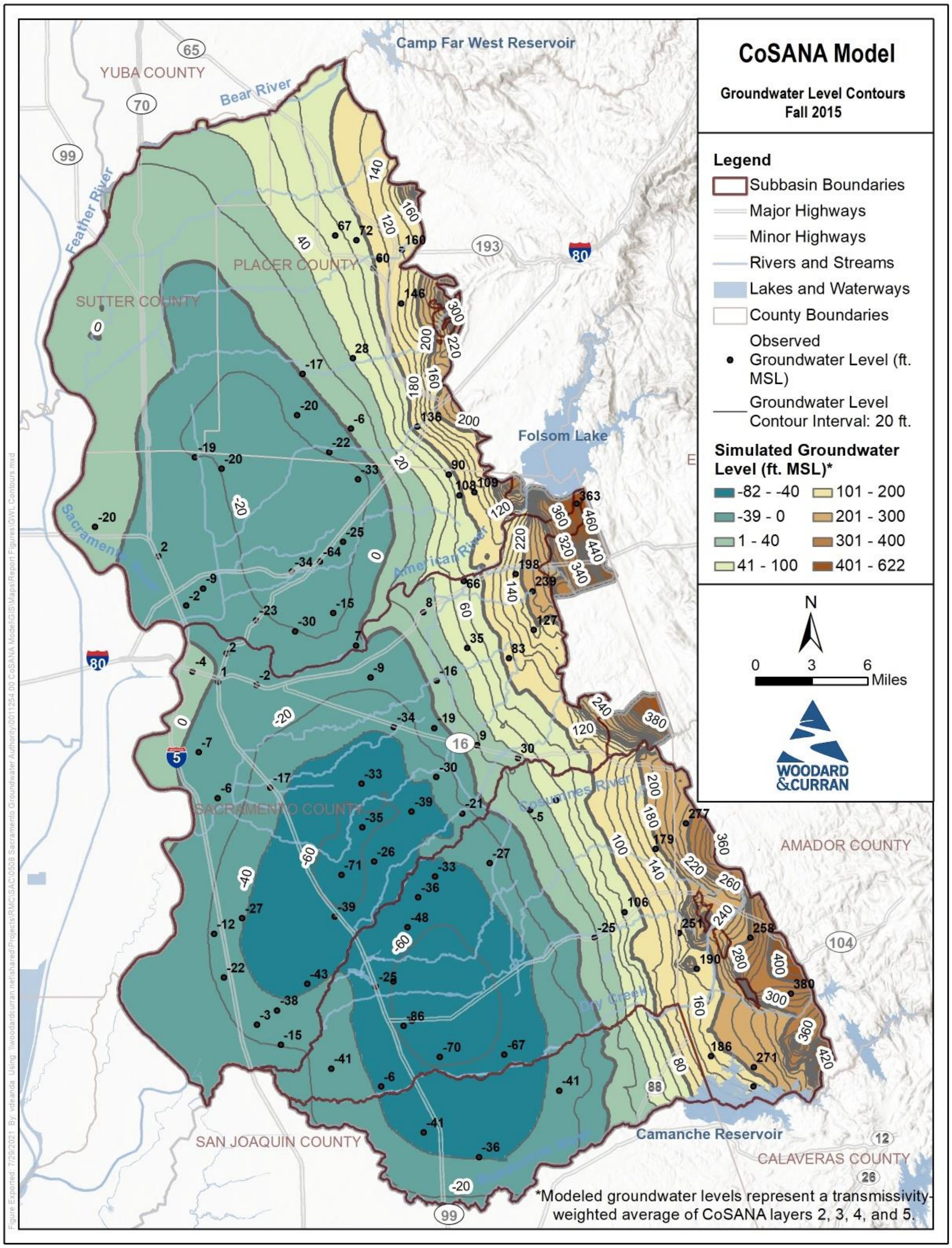


Figure 4-22: CoSANA Groundwater Level Contours – Fall 2015 (End of Drought Period)

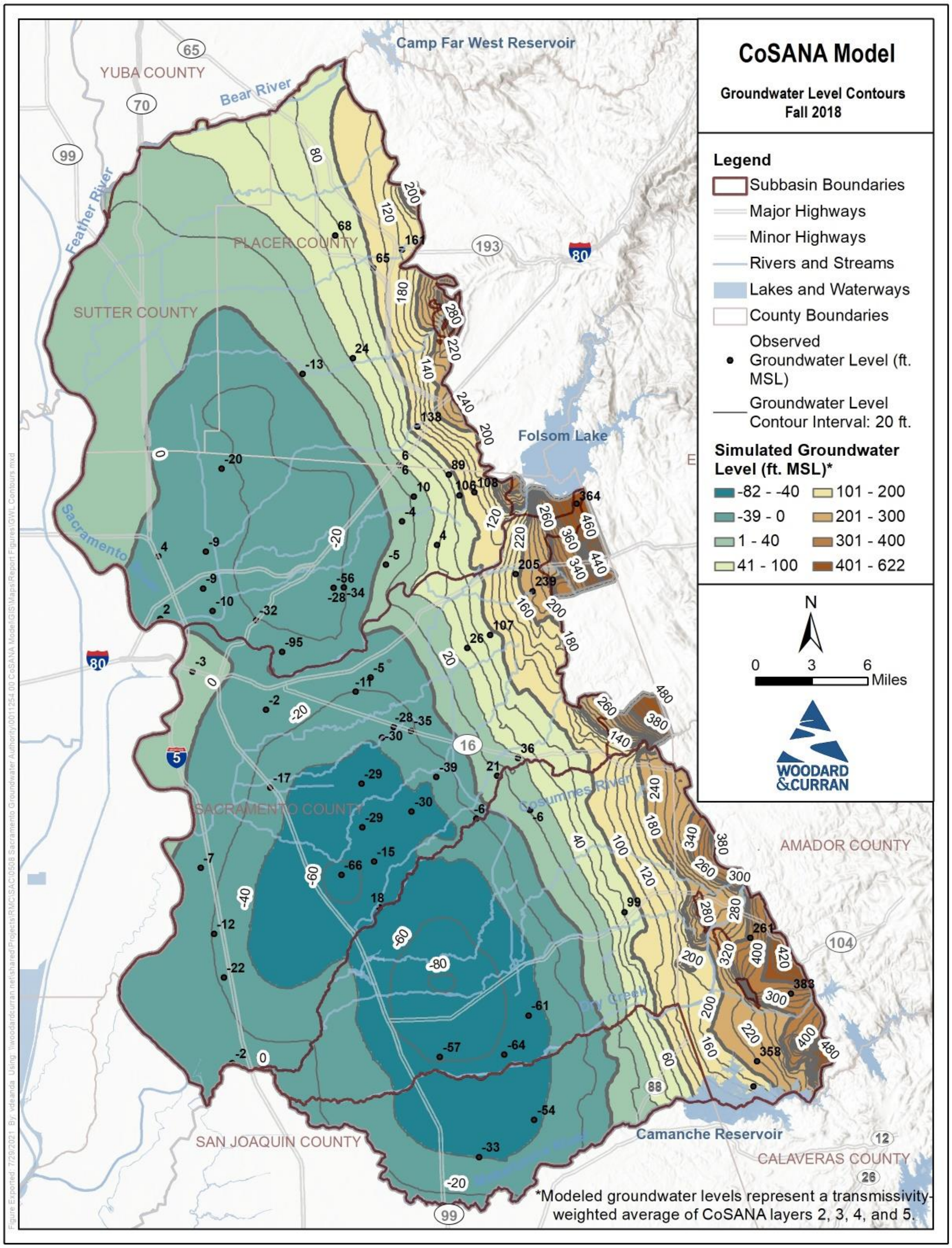


Figure 4-23: CoSANA Groundwater Level Contours – Fall 2018 (End of Simulation)

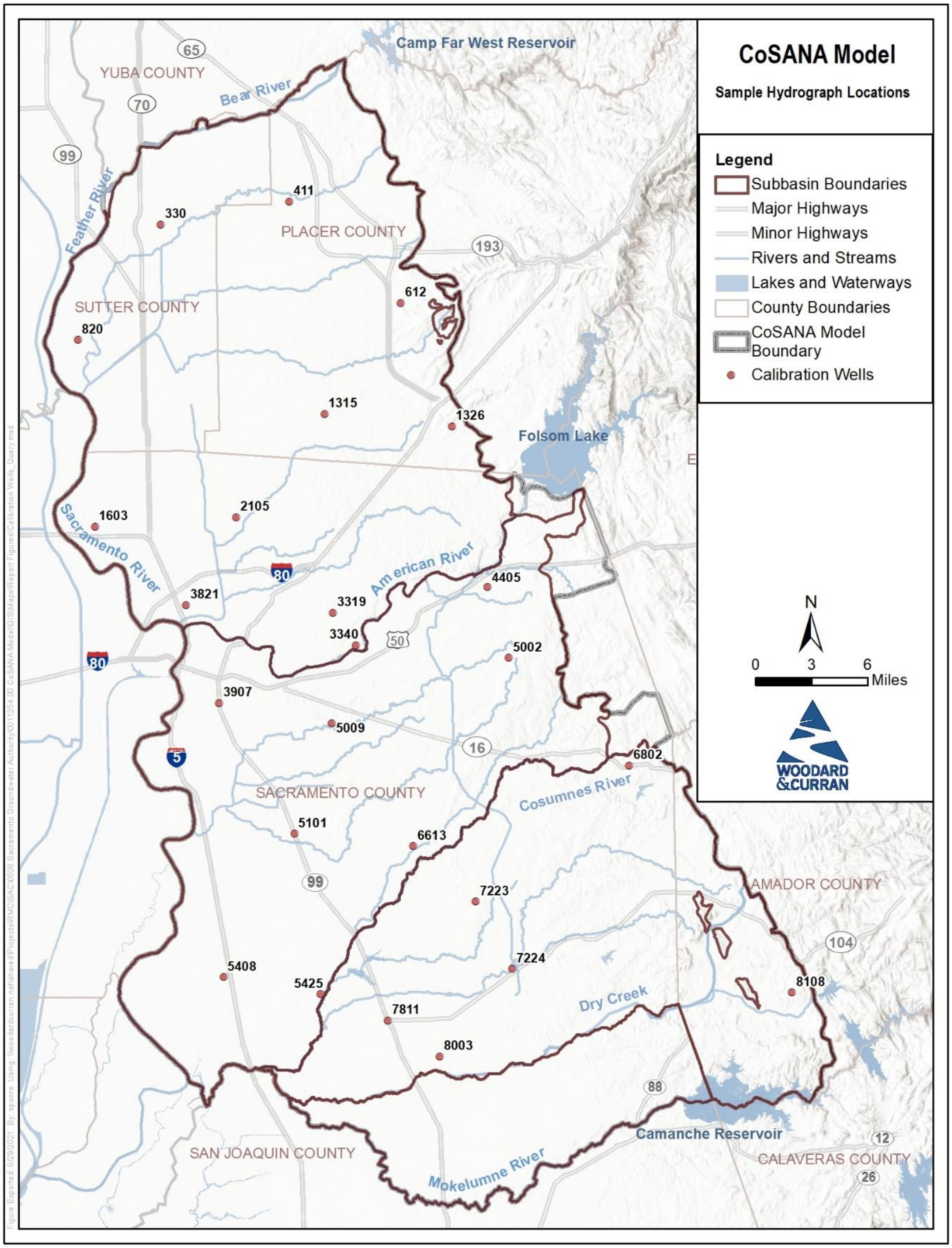


Figure 4-24: Location of Sample Hydrographs

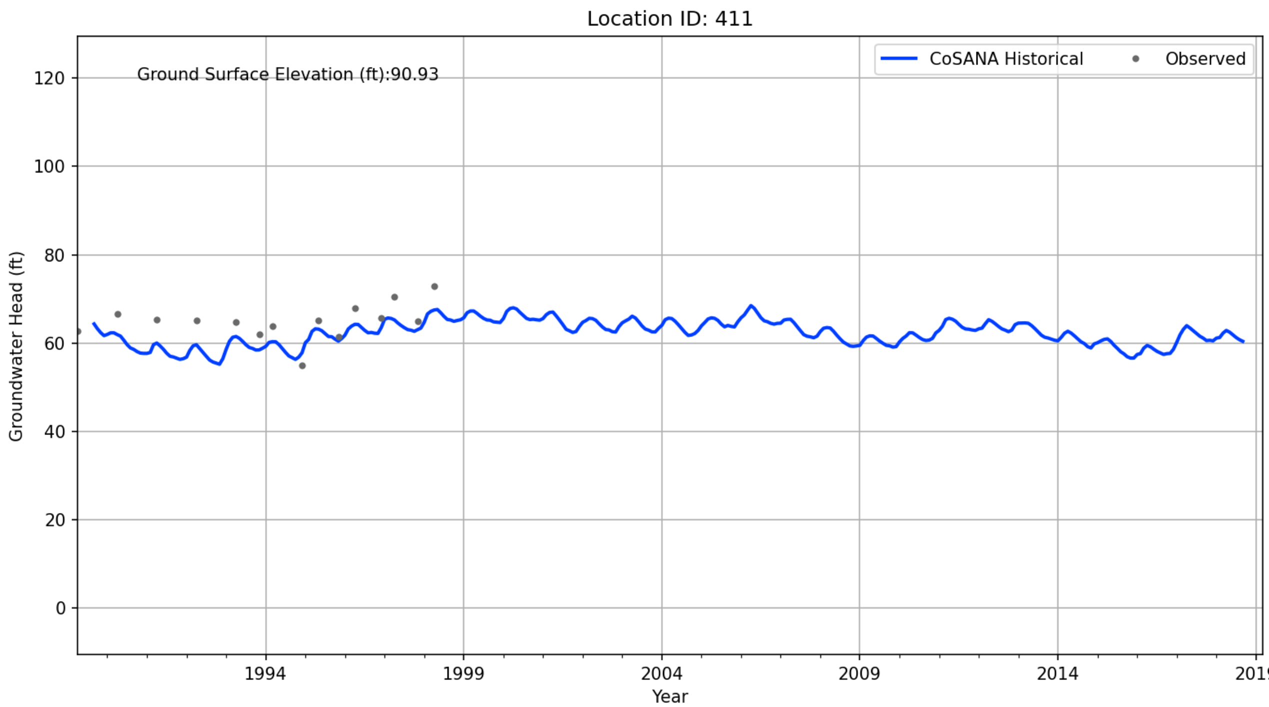


Figure 4-25: CoSANA Groundwater Level Hydrograph – Hydrograph #1

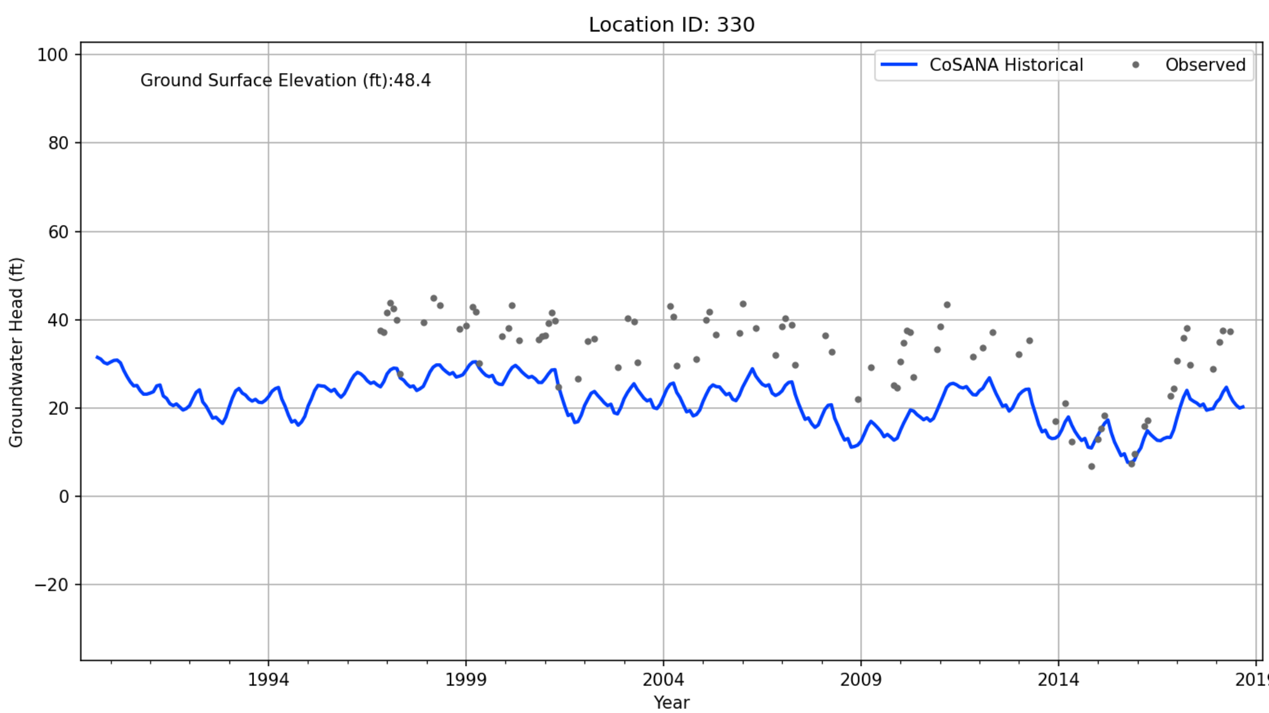


Figure 4-26: CoSANA Groundwater Level Hydrograph – Hydrograph #2

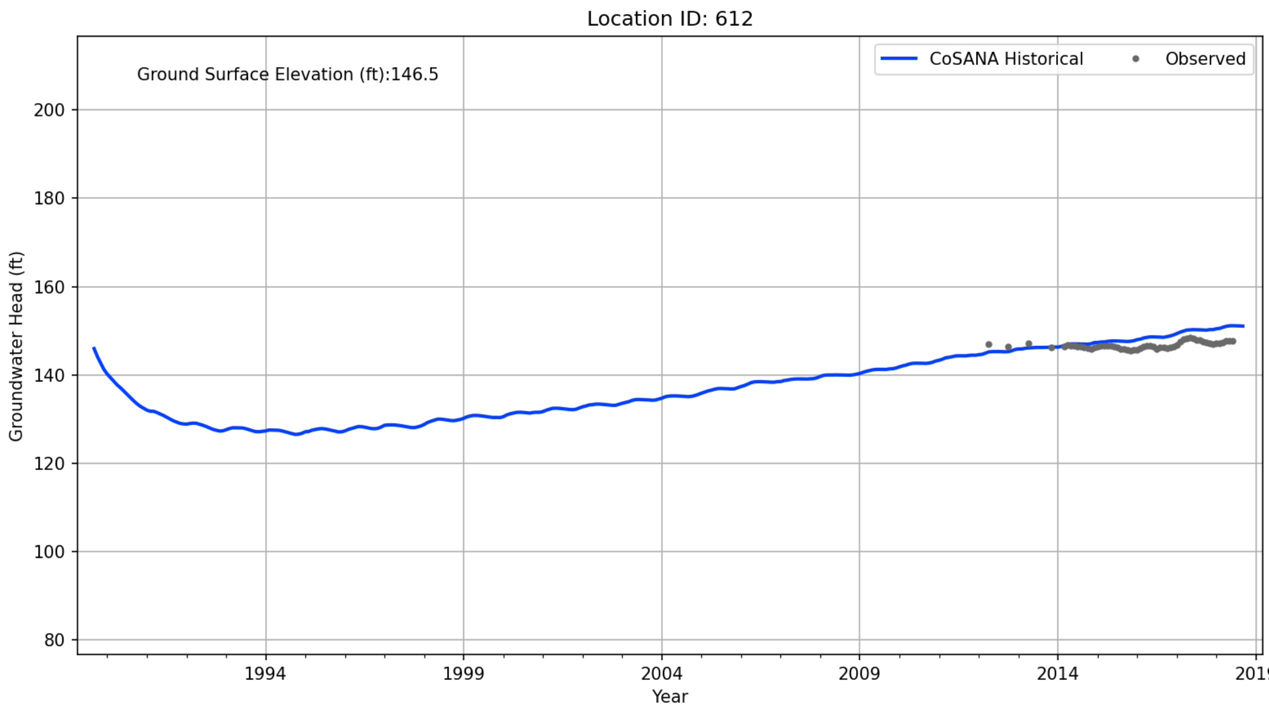


Figure 4-27: CoSANA Groundwater Level Hydrograph – Hydrograph #3

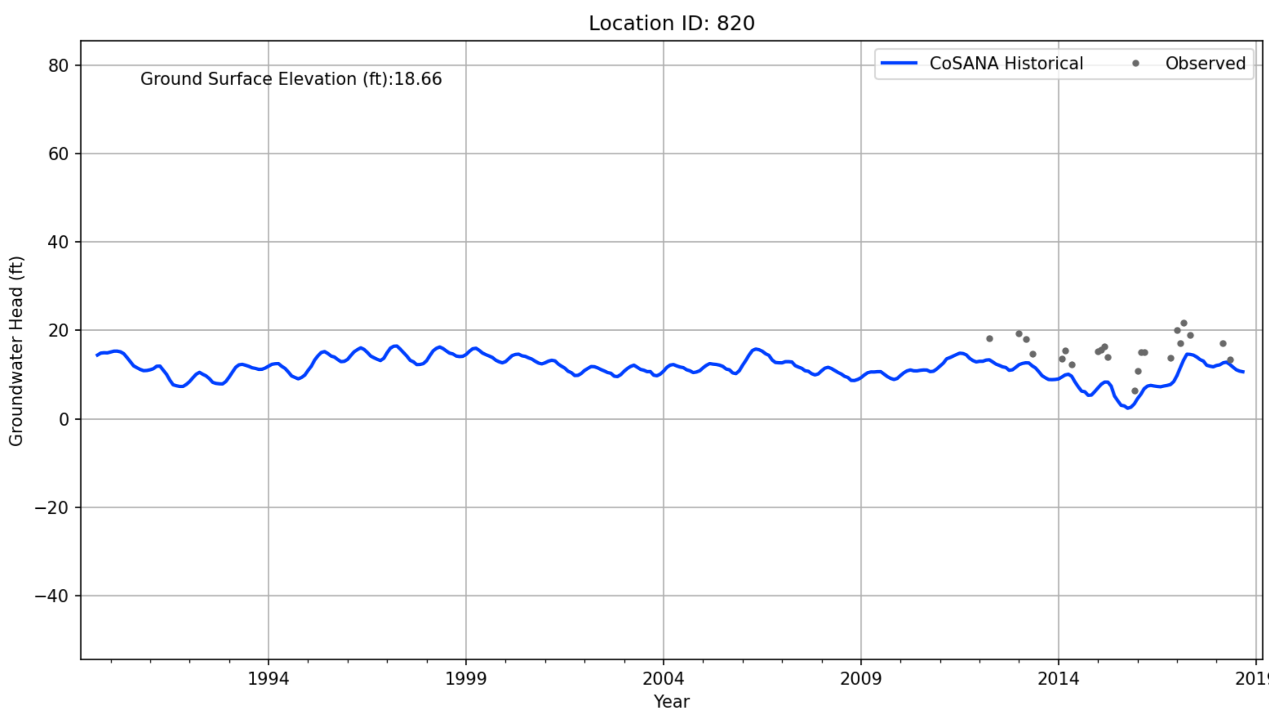


Figure 4-28: CoSANA Groundwater Level Hydrograph – Hydrograph #4

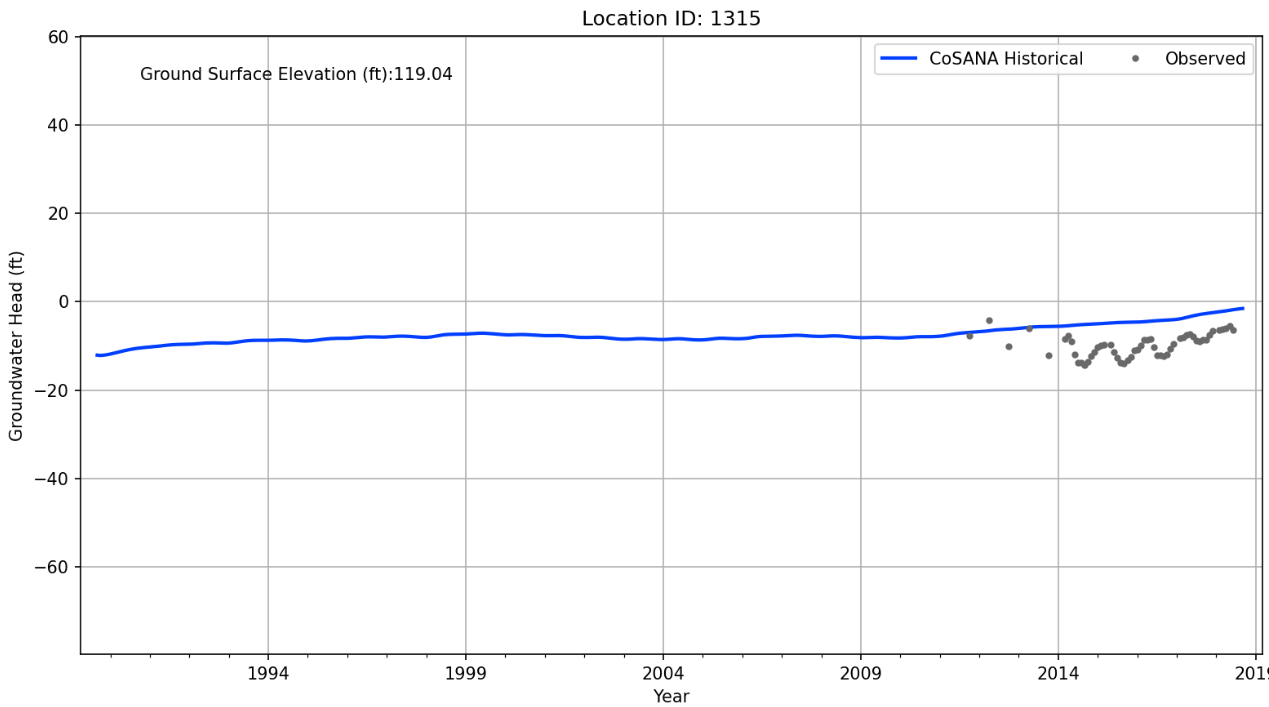


Figure 4-29: CoSANA Groundwater Level Hydrograph – Hydrograph #5

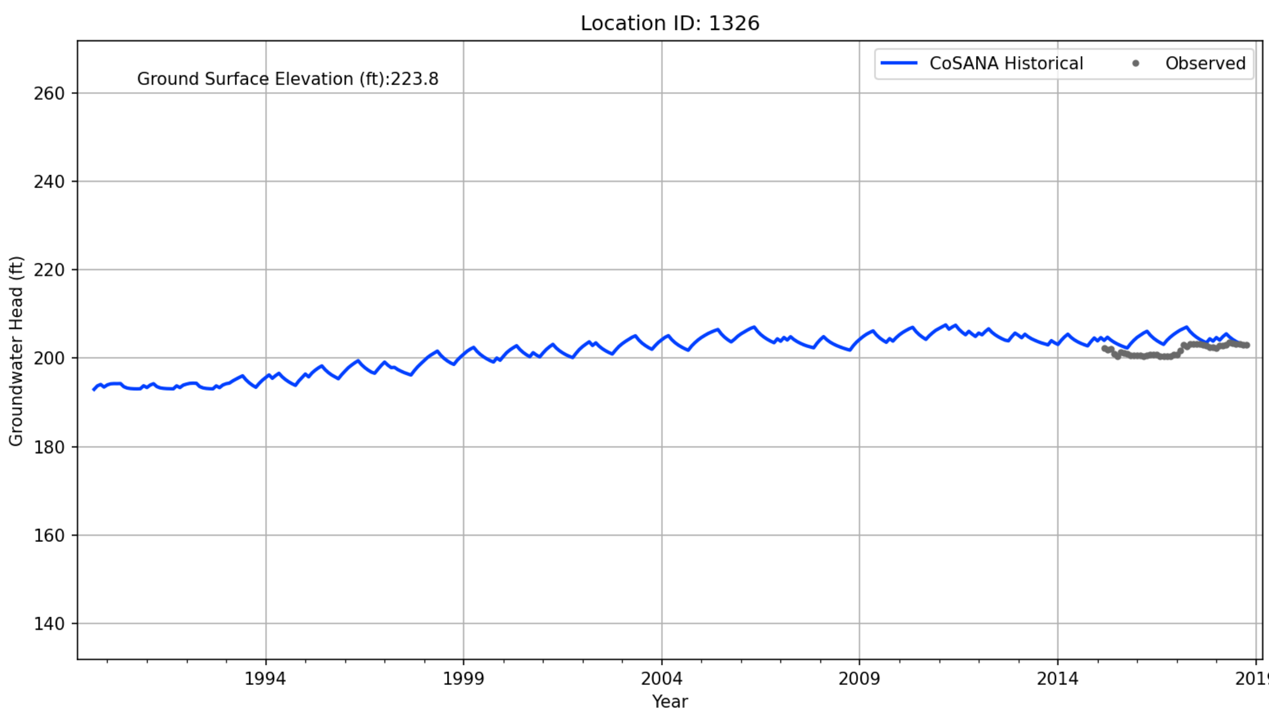


Figure 4-30: CoSANA Groundwater Level Hydrograph – Hydrograph #6

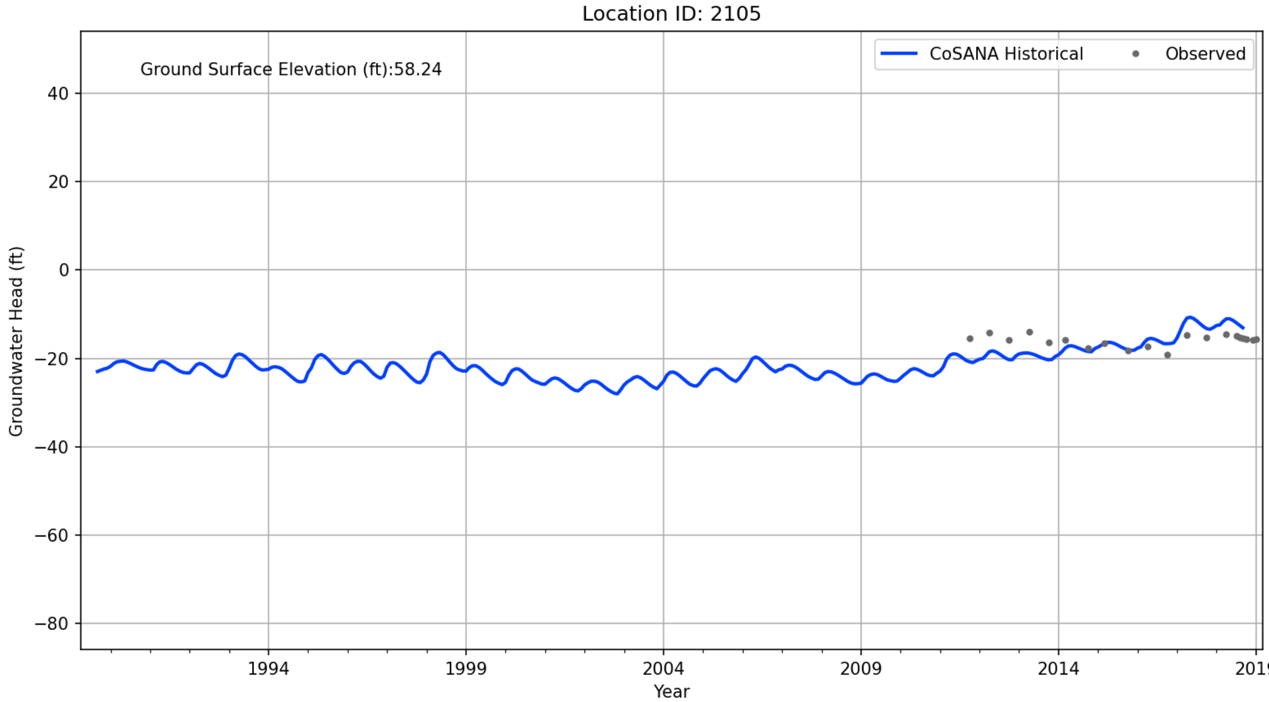


Figure 4-31: CoSANA Groundwater Level Hydrograph – Hydrograph #7

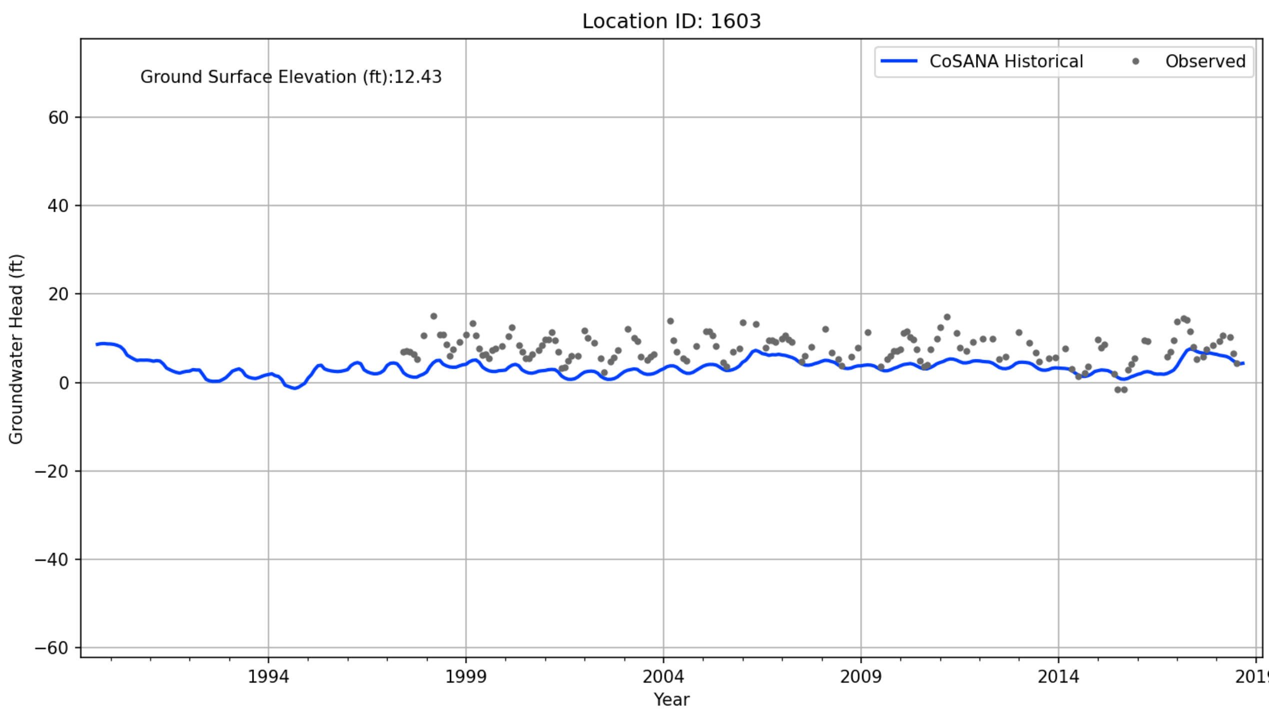


Figure 4-32: CoSANA Groundwater Level Hydrograph – Hydrograph #8

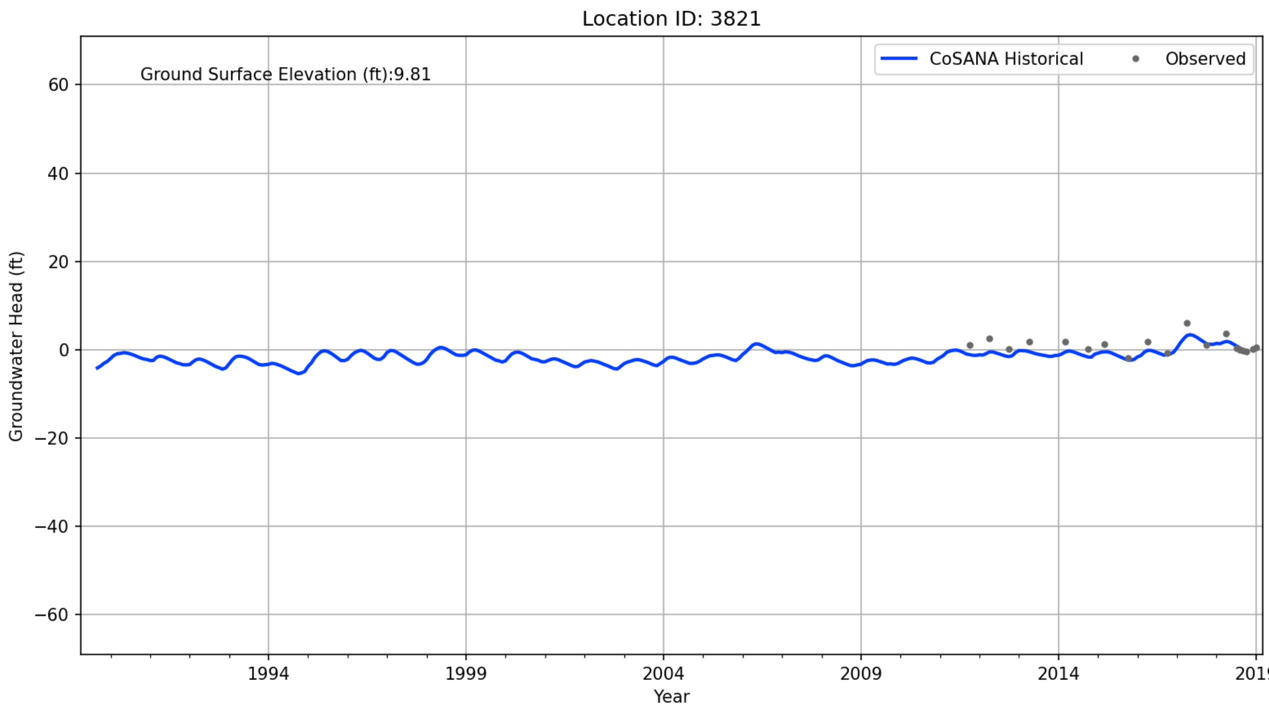


Figure 4-33: CoSANA Groundwater Level Hydrograph – Hydrograph #9

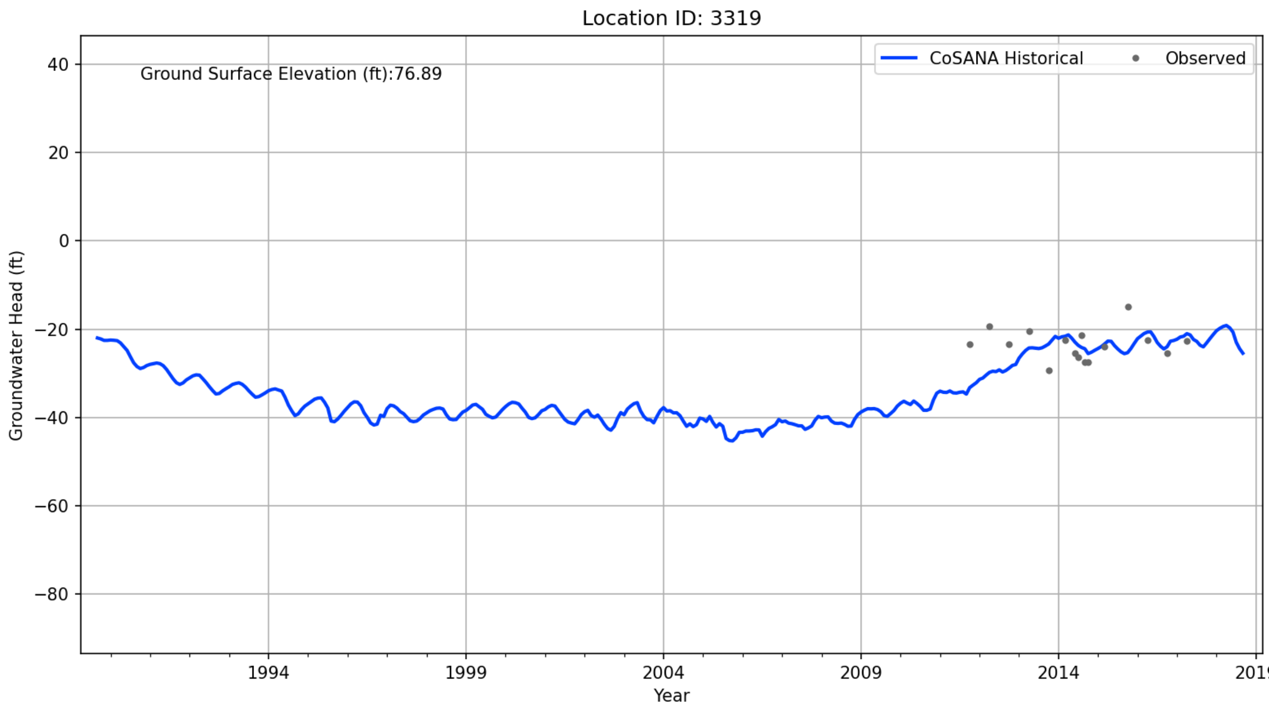


Figure 4-34: CoSANA Groundwater Level Hydrograph – Hydrograph #10

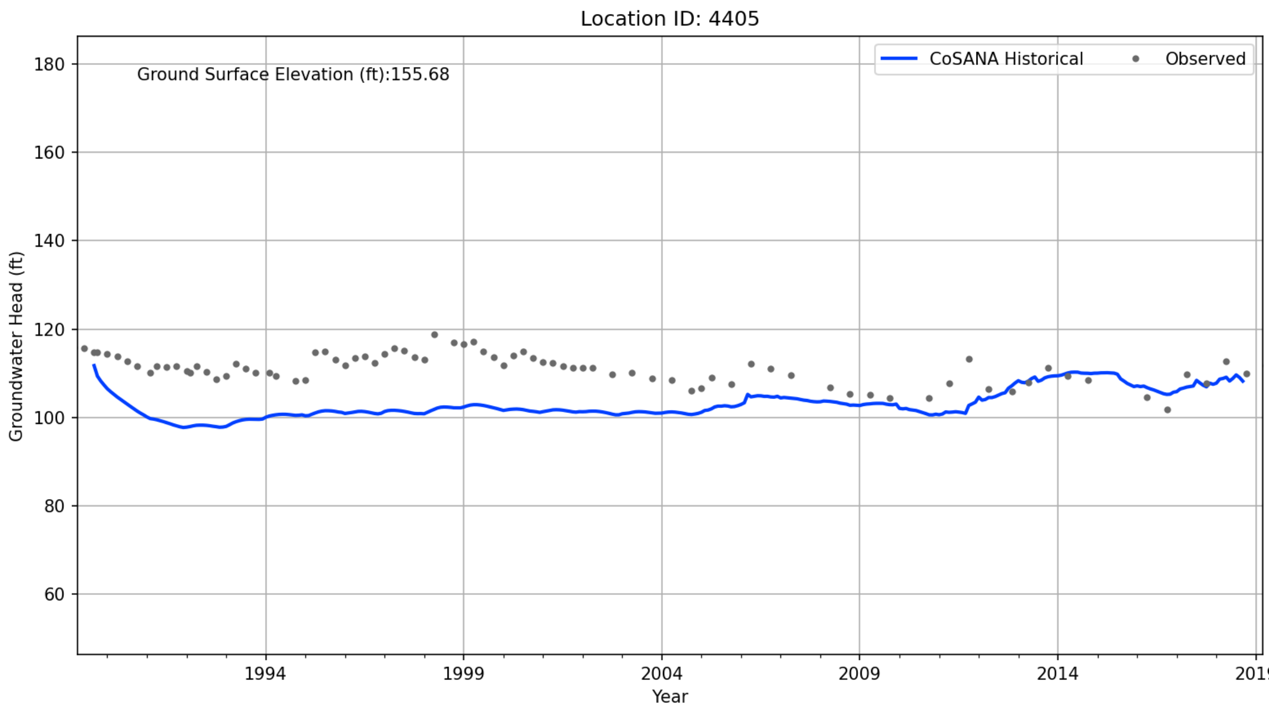


Figure 4-35: CoSANA Groundwater Level Hydrograph – Hydrograph #11

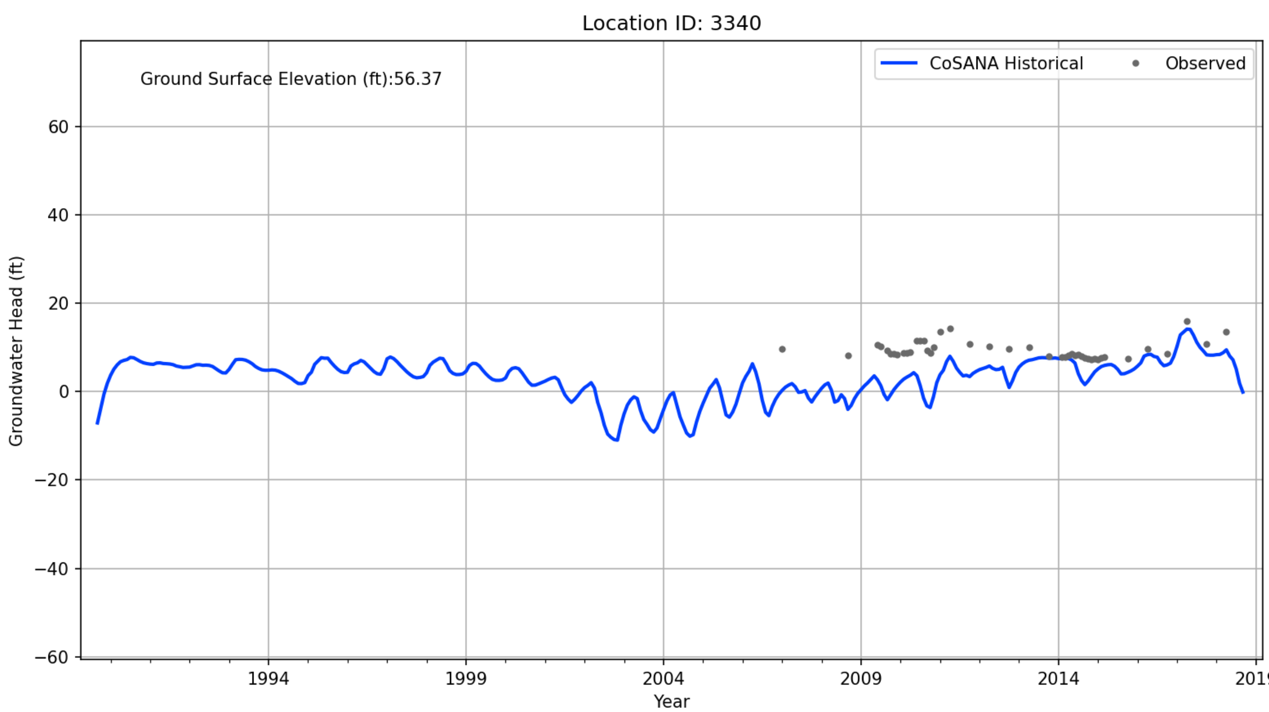


Figure 4-36: CoSANA Groundwater Level Hydrograph – Hydrograph #12

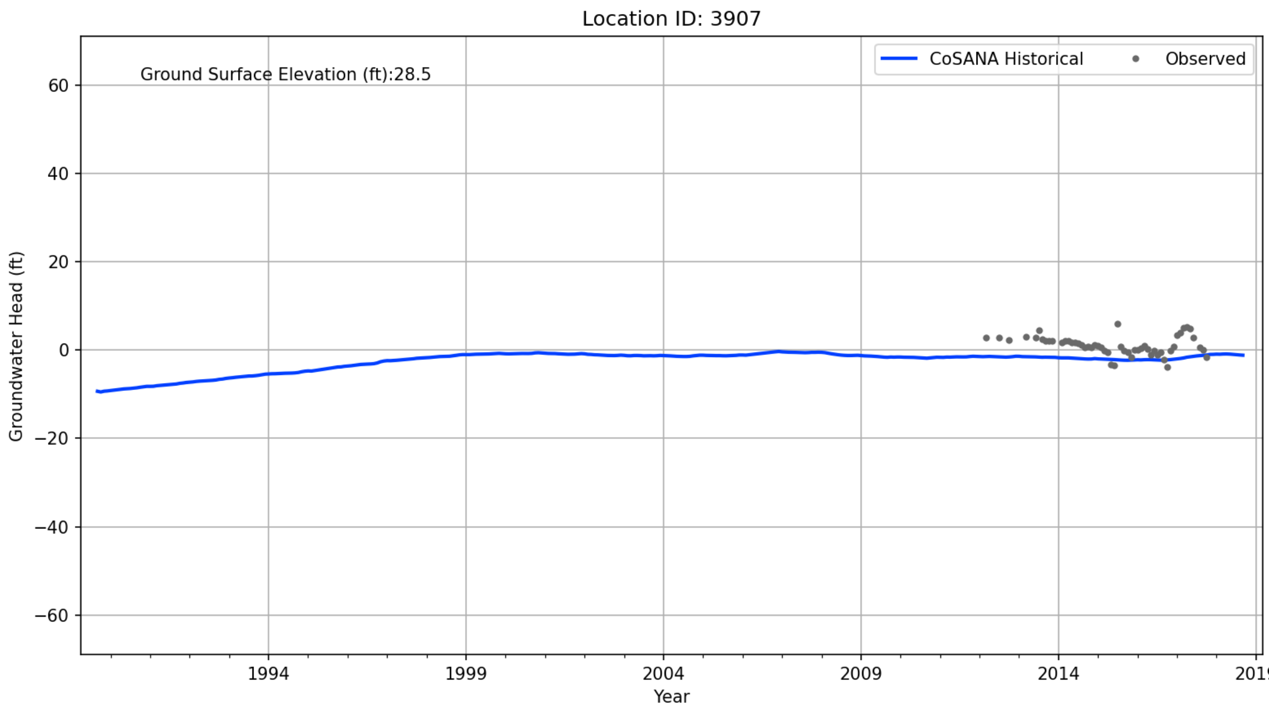


Figure 4-37: CoSANA Groundwater Level Hydrograph – Hydrograph #13

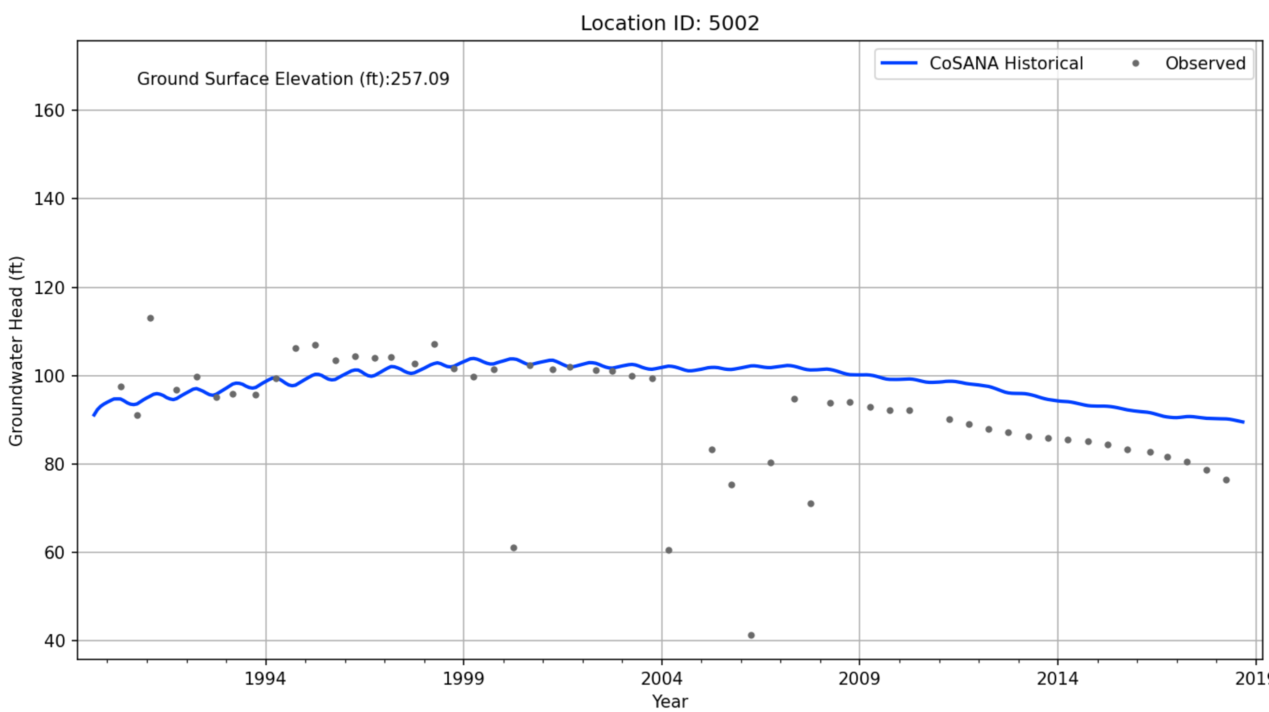


Figure 4-38: CoSANA Groundwater Level Hydrograph – Hydrograph #14

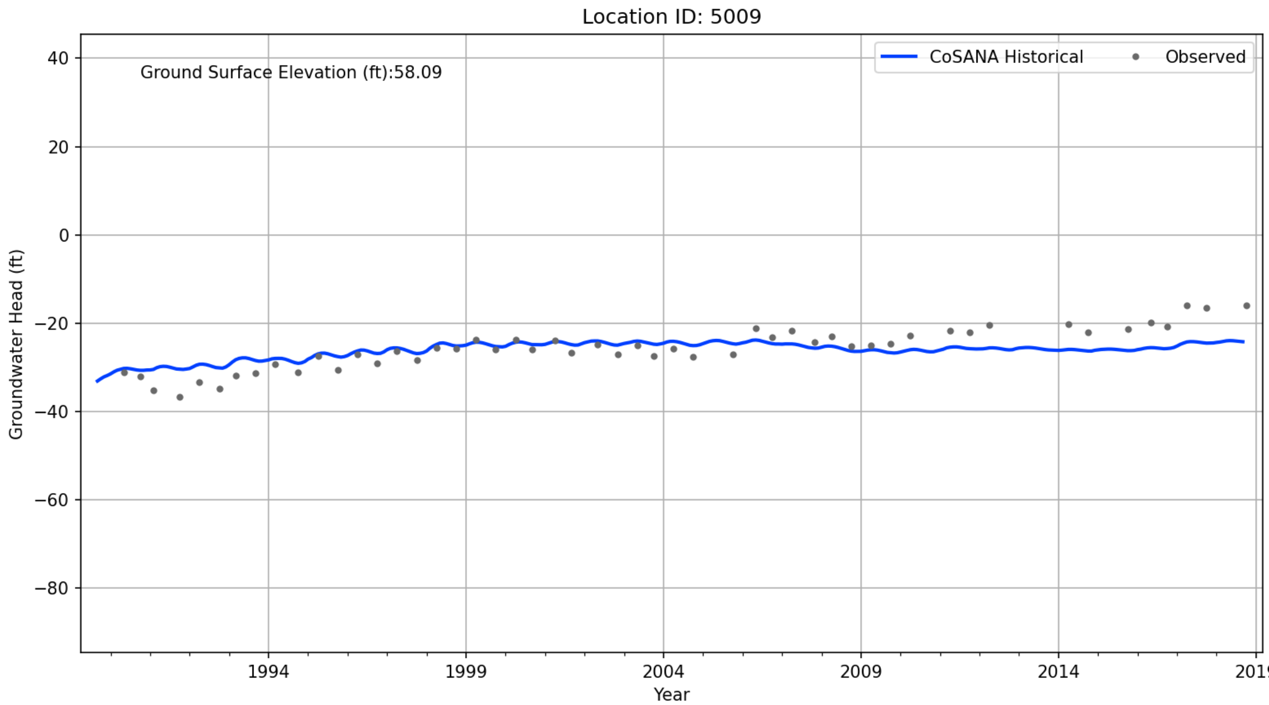


Figure 4-39: CoSANA Groundwater Level Hydrograph – Hydrograph #15

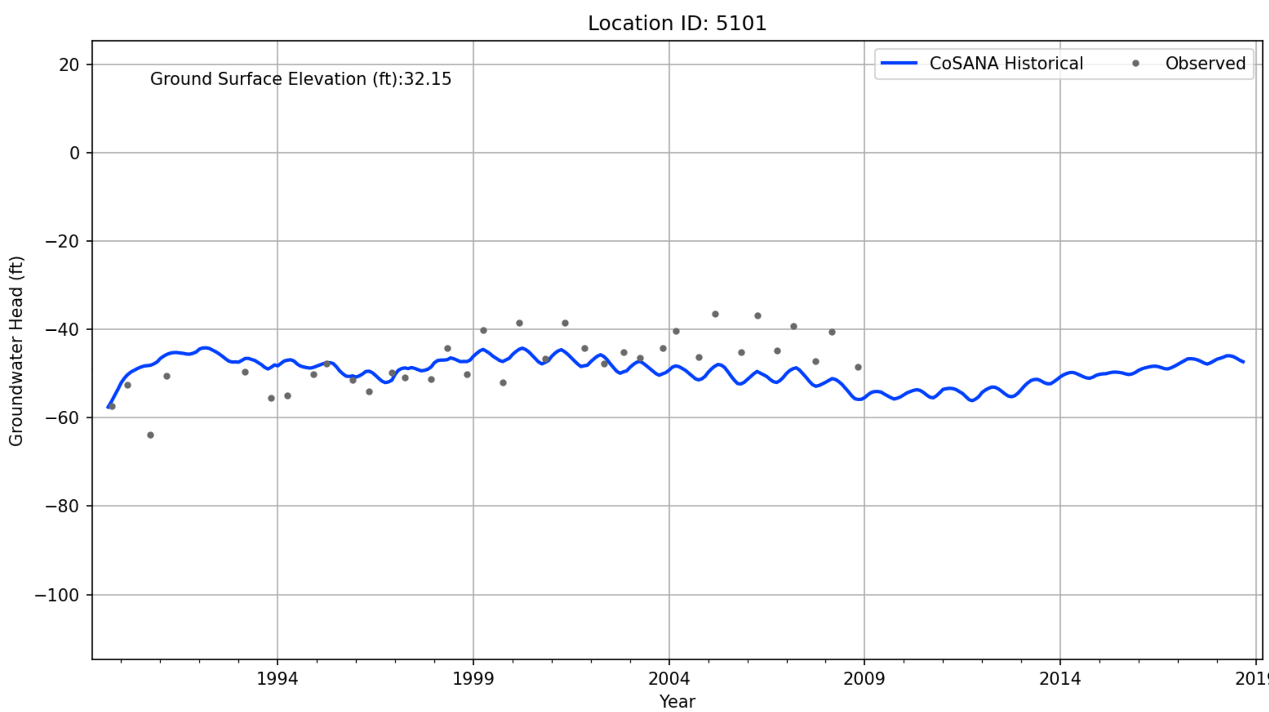


Figure 4-40: CoSANA Groundwater Level Hydrograph – Hydrograph #16

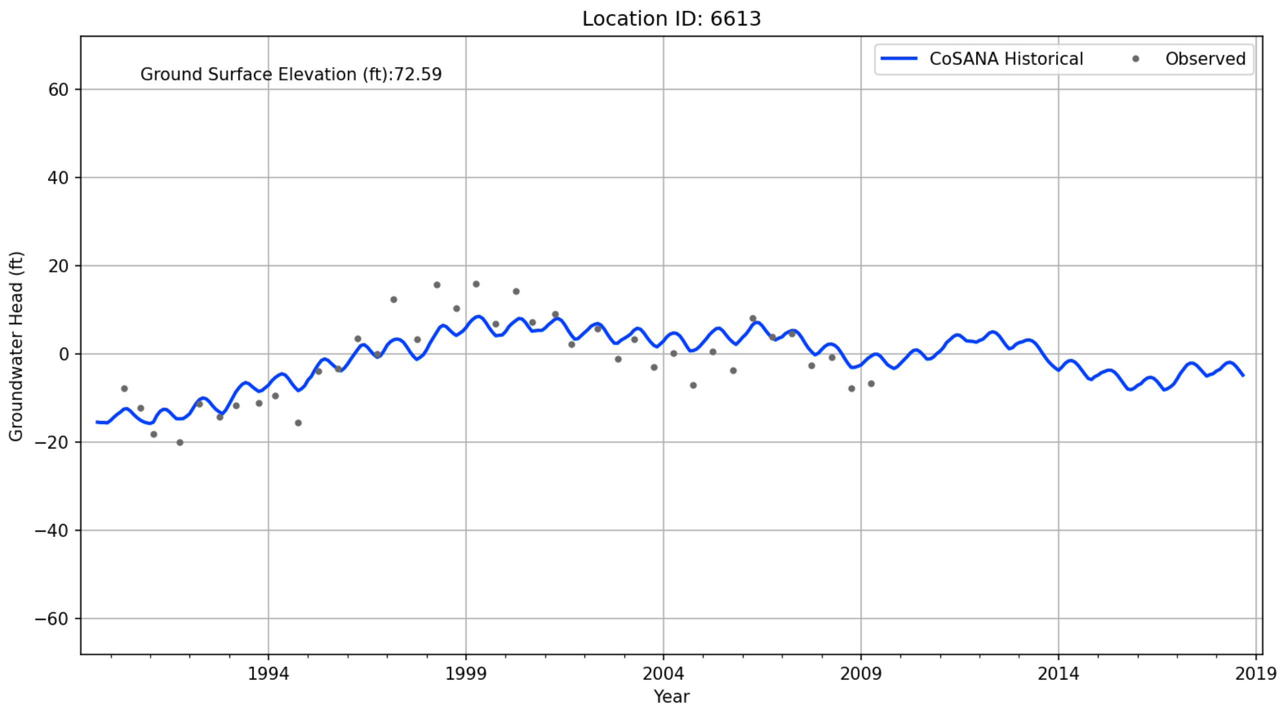


Figure 4-41: CoSANA Groundwater Level Hydrograph – Hydrograph #17

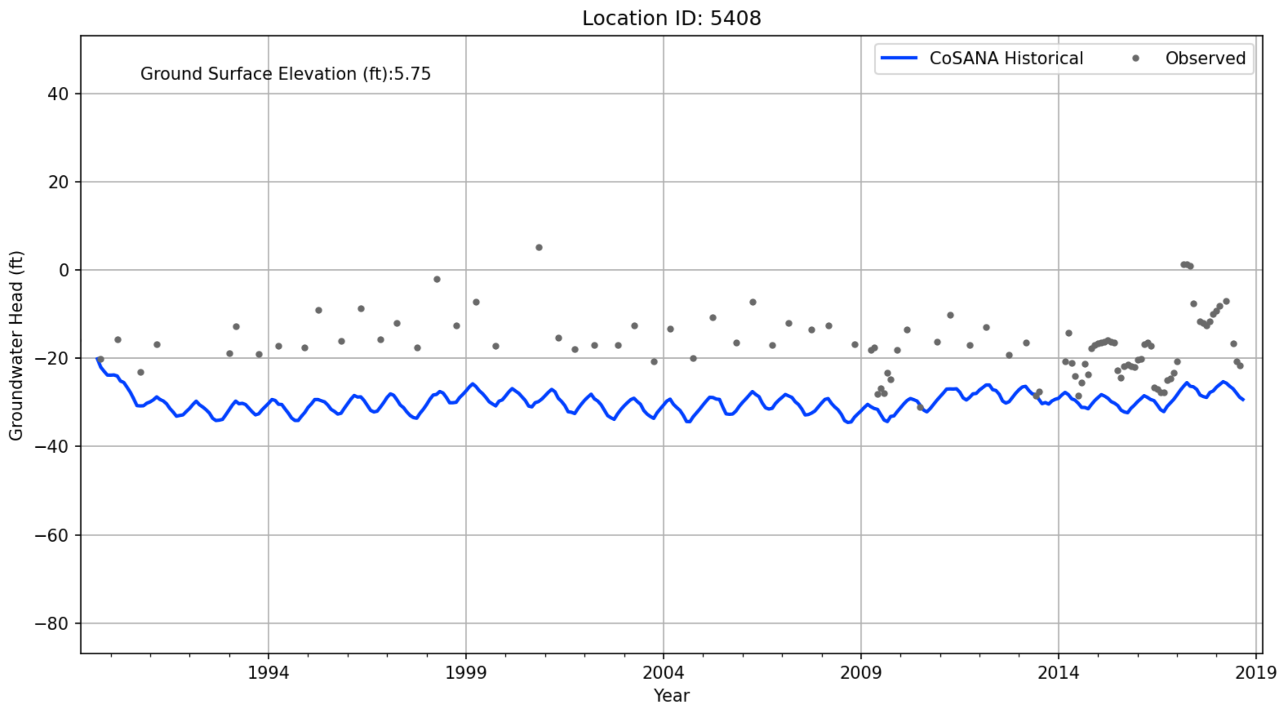


Figure 4-42: CoSANA Groundwater Level Hydrograph – Hydrograph #18

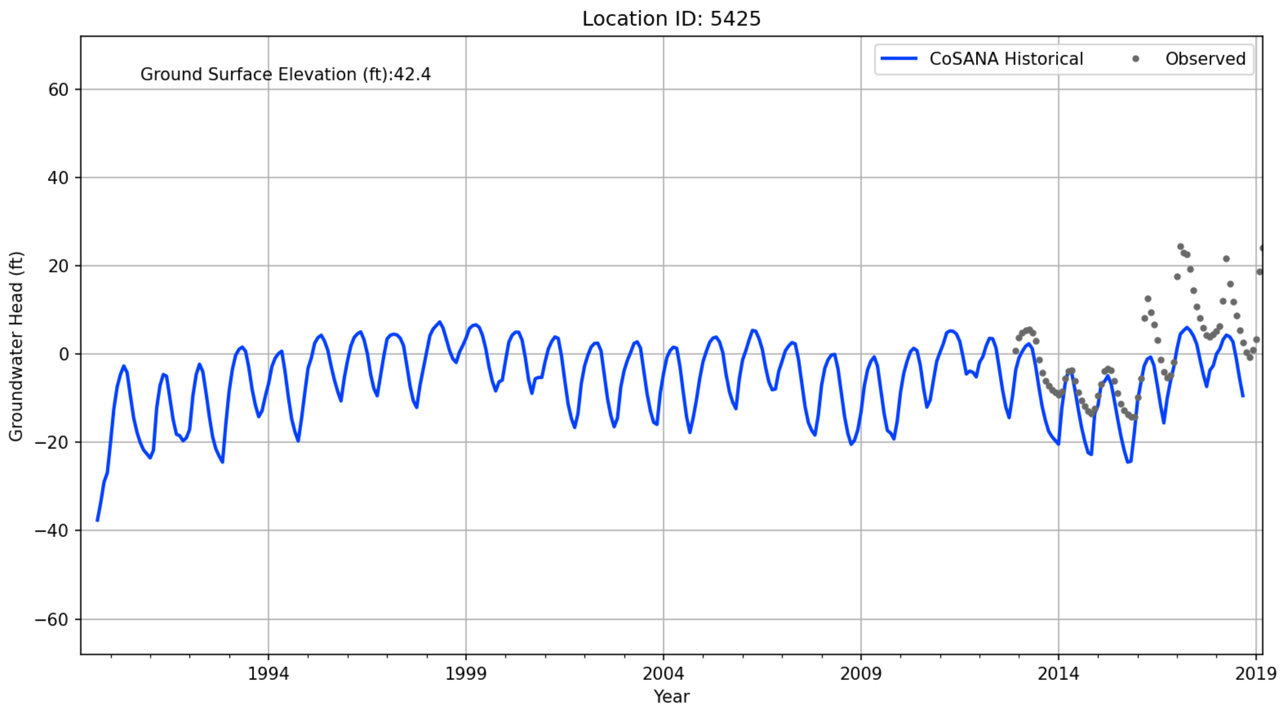


Figure 4-43: CoSANA Groundwater Level Hydrograph – Hydrograph #19

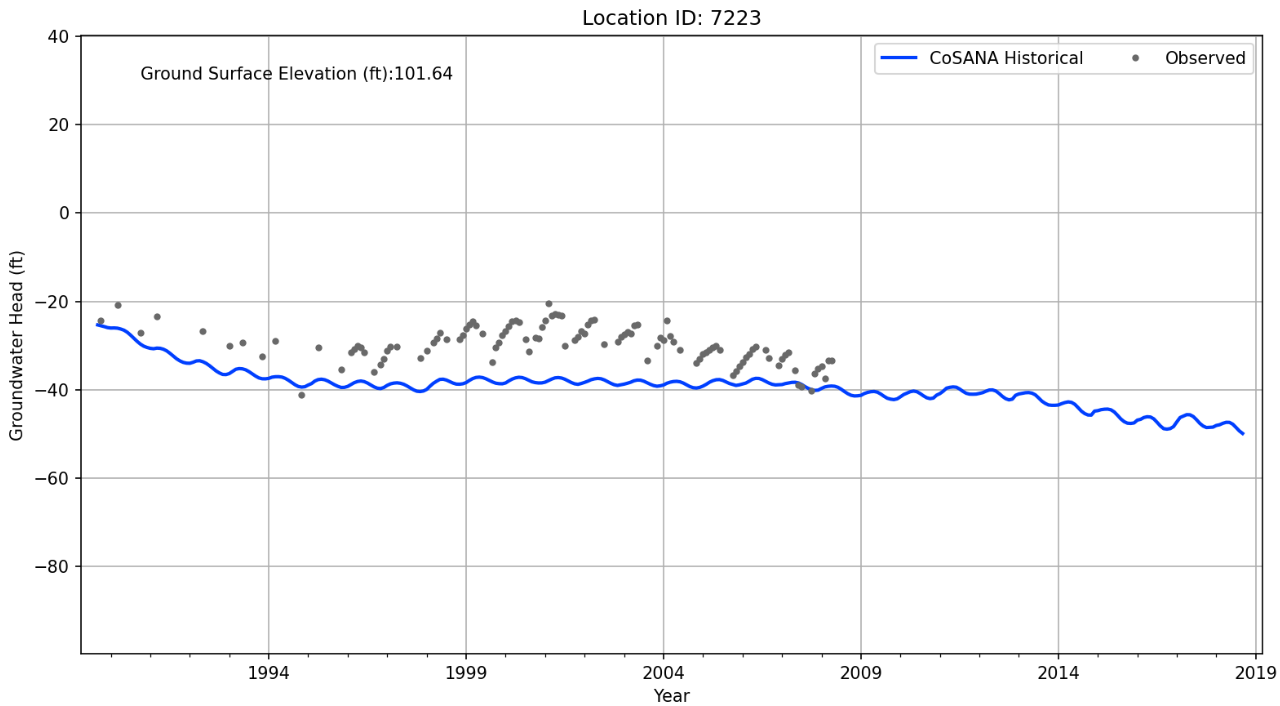


Figure 4-44: CoSANA Groundwater Level Hydrograph – Hydrograph #20

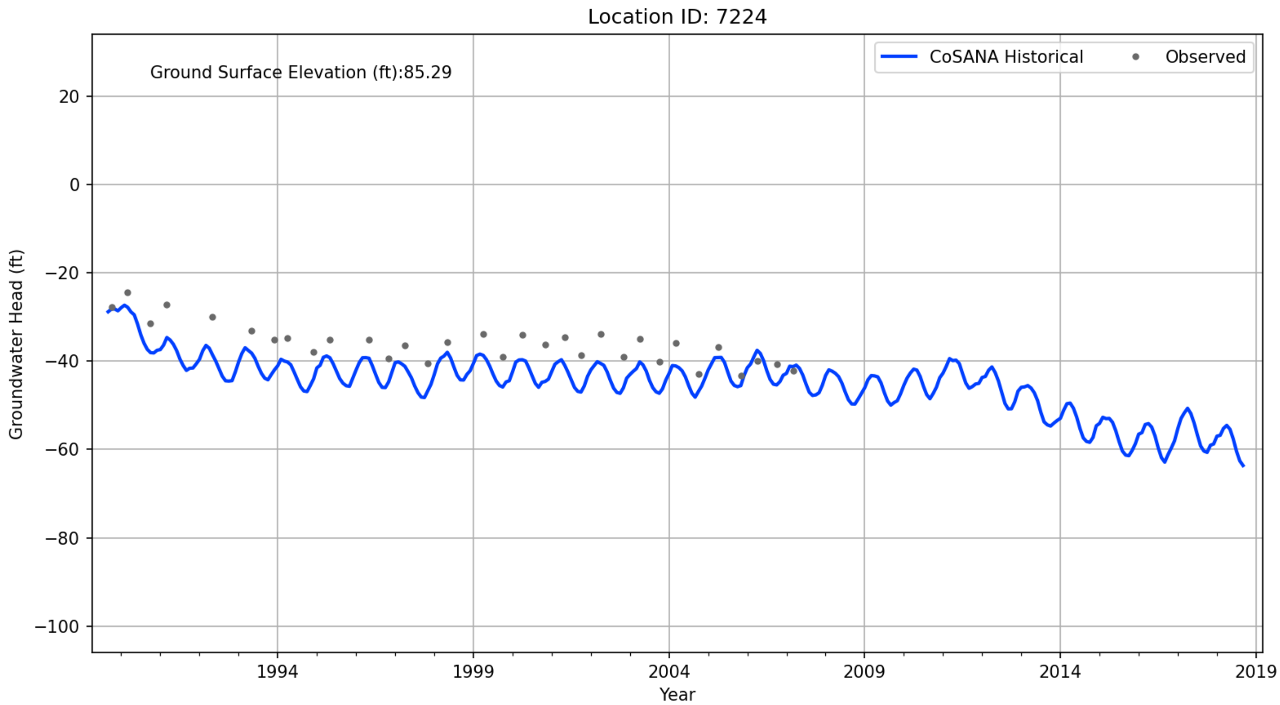


Figure 4-45: CoSANA Groundwater Level Hydrograph – Hydrograph #21

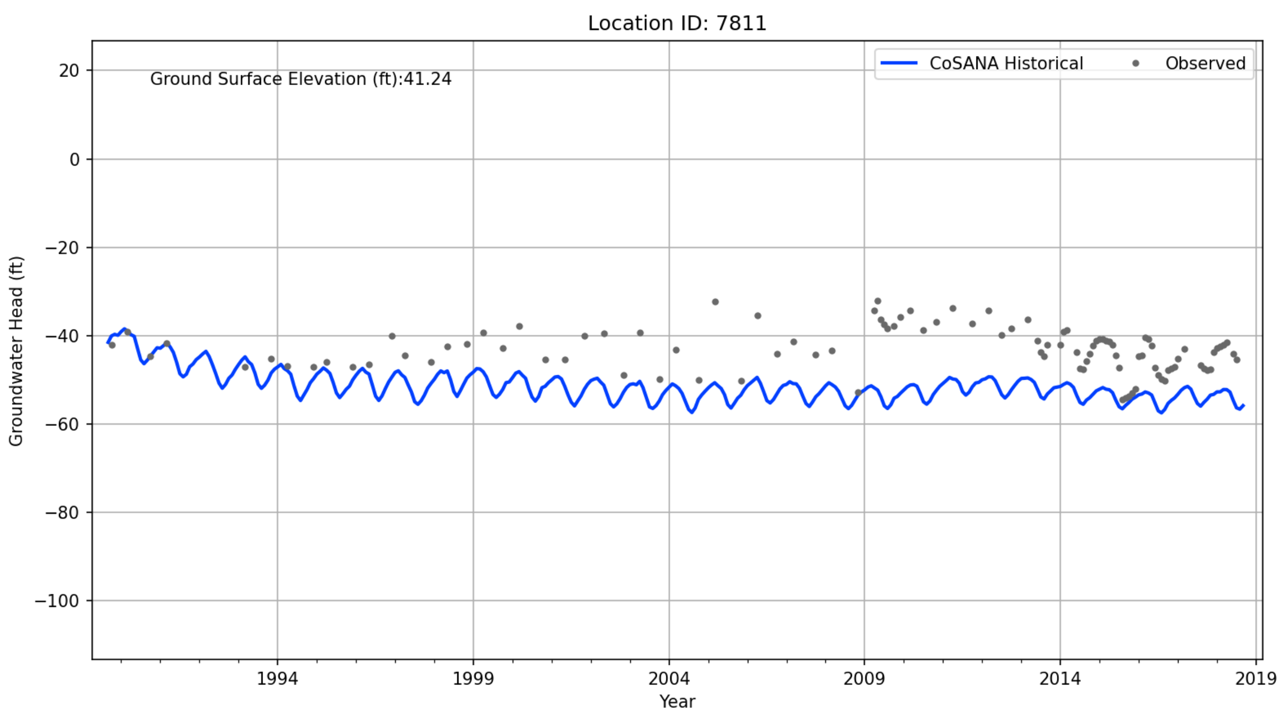


Figure 4-46: CoSANA Groundwater Level Hydrograph – Hydrograph #22

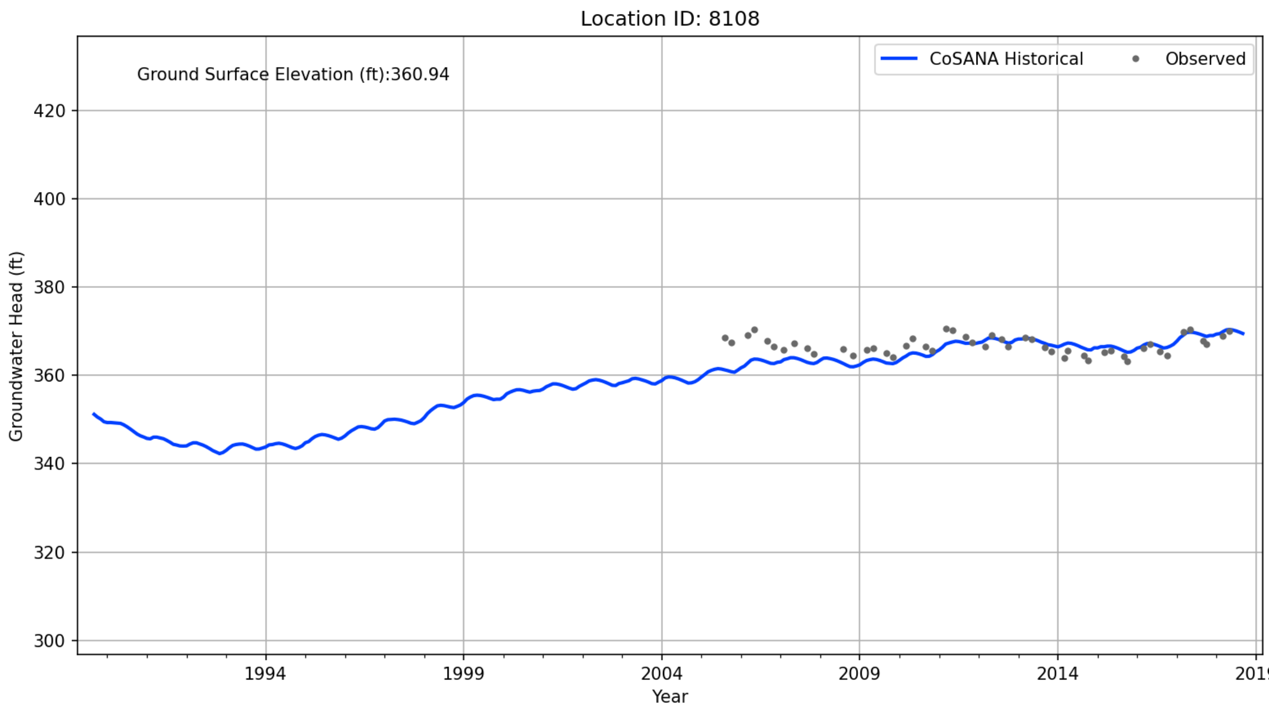


Figure 4-47: CoSANA Groundwater Level Hydrograph – Hydrograph #23

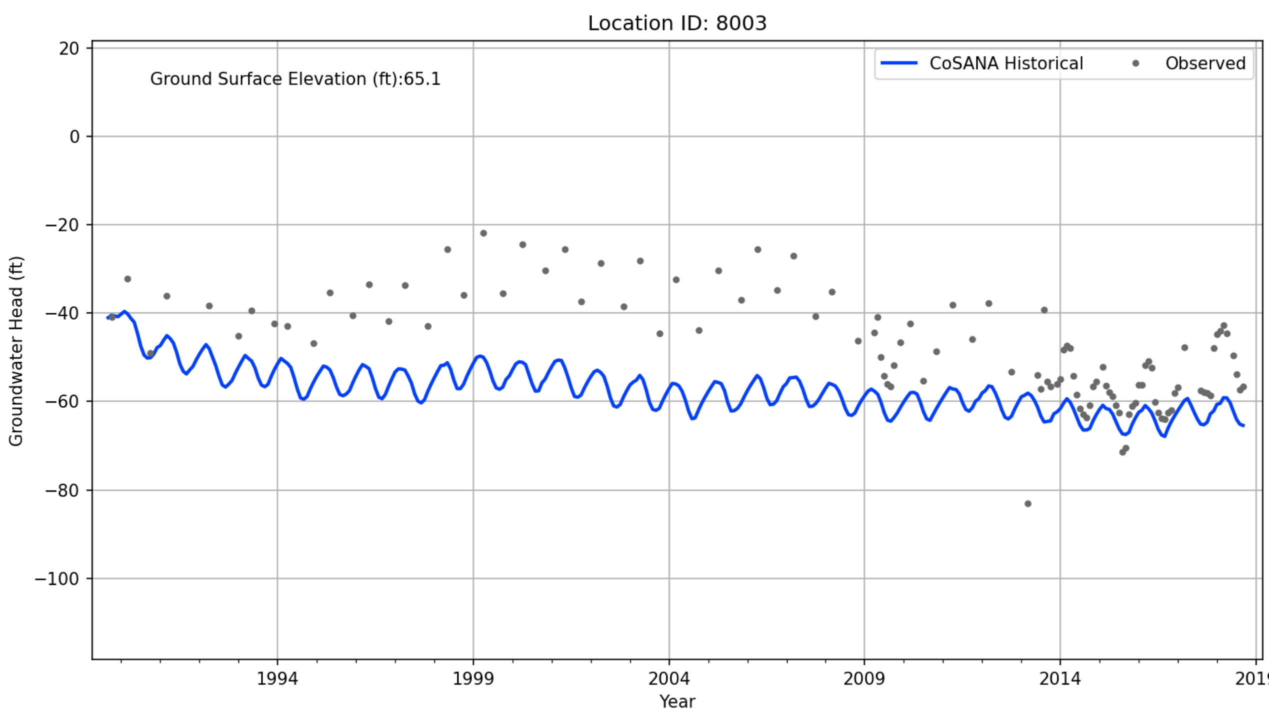


Figure 4-48: CoSANA Groundwater Level Hydrograph – Hydrograph #24

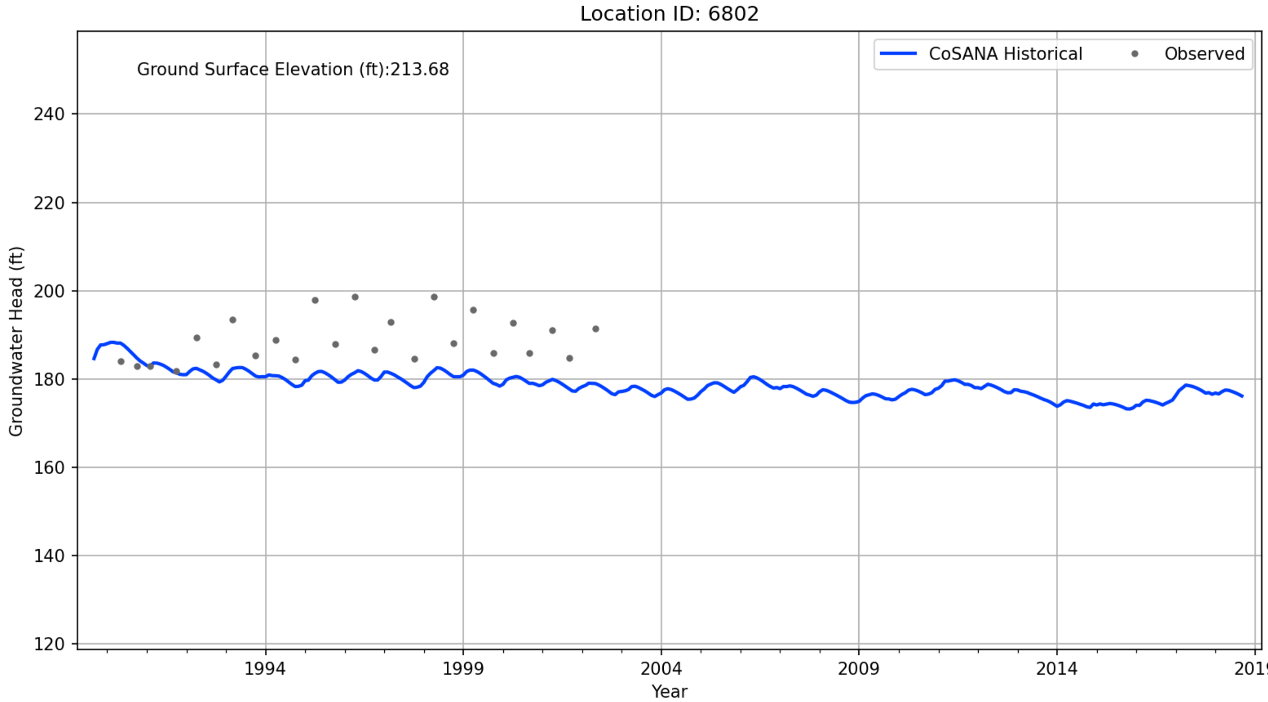


Figure 4-49: CoSANA Groundwater Level Hydrograph – Hydrograph #25

4.2.3 Streamflow Calibration

Similar to the process for groundwater levels, streamflows are calibrated to achieve reasonable agreement between the simulated and observed values (in this case, streamflows at the gaging stations). Streamflow gaging stations near the eastern boundary of the model are often used for inflow data (see Section 2.4). Other streamflow gaging stations are downstream of these inflow points and associated observed streamflow data can be compared to simulated streamflow in the calibration process. The comparison assists in modifications to parameters associated with stream aquifer interaction.

Streamflow calibration is primarily performed by comparing the simulated streamflow with local data from 15 stream gages (Table 4-3 and Figure 4-50). Data for these gages came from USGS or the California Data Exchange Center (CDEC).

Table 4-3: Summary of CoSANA Stream Calibration Gages

Stream	Stream Node	Description	Agency	Station ID	Period of Record
American River	895	American R at H St Bridge	CA DWR	CDEC ID: HST	1986 - Present
Arcade Creek	619	Arcade Cr at Winding Way	Sacramento County	CDEC ID: AMC	1995 - Present
Arcade Creek	625	Arcade Cr near Del Paso Heights	USGS	11447360	1995 - Present
Arcade Creek	600	Arcade Cr at Sunrise Blvd	Sacramento County Dep't Public Works	CDEC ID: ARD	1997 - Present
Bear River	49	Bear R at Pleasant Grove Rd	CA DWR	CDEC ID: BPG	2005 - Present
Cosumnes River	1667	Cosumnes R at McConnell, CA	USGS	11336000	1941 to 1982
Dry Creek (NASb)	510	Dry Cr at Vernon St. Bridge	City of Roseville	CDEC ID: VRS	1995 - Present
Dry Creek (CoSb)	1998	Dry Cr near Galt	USGS	11329500	1926 - 1997
Feather River	107	Feather R near Nicolaus	CA DWR	CDEC ID: NIC	1984 - Present
Laguna Creek (SASb)	1202	Laguna Cr near Eagles Nest Rd.	Sacramento County	CDEC ID: EGN	1996 - Present
Mokelumne River	2212	Mokelumne R at Woodbridge	EBMUD	CDEC ID: WBR	1997 - Present
Morrison Creek	1105	Morrison Cr at Mack Rd	Sacramento Dep't Public Works	CDEC ID: MCM	1998 - 2009
Sacramento River	947	Sacramento R at I St Bridge	CA DWR	CDEC ID: IST	1984 - Present
Sacramento River	1020	Sacramento R at Freeport	USGS	11447650	1948 - Present

Streamflow calibration included refinement of the streambed hydraulic conductivity originally from C2VSim. The calibrated streambed hydraulic conductivity is shown in Figure 4-51. Simulated streamflows were compared with observed records, and exceedance charts were also used to check the model performance when simulating high and low flows at each gage location. Calibration results for the Sacramento River at Freeport are shown in Figure 4-52 and Figure 4-53. Calibration results for the Cosumnes River at McConnell are shown in Figure 4-54 and Figure 4-55 (note that stage data but not flow data are available at McConnell).

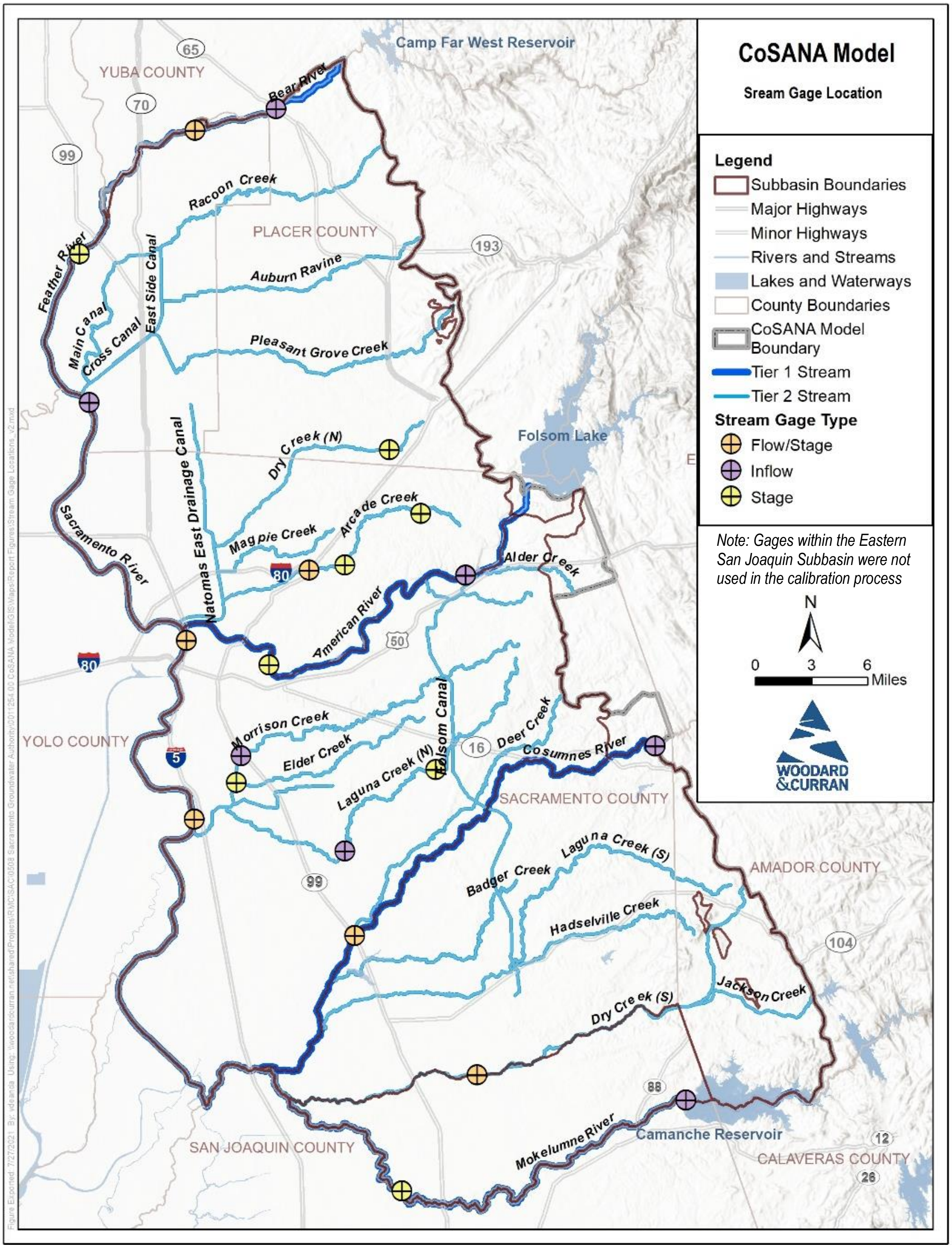


Figure 4-50: Stream Gage Locations

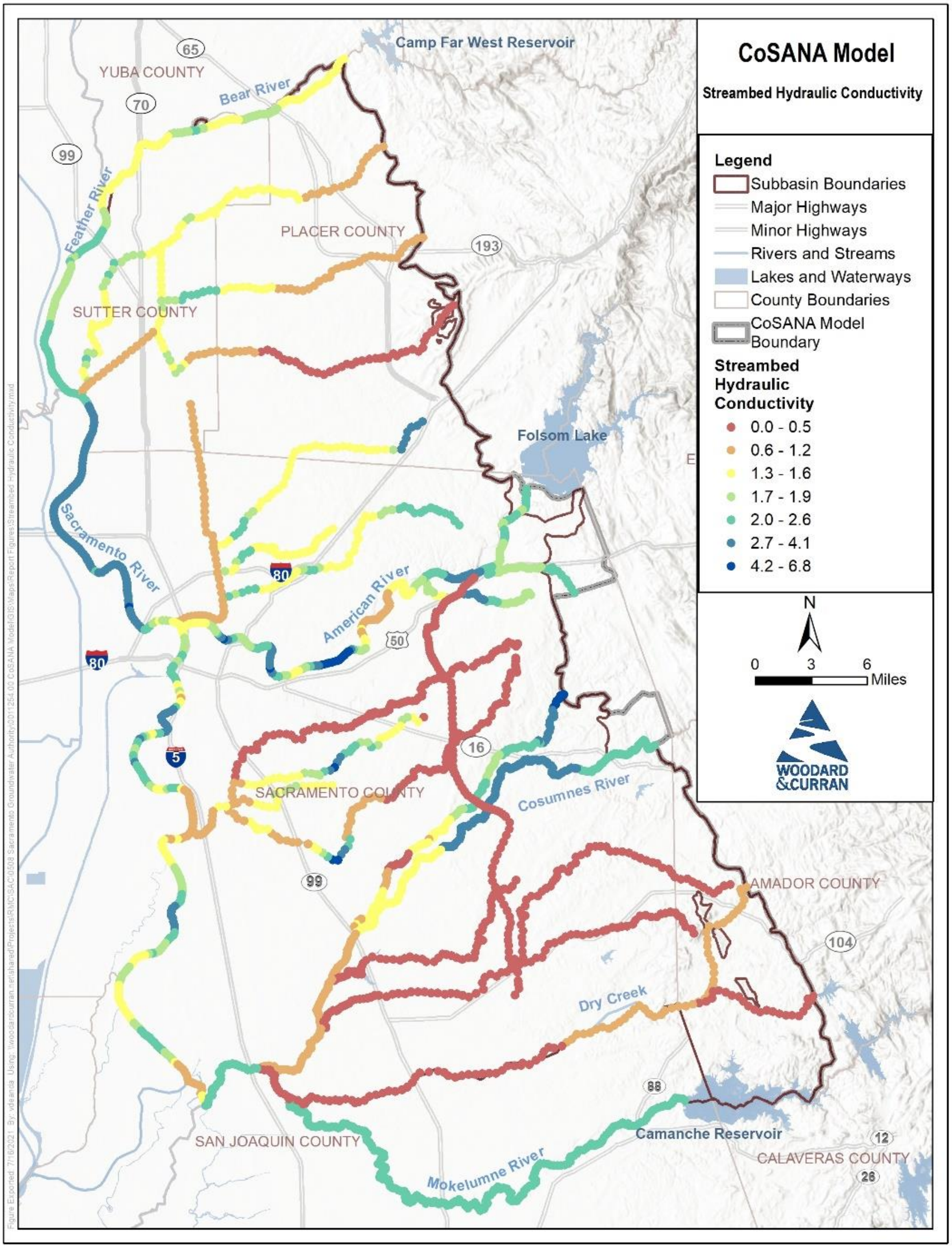


Figure 4-51: CoSANA Streambed Hydraulic Conductivity

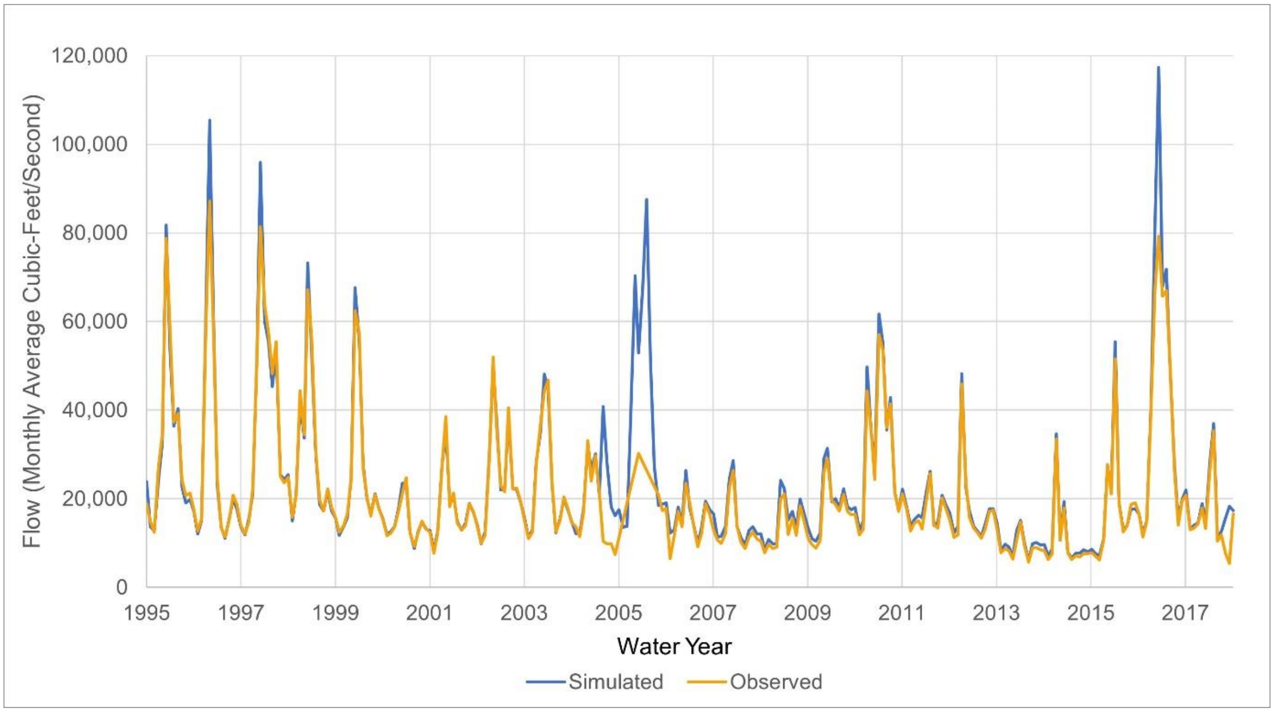


Figure 4-52: Streamflow Hydrograph for Sacramento River at Freeport, Simulated and Observed

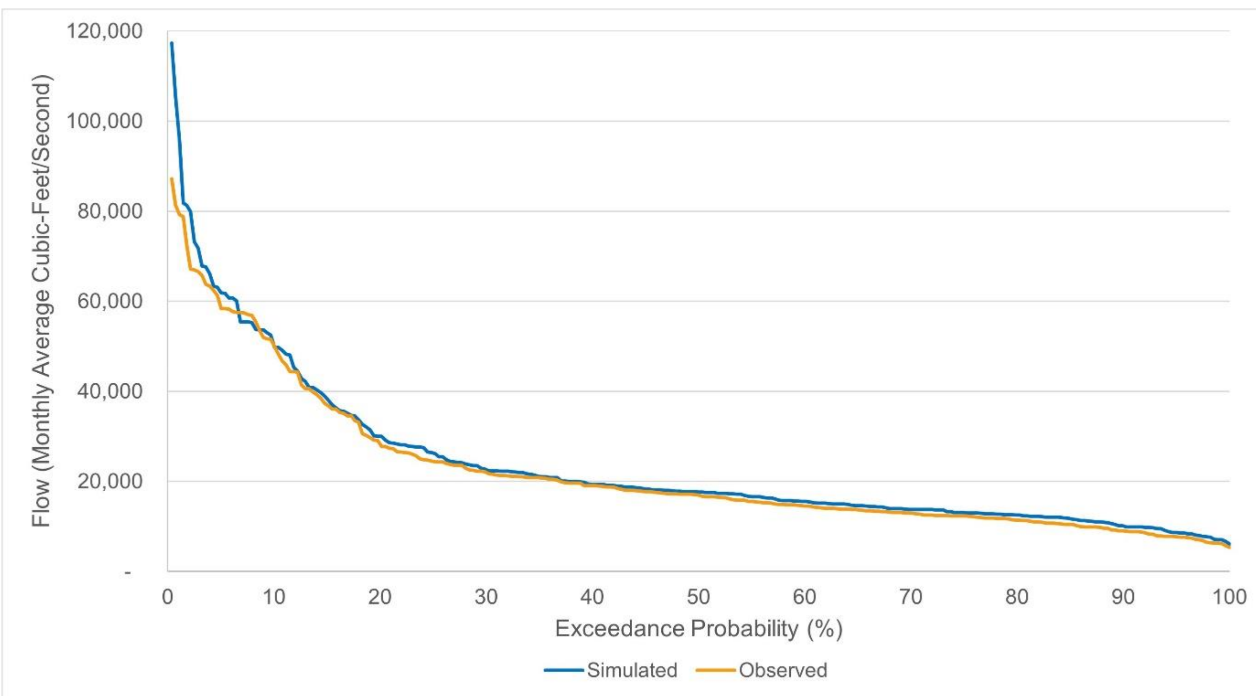


Figure 4-53: Sacramento River at Freeport Streamflow Exceedance, Simulated and Observed

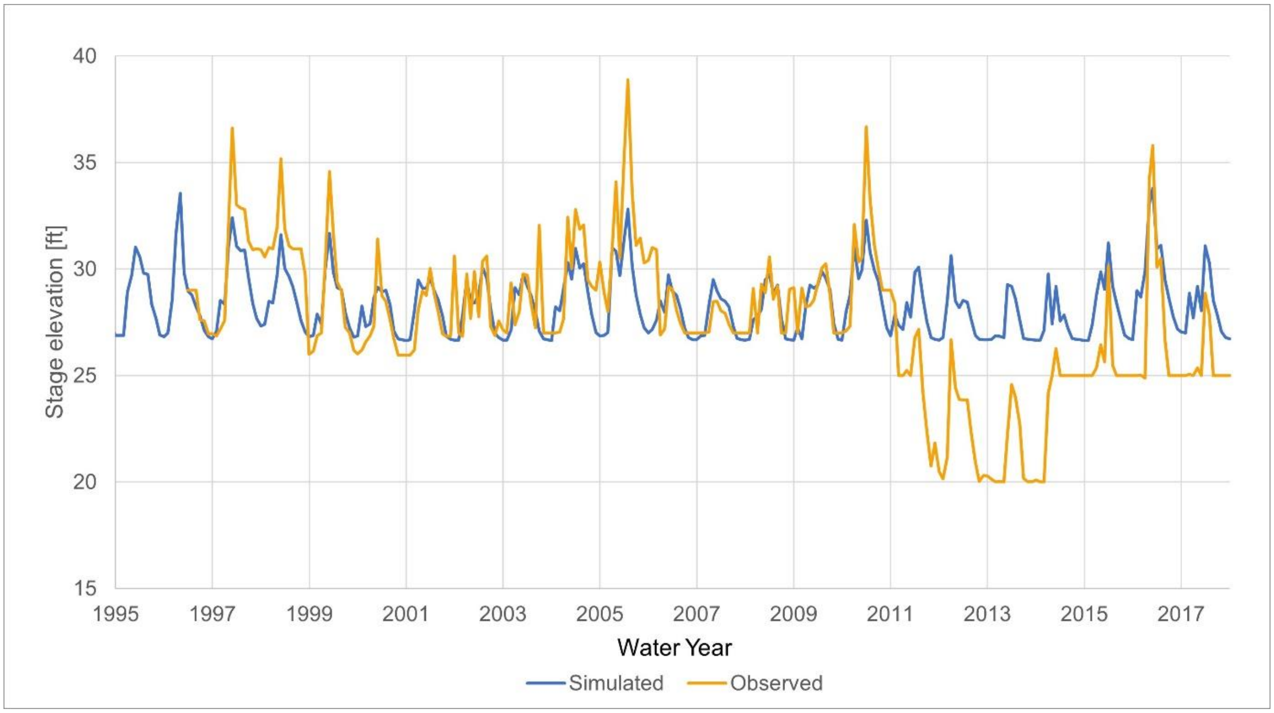
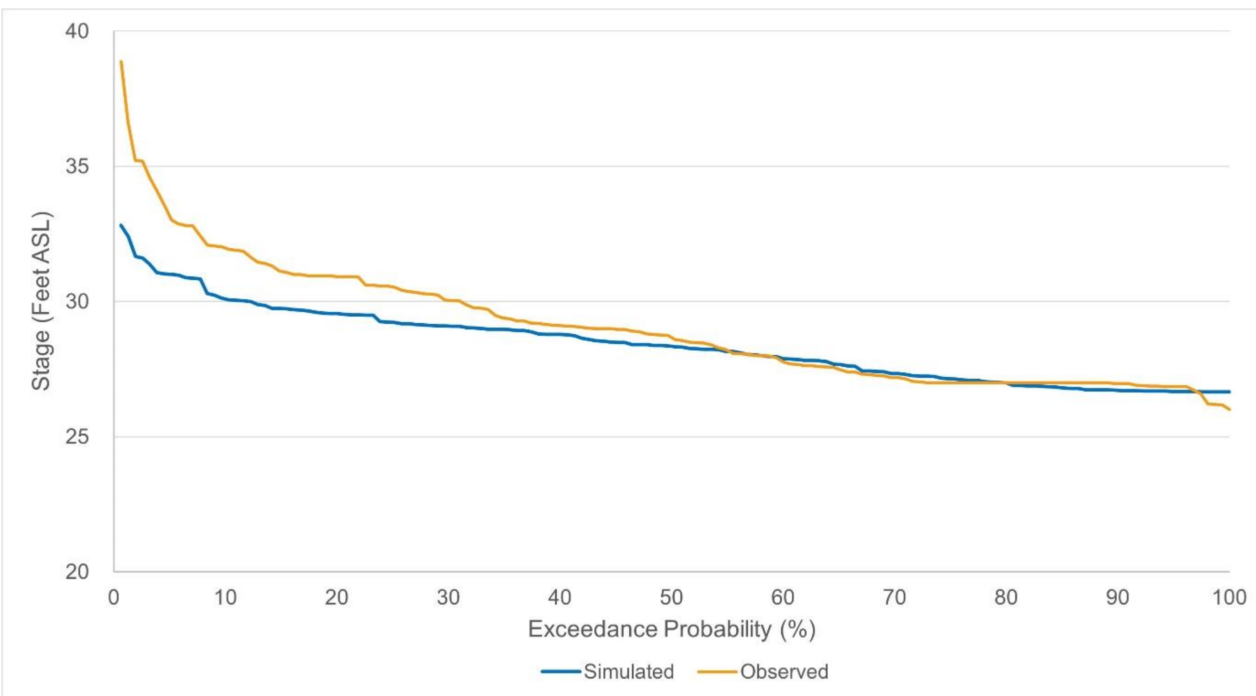


Figure 4-54: Stage for Cosumnes River at McConnell, Simulated and Observed



Note: due to apparent vertical datum issues (shown in Figure 4 53) the above exceedance chart shows data from only Mar-1997 to Sept-2010

Figure 4-55: Cosumnes River at McConnell Stage Exceedance, Simulated and Observed

4.2.4 Small Watershed Calibration

As discussed in Section 2.11, small watersheds are used to simulate inflows into the model from ungaged watersheds. The small watershed contributions are split between surface water runoff that enters the stream system, percolation that occurs during transport to the streams, and baseflow entering the groundwater system at the model boundary. Groundwater level hydrographs along the model boundary selected for groundwater level calibration (Section 4.2.2) were referenced to confirm and edit, as necessary, the various parameters of the small watersheds.

The distribution of small watershed inflows between surface runoff, percolation, and baseflow is primarily driven by the maximum recharge rate and recession coefficients. The recession coefficient governs how much of the total water enters the system as surface water and groundwater. The maximum recharge controls the percolation from runoff. Observed groundwater hydrographs along the model boundary were used to assess how much watersheds contributed to groundwater levels with a focus on seasonal fluctuations. Parameter adjustments were implemented across the small watersheds to maintain reasonable groundwater elevations and streamflows. Additionally, some small watersheds were turned off where additional data were available to characterize the inflows.

There is considerable uncertainty in subsurface conditions and nature of hydraulic interactions between the small watersheds adjacent and upslope to the Cosumnes Subbasin. Two small watersheds adjacent to Cosumnes Subbasin were set to zero area to minimize adjacent flooding of the Foothills Subarea (flooding refers the condition when model-calculated water levels exceed land surface). As Jackson Creek is controlled by Lake Amador dam, it was instead specified as a stream inflow. The Lower Sutter Creek watershed area is the next largest contributing small watershed whose surficial geology is composed of Jurassic-age bedrock, and therefore was assumed that no baseflow or subsurface percolation to groundwater occurs from this watershed. Even with these specifications, model-calculated water budgets and groundwater levels indicated additional data and model refinements are needed to improve reliability in this portion of the Cosumnes Subbasin.

4.3 Calibration Statistics and Goodness of Fit

The CoSANA calibration was primarily assessed using two metrics: groundwater level trends and the correlation between simulated and observed groundwater levels. In addition to quantifiable metrics, the CoSANA calibration included comparisons and modifications to result in regional groundwater flow directions and water budgets that are consistent with available information on observed conditions and consistent with the understanding of basin conditions by stakeholders.

Statistics related to the differences between simulated and observed groundwater levels were evaluated relative to the American Standard Testing Method (ASTM) standard. The "Standard Guide for Calibrating a Groundwater Flow Model Application" (ASTM D5981) states that "the acceptable residual should be a small fraction of the head difference between the highest and lowest heads across the site." The residual is defined as the simulated head minus the observed head. An analysis of all calibration water levels within the model indicated the presence of a range in groundwater levels of approximately 500 feet. Using 10 percent as the small fraction, the acceptable residual level would be 50 feet. The calibration exceeds that standard, as shown by the following statistics.

- 56% of observed groundwater levels are within +/- 10 feet of its respective simulated values
- 83% of observed groundwater levels are within +/- 20 feet of its respective simulated values
- 94% of observed groundwater levels are within +/- 30 feet of its respective simulated values

The residual histogram for the CoSANA is shown in Figure 4-56. Additionally, a scatter plot of simulated versus observed values is shown in Figure 4-57.

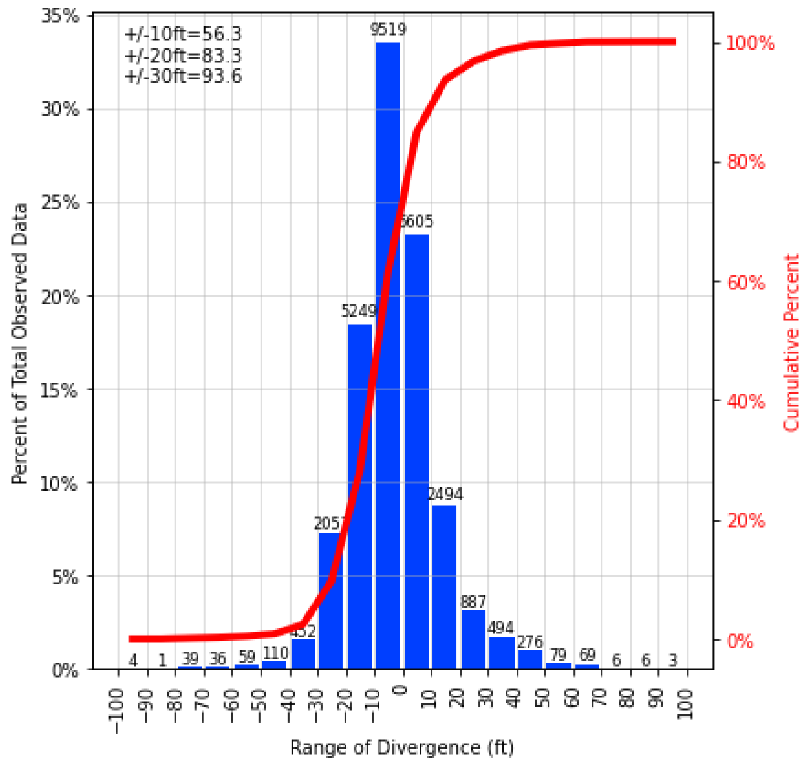
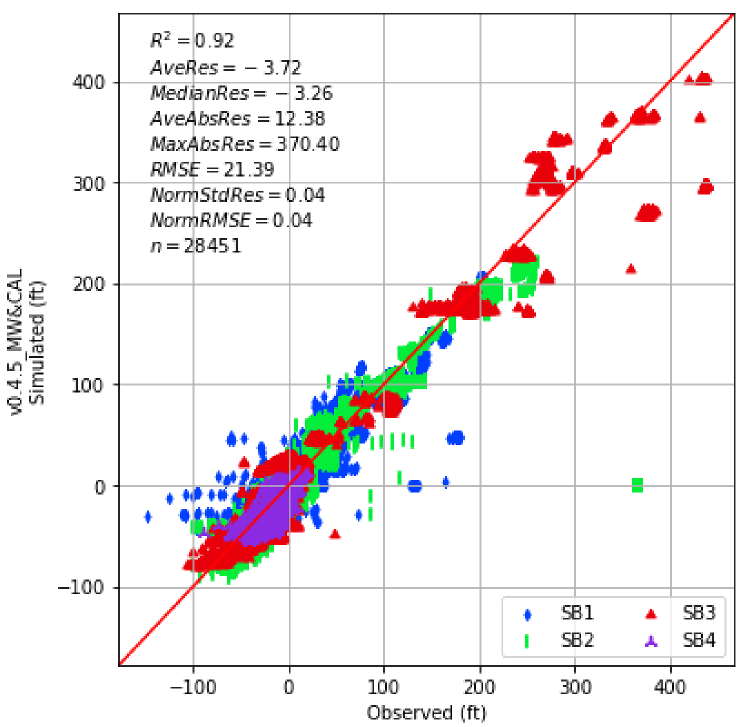


Figure 4-56: Residual histogram for the CoSANA Model



Note: SB1 = NASb, SB2 = SASb, SB3 = CoSb, SB4 = Eastern San Joaquin Subbasin

Figure 4-57: Scatter Plot of CoSANA Simulated versus Observed Values

4.4 Final Calibration Parameters

The parameters resulting from the calibration process are listed in Table 4-4. The spatial distribution of horizontal hydraulic conductivity is presented in Figure 4-58 through Figure 4-62.

Table 4-4: Range of Aquifer Parameter Values

Data		Layer 1	Layer 2	Layer 3	Layer 4	Layer 5
Horizontal Hydraulic Conductivity (ft/day)	Minimum	2.1	1.9	0.65	0.58	0.33
	Average	33.9	24.1	16.3	14.1	10.2
	Maximum	108.3	86.8	51.9	42.0	37.6
Vertical Hydraulic Conductivity (ft/day)	Minimum	0.012	0.0066	0.00045	0.0020	0.0012
	Average	0.99	0.73	0.19	0.42	0.35
	Maximum	4.6	5.2	2.0	2.6	2.3
Specific Storage (1/ft)	Minimum	2.67×10^{-6}	1.88×10^{-6}	1.54×10^{-6}	1.15×10^{-6}	9.80×10^{-6}
	Average	6.30×10^{-5}	6.40×10^{-5}	5.95×10^{-5}	6.09×10^{-5}	7.52×10^{-5}
	Maximum	4.73×10^{-4}	4.59×10^{-4}	4.68×10^{-4}	4.91×10^{-4}	4.96×10^{-4}
Specific Yield (unitless)	Minimum	0.057	0.068	0.056	0.073	0.052
	Average	0.13	0.12	0.13	0.13	0.11
	Maximum	0.24	0.22	0.24	0.24	0.22
Transmissivity (ft^2/day)	Minimum	0.64	0.067	0.077	0.25	0.23
	Average	2,765	5,128	9,679	3,489	1,726
	Maximum	15,005	24,090	69,562	17,019	11,078

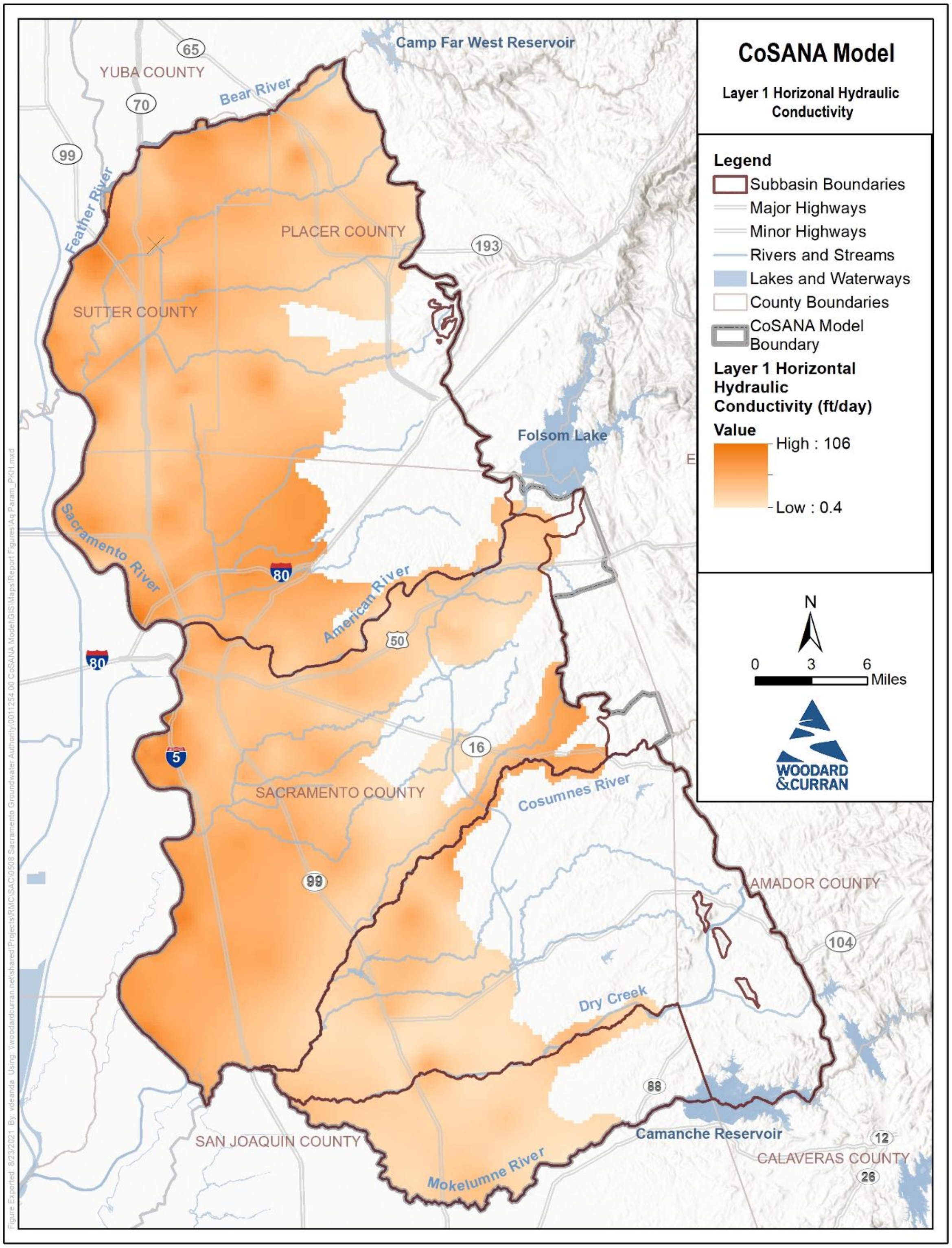


Figure 4-58: Distribution of CoSANA Layer 1 Horizontal Hydraulic Conductivity (K_H)

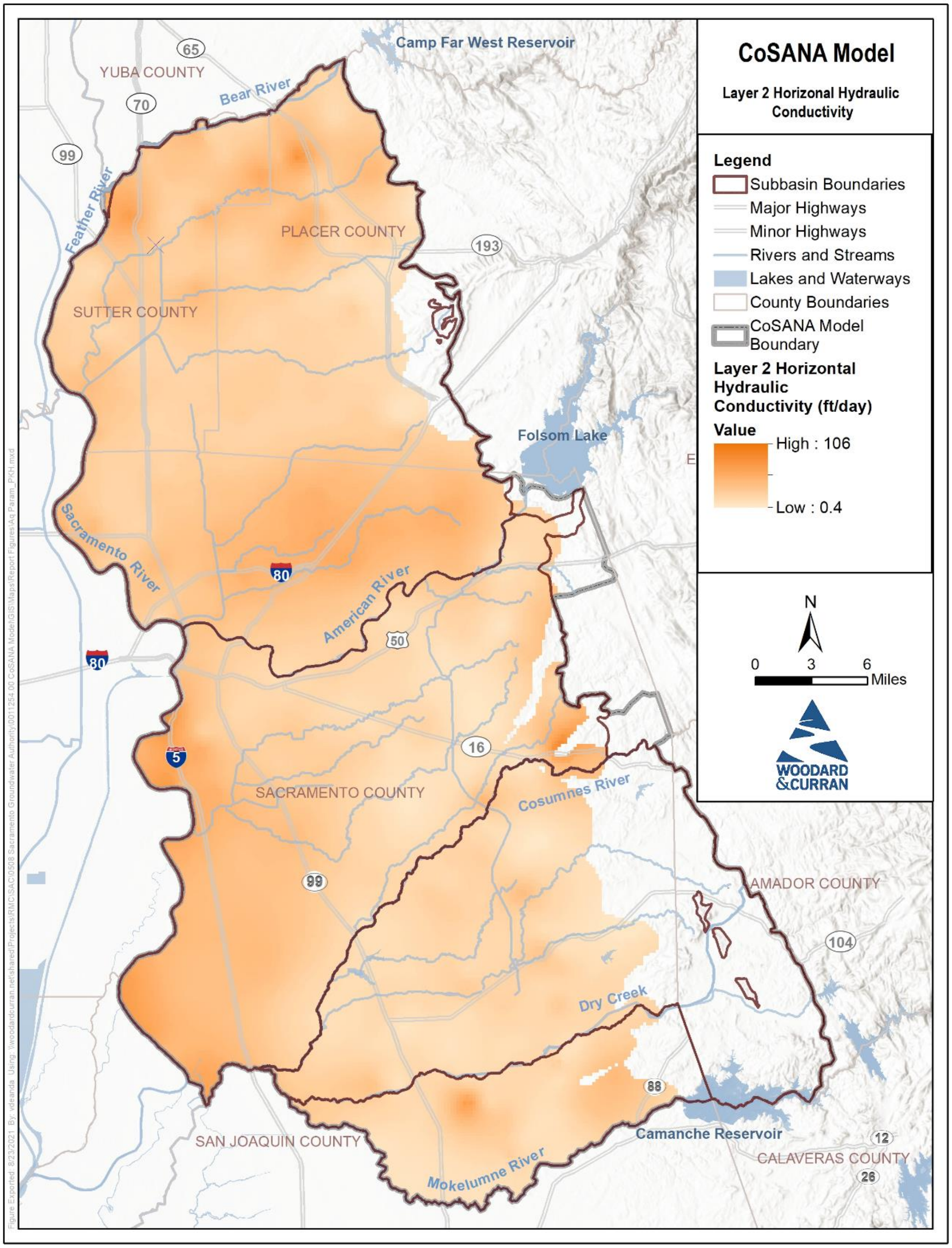


Figure 4-59: Distribution of CoSANA Layer 2 Horizontal Hydraulic Conductivity (K_H)

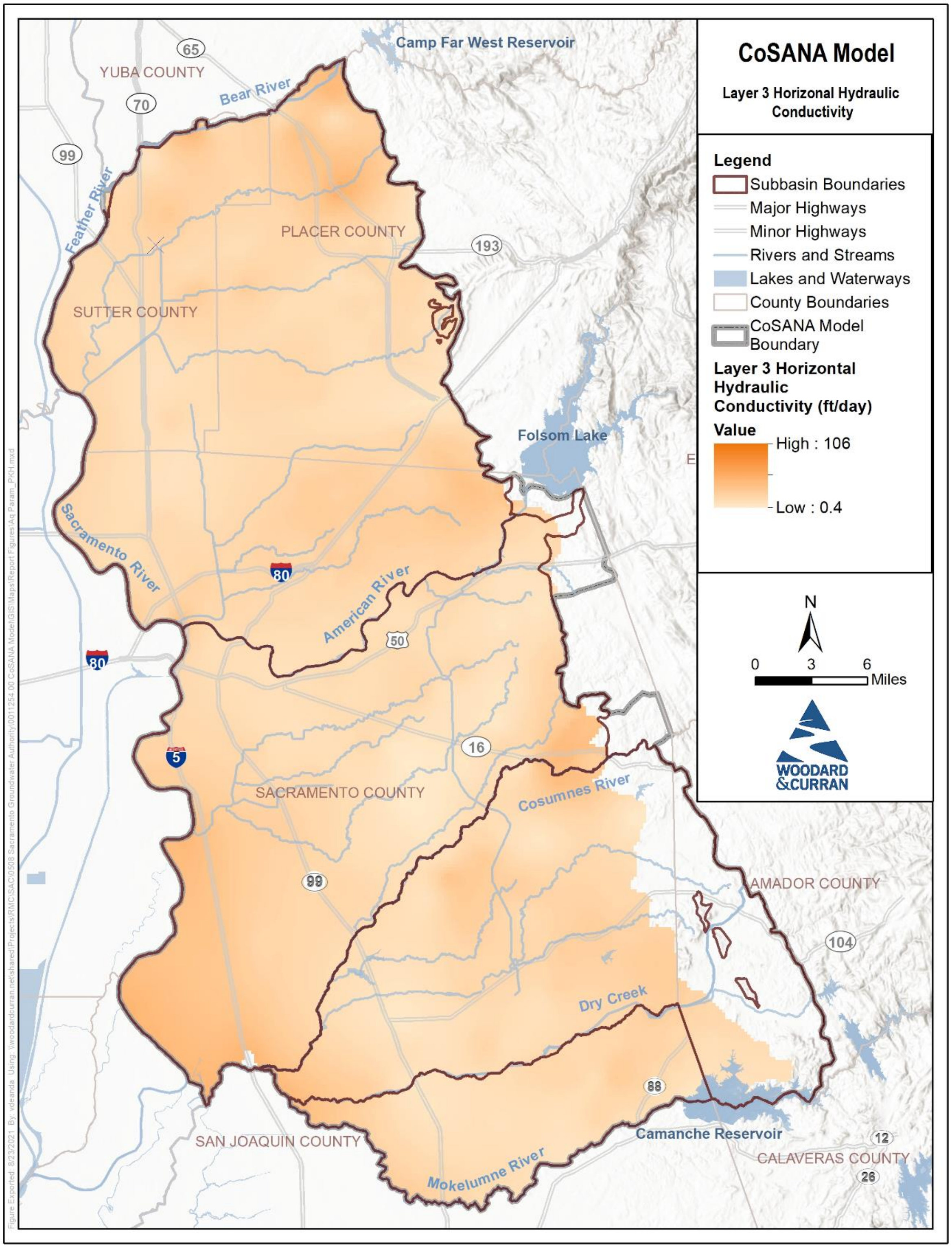


Figure 4-60: Distribution of CoSANA Layer 3 Horizontal Hydraulic Conductivity (K_H)

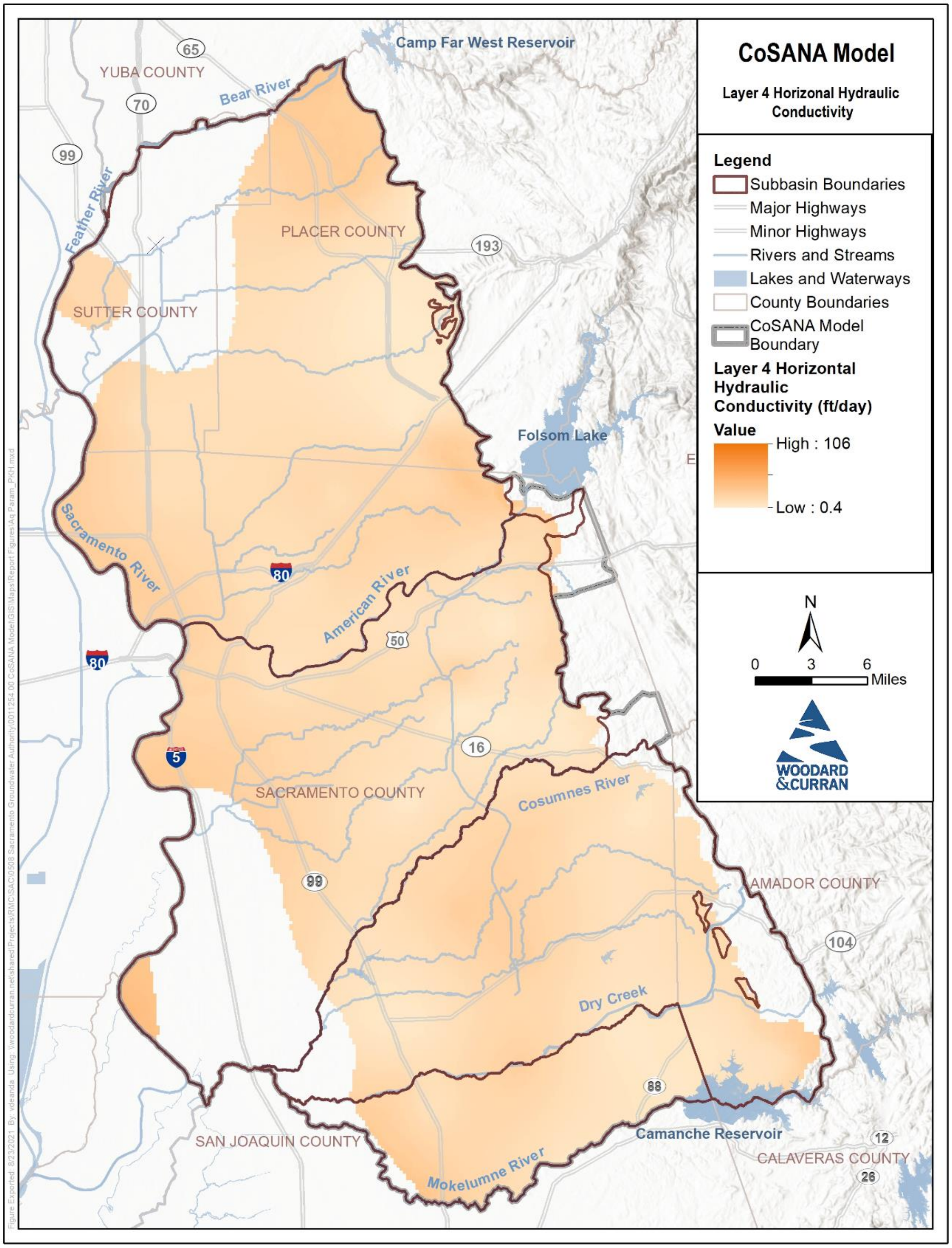


Figure 4-61: Distribution of CoSANA Layer 4 Horizontal Hydraulic Conductivity (K_H)

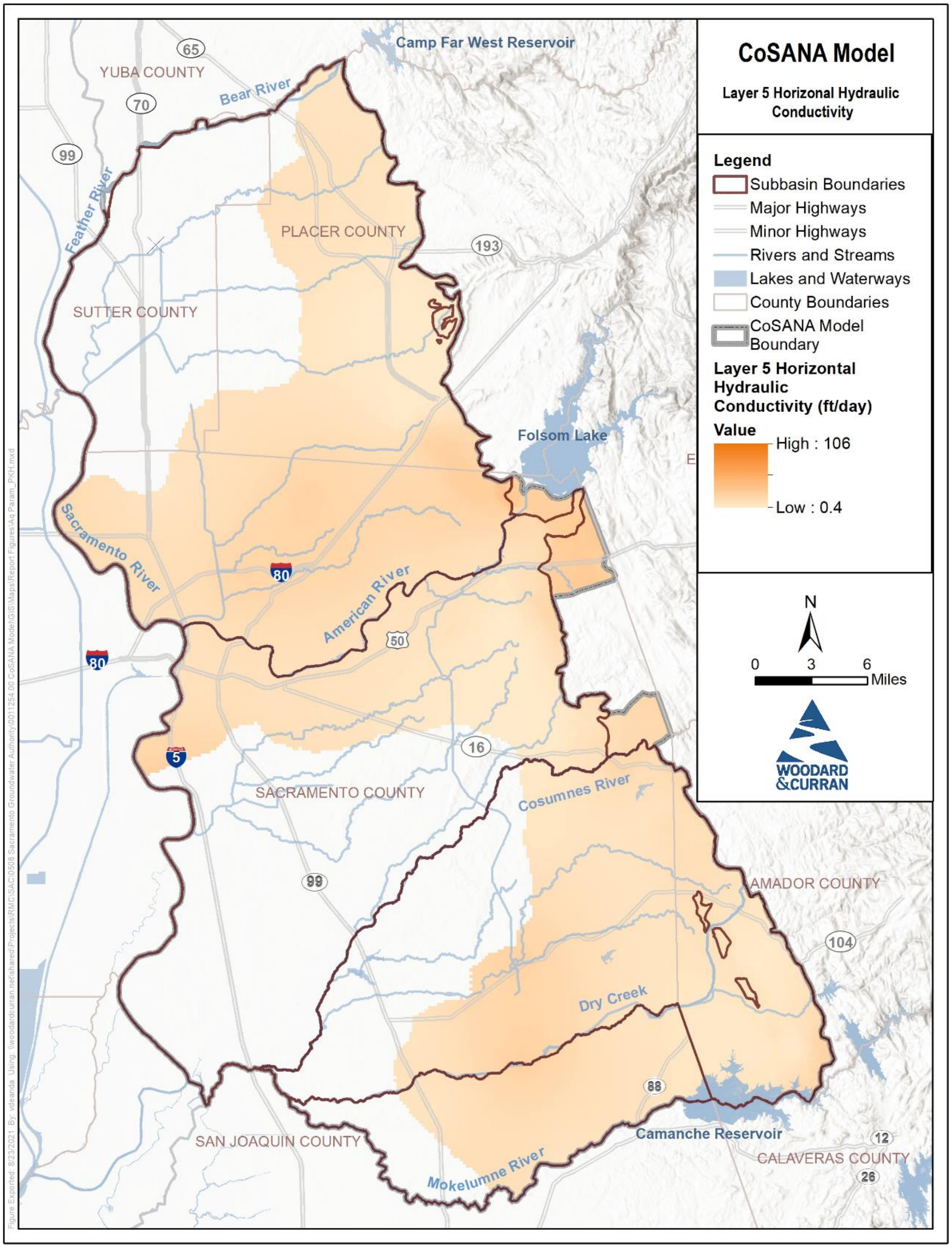


Figure 4-62: Distribution of CoSANA Layer 5 Horizontal Hydraulic Conductivity (K_H)

4.5 Model Features, Strengths, and Limitations

CoSANA has been developed based on years of integrated model development expertise and experience for the Sacramento area, including the SacIWRM and other groundwater planning and analysis efforts in the area. As such, the model data sets, conceptual representation of the groundwater system, the interaction with the surface water and land surface processes, and model calibration conditions are built on a strong foundation and reflect the experience and expertise of hydrologic and hydrogeologic conditions and modeling in the area. Having said that, the model has certain limitations that are outlined as follows:

4.5.1 Spatial Extent and Resolution

The accuracy of the model simulation is a function of spatial resolution of the data, as well as spatial discretization of the finite elements. As the spatial data such as land use or soil conditions are mapped to the elements, the size of elements reflect the accuracy of the underlying data sets as mapped. Much of the spatial data has been reviewed and verified against available statewide and local data available. The model is calibrated to target levels based on the spatial resolution in the model. However, when using the model for local scale analysis and modeling, the experienced user is encouraged to perform further validation of the underlying spatial data prior to use of the model for analysis of projects or management actions.

4.5.2 Temporal Scale

CoSANA includes monthly hydrologic data for the period WY 1970-2018. The model is calibrated for the period WY 1995-2018. Additionally, the model simulations are verified for the entirety of the period WY 1970-2018 for long-term trends and short -term seasonal conditions for groundwater levels and groundwater storage. The monthly time step is a reasonable one for a regional model and reflects the resolution of much of the recorded and reported data. However, the monthly time step at times may pose limitations for simulation of some of the model features, such as streamflows during high and peak flows. This is not of major concern as the regional model context and utilization of model for most long-term water supply planning needs is not affected by this limitation.

4.5.3 Geology and Hydrogeology

CoSANA includes an updated aquifer stratigraphy based on available maps and cross sections. CoSANA also uses the aquifer texture model used in C2VSimFG and SVSim (DWR, 2018a), which is based on the USGS aquifer texture data. The texture data is used in the model calibration and distribution of aquifer properties based on a field level set of lithologic log information. The details of the texture model affect the model performance and calibration in simulation of the various hydrogeologic conditions. The user is reminded to consider variabilities and uncertainties in the texture model as the model results are being interpreted and used for policy and planning purposes.

4.5.4 Land Use Data

Land use is one of the key data sets that affect water demand estimation as well as rainfall runoff, infiltration, and recharge conditions. This data set was developed based on numerous DWR county-level land use surveys, land use and cropping data available from the recent statewide DWR land use surveys, and local sources. This information was assembled, analyzed, and discrepancies were reconciled, which resulted in annual crop data by each model element. Mapping of land use data from various maps to element level within the model and temporal interpolation of land use changes between years of available data may introduce inaccuracies that need to be considered in evaluation of land use conditions at smaller spatial scales, such as parcel level, and for years in between dates of source data.

4.5.5 Water Demand Estimates

Water demands in the model are estimated for three user categories, urban purveyors, agricultural entities, and rural residential areas. The urban demands are based on the reported water supply and demand data from the urban purveyors. The agricultural demand estimates are based on respective model data sets and calibration of the model for each agricultural area. While care has been given to estimation of agricultural water use estimates, and the results have been shared and reviewed by the agricultural entities within the model area, inaccuracies in the source data or those mapped to the model may introduce inaccurate estimates in certain conditions. The rural residential water use estimates have also been shared and presented to the representatives of the rural residential water users at a number of public workshops. In general, the model user is encouraged to validate the estimates with additional local data and is also requested to share their findings with the model developers for future refinements of the model.

4.5.6 Water Supply Data

The surface water delivery data set in the model is one of the most reliable data sets as it is provided by the purveyors. However, some surface water diversions by the agricultural entities are subject to more uncertainty, which affects the model simulation results. Local entities are encouraged to review the surface water delivery data and provide feedback to the model developers as issues arise or inaccuracies are identified.

4.5.7 Groundwater Pumping Estimates

CoSANA includes groundwater wells for all urban purveyors and groundwater pumping rates are, with a few exceptions, provided by the urban purveyors. The model includes estimated monthly groundwater pumping by each model element for the agricultural water use and rural residential users. Agricultural groundwater pumping is estimated as the balance of agricultural demand estimates and surface water that is available to meet the demand for each element and at each model time step. The contamination remediation groundwater extractions are based on data supplied by the entity performing the remediation and are assumed to be accurate. However, these remediation systems are complex, and some details of extraction and the fate of extracted water may be missing or inaccurate. Notably, details on individual well pumping volumes and injection volumes at Mather are not known, although overall pumping and injection volumes are incorporated into CoSANA. Where data were not available, values have been estimated for the model to the best of the model development team's knowledge.

4.5.8 Water Budgets

CoSANA provides detailed water budgets at each model element, which, when aggregated, can provide water budgets for a selected geographic area representing a subregion, subbasin, water/irrigation district, a GSA, or other geographies. The model water budgets have been verified for major model subregions against data and information available from local sources. Additionally, the subbasin-scale model water budgets have been reviewed and verified by the respective technical staff and/or representatives of the GSAs to check the accuracy and reliability of the water budgets for GSP use. When using the CoSANA for more detailed analysis, the user is encouraged to verify the water budgets for reasonableness and consistency with local data and information.

4.5.9 Groundwater Flow and Levels

CoSANA has been calibrated against long-term groundwater trends and seasonal groundwater level changes at approximately 761 wells throughout the model area. The calibration process included adjustments to model input data and/or parameters to ensure that reasonable water budgets are achieved for each model subregion, and long-term simulated groundwater levels match the observed levels within acceptable tolerances. Subsequently, an automated calibration process using PEST was performed to further refine the model calibration by adjusting the aquifer hydraulic properties throughout the model domain. The process of automated calibration also used aquifer texture data for spatial distribution of aquifer parameters. Inaccuracies in observation and reported groundwater levels may influence the quality of calibration. Further, lack of detailed well construction information in many of the calibration wells limited the ability to use data at those sites to properly calibrate the model with depth.

4.5.10 Streamflows

CoSANA simulates streamflows many rivers and streams, including the Sacramento, American, and Cosumnes Rivers. CoSANA stream budgets have been developed and reviewed for several key stream reaches, including reaches along the major river reaches. Additional care has been given to the nature of stream-aquifer interaction to allow proper representation of the stream reaches that potentially have hydraulic connection to the groundwater system, as well as reaches that are gaining or losing. In specific, published information by various non-governmental organizations, such as TNC have been used in model calibration. The quantity and quality of data on the physical nature, extent, and rate of stream-aquifer interaction is, in general, low throughout the state. The Sacramento region and the CoSANA model area is not an exception to this lack of quality data, despite improvements over the past decades. Government agencies and non-governmental organizations are encouraged to allocate additional research to this area for better representation of the nature, extent, and conditions of stream-aquifer relationship.

4.6 Modeling Uncertainties

A model is a numerical representation of physical process and inherently possesses uncertainties that affect the calibration, performance, and results of the model. Integrated hydrologic models are complex models that involve simulation of complex physical systems and interrelationships and require many different types of data, each of which may be available at different temporal and spatial scales. Uncertainties in the performance of an integrated hydrologic model can arise from uncertainties in how the physical processes are conceptualized and formulated, inaccuracies in the underlying data, calibration process and eventually the assumptions used in applications of the model to evaluate projects, including projections of future conditions. The following are additional details on each of these uncertainty categories.

4.6.1 Structural Uncertainties

First set of model uncertainties can arise due to the structural framework of the model, which can include:

- Representation of Physical Features- In order to properly represent natural conditions, the physical and natural features need to be well understood so that they can be conceptualized in a simplified manner for development of theoretical formulations.
- Theoretical Concepts and Representation of the Natural and Physical Systems- This type of uncertainty can be attributed to the conceptualization of the physical and natural systems in the form of mathematical functions and formulas that govern the movement of groundwater and surface water systems and the interrelation of these systems. These formulas are typically referred to as governing equations for each of the hydrologic or hydrogeologic features modeled.
- Formulation, Code Development, Solution Techniques, and Assumptions- The governing equations are typically so complex that analytical solutions to these equations are either not available or are so simplified that they would add to the inaccuracies in the representation of complex hydrologic systems. Therefore, numerical solutions are employed, including finite element or finite difference techniques, which require their own set of assumptions. Computer software is used to implement the theoretical formulations.
- Model Spatial and Temporal Resolution- The governing equations representing the natural and/or physical systems are either solved at two levels:
  - Lumped solution- At this level, the formulation represents a lumped parameter system, and the solution will be for an aggregated system at the large scale. This aggregated and lumped scale can be both for the spatial and temporal scale of the problem. Lumped level solutions are typically employed in conditions where there is a lack of accurate information or where the system is small enough that further spatial or temporal breakdown of the system is not possible due to lack of data and information.

- Distributed Solution- At this level, the system is subdivided in further spatial resolution to take advantage of spatial variability in the data and information that is available at smaller scales. Additionally, the solution to the formulation of the system is also subdivided in smaller temporal scales, such as a monthly or daily time step, so that short-term and long-term variability in the data over time is properly represented in the solution.

4.6.2 Data Uncertainties

This category of uncertainty is related to the data and information that is used and employed in development of a model.

- Data and Information Accuracy, Data Gaps, and Estimates- Collection and compilation of data for natural and physical systems, including precipitation, streamflow, land use, cropping patterns, population, water use, crop evapotranspiration, soil conditions, groundwater levels, streamflow, surface water use, groundwater pumping, infrastructure, facilities, and operations all include a certain level of inaccuracy and uncertainty. This uncertainty is exacerbated when data gaps and inconsistencies exist. The methodology used to identify and fill data gaps can introduce levels of uncertainty.
- Data Spatial and Temporal Resolution- In addition to the above, the spatial and temporal resolution of data may contain inaccuracies and uncertainties that would affect the data that are used in the model.

4.6.3 Calibration Uncertainties

- Estimates of Hydrologic and Hydrogeologic Parameters- Often, data and/or information for specific parameters that are used to represent the governing equations in the model may not be available. In these circumstances, the modeler uses professional judgement, or adopts conditions from similar areas, which may introduce uncertainties and inaccuracies in model simulations.
- Calibration Approach, Target Characteristics, and Accuracy- Model calibration requires certain quality, consistency, and care, so that the model properly represents the natural and physical conditions observed in the field. In addition to the quality and uncertainties in data and methodologies, the approach employed, tools and techniques used, and experience and expertise of the model developer affects the quality of model calibration and accuracy of the results. Often, the calibration targets are prone to uncertainty or lack of information. For example, information on the depth of the screened interval, as well as pumping rate and depth at the well, whether the recorded groundwater level reflects static or pumping conditions, and whether a well is under the influence from other nearby wells or a nearby stream can have significant bearing on the approach and quality of the calibration.

4.6.4 Application Uncertainties

- Assumptions and Project Applications, Including Data Projections and Forecasting Methods- It is imperative that model application be defined and considered in such a way that is supported by model calibration. Assumptions on a model application to analyze a particular project can often be generalized with little knowledge of the conditions. For example, significant uncertainties exist with respect to the following data, which can affect the quality and results of the model output for planning and policy making:
  - Hydrologic conditions and rainfall patterns
  - Land use and cropping patterns
  - Population and water use
  - Water supply conditions
  - Climate change conditions

While modeling uncertainties need to be considered in use and application of models for evaluation of project conditions for potential impacts, benefits, and design of plans and facilities, the model should be considered a reasonably robust tool to support the major decisions, including GSPs, projects and management actions, and sustainability analysis.

4.7 Sensitivity Analysis

Sensitivity analysis is a way of investigating how sensitive certain model results are to changes in certain model parameters. A sensitive parameter is when the simulation results are greatly affected by changes in that parameter within its valid range. Conversely, an insensitive parameter means the changes in that parameter within its valid range do not affect the simulation results greatly.

Model parameters that are sensitive can be the largest sources of error and uncertainty when not precisely measured and well understood. For this reason, sensitivity analysis is an important step of the model calibration process. The sensitivity analysis serves the following purposes:

- To improve the understanding of input-output relationships
- To quantify the impact of inaccuracies in model parameters
- To evaluate the stability and robustness of the model
- To understand the overall range of accuracy of the model results

For these purposes, the following set of calibration parameters were selected for investigation under CoSANA Model sensitivity analysis:

- Aquifer horizontal hydraulic conductivity (PKH) changed globally by factors of 0.5, 0.67, 1.5, 2.0
- Aquifer vertical hydraulic conductivity (PL) changed globally by factors of 0.5, 0.67, 1.5, 2.0
- Specific yield (PN) changed globally by factors of 0.8, 1.2
- Specific storage (PS) changed globally by factors of 0.1, 0.2, 5, 10
- Streambed conductivity (CSTRM) changed globally by factors of 0.2, 0.5, 2.0, 5.0
- Small watersheds curve number (CNS) changed globally by -10, -5, 5, 10
- General head boundary condition head time series (BHTS) changed globally by -10, 10 feet

4.7.1 Metrics of the Sensitivity Analysis

In the process of evaluating the sensitivity of model results to certain parameter changes, the results from the sensitivity runs were analyzed for the NASb, SASb, and CoSb and compared to the calibrated model in terms of the groundwater residual statistics.

The changes to the input parameters for sensitivity analysis were made globally. Therefore, the changes in the model performance should be considered on a global scale. An improvement in the model performance based on changes in one parameter at a global scale does not necessarily mean improvements in the overall model performance and/or calibration, as the model is calibrated to a number of target parameters, only some of which may be included in the performance assessment during the sensitivity analysis. The residual statistics for this sensitivity analysis was used as the performance indicator.

4.7.2 Results of the Sensitivity Analysis

Figure 4-63, Figure 4-64, and Figure 4-65 present the relative change in the three groundwater level residual statistics used in the evaluation of model calibration performance for 10 sensitive parameters in NASb, SASb, and CoSb respectively. These three statistics are:

- Root mean square error (RMSE): This statistic is a measure of how spread out the residuals are.
- Average residual: This statistic measures how inaccurate simulation results are with respect to the corresponding observations on average.

- Correlation coefficient (R2): This statistic is a measure of the strength of the linear relationship between the simulated and observed pairs.

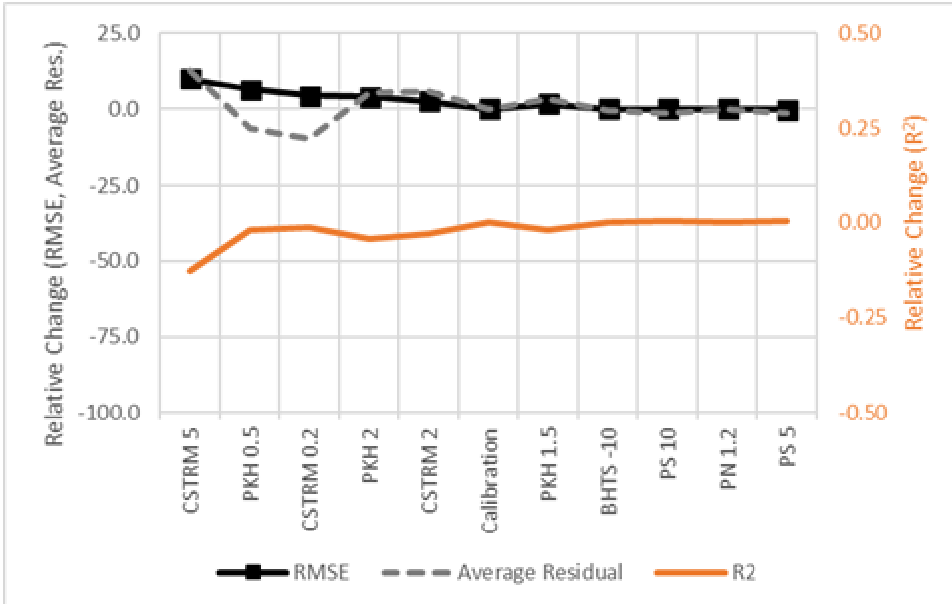


Figure 4-63: Sensitivity of Groundwater Level Residual Statistics in NASb

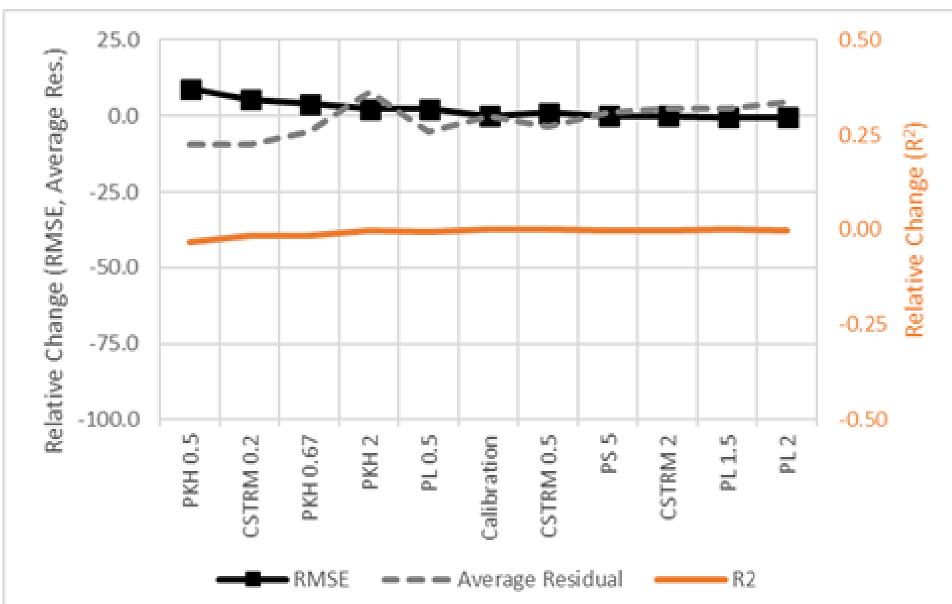


Figure 4-64: Sensitivity of Groundwater Level Residual Statistics in SASb

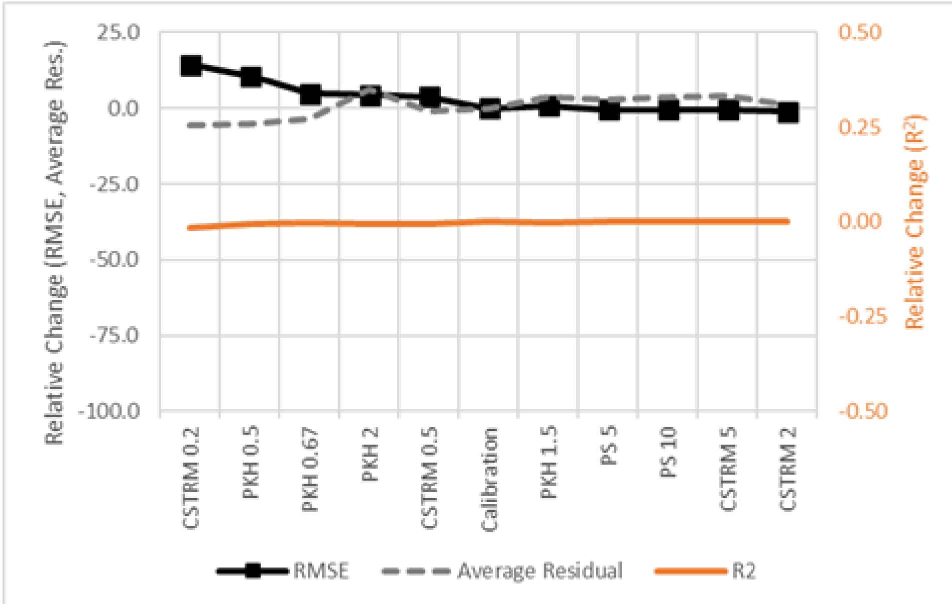


Figure 4-65: Sensitivity of Groundwater Level Residual Statistics in CoSb

None of the sensitivity runs resulted in a significant improvement in these statistics for any of the subbasins. This means that the model is stable and that the calibration is at or near an optimal point when global parameter changes are considered.

5. BASELINE CONDITIONS

Integrated hydrologic and water resources models are used to evaluate effects, benefits, and impacts of particular projects and management actions under a set of baseline conditions. These baseline conditions can represent a set of pre-established hydrologic, land and water use, water demand, water supply, and basin operational conditions. As part of the development of the GSPs for the NASb, SASb, and CoSb, three sets of baseline conditions have been defined for the CoSANA model. These represent the current, projected, and projected under climate change baseline conditions.

Following are descriptions of the assumptions and results for each of these baseline scenarios.

5.1 Current Conditions Baseline

The CoSANA Current Conditions Baseline (CCBL) is a representation of long-term average conditions assuming that a recent level of development and water demand persists over a long-term period of hydrologic conditions. Initial groundwater levels and soil conditions in the CCBL represent those at the end of the simulation period of the historical CoSANA (representing September 30, 2018).

5.1.1 Hydrology

The CCBL uses a 50-year historical hydrology from water years (WY) 1970 through 2019 (October 1, 1969 through September 30, 2019) for precipitation, evapotranspiration, and streamflow.

5.1.1.1 Precipitation

Precipitation in the historical simulation, discussed in Section 2.6, uses the PRISM database for the entire period of record. The precipitation used in the historical simulation was extended through WY 2019 for use in the CCBL. The average CCBL precipitation across the entire model area is 20.2 inches, with a minimum of 7.5 inches in WY 1977 and a maximum of 38.9 inches in WY 1983.

Figure 5-1 graphically illustrates the cumulative departure of the spatially averaged rainfall within the CoSANA model area. The figure includes bars displaying annual precipitation for each water year from WY 1970 through 2019 and a horizontal line representing the long-term mean precipitation of 20.2 inches. The cumulative departure from mean precipitation is displayed as a line that highlights wet periods with upward slopes (positive departure) and dry periods with downward slopes (negative departure). More severe events are shown by steeper slopes and greater changes.

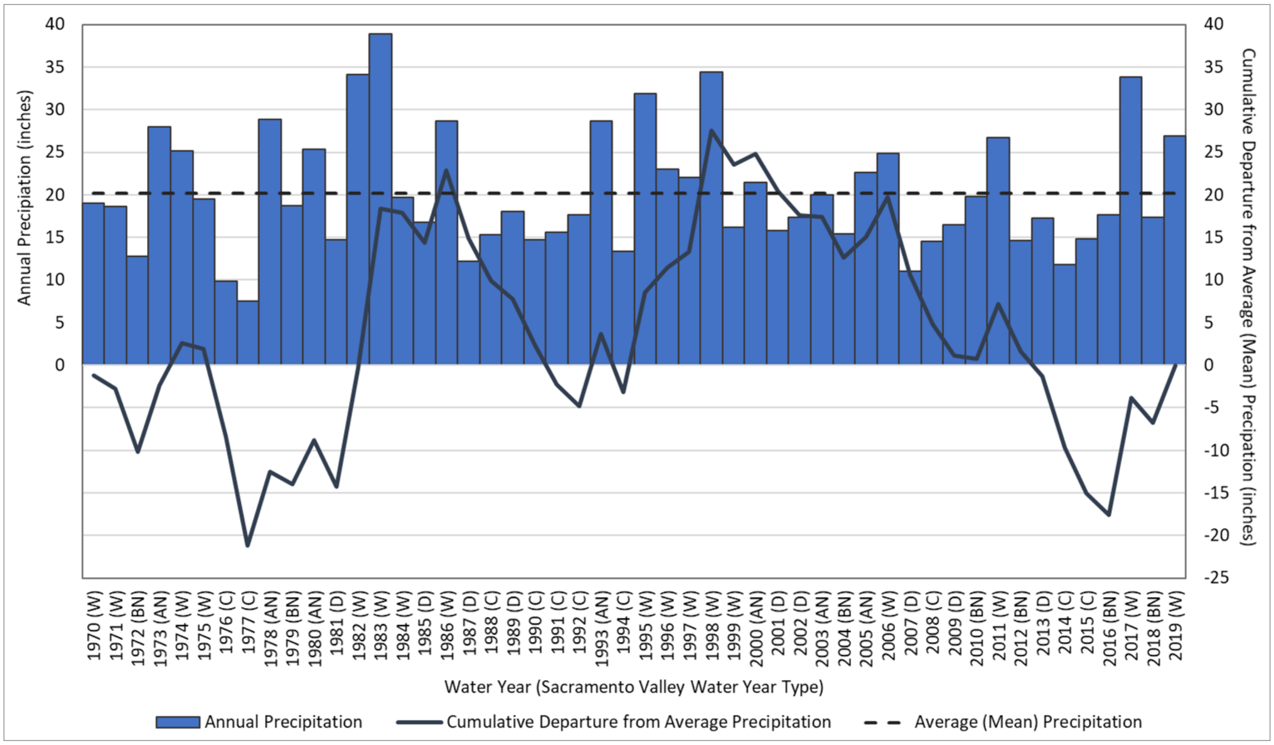


Figure 5-1: 50-Year Historical Precipitation and Cumulative Departure from Mean Precipitation

5.1.1.2 Evapotranspiration

As discussed in Section 2.8, the crop ET requirement was based on values from regional modeling (C2VSimFG) and associated CIMIS Zones 12 and 14. The ET used in the historical simulation was extended through WY 2019 for use in the CCBL.

5.1.1.3 Stream Inflow

As discussed in Section 2.4, stream inflows are from stream gaging stations at the upstream area of CoSANA river reaches. The stream inflow points and gaging stations are described in Section 2.4 and listed in Table 2-4. As the CCBL uses the historical hydrologic conditions as the basis for planning the baseline conditions, the stream inflows used in the historical simulation were extended through WY 2019 for use in the CCBL.

5.1.1.4 Hydrologic Year Types

The 50 years of the CCBL, from WY 1970 through 2019, represent a range of hydrologic conditions, as identified by the water year types in the Sacramento Valley Water Year Hydrologic Classification, which classifies water years 1901 through 2020 as Wet (W), Above Normal (AN), Below Normal (BN), Dry (D), and Critical (C) based on inflows to major reservoirs or lakes. A description of how this index is calculated and the specific data used to calculate this index is available online from CDEC at http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST. In the 50 years of hydrology used in the CCBL, there are 10 Critical years, 9 Dry years, 7 Below Normal years, 7 Above Normal years, and 17 Wet years.

To facilitate assumptions for baseline water supplies and demands, these five water year types were simplified into three water year types. Critical and Dry years are combined into one category in the baseline water year types (called Dry years), Above Normal and Below Normal years are also combined into one category (Normal years), and Wet years remain in one category (called Wet years). With this breakdown, the three baseline water year types have a distribution of 19 Dry years, 14 Normal years, and 17 Wet years. These baseline water year types (Table 5-1) are used in the remainder of the CCBL data development and results discussion.

Table 5-1: Hydrologic Water Year Types

Baseline Year	Water Year	Sacramento Valley Water Year Hydrologic Classification	Baseline Year Type		Baseline Year	Water Year	Sacramento Valley Water Year Hydrologic Classification	Baseline Year Type
1	1970	Wet	Wet		26	1995	Wet	Wet
2	1971	Wet	Wet		27	1996	Wet	Wet
3	1972	Below Normal	Normal		28	1997	Wet	Wet
4	1973	Above Normal	Normal		29	1998	Wet	Wet
5	1974	Wet	Wet		30	1999	Wet	Wet
6	1975	Wet	Wet		31	2000	Above Normal	Normal
7	1976	Critical	Dry		32	2001	Dry	Dry
8	1977	Critical	Dry		33	2002	Dry	Dry
9	1978	Above Normal	Normal		34	2003	Above Normal	Normal
10	1979	Below Normal	Normal		35	2004	Below Normal	Normal
11	1980	Above Normal	Normal		36	2005	Above Normal	Normal
12	1981	Dry	Dry		37	2006	Wet	Wet
13	1982	Wet	Wet		38	2007	Dry	Dry
14	1983	Wet	Wet		39	2008	Critical	Dry
15	1984	Wet	Wet		40	2009	Dry	Dry
16	1985	Dry	Dry		41	2010	Below Normal	Normal
17	1986	Wet	Wet		42	2011	Wet	Wet
18	1987	Dry	Dry		43	2012	Below Normal	Normal
19	1988	Critical	Dry		44	2013	Dry	Dry
20	1989	Dry	Dry		45	2014	Critical	Dry
21	1990	Critical	Dry		46	2015	Critical	Dry
22	1991	Critical	Dry		47	2016	Below Normal	Normal
23	1992	Critical	Dry		48	2017	Wet	Wet
24	1993	Above Normal	Normal		49	2018	Below Normal	Normal
25	1994	Critical	Dry		50	2019	Wet	Wet

5.1.2 Initial Conditions

The initial conditions for the 50-year CCBL are defined as the groundwater, surface water, and hydrologic conditions for the end of WY 2018 from the end of simulation of the CoSANA historical model. Figure 5-2 shows a map of initial groundwater levels used in the CCBL. The initial conditions for the CCBL are also used for other baseline models.

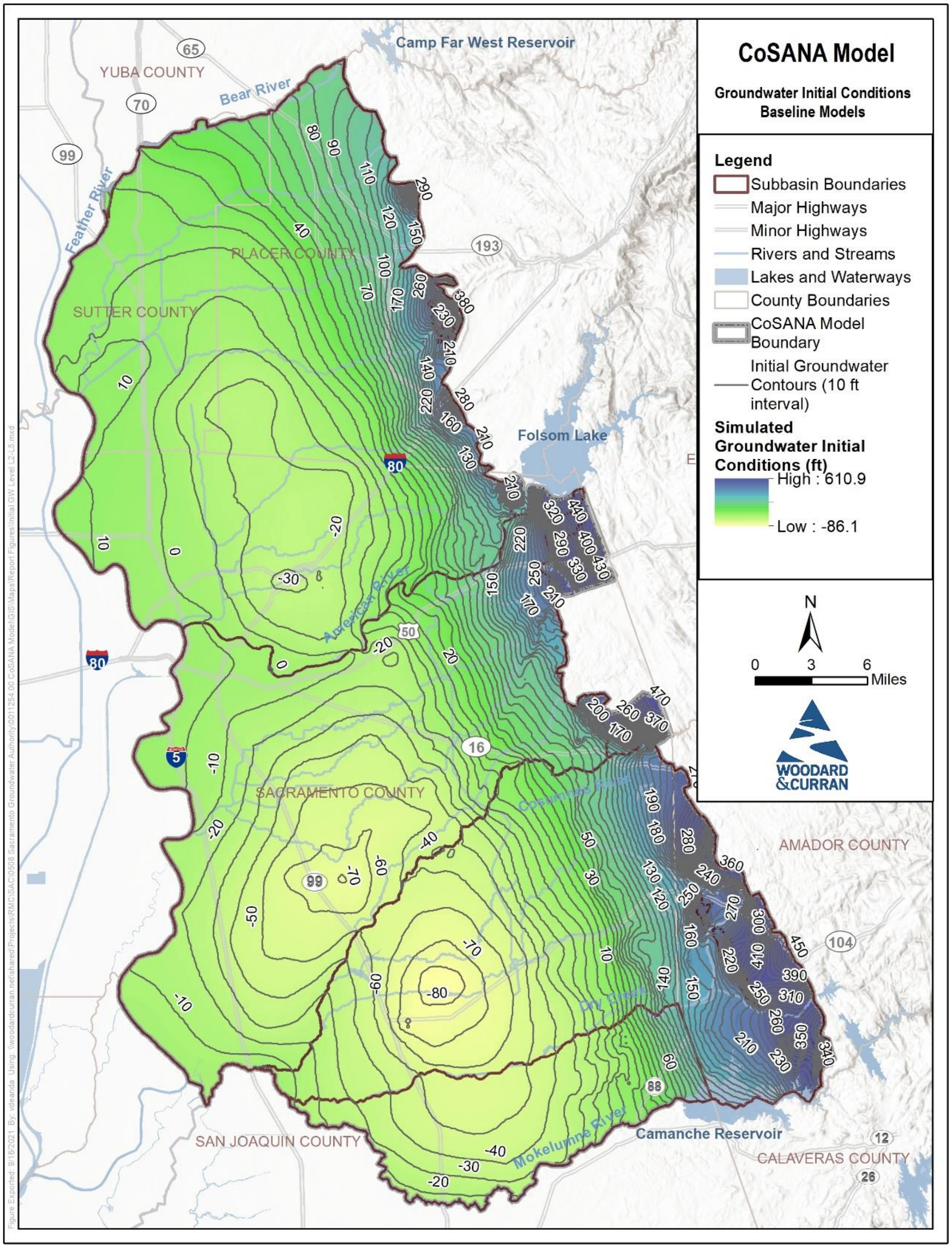


Figure 5-2: Initial Groundwater Levels for CoSANA Baseline Models

5.1.3 Boundary Conditions

CCBL boundary conditions are based on an average for each baseline water year type (normal, wet, and dry) during the last 10 years of the historical simulation (WY 2009-2018). This averaging is applied to the constrained head boundary conditions that represent Lake Camanche in the southeast corner of the model, and the general head boundary conditions that represent groundwater levels to the north, south, and west of the model boundary. Water year type averaging is not applied to the small watersheds form the eastern boundary of the model, as these are driven by hydrology (precipitation and evapotranspiration.) Further detail of how boundary conditions are applied in CoSANA are provided in Section 2.12.

5.1.4 Land Use

The CCBL used the land use from the last year of the historical simulation, discussed in Section 2.7. The last year of the historical simulation represents the digital land use coverage developed to represent 2015 (see Figures 15-21). As also described in Section 2.7, certain lands regarded as temporarily fallowed due to drought were represented as their typical land use for purposes of historical interpolation and for purposes of the CCBL. Minor changes to specified land use conditions were made to account for recent changes. Land use in Sutter County and Placer County was updated to incorporate recent conversions of rice fields to orchards. In the Cosumnes Subbasin, the land use was updated to incorporate recent conversion of vineyards or pasture to almonds and native land to agricultural and urban uses. A spatial representation of the CCBL land use is shown in Figure 5-3. The time-series of land use for the CoSANA CCBL is shown in Figure 5-4, highlighting the constant nature of land and water use in the baseline conditions. Figure 5-5 through Figure 5-7 show time-series of land use for the NASb, SASb, and CoSb, respectively.

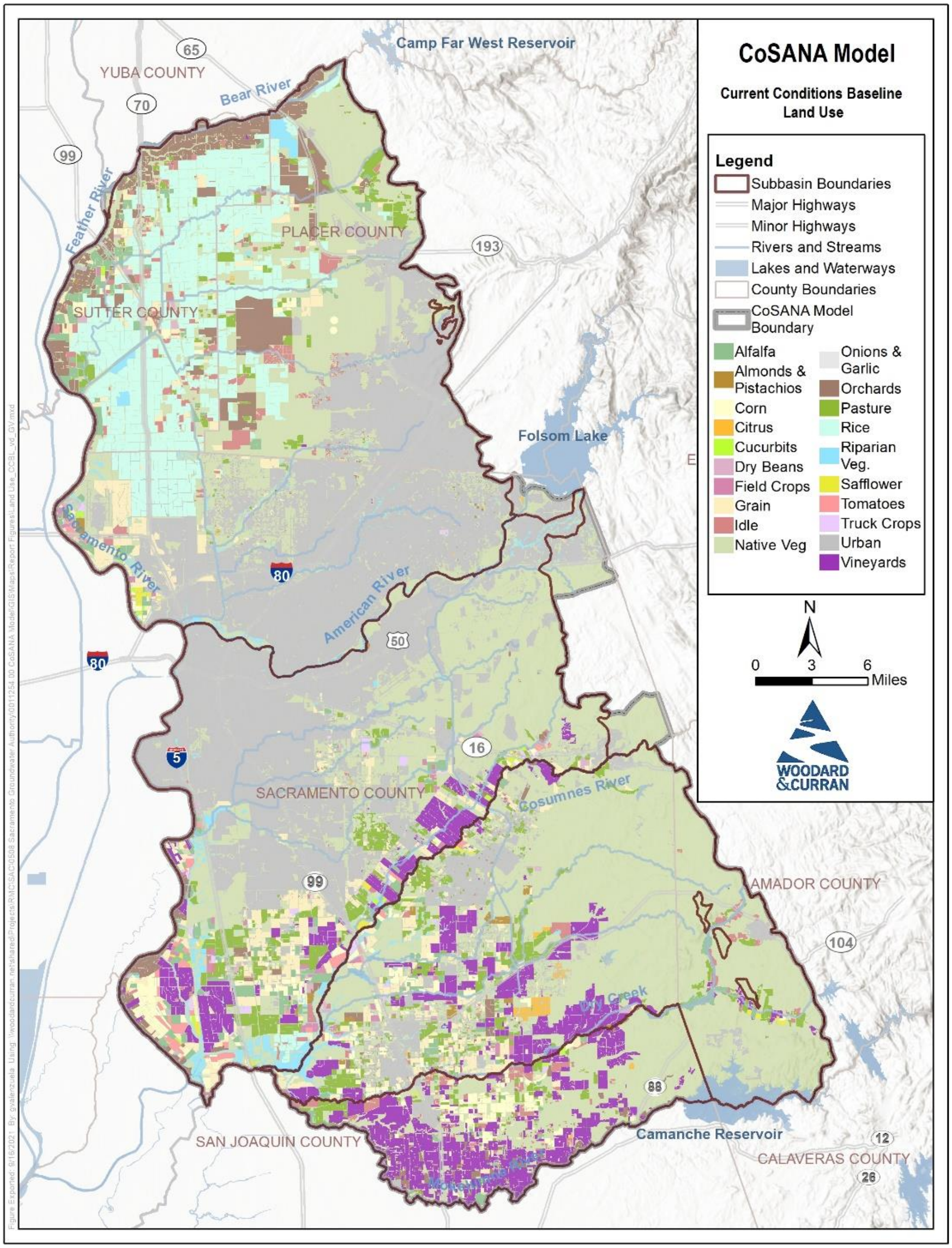


Figure 5-3: Current Conditions Baseline Land Use

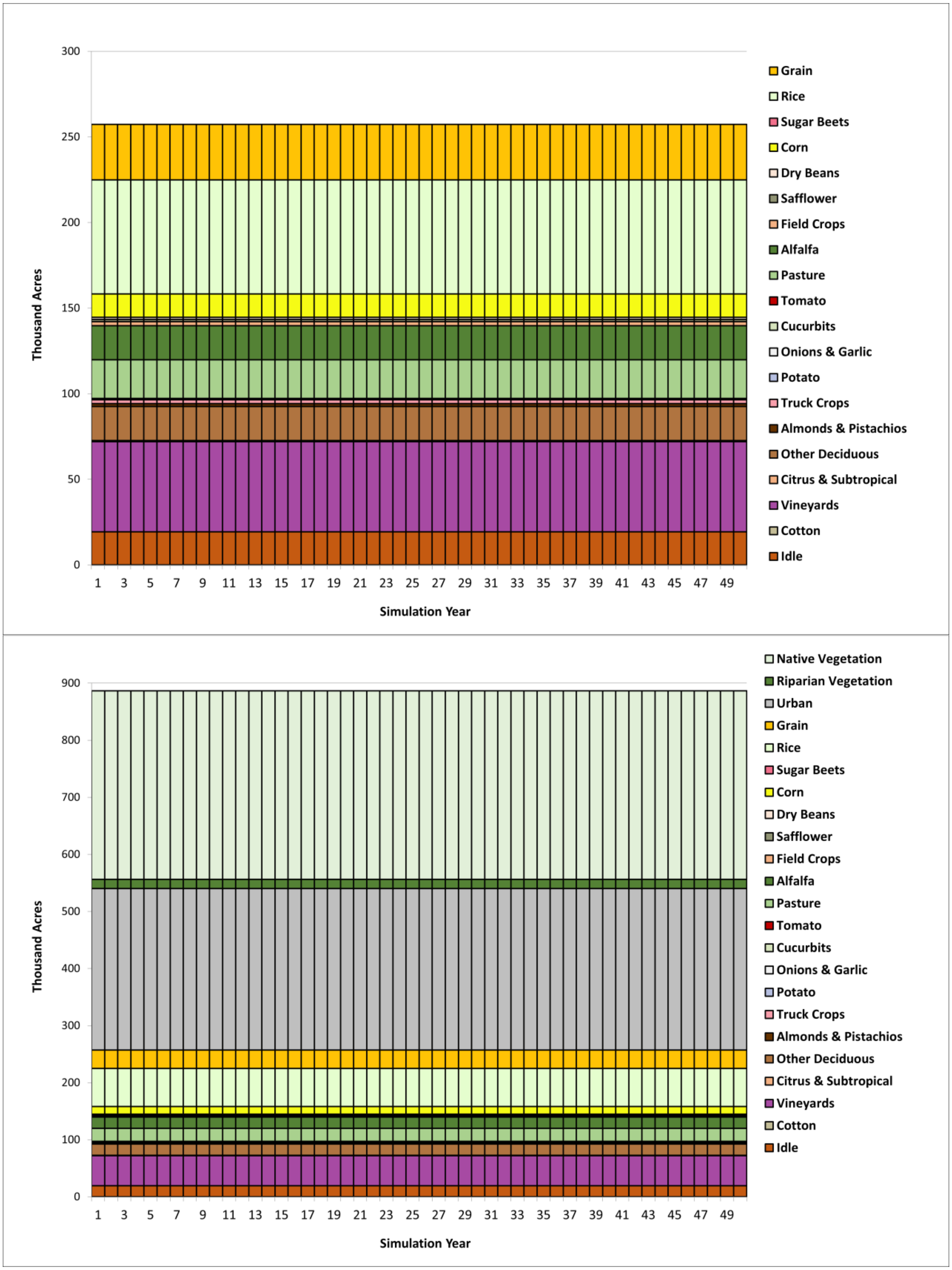
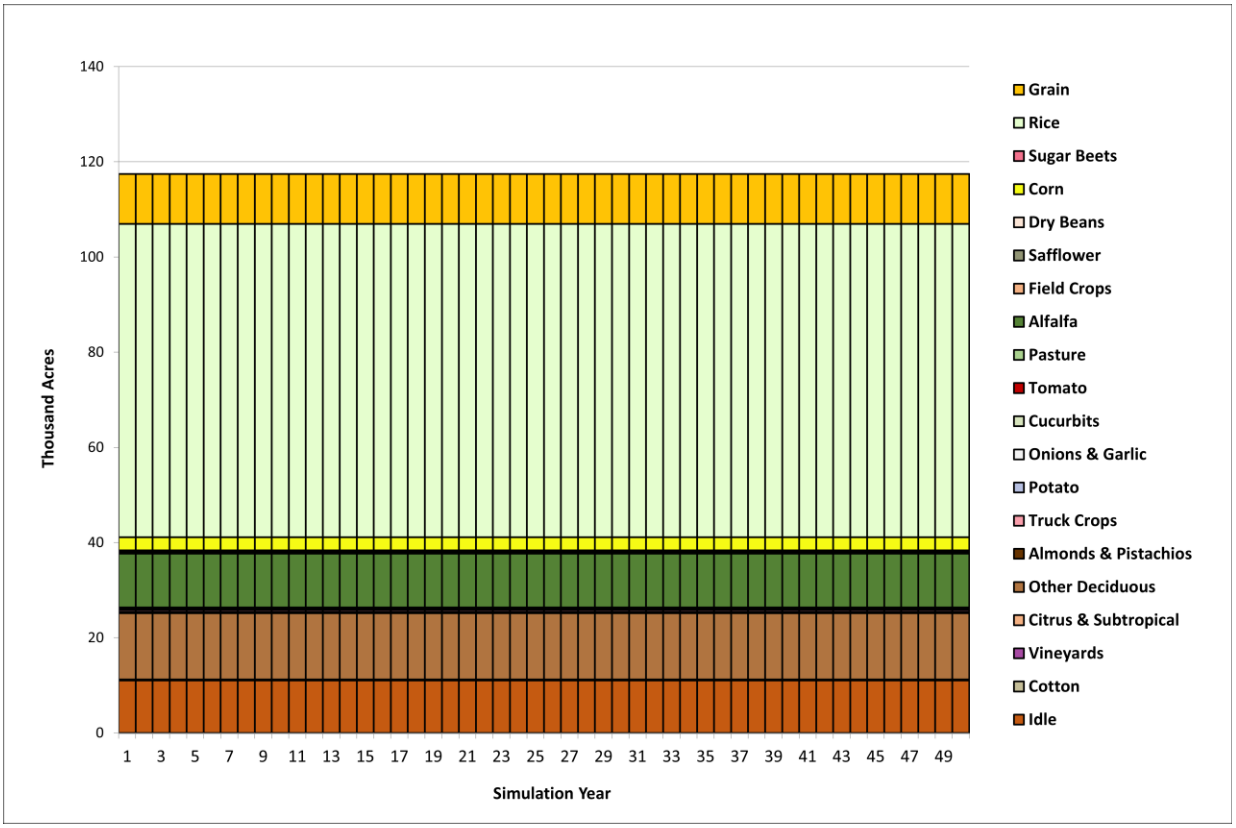


Figure 5-4: Current Conditions Baseline Land Use for CoSANA



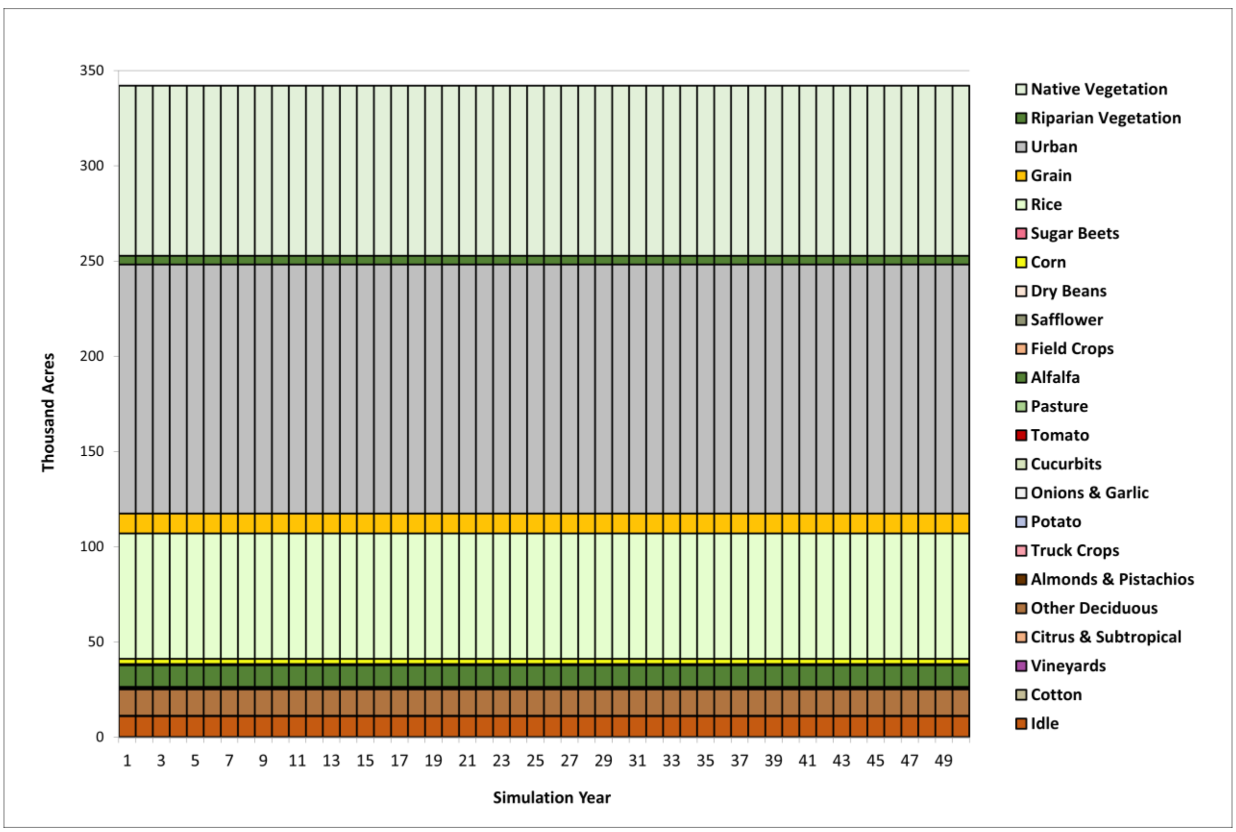


Figure 5-5: Current Conditions Baseline Land Use for North American Subbasin

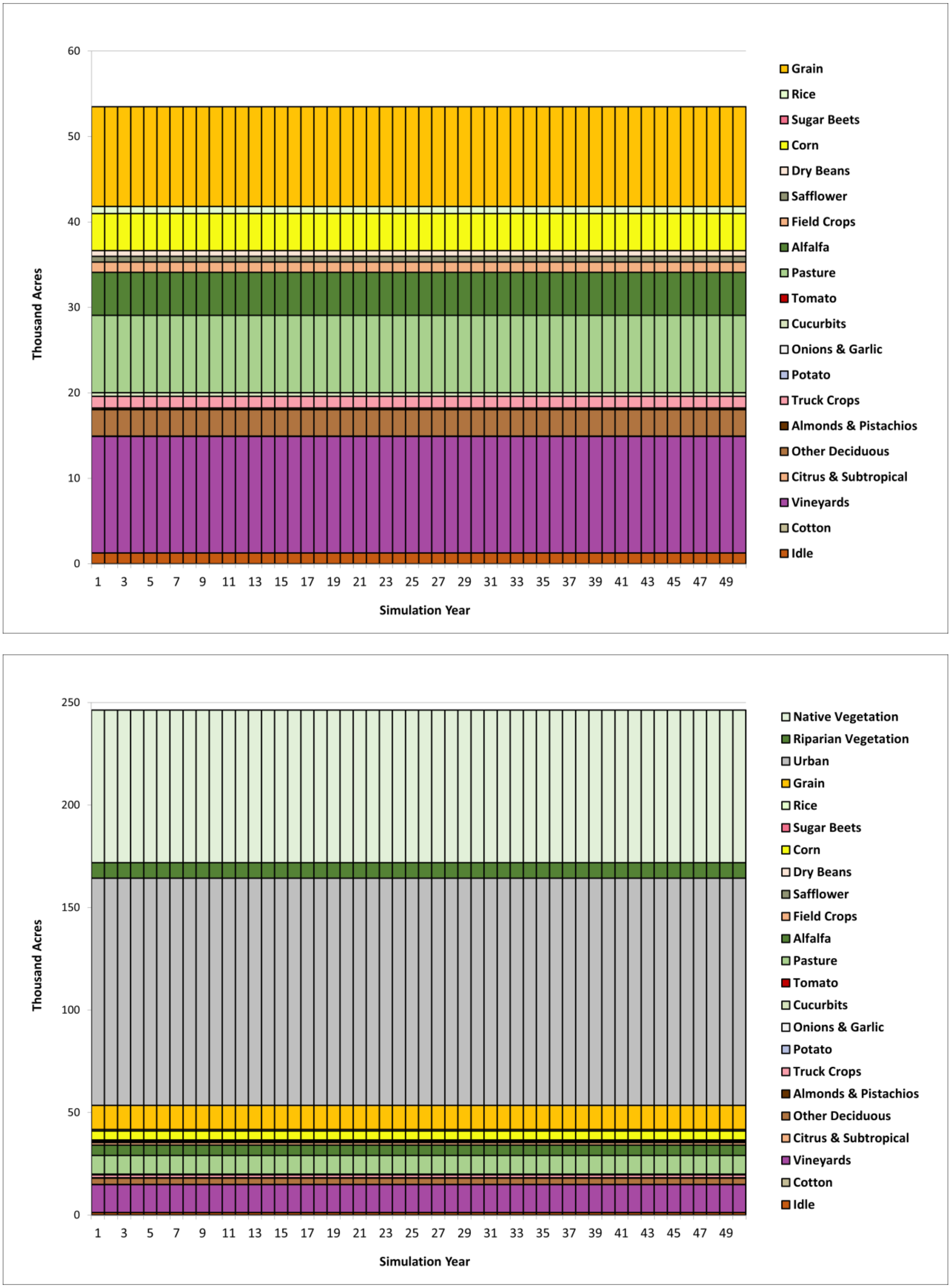
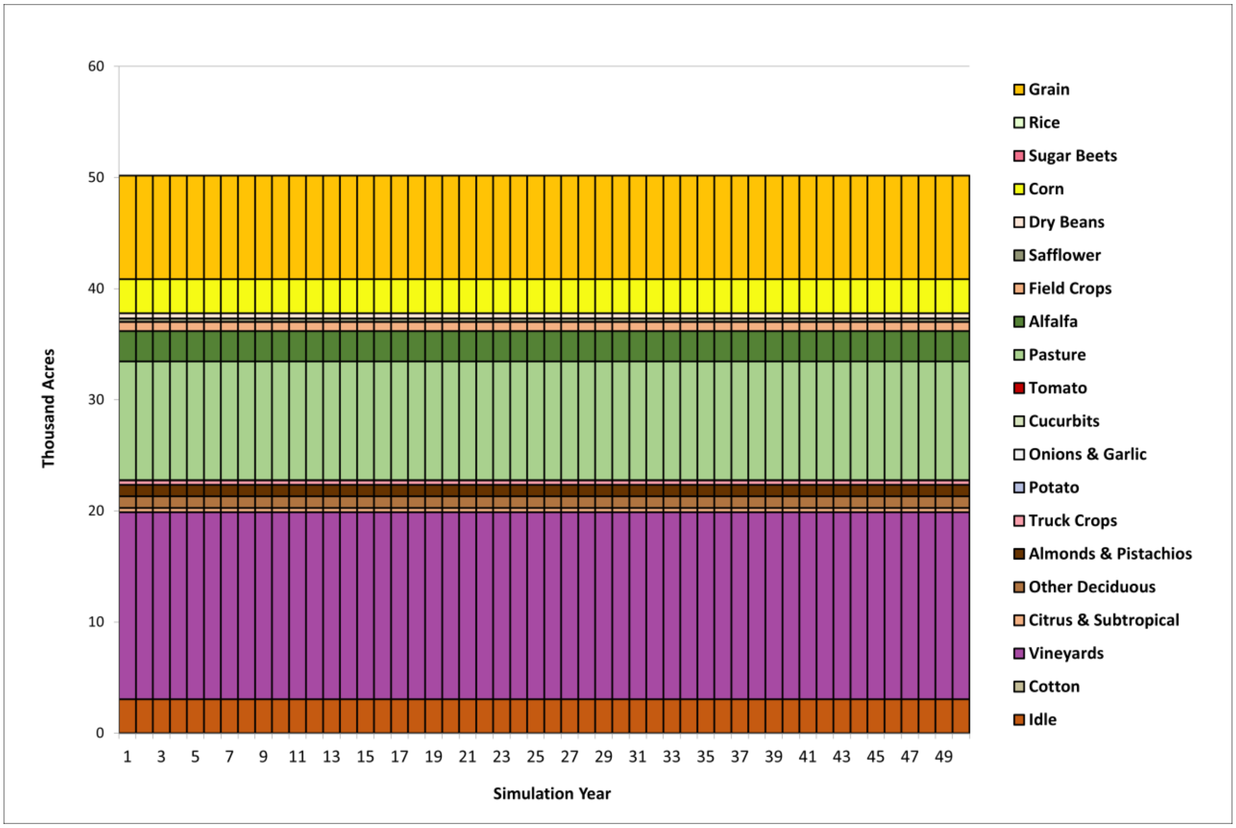


Figure 5-6: Current Conditions Baseline Land Use for South American Subbasin



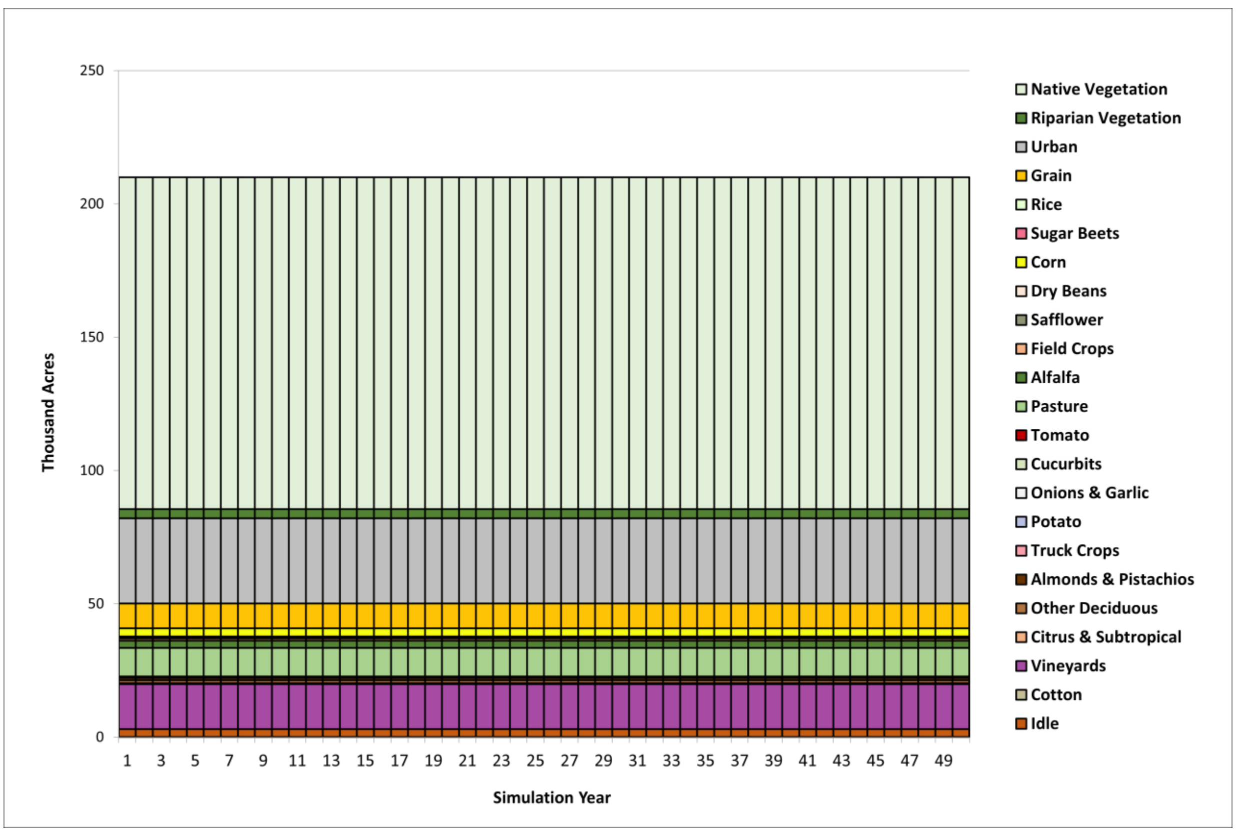


Figure 5-7: Current Conditions Baseline Land Use for Cosumnes Subbasin

5.1.5 Urban Demand and Supply

Urban demand is represented for each urban area based on supply data. Like the CoSANA historical model, each baseline assumes that urban supply (combined groundwater, surface water, and other sources such as recycled water) is equal to urban demand.

Urban water supply, including surface water deliveries, groundwater pumping, recycled water, and remediated water, are all calculated using the method described below, unless exceptions are listed in the individual purveyor sections that follow. To estimate CCBL water supply, the information for the last 10 years of the historical simulation (WY 2009 through 2018) was averaged by the three baseline water year types (normal, wet, and dry) described in Section 5.1.1.4. WY 2009 through 2018 contains four normal years (2010, 2012, 2016, and 2018), two wet years (2011 and 2017), and 4 dry years (2009, 2013, 2014, and 2015). Appendix G shows subregion/purveyor urban demand and supply for each entity for the three WY types (normal, wet, and dry). The water supply conditions for these three baseline year types were applied to the 50 years of hydrology within the CCBL.

For urban groundwater pumping, a well was assumed active in the CCBL if there was historical recorded pumping in WY 2016-2018. Average pumping by baseline year type was distributed in the CCBL to all active wells by purveyor based on their proportion of the historical simulation purveyor totals.

As previously noted, urban demand and supply were calculated using averages developed from the last 10 years of the historical simulation for all agencies except those specified otherwise in the following subsections.

5.1.5.1 North American Subbasin

The following subsections present demand and supply assumptions for purveyors within the North American Subbasin whose assumptions are different from the standard methodology outlined above.

5.1.5.1.1 City of Sacramento

City of Sacramento's demand was based on the last 10 years of the historical simulation. Demand varies slightly with water year types from 34,702 AFY for wet years to 35,274 AFY for dry years. Approximately 35% of the demand was assumed to be in the NASb portion of the model, based on urban area.

The City of Sacramento's current supplies include groundwater pumping and surface water supplies that vary by five water year types (as opposed to three water year types used for other purveyors) based on the City of Sacramento's 2017 Groundwater Master Plan (GWMP) (City of Sacramento, 2017). Groundwater pumping assumptions for the CCBL were consistent with the Future Conditions Baseline scenario developed in the 2017 GWMP, based on the discussions with the City of Sacramento (B. Ewart, personal communication, December 2020). Monthly pumping assumptions by each well were incorporated into the CCBL based on well locations and monthly well operations, as specified in the 2017 GWMP. Groundwater pumping in the NASb varies from 6,989 AFY during wet years to 41,841 AFY during driest years. Demand after groundwater pumping was assumed to be supplied by surface water.

The City of Sacramento also has specific wells that supply certain larger parks and green areas within the city. These irrigation wells are simulated using six representative irrigation wells that pump 2,400 AFY. Based on the locations of the irrigated parks and green areas, approximately half of the irrigation pumping was estimated in the NASb and the remaining half in the SASb.

5.1.5.1.2 Sacramento County Water Agency (Arden Park Vista and Northgate)

Due to changing supply conditions over the last 10 years of the historical simulation, the SCWA service areas of Northgate and Arden Park Vista in the CCBL use groundwater pumping from WY 2018 for normal and dry baseline years and WY 2019 for wet baseline years.

5.1.5.2 South American Subbasin

The following subsections present demand and supply assumptions for purveyors within the South American Subbasin whose assumptions are different from the standard methodology.

5.1.5.2.1 City of Sacramento

The discussion also applies to the portion of the City of Sacramento that lies within the South American Subbasin; the portion within the NASb was discussed above in Section 5.1.5.1. Groundwater pumping in the SASb by the city varies from 1,761 AFY during wet years to 11,885 AFY during driest years, based on the Future Conditions Baseline scenario developed in the 2017 GWMP and the discussions with the City of Sacramento (B. Ewart, personal communication, December 2020). Monthly pumping assumptions by each well and by each water year type were incorporated into the CCBL based on well locations and monthly well operations, as specified in the 2017 GWMP. Demand after groundwater pumping was assumed to be supplied by surface water.

5.1.5.2.2 Sacramento County Water Agency (Hood, Laguna Vineyard, and Mather)

Due to changing supply conditions over the last 10 years of the historical simulation, including construction of the Vineyard Surface Water Treatment Plant (online in WY 2011), the SCWA service areas of Hood, Laguna Vineyard, and Mather in the CCBL use surface water deliveries, groundwater pumping, recycled water, and remediated water from WY 2018 for normal and dry baseline years and WY 2019 for wet baseline years.

5.1.5.3 Cosumnes Subbasin

The following subsections present demand and supply assumptions for purveyors within the Cosumnes Subbasin whose assumptions are different from the standard methodology.

5.1.5.3.1 City of Galt

The average historical groundwater production for WY 2015-2018 for the City of Galt was used to estimate groundwater pumping for all CCBL years. This pumping occurs at six active wells.

5.1.5.3.2 City of Ione

To estimate CCBL surface water supply to the City of Ione, the average for WY 2015-2018 was used for all CCBL years.

5.1.5.3.3 Camanche Village

To estimate CCBL groundwater pumping water supply for Camanche Village from six active wells, the average for WY 2015-2018 was used for all CCBL years.

5.1.5.3.4 Sacramento Municipal Utility District

The imported Central Valley Project water from the American River via the Folsom South Canal to the Sacramento Municipal Utility District (SMUD) facility uses the average for WY 2015-2018 for all CCBL years.

5.1.5.4 Fish Farms

In the North American Subbasin, four wells were used to simulate 3,480 AFY of pumping for Sterling Caviar, which is located near the Sutter/Sacramento County line just east of Highway 99.

Groundwater pumping at fish farms in the South American Subbasin and Cosumnes Subbasin uses the average for WY 2015-2018 for all CCBL years.

5.1.6 Agricultural Demand and Supply

Agricultural demand in the CCBL is calculated within the model using land use, evapotranspiration, precipitation, and other information, as described for the historical simulation in Section 3.3.

Agricultural supply in the CCBL made of up primarily of surface water deliveries and groundwater pumping. Surface water deliveries are based on water year types (normal, wet, and dry) averages calculated using the last 10 years of the historical simulation (WY 2009-2018). Demand not met by surface water is assumed to be met by groundwater pumping, which is pumped within the associated model element, rather than coming from specific agricultural pumping wells.

5.1.6.1 Rural-Residential Pumping

Rural residential pumping for the current conditions baseline is assumed to be the same as the historical model for water year 2018. Refer to Section 3.3.1 in the historical model documentation.

5.1.6.2 Galt Wastewater Treatment Plant Effluent

The reclaimed water use from the Galt Wastewater Treatment Plant (WWTP) uses the average for WY 2015-2018 for all CCBL years, regardless of baseline water year type.

5.1.6.3 Agricultural Groundwater Substitution Transfers

Pumping associated with agricultural water transfers occurs in three entities in the North American Subbasin: Natomas Mutual Water Company (NMWC), Pleasant Grove-Verona Mutual Water Company (PGVMWC), and South Sutter Water District. NMWC and PGVMWC participate in groundwater substitution transfers under certain conditions. South Sutter Water District is different from the other two, as they transfer water based on a hybrid approach. The water made available is released from storage in Camp Far West Reservoir. Generally, a similar volume of groundwater is pumped by private well owners within the district. This volume is not directly measured and is assumed to be slightly less than the amount released from storage. This is represented in the CCBL by delivering less surface water during dry years than normal or wet years, with averages calculated using the data from the last 10 years of the historical simulation. The groundwater pumping is calculated internally in the model and therefore automatically adjusts for years with less or more surface water.

For NMWC and PGVMWC, historical groundwater substitution transfer pumping data was provided for water years 2020 and 2021 (2019 was not a transfer year). For the CCBL estimates of groundwater substitution transfer pumping, dry year averages were calculated using historical data for WY 2012-2021. During this 10-year period, all groundwater substitution transfer pumping occurs in the five dry years (2013, 2014, 2015, 2020, and 2021). The estimated dry year transfer pumping for NMWC and PGVMWC was distributed among all transfer wells in the same proportion as in the historical data. The surface water deliveries to NMWC and PGVMWC in the CCBL are adjusted based on the amount of dry year transfer pumping.

5.1.7 Remediation Operations

Remediation operations for Mather, McClellan, Kiefer, and Aerojet, discussed for the historical simulation in Section 3.4, in the CCBL are held constant at the WY 2018 level of pumping for the entire CCBL. The number and location of the remediation wells is assumed to remain the same as in the historical simulation. Mather remediation pumping is set at 209 AFY, McClellan remediation pumping is set at 2,409 AFY, Kiefer remediation pumping is set at 621 AFY, and Aerojet remediation pumping is set at 32,040 AFY.

5.1.8 Results

This section provides a summary of the CoSANA CCBL results.

5.1.8.1 Land and Water Use Budget

The land and water use budget provides details on the urban and agricultural demand and the water supply meeting the demand (groundwater pumping, surface water deliveries, recycled water, or remediation pumping). Average annual CCBL model results by groundwater subbasin are shown in Table 5-2. Annual agricultural water demand and supply by subbasin are shown in Figure 5-8 through Figure 5-10. Annual urban demand and supply by subbasin are shown in Figure 5-11 through Figure 5-13. Appendix H includes model subregion land and water use budgets for the baselines.

Table 5-2: CCBL Average Annual Land and Water Use Budget

Subbasin	Ag. Demand (AFY)	Ag. Ground-Water Use* (AFY)	Ag Surface Water Deliveries (AFY)	Urban Demand (AFY)	Urban Ground-Water Use** (AFY)	Urban Surface Water Deliveries (AFY)	Urban Recycled Water (AFY)	Remediation Pumping (AFY)
NASb	392,619	206,201	188,962	200,913	83,319	117,596	-	5,515
SASb	142,961	98,369	44,804	174,487	79,948	93,871	856	29,765
CoSb	126,838	105,049	21,458	27,520	22,825	2,483	-	-
Total	**662,418**	**409,619**	**255,224**	**402,920**	**186,092**	**213,950**	**856**	**35,280**

Note:
* Agricultural groundwater use presented in the above table may differ slightly from the values shown in the respective GSP due to minor difference in the methodology on calculation of rural residential water use.
** Urban groundwater use in the above table represents water used that originated from groundwater production but can include water that was pumped in areas outside of the respective subbasin.

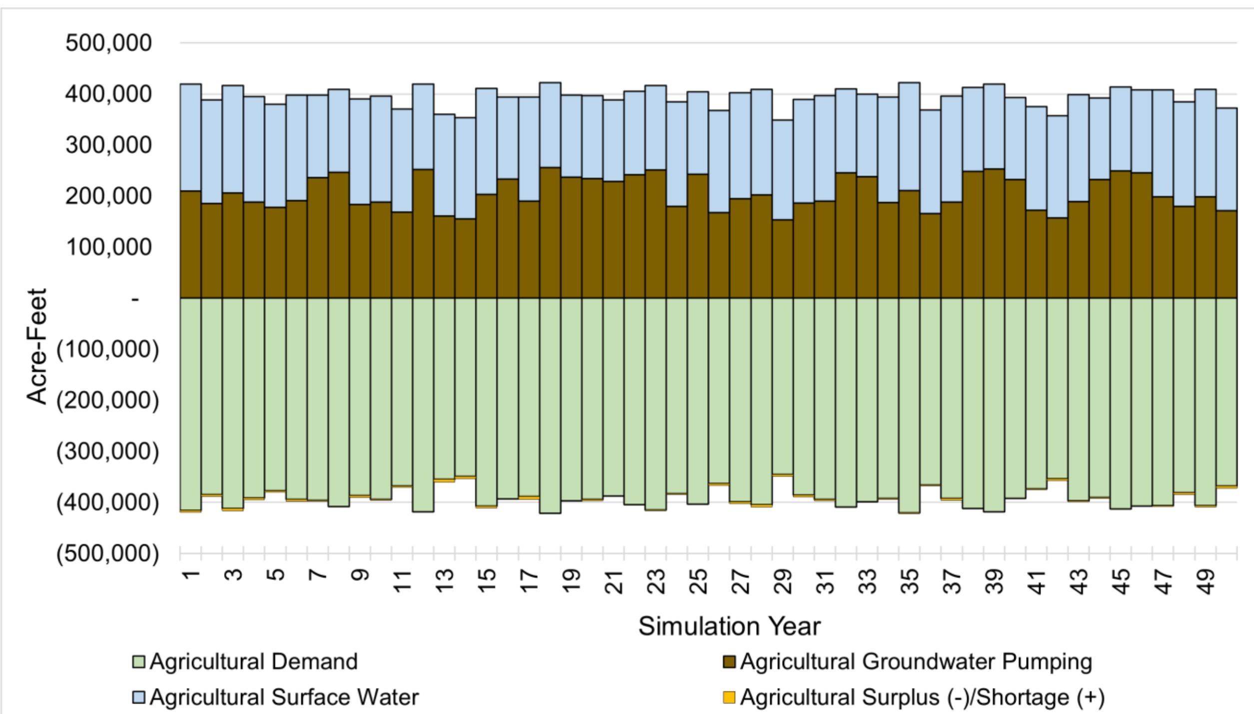


Figure 5-8: Annual Agricultural Water Demand and Supply – North American Subbasin, Current Conditions Baseline

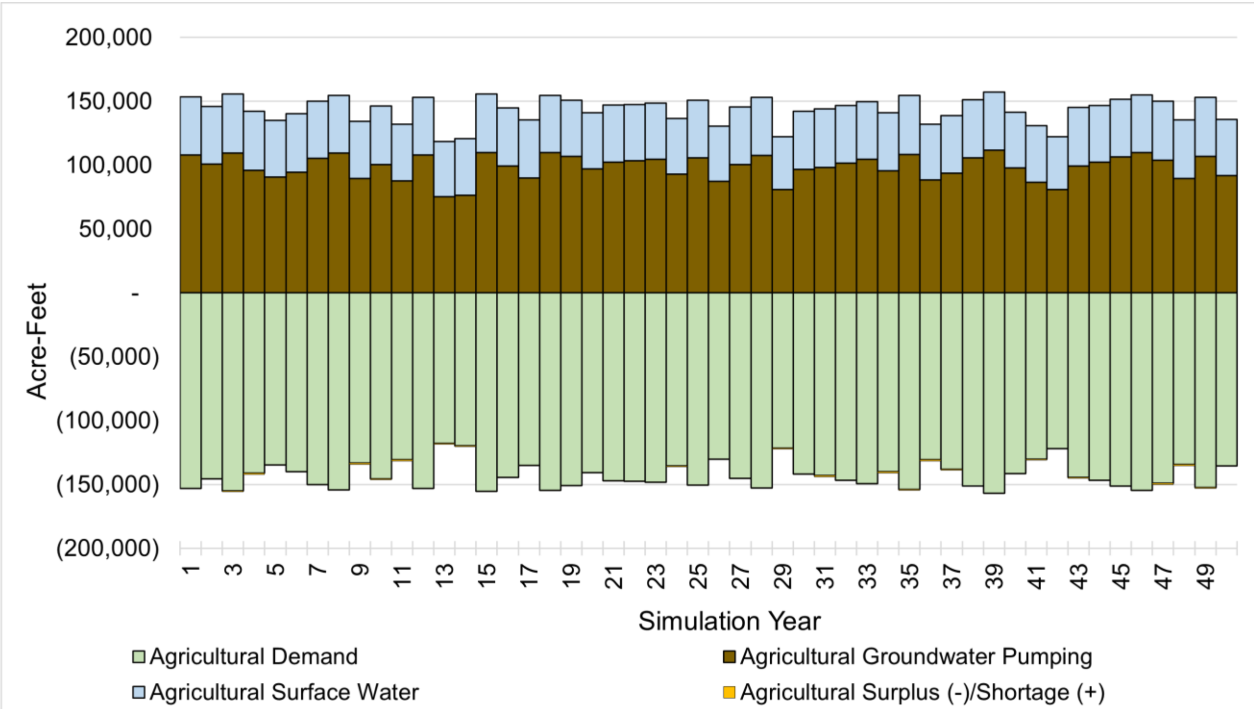


Figure 5-9: Annual Agricultural Water Demand and Supply – South American Subbasin, Current Conditions Baseline

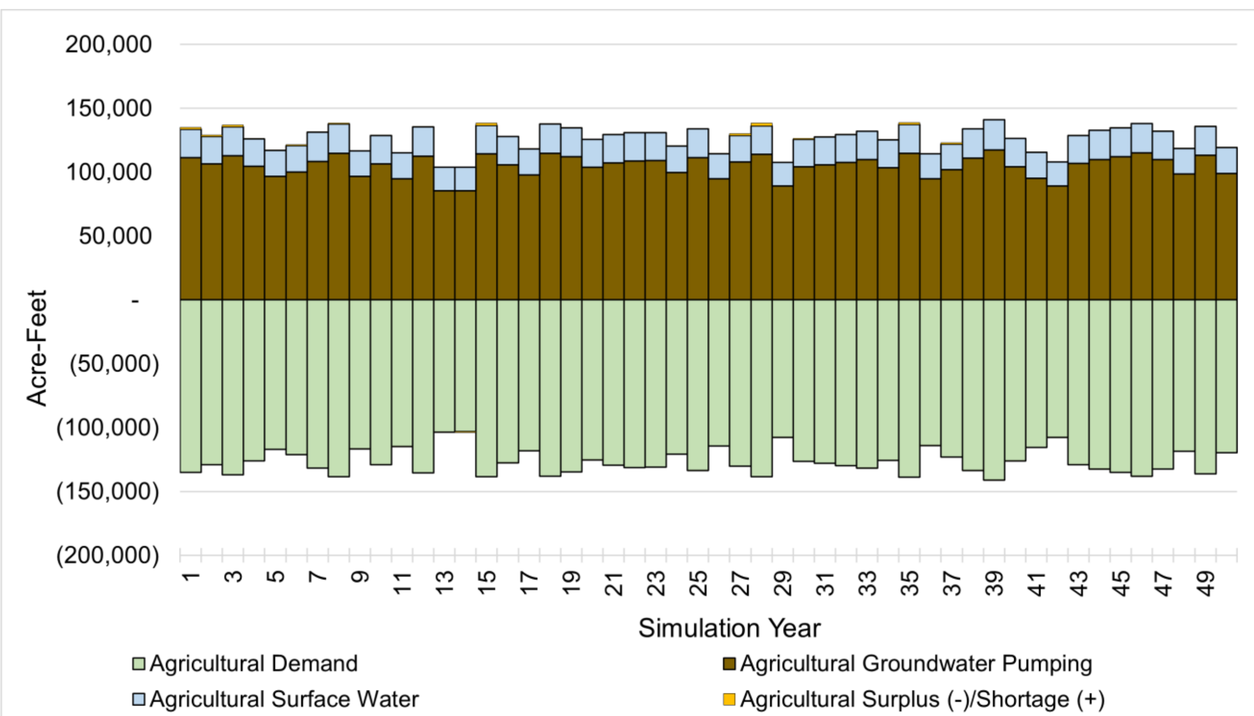


Figure 5-10: Annual Agricultural Water Demand and Supply – Cosumnes Subbasin, Current Conditions Baseline

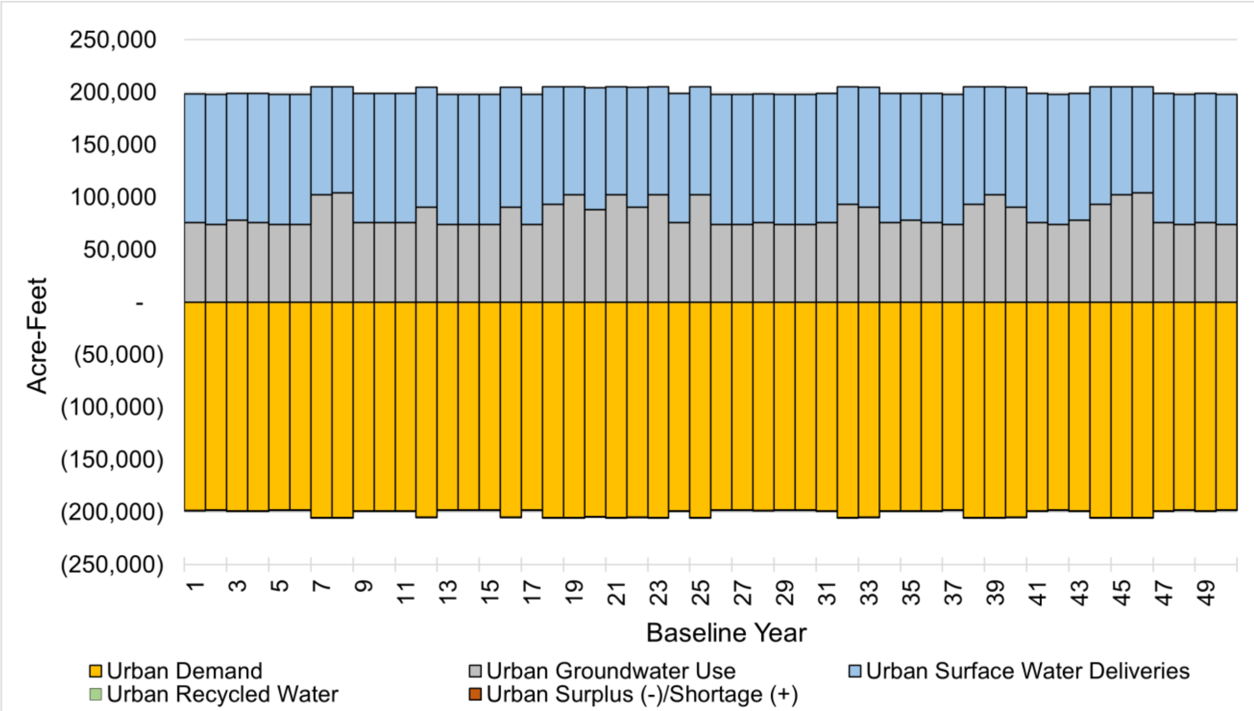


Figure 5-11: Annual Urban Water Demand and Supply – North American Subbasin, Current Conditions Baseline

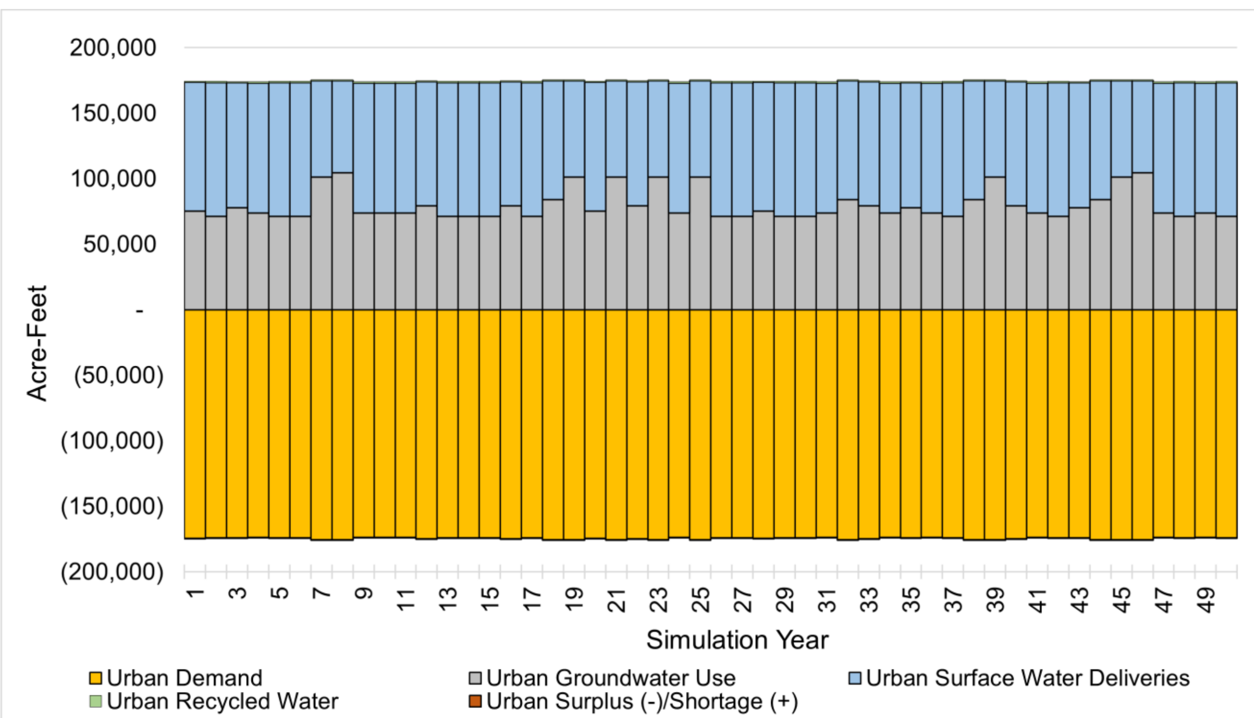
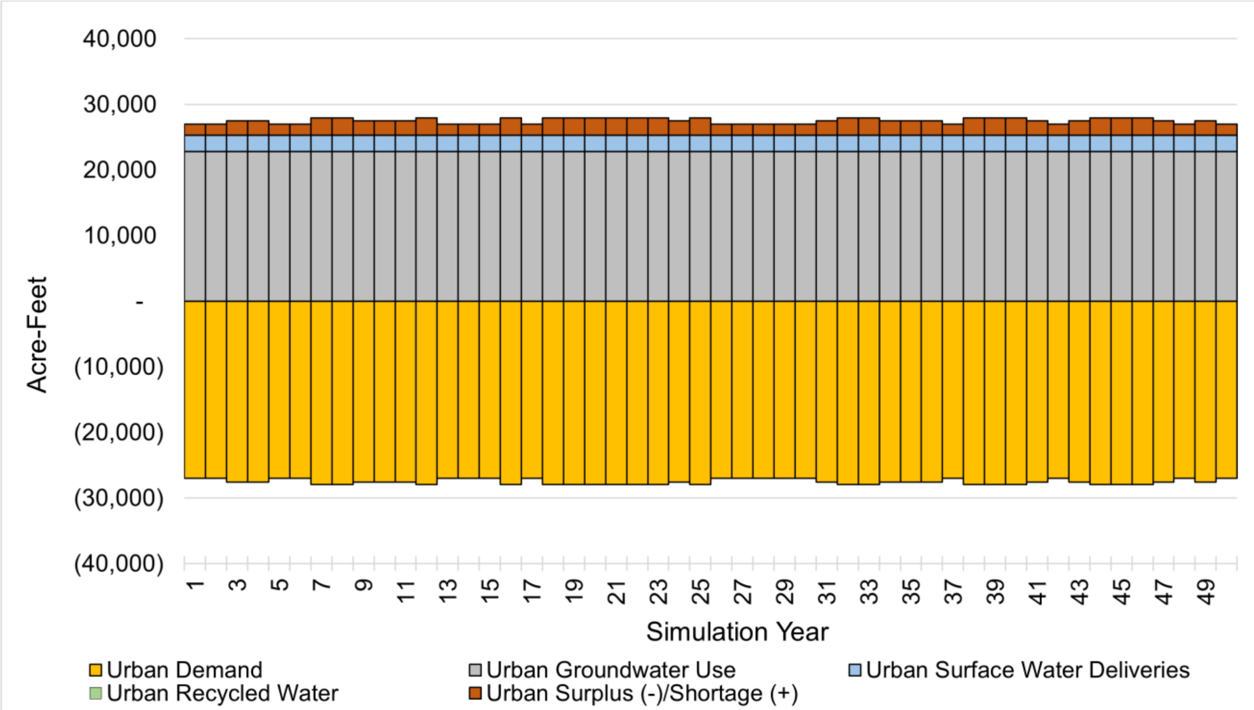


Figure 5-12: Annual Urban Water Demand and Supply – South American Subbasin, Current Conditions Baseline



Note: Urban groundwater use is specified in the CoSb model input data set. The model-calculated surplus/shortage in urban demand is therefore not utilized to calculate the CoSb groundwater budget.

Figure 5-13: Annual Urban Water Demand and Supply – Cosumnes Subbasin, Current Conditions Baseline

5.1.8.2 Groundwater Budget

The groundwater budget provides all inflows and outflows to the groundwater aquifer system. Average annual CCBL model results by groundwater subbasin are shown in Table 5-3. Annual groundwater budgets with cumulative change in storage by subbasin are shown in Figure 5-14 through Figure 5-16. Appendix I includes model subregion groundwater budgets for the baselines. Appendix J includes a set of sample hydrographs for the baseline models.

Table 5-3: CCBL Average Annual Groundwater Budget

Subbasin	Pumping (AFY)	Deep Percolation (AFY)	Gain from Stream (AFY)	Recharge from Canals (AFY)	Boundary Flows (AFY)	Subsurface Inflow (AFY)	Change in Storage (AFY)
NASb	303,094	183,468	81,494	16,732	28,125	8,161	14,843
SASb	212,626	120,915	91,328	26	4,089	-1,573	2,158
CoSb	127,875	109,064	15,575	0	1,442	1,559	-233
Total	**643,595**	**413,447**	**188,397**	**16,758**	**33,656**	**8,147**	**16,768**

Note: Boundary Flows term includes flow between areas outside of the CoSANA model domain and baseflow from small watersheds. Subsurface Inflows includes flow between the simulated subbasins in CoSANA and areas outside of Bulletin 118 subbasins.

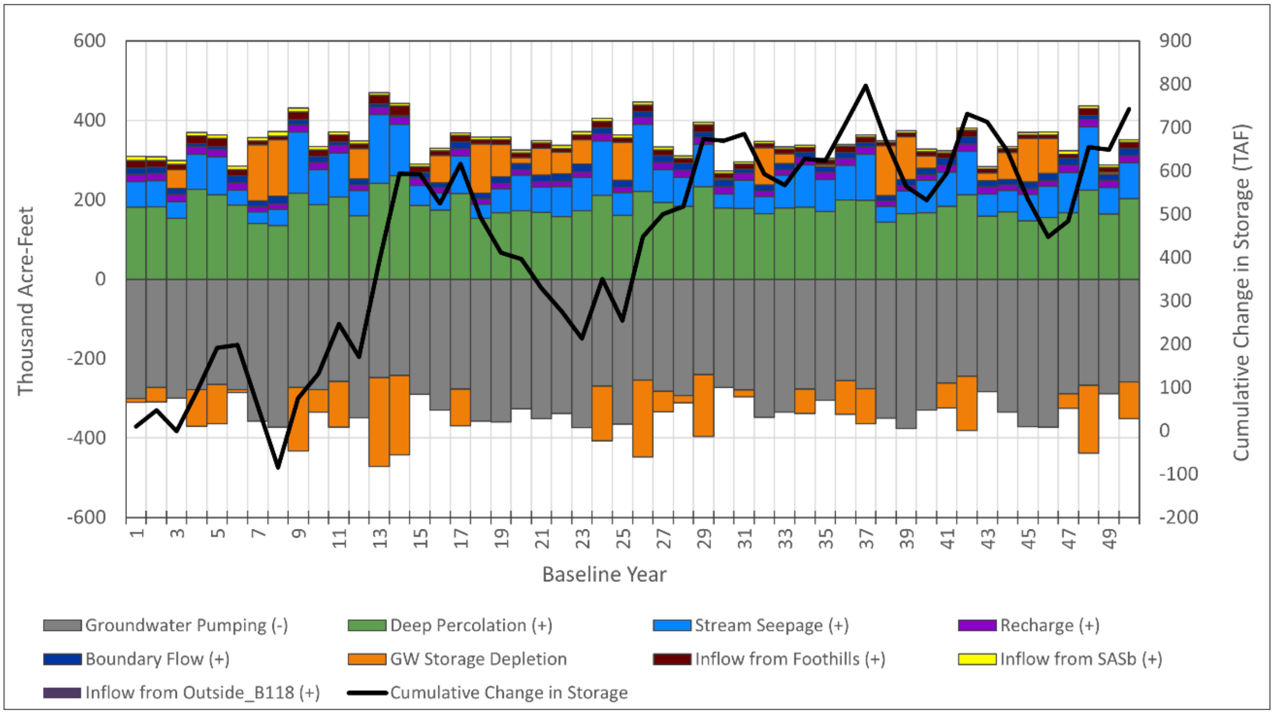


Figure 5-14: Annual Groundwater Budget and Cumulative Change in Storage – North American Subbasin, Current Conditions Baseline

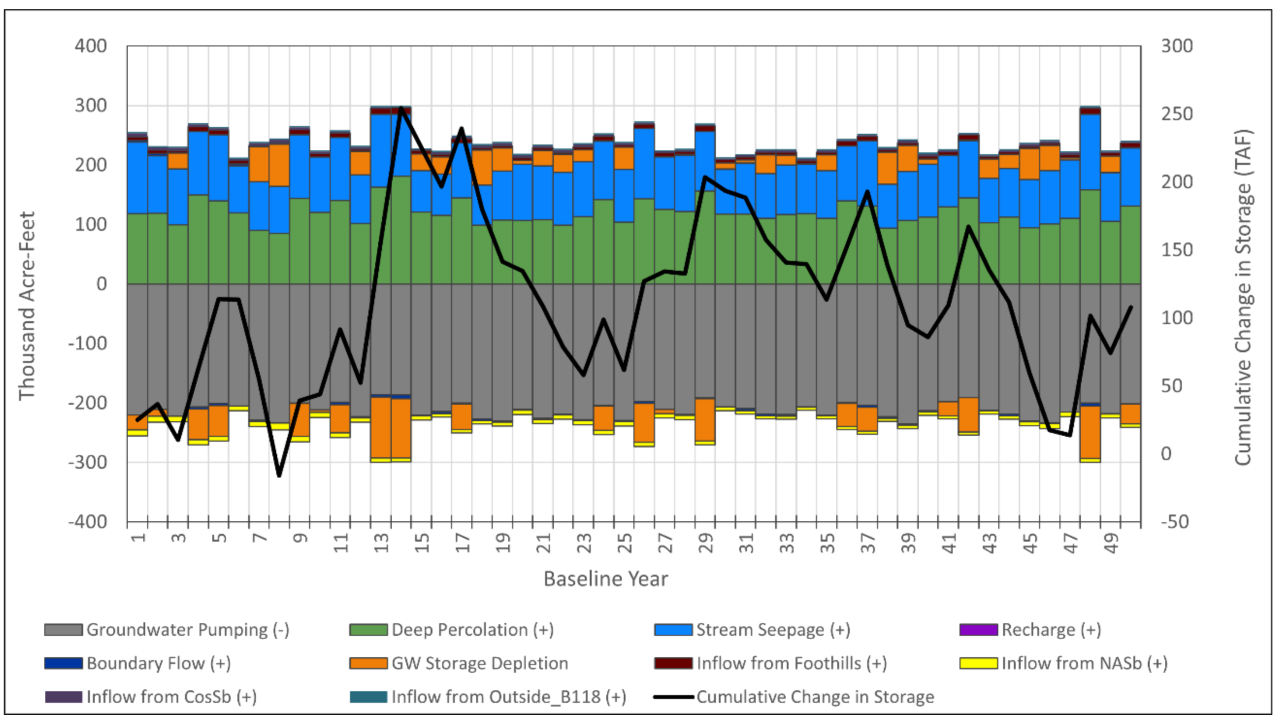


Figure 5-15: Annual Groundwater Budget and Cumulative Change in Storage – South American Subbasin, Current Conditions Baseline

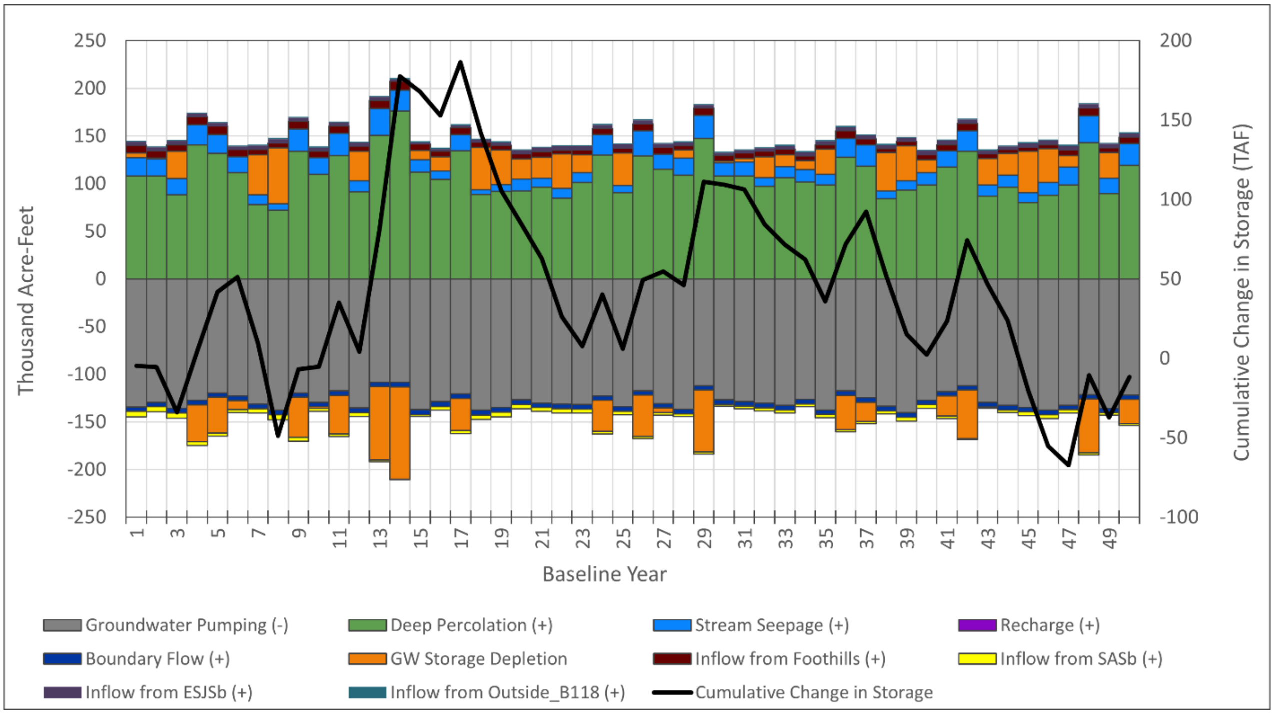


Figure 5-16: Annual Groundwater Budget and Cumulative Change in Storage – Cosumnes Subbasin, Current Conditions Baseline

5.2 Projected Conditions Baseline

The CoSANA Projected Conditions Baseline (PCBL) is a representation of the projected land and water use conditions of 2040, or the closest information available from planning documents. This section presents the key data sources and assumptions used to develop the PCBL and provides the model results. Initial groundwater levels and soil conditions in the PCBL represent those at the end of the simulation period of the historical CoSANA (September 30, 2018).

5.2.1 Hydrologic Period

The PCBL uses the 50-year historical hydrology from WY 1970 through 2019 (October 1, 1969 through September 30, 2019) for precipitation, evapotranspiration, and streamflow. This is the same as for the CCBL, discussed in Section 5.1. The hydrologic year types discussed in Section 5.1.1.4 are used in the PCBL to develop projected water demands and supplies.

5.2.2 Land Use

The PCBL incorporates the proposed new developments to reflect the 2040 land use conditions or the closest data available from planning documents. The existing land use data for 2015 conditions used in the CCBL were modified to incorporate the future projected urban footprint. The urban footprint for the proposed new developments, urban demand, and urban supply projections including the new developments were incorporated into the model, as further explained below.

Table 5-4 lists the proposed new developments incorporated into the PCBL. A total of 62 proposed new developments were identified, including 34 in the NASb, 25 in the SASb, and 3 in CoSb. In the CoSb, urban land was expanded around existing developed areas, as projected in planning documents.

The main data source for identifying the new developments in Sacramento County was information and GIS files provided by the Sacramento County Office of Planning and Environmental Review (T. Smith, personal communication, October 2020). In addition, public information available from the Sacramento Area Council of Governments (SACOG) was also collected and reviewed for identifying and confirming the developments within Placer and Sutter Counties. Placer County also reviewed the list of the new developments and provided inputs (J. Byous, personal communication, December 2020). Information was also available for many of the developments in Sutter and Placer Counties (R. Shatz, personal communication, December 2020).

The majority of the new developments in the NASb are located in Placer County near the City of Rocklin (Sunset Ranchos and Clover Valley), City of Lincoln (SUD A, SUD B, SUD C, Village 1, Village 2, Village 3, Village 4, Village 5, Village 6, and Village 7), City of Roseville (Amoruso Ranch, Creekview, HP Campus Oaks, North Area, Northwest Roseville, Sierra Vista, Sun City Roseville [or Del Webb] and West Roseville Specific Plans), and Cal-Am West Placer (Placer Vineyards Specific Plans East and West and Riolo Vineyards). Other proposed developments include the Placer Ranch and Regional University in Placer County, Sutter Pointe in Sutter County; and Grandpark Specific Plan, Elverta, Greenbrier, Panhandle, Northborough, and Upper Westside in Sacramento County.

The majority of the proposed new developments in the SASb are located within the SCWA service areas (Arboretum, Jackson Township, Laguna Ridge, Ranch at Sunridge, Rio del Oro (partially in the Cal-Am service area), Southeast Planning Area (Meridian), Sterling Meadows, SunCreek, SunRidge, Vineyards, Cordova Hills, Florin Vineyard Gap, Mather South, NewBridge, North Vineyard Station, Vineyard Springs, Lent Ranch, and West Jackson Highway Master Plan). Other proposed developments are located around or within the City of Folsom (Easton, Folsom South Area, and Glenborough), Rancho Murieta Community Service District (Rancho Murieta), and Elk Grove Water District (Triangle).

In the CoSb, urban land in the City of Galt was expanded based on 2030 projections in the City's General Plan, and areas in the vicinity of Ione ("Urban Planning Area") and Camanche Village ("Rural Residential") were expanded based on Amador County's General Plan. The footprint of the Buena Vista Rancheria was converted from native to urban.

The proposed new developments and future land use conditions are shown in Figure 5-17. The time-series of land use for the CoSANA PCBL is shown in Figure 5-18, highlighting the constant nature of land and water use in the baseline conditions. Figure 5-19 through Figure 5-21 show time-series of land use for the NASb, SASb, and CoSb, respectively.

Table 5-4: Proposed New Developments

Proposed Development Name	ID		Proposed Development Name	ID
Village 4	1		Greenbriar	32
SUD A	2		Panhandle	33
Village 3	3		Upper Westside	34
Village 5	4		Westborough	35
SUD B	5		Easton	36
Village 2	6		Glenborough	37
Village 1	7		Folsom South Area	38
Village 6	8		Rio Del Oro	39
Village 7	9		Mather South	40
SUD C	10		Ranch At Sunridge	41
Sunset Ranchos	11		SunRidge	42
Amoruso Ranch Specific Plan	12		SunCreek	43
Clover Valley	13		Cordova Hills	44
Placer Ranch	14		West Jackson Highway Master Plan	45
Creekview	15		Jackson Township	46
West Roseville	16		NewBridge	47
North Area Specific Plan	17		Arboretum	48
Sun City Roseville	18		Rancho Murrieta	49
HP Campus Oaks	19		Florin-Vineyard	50
Sierra Vista Specific Plan	20		North Vineyard Station	51
North Area Specific Plan 2	21		Delta Shores	52
Northwest Roseville Specific Plan	22		Vineyards	53
Sutter Pointe	23		Vineyard Springs	54
Regional University	24		Triangle	55
Riolo Vineyards	25		Laguna Ridge	56
Placer Vineyards Specific Plan (east)	26		Southeast Planning Area (Meridian)	57
Placer Vineyards Specific Plan (west)	27		Sterling Meadows	58
Dry Creek-West Placer Community Plan	28		Lent Ranch	59
Grandpark Specific Plan	29		Galt Sphere of Influence	60
Elverta Specific Plan	30		Camanche Village Rural Residential	61
Northborough Boundary	31		Ione Urban Planning Area	62

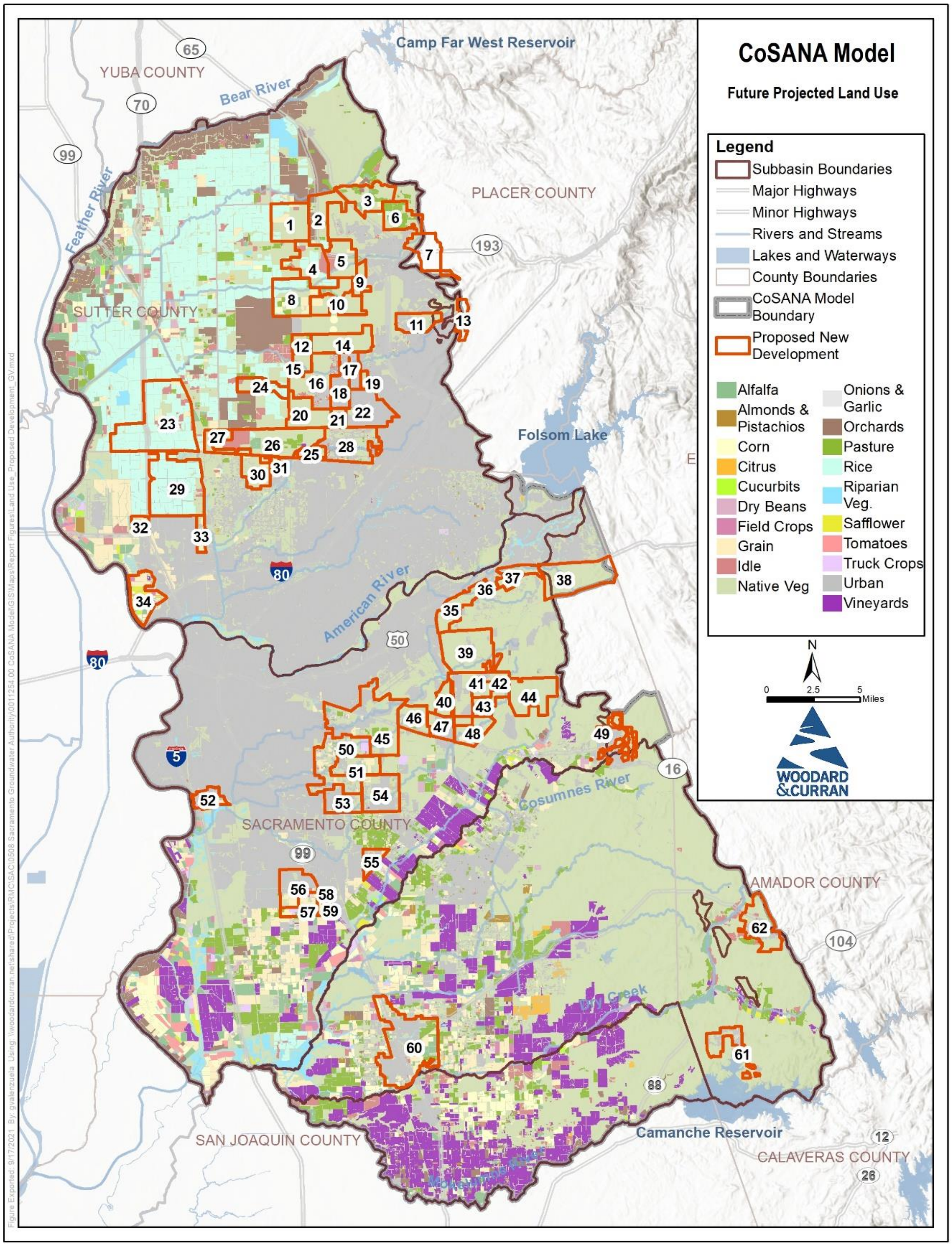


Figure 5-17: Projected Land Use and Proposed New Developments

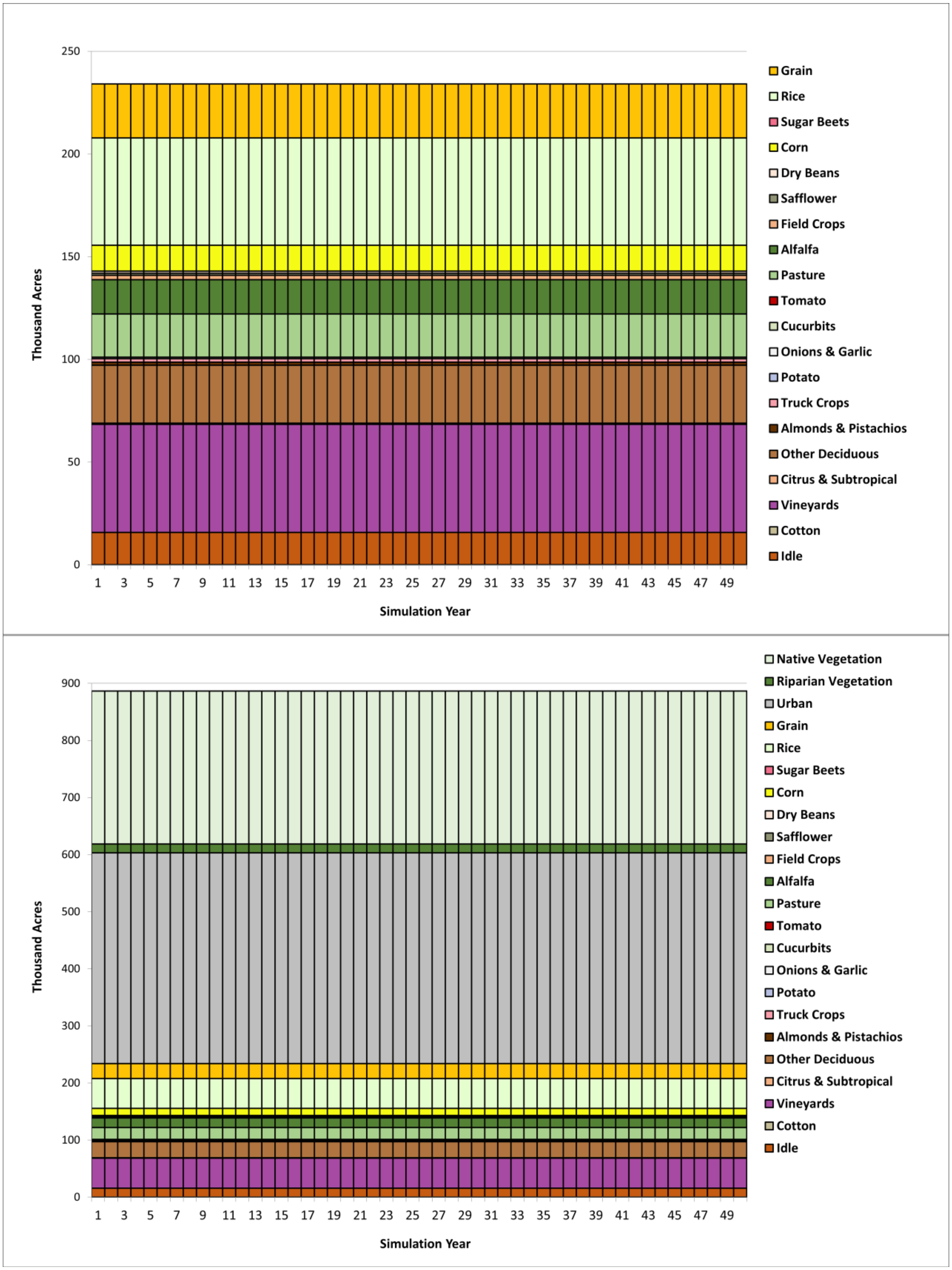
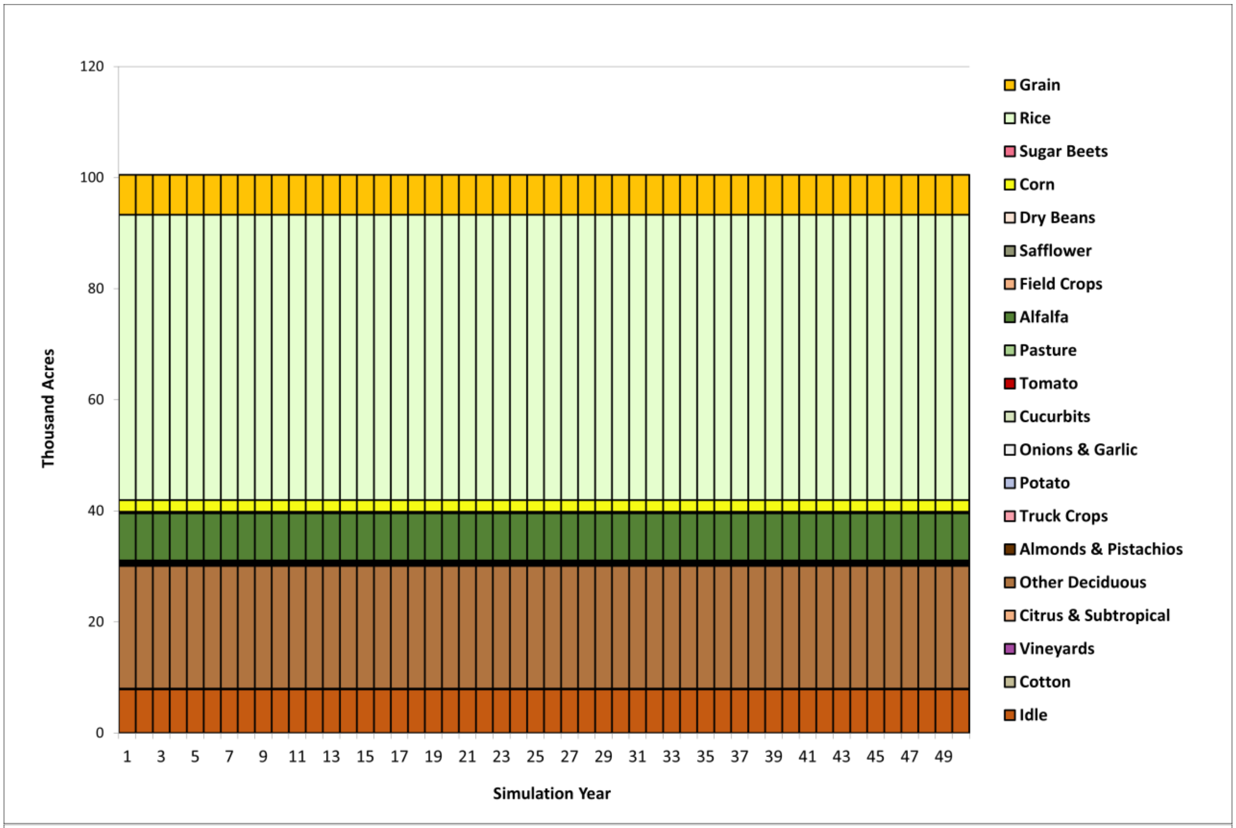


Figure 5-18: Projected Conditions Baseline Land Use for CoSANA



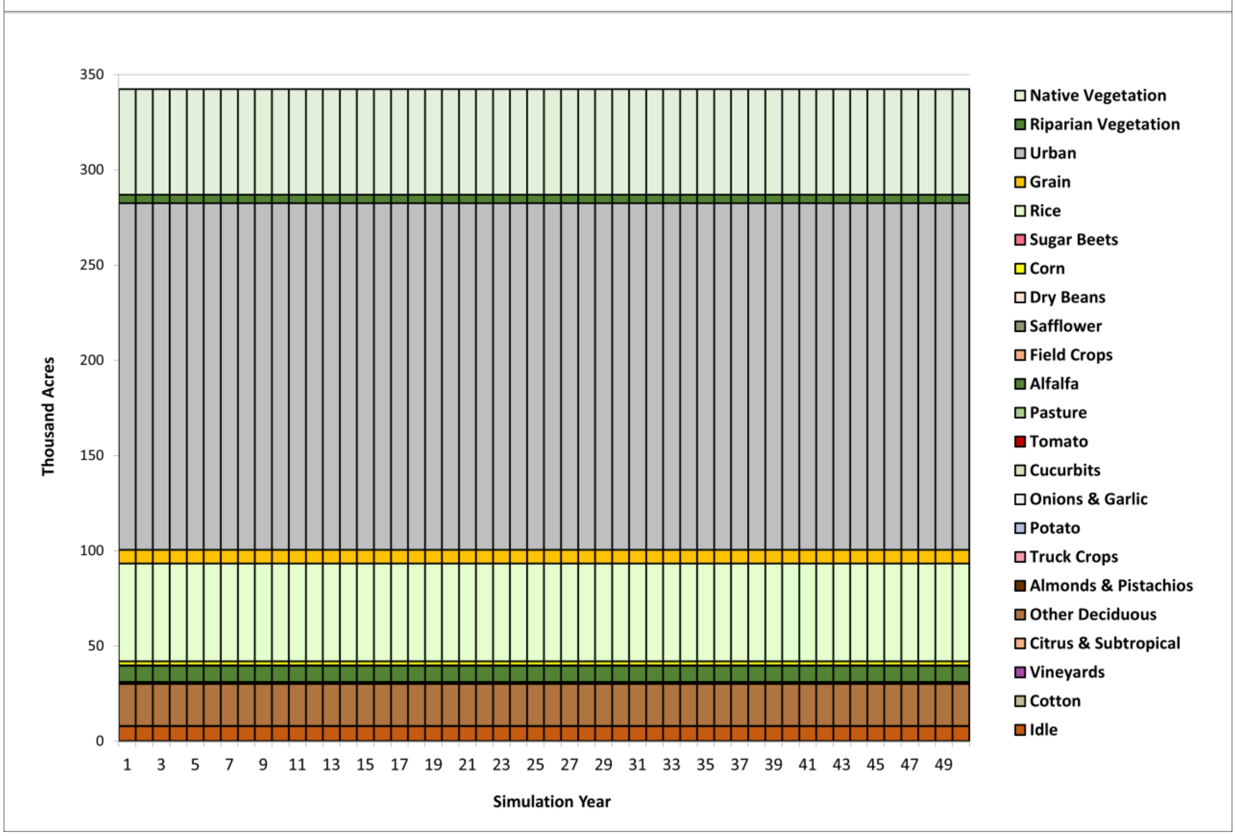
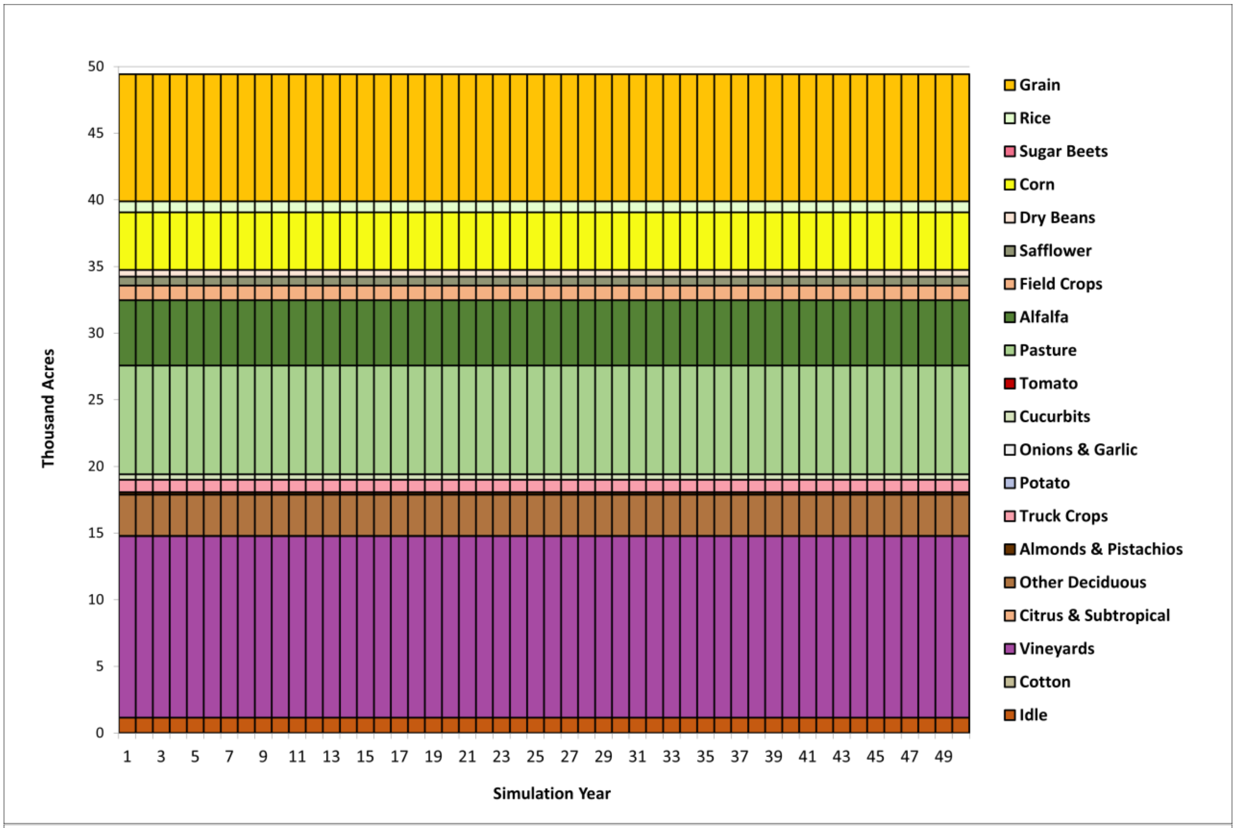


Figure 5-19: Projected Conditions Baseline Land Use for North American Subbasin



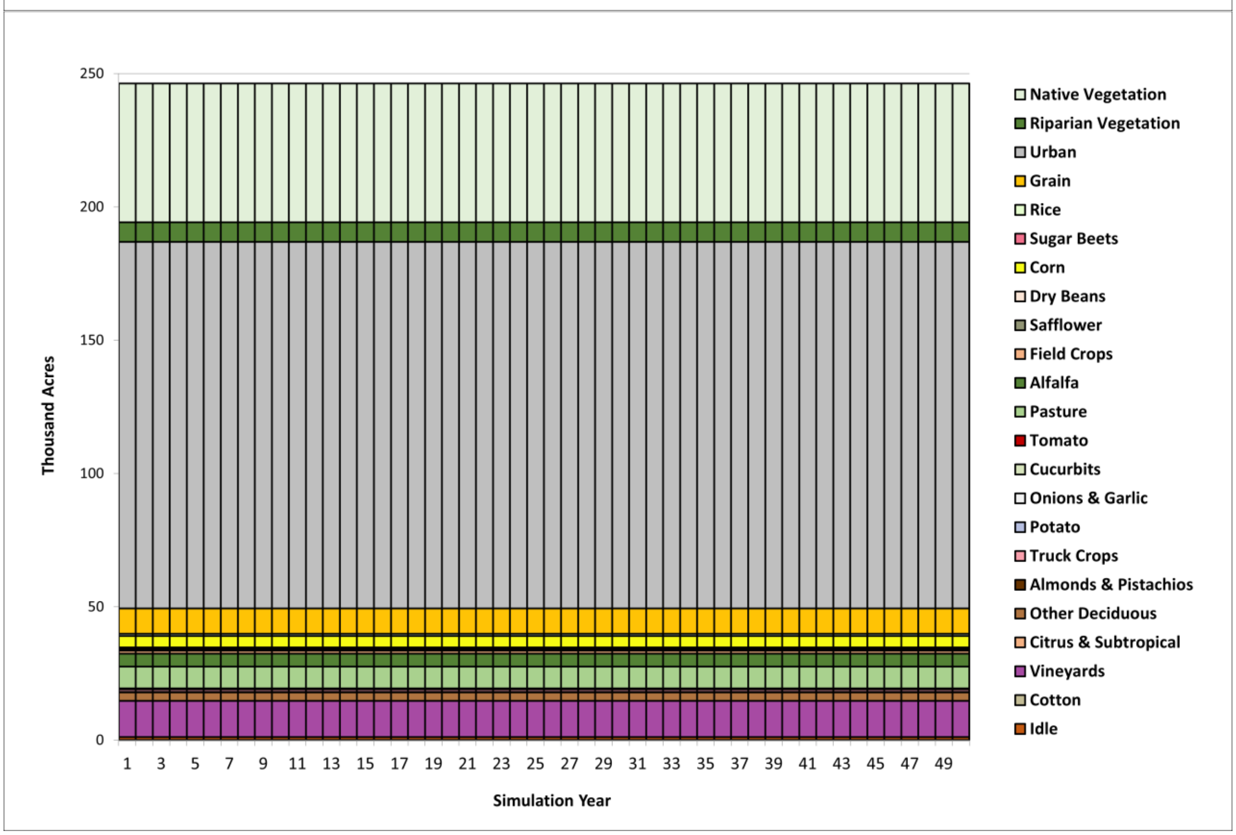
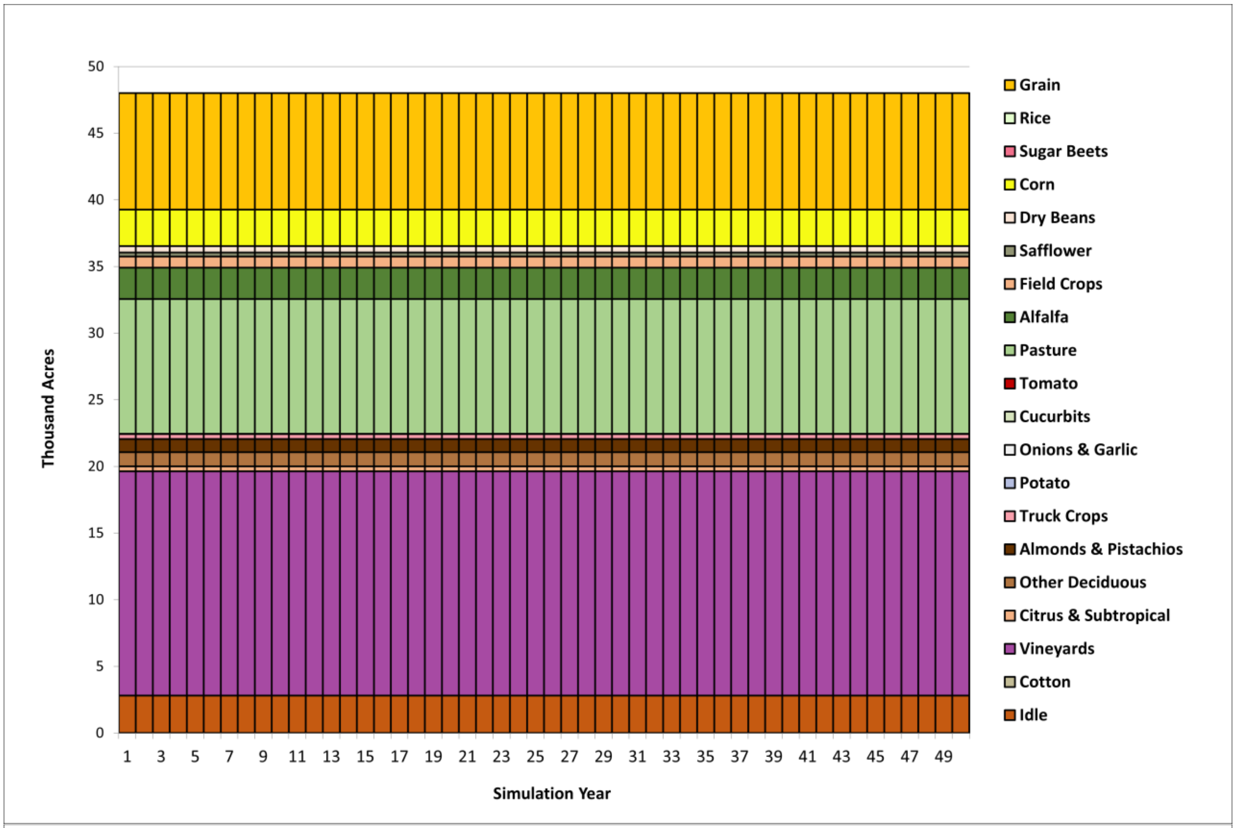


Figure 5-20: Projected Conditions Baseline Land Use for South American Subbasin



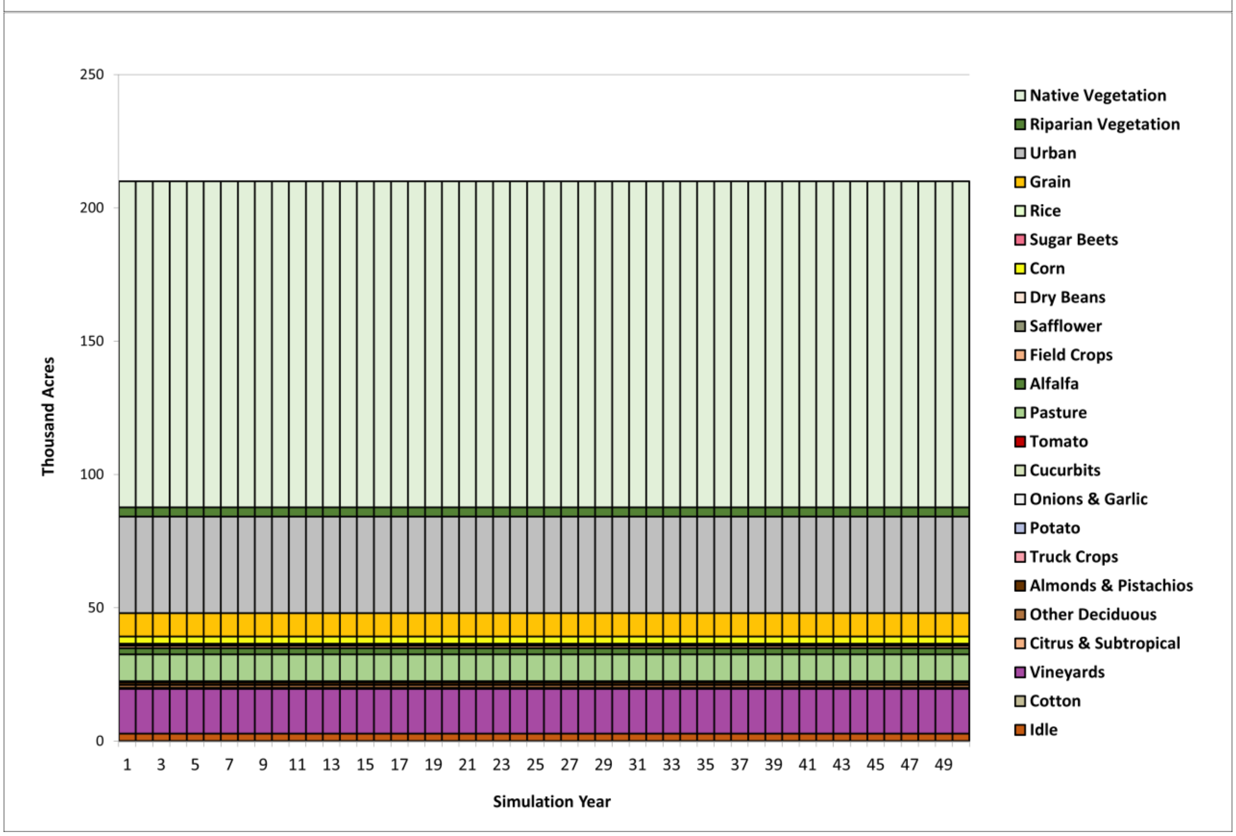


Figure 5-21: Projected Conditions Baseline Land Use for Cosumnes Subbasin

5.2.3 Urban Demand and Supply

Urban water demand in the PCBL is generally reflective of 2040 conditions. Demand and supply projections were generally available for 2040 conditions; when data for 2040 was not readily available, 2035 projections were used as the latest information. Water demand and supply assumptions are based on the 2015 UWMPs, general plans, other planning documents, or most current information provided by purveyors. Note that the 2020 UWMPs were not available at the time of model development. Appendix G presents the annual average demand and supply assumptions used in the PCBL by three water year types for each purveyor and five water year types for the City of Sacramento. Urban demand and supply projections were defined by three water year types for wet, normal, and dry conditions, using the same water year types as in the CCBL. All dry year projections were assumed to be single dry year projections based on the information available. Projections for wet years were assumed to be the same as normal conditions when wet year projections were unavailable. For the purpose of the modeling, supply was assumed to meet the demand with no surplus.

2015 UWMPs and other planning and environmental permitting documents were reviewed to estimate demand and supply sources for the proposed developments. Review of the publicly available information suggested that demand and supply projections were generally included in the purveyors' projected demand and supply estimates as reported in the 2015 UWMPs with the exception of two new developments - Sutter Pointe and Grandpark Specific Plans. Sutter Pointe and Grandpark Specific Plans were assumed to be on a mix of groundwater pumping and surface water supplies based on available documentation. It was assumed that all new developments in Placer County would be on surface water supplies.

This section briefly describes the demand and supply assumptions used in the PCBL for each purveyor. Similar to the approach in the CCBL, demand and supply information is described for purveyors grouped by the three subbasins NASb, SASb, and CoSb.

5.2.3.1 North American Subbasin

This section briefly describes the demand and supply assumptions used in the PCBL within the NASb.

5.2.3.1.1 Placer County Water Agency – Rocklin Retail Area

- **Demand**: The City of Rocklin's future demand of 18,942 AFY was based on the Placer County Water Agency's 2015 UWMP (Table 4-9; PCWA, 2016) with a partial demand estimated and incorporated into the PCBL to represent the portion of the City of Rocklin within the model domain. It is estimated that approximately 33% of the City of Rocklin's demand was within the model area. Demand was adjusted by water year type based on the trends seen in the CCBL, with slightly lower demand during dry years than normal and wet years.

- **Supply**: All future demand was assumed to be met by surface water.

5.2.3.1.2 City of Lincoln

- **Demand**: 2040 demand projections were 20,336 AFY for normal and wet years and 20,947 AFY for dry years, based on the 2015 UWMP (Table 4-6 and Table 7-2) (City of Lincoln, 2016a).

- **Supply**: Demand was assumed to be met by 3,300 AFY of groundwater pumping, 6,063 AFY of recycled water, and the remaining demand met by surface water. These values were based on the Water Master Plan (Tables 3-10 and 3-11; City of Lincoln, 2016b) and the latest information available (R. Shatz, personal communication, December 2020). The City of Lincoln's proposed future wells to support the proposed developments were incorporated into the PCBL.

5.2.3.1.3 City of Roseville

- **Demand**: The 2040 demand projection was based on the 2015 UWMP (City of Roseville, 2016) and information provided by the City of Roseville (T. Joseph, personal communication, December 2020). Demand was assumed at 56,865 AFY during normal and wet years and reduced to 46,708 AFY during dry years, which accounts for a reduction of 11,677 AFY through water conservation.
- **Supply**: Demand was assumed to be met by 5,958 AFY of recycled water in all years, based on the 2015 UWMP (Table 6-11); the remaining demand was assumed to be met by surface water and the city's aquifer storage and recovery (ASR) program. The PCBL incorporated the ASR program at buildout with 15 ASR wells operating and included well information (well IDs, well locations, and well screens) and annual extraction and injection schedules provided by the City of Roseville. With the ASR program, the city assumes no net take on groundwater supply over the long-term, based on the following ASR operations by water year types:
  - During dry years, the City of Roseville's ASR wells extract 6,907 AFY of groundwater.
  - During wet years, the City of Roseville recharges groundwater through injection of 6,200 AFY of surface water into aquifer.
  - During normal and wet years, ASR wells pump a small volume of 25 AFY for maintenance.

5.2.3.1.4 California American Water Company (West Placer, Antelope, Lincoln Oaks, and Arden)

- **Demand**: A 2035 demand projection was developed for each service area based on the 2015 UWMP (Table 4-2; Cal-Am, 2016). Demand remains the same in all water year types.
- **Supply:** Supply projections by service area were based on the 2015 UWMP as follows:
  - West Placer was assumed to be all surface water provided to Cal-Am by the wholesaler, PCWA.
  - Antelope and Lincoln Oaks were assumed to be on surface water from Sacramento Suburban WD (only during normal and wet years) and groundwater pumping. The 2,000 AFY of surface water supply was assumed to be distributed as 60% to Antelope and 40% to Lincoln Oaks (2015 UWMP Table 5-9); the remaining supply comes from groundwater.
  - The City of Sacramento supply of 4,831 AFY was distributed between Arden (NASb), Parkway (SASb), and Suburban Rosemont (SASb) based on the 2015 UWMP (Table 5-9).

5.2.3.1.5 Sacramento International Airport

- **Demand**: Demand was estimated based on the average of 2017 and 2018 in the CCBL.
- **Supply**: Demand was assumed to be met by surface water and groundwater, proportional to the volumes in 2017 and 2018.

5.2.3.1.6 Rio Linda / Elverta Community Water District

- **Demand**: A 2035 demand projection of 7,462 AFY for normal and wet years (Table 4-2) and 8,208 AFY for dry years (Table 7-3) was assumed based on the 2015 UWMP (RLECWD, 2016).
- **Supply**: Demand was assumed to be met by groundwater, similar to the CCBL conditions (UWMP Table 6-9).
- **Proposed Development**: The PCBL incorporates the Elverta and Northborough Specific Plans, which are located outside of the RLECWD's current service area.

5.2.3.1.7 Sacramento Suburban Water District

- **Demand**: A 2040 demand projection of 41,304 AFY was assumed based on the 2015 UWMP (Table 3-5) (Sacramento Suburban WD, 2016). Demand remains the same for all water year types.

- **Supply**: Demand was assumed be met by a maximum groundwater pumping of 35,000 AFY during dry years, based on the 2015 UWMP (Table 5-11); the remaining demand was assumed to come from surface water. For normal and wet years, the groundwater and surface water supply mix was assumed to be proportional to CCBL conditions.

5.2.3.1.8 Citrus Heights Water District

- **Demand**: 2035 demand was assumed as 18,210 AFY for normal and wet years and 15,478 AFY for dry years, based on the 2015 UWMP (Table 4-2 and Table 7-3; Citrus Heights Water District, 2016).

- **Supply**: Demand was assumed be met by 900 AFY of groundwater pumping, with the remaining demand from San Juan WD surface water, based on the 2015 UWMP (Table 6-9).

5.2.3.1.9 Orange Vale Water Company

- **Demand**: 2035 demand was assumed as 4,981 AFY for normal and wet years and 4,234 AFY for dry years, based on the 2015 UWMP (Table 4-2 and Table 7-3; Orange Vale Water Company, 2016).

- **Supply**: Demand was assumed be met by San Juan WD surface water, similar to the CCBL.

5.2.3.1.10 San Juan Water District

- **Demand**: A 2040 demand projection of 19,393 AFY was assumed for retail demand, based on the 2015 UWMP (Table 4-2b; SJWD, 2016).

- **Supply**: Demand was assumed to be met by surface water, based on the 2015 UWMP (Table 6-9).

5.2.3.1.11 City of Sacramento

- **Demand**: A 2040 demand projection of 161,029 AFY was assumed based on the 2015 UWMP (Table 4-2) (City of Sacramento, 2016). Demand remains the same for all water year types. Approximately 35% of the demand was assumed to be in the NASb portion of the model, based on urban area.

- **Supply**: Supply projections include groundwater pumping and surface water supplies that vary by five water year types (as opposed to three water year types used for other purveyors) based on the City of Sacramento's 2017 GWMP (City of Sacramento, 2017). Groundwater pumping assumptions were consistent with the Maximum Groundwater Use scenario developed in the 2017 GWMP, based on the discussions with the City of Sacramento. Monthly pumping assumptions by each well were incorporated into the PCBL based on well locations and monthly well operations, as specified in the 2017 GWMP. Groundwater pumping in the NASb varies from 11,553 AFY during wet years to 38,261 AFY during driest years. Demand after groundwater pumping was assumed to be supplied by surface water. The City of Sacramento also has specific wells that supply some of the larger parks and green areas within the city boundaries. These irrigation wells are simulated using six representative irrigation wells that pump 2,200 AFY. Based on the locations of the irrigated parks and green areas, approximately half of the irrigation pumping was estimated in the NASb and the remaining half in the SASb.

5.2.3.1.12 Sacramento County Water Agency (Arden Park Vista and Northgate)

- **Demand**: 2045 demand projections for Arden Park Vista and Northgate were based on the Draft 2020 UWMP (Tables 4-10(b) and 4-10(c)) provided by SCWA and input from SCWA (M. Grinstead, personal communication, April 2021).
- **Supply**: Arden Park Vista and Northgate were assumed to be on groundwater, similar to the CCBL conditions.

5.2.3.1.13 Del Paso Manor Water District

- **Demand**: Demand was estimated based on the average of 2017 and 2018 in the CCBL.
- **Supply**: Demand was assumed to be met by groundwater, similar to the CCBL.

5.2.3.1.14 Golden State Water Company (Arden)

- **Demand**: Demand for the Arden service area was assumed to remain the same as in the CCBL conditions.
- **Supply**: Arden service area was assumed to be on groundwater, consistent with the CCBL conditions.

5.2.3.1.15 Carmichael Water District

- **Demand**: A 2040 demand projection was assumed as 10,334 AFY for normal and wet years and 10,851 AFY for dry years, based on the 2015 UWMP (Table 4-6 and Table 7-2) (Carmichael Water District, 2016).
- **Supply**: Demand was assumed to be met by groundwater pumping and surface water, proportional to the CCBL conditions.

5.2.3.1.16 Fair Oaks Water District

- **Demand**: A 2035 demand projection of 12,726 AFY was assumed based on the 2015 UWMP (Table 4-2) (Fair Oaks Water District, 2016).
- **Supply**: Demand was assumed to be met by groundwater pumping and surface water, proportional to the CCBL conditions.

5.2.3.1.17 Sutter Pointe

- **Demand**: A demand projection of 15,786 AFY was assumed, based on the Phase 2+B proposed water supply program from the *Supplement to the Water Supply Assessment for Lakeside at Sutter Pointe* (Golden State Water Company, 2020).
- **Supply**: Demand was assumed to be met by a mixture of groundwater pumping and surface water. Groundwater pumping is assumed to meet 10,919 AFY of demand, and surface water is assumed to meet the remaining 4,867 AFY of demand.

5.2.3.1.18 Grandpark

- **Demand**: A demand projection of 12,030 AFY was assumed, based on build out projections for the project (K. Giberson, pers comm. Feb 14, 2019).
- **Supply**: Demand was assumed to be met by a mixture of groundwater pumping and surface water. Groundwater pumping is assumed to meet 2,407 AFY of demand during normal and wet years, and 3,007 AFY

of demand during dry years. Surface water is assumed to meet 9,623 AFY of demand during normal and wet years, and 9,395 AFY of demand during dry years.

5.2.3.2 South American Subbasin

This section briefly describes the demand and supply assumptions used in the PCBL for the purveyors located within the SASb. All new developments were assumed to be on supplies projected by the purveyors.

5.2.3.2.1 City of Sacramento

- **Demand**: As described above in Section 5.2.3.1.11, a city-wide 2040 demand projection of 161,029 AFY was assumed, based on the 2015 UWMP (Table 4-2) (City of Sacramento, 2016). Approximately 65% of the demand was assumed to be in the SASb portion of the model, based on urban area.

- **Supply**: As with the NASb, supply projections include groundwater pumping and surface water that vary by five water year types (as opposed to three water year types used for other purveyors) based on the City of Sacramento's 2017 GWMP (City of Sacramento, 2017). Groundwater pumping follows the Maximum Groundwater Use scenario specified in the 2017 GWMP. Based on the specific well pumping assumptions, groundwater pumping in the SASb varies from 12,749 AFY during wet years to 43,029 AFY during driest years. Remaining demand after groundwater pumping was assumed to be supplied by recycled water (1,000 AFY) and surface water. As described above in Section 5.2.3.1.11, the City of Sacramento also has specific wells that supply some parks and green areas within the city boundaries. These irrigation wells are simulated using six representative irrigation wells that pump 2,600 AFY. Based on the locations of the irrigated parks and green areas, approximately half of the irrigation pumping was estimated in the SASb.

5.2.3.2.2 California American Water Company (Suburban Rosemont, Security Park, and Parkway)

- **Demand**: As described above in Section 5.2.3.1.4 for Cal Am service areas within the NASb, demand projections reflect the 2035 conditions based on the 2015 UWMP (Tables 4-2) (Cal-Am, 2016). Demand remains the same in all water year types.

- **Supply:** Supply projections by service area were based on the 2015 UWMP as follows:
  - Security Park was assumed to be all on groundwater and served water from SCWA, similar to the CCBL conditions.
  - As described above in Section 5.2.3.1.4, surface water supply from the City of Sacramento was distributed between Arden (NASb), Parkway (SASb), and Suburban Rosemont (SASb), based on the 2015 UWMP (Table 5-9). Remaining demand is met by groundwater from Cal Am wells.

5.2.3.2.3 California American Water Company (former Fruitridge Vista Water Company)

- **Demand**: A 2035 demand projection of 4,957 AFY was assumed, based on the discussions with Cal-Am.

- **Supply**: Supply projections include local groundwater pumping and surface water wholesale supply from the City of Sacramento, with 50% of demand met by groundwater and the remaining 50% of demand met by surface water.

5.2.3.2.4 Golden State Water Company (Cordova)

- **Demand**: A 2040 demand projection of 19,572 AFY was assumed for the Cordova service area, based on the 2015 UWMP (Table 4-4) (GSWC, 2016).

- **Supply**: Cordova's supply projections include groundwater pumping of 9,752 AFY, 5,000 AFY of remediated water from the Aerojet Granted Water Supply, and 5,000 AFY of American River diversion from Folsom South Canal, as reported in the 2015 UWMP (Table 6-12).

5.2.3.2.5 City of Folsom

- **Demand**: A 2040 demand projection was assumed as 29,923 AFY for normal and wet years and 30,819 AFY for dry years, based on the 2015 UWMP (Table 4-2 and Table 7-2) (City of Folsom, 2016).

- **Supply**: City of Folsom supply was assumed all surface water, as with the CCBL conditions.

5.2.3.2.6 Florin County Water District

- **Demand**: Demand was estimated based on the average of 2017 and 2018 in the CCBL.

- **Supply**: Demand was assumed to be met by groundwater, consistent with CCBL conditions.

5.2.3.2.7 Sacramento County Water Agency (Hood, Laguna Vineyard, and Mather)

- **Demand**: The 2045 demand projection for Hood was based on the Draft 2020 UWMP (Table 4-10[e]), provided by SCWA and input from SCWA (M. Grinstead, personal communication, April 2021). Demand projections for Laguna Vineyard and Mather reflect 2052 conditions based on the 2021 Zone 40 Water Supply Master Plan Amendment (Tables B-6, B-7, and B-8) (SCWA, 2021), and discussions with SCWA (M. Grinstead, personal communication, April 2021). Laguna Vineyard in the PCBL represents the South Service Area and Central Service Area; and Mather represents the North Service Area.
- **Supply**: Hood was assumed to be on groundwater, consistent with the CCBL. Supply projections for Laguna Vineyard and Mather reflect 2052 conditions based on a mix of groundwater, surface water, recycled water, and remediated water, as reported in the 2021 Zone 40 Master Plan Amendment (Tables B-6, B-7, and B-8). Recycled water of 1,700 AFY would be available in the Laguna Vineyard demand area (South Service Area) and remediated water of 8,900 AFY would be available every year.

5.2.3.2.8 Elk Grove Water District

- **Demand**: A 2045 demand projection was assumed be 8,080 AFY for normal and wet years and includes demand both for Service Area 1 and Service Area 2 based on the 2015 UWMP (Table 4-6; EGWD, 2016). Dry year demand projection was assumed to 8,323 AFY based on the 2015 UWMP (Table 7-2) and was assumed to be distributed to Service Area 1 and Service Area 2 proportional to demand in normal and wet years in the two service areas.
- **Supply**: The 2015 UWMP does not break future supply projections into groundwater and surface water supplies by service areas. It was assumed Service Area 1 was served with groundwater and Service Area 2 served with a mix of groundwater and surface water by SCWA.

5.2.3.2.9 Rancho Murieta Community Service District

- **Demand**: Demand for the entire service area was assumed to be 3,477 AFY based on a medium growth projection of 3,659 AFY at buildout with 20% reduction (or 2,927 AFY potable demand) and additional recycled water demand of approximately 550 AFY, based on the information available from the Rancho Murieta Community Services District's (CSD) 2010 Integrated Water Master Plan Update (Figure ES-1, Table 2-3, and Table 3-2; Rancho Murieta CSD, 2010). Approximately 32% of demand falls within the SASb based on urban area.
- **Supply**: Demand was assumed to be met by surface water for potable demand and recycled water of 550 AFY for golf course irrigation.

5.2.3.3 Cosumnes Subbasin

This section briefly describes the demand and supply assumptions used in the PCBL for the purveyors located within the CoSb.

5.2.3.3.1 Rancho Murieta Community Service District

Several proposed developments were identified within the Rancho Murieta CSD and incorporated into the PCBL. Note that the majority of the developments would occur outside of the three subbasins but within the model boundary.

- **Demand**: As described above in Section 5.2.3.2.9, total demand was assumed to be 3,477 AFY. Approximately 22% of the demand falls within the CoSb based on urban area, compared to 32% within the NASb. The remaining demand of 46% falls outside of the NASb, SASb and CoSb, but within the model boundary.
- **Supply**: As described above in Section 5.2.3.2.9, demand was assumed to be met by surface water for potable demand and recycled water.

5.2.3.3.2 City of Galt

- **Demand**: A 2040 groundwater demand projection of 7,663 AFY was assumed based on the 2015 UWMP (Table 4-3; City of Galt, 2016).
- **Supply**: Demand was assumed to be met by groundwater with pumping distributed between six active CCBL wells proportional to their historical maximum annual yield. Dry year supply projections were assumed to be the same as normal year supplies.

5.2.3.3.3 Amador County Water Agency

- **Demand**: 2040 demand projections were updated based on supply assumptions, as discussed below, and distributed to the expanded urban land use areas.
- **Supply**: Supply projections include surface water and recycled water for the City of Ione and groundwater, surface water, and recycled water for Camanche Village. CCBL City of Ione surface water supply was doubled based on the projected demand increases from the Amador Water Agency 2015 UWMP; there was no change to the recycled water use relative to the CCBL. CCBL groundwater pumping for Camanche Village from the four active wells was doubled based on expansion and development of currently vacant parcels (Dunn Environmental, 2012). CCBL groundwater pumping for Camanche North Shore from the two active wells was increased by a total of 11 AFY based on a projected maximum daily treated water demand increase from the *Camanche Area Regional Water Supply Plan Feasibility Study and Conceptual Design* (RMC Water and Environment, 2012). Specified groundwater pumping to three wells operated by the Buena Vista Rancheria are based on reported May 2019-April 2020 pumping, in which the seasonal average pumping rates were distributed to associated months.

5.2.3.3.4 Sacramento Municipal Utility District

No change in demand or supply relative to the CCBL.

5.2.3.4 Fish Farms

No change in demand or supply relative to the CCBL.

5.2.4 Agricultural Demand and Supply

Agricultural demand and supply in the PCBL is similar to the discussion in the CCBL (Section 5.1.6), with demand being driven by the land use changes in the PCBL discussed in Section 5.2.2 and much of the supply being internally calculated within the model or based on the last 10 years of the historical simulation.

5.2.4.1 Galt Wastewater Treatment Plant Effluent

No change in treatment plant effluent use relative to the CCBL.

5.2.4.2 Rural Residential

Refer to section 3.3.1 in the historical model report for a description of the methodology used to estimates rural residential pumping.

Rural residential demand in the PCBL version of CoSANA accounts for the urbanization of areas that would lead to a decrease in the rural residential population. It is assumed that the projected urbanization of areas previously used for agricultural purposes would result in a decline in rural residential population, and therefore demand. These areas are subsequently served by an urban water purveyor.

In the CoSb, rural residential demand was assumed to increase as a result of projected population increases. Assuming a rural residential population, and associated demand increase of 1% per year, total projected annual groundwater consumption was estimated to be 9,448 AFY and was proportionally distributed monthly as specified in the CCBL.

5.2.4.3 Agricultural Groundwater Substitution Transfers

As discussed for the CCBL, two purveyors engage in agricultural groundwater substitution transfer pumping in the NASb: NMWC and PGVMWC, Additionally, South Sutter Water District operates a transfer program that behaves very similarly to a groundwater substitution transfer. South Sutter Water District uses a hybrid approach to groundwater substitution transfer pumping similar to the CCBL model. Dry year decreases of surface water deliveries from Camp Far West Reservoir are offset by an increase in groundwater pumping.

For NMWC and PGVMWC, agricultural transfer pumping was assumed to occur in 16 years of the baseline (15 of the 19 dry years and one normal year), with timing and pumping volumes based on information included in the Long-Term Water Transfer (LTWT) EIS/R (Reclamation, 2019). The estimated transfer pumping for NMWC and PGVMWC was distributed among all transfer wells in the same proportion as in the historical data. NMWC surface water deliveries are automatically adjusted to meet total agricultural demand, and PGVMWC surface water deliveries are estimated using the last 10 years of historical simulation data, reduced by the amount of agricultural transfer pumping estimated to occur in the PCBL.

5.2.5 Remediation Operations

Information about future remediation operations is not available, so remediation operations in the PCBL are the same as in the CCBL, discussed in Section 5.1.7.

5.2.6 Results

This section provides a summary of the CoSANA PCBL results.

5.2.6.1 Land and Water Use Budget

The land and water use budget provides details on the urban and agricultural demand and the water supply meeting the demand (groundwater pumping, surface water deliveries, recycled water, and remediation pumping). Average annual PCBL model results by groundwater subbasin are shown in Table 5-5. Annual agricultural water demand and supply by subbasin are shown in Figure 5-22 through Figure 5-24. Annual urban demand and supply by subbasin are shown in Figure 5-25 through Figure 5-27. Appendix H includes model subregion land and water use budgets.

Table 5-5: PCBL Average Annual Land and Water Use Budget

Subbasin	Ag. Demand (AFY)	Ag. Ground-Water Use* (AFY)	Ag Surface Water Deliveries (AFY)	Urban Demand (AFY)	Urban Ground-Water Use** (AFY)	Urban Surface Water Deliveries (AFY)	Urban Recycled Water (AFY)	Remediation Pumping (AFY)
NASb	349,317	202,228	149,868	328,654	108,492	220,161	-	5,515
SASb	135,956	91,599	44,369	301,060	116,385	167,661	17,200	29,765
CoSb	121,676	99,886	21,460	30,168	28,445	3,943	-	-
Total	**606,949**	**393,713**	**215,697**	**659,882**	**253,322**	**391,765**	**17,200**	**35,280**

Note:

* Agricultural groundwater use presented in the above table may differ slightly from the values shown in the respective GSP due to minor difference in the methodology on calculation of rural residential water use.

** Urban groundwater use in the above table represents water used that originated from groundwater production but can include water that was pumped in areas outside of the respective subbasin.

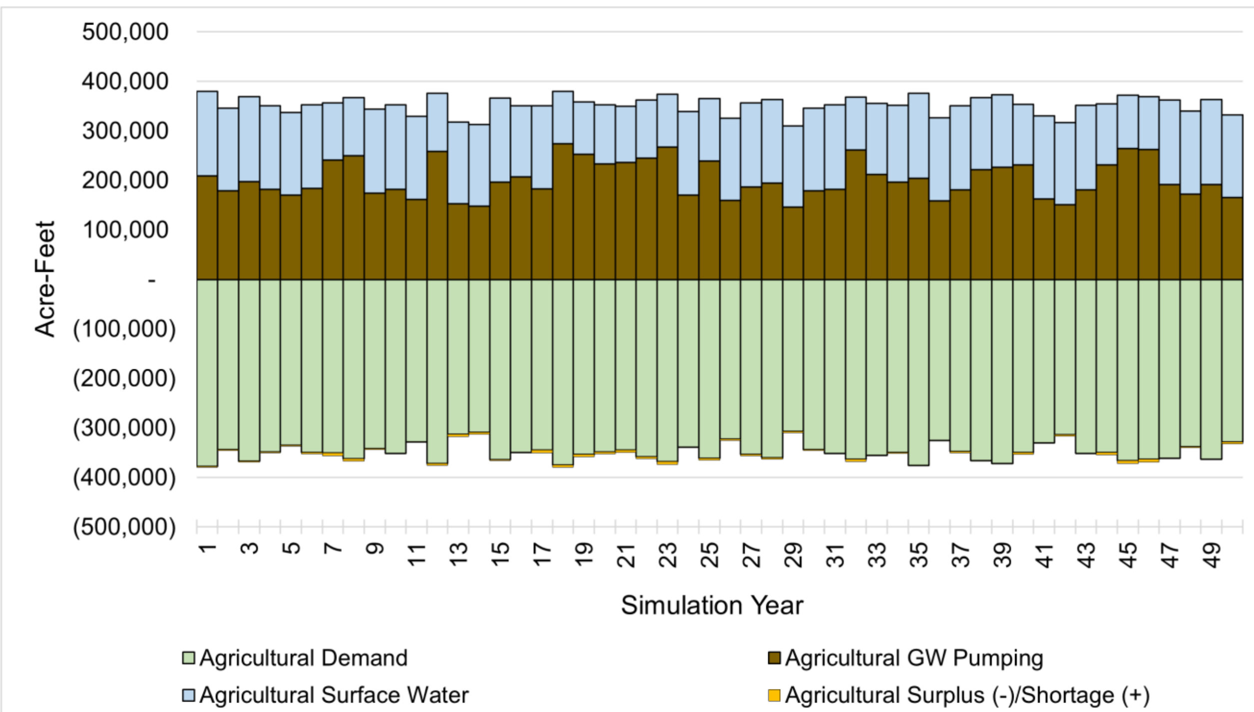


Figure 5-22: Annual Agricultural Water Demand and Supply – North American Subbasin, Projected Conditions Baseline