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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SAN BERNARDINO

CHINO BASIN MUNICIPAL WATER DISTRICT,

Plaintiff,

v.

CITY OF CHINO, ET AL.,

Defendants.

Case No. RCVRS51010

[Assigned for All Purposes to the Honorable Carlos M. Cabrera]

EXHIBIT A - PART 1 OF 4 TO DECLARATION OF GARRETT RAPP IN SUPPORT OF MOTION REGARDING 2025 SAFE YIELD REEVALUATION, AMENDMENT OF RESTATED JUDGMENT, PARAGRAPH 6

Date: November 13, 2026
Time: 10:00 a.m.
Dept.: S24

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Exhibit A

FINAL REPORT | JUNE 2026

2025 Safe Yield Reevaluation

PREPARED FOR

Chino Basin Watermaster

PREPARED BY

WEST YOST
Water. Engineered.

2025 Safe Yield Reevaluation

Prepared for

Chino Basin Watermaster

Project No. 941-80-24-32



June 23, 2026

Prepared by: Garrett Rapp — Date

June 23, 2026

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Table of Contents

SECTION 1 Introduction 1-1

1.1 Background 1-1
1.1.1 Prior Safe Yield Recalculations 1-1
1.1.2 2022 Safe Yield Reset Methodology 1-3
1.1.3 2025 Safe Yield Reevaluation 1-4

1.2 Scope of Work 1-5

1.3 Peer Review and Stakeholder Engagement 1-6
1.3.1 Third-Party Peer Review of 2025 CVM and 2025 SYR 1-6

1.4 Report Organization 1-7

SECTION 2 Update of Hydrogeologic Conceptual Model 2-1

2.1 Introduction and Scope 2-1

2.2 Geologic and Lithologic Information 2-1

2.3 Remote Sensing 2-2
2.3.1 InSAR 2-2
2.3.2 NDVI and Aerial Photos 2-6
2.3.3 DEM 2-6

2.4 Faults and Basin Boundaries 2-8

SECTION 3 2025 Updates to the Chino Valley Model 3-1

3.1 Extension of Historical Simulation Period for the 2025 CVM 3-3
3.1.1 Time Series Data 3-3
3.1.2 Land Use 3-3

3.2 Updates to the MODFLOW Model 3-3
3.2.1 Model Domain and Grid 3-3
3.2.2 Model Layer Elevation and Thickness 3-3
3.2.3 Travel Time of DIPAW Through the Vadose Zone 3-10
3.2.4 Evapotranspiration of Groundwater 3-10
3.2.5 Santa Ana River and Tributaries 3-10
3.2.6 Groundwater Pumping 3-10
3.2.7 Fault Barriers 3-14
3.2.8 Subsurface Inflow 3-14

SECTION 4 Model Calibration and Uncertainty Analysis 4-1

4.1 Validation of R4 Model 4-1
4.1.1 Evaluation Criteria 4-1
4.1.2 Validation Results 4-1
4.1.2.1 Simulated Streamflow 4-1
4.1.2.2 Simulated Urban Outdoor Water Use 4-3
4.1.2.3 Stormwater Recharge in Basins 4-7

4.2 Recalibration and Uncertainty Analysis 4-12
4.2.1 Methods 4-12

Table of Contents

4.2.2 Update of Calibration Period 4-13
4.2.3 Select Adjustable Model Parameters and Prepare Input Files for PESTPP-IES 4-14
4.2.3.1 DIPAW 4-14
4.2.3.2 Evapotranspiration 4-15
4.2.3.3 Subsurface Inflow 4-15
4.2.3.4 Specified Head Boundary 4-15
4.2.3.5 Santa Ana River and Its Tributaries 4-16
4.2.3.6 Faults 4-16
4.2.3.7 Aquifer Properties and Pilot Points 4-16
4.2.4 Prepare Observation Data as Calibration Targets 4-17
4.2.4.1 Groundwater Elevation Time Series 4-18
4.2.4.2 Stream Discharge Time Series 4-19
4.2.5 Use PESTPP-IES to Generate Calibrated Realizations 4-19
4.2.5.1 Manual Calibration 4-22
4.2.5.2 Automated Calibration 4-23
4.2.5.2.1 Pilot Point Scenario 5 4-24
4.2.6 Rank and Select Calibrated Realizations for Projection Scenarios 4-33

4.3 Water Budget and Comparison to the 2020 CVM 4-39
4.3.1 Water Budget for Selected Realization 4-39
4.3.2 Comparison of 2025 CVM Realizations to 2020 CVM 4-43
4.3.2.1 Subsurface Inflows (Figure 4-25) 4-44
4.3.2.2 Other Variable Water Budget Components (Figure 4-26) 4-44
4.3.2.3 Summary of Water Budget (Figure 4-27) 4-44

4.4 References 4-48

SECTION 5 Projection Ensemble 5-1

5.1 Objectives of the Projection Ensemble 5-1

5.2 Stakeholder Engagement and Timeline 5-2
5.2.1 Timeline for Development of the Projection Ensemble 5-3

5.3 Characterizing Uncertainty in Future Climate 5-4
5.3.1 Use of Historical Precipitation and ET_o Data 5-5
5.3.2 Incorporating DWR Climate Change Factors 5-5
5.3.3 Summary of Climate Scenarios 5-7

5.4 Characterizing Uncertainty in Future Cultural Conditions 5-11
5.4.1 Reference Water Plans 5-11
5.4.1.1 Overlying (Agricultural) Pool 5-12
5.4.1.2 Overlying (Non-Agricultural) Pool 5-12
5.4.1.3 Appropriative Pool 5-12
5.4.1.4 Summary of Reference Water Plans 5-15
5.4.2 Primary Elements of Uncertainty in Cultural Conditions 5-15
5.4.2.1 Historical Variation in Water Demands and Use of Water Supplies 5-15
5.4.2.2 Uncertainty in Demands 5-16
5.4.2.2.1 Growth 5-16

Table of Contents

5.4.2.2.2 Conservation Regulation 5-16
5.4.2.2.3 Climate Change 5-18
5.4.2.2.4 Impacts of Demand Deviations on Groundwater Levels and Net Recharge 5-18
5.4.2.3 Groundwater Utilization 5-19
5.4.2.4 Imported Water Utilization 5-20
5.4.3 Water Plan Scenarios 5-21
5.4.3.1 Response to the Conservation Regulation 5-23
5.4.3.2 Groundwater and Imported Water Utilization 5-24
5.4.3.3 Pumping Adjustments for Other Parties 5-24
5.4.3.4 Buildout 5-25
5.4.3.5 Replenishment Obligation 5-25
5.4.3.6 Variability of Demands due to Climate Scenarios 5-26
5.4.3.6.1 Variability of Demands due to Precipitation 5-26
5.4.3.6.2 Variability of Demands due to Temperature 5-27
5.4.3.7 Comparison of Water Plan Scenarios 5-29
5.4.3.7.1 Demand 5-29
5.4.3.7.2 Groundwater Utilization 5-29
5.4.3.7.3 Imported Water Utilization 5-29
5.5 Summary of Projection Ensemble 5-34
5.6 Likelihoods 5-35
SECTION 6 2025 Determination of Tentative Safe Yield 6-1
6.1 Background and Methods 6-1
6.1.1 Methods 6-1
6.1.2 Development of the TSY Ensemble 6-3
6.1.2.1 Managed Storage 6-3
6.1.2.2 Imported Water Recharge 6-4
6.2 Results of TSY Ensemble 6-4
6.2.1 Water Budgets 6-9
6.2.1.1 Net Recharge and TSY 6-11
6.2.1.2 Drivers of the Difference in DIPAW Between the 2020 SYR and 2025 SYR 6-25
6.2.1.3 Average Net Recharge Across the TSY Ensemble 6-25
6.2.2 Groundwater Conditions 6-30
6.2.2.1 Groundwater Levels 6-30
6.2.2.1.1 Groundwater Level Changes, FY 2022 to 2030 6-30
6.2.2.1.2 Groundwater Level Changes, FY 2022 to 2050 6-34
6.2.2.2 Groundwater Flow Patterns 6-38
SECTION 7 2025 Safe Yield Reevaluation 7-1
7.1 Background and Objectives 7-1
7.1.1 Categories of Material Physical Injury 7-1
7.1.2 MPI Analysis Methods 7-2
7.2 MPI Analysis For the TSY Ensemble 7-3
7.2.1 Land Subsidence 7-3

7.2.1.1 Site-Specific MPI Thresholds for Land Subsidence 7-4
7.2.1.2 Subarea MPI Thresholds for Land Subsidence 7-4
7.2.1.3 Results of MPI Analysis for Land Subsidence 7-6
7.2.1.4 Discussion 7-6
7.2.1.4.1 Drivers of MPI for Land Subsidence 7-13
7.2.1.4.2 Potential Methods to Avoid or Mitigate MPI due to Land Subsidence 7-14
7.2.2 Pumping Sustainability 7-15
7.2.2.1 Evaluation Criteria and Methods 7-15
7.2.2.1.1 Party Input to Develop Site-Specific and Subarea MPI Thresholds 7-15
7.2.2.1.2 Subarea Threshold for MPI Due to Pumping Sustainability 7-18
7.2.2.2 Results 7-21
7.2.2.3 Discussion 7-33
7.2.2.3.1 Drivers of MPI for Pumping Sustainability 7-33
7.2.2.3.2 Potential Methods to Avoid or Mitigate MPI due to Pumping Sustainability 7-38
7.2.3 Hydraulic Control 7-38
7.2.3.1 Methods to Evaluate the State of Hydraulic Control 7-38
7.2.3.2 Results 7-39
7.2.3.3 Discussion 7-39
7.3 Determination of Viability of TSY 7-43
7.3.1 Summary of Findings 7-43
7.3.2 Evaluation of the Safe Yield 7-46
7.3.2.1 Comparison to 2020 Safe Yield Recalculation Results 7-47
7.3.2.2 Contribution from Conservation Regulations 7-47
7.4 Recommendations 7-48
7.4.1 Addressing Data Gaps and Improving CVM 7-48
7.4.2 Mitigation Measures 7-49
7.4.3 Operational Optimization 7-50

LIST OF TABLES

Table 4-1. R4 Model Calibration Statistics for Streamflow in the 2020 CVM and 2025 CVM 4-3
Table 4-2. R4 Model Calibration Statistics for Urban Outdoor Water Use in the 2020 CVM and 2025 CVM 4-7
Table 4-3. Calibration and Validation of R4 Model - Recharge Basins 4-12
Table 4-4. Number of Monitoring Wells by Screened Model Layer 4-19
Table 4-5. Summary of Adjustable Parameters for Scenario 5 4-33
Table 4-6. Summary of Net Recharge Statistics and Chosen Realizations, Pilot Point Scenario 5 4-34
Table 4-7. Water Budget for the Chino Basin for the Calibration Period - Realization C 4-40
Table 4-8. Comparison of Water Budget Components - 2020 and 2025 CVM 4-43
Table 5-1: Datasets Used for Climate Scenarios 5-7

Table 5-2. Aggregate Reference Water Plan for the Watermaster Parties 5-15
Table 5-3. Water Plan Scenario Descriptions 5-22
Table 5-4. Reductions in Demand Required to Meet the Water Use Objectives 5-23
Table 5-5. Summary of Conservation Regulation Responses in Water Plan Scenarios 5-24
Table 5-6a. Aggregate Water Plans for the Expected Demand Scenario 5-30
Table 5-6b. Aggregate Water Plans for the High Demand Scenario 5-31
Table 5-6c. Aggregate Water Plans for the Low Demand Scenario 5-31
Table 5-7. Historical and Projected Pumping for the Chino Basin Parties 5-31
Table 5-8. Projection Ensemble 5-34
Table 5-9. Projection Ensemble with Likelihood Weights 5-36
Table 6-1. Projection Ensemble 6-9
Table 6-2. Water Budget for the Chino Basin for the Period FY 2021-2080 – Scenario D1 6-12
Table 6-3. Water Budget Components for 2020 SYR and 2025 SYR TSY Ensemble, FY 2021-2030 6-14
Table 6-4. Decadal Average Water Budget Components for 2025 SYR TSY Ensemble 6-30
Table 6-5. Summary of Groundwater Elevations Selected Projection Realizations, July 2030 6-34
Table 6-6. Summary of Groundwater Elevations Selected Projection Realizations, July 2050 6-34
Table 7-1. Percentage of Wells Below Land Subsidence Thresholds, FY 2030 and FY 2050 7-7
Table 7-2. Summary of Party Responses to Pumping Sustainability Threshold Information Request 7-20
Table 7-3. Percentage of Wells Below Pumping Sustainability Thresholds, FY 2030 and FY 2050 7-34
Table 7-4. Potential Basin-Management Activities to Avoid MPI and Maintain or Enhance Safe Yield 7-51

LIST OF FIGURES

Figure 1-1. Hydrologic and Adjudicated Boundaries of the Chino Basin 1-2
Figure 2-1. Geologic Map and Boundaries of the Chino Basin 2-3
Figure 2-2. Borehole Locations 2-4
Figure 2-3. Map View of the Hydrostratigraphic Cross-Sections 2-5
Figure 2-4. Vertical Ground Motion as Estimated by InSAR 2-7
Figure 3-1. Chino Valley Model Surface Water Models 3-2
Figure 3-2. Hydrologic Sub-Areas 3-4
Figure 3-3. Land Use 2017 3-5

Table of Contents

Figure 3-4. Land Use 2022 3-6
Figure 3-5. Layer Thickness – Layer 1 3-7
Figure 3-6. Layer Thickness – Layer 3 3-8
Figure 3-7. Layer Thickness – Layer 5 3-9
Figure 3-8. Travel Time of DIPAW Through Vadose Zone 2020 CVM 3-11
Figure 3-9. Travel Time of DIPAW Through Vadose Zone 2025 CVM 3-12
Figure 3-10. Modeled Streams 3-13
Figure 3-11. Simulated Faults of 2020 and 2025 CVM 3-15
Figure 3-12. Segmentation of Simulated Faults – 2025 CVM 3-16
Figure 3-13. Subsurface Inflow Boundary 3-17
Figure 3-14. Specified Head Boundary 3-18
Figure 4-1. Location Map 4-2
Figure 4-2. R4-USGS Discharge Chino Creek 4-5
Figure 4-3. R4-USGS Discharge Cucamonga Creek 4-6
Figure 4-4. IEUA Estimated Total Monthly Water Supply to the RP1/RP4 Sewershed 4-8
Figure 4-5. IEUA Estimated Total Monthly Water Supply to the RP2/CC/RP5 Sewershed 4-9
Figure 4-6. IEUA – R4 Supply for RP1 – RP4 4-10
Figure 4-7. IEUA – R4 Supply for CC – RP5 4-11
Figure 4-8. Precipitation Time Series in the Chino Basin, FY 1896-2022 4-14
Figure 4-9. Calibration Wells 4-20
Figure 4-10. Calibration Targets 4-21
Figure 4-11. Comparison of Simulated and Measured Groundwater Levels in Wells 4-25
Figure 4-12. 2025 CVM: Manual Calibration Residuals of Groundwater Elevation 4-26
Figure 4-13. 2025 CVM: Manual Calibration RMSE of Groundwater Elevation 4-27
Figure 4-14. 2025 CVM: Manual Calibration Trend of Groundwater Elevation Residuals 4-28
Figure 4-15. MODFLOW Estimated Streamflow 4-29
Figure 4-16. Comparison of Simulated Stream Discharge at Prado Dam 4-30
Figure 4-17. Simulated Net Recharge for the Chino Basin Pilot Point Scenario 5 4-31
Figure 4-18. Mean Net Recharge in the Chino Basin 4-32
Figure 4-19. Comparison of Simulated and Measured Groundwater Levels in Wells 4-35
Figure 4-20. Residuals of Groundwater Elevation 4-36
Figure 4-21. RMSE of Groundwater Elevation 4-37
Figure 4-22. Trend of Groundwater Elevation Residuals 4-38

Figure 4-23. Mean Net Recharge in the Chino Basin 4-41
Figure 4-24. Simulated Net Recharge for Chosen Realizations 4-42
Figure 4-25. Comparison of Subsurface Inflows – 2020 and 2025 CVM 4-45
Figure 4-26. Comparison of Other Variable Water Budget Components – 2020 and 2025 CVM 4-46
Figure 4-27. Comparison of Net Recharge and Discharge – 2020 and 2025 CVM 4-47
Figure 5-1. Historical and Projected Annual Precipitation by Climate Scenario 5-8
Figure 5-2. Cumulative Departure from Mean Precipitation by Climate Scenario 5-9
Figure 5-3. Historical and Projected Annual ET_o by Climate Scenario 5-10
Figure 5-4. Projected Active Agricultural Wells at Buildout 5-14
Figure 5-5. Historical Water Supplies of the Chino Basin Parties 5-17
Figure 5-6. Process to Develop the Water Plan Scenarios 5-23
Figure 5-7. Projected Chino Basin Demands with Precipitation-Demand Multipliers 5-28
Figure 5-8. Total Demands for Water Plan Scenarios 5-31
Figure 5-9. Total Chino Basin Groundwater Pumping Demands for Water Plan Scenarios 5-32
Figure 5-10. Total Imported Water Demands for Water Plan Scenarios 5-33
Figure 6-1. Flowchart Characterizing Steps 6 through 9 of 2022 Safe Yield Reset Methodology 6-2
Figure 6-2. Managed Storage 6-5
Figure 6-3. Projected Imported Water Recharge, TSY Ensemble Scenario 1 6-6
Figure 6-4. Projected Imported Water Recharge, TSY Ensemble Scenario 5 6-7
Figure 6-5. Projected Imported Water Recharge, TSY Ensemble Scenario 9 6-8
Figure 6-6. Water Budget for the Chino Basin Scenario D1 6-15
Figure 6-7. Comparison of Subsurface Inflows 2020 SYR and 2025 SYR 6-16
Figure 6-8. Comparison of DIPAW 2020 SYR and 2025 SYR 6-17
Figure 6-9. Comparison of Managed Aquifer Recharge 2020 SYR and 2025 SYR 6-18
Figure 6-10. Comparison of SAR Infiltration 2020 SYR and 2025 SYR 6-19
Figure 6-11. Comparison of ET 2020 SYR and 2025 SYR 6-20
Figure 6-12. Comparison of Rising Groundwater 2020 SYR and 2025 SYR 6-21
Figure 6-13. Comparison of Net Recharge 2020 SYR and 2025 SYR 6-22
Figure 6-14. Comparison of Change in Storage 2020 SYR and 2025 SYR 6-23
Figure 6-15. Cumulative Change in Storage – TSY Ensemble 6-24
Figure 6-16. Average Net Recharge for the TSY Ensemble, FY 2021-2030 6-27
Figure 6-17. Likelihood-Weighted Exceedance Curve Average Net Recharge for TSY Ensemble, FY 2021-2030 6-29
Figure 6-18. 2022 Hydraulic Head Contours – Scenario D1, Layer 1 6-31

Figure 6-19. 2022 Hydraulic Head Contours – Scenario D1, Layer 3 6-32
Figure 6-20. 2022 Hydraulic Head Contours – Scenario D1, Layer 5 6-33
Figure 6-21. Projected Hydraulic Head Change – Layer 1 Scenario D1 6-35
Figure 6-22. Projected Hydraulic Head Change – Layer 1 Scenario E9 6-36
Figure 6-23. Projected Hydraulic Head Change – Layer 1 Scenario A5 6-37
Figure 6-24. Projected Hydraulic Head Change – Layer 1 Scenario D1 6-39
Figure 6-25. Projected Hydraulic Head Change – Layer 1 Scenario E9 6-40
Figure 6-26. Projected Hydraulic Head Change – Layer 1 Scenario A5 6-41
Figure 6-27. Projected Groundwater Level Elevations and Flow Vectors for July 2030 Scenario D1, Layer 1 6-42
Figure 6-28. Projected Groundwater Level Elevations and Flow Vectors for July 2030 Scenario E9, Layer 1 6-43
Figure 6-29. Projected Groundwater Level Elevations and Flow Vectors for July 2030 Scenario A5, Layer 1 6-44
Figure 6-30. Projected Groundwater Level Elevations and Flow Vectors for July 2050 Scenario D1, Layer 1 6-45
Figure 6-31. Projected Groundwater Level Elevations and Flow Vectors for July 2050 Scenario E9, Layer 1 6-46
Figure 6-32. Projected Groundwater Level Elevations and Flow Vectors for July 2050 Scenario A5, Layer 1 6-47
Figure 7-1. Site-Specific MPI Thresholds for Land Subsidence 7-5
Figure 7-2. Assessment of MPI due to Land Subsidence 2030 and 2050, Central MZ-1 7-8
Figure 7-3. Assessment of MPI due to Land Subsidence 2030 and 2050, Northeast Area 7-9
Figure 7-4. Assessment of MPI due to Land Subsidence 2030 and 2050, Northwest MZ-1 7-10
Figure 7-5. Assessment of MPI due to Land Subsidence 2030 and 2050, Southeast Area 7-11
Figure 7-6. Simulated Groundwater Levels at PA-7 Piezometer 7-12
Figure 7-7. Count of Subareas Indicating MPI for Land Subsidence for the TSY Ensemble (FY 2030 and 2050) 7-13
Figure 7-8. Change in Storage and Prevalence of MPI for Land Subsidence 7-17
Figure 7-9. Wells with Pumping Sustainability Thresholds 7-19
Figure 7-10. Assessment of MPI due to Pumping Sustainability 2030 and 2050, Chino Basin Desalter Authority 7-22
Figure 7-11. Assessment of MPI due to Pumping Sustainability 2030 and 2050, City of Chino 7-23
Figure 7-12. Assessment of MPI due to Pumping Sustainability 2030 and 2050, City of Chino Hills 7-24

Figure 7-13. Assessment of MPI due to Pumping Sustainability 2030 and 2050, Cucamonga Valley Water District 7-25
Figure 7-14. Assessment of MPI due to Pumping Sustainability 2030 and 2050, Fontana Water Company 7-26
Figure 7-15. Assessment of MPI due to Pumping Sustainability 2030 and 2050, Golden State Water Company 7-27
Figure 7-16. Assessment of MPI due to Pumping Sustainability 2030 and 2050, Jurupa Community Services District 7-28
Figure 7-17. Assessment of MPI due to Pumping Sustainability 2030 and 2050, Monte Vista Water District 7-29
Figure 7-18. Assessment of MPI due to Pumping Sustainability 2030 and 2050, City of Ontario 7-30
Figure 7-19. Assessment of MPI due to Pumping Sustainability 2030 and 2050, City of Pomona 7-31
Figure 7-20. Assessment of MPI due to Pumping Sustainability 2030 and 2050, City of Upland 7-32
Figure 7-21. Count of Subareas Indicating MPI for Pumping Sustainability for the TSY Ensemble (FY 2030 and 2050) 7-33
Figure 7-22. Change in Storage and Prevalence of MPI for Pumping Sustainability 7-37
Figure 7-23. Groundwater Flow Vectors and Groundwater Pumping Near Line of Hydraulic Control, Scenario D1 - 2030 7-40
Figure 7-24. Groundwater Flow Vectors and Groundwater Pumping near Line of Hydraulic Control, Scenario D1 - 2050 7-41
Figure 7-25. Flow through Chino Creek Well Field – TSY Ensemble 7-42
Figure 7-26. Count of Subareas Indicating MPI for All Categories for the TSY Ensemble (FY 2030 and 2050) 7-43
Figure 7-27. Change in Storage and Prevalence of MPI, TSY Ensemble 7-45

LIST OF APPENDICES

Appendix A. Supplemental Hydrogeologic Information
Appendix B. Results from the Calibration and Uncertainty Analysis
Appendix C. Scenario Design Information
Appendix D. TSY Ensemble Results
Appendix E. Peer Review and Stakeholder Comments and Responses

LIST OF ACRONYMS AND ABBREVIATIONS

2015 SYRM	2015 Safe Yield Reset Methodology
2017 Court Order	April 28, 2017 Court Order on the Safe Yield of the Chino Basin
2020 SYR	2020 Safe Yield Recalculation
2022 R&R	2022 Rules and Regulations
2022 SYRM	2022 Safe Yield Reset Methodology
2025 CVM	2025 Chino Valley Model
2025 SYR	2025 Safe Yield Reevaluation
afy	Acre-Feet/Year
AP	Appropriative Pool
Basin	Chino Basin
CDA	Chino Basin Desalter Authority
CDFM	Cumulative Departure from Mean Precipitation
CF	Change Factor
CII	Commercial, Industrial, and Institutional
CMIP6	Coupled Model Intercomparison Project Version 6
CVM	Chino Valley Model
DEM	Digital Elevation Model
DIM	Dedicated Irrigation Meter
DIPAW	Deep Infiltration of Precipitation and Applied Water
DWR	Department of Water Resources
ET	Evapotranspiration
ET_o	Reference Evapotranspiration
ETS1	Evapotranspiration Segments Package
FHB	Flow and Head Boundary Package
FY	Fiscal Year
GLMC	Ground-Level Monitoring Committee
GSP	Groundwater Sustainability Plan
GWU	Groundwater Utilization
HCM	Hydrogeologic Conceptual Model
HFB	Horizontal-Flow Barrier
HK	Horizontal Hydraulic Conductivity
HSPF	Hydrologic Simulation Program – Fortran
iES	Iterative Ensemble Smoother
IEUA	Inland Empire Utilities Agency
InSAR	Interferometric Synthetic Aperture Radar
IWU	Imported Water Utilization
Judgment	Stipulated Judgment
LST	Land Subsidence Threshold
MNW2	Multi-node Well Package
MPI	Material Physical Injury

MWD	Metropolitan Water District of Southern California
MZ	Management Zone
NDVI	Normalized Difference Vegetation Index
NSE	Nash-Sutcliffe Efficiency
OBMP	Optimum Basin Management Program
ONAP	Overlying Non-Agricultural Pool
OWDS	Onsite Wastewater Disposal System
PBHSP	Prado Basin Habitat Sustainability Program
PEST	Parameter Estimation
PRISM	Parameter-Elevation Relationships on Independent Slopes Model
PST	Pumping Sustainability Threshold
RCH	Recharge Package
RDM	Robust Decision Making
RMSE	Root Mean Squared Error
SAR	Santa Ana River
SFR	Streamflow-Routing Package
SS	Specific Storage
SSP&A	S.S. Papadopulos and Associates
State Board	State Water Resources Control Board
SY	Specific Yield
TM	Technical Memorandum
TSY	Tentative Safe Yield
UOWU	Urban Outdoor Water Use
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VK	Vertical Hydraulic Conductivity
WEL	Well Package
WQMP	Water Quality Management Program
WY	Water Year

SECTION 1
Introduction

This *2025 Safe Yield Reevaluation* (2025 SYR) report describes and documents the evaluation of the Safe Yield of the Chino Basin for the period of Fiscal Year (FY) 2021 through 2030.[1] The 2025 SYR was completed pursuant to the April 28, 2017 Court Order on the Safe Yield of the Chino Basin (2017 Court Order),[2,3] which was incorporated into Watermaster's Rules and Regulations (2022 R&R).[4] This 2025 SYR follows the 2022 Safe Yield Reset Methodology that was approved by the Court in December 2022. This section describes background information on the Court requirements to conduct the 2025 SYR, the scope of work of this effort, the peer review and stakeholder engagement, and the organization of this report.

1.1 BACKGROUND

The original Safe Yield of the Chino Basin (Basin) was defined in the Stipulated Judgment (Judgment) entered in 1978 (Chino Basin Municipal Water District vs. the City of Chino et al. [SBSC Case No. RCV 51010]). Figure 1-1 shows the adjudicated and hydrologic boundaries of the Basin. The Judgment defined the Safe Yield as "[t]he long-term average annual quantity of ground water... which can be produced from the Basin under cultural conditions of a particular year without causing an undesirable result," set an initial Safe Yield of 140,000 acre-feet/year (afy), and defined the allocation of pumping rights among the Parties. A physical solution was also established, requiring the Court-appointed Watermaster (the Chino Basin Watermaster, or Watermaster) to offset pumping in excess of these rights by acquiring and recharging supplemental water funded by assessments on over-producers.

In 2000, Watermaster developed the Optimum Basin Management Program (OBMP) and the Parties to the Judgment entered into the Peace Agreement and prepared the OBMP Implementation Plan. The OBMP Implementation Plan required that Watermaster recalculate the Safe Yield in 2011 and every ten years thereafter, acknowledging that the Safe Yield is influenced by changes in cultural conditions such as land use, water use, and groundwater pumping patterns.

1.1.1 Prior Safe Yield Recalculations

The initial Safe Yield recalculation was completed in 2015 for the period from FY 2011 through 2020. The methodology for this recalculation, known as the 2015 Safe Yield Reset Methodology (2015 SYRM), relied on long-term hydrology and incorporated data spanning 1921 to 2011. The 2015 SYRM involved recalibrating Watermaster's groundwater-flow model using the most recent data available, especially data collected since the implementation of the OBMP. To estimate the future net recharge in the Basin, the 2015 SYRM also considered a long-term historical record of precipitation along with anticipated future charges in cultural conditions, such as plans for pumping, stormwater recharge, and supplemental water recharge. Based on this process, a Safe Yield of 135,000 afy was calculated for the period from FY 2011 through 2020.

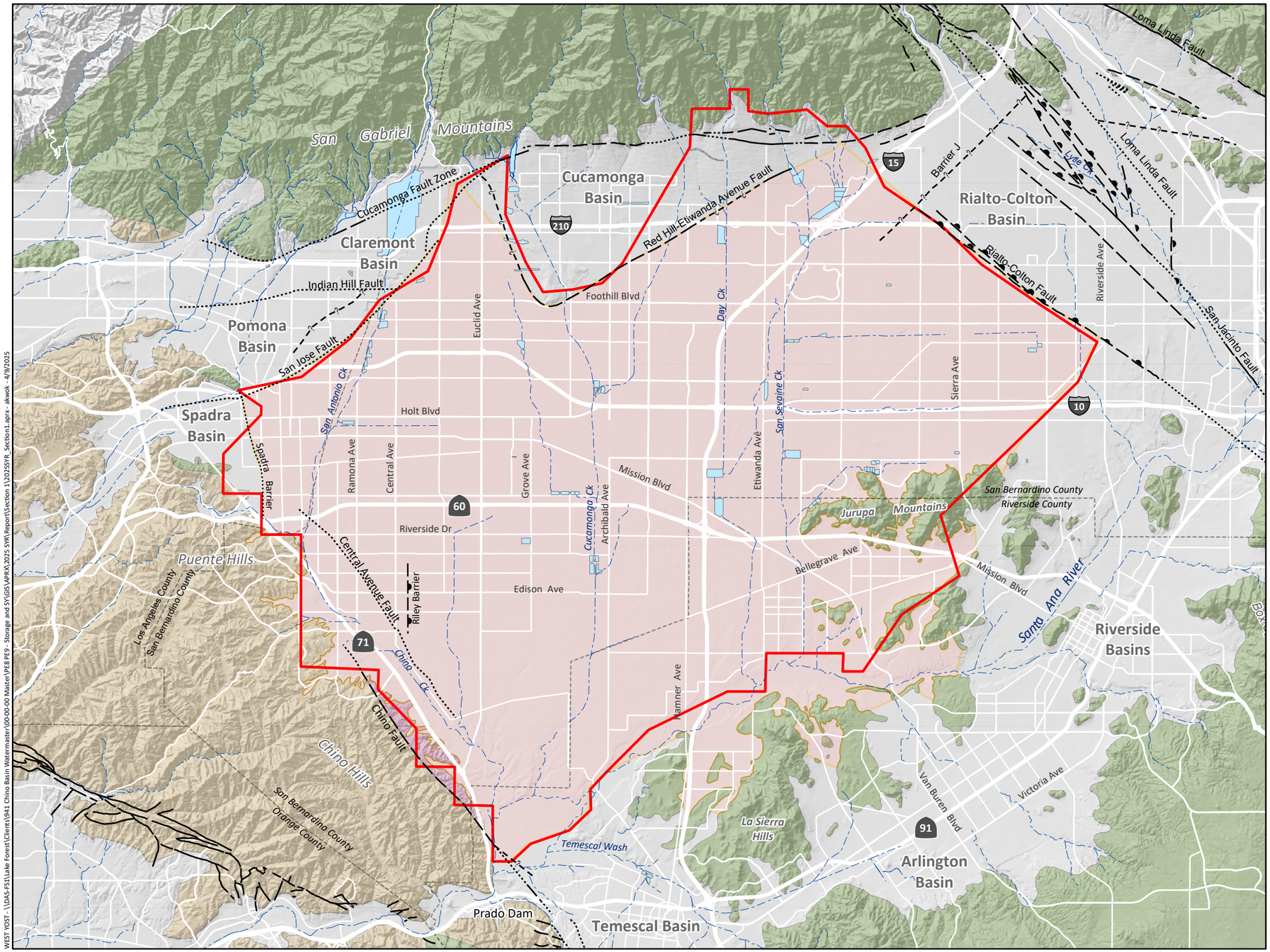
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[1] 20200716 Notice of Lodging of [Proposed] Order re CBWM Motion re 2020 Safe Yield Reset.pdf

[2] *Orders for Watermaster's Motion Regarding* the *2015 Safe Yield Reset Agreement, Amendment of Restated Judgment, Paragraph 6,* Superior Court for the County of San Bernardino (2017).

[3] *Order Regarding the Appeal Parties Motion,* Superior Court for the County of San Bernardino (2019).

[4] 2022 Watermaster Rules and Regulations



Chino Basin Adjudicated Boundary

Chino Basin Hydrologic Boundary

Rivers and Streams

Flood Control and/or Conservation Basins

Geology

Water-Bearing Sediments

Quaternary Alluvium

Consolidated Bedrock

Plio-Pleistocene Sedimentary Rocks

Cretaceous to Miocene Sedimentary Rocks

Pre-Tertiary Igneous and Metamorphic Rocks

Faults

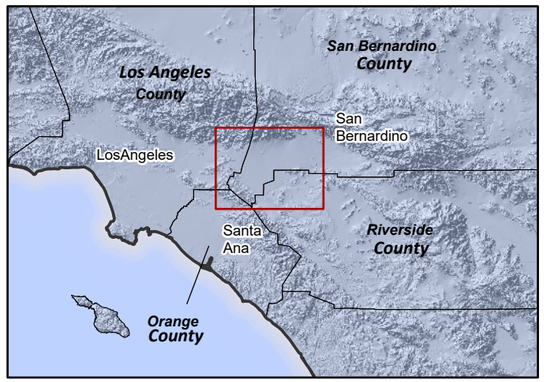
Location Certain

Location Approximate

Approximate Location of Groundwater Barrier

Location Concealed

Location Uncertain



Prepared by:

WEST YOST
Water. Engineered.

N

0 2 4 Miles

0 4 8 Km

Prepared for:

Chino Basin Watermaster
2025 Safe Yield Reevaluation

Hydrologic and Adjudicated Boundaries of the Chino Basin

Figure 1-1

WEST YOST - \\DAS-FS1\Lake Forest\Clients\941 Chino Basin Watermaster\00-00-00 Master\PE8 PE9 - Storage and SY\GIS\APRX\2025 SYR\Report\Section 1\2025SYR_Section1.aprx - akwok - 4/9/2025

Pursuant to the 2017 Court Order, Watermaster completed the 2020 Safe Yield Recalculation (2020 SYR) for the period of FY 2021 through 2030 using the 2015 SYRM. Watermaster's groundwater-flow model was recalibrated using long-term historical data and was used to project a prospective net recharge to the Basin of 131,000 afy under then-current and projected cultural conditions for the period of FY 2021 through 2030. The 2020 SYR resulted in the Court adopting a Safe Yield of 131,000 afy for the period of FY 2021 through 2030.

1.1.2 2022 Safe Yield Reset Methodology

During the peer review process for the 2020 SYR, the parties and peer reviewers provided several comments and recommendations to address the uncertainty in future water plans in calculating the Safe Yield. These included recommendations to simulate multiple pumping scenarios to address predictive uncertainty more comprehensively. In addition to the comments on the 2020 SYR Report, the City of Chino opposed the 2020 Safe Yield Reset on the grounds that the process did not adequately address uncertainty.[5]

The 2017 Court Order[6] permits Watermaster, with recommendation and advice from the Pools and Advisory Committee, to supplement the 2015 SYRM by incorporating advancements in best management practices and hydrologic science. In response to recommendations arising from the 2020 SYR, objections to the 2020 SYR, and pursuant to the authority granted by the 2017 Court Order, Watermaster initiated a process in 2021 to update the 2015 SYRM.

The SYRM update process began in October 2021. Three workshops occurred during the period from October 2021 through July 2022, in which three draft technical memoranda were circulated for review and comment by the parties and technical peer reviewers. The final technical memorandum (TM) documenting the revised SYRM (called the 2022 Safe Yield Reset Methodology, or 2022 SYRM) was published on October 6, 2022[7] and approved by the Court in December 2022.[8] The 2022 SYRM includes the following steps:

(i) Use data collected since the implementation of the OBMP to re-calibrate the Watermaster's groundwater-flow model. The re-calibration period should be long enough to include wet and dry periods relative to the long-term historical precipitation record.

(ii) Conduct an uncertainty analysis of the re-calibrated groundwater-flow model to identify a plausible range of calibrated models.

(iii) Describe current and projected future cultural conditions, including but not limited to land use and water-management practices, such as: pumping, managed recharge, managed groundwater storage, impervious land cover, water recycling, and water conservation practices. Identify a possible range of projected future cultural conditions.

(iv) Using the most current research on future climate and hydrology, identify a possible range of projected future climatic conditions in the Santa Ana River watershed.

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[5] 20200615 City of Chino's Opposition to CVWM Motion re 2020 Safe Yield Reset.pdf

[6] See pages 16-17 of the 2017 Court Order and Section 6.5(d) of the 2022 R&R.

[7] Final 2022 SYRM TM

[8] 20221219 Notice of Ruling and Entry of Orders.pdf

(v) Using the results of [3.] and [4.] above, prepare an ensemble of multiple projection scenarios of combinations of future climate/hydrology and cultural conditions (herein called the "Projection Ensemble"). Assign likelihoods to each scenario in the Projection Ensemble.

(vi) Simulate the range for the potential future water budget and groundwater conditions in the Chino Basin over no less than a 50-year future period. This is accomplished by using:

i. The range of calibrated models developed in [2.], and

ii. The Projection Ensemble developed in [5.] as model input data.

(vii) Using the results of [6.] above, characterize the range in the model results for:

i. Groundwater conditions, including: groundwater elevations, groundwater in storage, and groundwater flow directions, and

ii. The water budget, including: basin inflows, outflows, change in storage, and net recharge.

(viii) Using the set of net recharge results from [7.ii], determine a tentative Safe Yield as the likelihood-weighted average net recharge over the 10-year prospective period for which the Safe Yield is being redetermined (Tentative Safe Yield).

(ix) Evaluate whether the groundwater production at the Tentative Safe Yield estimated in [8] above will cause or threaten to cause "undesirable results" or "Material Physical Injury." If groundwater production at Tentative Safe Yield will cause or threaten to cause "undesirable results" or "Material Physical Injury," then Watermaster will identify and implement prudent measures necessary to mitigate "undesirable results" or "Material Physical Injury," set the value of Safe Yield to ensure there is no "undesirable results" or "Material Physical Injury," or implement a combination of mitigation measures and a changed Safe Yield.

1.1.3 2025 Safe Yield Reevaluation

The 2017 Court Order (restated in Section 6.5(f) of the 2022 R&R) requires that Watermaster update its groundwater model and evaluate the 2020 Safe Yield (131,000 afy) by June 30, 2025. Watermaster maintains and updates the Chino Valley Model (CVM) to facilitate this evaluation. The CVM, used for the 2020 SYR, has been updated for the 2025 SYR to implement the 2022 SYRM.

The 2025 SYR will apply the 2022 SYRM to evaluate the current Safe Yield for FY 2021 through 2030. Section 6.5(c) of the 2022 R&R outlines the potential next steps if the 2025 SYR results indicate that the reevaluated Safe Yield deviates by more than 2.5% from the current Safe Yield. This section states that the Safe Yield may be reset if:

(i) with the recommendation and advice of the Pools and Advisory Committee and in the exercise of prudent management discretion described in Section 6.5(e)(iii), below, Watermaster recommends to the court that the Safe Yield must be changed by an amount greater (more or less) than 2.5% of the then-effective Safe Yield.

(ii) The California State Water Resources Control Board develops water conservation measures prior to June 30, 2030, that result in a reduction in urban irrigation in the Chino Basin (i.e., reduced Evapotranspiration Adjustment Factors), as required by Water Code § 10609, et seq., that is reasonably likely to materially reduce recharge in the Chino Basin and such measures are determined to change the Safe Yield by more than 2.5% of the then-effective Safe Yield, and Watermaster moves the Court to reset the Safe Yield accordingly. (Orders Regarding Chino Basin Watermaster Motion Regarding 2020 Safe Yield Reset, Amendment of Restated Judgment, Paragraph 6, dated July 31, 2020 at 15.)

1.2 SCOPE OF WORK

The scope of work for the 2025 SYR includes the following key tasks:

- **Task 1 – Update Hydrogeologic Conceptual Model.** This task involves using the most current information to update the description of the Chino Basin hydrogeology and then translate the hydrogeologic description to the CVM.
- **Task 2 – Update Model and Input Data for Historical Period.** This task involves extending and updating the input data for the surface water and groundwater models through the historical calibration period to prepare for model recalibration.
- **Task 3 – Recalibrate Groundwater Model to Generate Calibrated Realizations.** This task involves recalibrating the CVM using historical data for the updated calibration period (FY 1992 through 2022) and employing uncertainty analysis methods like PESTPP-IES to generate a range of plausible calibrated model realizations.
- **Task 4 – Develop Planning Scenarios.** This task involves creating an ensemble of future projection scenarios that incorporate uncertainties in water demands, supply plans, and climate conditions through stakeholder engagement and analysis of available planning documents.
- **Task 5 – Conduct Planning Simulations to Update Projections of Net Recharge, Identify Undesirable Results and Associated Mitigation Measures, and Reevaluate Safe Yield.** This task utilizes the calibrated CVM realizations and projection scenarios to simulate future conditions, project net recharge, evaluate potential undesirable results or material physical injury (MPI), and develop recommendations for the Safe Yield and any potential mitigation measures.
- **Task 6 – Prepare Safe Yield Reevaluation Report.** This task involves documenting the entire 2025 SYR process, including methodologies, results, analyses, and recommendations in a comprehensive report.

1.3 PEER REVIEW AND STAKEHOLDER ENGAGEMENT

Section 6.5(g) of the 2022 R&R requires the Pools to have the opportunity for peer review of the 2025 SYR. The 2025 SYR was developed with input from the parties and stakeholders through a series of workshops and TMs. Watermaster hosted 11 workshops to review and gather feedback on interim results and various stages of the process. The workshops and TMs that supported this work are listed below.

- Workshops:
  - August 30, 2023 – Hydrogeologic Conceptual Model
  - October 24, 2023 – Scenario Design (#1)
  - March 7, 2024 – Scenario Design (#2)
  - May 29, 2024 – Calibration and Uncertainty Analysis (#1)
  - June 25, 2024 – Scenario Design (#3)
  - August 6, 2024 – Calibration and Uncertainty Analysis (#2)
  - August 27, 2024 – Scenario Design (#4)
  - November 20, 2024 – SYR Process and Evaluation of Material Physical Injury
  - March 25, 2025 – Preliminary Results
  - November 6, 2025 – Draft 2025 SYR Report
  - May 20, 2026 – Revised Draft 2025 SYR Report
- TMs/Reports:
  - Scenario Design TM #1
  - Scenario Design TM #2
  - Scenario Design TM #3
  - Analysis of Material Physical Injury and Undesirable Results for the 2025 SYR
  - 2025 Safe Yield Reevaluation Report (this report)

Each of the presentations and TMs (including draft documents) listed above are hosted on Watermaster's website[9] and were maintained for access throughout the 2025 SYR process. The written comments provided by the parties and stakeholders on the presentations and TMs were included as appendices in the TMs. Written comments from the March 25, 2025, November 6, 2025 workshop, and on the draft 2025 SYR report are documented with responses in Appendix E of this report.

1.3.1 Third-Party Peer Review of 2025 CVM and 2025 SYR

Following the March 25, 2025 workshop, the Watermaster Board directed staff to engage a third-party consultant to conduct an independent peer review of the 2025 CVM and the SYR assumptions and findings. Watermaster selected S.S. Papadopulos & Associates (SSP&A) to perform this review. The peer review was conducted from July through September 2025 and culminated with SSP&A presenting findings and recommendations to the Watermaster Advisory Committee and Board in September 2025 and

[9] https://cbwm.org/pages/syrm/

submitting a report of the findings and recommendations in October 2025. The full peer review report is provided in Appendix E.

At the Appropriative Pool (AP) Committee meeting on December 11, 2025, the AP requested that West Yost work with the AP's consultant, Thomas Harder and Company (THC) to develop a scope to address the peer review recommendations. West Yost met with THC staff in December 2025 to discuss a draft of the scope of work to respond to the peer review recommendations.

1.3.1.1 Implementation of Peer Review Recommendations

In January 2026, the Watermaster Board approved a scope of work to implement selected peer review recommendations and revise the 2025 SYR study and report.[10] The scope of work was developed to incorporate the major recommendations that would impact the evaluation of the Safe Yield and support the documentation of the surface-water model component of the 2025 CVM (i.e., the HSPF and R4 models – See Section 3). The scope of work included the following tasks:

- Task 1. Develop Integrated Water Budgets
- Task 2. Refine Calibration Data
- Task 3. Refine Model Mechanics and Numerical Stability
- Task 4. Prepare, Run, and Process Additional PESTPP-IES Configuration and Projection Ensemble
- Task 5. Update Report and Appendices
- Task 6. Conduct Stakeholder Workshop
- Task 7. Project Management and Meetings

This scope of work was initiated in February 2026. During the execution of Tasks 1 through 4, West Yost held four meetings with staff from Watermaster, THC, and SSP&A to review intermediate results, answer questions, and gather feedback. Revisions made to the 2025 SYR to implement the peer review recommendations are noted throughout the report.

1.4 REPORT ORGANIZATION

The remaining sections of this report are described below:

- **Section 2** – **Update of Hydrogeologic Conceptual Model**: This section describes the new information gathered and interpreted since the 2020 SYR on the hydrogeology of the Chino Basin, including the geologic setting, stratigraphy, base of aquifer, occurrence and movement of groundwater, aquifer system, aquifer properties, and land subsidence.
- **Section 3** – **Model Updates**: This section describes the updates made to the 2025 CVM including the surface water models, vadose zone models, and the groundwater-flow model.
- **Section 4** – **Model Calibration and Uncertainty Analysis**: This section documents the calibration of the CVM using a pilot point method and PESTPP-IES to generate multiple

[10] Business Item III.B. of the January 22, 2026 Watermaster Board meeting (Meeting Package)

calibrated model realizations and presents the results of the calibration process including the historical water budget, a discussion of uncertainty, and the selected calibrated realizations.

- **Section 5** – **Projection Ensemble:** This section describes the development of the projection ensemble including: stakeholder engagement and timeline, the characterization of uncertainty in future climate and cultural conditions, and the final Projection Ensemble.
- **Section 6 – 2025 Determination of Tentative Safe Yield:** This section summarizes the TSY Ensemble results, including projected water budgets, groundwater conditions, comparison to the 2020 SYR, and the likelihood-weighted net recharge used to determine the Tentative Safe Yield for FY 2021 through 2030.
- **Section 7 – 2025 Safe Yield Reevaluation:** This section documents the evaluation of whether production at the Tentative Safe Yield will cause or threaten undesirable results or MPI, and presents recommendations for data gaps, CVM improvements, mitigation measures, and Basin operational optimization.
- **Appendix A – Supplemental Hydrogeologic Information**
- **Appendix B – Results from the Calibration and Uncertainty Analysis**
- **Appendix C – Scenario Design Information**
- **Appendix D – TSY Ensemble Results**
- **Appendix E – Peer Review and Stakeholder Comments and Responses**

SECTION 2
Update of Hydrogeologic Conceptual Model

2.1 INTRODUCTION AND SCOPE

This section describes the new information and updates that were made to the geologic and hydrogeologic understanding and conceptual model for the groundwater basins that are simulated in the 2025 Chino Valley Model (2025 CVM), which include the Chino Basin, Cucamonga Basin, Six Basins, Spadra Basin, and Temescal Basin. Figure 2-1 shows these groundwater basins, the regional geology, and the model domain of the 2025 CVM.

The 2020 SYR Report described the hydrogeologic and hydrologic setting of the groundwater basins within the 2020 CVM domain, as well as the hydrogeologic conceptual model (HCM) that serves as the foundation for both the 2020 CVM and the 2025 CVM. An HCM is a description of the geologic and hydrologic framework governing the occurrence of groundwater and its flow through and across the boundaries of a basin and the general groundwater conditions in a basin or subbasin.[1]

The scope of Task 1 for the 2025 SYR includes: (i) review new data and information; (ii) update the HCM; and (iii) use the updated HCM to update the 2025 CVM. The following types of new data and information were used to update the HCM and the 2025 CVM:

- Geologic and lithologic information, such as new well lithologic logs and pump tests
- Remote sensing data
- Information on faults and basin boundaries that may affect groundwater flow

2.2 GEOLOGIC AND LITHOLOGIC INFORMATION

During the development of the 2025 CVM, Watermaster completed an inventory of new well information compiled since 2018, the cutoff for date for the update of the 2020 CVM. Watermaster maintains a comprehensive well inventory, which was augmented through contacting several agencies that have recently installed wells in the 2025 CVM domain. This effort yielded approximately 80 new well logs. Figure 2-2 is a map that shows the locations and depths of the new well logs (symbolized by CVM layer penetrated by the wells). Some of the new wells are located near each other or are nested wells, resulting in overlapping locations on the map.

The HCM relies heavily on lithological data from well driller's logs, which provide depth-specific descriptions of the thicknesses, type, and texture of the aquifer sediments that are used to characterize the basin hydrostratigraphy. For the 2025 CVM, the process of collecting and reviewing new well information was continued to update the HCM, building upon the approximately 1,150 logs reviewed for the development of the 2020 CVM and prior models.

Several of the new borehole lithologic logs were used to revise the hydrogeologic cross-sections of the HCM. Figure 2-3 shows the locations of the hydrogeologic cross-sections, with highlights indicating revisions since the 2020 CVM. Seven new wells, two in the Spadra Basin and five in the Chino Basin, were incorporated onto the cross-sections. Two wells that were used in the 2020 CVM were added to the cross-sections: Pomona well P-21 was added to more clearly delineate the Spadra Barrier (see Section 2.4), and the Monte Vista Water District Well 28 was added to more clearly delineate the layers

[1] Cal. Code Regs. Tit. 23, § 341(q)

in this region, as this lithology was used to develop a one-dimensional compaction model of the aquifer[2] to support Ground-Level Monitoring Program investigations of land subsidence. The revised cross-sections are in Appendix A.

The new hydrogeologic information, including the new well lithologic logs, were used for several updates to the 2025 CVM, including:

- Revising CVM layer elevations and thickness to improve the representation of the subsurface hydrostratigraphy.
- Integrating new information onto hydrostratigraphic sections to provide a visual representation of the subsurface hydrostratigraphy.
- Refining the understanding and characterization of the spatial distribution and values of aquifer properties.

2.3 REMOTE SENSING

Watermaster uses remote sensing datasets to support various monitoring efforts, such as the Prado Basin Habitat Sustainability Program and the Ground-Level Monitoring Program. To update the 2025 CVM, Watermaster reviewed the latest data from three remote sensing datasets: Interferometric Synthetic Aperture Radar (InSAR), Normalized Difference Vegetation Index (NDVI) and aerial photos of the Prado Basin, and a Digital Elevation Model (DEM). Watermaster reviewed the recent data for each of these datasets to inform updates to the 2025 CVM, each described in more detail below.

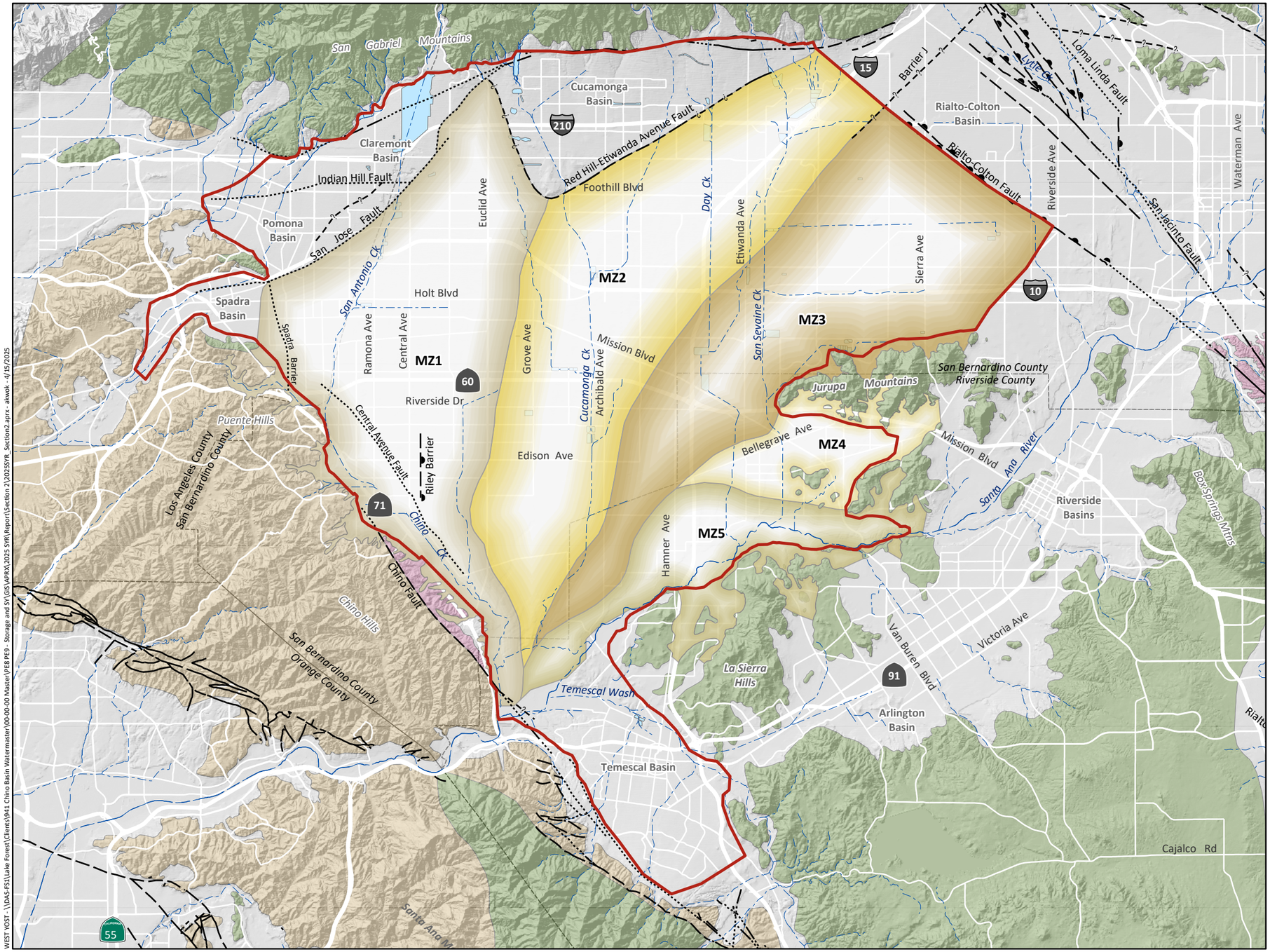
2.3.1 InSAR

Historically, the Watermaster has used InSAR as a monitoring technique to track vertical ground motion (e.g., land subsidence) as an element of its Ground-Level Monitoring Program. For instance, as groundwater levels rise, the aquifer-system sediments can expand under the increased heads, and the land surface can rise. Conversely, as groundwater levels decline, the aquifer-system sediments can compress or compact permanently, and the land surface can fall (i.e., land subsidence). Because of these aquifer-system mechanics that respond to rising and falling groundwater levels, InSAR has proven valuable in identifying the locations of subsurface faults and barriers to groundwater flow within the CVM domain.[3] This is because groundwater levels oftentimes deform differently on either side of fault barriers, which causes differential vertical ground motion across the fault barriers.

Recent InSAR data collected since the development of the 2020 CVM were reviewed to refine the location of certain fault barriers within the CVM domain. During the winter of FY 2023, InSAR measurements captured differential vertical ground motion in the northwestern corner of the CVM domain during a period of higher-than-average precipitation and recharge in the Six Basins and Cucamonga Basin. These data proved useful in refining the location of the West Cucamonga Barrier and the San Jose Fault in these areas.

[2] TM - 941 - 1D Model - Final.pdf

[3] Wildermuth Environmental, Inc. 2017. Strategic Plan for the Six Basins. Prepared for the Six Basins Watermaster. November 2017. Link



Chino Basin OBMP Management Zones

MODFLOW Model Boundary

Rivers and Streams

Flood Control and/or Conservation Basins

Geology

Water-Bearing Sediments

Quaternary Alluvium

Consolidated Bedrock

Plio-Pleistocene Sedimentary Rocks

Cretaceous to Miocene Sedimentary Rocks

Pre-Tertiary Igneous and Metamorphic Rocks

Santa_Ana_River

Faults

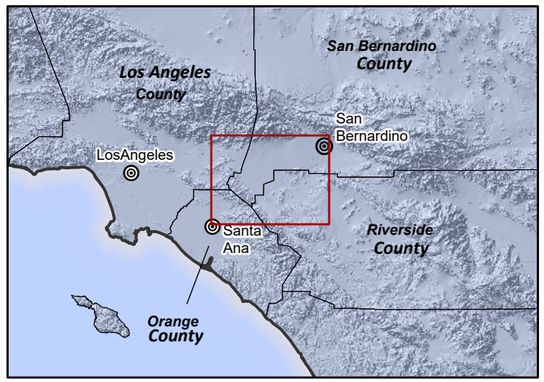
Location Certain

Location Approximate

Approximate Location of Groundwater Barrier

Location Concealed

Location Uncertain



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0 4 8 Km

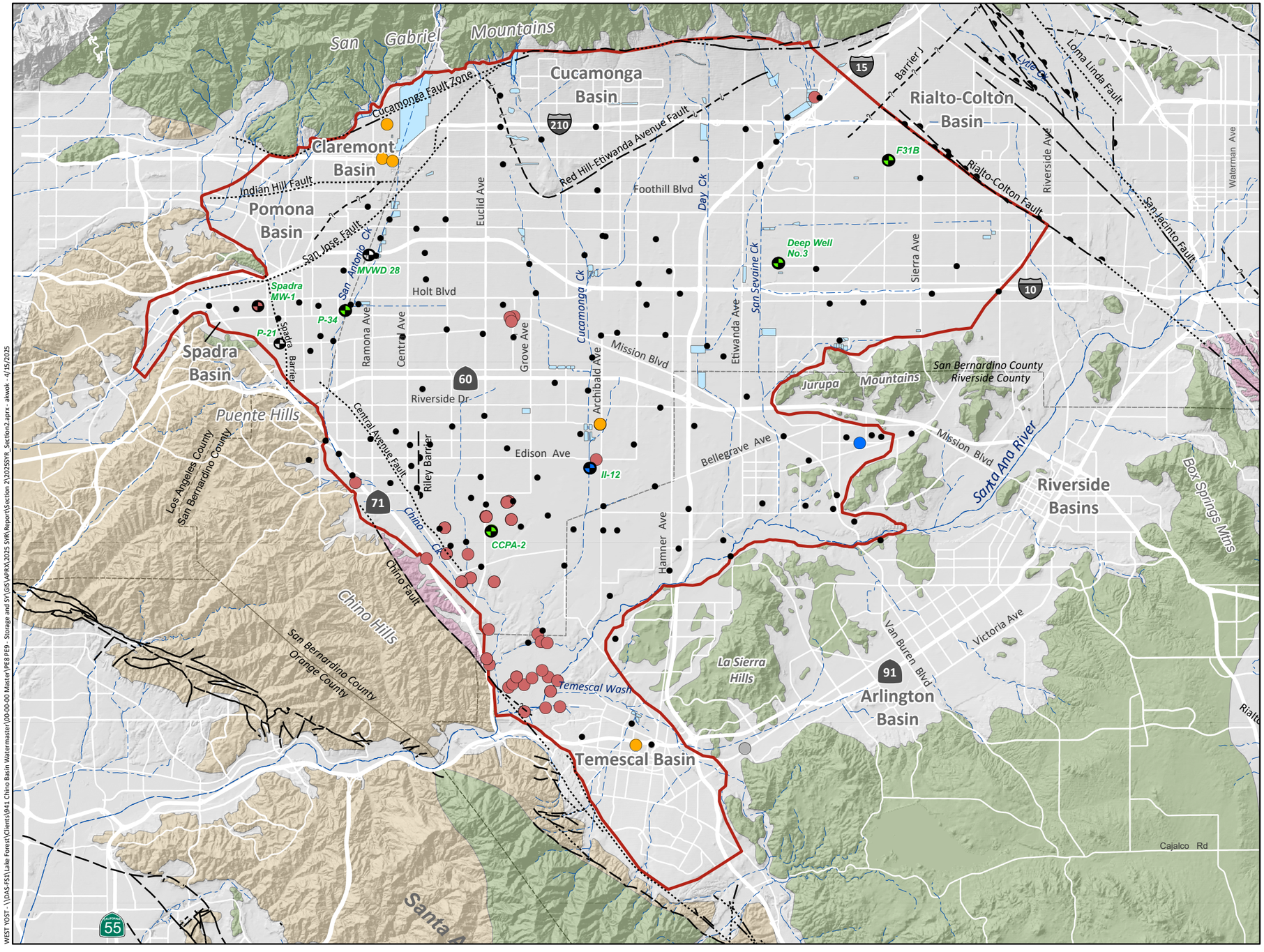
Prepared for:

Chino Basin Watermaster
2025 Safe Yield Reevaluation

Geologic Map and Boundaries of the Chino Basin

Figure 2-1

WEST YOST - \\OAS-FS1\Lake Forest\Clients\941 Chino Basin Watermaster\00-00-00 Master\PE8 PE9 - Storage and SY\GIS\APRX 2025 SYR\Report\Section 2\2025SYR_Section2.aprx - akwok - 4/15/2025



Borehole added to the HCM in the 2025 CVM

Borehole Lithology Used for the 2020 HCM Cross-Section

New Borehole Data Acquired for 2025 CVM

Symbolized by Aquifer Layer

- Layer 1
- Layers 1-2
- Layers 1-3
- Layers 1-4
- Layers 1-5
- Well Outside CVM Domain

MODFLOW Model Boundary

Rivers and Streams

Flood Control and/or Conservation Basins

Geology

Water-Bearing Sediments

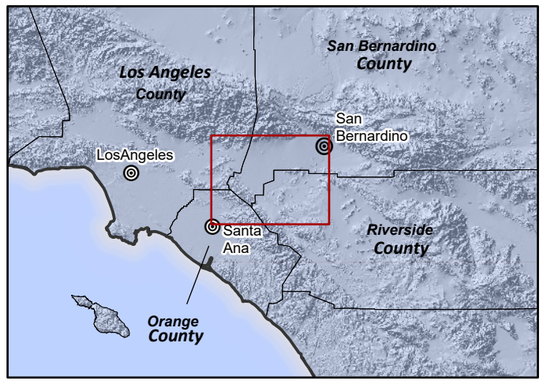
- Quaternary Alluvium

Consolidated Bedrock

- Plio-Pleistocene Sedimentary Rocks
- Cretaceous to Miocene Sedimentary Rocks
- Pre-Tertiary Igneous and Metamorphic Rocks

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain



Prepared by:

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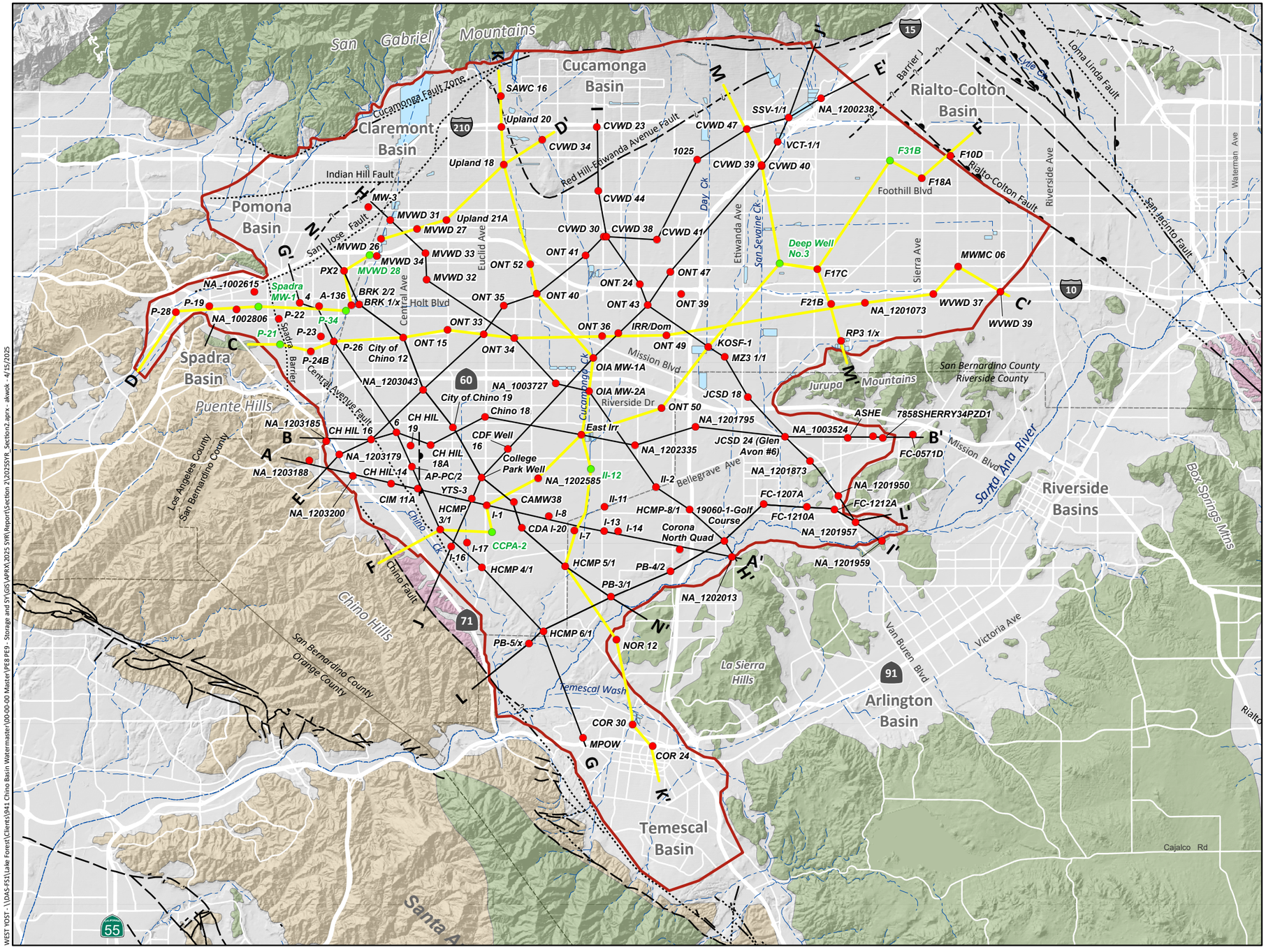
Prepared for:

Chino Basin Watermaster
2025 Safe Yield Reevaluation

Borehole Locations Used to Describe the Hydrogeologic Conceptual Model

Figure 2-2

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Hydrostratigraphic Cross-Section Profile Line Revised for the 2025 CVM

Hydrostratigraphic Cross-Section Profile Line Used for the 2020 and 2025 CVM

Borehole Used in Hydrostratigraphic Cross-Section

Borehole Added to Hydrostratigraphic Cross-Section for the 2025 CVM

MODFLOW Model Boundary

Rivers and Streams

Flood Control and/or Conservation Basins

Geology

Water-Bearing Sediments

Quaternary Alluvium

Consolidated Bedrock

Plio-Pleistocene Sedimentary Rocks

Cretaceous to Miocene Sedimentary Rocks

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Faults

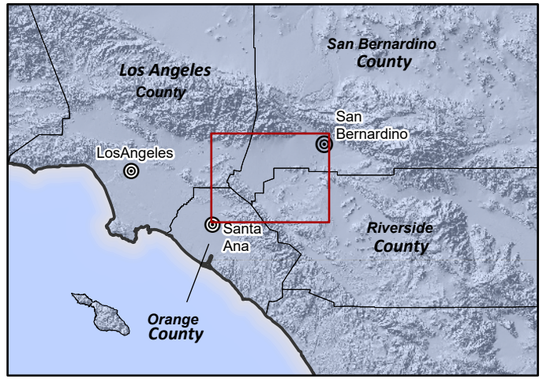
Location Certain

Location Approximate

Approximate Location of Groundwater Barrier

Location Concealed

Location Uncertain



Prepared by:

WEST YOST
Water. Engineered.

N

0 3 6 Miles

0 4 8 Km

Prepared for:

Chino Basin Watermaster
2025 Safe Yield Reevaluation

Map View of the Hydrostratigraphic Cross-Sections

Figure 2-3

WEST YOST - \\DAS-FS1\Lake Forest\Clients\941 Chino Basin Watermaster\00-00-00 Master\PE8 PE9 - Storage and SY\GIS\APRX\2025 SYR\Report\Section 2\2025SYR_Section2.aprx - akwok - 4/15/2025

Figure 2-4 illustrates the vertical ground motion observed in the northwestern corner of the CVM domain between Spring 2022 and Spring 2023. The areas in the Six Basins and Cucamonga Basin exhibited uplift because of the large volumes of recharge and increases in groundwater levels north of the West Cucamonga Barrier and the San Jose Fault, while little to no ground motion occurred south of these fault barriers. These findings not only illustrate improved understanding about the location of the fault barriers but also suggest that groundwater flow is restricted across the fault barriers. These observations and insights were used to revise the hydrologic boundary of the Chino Basin and the delineation of the San Jose Fault and the West Cucamonga Barrier in the 2025 CVM. Figure 2-4 illustrates these changes by showing the hydrologic basin boundary in the 2020 CVM as a gray line and the revised boundary in the 2025 CVM as a red line.

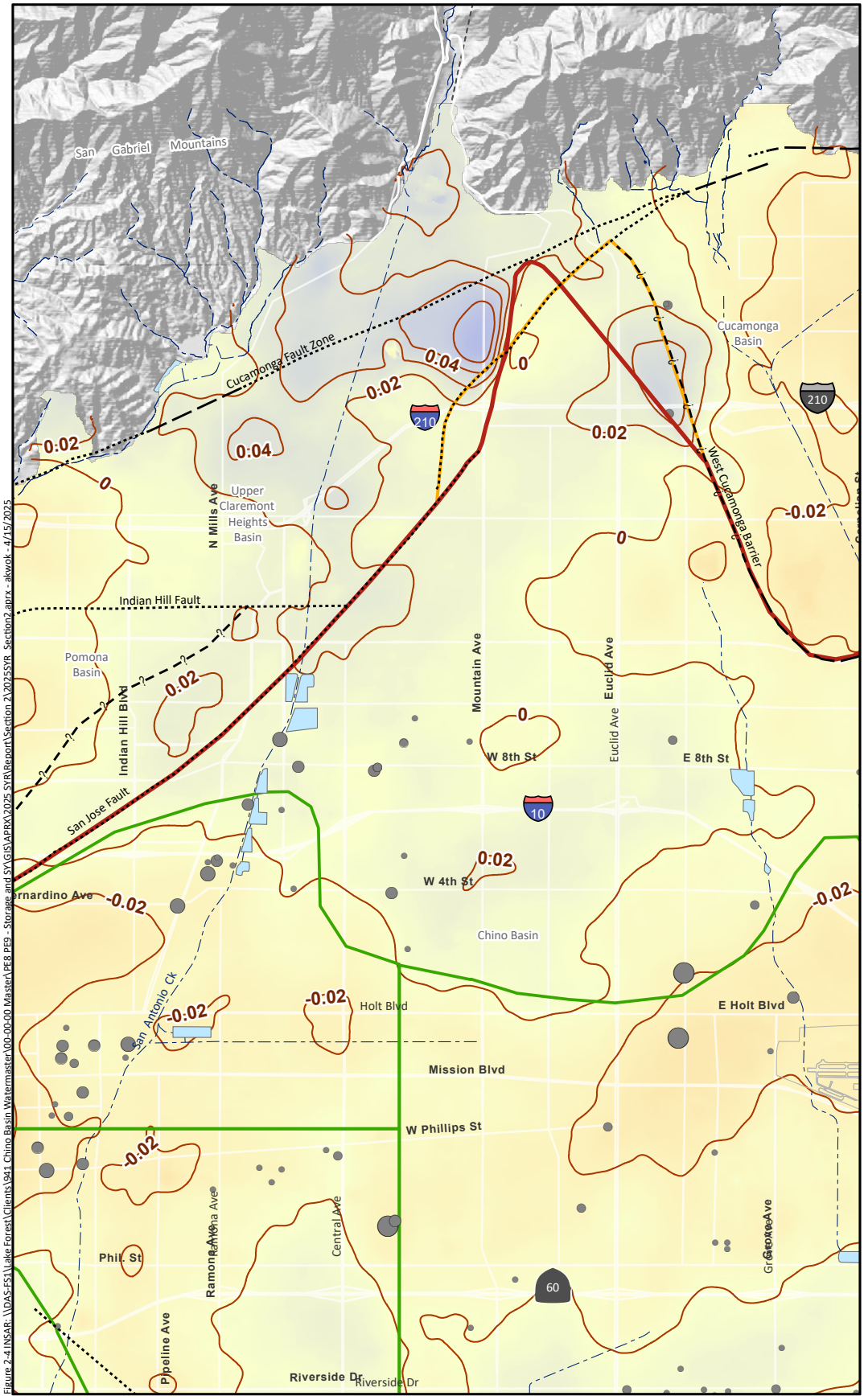
2.3.2 NDVI and Aerial Photos

The Prado Basin Habitat Sustainability Program (PBHSP) is designed to monitor the extent and health of the riparian vegetation in the Prado Basin in the southern Chino Basin, which is the largest groundwater-dependent ecosystem in southern California. The PBHSP publishes annual reports to document the monitoring data, analyses, and interpretations. As part of the PBHSP, Watermaster routinely collects and evaluates NDVI data and aerial photographs of the Prado Basin to determine the extent, density, and health of riparian vegetation in Prado Basin over time. For the 2025 CVM update, Watermaster reviewed these datasets in the context of the estimation of groundwater evapotranspiration (ET) in this area, which is one of the key processes that governs the water budget of the Chino Basin. Appendix B of the 2020 SYR Report documented the assumptions and process to calculate ET from the Prado Basin in the 2020 CVM.

Based on the review of the new NDVI data and aerial photos, it was determined that no changes were necessary to the existing ET estimation process, or the delineation of the riparian vegetation as implemented in the 2020 CVM. The spatial extent and density of the riparian vegetation used in the 2020 CVM has remained consistent since 2020 CVM was completed.

2.3.3 DEM

The groundwater and surface water interactions between the Chino Basin and the Santa Ana River (SAR) are important dynamics that are simulated by the CVM. Accurately characterizing the geometry (e.g., stream-bottom elevations and slope) and location of the SAR are key data for the simulations. In the 2020 CVM, the geometry and location of the SAR were computed using a 10-meter DEM from the United States Geological Survey (USGS). For the development of the 2025 CVM, Watermaster gathered the most recent 1-meter DEM data (2018) and aerial photos of the SAR. With these data, Watermaster updated the streambed elevations, slopes, and stream cross-sections to characterize the SAR in the groundwater-flow model.



Hydrologic Boundary for the 2020 CVM

Hydrologic Boundary for the 2025 CVM

Relative Change in Land Surface Elevation as Estimated by InSAR

March 2022 to May 2023

+ 0.2 ft

- 0.2 ft

InSAR contours (ft)

Groundwater Pumping (acre-feet)

April 1, 2022 to March 31, 2023

- 0.0 - 100
- 101 - 500
- 501 - 1,000
- 1,001 - 2,000
- >2,000

Recharge Basins

Areas of Subsidence Concern

Rivers and Streams

Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)

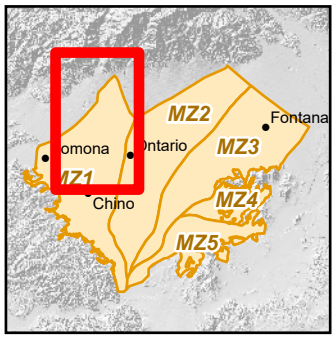


Figure 2-4 INSAR: \\DAS-FS1\Lake Forest\Clients\941 Chino Basin Watermaster\00-00-00 Master\PE8 PE9 - Storage and SY\GIS\APRX\2025 SYR\Report\Section 2\2025SYR_Section2.aprx - akwok - 4/15/2025

Prepared by: WEST YOST

N

2 Miles

3 Km

Prepared for: Chino Basin Watermaster

2025 Safe Yield Reevaluation

Vertical Ground Motion as Estimated by InSAR

Spring 2022 to 2023

Figure 2-4

2.4 FAULTS AND BASIN BOUNDARIES

Watermaster reviewed other new information related to the location and characterization of faults and basin boundaries to further refine the HCM. The new information included:

- **Spadra Barrier:** The Spadra Barrier marks the boundary between the Chino Basin and the Spadra Basin. Groundwater levels in the Spadra Basin are approximately 50 to 200 feet higher than those in the Chino Basin. A review of groundwater-level data from wells near this boundary has refined the location of the Spadra Barrier, as shown in Figure 2-1. The revised extent and location of the Spadra Barrier aligns with a concealed fault mapped by a USGS study.[4] Additionally, the northern extent of the Central Avenue Fault, which runs parallel to the western edge of the Chino Basin south of the Spadra Barrier, has been revised to intersect with the Spadra Barrier.
- **Rialto-Colton Fault:** The Rialto-Colton Fault separates the Rialto-Colton Basin from the Chino and Riverside Basins. It is a known barrier to groundwater flow along much of its length, particularly in its northern reaches. Watermaster reviewed recent information on the characterization of this fault, including a 2014 USGS study[5] and the groundwater model report from the Integrated SAR Model.[6] The conclusion of this review was that no new significant findings emerged that would necessitate changes to the current location of this fault in the CVM or its influence on groundwater flow.
- **Boundary between the Chino and Temescal Basins:** The Temescal Basin is included within the domain of the 2020 CVM. Groundwater within the Chino Basin flows southwest towards the Prado Basin and converges with groundwater flowing northwest out of the Temescal Basin. These groundwaters mix and flow southwest toward Prado Dam. Watermaster reviewed the groundwater-flow model that was recently developed to support the 2022 Groundwater Sustainability Plan (GSP) for the Temescal Basin.[7] Based on the review of the GSP and model documentation, it was determined that no changes should be made for the 2025 CVM.

[4] Morton, D., and Miller F. Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California. 2006. http://pubs.usgs.gov/of/2006/1217/

[5] Teague, Nick, Brown, A.A., and Woolfenden, L.R., 2014, Geohydrologic and water-quality data in the vicinity of the Rialto-Colton Fault, San Bernardino, California: U.S. Geological Survey Data Series 813, 76 p., *http://dx.doi.org/10.3133/ds813*.

[6] Geoscience, 2020. Integrated Santa Ana River Model Report. Prepared for San Bernardino Valley Municipal Water District, 2020.

[7] 2022 Temescal Basin Groundwater Sustainability Plan

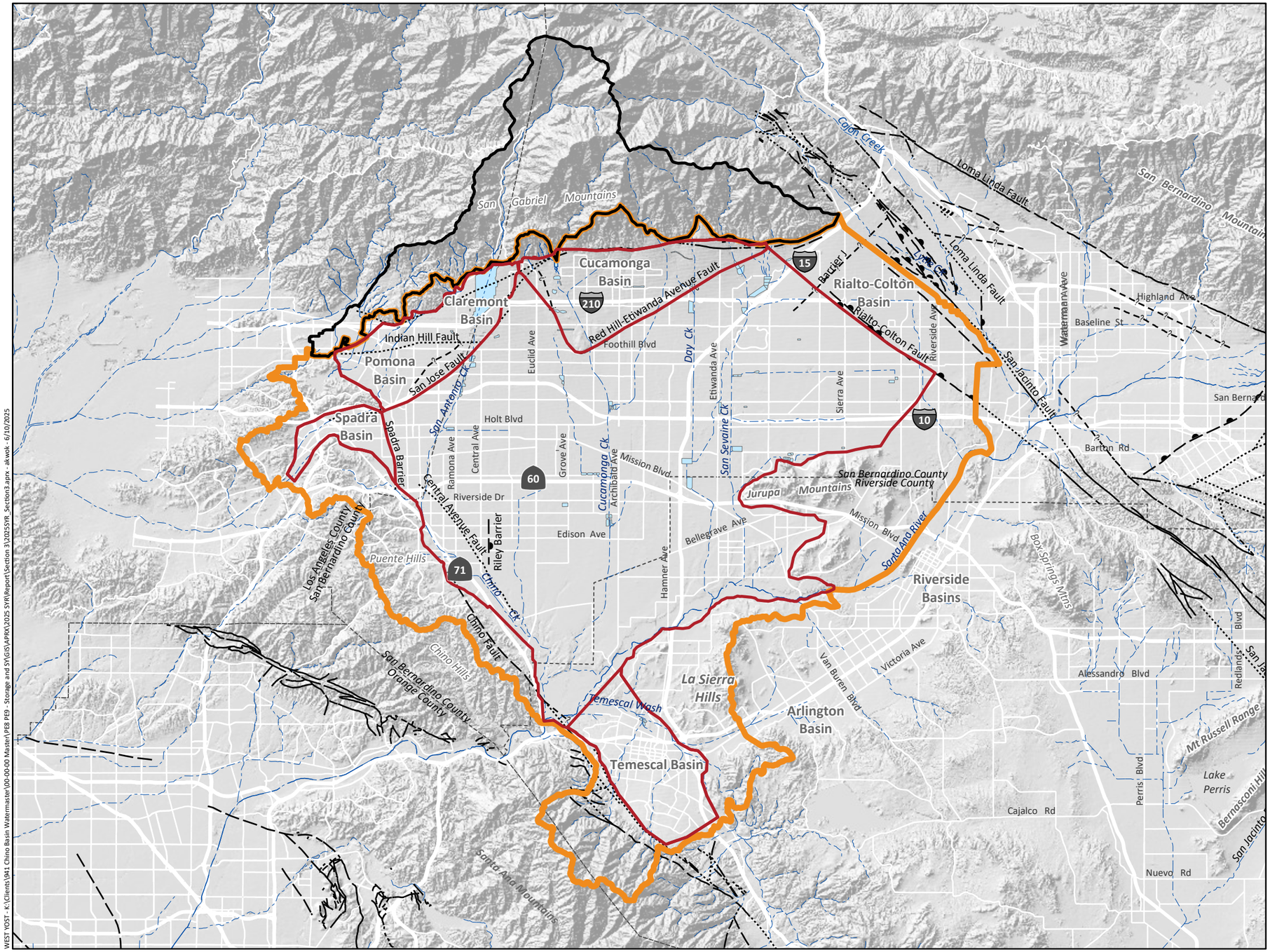
SECTION 3
2025 Updates to the Chino Valley Model

This section describes the updates that were made to the four models that compose the 2025 CVM: the Hydrologic Simulation Program – Fortran (HSPF) model, the R4 model, the HYDRUS-2D model, and the MODFLOW model. The purpose of each of these models is described below.

1. **Hydrologic Simulation Program – Fortran (HSPF)**. This model was implemented based on the HSPF code (Bicknell, et al., 2005), which is a numerical model developed to simulate hydrologic and water quality processes in natural and man-made water systems. The HSPF model uses meteorological data, land use data, and physical characteristics of the model domain to estimate surface runoff and subsurface inflow from the San Gabriel Mountains to the Chino Valley. The HSPF model was calibrated during the 2020 SYR and was not recalibrated during the 2025 SYR. However, the simulation period of the HSPF model was extended through FY 2023 to cover the calibration period of the 2025 CVM and one year of the projection period.
2. **R4**. This model was implemented based on the R4 code (WEI, 2007).[1] Like the HSPF model, the R4 model uses meteorological data, land use data, and physical characteristics of the model domain to simulate the surface-water processes, including rainfall, evapotranspiration, runoff, runoff routing, and deep infiltration of precipitation and applied water (DIPAW) within the Chino Valley. The simulated streamflow from the HSPF model is used as input data to the R4 model. The R4 model was calibrated during the 2020 SYR and was not recalibrated during the 2025 SYR. However, the simulation period of the R4 model was extended through FY 2023 to cover the calibration period of the 2025 CVM and one year of the projection period.
3. **HYDRUS-2D**. Seven HYDRUS-2D models were implemented based on the HYDRUS-2D code (Simunek, et al., 1999), which is a modeling environment for the analysis of water flow and solute and heat transport in variably saturated porous media. These models were used during the 2020 SYR to simulate the movement of DIPAW through the Vadose zone and to estimate the lag time for DIPAW to reach the groundwater table at selected locations in the Chino Basin. The HYDRUS-2D models were not updated during the 2025 SYR, as the lag time was assumed to be spatially static; therefore, an update to the model was not deemed necessary.
4. **MODFLOW**. This model was implemented based on the MODFLOW-NWT code (Niswonger, et al., 2011). The MODFLOW model was used to simulate saturated groundwater flow in the Chino Basin, Spadra Basin, Cucamonga Basin, and Six Basins area. The results of the HSPF, R4, and Hydrus-2D models are used to inform the input values to the domain of the MODFLOW model, including boundary subsurface inflows; subsurface inflows from the San Gabriel Mountains; runoff to streams; percolation in recharge basins; and the magnitude and timing of DIPAW.

Figure 3-1 shows the boundaries of the 2025 CVM domains for the HSPF, R4, and MODFLOW models. The remainder of this section describes the revisions that were made to the 2025 CVM during the 2025 SYR.

[1] The model is in the public domain and can be downloaded from https://github.com/weiwater/R4



2025 CVM Domains

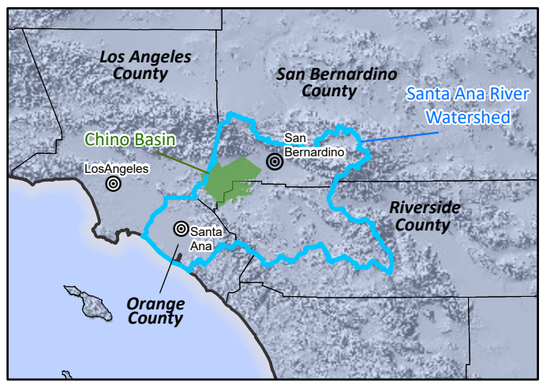
- HSPF Model Domain
- R4 Model Domain
- MODFLOW Domain

Other Features

- Rivers and Streams
- Flood Control and/or Conservation Basins

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain



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0 3 6 Miles

0 4 8 Km

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2025 CVM Domains for Surface-Water and Groundwater Models

Figure 3-1

WEST YOST - K:\Clients\941 Chino Basin Watermaster\00-00-00 Master\PEB PEB - Storage and SY\GIS\APRX\2025 SYR\Report\Section 3\2025SYR_Section3.aprx - akwek - 6/10/2025

3.1 EXTENSION OF HISTORICAL SIMULATION PERIOD FOR THE 2025 CVM

The historical simulation period of the 2020 CVM was July 1, 1977 through June 30, 2018. For the development of the 2025 CVM, historical data was extended through June 30, 2023.

3.1.1 Time Series Data

Updated meteorological stresses, applied water, and recharged water data were used as input data for the extended simulation period of the R4 and HSPF models. The results of the HSPF and R4 models provide input data to the MODFLOW model, including surface-water runoff and mountain-front flow (from the HSPF model) and DIPAW, stormwater runoff and recharge, and subsurface boundary inflow (from the R4 model).

In addition to the output data from the R4 and HSPF models, time series data for groundwater pumping, managed aquifer recharge, and groundwater levels (to calculate time-variant specified-head boundary flows) were used to extend the historical simulation period of the MODFLOW model.

3.1.2 Land Use

The domains of the HSPF and R4 models, and the hydrologic sub-areas of these models, are shown on Figure 3-2. Land use data is an input into the HSPF and R4 models that the models use to estimate runoff, applied water, and deep percolation of precipitation and applied water. Since the development of the 2020 CVM, land use was collected in 2022 from Land IQ, a land use consulting firm that has documented recent land use changes in the southern Chino Basin. The southern portion of the Chino Basin is the only region where land use has changed significantly since the development of the 2020 CVM (the land use data for which ended in 2017) and was the only area where land use designations were updated from the 2020 CVM. Figures 3-3 and 3-4 show the land use in the Chino Basin in 2017 and 2022, respectively. Land use in the HSPF model domain was not updated for the 2025 CVM.

3.2 UPDATES TO THE MODFLOW MODEL

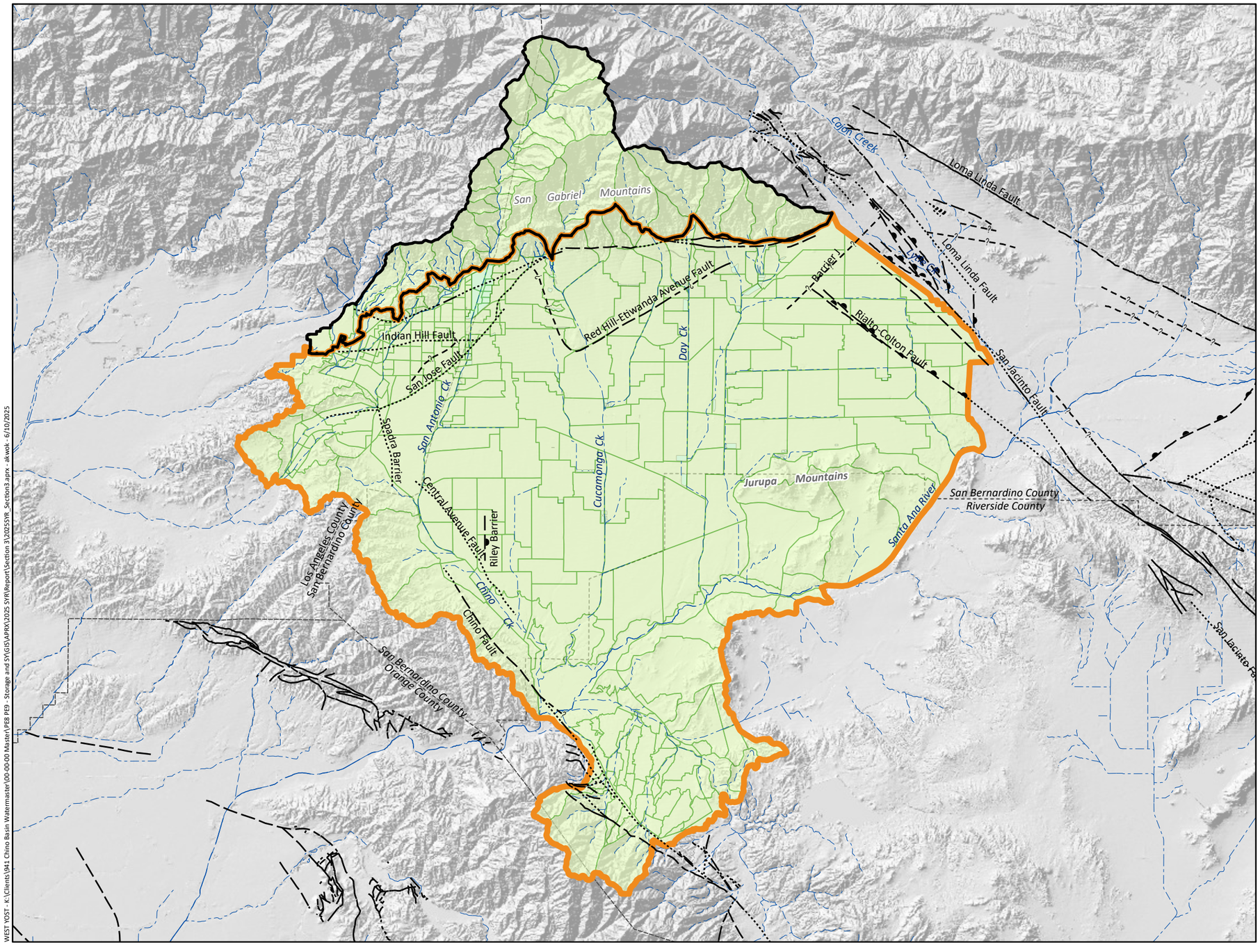
3.2.1 Model Domain and Grid

Like the 2020 CVM, the MODFLOW model of the 2025 CVM has a rectilinear grid consisting of five layers, 577 rows, and 648 columns, with a uniform row/column width of 196.86 ft (60 meters). The model has a total of 1,869,480 cells, among which 838,113 are active cells where groundwater elevations are simulated.

3.2.2 Model Layer Elevation and Thickness

The Chino Basin is simulated with five model layers. The Spadra Basin, Cucamonga Basin, Temescal Basin, and Six Basins are simulated with a single model layer. The model layer elevations were updated based on the geological cross-sections of the updated HCM that included lithological/geophysical logs from new wells constructed since the last CVM update (see Section 2 and Appendix A).

Layers 1, 3, and 5 represent regional aquifers from which most groundwater is pumped by wells. Layers 2 and 4 represent regional clay-rich aquitards. Figures 3-5 through 3-7 are maps that display the model layer thicknesses for the 2025 CVM for Layers 1, 3, and 5, respectively. The thicknesses of Layers 2 and 4 are not shown; they are typically less than 100 feet thick.



Main Features

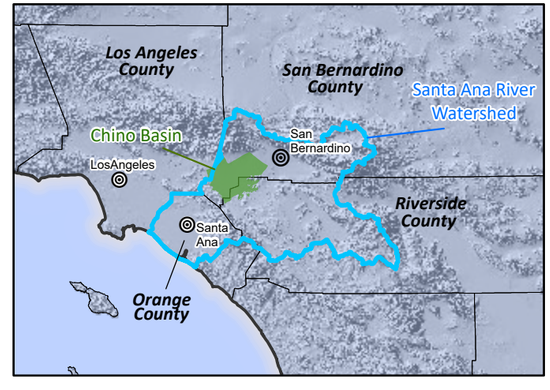
- HSPF Model Domain
- R4 Model Domain
- Hydrologic Sub Area

Other Features

- Rivers and Streams
- Flood Control and/or Conservation Basins

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain



Prepared by:

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N

0 3 6 Miles

0 4 8 Km

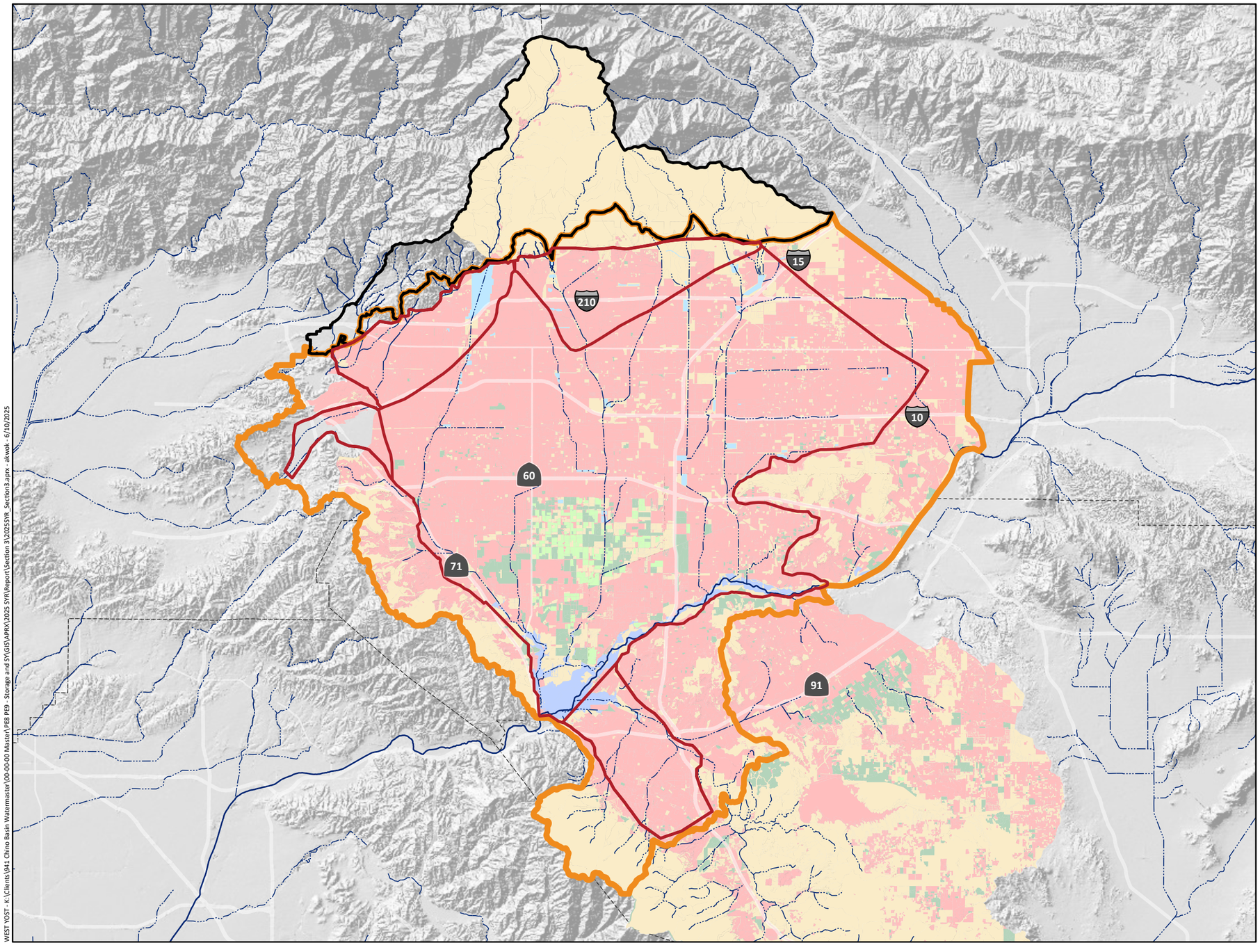
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2025 Safe Yield Reevaluation

Hydrologic Sub Areas in the HSPF and R4 Models

Figure 3-2

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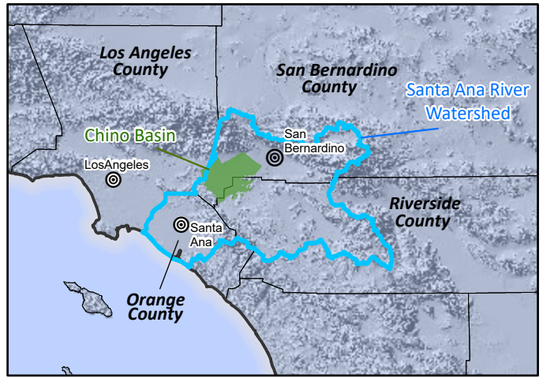


Land Uses

- Agriculture
- Dairy
- Urban
- Vacant
- Riparian Vegetation

Other Features

- MODFLOW Domain
- HSPF Model Domain
- R4 Model Domain
- Rivers and Streams
- Flood Control and/or Conservation Basins



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0 3 6 Miles

0 4 8 Km

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2025 Safe Yield Reevaluation

2017 Land Use within the Chino Basin

Figure 3-3

CHINO BASIN WATERMASTER
Case No. RCVRS 51010
Chino Basin Municipal Water District v. City of Chino, et al.

PROOF OF SERVICE

I declare that:

I am employed in the County of San Bernardino, California. I am over the age of 18 years and not a party to the action within. My business address is Chino Basin Watermaster, 9641 San Bernardino Road, Rancho Cucamonga, California 91730; telephone (909) 484-3888.

On October 14, 2026, I served the following:

1. EXHIBIT A - PART 1 OF 4 TO DECLARATION OF GARRETT RAPP IN SUPPORT OF MOTION REGARDING 2025 SAFE YIELD REEVALUATION, AMENDMENT OF RESTATED JUDGMENT, PARAGRAPH 6

/ X / BY MAIL: in said cause, by placing a true copy thereof enclosed with postage thereon fully prepaid, for delivery by the United States Postal Service mail at Rancho Cucamonga, California, addresses as follows:
See attached service list: Mailing List 1

/ ___ / BY PERSONAL SERVICE: I caused such envelope to be delivered by hand to the addressee.

/ ___ / BY FACSIMILE: I transmitted said document by fax transmission from (909) 484-3890 to the fax number(s) indicated. The transmission was reported as complete on the transmission report, which was properly issued by the transmitting fax machine.

/ X / BY ELECTRONIC MAIL: I transmitted notice of availability of electronic documents by electronic transmission to the email address indicated. The transmission was reported as complete on the transmission report, which was properly issued by the transmitting electronic mail device.
See attached service list: Master Email Distribution List

I declare under penalty of perjury under the laws of the State of California that the above is true and correct.

Executed on October 14, 2026, in Rancho Cucamonga, California.

By: Kirk Richard C. Dolar
Chino Basin Watermaster

PAUL HOFER
11248 S TURNER AVE
ONTARIO, CA 91761

JEFF PIERSON
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