Notice and Agenda
Regular Meeting of the Beaumont Basin Watermaster

Wednesday, August 7, 2024 at 11:00 a.m.

Meeting Location:
Beaumont-Cherry Valley Water District
560 Magnolia Avenue • Beaumont, California 92223

This meeting is hereby noticed pursuant to California Government Code Section 54950 et. seq.

Members of the Watermaster Committee:

City of Banning
City of Beaumont
Beaumont-Cherry Valley Water District
South Mesa Water Company
Yucaipa Valley Water District

Remote attendance options are provided primarily as a matter of convenience to the public. Unless a Watermaster Committee member is attending remotely pursuant to provisions of GC 54953 et. seq., the public, in-person meeting will not stop or be otherwise suspended should a technological interruption occur with respect to the Zoom teleconference or call-in line listed on the agenda. Members of the public are encouraged to attend BBWM meetings in person at the above address, or remotely using the options listed.

Online Meeting Participation Link:
https://us02web.zoom.us/j/81638720446?pwd=UnNZcC9TbGZzTGFuMHdhVkRMblczQT09

Telephone: (669) 900-9128 / Meeting ID: 816-3872-0446 / Passcode: 636756
One-Tap Mobile: +16699009128,,81638720446#,,,,*636756#

*For Public Comment, use the **"Raise Hand"** feature if on the video call when prompted, if dialing in, please **dial *9 to "Raise Hand"** when prompted*

Meeting materials are available on the Watermaster website:
https://beaumontbasinwatermaster.org/

BEAUMONT BASIN WATERMASTER COMMITTEE – AUGUST 7, 2024

I. Call to Order

II. Roll Call

Committee Member Agency	Primary Representative		Alternate	
City of Banning	Arturo Vela, Chair		Nathan Smith	
City of Beaumont	Robert Vestal		Dustin Christensen	
Beaumont-Cherry Valley Water District	Daniel Jaggers		Mark Swanson	
South Mesa Water Company	Dave Armstrong		Brittany Lim	
Yucaipa Valley Water District	Joseph Zoba		Jennifer Ares	

III. Pledge of Allegiance

IV. Public Comments At this time, members of the public may address the Beaumont Basin Watermaster on matters within its jurisdiction; however, no action or discussion may take place on any item not on the agenda. To provide comments on specific agenda items, please complete a Request to Speak form and provide that form to the Secretary prior to the commencement of the meeting, or, RAISE HAND electronically or Press *9 when prompted for public comment.

ACTION ITEMS

Action may be taken on any item on the agenda.

V. Consent Calendar

A. Meeting Minutes

i. June 5, 2024 Regular Meeting [Page 6]

ii. July 10, 2024 Special Meeting [Page 17]

B. Status Report on Water Level Monitoring throughout the V-B and Beaumont Basin through July 23, 2024 [Page 21]

C. Comparison of Production Rights versus Production through June 2024 [Page 32]

VI. Reports

A. Report from Engineering Consultant - Hannibal Blandon, ALDA Engineering

B. Report from Hydrogeological Consultant - Thomas Harder, Thomas Harder & Co.

C. Report from Administrative Consultant – Steve Stuart, Dudek

D. Report from Legal Counsel - Thierry Montoya/Keith McCullough, Frost, Brown, Todd

VII. Discussion Items

A. Update on Safe Yield Redetermination Technical Report (tabled from 7/10/2024 meeting) [Memorandum No. 24-24, Page 34]

Recommendation: For information and discussion

B. Update on Revising the BBWM Rules and Regulations [Memorandum No. 24-25, Page 166]

Recommendation: For discussion purposes only

C. Revisions to the **2013** Annual Report and Revisions to the **2023** Consolidated Annual Report and Engineering Report [Memorandum No. 24-26, Page 168]

Recommendation: Approve the Revisions to the Final 2023 Consolidated Annual and Engineering Report or Delay Finalizing the Report until the Beaumont Basin Safe Yield for the 2023-32 Period is Approved and a Corresponding Resolution is Adopted

D. Discussion on Basin Losses (tabled from 7/10/2024 meeting) [Page 177]

Recommendation: For information and discussion

E. Discussion on Evaluating Future Hydrogeologic Scenarios Using the Model (tabled from 7/10/2024 meeting) [Page 182]

Recommendation: None. Presentation only.

VIII. Topics for Future Meetings

	Item	Date Listed
A	Development of a Recycled Water Policy	3/27/2019
B	Development of a return flow accounting policy	3/27/2019
C	Development of a methodology and policy to account for groundwater storage losses in the basin / groundwater management	3/27/2019
D	Procurement Policy including thresholds for RFP process	8/17/2021
E	Incidental discharge	10/6/2021
F	Monitoring of future west side well sites and methodologies, and potential collaboration with USGS	10/5/2022
G	Discussion on what to do when an Appropriator goes negative	10/4/2023 and 11/1/2023
H	Discussion on Policy to Document and Account for Emergency Potable Water Transfers from Appropriator to Overlying Party (Tabled from 4/17/24 meeting)	4/17/2024

IX. Comments from the Watermaster Committee Members

X. Announcements

2024 Meeting Dates:

Wednesday, September 4 at 11 a.m.	Special Meeting
Wednesday, October 2 at 11 a.m.	Regular Meeting
Wednesday, December 4 at 11 a.m.	Regular Meeting

XI. Adjournment

NOTICES

AVAILABILITY OF AGENDA MATERIALS - Agenda exhibits and other writings that are disclosable public records distributed to all or a majority of the members of the Beaumont Basin Watermaster Committee in connection with a matter subject to discussion or consideration at an open meeting of the Committee are available for public inspection in the Office of the Watermaster Secretary, at 560 Magnolia Avenue, Beaumont, California ("Office") during business hours, Monday through Thursday from 7:30 a.m. to 5 p.m. If such writings are distributed to members of the Committee less than 72 hours prior to the meeting, they will be available from the Office at the same time or within 24 hours' time as they are distributed to Board Members, except that if such writings are distributed one hour prior to, or during the meeting, they can be made available in the Board Room at the District Office. Materials may also be available on the Watermaster website: https://beaumontbasinwatermaster.org/.

REVISIONS TO THE AGENDA - In accordance with §54954.2(a) of the Government Code (Brown Act), revisions to this Agenda may be made up to 72 hours before the Board Meeting, if necessary, after mailings are completed. Interested persons wishing to receive a copy of the set Agenda may pick one up at the Office, located at 560 Magnolia Avenue, Beaumont, California, or download from the website up to 72 hours prior to the Meeting.

REQUIREMENTS RE: DISABLED ACCESS - In accordance with §54954.2(a), requests for a disability related modification or accommodation, including auxiliary aids or services, in order to attend or participate in a meeting, should be made to the Office, at least 48 hours in advance of the meeting to ensure availability of the requested service or accommodation. The Office may be contacted by telephone at (951) 845-9581, email at info@bcvwd.gov or in writing to the Beaumont Basin Watermaster Committee, c/o Beaumont-Cherry Valley Water District, 560 Magnolia Avenue, Beaumont, California 92223.

CERTIFICATION OF POSTING: A copy of the foregoing notice was posted near the regular meeting place of the Beaumont Basin Watermaster Committee and to its website at least 72 hours in advance of the meeting (Government Code §54954.2(a)).

Consent Calendar

Record of the Minutes of the
Beaumont Basin Committee Meeting of the
Beaumont Basin Watermaster
Regular Meeting
Wednesday, June 5, 2024

Meeting Location:

Beaumont-Cherry Valley Water District
560 Magnolia Ave., Beaumont, CA 92223

I. Call to Order

Chair Art Vela called the meeting to order at 11:01 a.m.

II. Roll Call

City of Banning	*Art Vela*	*Present*
City of Beaumont	*Robert Vestal*	*Present*
Beaumont-Cherry Valley Water District	*Dan Jaggers*	*Present*
South Mesa Water Company	*David Armstrong*	*Present*
Yucaipa Valley Water District	*Joseph Zoba*	*Present*

Hanibal Blandon was present as engineer for the Beaumont Basin Watermaster (BBWM).
Thomas Harder was present as hydrogeologist for BBWM.
Thierry Montoya was present as BBWM legal counsel.
Steve Stuart of Dudek was present as BBWM administrator.

Members of the public who registered and / or attended:
Jennifer Ares, Yucaipa Valley Water District
Madeline Blua, Yucaipa Valley Water District
Erin Anton, Yucaipa Valley Water District
Joyce McIntire, Yucaipa Valley Water District
Mike Kostelecky, Yucaipa Valley Water District
Erin Anton, Yucaipa Valley Water District
Allison Edmisten, Yucaipa Valley Water District
Brittany Lim, South Mesa Water Company
Lance Eckhart, San Gorgonio Pass Water Agency
Matt Howard, San Gorgonio Pass Water Agency
Ron Duncan, San Gorgonio Pass Water Agency
Kevin Walton, San Gorgonio Pass Water Agency
Larry Smith, San Gorgonio Pass Water Agency
James Bean, Beaumont-Cherry Valley Water District
Evan Ward, Beaumont-Cherry Valley Water District
Khalid Sebai, Beaumont-Cherry Valley Water District
Mark Swanson, Beaumont-Cherry Valley Water District
Robert Rasha, Beaumont-Cherry Valley Water District

John Covington
Thaxton van Belle, City of Beaumont
Dustin Christensen, City of Beaumont

III. Pledge of Allegiance

IV. Public Comments: None.

V. Consent Calendar

A. Meeting Minutes (note the April 3 meeting was cancelled)
   a. April 17, 2024 Special Meeting

B. Status Report on Water Level Monitoring throughout the Beaumont Basin through May 20, 2024

C. A Comparison of Production Rights versus Production through April 2024

It was moved by Member Zoba and seconded by Member Armstrong to approve Consent Calendar items A, B and C.

AYES:	Armstrong, Jaggers, Vela, Vestal, Zoba
NOES:	None
ABSTAIN:	None
ABSENT:	None
STATUS:	Motion Approved

VI. Reports

A. Report from Engineering Consultant – Hannibal Blandon, ALDA Engineering
No report.

B. Report from Hydrogeological Consultant – Thomas Harder
No report.

C. Report from Administrative Consultant – Steve Stuart, Dudek – *Mr. Stuart provided an update that YVWD and BCVWD provided surveying results for their respective wells in the Beaumont Basin. This information will be incorporated into the Beaumont Basin Data Management System (DMS). Mr. Stuart also provided an update on the development of the DMS and reminded the Committee members that, on March 6, Mr. Palavido provided them with login information to access and test the DMS site. Mr. Stuart requested feedback from the Committee members by the end of June. After that, Mr. Palavido will provide documentation to the Committee members instructing them how to input data into the DMS.*

D. Report from Legal Counsel – Thierry Montoya – Frost, Brown, Todd
No report (Mr. Montoya was not present/online at this time to provide a report).

E. Report from BBWM Treasurer – Joe Zoba – Financial Status Report
Mr. Zoba directed the Committee's attention to page 29 that listed task orders that will be closing at end of this fiscal year where unspent funds will be returned back to an account(s) for those that participated in the task orders.

VII. Discussion Items

A. Consideration of the Watermaster Budget for Fiscal Year 2024-25

Recommendation: Approve the Budget as presented and invoice each committee member accordingly.

Mr. Zoba noted that the way the Watermaster works is any time that an item is approved by the participating members they share the cost. This fiscal budget includes administrative items, including bank fees, the annual audit and legal expenses, which come out of this budget. The budget is $29,675. If this is approved, then each agency will share in the administrative cost.

It was moved by Member Armstrong and seconded by Member Jaggers to approve Budget.

AYES:	Armstrong, Jaggers, Vela, Vestal, Zoba
NOES:	None
ABSTAIN:	None
ABSENT:	None
STATUS:	Motion Approved

B. 2023 Consolidated Annual and Engineering Report

Recommendation: That the Watermaster Committee Considers Approving the 2023 Annual Report after Comments Received on the Draft Report are presented and Discussed.

Mr. Blandon presented a summary of comments received on the draft report. The Watermaster had a previous discussion about reporting in calendar year vs. reporting to the State for the water year. A new section was created in the annual report titled, "Certification of Groundwater Production and Imported Water Use during Water Year 2023". Imported water deliveries documented in Table 3-10 of the annual report, but discrepancy in SGPWA delivered based on Point of Delivery vs. Retail

Agencies. Change in Storage documented in new figure, 3-17. Change in storage from October 2022 to October 2023 is 3,643 acre-feet.

Mr. Jaggers pointed out that SGPWA delivered water to their storage account, and then BCVWD purchased that amount. This transaction could explain the discrepancy between the SGPWA deliveries.

Comments received by BCVWD and City of Banning; no comments received by City of Beaumont, South Mesa, and YVWD.

Main concern by BCVWD was the absence of documentation of water services provided by YVWD to specific parcels as a result of the OVP transfers. Mr. Jaggers noted that the Committee approved previously that water service would be reported parcel by parcel on an annual basis. This is reflected in the proposed revisions to the rules and Regulations. Mr. Jaggers is not disputing the overall transfer.

[Note that Legal joined at 11:13 a.m.]

Mr. Blandon requested clarification from the Committee on how to report the OVP transfers of 478.25 acre-feet to YVWD to finalize the annual report. Mr. Jaggers noted that there was no submittal of data on parcels receiving water service from YVWD. Mr. Jaggers thought that an accounting of parcels served should be provided, even if the service was below the amount previously transferred. BCVWD's comments included two questions: (1) are we following this format moving through time? and (2) are we reflecting it in this report? Mr. Jaggers proposed that the report be amended to include 2023 conversions to parcels that received service from YVWD and report a total aggregate of parcels served to date. Mr. Zoba noted that the annual report documents conditions in the basin for the year, including transfers from Overlyers to Appropriators. There was no transfer of Overlying Water Right from OVP to YVWD in 2023, and so the 2023 report being silent on that is reflective of this. To satisfy Mr. Jaggers' concern, Mr. Zoba proposed that the 2023 annual report include a statement that confirms no additional Overlying Water Right was transferred to YVWD from OVP in 2023.

Mr. Jaggers proposed to approve the draft report as noted with the additional comments proposed by Mr. Zoba.

Public comments: Lance Eckhart, general manager of SGPWA, noted that the report stated there was a lack of monitoring data at the intersection of Brookside and Beaumont Ave., and that SGPWA is recharging a lot of water there this year. SGPWA would like to work with the Watermaster to add some monitoring sites in that area. Mr. Jaggers noted that BCVWD is looking into the possibility of installing a production well in the northwest corner of Noble Creek Recharge

Facility and asked Mr. Eckhart if that well would also serve for monitoring purposes. Mr. Eckhart reiterated that SGPWA is willing to work with the Watermaster to address the data gap as more imported water is brought into the area.

It was moved by Member Jaggers and seconded by Member Armstrong to approve the annual report by including the additional statements.

AYES:	Armstrong, Jaggers, Vela, Vestal, Zoba
NOES:	None
ABSTAIN:	None
ABSENT:	None
STATUS:	Motion Approved

C. Update on the Safe Yield Reset of the Beaumont Basin

Recommendation: for information and discussion

Thomas Harder presented an update on the Safe Yield Redetermination for the Beaumont Basin. Mr. Harder noted that the Safe Yield is to be redetermined every 10 years per the Judgement. Originally, the Safe Yield was 8,650 acre-feet per year (AFY). A redetermination in 2013 defined the Safe Yield at 6,700 AFY. Safe Yield is being redetermined in 2023 for the next 10-year period. Thomas Harder & Company (TH&C) performed an uncertainty analysis by looking at different combinations of parameters in the basin and analyzed multiple realizations. This gave a range of Safe Yield estimates for the basin. Based on that range and plotting the estimates on a probability plot, the 50% probability was 7,100 AFY. TH&C recommends that the Safe Yield be adjusted to 7,100 AFY for the next 10-year period. Mr. Harder stated that they are looking forward to any input from the Committee on the technical memo and results of the Safe Yield redetermination at their earliest convenience.

Mr. Zoba requested that TH&C include a table in the report that summarizes how the Overlying Water Rights are affected by the change in the Safe Yield. Mr. Vela asked Mr. Montoya where does the Court action to apply this to the Judgment take affect? Perhaps this remains in draft form until the Court takes action? Mr. Montoya recommended the draft should remain in draft form for the time being. Mr. Jaggers noted that the draft report should be shared with the Overlyers for their review before the Watermaster Committee approves and adopts the change in Safe Yield. Mr. Zoba noted that the Judgement only requires that the Watermaster adopts the redetermination of the Safe Yield and files it with the Court. The Judgement does not require the Court to approve the redetermination of the Safe Yield. Mr. Montoya concurred that the redetermination only be filed with the Court, but supported Mr. Jaggers' recommendation to disseminate the draft

report to the Overlyers before filing. Mr. Jaggers recommended defining a period of review and comments by the Overlyers before the Watermaster files the report. Mr. Vela concurred with a 45-day review period.

Public Comments: Mr. Eckhart noted in Section 3.3 in the report on imported water forecast and highlighted other sources of imported water outside the Table A allocations and that there could be other potential sources like Sites. Mr. Eckhart wanted to make sure the Watermaster was aware that the regional water portfolio is larger than the Table A allotment and that the Watermaster has a complete picture of the available imported water supply. Mr. Harder noted that they identified imported water supplies that they were aware of in the report.

Mr. Harder will revise the draft report per comments by the Committee today, including a new table summarizing the changes in the Overlying Water Rights as a result of the redetermination of the Safe Yield. Mr. Harder will turn around the revised draft to the Committee members in time to discuss by the August meeting.

D. Update on Revising the BBWM Rules and Regulations

Recommendation: for information and discussion

Mr. Stuart presented an update on revising the Rules and Regulations. Two versions of the recommended revisions to the Rules and Regulations: a red-lined version showing the edits, and a clean version with the recommended changes incorporated into the Rules and Regulations. New definitions added to the Rules and Regulations: "Storage Account" and "Storage Party".

Regarding Section 2.13, Interventions, last sentence reads, "Interveners shall have no water rights under the Judgement (unless acquired from an Appropriator Party)." No mention of this in the Judgement. Does this last question still apply? Mr. Montoya replied that there is no reason to have that last sentence in the Rules and Regulations. The stipulated Judgement deals with the rights of parties that have claims to water rights to the basin. An intervener, an unidentified third party, if they want to make any claim the burden is entirely upon the intervener to file a motion to intervene with the Court. Mr. Vela concurred with Mr. Montoya to remove the last sentence. Mr. Zoba suggested to remove the entire section on intervention. Mr. Montoya suggested that the Rules and Regulations say as little as possible on intervention. Mr. Jaggers requested time to review the Judgement before making a final decision, but concurs with striking out the last sentence.

Mr. Stuart noted that the last sentence in Section 4.3 on Losses or Spills from the basin reads, "Supplemental Water stored pursuant to Groundwater Storage Agreements shall be lost prior to Basin water (i.e.,

unused operating safe yield) held in Storage by a Party to the Judgement." Mr. Stuart inquired if this statement referred to the physical loss of water at these boundaries of the basin, and if that is the case then we need to know where the Stored Water was introduced to the basin as recharge and the migration of that water to the boundaries of the basin. Mr. Stuart asked the Committee members if his interpretation of this sentence is correct, or do we want to strike this sentence from the Rules and Regulations? Mr. Jaggers noted that the agencies work to store water and build up their respective storage accounts, and that when we start looking at how we aggregate losses he is concerned that we start differentiating and striking the last sentence is probably best because it allows us to work together for the maximum health of the basin. Mr. Zoba stated that we should understand losses from the basin. We have a great model, so let's get some information in front of us and see what water molecules are leaving the basin and make an educated decision on this topic. Mr. Zoba suggested that the language not be stricken but remain. Mr. Vela concurred with Mr. Zoba with using the model to help develop and implement a policy on water losses. Mr. Jaggers noted that the basin has always had losses, and would be interested in knowing what the losses were at the time of the Judgement and to differentiate between current losses to historical losses. Mr. Stuart mentioned that he will leave the sentence as it is, but will work with Mr. Harder on simulations with particles to see what the travel time is from the spreading basins to the basin boundaries.

Mr. Stuart posed a question on the definition of "Stored Water" in the Judgement, which reads, "means Supplemental Water stored in the Beaumont Basin pursuant to a Groundwater Storage Agreement with the Watermaster." Should "Stored Water" include New Yield Water? New Yield Water is created through the actions of a project and will add a new yield that is accessible to the Party that created that New Yield. This will allow New Yield Water to be identified as a source of water in a Groundwater Storage Agreement, to which the Party creating the New Yield will have a Storage Account to account for that New Yield, and will be available for recapture, transfers, etc. Mr. Jaggers noted that we all will be looking at developing other sources of water and is a proponent for analyzing everything. Mr. Vela doesn't mind adding New Yield to the definition.

Mr. Stuart, in reviewing the Rules and Regulations and documenting recommended revisions, realized that the Watermaster Forms will need updating and/or revisions. In particular, Forms 7 and 8 appear to be asking the same thing. We are not differentiating sources of water, and so Form 7 doesn't seem needed anymore. Recommend striking Form 7 and just use Form 8 to document the transfer of water between Appropriators. Mr. Vela noted from an administrative perspective that there has been so much discussion on Form 7 activities and would hate to have a new Form 7 that is completely different and whether we vacate Form 7 and move on to a new Form 9. Mr. Stuart reiterated that at this time he is looking for feedback

from the Committee members, including feedback on how to proceed with the Form 7. Mr. Jaggers noted that we have resolutions in place that track along some of these things, that if we are going to tie it all up we have to go back and pick all these up and handle it holistically.

Mr. Stuart provided a timeline for receiving comments from the Committee on the recommended revisions. Mr. Stuart will address any comments at the July 10 and August 7 meetings. Goal is to finalize the revisions by the end of 2024. Mr. Jaggers requested that Mr. Stuart provide digital copies of the Watermaster Forms that he is reviewing to the Committee members in the next week or two so that all members are reviewing the same documents.

Mr. Stuart referred back to the discussion on the transfer of Overlying Water Right from Oak Valley Partners to YVWD. The Rules and Regulations were revised to reflect the policy on documenting such transfers. Mr. Stuart reminded the Committee that one Form 5 was received and filed, which was dated in 2018, and in that Form 5 OVP agreed to transfer all of its Overlying Water Right to YVWD. As parcels are being developed and water service is brought to these parcels, the Committee agreed that YVWD would provide annually the amount of water that was served, a map showing the parcels that were served, and a table listing the parcels as they are defined today and their correlating APN at the time of the Judgement. Then, whenever the service exceeds the amount of water already transferred, YVWD would file the information documenting the water service. Mr. Stuart presumed that YVWD did not serve more than 478 AF in 2023, and so no documentation was required since no transfer was done. Only when the water service exceeds the amount already transferred, then documentation is required to note the transfer.

Public Comments: Mr. Eckhart noted that Section 4.3 is concerning with the statement that Supplemental Water is lost before Basin Water. Mr. Eckhart referred to the period of temporary surplus when a hole was developed to create space for imported water. Mr. Eckhart doesn't see how imported water that was brought in for that created storage could be lost first. In addition, the Basin losses could be considered an upstream obligation to a downstream basin. When thinking about basin losses to the east, coordination with the GSA to the east should be done as consideration in determining losses from the Basin. Mr. Eckhart addressed data gaps and looking to install monitoring wells in the area where there is active recharge via spreading basins. SGPWA is looking to install monitoring wells at the eastern boundary of the Basin to fill in the data gap there. Mr. Eckhart suggested that the Watermaster walk through these recommended changes at a paced, deliberative manner along with workshops to fully vet how these rules may affect the basin and the various entities to holistically manage supplies. Mr. Eckhart doesn't recommend the Watermaster adopt

full scale changes to the Rules without going through a transparent process that works through the issues with the region's water managers.

E. Analysis of Future Hydrogeologic Scenarios Using the Model

Recommendation: for information and discussion

Mr. Harder noted from previous special meetings the discussion on undesirable results in the Basin and what those may look like. Mr. Harder presented a proposal, for discussion only, for three scenarios to be evaluated against a baseline which was included in the Safe Yield analysis. Scenario 1 is a worst case scenario, a very, very dry scenario and includes assumptions for Overlyer and Appropriator pumping, plus injection of water by YVWD; scenario 2 would be an intermediate not as dry scenario; and scenario 3 less drier. Mr. Harder is requesting feedback from the Committee on running the simulations as proposed. Ideas for output may be looking at losses from the Basin, and what if Sites Reservoir water was available as an imported water supply. Mr. Harder suggested the Committee address this topic again at the July Special Meeting.

Public Comment: Mr. Eckhart wanted to make sure that all projects to increase artificial recharge to the Basin be considered in these scenarios. Mr. Eckhart pointed out that DWR's delivery capability report lays out the estimated water supply for the region. This is the foundation for imported supplies for SGPWA and is our realistic scenario.

F. Consideration of Amendment to Task Order No. 4 for Preparation and Attendance at Special Committee Meetings

Recommendation: Approve an amendment to Task Order No. 4 for a sum not-to-exceed $12,825.00.

Mr. Harder noted that additional three special meetings were approved by the Committee, and so Mr. Harder is requesting additional funds to prepare for and participate in the three additional special meetings.

It was moved by Member Zoba and seconded by Member Jaggers to approve an amendment to Task Order No. 4 for a sum not-to-exceed $12,825 by the following vote:

AYES:	Armstrong, Jaggers, Vela, Vestal, Zoba
NOES:	None
ABSTAIN:	None
ABSENT:	None
STATUS:	Motion Approved

DRAFT

G. Update on Annual Water Budget Analysis for Proposed Beaumont Basin Study Areas

Recommendation: Presentation only. No action required

Mr. Harder noted that this is another information item. Mr. Harder acknowledges that the basin is different on the west side compared to the east side. Most of the Overlyer pumping is on the west side of the Basin. We originally looked at the middle fault of the Beaumont Plains Fault zone as the divider between the west and east. By including well BCVWD-24 in the west side of the Basin, this tended to skew the water budget. So, Harder used the fault trace west of the middle trace to be the boundary between the west and east sides of the Basin. Mr. Harder did a water budget for the West Beaumont study area and the East Beaumont study area. Mr. Harder showed the results of a water budget for the west side using the numerical model, which indicated an average annual loss of 789 AFY in storage. This provides an idea of what needs to be done to overcome the losses and make this part of the Basin whole.

The average annual change in storage in the east side of the Basin is estimated at a positive 4,396 AFY. These results should help inform on how to manage the Basin. Mr. Zoba inquired about the losses to the east of the Basin, and how we need to account for these losses and that supplemental water may be what's lost prior to native water due to the increased hydraulic gradient caused by recharge in the east side of the Basin. Mr. Jaggers inquired about the model drains in the west side of the Basin domain in the narrow alluvial channels between the non-active model "islands". Mr. Harder pointed out that the USGS identified springs in that area of the Basin. TH&C was having some numerical instability in that area, so to stabilize the model they added drains. The drains are a modeling feature that basically takes water out of the model. In this particular case, it's a drain return. It takes water out of the model and dumps it back into the channel. Mr. Jaggers asked if the water is returned back to the basin. Mr. Harder responded that no, the water is returned out of the basin.

DRAFT

VIII. Topics for Future Meetings

	Item	Date Listed
A	Development of a Recycled Water Policy	3/27/2019
B	Development of a return flow accounting policy	3/27/2019
C	Development of a methodology and policy to account for groundwater storage losses in the basin / groundwater management	3/27/2019
D	Procurement Policy including thresholds for RFP process	8/17/2021
E	Incidental discharge	10/6/2021
F	Monitoring of future west side well sites and methodologies, and potential collaboration with USGS	10/5/2022
G	Discussion on what to do when an Appropriator goes negative	10/4/2023 and 11/1/2023
H	Development of a Policy to Document and Account for Emergency Potable Water Transfers from Appropriator to Overlying Party	4/17/24 (tabled)

IX. Comments from the Watermaster Committee Members: None.

X. Announcements

2024 Meeting Dates:

Wednesday, July 10 at 11 a.m.	Special Meeting
Wednesday, August 7 at 11 a.m.	Regular Meeting
Wednesday, September 4 at 11 a.m.	Special Meeting
Wednesday, October 2 at 11 a.m.	Regular Meeting
Wednesday, December 4 at 11 a.m.	Regular Meeting

XI. Adjournment

Chair Vela adjourned the meeting at 12:57 p.m.

Attest:

DRAFT UNTIL APPROVED

_____

Daniel Jaggers, Secretary
Beaumont Basin Watermaster

DRAFT

Record of the Minutes of the
Beaumont Basin Committee Meeting of the
Beaumont Basin Watermaster
Special Meeting
Wednesday, July 10, 2024

Meeting Location:

Beaumont-Cherry Valley Water District
560 Magnolia Ave., Beaumont, CA 92223

I. Call to Order

Chair Art Vela called the meeting to order at 11:00 a.m.

II. Roll Call

City of Banning	*Art Vela*	*Present*
City of Beaumont	*Robert Vestal*	*Present*
Beaumont-Cherry Valley Water District	*Mark Swanson*	*Present*
South Mesa Water Company	*David Armstrong*	*Present*
Yucaipa Valley Water District	*Jennifer Ares*	*Present*

Hannibal Blandon and Thomas Harder were present as engineers for the Beaumont Basin Watermaster (BBWM).
Steve Stuart, Dudek, BBWM administrator
Thierry Montoya, BBWM legal counsel

Members of the public who registered and / or attended:
Ron Duncan, San Gorgonio Pass Water Agency
Lance Eckhart, San Gorgonio Pass Water Agency
Joyce McIntire, Yucaipa Valley Water District
Alison Edmisten, Yucaipa Valley Water District
Matt Ford, Thomas Harder & Co.
Erin Anton, Yucaipa Valley Water District
Thaxton Van Belle, City of Beaumont
Larry Smith, San Gorgonio Pass Water Agency
Robert Rasha, Beaumont-Cherry Valley Water District
Lynda Kerney, Beaumont-Cherry Valley Water District
Dan Jaggers, Beaumont-Cherry Valley Water District

III. Pledge of Allegiance: Chair Vela led the pledge.

IV. Public Comments: None.

V. Workshop / Discussion Items

A. Posting of Online Meeting Video Recordings to the Watermaster Website

Member Jaggers asked about the nature of the link and suggested the most judicious / accessible method. Mr. Rasha advised that BCVWD records the meeting in both audio and video, but YVWD manages the BBWM website. BCVWD would be happy to coordinate with YVWD for access to the recordings. To start, he said they would likely be posted on the BBWM website, but there is no technical limitation to prevent posting on YouTube or other online platform. Ms. Ares indicated YVWD would take responsibility for posting the recordings on the BBWM website.

It was moved by Member Armstrong and seconded by Member Vela to authorize posting of meeting video recordings to the Watermaster website.

AYES:	Armstrong, Swanson, Vela, Vestal, Ares
NOES:	None
ABSTAIN:	None
ABSENT:	None
STATUS:	Motion Approved

B. Update on Safe Yield Redetermination Technical Report

Mr. Harder indicated that comments on the Tech Memo are being addressed. The Committee had requested a table showing how the new safe yield would look in terms of overlying rights, and it is included in the agenda packet.

It was moved by Member Swanson and seconded by Member Armstrong to table items V-B, V-C, V-D and V-E to a future meeting.

AYES:	Armstrong, Swanson, Vela, Vestal, Ares
NOES:	None
ABSTAIN:	None
ABSENT:	None
STATUS:	Motion Approved

C. Discussion on Basin Losses

This item was tabled.

DRAFT

D. Discussion on Annual Water Budget Analysis for Proposed Beaumont Basin Study Areas

This item was tabled.

E. Discussion on Evaluating Future Hydrogeologic Scenarios Using the Model

This item was tabled.

VI. Topics for Future Meetings

	Item	Date Listed
A	Development of a Recycled Water Policy	3/27/2019
B	Development of a return flow accounting policy	3/27/2019
C	Development of a methodology and policy to account for groundwater storage losses in the basin / groundwater management	3/27/2019
D	Procurement Policy including thresholds for RFP process	8/17/2021
E	Incidental discharge	10/6/2021
F	Monitoring of future west side well sites and methodologies, and potential collaboration with USGS	10/5/2022
G	Discussion on what to do when an Appropriator goes negative	10/4/2023 and 11/1/2023
H	Discussion on Policy to Document and Account for Emergency Potable Water Transfers from Appropriator to Overlying Party (Tabled from 4/17/24 meeting)	4/17/2024

VII. Comments from the Watermaster Committee Members: None.

DRAFT

VIII. Announcements

2024 Meeting Dates:

Wednesday, August 7 at 11 a.m.	Regular Meeting
Wednesday, September 4 at 11 a.m.	Special Meeting
Wednesday, October 2 at 11 a.m.	Regular Meeting
Wednesday, December 4 at 11 a.m.	Regular Meeting

XI. Adjournment

Chair Vela adjourned the meeting at 11:15 a.m.

Attest:

DRAFT UNTIL APPROVED

_____

Daniel Jaggers, Secretary
Beaumont Basin Watermaster

DRAFT

BEAUMONT BASIN WATERMASTER

Date: August 7th, 2024

From: Hannibal Blandon, ALDA Inc.

Subject: Status Report on Water Level Monitoring throughout the Beaumont Basin through Jul 23, 2024

Recommendation: Presentation - No recommendation.

At the present time, there are 15 monitoring wells equipped with pressure transducers collecting water level information on an hourly basis at various locations throughout the basin. In addition, two of these monitoring wells are equipped with additional probes to collect barometric pressures at opposite ends of the Beaumont Basin. The location of active monitoring wells is depicted in the attached Figure No. 1. The location of two potential monitoring wells currently being considered are identified in red in this figure. Ground elevations at all sites were obtained from Google Earth, which has varied over time at selected sites and could continue to vary in the future. The Watermaster Committee is in the process of surveying all production and monitoring wells using a common datum.

Water levels at selected locations are depicted in Figures 2 through 7 and are described as follows:

- ✓ Figure No. 2 – Water levels at YVWD Well No. 34 and Oak Valley Well No. 5 are considered representative of basin conditions in the Northwest portion of the basin. From the summer of 2015 through the spring of 2019, water levels at these two wells were fairly steady; however, over the last five years a significant decline has been observed. A 20-foot decline has been recorded at YVWD 34 over this period to its current elevation of 2,121 ft. The decline at Oak Valley 5 has been steeper with a drop 24 feet in the first half of 2020 despite the fact that this well was pumped last in the fall of 2019. Oak Valley 5 is no longer being monitored, as of the Summer of 2020, as it has been destroyed. It is being included here for reference purposes at this time since there is no other well in the immediate area that could be used to monitor levels in the area.

- ✓ Figure No. 3 – Two of the Noble Creek observation wells are presented in this figure representing the shallow and deep aquifers. From the summer of 2016 through the spring of 2018, the water level in the shallow aquifer monitoring well increased over 80 feet to an elevation of 2,422 ft. Water level continued to increase, although at a lower rate, over the ensuing 18 months reaching a peak elevation of 2,431 ft in the fall of 2019. Since, it declined 100 feet to 2,331 ft. in the spring of 2023, a significant recovery of 91 ft has been recorded over the last year to its current elevation of 2,422 ft. In the deeper aquifer, the increase in water level was steady from the summer of 2016 through the spring of 2020 reaching a peak elevation of 2,302 ft.; a decline of 57 feet has been recorded since to a low elevation of 2,245 ft, recorded on August 15, 2023. On that date, this well was vandalized resulting in the disruption of the communications cable and the temporary collection of accurate water level information. With the November visit, the data was

cleaned and it is now included in the figure. A new communications cable was installed on December 6th 2023. Since August 2023, water level at this well has increased by 28 ft. to elevation 2,273 ft.

- ✓ Figure No. 4 – Southern Portion of the Basin. The water level at the Summit Cemetery well is highly influenced by a nearby pumping well that is used to irrigate the cemetery grounds. Since monitoring began, the water level has fluctuated over a 20-foot range. Water level information between January and October 2022 was not collected due to equipment malfunction and vandalism. New water level monitoring equipment was installed at the beginning of October 2022 and the site has been secured to minimize future vandalism. The newly installed optical communications cable worked for a few months, but failed to transmit and was replaced on January 10, 2024. Since the beginning of the spring, water level at this well has declined 21 ft to a 2,498 ft elevation near the bottom of its operating range.

- ✓ Also depicted in Figure No. 4 is the water level at the Sun Lakes well site. It has fluctuated minimally between 2015 and the end of 2021, when it began to decline. Between November 2021 and May 2022, the water level dropped by eight feet to 2,405 ft. However, it has recovered to 2,417 ft in the last two years. Water level information could not be collected between May and early October 2022 due to equipment malfunction. A new communications cable and recording probe were installed in early October 2022, while the probe has been working properly, the new optical cable did not and was replaced during our January 2024 visit.

- ✓ Figure No. 5 illustrates water levels at three wells owned by the City of Banning in the Southeast portion of the basin. While water level at the Old Well No. 15 (Chevron Well) has been fairly flat over the last six years at an elevation of 2,197 ft. A somewhat significant and steady decline, close to 37 feet, has been recorded at Banning M-8 between the summer of 2015 and the present to its current elevation of 2,042 ft. Water level at Banning M-9 has fluctuated in a 19-foot range, between 2,128 ft and 2,147 ft. Current water level elevation is at 2,141 ft. While the water level probe has been collecting data hourly at this well, over the last year, three communications cables have been replaced due to the failure of the water seal at the bottom of the cable. The latest replacement cable was installed during our January visit and continued to work through our July 2024 visit, a good sign.

- ✓ Figure No. 6 illustrates recorded water level at BCVWD No. 2 and BCVWD No. 25. Water level at these two wells follow the same seasonal pattern rising in the fall through the spring months and falling during the summer as production increases. The water level at BCVWD No. 25 has been fluctuating over a 25 ft range between 2,191 ft and 2,215 ft in elevation; however, this past summer (2023) it declined more than normal to a low elevation of 2,192 ft; since, water level is recovering to the March 2024 elevation of 2,203 ft. Over the last three years, summer lows have been lower each year, 2,199 ft in the summer of 2021, 2,194 ft in 2022, and 2,193 in 2023. Currently, BCVWD No. 25 is at 2,198 ft. within a foot of BCVWD No. 2's elevation. At BCVWD No. 2, water levels since 2017 have ranged between 2,188 ft and 2,216 ft with a current elevation of 2,199 ft. in the middle portion of its operating range. Similar to BCVWD No. 25, lower summer lows have been recorded in recent years. A new communications cable was installed at this well on December 6, 2023; however, no data was recorded through March 2024 due to

malfunctioning of the recording probe. A different probe was installed at that time and has been working fine since.

- ✓ Figure No. 7 depicts the recorded water level at the two newest observation wells, BCVWD No. 29 and Tukwet Canyon Well "B". BCVWD No. 29 is a pumping well on the western portion of the basin. This well was extensively used prior to 2022; however, minimum pumping has been recorded since the winter of 2021. A decline in water level of nine feet has been recorded between the spring of 2019 and the spring of 2021. During the May 2021 visit, the communications cable could not be pulled and information from the water level probe could not be downloaded. During our January 2022 visit, the water level meter got lodged between the pump column and the well casing and could not be removed; it has been there since. There is a chance that the water level meter probe may not be recovered until the column is pulled from the well and the equipment recovered.

- ✓ Tukwet B is a dedicated monitoring well in the southern portion of the basin with minimal fluctuations in elevation since the probe was installed in the spring of 2019. The March 2024 water level was recorded at 2,218 ft representing the highest recorded level since monitoring began. No water level information was available between March and May 2024 due to malfunctioning of the recording probe. Water level between May and July could not be collected due to miscommunications with operations staff.

Monitoring Wells Additions

No additional monitoring wells were added during this reporting period.

Equipment Installation and Replacement

Water level probes were replaced at the following wells:

- ✓ BCVWD No. 25
- ✓ Icon Warehouse
- ✓ Mountain View
- ✓ Noble Creek Shallow Aquifer

Troubleshooting Issues

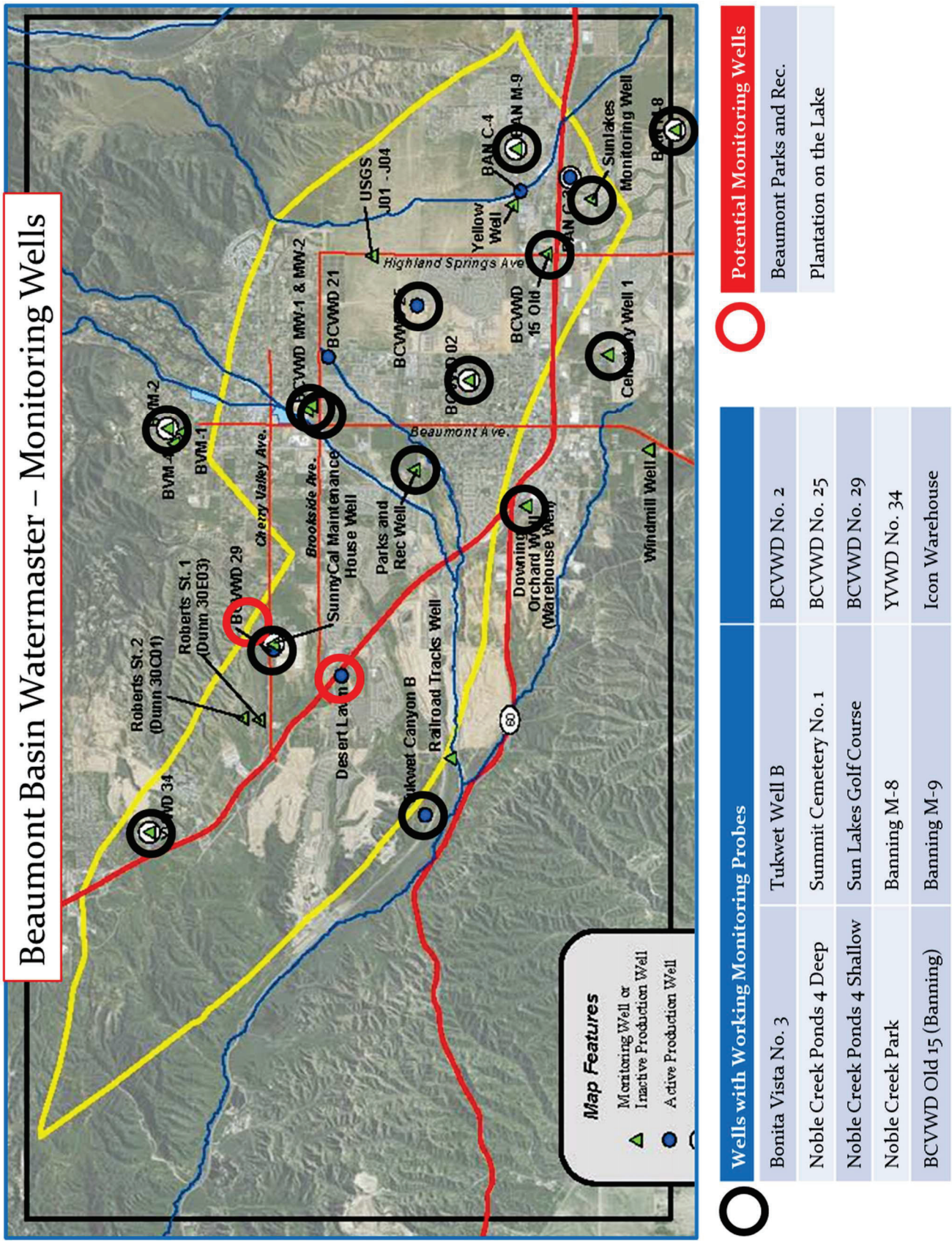
Water level information was manually retrieved at the following wells due to malfunctioning of the communication cables:

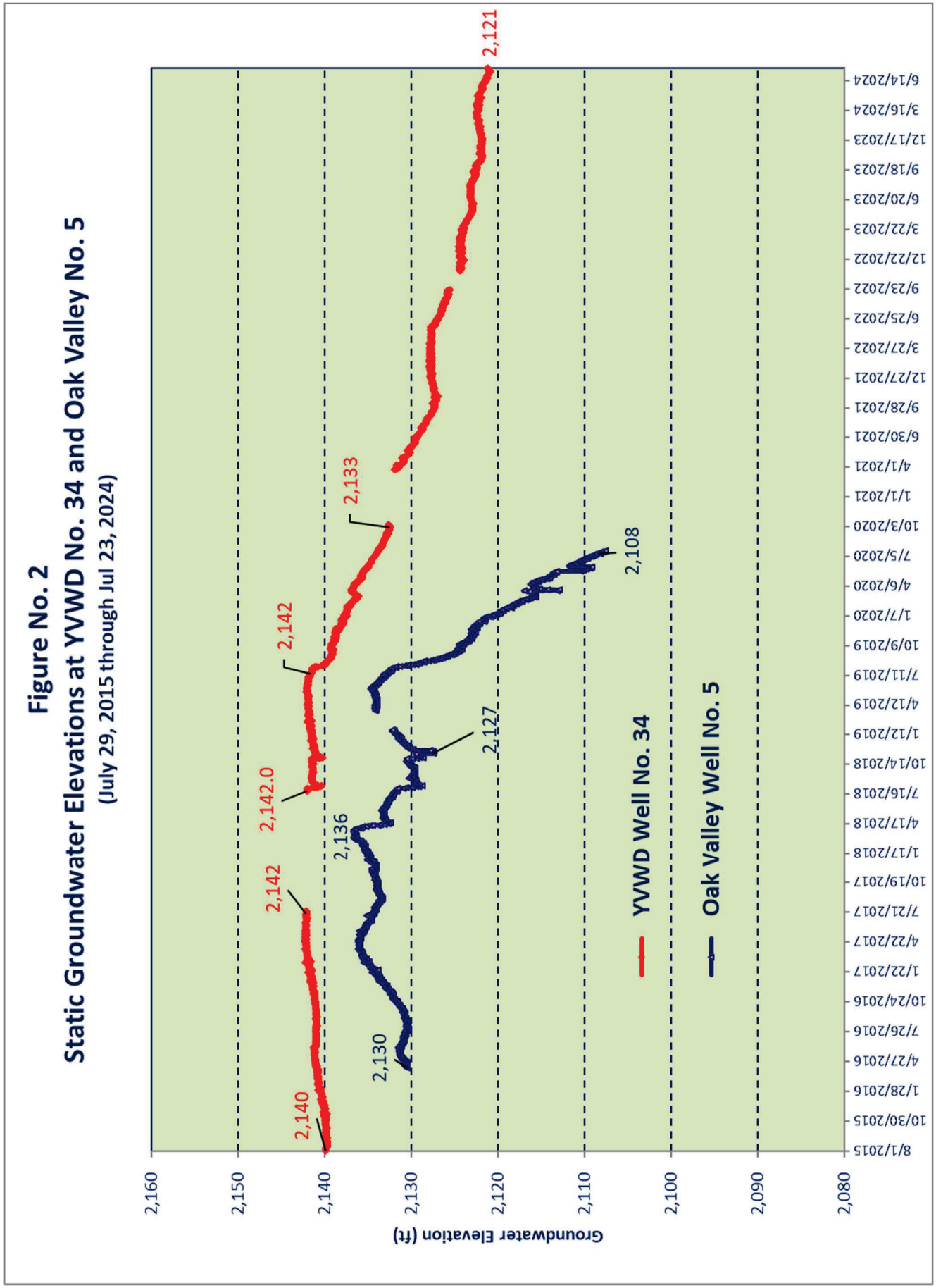
- ✓ Mountain View

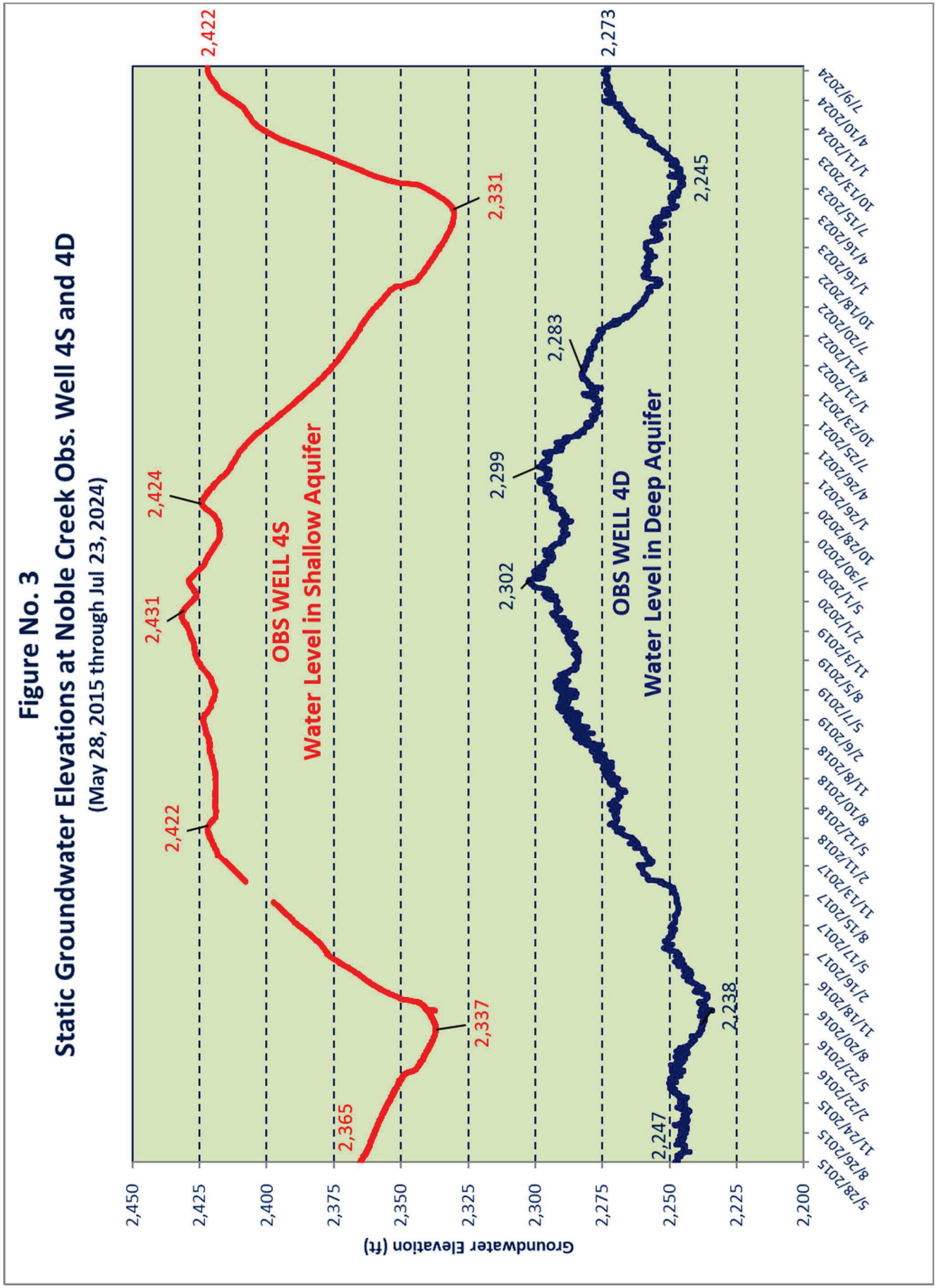
Potential Monitoring Sites

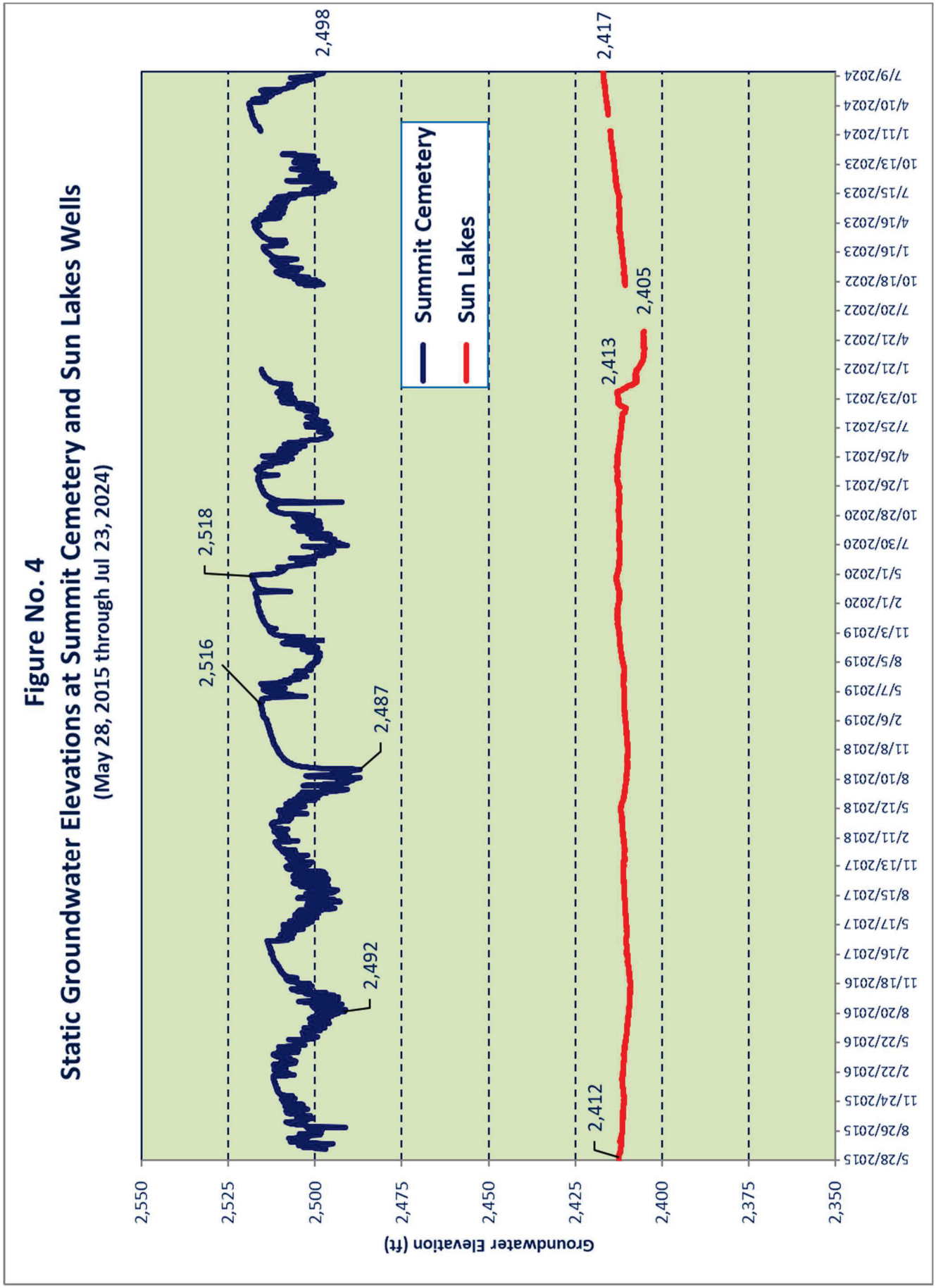
Two production wells have been identified as potential monitoring wells recently. The owners have been contacted and the sites visited. The first well is owned by the Beaumont-Cherry Valley Recreation and Park District. The well is located on the north side of Cherry Valley Blvd and has been recently used to supply water during grading for construction of two warehouses nearby. Upon construction of these facilities, this well will be available to irrigate nearby lands; a monitoring probe could be installed with minor modifications at the well head.

The second well is owned by Plantation on the Lake. The site has been visited and owner is considering drilling a hole on the well head to accommodate the monitoring probe. No progress has been made by owner.


Beaumont Basin Watermaster – Monitoring Wells
Map Features
Monitoring Well or Inactive Production Well
Active Production Well
Roberts St. 2 (Dunn 30C01)
Roberts St. 1 (Dunn 30E03)
Cherry Valley Ave.
Brookside Ave.
Beaumont Ave.
Highland Springs Ave
SunnyCal Maintenance House Well
Parks and Rec Well
Railroad Tracks Well
Tukwet Canyon B
Desert Lawn
Downing Orchard Well (Warehouse Well)
Windmill Well
Yellow Well
USGS J01 - J04
Sunlakes Monitoring Well
BCVWD 21
BCVWD 15 Old
BVM-1
BVM-2
Wells with Working Monitoring Probes
Bonita Vista No. 3
Tukwet Well B
BCVWD No. 2
Noble Creek Ponds 4 Deep
Summit Cemetery No. 1
BCVWD No. 25
Noble Creek Ponds 4 Shallow
Sun Lakes Golf Course
BCVWD No. 29
Noble Creek Park
Banning M-8
YVWD No. 34
BCVWD Old 15 (Banning)
Banning M-9
Icon Warehouse
Potential Monitoring Wells
Beaumont Parks and Rec.
Plantation on the Lake


Figure No. 2
Static Groundwater Elevations at YVWD No. 34 and Oak Valley No. 5
(July 29, 2015 through Jul 23, 2024)
Groundwater Elevation (ft)
2,160
2,150
2,140
2,130
2,120
2,110
2,100
2,090
2,080
YVWD Well No. 34
Oak Valley Well No. 5
2,121
2,133
2,142
2,142.0
2,142
2,140
2,136
2,130
2,127
2,108
8/1/2015
10/30/2015
1/28/2016
4/27/2016
7/26/2016
10/24/2016
1/22/2017
4/22/2017
7/21/2017
10/19/2017
1/17/2018
4/17/2018
7/16/2018
10/14/2018
1/12/2019
4/12/2019
7/11/2019
10/9/2019
1/7/2020
4/6/2020
7/5/2020
10/3/2020
1/1/2021
4/1/2021
6/30/2021
9/28/2021
12/27/2021
3/27/2022
6/25/2022
9/23/2022
12/22/2022
3/22/2023
6/20/2023
9/18/2023
12/17/2023
3/16/2024
6/14/2024


Figure No. 3
Static Groundwater Elevations at Noble Creek Obs. Well 4S and 4D
(May 28, 2015 through Jul 23, 2024)
OBS WELL 4S
Water Level in Shallow Aquifer
OBS WELL 4D
Water Level in Deep Aquifer
Groundwater Elevation (ft)
2,422
2,424
2,431
2,422
2,365
2,337
2,331
2,299
2,302
2,283
2,273
2,245
2,247
2,238
2,450
2,425
2,400
2,375
2,350
2,325
2,300
2,275
2,250
2,225
2,200


Figure No. 4
Static Groundwater Elevations at Summit Cemetery and Sun Lakes Wells
(May 28, 2015 through Jul 23, 2024)
Summit Cemetery
Sun Lakes
2,498
2,518
2,516
2,487
2,492
2,417
2,405
2,413
2,412
Groundwater Elevation (ft)
2,550
2,525
2,500
2,475
2,450
2,425
2,400
2,375
2,350
5/28/2015
8/26/2015
11/24/2015
2/22/2016
5/22/2016
8/20/2016
11/18/2016
2/16/2017
5/17/2017
8/15/2017
11/13/2017
2/11/2018
5/12/2018
8/10/2018
11/8/2018
2/6/2019
5/7/2019
8/5/2019
11/3/2019
2/1/2020
5/1/2020
7/30/2020
10/28/2020
1/26/2021
4/26/2021
7/25/2021
10/23/2021
1/21/2022
4/21/2022
7/20/2022
10/18/2022
1/16/2023
4/16/2023
7/15/2023
10/13/2023
1/11/2024
4/10/2024
7/9/2024

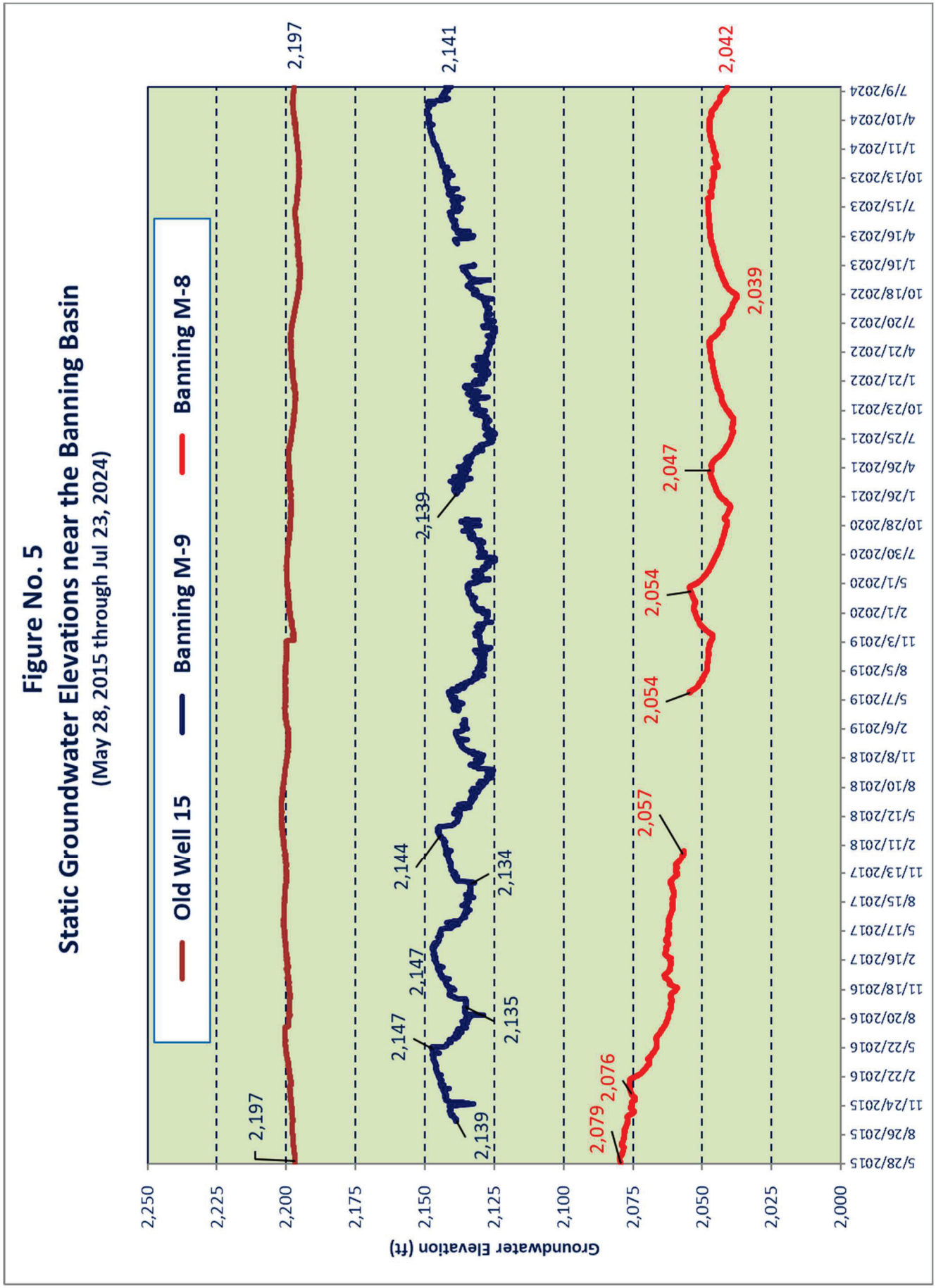
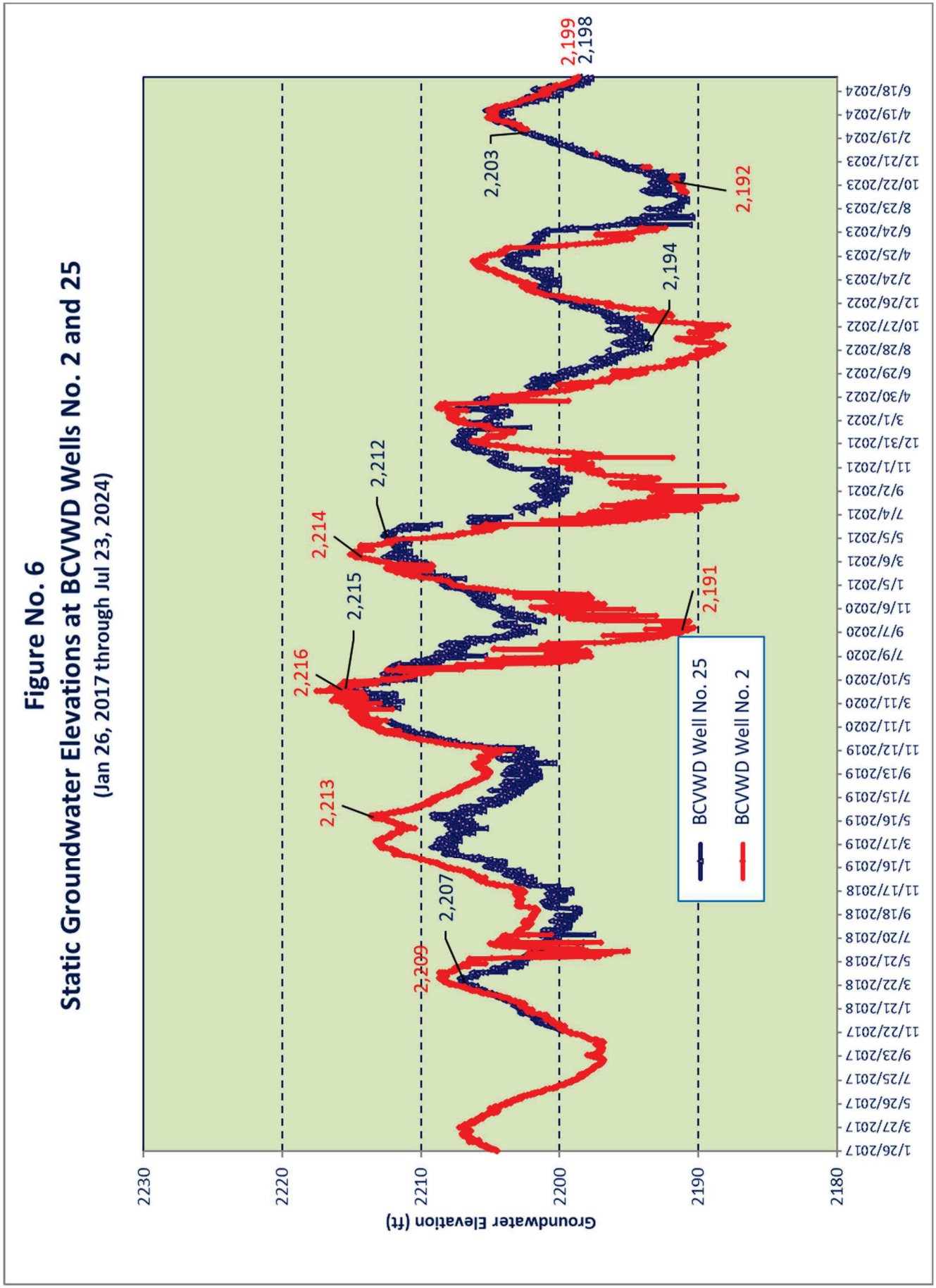
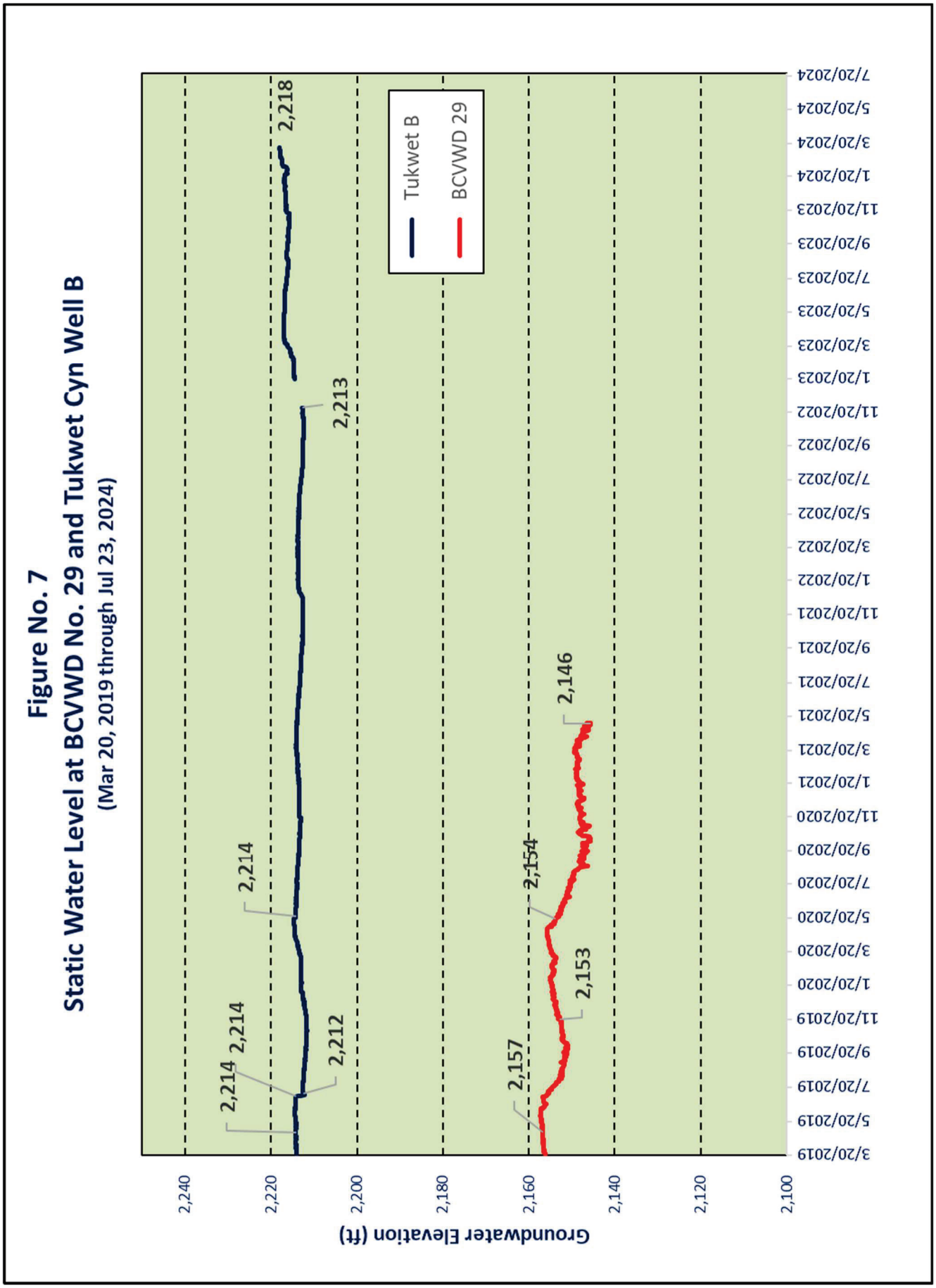

Figure No. 5
Static Groundwater Elevations near the Banning Basin
(May 28, 2015 through Jul 23, 2024)
Old Well 15
Banning M-9
Banning M-8
Groundwater Elevation (ft)
2,250
2,225
2,200
2,175
2,150
2,125
2,100
2,075
2,050
2,025
2,000
5/28/2015
8/26/2015
11/24/2015
2/22/2016
5/22/2016
8/20/2016
11/18/2016
2/16/2017
5/17/2017
8/15/2017
11/13/2017
2/11/2018
5/12/2018
8/10/2018
11/8/2018
2/6/2019
5/7/2019
8/5/2019
11/3/2019
2/1/2020
5/1/2020
7/30/2020
10/28/2020
1/26/2021
4/26/2021
7/25/2021
10/23/2021
1/21/2022
4/21/2022
7/20/2022
10/18/2022
1/16/2023
4/16/2023
7/15/2023
10/13/2023
1/11/2024
4/10/2024
7/9/2024
2,197
2,197
2,139
2,147
2,147
2,144
2,135
2,134
2,139
2,141
2,079
2,076
2,057
2,054
2,054
2,047
2,039
2,042

Figure No. 6
Static Groundwater Elevations at BCVWD Wells No. 2 and 25
(Jan 26, 2017 through Jul 23, 2024)




Figure No. 7
Static Water Level at BCVWD No. 29 and Tukwet Cyn Well B
(Mar 20, 2019 through Jul 23, 2024)
Groundwater Elevation (ft)
2,240
2,220
2,200
2,180
2,160
2,140
2,120
2,100
Tukwet B
BCVWD 29
2,218
2,213
2,214
2,214
2,214
2,212
2,157
2,154
2,153
2,146
3/20/2019
5/20/2019
7/20/2019
9/20/2019
11/20/2019
1/20/2020
3/20/2020
5/20/2020
7/20/2020
9/20/2020
11/20/2020
1/20/2021
3/20/2021
5/20/2021
7/20/2021
9/20/2021
11/20/2021
1/20/2022
3/20/2022
5/20/2022
7/20/2022
9/20/2022
11/20/2022
1/20/2023
3/20/2023
5/20/2023
7/20/2023
9/20/2023
11/20/2023
1/20/2024
3/20/2024
5/20/2024
7/20/2024

BEAUMONT BASIN WATERMASTER

Date: August 7th, 2024

From: Hannibal Blandon, ALDA Inc.

Subject: A Comparison of Production Rights vs. Production through June 2024

Recommendation: No recommendation - For informational purposes only

This Technical Memorandum presents a comparison of Appropriator's Production Rights from the Basin against actual production. At the beginning of each year, Appropriators have certain Production Rights resulting from: a) unused production by overlying users from 2019 and/or b) permanent transfers of overlying water rights. Production Rights for individual Appropriators can be increased through the course of the year by spreading imported (supplemental) water.

Total production by Appropriators through June 2024 was 4,501 ac-ft while Appropriator's Production Rights for the same period were 11,708 ac-ft resulting in a positive storage balance of 7,207 ac-ft, as presented in the table below. Spreading of supplemental water in the first half of the year was 6,368 ac-ft between BCVWD, the city of Banning, and YVWD. The Production Rights for all Appropriators was higher than their respective production amounts resulting in a net temporary addition to their individual storage accounts. Storage accounts will be adjusted throughout the calendar year.

	City of Banning	Beaumont Cherry Valley W. D.	South Mesa Mutual W. C.	Yucaipa Valley W. D. (1)	Total
Appropriative Water Rights	1,528	2,067	607	660	4,862
Transfer of Overlying Water Right to Appropriator	0	0	0	478	478
Supplemental Water	1,000	4,368	/0	1,000	6,368
Appropriator's Production Rights	2,528	6,435	607	2,138	11,708
Production (2)	214	3,817	61	395	4,501
Change in Storage Account	2,299	2,618	546	1,743	7,207
Storage Account Balance as of December 2023 (3)	47,038	32,055	10,263	16,591	105,947

1.- YVWD was credited at the beginning of the year with 478.30 ac-ft of Overlying transfers from OVP. Actual credit may be different at the end of the year.
2.- Production by the City of Banning includes 15 ac-ft of groundwater produced by BCVWD and delivered to the city at their two connection points.
3.- Storage Account Balance as of the end of 2023 was revised down by 1,950 ac-ft combined to reflect unused Overlying water changes from CY 2013 that had been erroneously calculated.

Discussion Items

ITEM VII-A

BEAUMONT BASIN WATERMASTER

MEMORANDUM NO. 24-24

Date:	August 7, 2024
From:	Thomas Harder, Thomas Harder & Co.
Subject:	Update on the Safe Yield Reset of the Beaumont Basin
Recommendation:	For Information and Discussion

Tabled from the July 10, 2024 meeting

At the June 2024 Committee meeting, TH&Co presented a recommended Safe Yield for the next ten years (2023 through 2032). The Safe Yield was redetermined using an updated version of the groundwater flow model of the Beaumont Basin that was previously developed for the 2013 Safe Yield redetermination. TH&Co has prepared a draft technical report to the Committee for review and consideration. The technical report includes:

- Updates to the Beaumont Basin Groundwater Flow Model Used to Estimate Safe Yield
- Assumptions for Future Basin Management Forecasts for Use in Model Analysis
- A Description of the Model Calibration
- A Summary of the Analysis of Safe Yield
- Findings and Recommendations

TH&Co is in the process of addressing comments from Dudek on the Safe Yield redetermination report and will be prepared to present the final report to the Beaumont Basin Watermaster Committee at the August meeting.

As reported in June, the recommended Safe Yield of the Beaumont Basin for 2023 to 2032 is 7,100 acre-ft/yr. This value is higher than the Safe Yield value for 2013 through 2022, which was 6,700 acre-ft/yr. Accordingly, the allocation of overlying production rights is different for the 2023 to 2032 period. At the request of the Watermaster Committee, we have prepared the attached table comparing the allocation of water rights among overlying parties for 2003 to 2012, 2013 to 2022, and 2023 to 2032. The table also shows the average annual overlying production for the last five-year period (2019 to 2023), which is 1,860.7 acre-ft. The five-year running average overlying production is approximately 26 percent of the updated 2023 to 2032 Beaumont Basin Safe Yield.

DRAFT-FINAL 2023 Reevaluation of the Beaumont Basin Safe Yield

July 2024

Prepared for

Beaumont Basin Watermaster

Prepared by

Thomas Harder, PG, CHG
Principal Hydrogeologist

Matthew Ford
Staff Hydrogeologist

Jim Van de Water, PG, CHG
Principal Hydrogeologist

Thomas Harder & Co.
Groundwater Consulting

Table of Contents

Beaumont Basin Watermaster ..... Error! Bookmark not defined.

1.0 Introduction 1

1.1 Background 1

1.2 Purpose and Scope 1

1.3 Safe Yield Reevaluation Approach 2

1.4 Types and Sources of Data 4

2.0 Updates to the Groundwater Flow Model 6

2.1 Updated Model Calibration Period 8

2.2 Created Uniform Model Stress Periods 8

2.3 Changed Model Layering 8

2.4 Updated The Model Solver 9

2.5 Updated the Stream Simulation Package in the Model 9

2.6 Modified Simulation Method for Groundwater Flow Between No Flow Zones in the Western Model Domain 10

2.7 Updates to Model Package Controlling Cell-by-Cell Flow 10

2.8 Updated Model Calibration Targets 10

2.9 Updated Model Boundary Conditions 11

2.9.1 Conversion of Constant Head Boundary Cells to General Head Boundary Cells 11

2.9.2 Conversion of General Head Boundary Cells to Mountain Block Recharge Cells 11

2.10 Updates to Groundwater Pumping 11

2.11 Incorporated Additional Recharge Basins 12

2.12 Updated Recharge From Precipitation 12

2.13 Changes in Aquifer Parameters from Recalibration of the Updated Model 13

3.0 Future Projections 14

3.1 Climate and Precipitation Projection 14

3.2 Groundwater Pumping Forecast 14

3.3 Imported Water Forecast 14

3.4 Natural Recharge Water Forecast 15

3.5 YVWD ASR Project 15
4.0 Model Calibration 16
5.0 Analysis of Safe Yield 19
6.0 Findings and Recommendations 21
7.0 References 22

Tables

1 Beaumont Basin Annual Imported Water Deliveries
2 Beaumont Model Forecast Period Proxy Year Selection
3 Model Forecast Period State Water Project Imported Water Proxies
4 Groundwater Budget for the Beaumont Basin Adjudicated Area

Figures

1 Regional Map
2 Beaumont Basin Study Area
3 Conceptual Water Balance – Pre-developed Conditions
4 Conceptual Water Balance – Developed Conditions
5 Data Type Diversity Flow Chart
6 Geology of the Beaumont Basin
7 Model Layers Cross Section A-A'
8 Model Layers Cross Section B-B'
9a Model Layer 1 Thickness
9b Model Layer 2 Thickness
9c Model Layer 3 Thickness
9d Model Layer 4 Thickness
10 Surface Water Features in the Beaumont Basin Area
11 Stream Segment 1 Streamflow
12 Stream Segment 2 Streamflow
13 Model Boundary Conditions and Features

14 Monitoring Wells Used for Model Calibration
15 2023 Updates to Model Boundary Conditions
16 Groundwater Wells and Recharge Facilities
17 Beaumont Basin Groundwater Production
18 Beaumont Annual Precipitation 1888-2022
19 Recharge Zones Used in the Groundwater Flow Model
20 Climate Change Model Areas
21 Yucaipa Valley Water District Proposed Aquifer Storage & Recovery Project Wells
22 Model Calibration Scatterplot
23 Safe Yield vs. Cumulative Probability

Appendices

A. Model Boundary Condition Hydrographs
B. Model Parameters
C. Model Calibration & Forecast Period Hydrographs at Calibration Targets

Acronyms

ASR – Aquifer Storage & Recovery

BCF – Block-Centered Flow Package

BCVWD - Beaumont-Cherry Valley Water District

CGS – California Geological Survey

CHD - Constant Head Boundary

CIMIS – California Irrigation Management Information System

DEM – Digital Elevation Model

DRT – Drain Return Package

DWR – Department of Water Resources (California)

ESRI – Environmental Systems Research Institute

ET- Evapotranspiration

ET_o – Reference evapotranspiration

GHB – General Head Boundary

LSGCRF – Little San Gorgonio Creek Recharge Facility

MBR – Mountain Block Recharge

MODFLOW – Modular Finite-Difference Flow Model

NRMSE – Normalized Root Mean Square Error

PEST – Parameter Extinction Software Test

RIC – Responsive Interventions for Change

SFR – Streamflow-Routing Package

SGPWA - San Gorgonio Pass Water Agency

SMWC - South Mesa Water Company

STF – San Timoteo Formation

STR – Stream Package

SWP – State Water Project (California)

TH&Co - Thomas Harder & Company

UPW – Upstream Weighting Package

USGS – United States Geological Survey

VIC – Variable Infiltration Capacity

WEL – Well Package

WWTP – Wastewater Treatment Plant

YVWD - Yucaipa Valley Water District

1.0 Introduction

1.1 Background

The Beaumont Basin is located in the San Gorgonio Pass, a low-relief highland located between the San Bernardino Mountains and the San Timoteo Hills in Riverside County, California (Figure 1). The boundaries of the Beaumont Basin (also referred to as the Beaumont Storage Unit) were originally defined by Bloyd (1971) and adopted by the Superior Court of the State of California (the Court), when the basin was adjudicated per Riverside County case number RIC 389197, *San Timoteo Watershed Management Authority vs. City of Banning, et al*. (the Judgment) (Figure 2). It is noted that subsequent studies of the Beaumont Basin area have redefined the hydrogeologic boundaries of the groundwater basin (Rewis et al., 2006). However, for purposes of this report, the Beaumont Basin refers to the adjudicated basin area as defined in the Judgment.

The Safe Yield of the Beaumont Basin is defined by the Judgment as "The maximum quantity of water which can be produced annually from a groundwater basin under a given set of conditions without causing a gradual lowering of the groundwater level leading eventually to depletion of the supply in storage." The Safe Yield in the original Judgment was 8,650 acre-ft/yr. As per the Judgment, the Safe Yield is to be reevaluated every 10 years. In 2013, the Safe Yield was reset at 6,700 acre-ft/year. This report presents the 10-yr reevaluation of the Safe Yield of the Beaumont Basin for 2023.

1.2 Purpose and Scope

The purpose of this analysis was to reevaluate the Safe Yield of the Beaumont Basin in keeping with the requirements of the Judgment. The evaluation was conducted by developing a detailed water balance of the basin and vicinity with the aid of a calibrated numerical groundwater flow model.

The groundwater flow model used for the analysis was originally based on a model previously developed by the United States Geological Survey (USGS) for the Beaumont area (Rewis et al., 2006). The model had been updated and refined for the 2013 Safe Yield reset. For the 2023 Safe Yield reset, the groundwater model was further updated and refined to reflect new data collected over the previous 10 years.

The scope of the evaluation consisted of:

1. Obtaining and compiling data.
2. Updating and refining the existing groundwater flow model.

3. Calibrating the groundwater flow model through December 2022.
4. Create a 50-year future model projection.
5. Reevaluating the safe yield of the Beaumont Basin Adjudicated Area using the calibrated groundwater flow model.
6. Preparing this report summarizing the findings.

1.3 Safe Yield Reevaluation Approach

The Safe Yield of the Beaumont Basin is a function of the overall water balance of the area. Changes in water/groundwater inflow to the basin and water/groundwater outflow from the basin impact the Safe Yield. As groundwater management and land use changes impact the water balance, they also impact the Safe Yield. A generalized expression of the water balance is as follows:

$$\text{Inflow} - \text{Outflow} = +/- \text{ Change in Storage} \qquad (1)$$

The water balance equation for pre-developed conditions (prior to human occupation) can be further expressed as:

$$(I_{ss} + I_{mfr} + I_{pr} + I_{str}) - (O_{ss} + O_{et} + O_{st}) = \Delta S \qquad (2)$$

Where:

I_{ss} = Inflow from Subsurface Underflow

I_{mfr} = Inflow from Mountain Front Recharge

I_{pr} = Inflow from Areal Recharge from Precipitation

I_{str} = Inflow from Infiltration from Runoff in Stream Beds

O_{ss} = Subsurface Outflow

O_{et} = Evapotranspiration

O_{st} = Groundwater Discharge to Streams

ΔS = Change in Groundwater Storage

Under pre-developed conditions, the groundwater basin would be in a state of equilibrium such that the inflow and outflow would balance and there would be no significant long-term change in storage. Under this condition, groundwater levels would be relatively stable (Figure 3).

Under developed land use conditions, the water balance changes as groundwater is pumped from the basin for irrigation and municipal supply (Figure 4). Lowering of the groundwater table resulting from pumping reduces the amount of groundwater that would otherwise leave the basin and reduces evapotranspiration losses in areas of shallow groundwater (e.g. San Timoteo Creek). Some of the pumped groundwater used for irrigation infiltrates past the roots of the plants and returns to the groundwater as return flow. Groundwater return flow also occurs as a result of discharges from individual septic systems. Other sources of recharge to the groundwater under developed land use include wastewater treatment plant discharges and artificial recharge in spreading basins. Finally, the balance of precipitation infiltration and runoff changes in areas of buildings and roads that were previously native soil and vegetation.

The water balance equation for developed land use conditions is as follows:

$$(I_{ss} + I_{mfr} + I_{pr} + I_{str} + I_{rf} + I_{ar}) - (O_{ss} + O_{et} + O_{st} + O_p) = \Delta S \qquad (3)$$

Where:

I_{rf} = Inflow from Return Flow

I_{ar} = Inflow from Artificial Recharge

O_p = Outflow from Groundwater Pumping

Under developed basin conditions, if the inflow terms exceed the outflow terms, then the groundwater in storage increases (become positive) and groundwater levels rise. If the outflow terms exceed the inflow, then the groundwater in storage decreases (become negative) and groundwater levels drop.

The Safe Yield of a developed groundwater basin is the combination of pumping and recharge under a given land use condition that results in no long-term change in groundwater storage in the basin. The water balance equation can be rearranged and simplified to estimate Safe Yield:

$$\text{Safe Yield} = \Delta S + O_p - I_{ar} \qquad (4)$$

This relationship is valid if the following conditions are met:

1. The Safe Yield incorporates a hydrology that is representative of a relatively long period of record that includes multiple wet and dry hydrologic cycles.
2. The land use conditions are representative of the time period.
3. Pumping and recharge within the basin does not result in adverse impacts.

The approach used to reevaluate the Safe Yield of the Beaumont Basin was to use the calibrated numerical groundwater flow model to simulate future projections of groundwater pumping and artificial recharge in the context of a long-term average hydrology and return flow based on projected land use conditions. The Safe Yield for 2023 to 2032 is based on Equation 4 above and is the arithmetic average of 55 annual safe yield values spanning the calendar years 1978 through 2032.[1]

1.4 Types and Sources of Data

Compilation, review and analysis of multiple types of data were necessary to refine the groundwater flow model. The various types of data are summarized in Figure 5 and include geology, soils/lithology, hydrogeology, surface water hydrology, climate, land use, topography, groundwater recharge and recovery, and climate change data. Groundwater levels, precipitation, imported water, well construction information, groundwater quality, and pumping test data were stored in a relational database expanded from database files provided by the USGS, San Gorgonio Pass Water Agency (SGPWA), Beaumont Cherry Valley Water District (BCVWD), South Mesa Water Company (SMWC), City of Banning, Yucaipa Valley Water District (YVWD), Riverside County Flood Control and Water Conservation District, and Beaumont Basin Watermaster. Other types of data necessary for analysis were compiled into spreadsheets. Historical groundwater quality data was collected and can be incorporated into future model analyses if a water quality transport component is added to the existing groundwater flow model.

Data for updating and refining the groundwater flow model were obtained from multiple sources:

Geological Data including geologic maps and cross sections were obtained from the USGS and the California Geological Survey (CGS).

Soils/Lithological Data including detailed lithologic logs from wells and test boreholes, geophysical logs, and drillers' logs from wells and test boreholes were obtained from the California Department of Water Resources (DWR), City of Banning, Yucaipa Valley Water District (YVWD), South Mesa Water Company (SMWC), and Beaumont-Cherry Valley Water District (BCVWD).

[1] Each of the 55 annual safe yield values is based on 12 monthly safe yield values. For example, the annual safe yield for calendar year 2020 is the sum of the safe yield values for January through December 2020.

Hydrogeological Data including groundwater levels, pumping test data, and groundwater chemistry were obtained from the San Gorgonio Pass Water Agency (SGPWA), BCVWD, SMWC, YVWD, and City of Banning.

Groundwater Recharge and Recovery Data including spreading basin locations and dimensions, artificial recharge, water well construction, well locations, groundwater production, and information for septic return flow estimates were obtained from SGPWA, BCVWD, SMWC, YVWD, and City of Banning.

Hydrological (i.e. Surface Water) Data consisted of stream gage data along Little San Gorgonio Creek and San Timoteo Creek and was obtained from BCVWD and USGS. Wastewater treatment plant discharge data was obtained from the City of Beaumont.

Climate Data was acquired from the Riverside County Flood Control and Water Conservation District for the Beaumont weather station and DWR's California Irrigation Management Information System (CIMIS) at the University of California, Riverside station. Future climatology, hydrology, and streamflow was obtained from DWR.

Land Use Data was obtained from the DWR. Aerial photographs of land use conditions were obtained from the USGS, the United States Department of Agriculture Firescope, and ESRI Imagery Basemaps. Zoning maps from General Plans were obtained from the City of Beaumont, the City of Banning, the City of Calimesa, and Riverside County.

Topographical Data including Digital Elevation Models (DEMs) and topographical maps were acquired from the USGS.

In addition to the various types of data, numerous historical reports on the geology, hydrogeology and groundwater management of the Study Area were reviewed. These reports included USGS publications, DWR reports and bulletins, and agency reports. Publications relied on for the generation of this report are listed in the References (Section 7).

2.0 Updates to the Groundwater Flow Model

The groundwater flow model used for the analysis was originally based on a model previously developed by the United States Geological Survey (USGS) for the Beaumont area (Rewis et al., 2006). For the 2013 Reevaluation of the Beaumont Basin Safe Yield, Thomas Harder & Co. (TH&Co) refined and updated the USGS model for use in the Safe Yield estimate. Full documentation of the model used in the 2013 Safe Yield redetermination (i.e., "the previous model") is provided in TH&Co (2015).

For the 2023 Reevaluation of the Beaumont Basin Safe Yield, certain aspects of the 2013 model (i.e. "the previous model") remain unchanged. The area of the model remains approximately 6.5 miles in the north-south direction and 12.2 miles in the east-west direction (approximately 79 square miles). Discretization of the model is also unchanged, with 164 ft by 164 ft cells in 393 columns and 210 rows. The model coordinate system remains State Plane Zone 6.

Several updates and modifications were applied to the previous model thereby resulting in the "updated model" used for the analysis presented herein. These updates were made: 1) to incorporate data collected since the previous update, 2) to make use of more recent groundwater flow modeling software, and 3) to make use of the most recent advances in model calibration and uncertainty analysis software. These updates and modifications are summarized in the list below and detailed in the subsections that follow as necessary.

1. The previous model was converted from an outdated single-precision version of MODFLOW-2005 to the most recent[2] double-precision version of MODFLOW-NWT (Niswonger and Panday, 2011). This conversion necessitated replacing the block-centered flow (BCF) package with the upstream weighting (UPW) package and the preconditioned conjugate-gradient (PCG) package with the Newton solver (NWT) package.
2. A low permeability layer was inserted within Layer 1 of the previous model thereby increasing the number of model layers from two to four. That is, Layer 1 of the previous model now consists of three layers in the updated model used for this analysis and Layer 2 of the previous model is now Layer 4 in the updated model. This necessitated modification of several packages, notably, the horizontal flow barrier (HFB) and general head boundary (GHB) packages.
3. The stream (STR) package was replaced with the streamflow routing (SFR) package.
4. The well (WEL) package was replaced with the multinode well (MNW2) package.
5. The time-variant specified head (CHD) package was integrated within the revised general head boundary (GHB) package and is therefore not used in the updated model. The GHB package was expanded along the perimeter of the active model area using 16 segments of varying lengths in those areas believed to contribute or remove groundwater. Wells used

[2] Version 1.3.0, July 1, 2022 as posted on USGS website.

as influx boundaries along the perimeter of the active model area in the previous model were integrated into the revised GHB package. Therefore, there no longer any influx boundaries simulated using wells in the updated model. The new GHB segments extend through all four of the new layers comprising the updated model.

6. Additional months of measured data (e.g., pumping, imported water, wastewater discharges, and groundwater elevations) were appended to model stress packages (e.g., well [MNW2], recharge [RCH], streamflow routing [SFR], and general head boundary [GHB] packages) through December 2022.
7. The RCH package was modified to include additional managed recharge facilities (i.e., Noble Creek Southeast, Brookside West, and Brookside East).
8. The drain return flow (DRT) package was introduced to simulate groundwater outflow through alluvial channels in the northwestern area of the Beaumont Basin. It was later found that the original USGS model incorporated the drain (DRN) package for the same reason. As such, the approach taken in the updated model is conceptually consistent with the original USGS model.
9. Model stress periods, which were variable in length in the previous model, were modified such that all model stress periods are 1 month in duration (i.e., 28 or 29 days for February, 30 days for April, June, September, and November, and 31 days for January, March, May, July, August, October, and December). These changes necessitated changes to the stress packages (i.e., the evapotranspiration [EVT], GHB, RCH, SFR, MNW2 packages).
10. The updated model was configured within a PEST++-IES framework as discussed in Section 4.

Given these modifications, the updated model:

- Consists of four layers, each of which contains 210 rows by 393 columns;
- Consists entirely of uniformly-sized square model grid cells that are 164 feet on each side (these dimensions are retained from the original USGS model, which used units of meters and square cells 50 meters on each side);
- The active area of Layers 1 and 2 are identical whereas those of Layers 3 and 4 are smaller);[3]
- Layers 1 and 2 each contain 37,503 active cells whereas Layers 3 and 4 contain 37,282 and 29,067 active cells, respectively (i.e,, the updated model contains a total of 141,355 active cells);
- Simulates the time period of January 1, 1978 through December 31, 2032;
- Contains 660 monthly stress periods; and

[3] The "active area" consists of those model cells in which the equations associated with the various input packages (e.g., UPW, SFR, GHB, etc.) are solved by MODFLOW-NWT.

- As each stress period consists of a single timestep, the time step multiplier was set to 1.0 for all stress periods.

2.1 Updated Model Calibration Period

The previous model had been updated each year since 2013 with groundwater pumping, recharge, and imported water data through December 2021. For the update described herein, data for the calendar year 2022 were appended to these input files to extend the model calibration period from January 2022 through December 2022. The updated 2023 model uses monthly stress periods; therefore, twelve stress periods were appended to the model to extend the calibration through December 2022.

The previous historical period of the model was January 1927 through December 2021. TH&Co shortened the historical calibration period by removing January 1927 through December 1977 from the model. This modification was made to reduce model runtimes. Therefore, the model calibration period for the updated model is January 1978 through December 2022.

2.2 Created Uniform Model Stress Periods

Model stress periods are discrete time intervals over which groundwater flow and associated boundary conditions are simulated in a groundwater flow model. These stress periods divide the simulation period into manageable segments, allowing for the representation of temporal variations in boundary conditions, such as recharge rates, pumping rates, and hydraulic head values. Each stress period typically represents a fixed duration, such as a month, a season, or a year, depending on the temporal resolution required for the model simulation period.

In the previous version of the model, each stress period did not represent a uniform period. There were stress periods which represented multiple years and stress periods which represented only a few days. Having uniform stress periods helps maintain numerical stability during the simulation by preventing abrupt changes in boundary conditions between time steps. This reduces the likelihood of convergence issues, and numerical instabilities that may arise when the model encounters discontinuities in boundary conditions. Consistent stress periods make model updates easier as it becomes unnecessary to convert model input data received from the stakeholders into various time units of years, months, and days. Lastly, uniform stress periods increase the compatibility of post-processing the results of the groundwater flow model; making temporal conversions redundant.

2.3 Changed Model Layering

The previous version of the Beaumont Basin groundwater model consistently underestimated shallow groundwater levels at the Noble Creek recharge basins, relative to measured groundwater level data. The discrepancy between simulated and measured groundwater levels

at Noble Creek Shallow monitoring well NC-4S was greatest during times when large volumes were being recharged into the Noble Creek recharge basins. Further analysis of cross sections of the area suggested that the model was not representing the interbedded fine-grained layers (silt and/or clay) in the upper approximately 400 feet of subsurface sediments that were, in reality, impeding the recharge rates and resulting in a higher recharge mound.

To address the model calibration issues in the Noble Creek recharge basin area and better represent the interbedded nature of the sediments above the regional aquifer system, TH&Co added a low permeability 50-foot-thick confining unit uniformly across the entire model domain (Figures 6 through 8). This confining unit was added based upon silt/clay lenses observed in lithologic logs for wells SMWC 04, YVWD 34 and 48, BCVWD 24 through 26, BCVWD 29, BCVWD MW-1, 2S/1W-35J01, Banning C-2A, Banning C-3, and Banning M9. The addition of the new low permeability unit resulted in splitting the previous model Layer 1 into three layers (Layers 1 through 3; Figures 7 and 8). The previous model Layer 2 became model Layer 4 and has not changed in terms of thickness or depth relative to the previous version of the model. The thickness of each of the four new model layers is shown on Figure 9a through 9d.

Overall, adding the low permeability layer significantly improved model calibration at well NC-4S (see Section 4). The model calibration at well NC-4D was largely unchanged and is acceptable, especially from 2019 onward (see Appendix C, page 23 of 87).

2.4 Updated The Model Solver

As discussed in the introduction to this section, the model was converted from a single-precision version MODFLOW 2005 to the most recent double-precision version of MODFLOW-NWT. This conversion required the use of the NWT solver and UPW package. This conversion was made to improve accuracy of groundwater flow calculations, convergence, and stability.

2.5 Updated the Stream Simulation Package in the Model

To better represent flow in San Timoteo Creek in the southern part of the model domain, TH&Co updated the Beaumont Basin groundwater flow model with an updated version of the MODFLOW stream package. The stream package was updated from the STR package (Prudic, 1989) to the Streamflow Routing package (SFR) (Niswonger et al., 2006). The SFR package allows for dynamic simulation of streamflow routing and more accurate simulation of surface water-groundwater interactions, such as gaining and losing streams, infiltration, and seepage, which are critical for representing groundwater-surface water interactions, such as occur along the San Timoteo Creek drainage.

Streamflow in San Timoteo Creek is generated by a combination of discharges of treated wastewater from the City of Beaumont wastewater treatment plant, rising groundwater, and periodic stormflow runoff from Marshall Creek, Noble Creek, and Little San Gorgonio Creek

(Figure 10). Stream flow data used for this study were obtained from a USGS stream gage on Little San Gorgonio Creek and manual gaging of San Timoteo Creek (Figure 10). Little San Gorgonio Creek surface water flows were measured by the USGS from 1948 to 1985. Surface water flow within San Timoteo Creek was measured by YVWD on a weekly basis from 2002 to 2012.

Baseflow in San Timoteo Creek is sustained from treated wastewater discharges to Cooper's Creek by the City of Beaumont and groundwater discharge to the creek channel. The primary wastewater discharge point is in Cooper's Creek adjacent to the wastewater treatment plant (WWTP) (Figure 10). The second discharge point is in a small drainage north of the WWTP. Monthly wastewater discharge data were available from the City of Beaumont for the model update period through 2022 and historical discharges formed the basis for San Timoteo Creek flow in Segment 1 of the SFR (Figure 11). Flow in Segment 2 of the SFR was based on YVWD manual measurements (Figure 12) taken at the downstream location shown on Figure 10.

2.6 Modified Simulation Method for Groundwater Flow Between No Flow Zones in the Western Model Domain

The MODFLOW DRT (Drain Return) (Prudic, 1989) package was incorporated into the Beaumont Basin model in parts of the western Beaumont Basin to better simulate groundwater flow between isolated no flow zones (Figure 13). The isolated no flow zones are conceptualized to represent outcrops of low permeability San Timoteo Formation separated by more permeable shallow alluvial channels that direct groundwater from the Singleton Hills area to San Timoteo Creek.

2.7 Updates to Model Package Controlling Cell-by-Cell Flow

Use of the MODFLOW Newton solver allowed TH&Co to incorporate a more robust package to simulate the flow between model cells. Accordingly, TH&Co replaced the Block-Centered Flow (BCF) package (McDonald & Harbaugh, 1988) in the previous model with the Upstream Weighting (UPW) (Niswonger & Panday, 2011) package, which is designed to improve the representation of hydraulic conductivity and anisotropy within the model domain. The transition to the UPW package enhances the model's capability to represent spatial variability in hydrogeological properties, improve simulation accuracy, and better capture flow dynamics in heterogeneous groundwater systems.

2.8 Updated Model Calibration Targets

In addition to appending the previous model calibration target wells with updated data, TH&Co revised the calibration targets in the updated model. Three calibration targets were removed: Powers (2S/1W-32G01), Phillips (3S/1W-12D01), and Wilkins (2S/1W-34M01). These wells were removed since data for the updated calibration period was unavailable. TH&Co added ten

new groundwater level calibration target wells: Noble Creek Park, Noble Creek 4, BCVWD 25, Tukwet B, Tukwet C, Tukwet D, YVWD 34, BCVWD 29, Delph, and Hewitt (Figure 14). New calibration targets were primarily wells identified as locations in the model which had good quality groundwater level data and were generally further from other calibration targets.

2.9 Updated Model Boundary Conditions

In addition to updating model input files, TH&Co updated the hydrographs used for boundary conditions with groundwater level data measured through December 2022 (Appendix A). Figure 13 shows the updated 2023 model boundary conditions which includes no flow cells, General Head Boundary (GHB) (McDonald & Harbaugh, 1988) cells, and Boundary Recharge cells. A comparison of previous model boundary conditions with the current updated model is shown on Figure 15.

2.9.1 Conversion of Constant Head Boundary Cells to General Head Boundary Cells

For some boundary conditions, TH&Co converted the Constant Head (CHD) (Harbaugh et al., 2000) package boundary condition cells to the General Head Boundary (GHB) package (Figure 13). MODFLOW GHB boundary cells are more flexible and versatile than CHD boundaries. While CHD boundaries maintain a constant head value throughout the simulation, GHB boundaries allow for spatially varying head values, which can better represent natural conditions such as local gradients or hydraulic head variations along a boundary. GHB boundaries can simulate various boundary conditions, including specified head, specified flow, or a combination of both. This flexibility allows for the simulation of more complex hydrogeological scenarios.

2.9.2 Conversion of General Head Boundary Cells to Mountain Block Recharge Cells

TH&Co converted all of the cells along the northern model boundary from GHB cells to mountain block recharge cells. Recharge in these cells is simulated using injection wells in the MODFLOW WEL (Well) (Harbaugh et al., 2020) package (Figure 13). Mountain block recharge cells are used to represent the infiltration of precipitation or snowmelt into the groundwater system, capturing the spatial variability of recharge rates along the boundary. This allowed for more flexibility in adjusting recharge across the boundary during calibration.

2.10 Updates to Groundwater Pumping

Groundwater pumping for municipal supply was updated in the 2023 model based on data provided by BCVWD, SMWC, YVWD, and City of Banning. All municipal groundwater pumping was updated through December of 2022. Figure 16 shows the location of all the production wells inside the model. Total groundwater pumping in the Beaumont Basin has increased from just over 5,000 acre-ft/yr in 1978 to just under 19,000 acre-ft/yr in 2022 (Figure 17).

2.11 Incorporated Additional Recharge Basins

Additional recharge basins were constructed and put into operation within the Beaumont Basin Adjudicated area since the last Safe Yield reset in 2013 (Figure 16). In the previous model only San Gorgonio Pass Water Agency's (SGPWA's) Little San Gorgonio Creek Recharge Facility (LSGCRF) (located outside the adjudicated boundary) and BCVWD's Noble Creek northwest recharge facility existed. In the 2023 model update, TH&Co incorporated Noble Creek southeast and Brookside East and West were added to the model. Imported water deliveries to LSGCRF were discontinued in 2020 and no deliveries to these basins were included in the 10-year forecast period. BCVWD started delivering imported water to Noble Creek 1 & 2 starting in 2006 and continued to recharge water through 2022 and into the forecast (Table 1). SGPWA delivered water to Brookside East from 2019 to 2022. Brookside West was added to the model but in this model update does not receive water in the calibration or forecast period. SGPWA along with other stakeholders do plan on using this basin for imported water recharge in the future.

2.12 Updated Recharge From Precipitation

The climate of the Study Area has been characterized as transitional, with marine coastal influences to the west and arid Mojave Desert influences to the east (Rewis et al., 2006). The area has hot summers and cool winters. Historical annual precipitation at the Beaumont precipitation station, operated by the Riverside County Flood Control District, has ranged from 6.4 inches in 1999 to 35.0 inches in 1978 with an annual average of 17.2 inches (Figure 18). Analysis of the cumulative departure from mean precipitation at this station indicates the following trends:

- The period from approximately 1885 through 1903 was relatively dry.
- The period from 1904 through 1946 was relatively wet.
- The period from 1947 through 1977 was relatively dry.
- The period from 1978 through 1983 was relatively wet.
- The period from 1984 through 1990 was relatively dry.
- The period from 1991 through 1998 was relatively wet.
- The period from 1999 through 2023 was relatively dry.

Average annual reference evapotranspiration (ET_o) in the Study Area is relatively high. Average annual ET_o at the University of California, Riverside CIMIS station, located approximately 12 miles west of the Study Area, is 56.37 inches. Due to the relatively deep groundwater table throughout most of the Study Area, only groundwater in the riparian area along San Timoteo Creek is subject to ET (Figure 10).

Groundwater recharge from artificial recharge basins, return flow associated with the various land use conditions, and infiltration in Noble Creek and Marshall Creek were addressed in the

model using the recharge package. Recharge was applied to the uppermost active model layer within 34 individual recharge zones (Figure 19). The relatively large number of recharge zones was necessary to enable the simulation of changes in return flow and streambed infiltration over time.

2.13 Changes in Aquifer Parameters from Recalibration of the Updated Model

Given the changes in model layering and other boundary conditions in the updated 2023 model relative to the previous version, it was necessary to recalibrate the model to provide an optimum match of measured and model-generated groundwater levels (see Section 4 herein). As aquifer parameters were adjusted during this process, the recalibration effort resulted in changes to parameter value arrays in the model, including horizontal hydraulic conductivity, vertical hydraulic conductivity, specific yield, and specific storage (see Appendix B).

3.0 Future Projections

As the reevaluation of the Safe Yield of the Beaumont Basin applies to the future period from 2023 through 2033, TH&Co included a 10-year projection of basin recharge and pumping in the water budget period used to estimate the Safe Yield. The forecast is based on assumptions for hydrology, groundwater pumping demand, imported water recharge, and anticipated projects to recharge/pump groundwater for a 50-year projection, as described herein. However, only the forecasted period from 2023 through 2033 was quantified in the analysis of Safe Yield.

3.1 Climate and Precipitation Projection

The climate and precipitation forecast for the 50-year projection period was completed using the 2070 climate change factors from the DWR climate change model (DWR, 2018). DWR's climate change model outputs a precipitation factor across a 6 km by 6 km grid matrix covering California. The precipitation factor is applied to the historical precipitation record at each grid cell to estimate how much a historical year's rainfall will be affected by climate change by 2070 (Figure 20). To account for future precipitation in the Beaumont model forecast, TH&Co conducted a statistical analysis on the historical precipitation record at the Beaumont Precipitation Station (see section 2.12), classifying historical years into the following precipitation categories: very wet, wet, average, dry, and very dry. A proxy precipitation year was then picked for each one of the categories and the DWR 2070 climate change factor was then applied (Table 2). TH&Co applied a random 50-year pattern of the five precipitation categories described above across the 50-year model projection (2023-2071).

3.2 Groundwater Pumping Forecast

Projected groundwater pumping in the model forecast period 2023-2072 was based on pumping projections provided by BCVWD, SMWC, YVWD, and City of Banning. Forecast period total groundwater pumping for the entire Study Area for 2023-2032 is shown in (Figure 17). Groundwater pumping is forecast to increase from just over 20,000 acre-ft/yr in 2023 to over 25,000 acre-ft/yr in 2032. Overlyer pumping for the 50-yr projection simulation was based on the 5-year historical average monthly pumping from 2018-2022.

3.3 Imported Water Forecast

Projections of artificial recharge in the model forecast period were estimated based on SGPWA's Table A imported water allocation and DWR projections of imported water availability in the future. SGPWA's Table A allocation is 17,300 acre-ft/yr. DWR's Final State Water Project Delivery Capability Report (DWR, 2020) describes the percentage of Table A water State Water Project contractors can expect in the future and the number of years they can expect it. TH&Co assigned imported water deliveries in any given year in accordance with the climate categories described in Section 3.1 (Table 3). Very wet years hydrologically were assigned a high

percentage of imported water delivery (97 percent). In contrast, very dry years hydrologically were assigned a low percentage of imported water delivery (7 percent).

Imported water was assigned to individual recharge facilities in the Beaumont Basin on a priority basis. Water was first assigned to the Noble Creek Recharge facility. If the recharge capacity of those basins were maximized, recharge was then assigned to Brookside East. The recharge capacity at each facility was based upon the area of each basin and a historical maximum infiltration rate.

3.4 Natural Recharge Water Forecast

Precipitation recharge for the model forecast period was assigned to the MODFLOW recharge package based on the proxy year precipitation projections shown in Table 2. The recharge value for each recharge package zone (Figure 19) for the historical proxy year was applied to the forecast period in accordance with its precipitation category (very wet, wet, average, dry, and very dry (see Section 3.1 and Table 2 for more information).

3.5 YVWD ASR Project

The YVWD is planning to implement a groundwater recharge and recovery project which would become operational in 2026. This project includes four injection wells and three extraction wells, as shown on Figure 21. The project would recharge and/or recover up to 2,000 acre-ft/yr of imported water. These injection and extraction wells were added into the 2023 updated model based on planned locations provided to TH&Co by YVWD (Figure 21). The ASR project involves purchasing imported water during wet periods when excess water is available and injecting it into the local aquifer for storage. During times of high demand or drought, the stored water can be withdrawn from the aquifer and treated for distribution to meet the needs of YVWD's customers.

4.0 Model Calibration

The revisions to the model changed the pumping and recharge stresses that affect model calibration, so the model was recalibrated to reflect the new data. This involved a two-step process:

1. Manually modifying aquifer property values to optimize the fit between measured groundwater levels and modeled groundwater levels, and
2. Conducting an automated parameter estimation process (PEST++-IES, White et al, 2020) to further refine the calibration.

PEST++" refers to a suite of software programs that are the most recent update of "PEST" whereas IES (iterative ensemble smoother) is one of several variants of PEST++. IES was used as it allows for calibration of many thousands of parameters without incurring the computational burden of doing so as is the case with other PEST variants.[4] IES also simplifies uncertainty analysis in that it generates a user-specified number of realizations.

With respect to the second step noted above, PEST varied the following parameters (137,379 total) to calibrate the model:

- BAS package: layer-specific array multiplier for starting heads (initial conditions) arrays (4 parameters);
- WEL package: layer- and stress period-specific injection rates for mountain block recharge (15,120 parameters);
- EVT package: stress period-specific array multipliers for evapotranspiration surface and evaporation rate, and constant extinction depth (1,620 parameters);
- GHB package: layer-specific conductances and layer- and stress period-specific heads (5,099 parameters);
- SFR package: segment- and reach-specific streambed thicknesses and conductances and segment- and stress period-specific roughness coefficients, upstream widths, and downstream widths (3,920 parameters);
- HFB package: layer- and cell-specific fault conductivities (13,236 parameters);
- DRT package: drain conductances (479 parameters);
- UPW package: layer-specific hydraulic conductivities, storage coefficients, and anisotropy ratios (78,725 parameters); and
- RCH package: stress period and zone-specific recharge rates (19,176 parameters).

Except for aquifer parameters (i.e., parameters associated with hydraulic conductivities and storage coefficients), all parameters that were varied by PEST were characterized by their

[4] Note that PEST stands for "Parameter ESTimation" and, in the text follows, the terms "PEST", "PEST++", and IES are used interchangeably.

"priors" (a.k.a., 'mean values', 'preferred values', or simply 'initial pre-calibration estimates') and standard deviations based on their ranges (assumed lower and upper bounds), with the assumption that all are lognormally distributed. Aquifer parameters were also assumed to be lognormally distributed but were characterized by their priors and covariance matrices. The covariance matrix approach is commonly used for aquifer parameters because it is generally accepted that the latter are spatially correlated. For example, the hydraulic conductivity in a specific model cell is expected to be similar to the hydraulic conductivity in nearby model cells with this expectation decreasing for more distant model cells. Given the spatial configuration of the aquifer parameters, pilot points (Doherty et al., 2003) along with the PEST spatial interpolation utility program PLPROC (Doherty, 2020), was used to assign the cell-specific values to the aquifer parameters varied by PEST.

IES generates an initial "ensemble", which is group of models. The initial ensemble consisted of 100 realizations; however, the final ensemble consisted of 79 calibrated models (a.k.a., "realizations"). The 21 realizations that are not part of the final ensemble were likely removed by IES due to 'timed-out' runs. Timed-out runs occur when the runtime for a realization being conducted by a particular agent exceeds twice the average runtime of all previously completed runs conducted during the PEST iteration up to that point. The long runtime for a timed-out run is usually due to a difficult parameter field, an overworked operating system, or both.

Regardless of the reason, the calibration can only be assessed for the 79 surviving realizations. The calibration is assessed in two ways: 1) visual inspection of calibration hydrographs and 2) consideration of calibration statistics, with the first way being self-explanatory, qualitative, and generally subjective. With respect to the second way, the calibration statistics used for this analysis include the correlation coefficient, normalized root mean square error (NRMSE), and the coefficient of variation of objective functions for all realizations in the final ensemble.

Calibration hydrographs showing both measured and model-generated groundwater elevations are provided in Appendix C. These hydrographs are for one of the realizations in the final ensemble. The simulated groundwater elevations reasonably match the measured elevations at most of the target wells in the model. A scatter plot for this same realization of simulated versus measured groundwater elevations for the 2,689 groundwater level observations in the calibration is displayed model wide in (Figure 22). The correlation coefficient between the simulated and measured values is 0.93, which meets the benchmark minimum value of 0.90 noted in DWR (2016) and Hill and Tiedemann (2007). Values of 0.90 and above indicate a strong positive correlation between the measured and model-generated groundwater levels (i.e., as one value increases, so does the other and vice versa).

The NRMSE is expressed in units of percent, where the error is the difference between the measured and model-generated groundwater level. NRMSE values less than 10 percent are

generally considered to be acceptable. The NRMSE for the 2023 model with respect to groundwater elevations is 5.4 percent (Figure 22).

For uncertainty analysis, which relies on all realizations in the final ensemble, the coefficient of variation, which is the standard deviation of the objective function (which is the sum of squared errors) divided by its mean value. The coefficient of variation is 2%, which means the fits for all 79 realizations in the final ensemble are very similar. The NRMSE of the "best fit" realization (the one with the lowest objective function) and that of the “worst fit” realization (the one with highest objective function) were 5.3% and 5.6%, respectively. These acceptably low summary statistics support the inclusion of all 79 realizations in the uncertainty analysis.

5.0 Analysis of Safe Yield

The Safe Yield of the Beaumont Basin is a function of the overall water balance of the adjudicated area. As described in Section 1.3, the Safe Yield can be expressed using the following equation:

$$\text{Safe Yield} = \Delta S + O_p - I_{ar} \qquad (4)$$

where:

ΔS = Change in Groundwater Storage

O_p= Outflow from Groundwater Pumping

I_{ar} = Inflow from Artificial Recharge of Supplemental Water

This relationship is valid if the following conditions are met:

1. The Safe Yield incorporates a hydrology that is representative of a relatively long period of record that includes multiple wet and dry hydrologic cycles.
2. The land use conditions are representative of the time period.
3. Pumping and recharge within the basin does not result in adverse impacts.

The updated Safe Yield estimate for the Beaumont Basin was based on a water budget developed using the updated and recalibrated groundwater flow model of the basin (see Table 4). The water budget includes both the historical period from 1978 through 2022 and the forecast period from 2023 through 2032. The Safe Yield is based on Equation 4 and is the arithmetic average of 55 annual safe yield values spanning the calendar years 1978 through 2032.[5]

Multiple realizations of the Beaumont Basin model, as discussed in Section 4, were evaluated before selecting the water budget shown on Table 4, which was used to estimate Safe Yield. The purpose of analyzing multiple model realizations is to account for uncertainty in the model input parameters, many of which are estimated. A model realization is an acceptably-calibrated model with the same area and layering but different parameter distributions. For the analysis of Safe Yield, the 79 realizations discussed in Section 4, each with different aquifer parameters, hydrology, and mountain front recharge varied within reasonable ranges.

[5] Each of the 55 annual safe yield values is based on 12 monthly safe yield values. For example, the annual safe yield for calendar year 2020 is the sum of the safe yield values for January through December 2020.

The Safe Yield estimates from each of the 79 acceptable realizations are plotted on Figure 23. The Safe Yield estimates ranged from approximately 6,800 acre-ft/yr to 7,300 acre-ft/yr and do not include artificial recharge as shown in Equation 4 above. The Safe Yield recommended herein (7,100 acre-ft/yr) represents the 50th percentile of the Safe Yield values derived using the 79 realizations (i.e., the curve shown on Figure 23 is a smoothed line through 79 data points). This 50th percentile value means that half of the realizations gave a Safe Yield less than 7,100 acre-ft/yr and half gave a Safe Yield greater than 7,100 acre-ft/yr. That is, there is a 50 percent chance that the actual Safe Yield is between 6,800 and 7,100 acre-ft/yr and a 50 percent change that the actual Safe Yield is between 7,100 and 7,300 acre-ft/yr. Along those same lines, there is no chance the Safe Yield is less than 6,800 acre-ft/yr or greater than 7,300 acre-ft/yr.

6.0 Findings and Recommendations

A calibrated numerical groundwater flow model of the Beaumont Basin has been updated and refined based data collected since the earlier version of the model was developed. The updated and refined model is calibrated to industry standards and is a valuable tool for evaluating both the historical water balance of the Beaumont Basin and future water balance based on projections of groundwater production and artificial recharge. Analysis of the Beaumont Basin historical water budget from the groundwater flow model has resulted in the following findings:

- The water balance resulting from the analysis of future groundwater production and artificial recharge shows that change in groundwater storage during the 50-yr historical and forecast period from 1978 to 2032 ranges from 10,370 acre-ft/yr to -13,995 acre-ft/yr with an average of -1,634 acre-ft/yr. Average storage change over the 10-yr period (2013-2022) was -3,258 acre-ft/yr.
- Changes in groundwater storage over the 50-year period (1978-2032) are variable and are highly dependent on groundwater pumping, recharge from precipitation, and imported water for recharge. As noted in TH&Co (2018), imported water recharge that is not captured downgradient will likely result in higher losses.
- The Safe Yield based on an uncertainty analysis of the model-generated water budgets from 79 different realizations of the updated Beaumont Basin model is approximately 7,100 acre-ft/yr. This value represents the 50th percentile of the normalized distribution of safe yield estimates from the 79 different realizations.

Based on the analysis presented herein, including an analysis of model uncertainty, the recommended Safe Yield of the Beaumont Basin for the next 10 years (2023 through 2032) is 7,100 acre-ft/yr.

7.0 References

Bloyd, R.M., 1971. *Underground Storage of Imported Water in the San Gorgonio Pass Area, Southern California.* USGS Water Supply Paper 1999-D.

California Department of Water Resources (DWR), 2016. *Best Management Practices for the Sustainable Management of Groundwater; Modeling BMP.* Sustainable Groundwater Management Program. December, 2016.

California Department of Water Resources (DWR), 2018. *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development.* Sustainable Groundwater Management Program. July, 2018.

California Department of Water Resources (DWR), 2020. *The Final State Water Project Delivery Capability Report 2019.* Sustainable Groundwater Management Program. August 26, 2020.

Doherty, J., 2003. *Groundwater Model Calibration using Pilot Points and Regularization. Groundwater*, Volume 41, No. 2, March - April.

Doherty, J., 2020. *PLPROC: A Parameter List Processor*. Watermark Numerical Computing and National Centre for Groundwater Research and Training, Australia. May.

Harbaugh, A. W., Banta, E. R., Hill, M. C., & McDonald, M. G., 2000. *MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model—User Guide to Modularization Concepts and the Ground-Water Flow Process* (Open-File Report 00-92). U.S. Geological Survey. https://pubs.usgs.gov/of/2000/ofr00-92/

Hill, Mary C., and Tiedeman, Claire R., 2007. *Effective Groundwater Model Calibration, with Analysis of Data, Sensitivities, Predictions, and Uncertainty.* Wiley-Interscience, New Jersey.

McDonald, M. G., & Harbaugh, A. W., 1988. *A modular three-dimensional finite-difference ground-water flow model* (Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Chapter A1). U.S. Geological Survey. https://pubs.usgs.gov/twri/twri6a1/

Prudic, D. E. 1989. *Documentation of a computer program to simulate stream-aquifer relations using a modular, finite-difference, ground-water flow model* (MODFLOW). U.S. Geological Survey Open-File Report 88-729. https://doi.org/10.3133/ofr88729

Niswonger, R. G., & Panday, S. 2011. *MODFLOW-NWT, A Newton formulation for MODFLOW-2005* (Techniques and Methods 6-A37). U.S. Geological Survey. https://pubs.usgs.gov/tm/tm6a37/

Niswonger, R. G., Prudic, D. E., & Regan, R. S., 2006. *Documentation of the Streamflow-Routing (SFR2) Package to include unsaturated flow beneath streams - A modification to the Streamflow-Routing (SFR1) Package* (Techniques and Methods 6-A13). U.S. Geological Survey. https://pubs.usgs.gov/tm/2006/tm6A13/

Rewis, D.L., Christensen, A.H., Matti, J.C., Hevesi, J.A., Nishikawa, T., Martin, P., 2006. *Geology, Ground-Water Hydrology, Geochemistry, and Ground-Water Simulation of the Beaumont and Banning Storage Units, San Gorgonio Pass Area, Riverside County, California*. USGS Scientific Investigations Report 2006-5026.

TH&Co, 2018. *Beaumont Basin Storage Loss Analysis.* Prepared for the Beaumont Basin Watermaster, dated September 6, 2018.

White, J.T., Hunt, R.J., Fienen, M.N., and Doherty, J.E., 2020. *Approaches to Highly Parameterized Inversion: PEST++ Version 5, a Software Suite for Parameter Estimation, Uncertainty Analysis, Management Optimization and Sensitivity Analysis: U.S. Geological Survey Techniques and Methods* 7C26, 52 p. https://pubs.usgs.gov/publication/tm7C26

Tables

Beaumont Basin Annual Imported Water Deliveries

Calendar Year	Little San Gorgonio Creek Recharge Facility (acre-ft)	Noble Creek Recharge Facility (1 & 2) (acre-ft)	Brookside East Recharge Facility (acre-ft)	Brookside West Recharge Facility (acre-ft)	Annual Total (acre-ft)
2003	77	0	0	0	77
2004	814	0	0	0	814
2005	687	0	0	0	687
2006	778	3,501	0	0	4,279
2007	541	4,501	0	0	5,042
2008	758	3,933	0	0	4,691
2009	852	5,482	0	0	6,335
2010	1,215	7,065	0	0	8,280
2011	1,842	8,779	0	0	10,621
2012	1,827	8,983	0	0	10,810
2013	881	8,634	0	0	9,515
2014	17	5,013	0	0	5,030
2015	9	3,467	0	0	3,476
2016	18	10,796	0	0	10,814
2017	6	14,940	0	0	14,946
2018	0	12,621	0	0	12,621
2019	0	13,770	383	0	14,153
2020	1	11,005	464	0	11,470
2021	0	2,387	117	0	2,504
2022	0	1,311	500	0	1,811
2023	0	16,781	0	0	16,781
2024	0	13,496	0	0	13,496
2025	0	6,921	0	0	6,921
2026	0	10,034	0	0	10,034
2027	0	7,437	0	0	7,437
2028	0	4,801	0	0	4,801
2029	0	12,414	0	0	12,414
2030	0	12,020	0	0	12,020
2031	0	14,795	0	0	14,795
2032	0	7,437	0	0	7,437
Average (2003-2032)	344	7,744	49	0	8,137
Total (2003-2032)	10,323	232,324	1,464	0	244,112

Notes: Historical & forecast period imported water data was received from SMWC, YVWD, BCVWD, SGPWA, and The City of Banning.

Beaumont Model Forecast Period Proxy Year Selection

Model Forecast Year	Proxy Year	Proxy Year Precipitation (in.)	Category
2023	2005	26.9	Very Wet
2024	2005	26.9	Very Wet
2025	2018	6.6	Dry
2026	2015	10.1	Average
2027	2015	9.6	Average
2028	2007	4.4	Very Dry
2029	2019	19.8	Wet
2030	2015	10.7	Average
2031	2005	30.0	Very Wet
2032	2015	12.1	Average

Notes: Proxy year precipitation was determined from data at Beaumont Precipitation Station #13. Categories were determined by statistically classifying the historical precipitation data.

Model Forecast Period SWP[2] Imported Water Proxies

Category[1]	Proxy Year	SWP Allocation (%)	Annual Allocation Volume[3] (acre-ft)	Logic
Very Wet	2005	97%	16,781	Single Wet Year allocation From DWR[4] SWP 2019 Delivery Capability Report
Wet	2019	78%	13,494	Average Between Average and Very Wet Year
Average	2015	58%	10,034	Long Term Average allocation From DWR SWP 2019 Delivery Capability Report
Dry	2018	33%	5,709	Average Between Average and Very Dry Year
Very Dry	2007	7%	1,211	Single Dry Year allocation From DWR SWP 2019 Delivery Capability Report

Notes:

[1] Categories were determined by statistically classifying the historical precipitation data. See Table 2 For More Information.

[2] SWP = State Water Project

[3] Based on San Gorgonio Pass Water Agencies maximum SWP Table A allocation which equals 17,300 acre-ft/yr.

[4] DWR = California Department of Water Resources

Table 4

Groundwater Budget for the Beaumont Basin Adjudicated Area (January 1978 - December 2032)

	Groundwater Inflows (acre-ft)								Groundwater Outflows (acre-ft)						
									Total Subsurface Outflow[f]						
Year	Subsurface Inflow into the Adjudicated Area	"Channels" Inflow into the Adjudicated Area (DRT)	Imported Water for Recharge[a]	Imported Water for Injection[b]	Deep Infiltration of Precipitation and Runoff in Stream[c]	Recharge from the Mountain Block	Wellbore Flow[d]	Total Inflow[e]	Non-Channel Subsurface Outflow	Channel Subsurface Outflow	Evapotran-spiration (ET)	Groundwater Pumping	Total Outflow[g]	Change in Storage[h]	Annualized Safe Yield[i]
1978	11,318	0	0	0	3,279	46	1,178	15,820	(7,169)	(4,750)	0	(6,752)	(18,671)	(2,851)	2,724
1979	12,640	0	0	0	3,507	31	937	17,115	(8,170)	(2,483)	0	(6,738)	(17,391)	(276)	5,524
1980	15,055	0	0	0	3,419	47	719	19,240	(7,089)	(2,401)	0	(5,736)	(15,226)	4,014	9,031
1981	11,970	0	0	0	3,616	13	719	16,318	(6,637)	(2,327)	0	(6,341)	(15,305)	1,013	6,635
1982	14,024	0	0	0	3,600	29	707	18,360	(7,295)	(2,343)	0	(5,172)	(14,810)	3,551	8,016
1983	16,928	0	0	0	3,516	38	760	21,242	(8,057)	(2,337)	0	(4,479)	(14,873)	6,369	10,088
1984	12,514	0	0	0	3,700	10	724	16,949	(8,449)	(2,333)	0	(5,229)	(16,011)	938	5,443
1985	11,101	0	0	0	3,572	9	632	15,314	(7,214)	(2,306)	0	(6,464)	(15,984)	(670)	5,162
1986	11,173	0	0	0	3,692	10	598	15,474	(6,011)	(2,298)	0	(6,471)	(14,781)	693	6,566
1987	11,002	0	0	0	3,544	11	601	15,158	(7,221)	(2,287)	0	(7,240)	(16,748)	(1,590)	5,049
1988	10,528	0	0	0	3,738	10	576	14,852	(6,058)	(2,338)	0	(7,843)	(16,239)	(1,387)	5,881
1989	10,806	0	0	0	3,787	10	733	15,336	(6,066)	(2,316)	0	(10,924)	(19,305)	(3,969)	6,221
1990	10,796	0	0	0	3,795	8	729	15,330	(6,207)	(2,266)	0	(12,329)	(20,801)	(5,472)	6,128
1991	10,763	0	0	0	3,810	9	738	15,320	(6,783)	(2,300)	0	(10,497)	(19,580)	(4,260)	5,499
1992	12,031	0	0	0	3,778	24	701	16,534	(6,441)	(2,334)	0	(9,511)	(18,285)	(1,751)	7,059
1993	16,674	0	0	0	3,762	31	617	21,084	(7,370)	(2,368)	0	(7,157)	(16,895)	4,188	10,728
1994	14,501	0	0	0	3,769	30	614	18,914	(7,904)	(2,370)	0	(7,908)	(18,182)	732	8,026
1995	17,348	0	0	0	3,914	38	722	22,022	(8,187)	(2,403)	0	(5,859)	(16,448)	5,574	10,711
1996	12,728	0	0	0	3,802	9	715	17,254	(7,848)	(2,456)	0	(6,601)	(16,905)	349	6,234
1997	13,516	0	0	0	3,860	25	777	18,178	(8,056)	(2,476)	0	(7,887)	(18,419)	(241)	6,869
1998	17,156	0	0	0	4,016	35	884	22,090	(8,994)	(2,501)	0	(7,527)	(19,023)	3,068	9,711
1999	12,646	0	0	0	3,680	7	869	17,202	(7,889)	(2,489)	0	(9,820)	(20,198)	(2,996)	5,954
2000	11,648	0	0	0	3,916	8	849	16,422	(7,200)	(2,468)	0	(14,049)	(23,717)	(7,295)	5,905
2001	11,603	0	0	0	3,957	8	904	16,471	(7,407)	(2,367)	0	(14,538)	(24,313)	(7,842)	5,793
2002	11,278	0	0	0	3,870	9	829	15,987	(5,579)	(2,277)	0	(18,380)	(26,237)	(10,250)	7,301
2003	13,181	0	0	0	3,933	18	957	18,089	(5,686)	(2,301)	0	(12,107)	(20,094)	(2,005)	9,145
2004	14,892	0	0	0	4,033	22	805	19,752	(6,553)	(2,241)	0	(16,585)	(25,379)	(5,627)	10,153
2005	18,994	0	0	0	3,920	32	785	23,731	(7,106)	(2,229)	0	(14,497)	(23,832)	(101)	13,611
2006	14,645	0	3,501	0	4,242	5	826	23,220	(7,235)	(2,171)	0	(17,639)	(27,045)	(3,825)	9,486
2007	12,101	0	4,501	0	4,170	4	825	21,601	(7,740)	(2,115)	0	(20,329)	(30,184)	(8,583)	6,419
2008	12,520	0	3,933	0	4,764	12	736	21,964	(7,895)	(2,178)	0	(18,064)	(28,137)	(6,173)	7,222
2009	12,884	0	5,482	0	4,788	10	766	23,930	(8,128)	(2,217)	0	(16,410)	(26,755)	(2,825)	7,337
2010	14,003	0	7,065	0	5,270	15	754	27,106	(8,903)	(2,217)	0	(14,365)	(25,485)	1,620	8,167
2011	15,546	0	8,779	0	5,001	20	792	30,138	(10,499)	(2,209)	0	(14,471)	(27,179)	2,959	7,859
2012	14,738	0	8,983	0	5,198	8	738	29,665	(10,208)	(2,175)	0	(15,149)	(27,532)	2,133	7,561
2013	13,750	0	8,634	0	4,447	5	834	27,669	(11,260)	(2,089)	0	(17,613)	(30,962)	(3,293)	4,852
2014	13,750	0	5,013	0	3,365	7	760	22,895	(10,423)	(1,997)	0	(17,717)	(30,138)	(7,243)	4,701
2015	13,806	0	3,467	0	2,767	8	636	20,684	(9,943)	(1,982)	0	(13,421)	(25,346)	(4,662)	4,656
2016	13,860	0	10,796	0	4,624	11	690	29,981	(10,199)	(2,003)	0	(16,525)	(28,727)	1,254	6,293
2017	13,116	0	14,940	0	6,294	10	751	35,111	(12,461)	(1,979)	0	(16,618)	(31,058)	4,053	4,980
2018	14,450	0	12,621	0	4,367	12	736	32,187	(12,327)	(1,939)	0	(17,985)	(32,251)	(64)	4,564
2019	16,732	0	14,153	0	6,512	19	828	38,245	(14,103)	(1,900)	0	(16,961)	(32,965)	5,280	7,261
2020	15,652	0	11,469	0	5,908	9	812	33,849	(13,582)	(1,812)	0	(19,452)	(34,847)	(997)	6,174
2021	15,027	0	2,504	0	1,750	4	700	19,985	(11,017)	(1,924)	0	(21,039)	(33,980)	(13,995)	3,840
2022	15,166	0	1,811	0	2,321	5	762	20,065	(11,477)	(1,738)	0	(19,763)	(32,979)	(12,914)	4,276
2023	20,176	0	16,781	0	4,753	41	581	42,332	(9,068)	(1,756)	0	(21,138)	(31,962)	10,370	14,146

Groundwater Budget for the Beaumont Basin Adjudicated Area (January 1978 - December 2032)

	Groundwater Inflows (acre-ft)								Groundwater Outflows (acre-ft)						
									Total Subsurface Outflow[f]						
Year	Subsurface Inflow into the Adjudicated Area	"Channels" Inflow into the Adjudicated Area (DRT)	Imported Water for Recharge[a]	Imported Water for Injection[b]	Deep Infiltration of Precipitation and Runoff in Stream[c]	Recharge from the Mountain Block	Wellbore Flow[d]	Total Inflow[e]	Non-Channel Subsurface Outflow	Channel Subsurface Outflow	Evapotran-spiration (ET)	Groundwater Pumping	Total Outflow[g]	Change in Storage[h]	Annualized Safe Yield[i]
2024	20,765	0	13,496	0	4,098	32	578	38,969	(9,361)	(1,766)	0	(21,388)	(32,516)	6,453	13,767
2025	16,249	0	6,921	0	2,439	8	591	26,208	(9,812)	(1,951)	0	(21,822)	(33,584)	(7,376)	6,934
2026	15,404	0	10,034	2,000	1,303	9	2,753	31,503	(10,011)	(1,625)	0	(23,732)	(35,367)	(3,864)	5,080
2027	14,835	0	7,437	2,000	1,416	6	2,740	28,434	(10,103)	(1,599)	0	(23,973)	(35,676)	(7,242)	4,555
2028	14,181	0	4,801	2,000	1,708	9	2,750	25,448	(8,642)	(1,827)	0	(24,226)	(34,695)	(9,247)	5,428
2029	16,746	0	12,414	2,000	783	20	2,775	34,738	(11,330)	(1,753)	0	(24,497)	(37,580)	(2,842)	4,465
2030	16,562	0	12,020	2,000	1,555	17	2,735	34,889	(10,053)	(1,533)	0	(24,711)	(36,297)	(1,408)	6,548
2031	20,821	0	14,795	2,000	2,501	33	2,689	42,839	(8,793)	(1,725)	0	(24,888)	(35,406)	7,433	12,837
2032	16,336	0	7,437	2,000	1,423	6	2,710	29,912	(10,068)	(1,501)	0	(25,147)	(36,716)	(6,804)	6,197
Average (1978 - 2022)	13,568	0	2,837	0	4,013	17	763	21,197	(8,401)	(2,289)	0	(12,181)	(22,872)	(1,675)	6,907
Average (1978 - 2032)	14,230	0	4,251	255	3,683	17	1,004	23,439	(8,642)	(2,183)	0	(14,249)	(25,073)	(1,634)	7,105

Notes:

[a] Values prior to 2023 are reported values provided by the stakeholders. Values from 2023 onward are based on anticipated deliveries off the State Water Project associated with forecasted precipitation.

[b] Values reported by YVWD.

[c] Includes deep percolation of precipitation and runoff in stream, channels (stream channels include Noble Creek and Marshall Creek), and return flows (e.g., landscaping, parks, golf courses, transmission losses, septic systems, etc.).

[d] Wellbore flow refers to the movement of water through the annular space between the well casing and the surrounding formation in a groundwater well.

[e] "Total Inflow" is the sum of all the groundwater inflows.

[f] Total Subsurface Outflow is the sum of "Non-Channel Subsurface Outflow" and "Channel Subsurface Outflow".

[g] "Total Outflow" is the sum of "Total Subsurface Outflow", "Evapotranspiration", and "Groundwater Pumping".

[h] As all "Total Outflow" values are presented as negative (parenthesized) values, the "Change in Storage" is calculated as "Total Inflow plus Total Outflow".

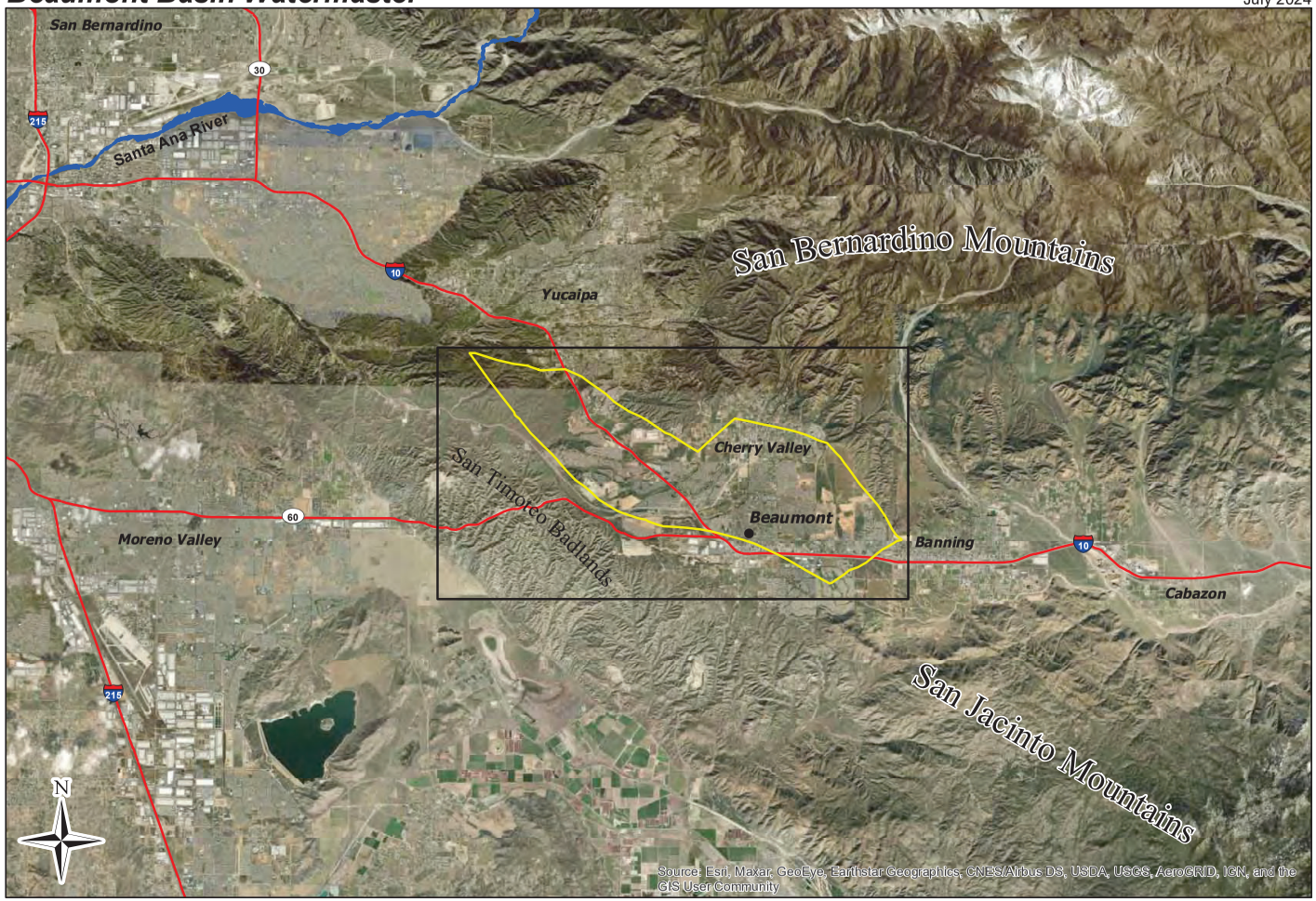
[i] Annualized Safe Yield is based on net groundwater pumping, change in storage, and imported water for recharge and injection. Net groundwater pumping is the difference between "Groundwater Pumping" and "Wellbore Flow". (See Equation 4 in Section 1.3)

Figures

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

- Study Area
- Beaumont Basin Adjudicated Area
- Santa Ana River
- Freeway/Highway

Regional Setting



Regional Map

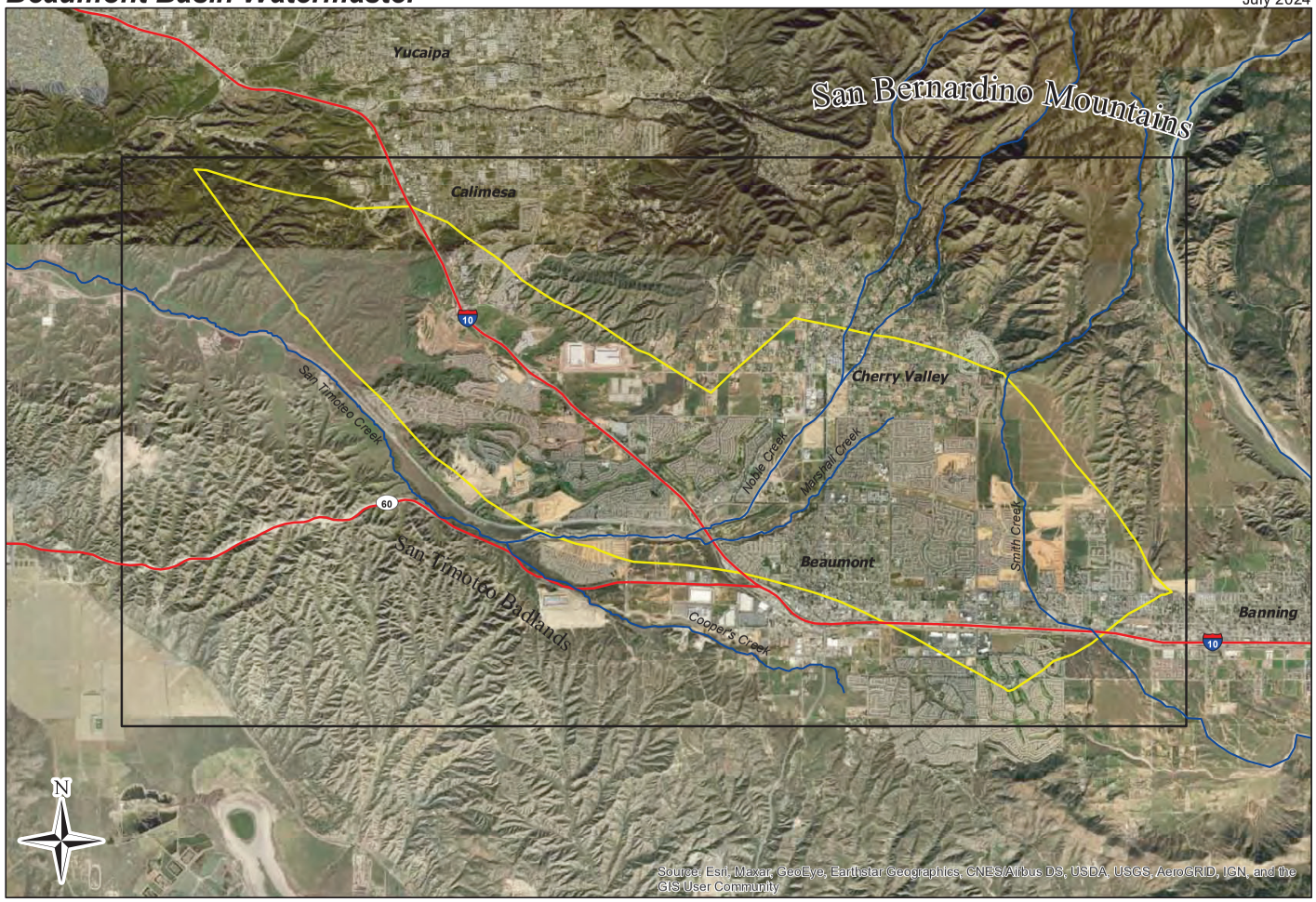
Figure 1

Thomas Harder & Co.
Groundwater Consulting

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



Map Features

- Study Area
- Beaumont Basin Adjudicated Area
- Creek
- Freeway/Highway

NAD 83 State Plane Zone 6

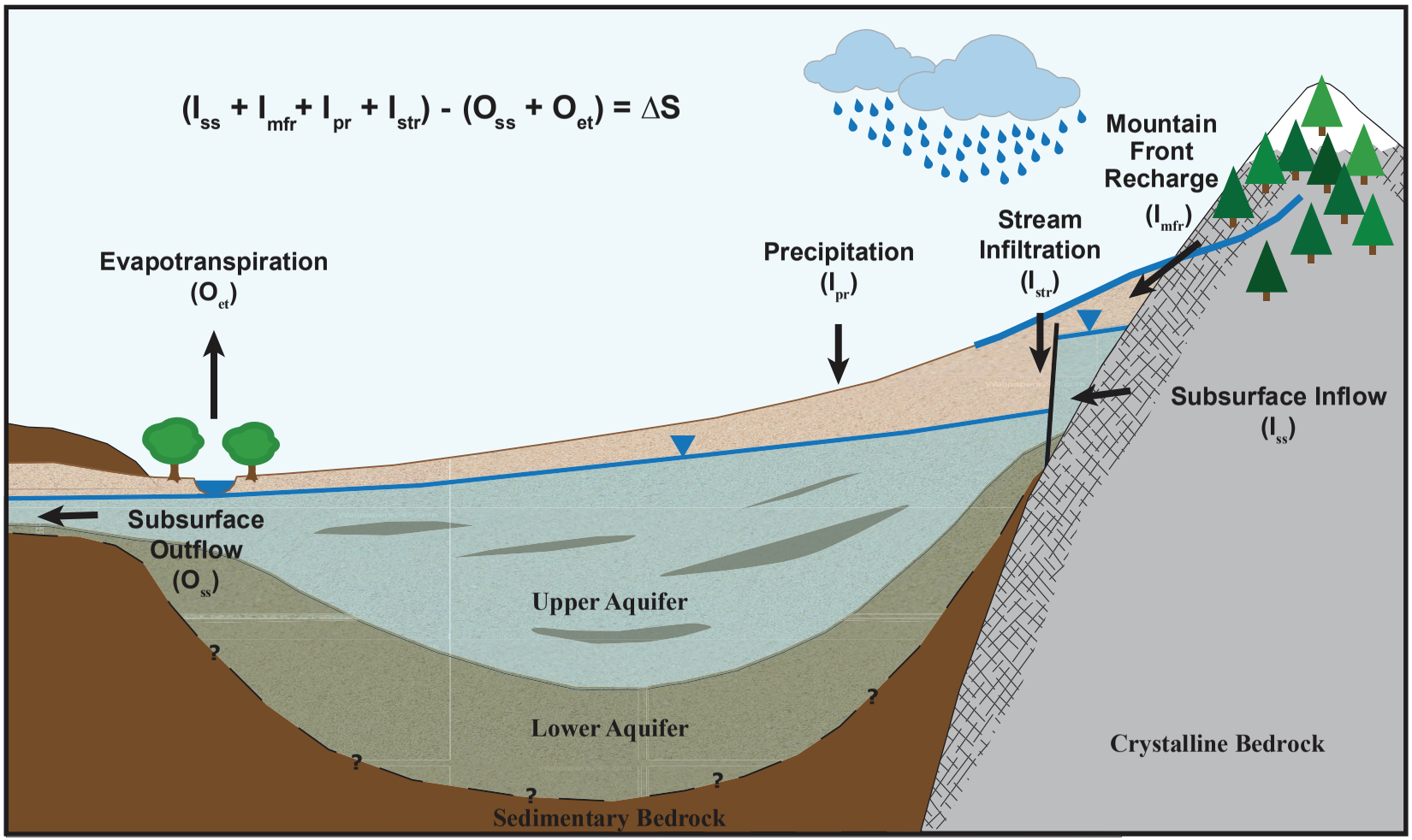
Thomas Harder & Co.
Groundwater Consulting

Beaumont Basin Study Area

Figure 2

Figure 3

Conceptual Water Balance - Pre-developed Conditions



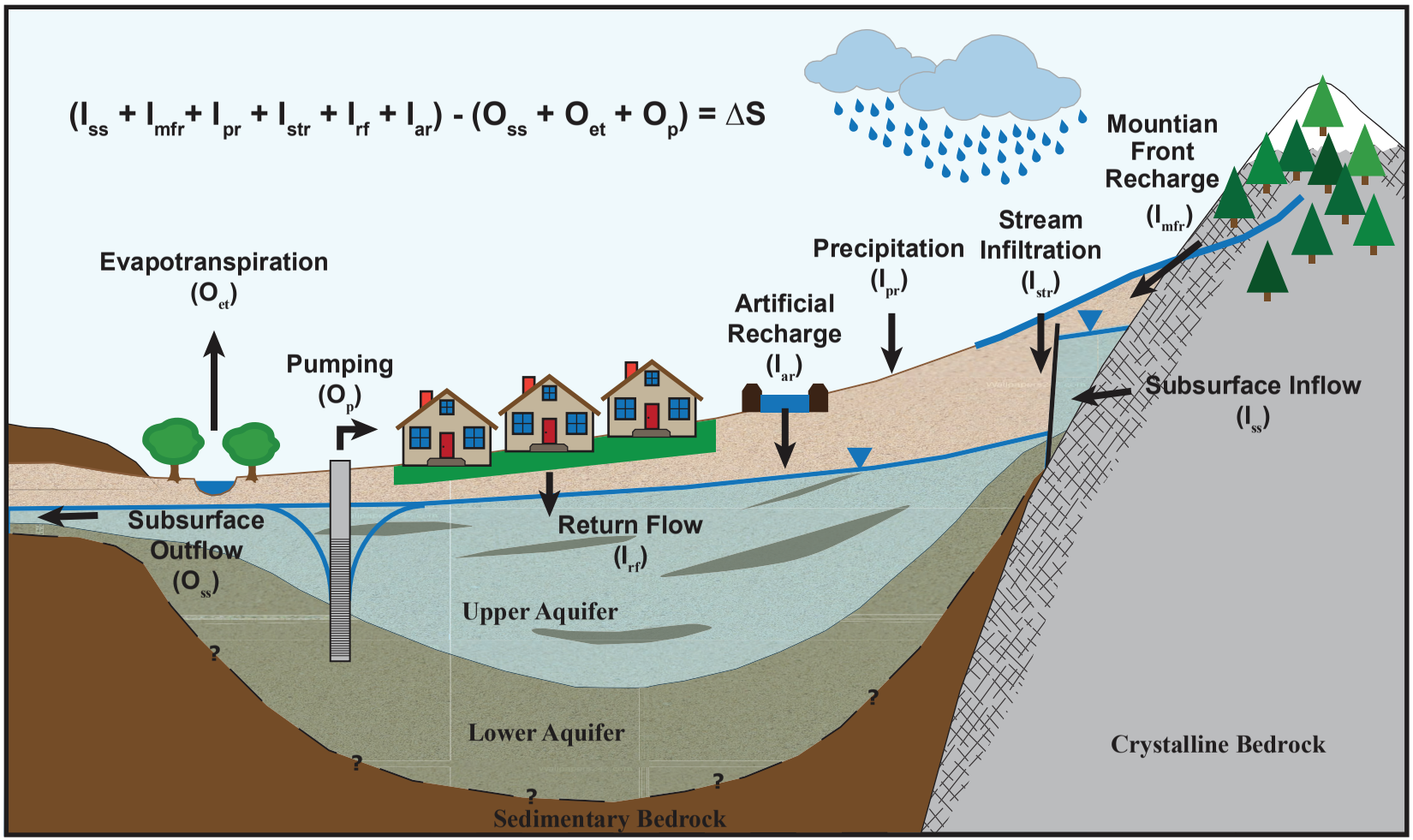
Note:
*Not to scale.

Thomas Harder & Co.
Groundwater Consulting

July 2024

Figure 4

Conceptual Water Balance - Developed Conditions

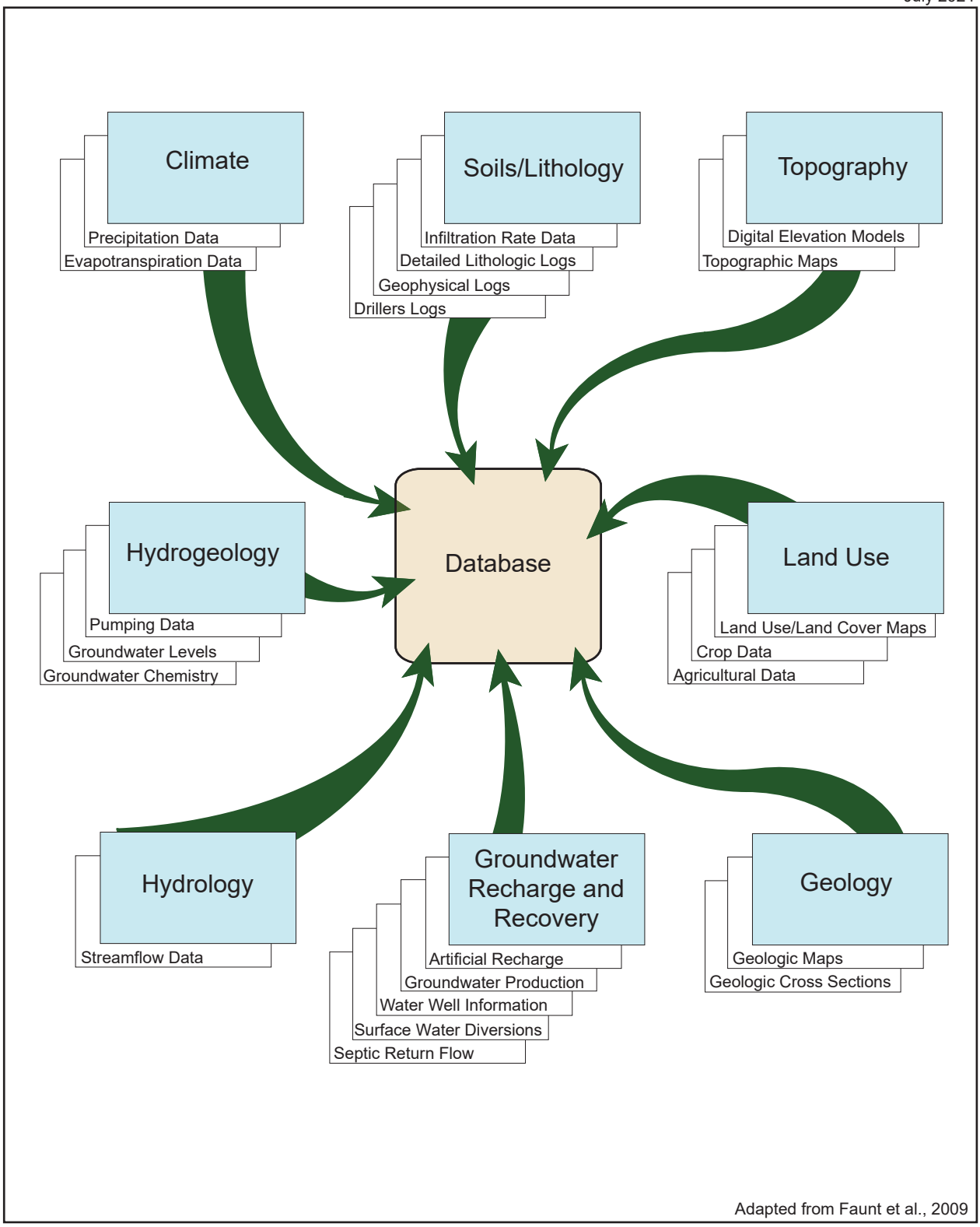


Note:
*Not to scale.

Thomas Harder & Co.
Groundwater Consulting

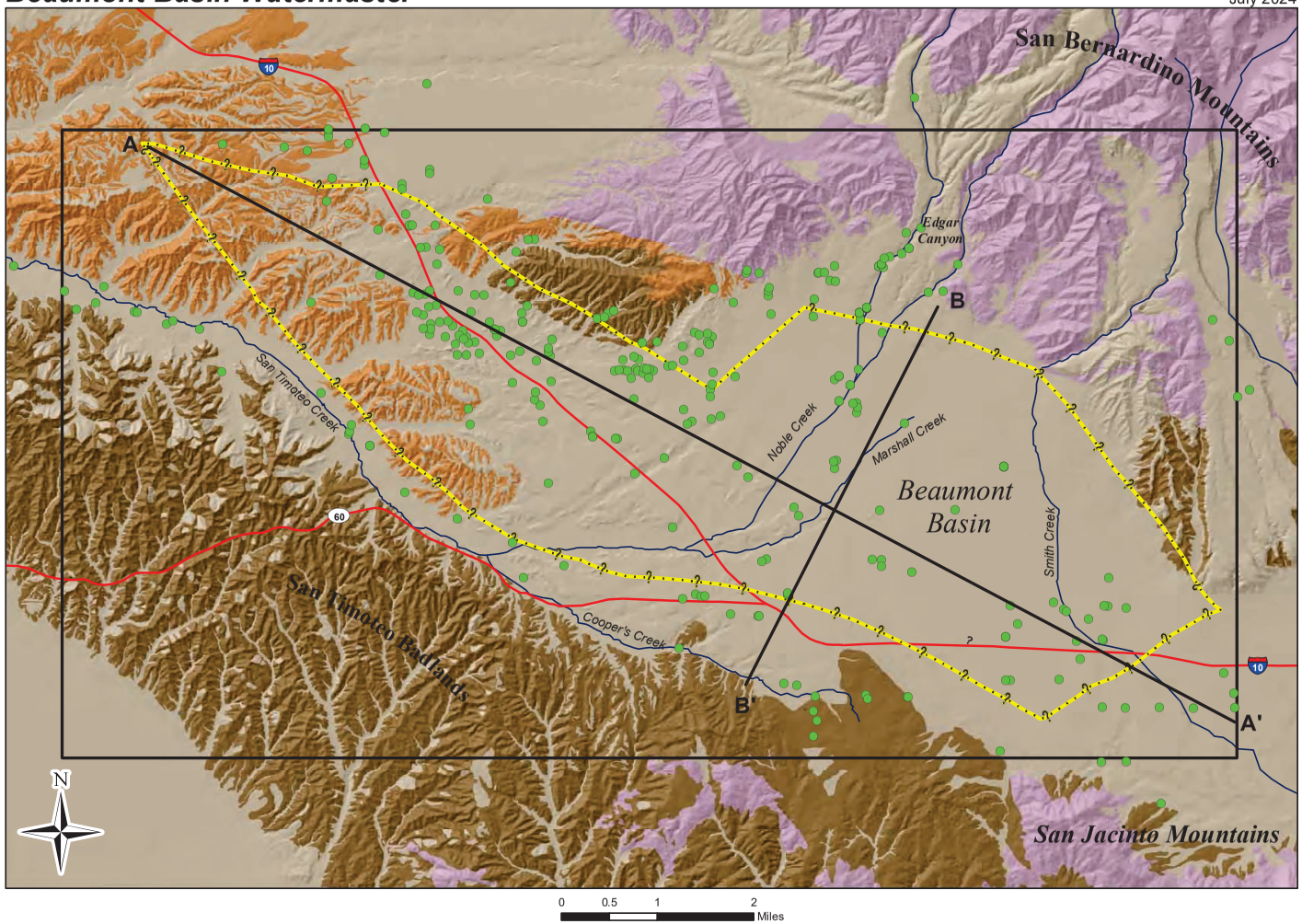
July 2024

Beaumont Basin Watermaster



Thomas Harder & Co.
Groundwater Consulting

Data Type Diversity Flow Chart
Figure 5



NAD 83 State Plane Zone 6

Map Features

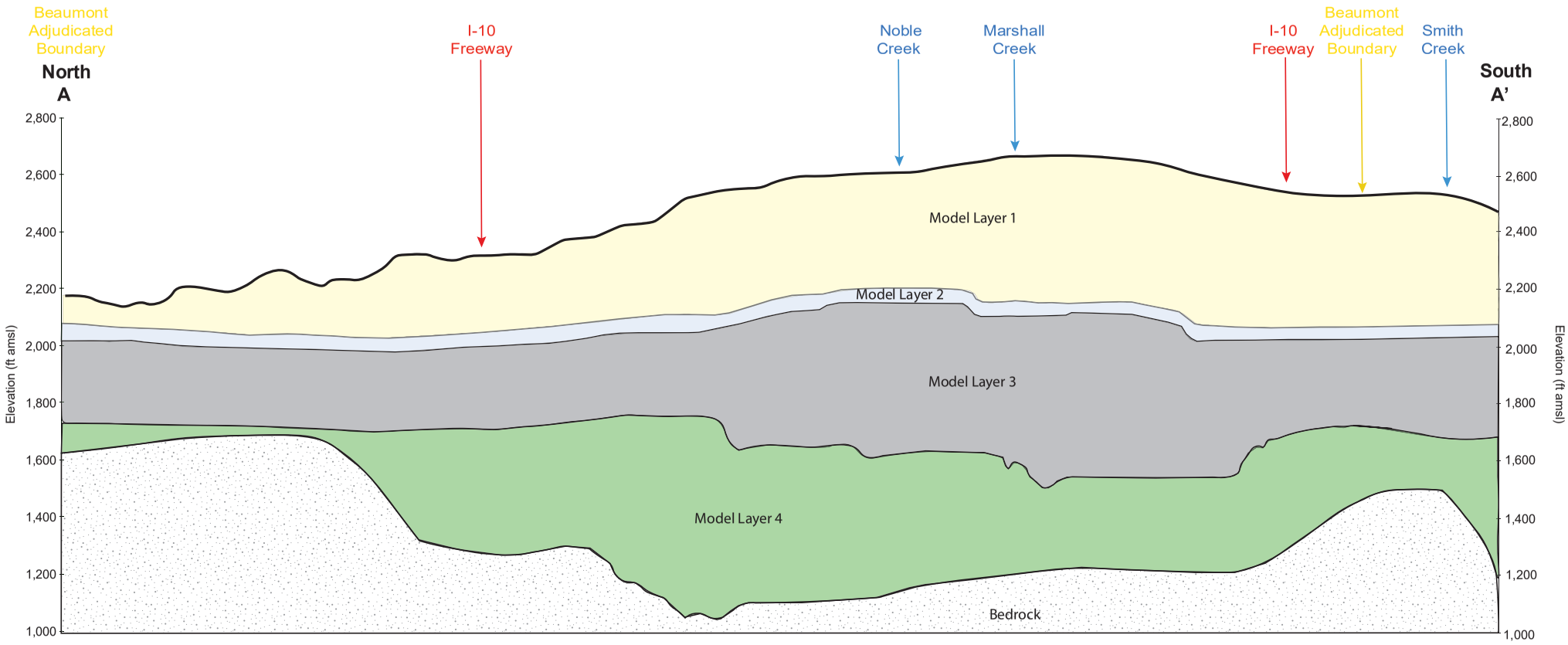
- Well
- Surficial or Alluvial Deposits
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Concealed Fault (Bloyd, 1971) - Hypothetical where Queried
- (Beaumont Basin Adjudication Boundary)
- Stream
- Freeway/Highway
- Study Area

Note: Geology modified from California Geological Survey, Special Report 217 (Revised, 2012); USGS Open-File Report 2005-1305; and USGS Scientific Investigations Report 2006-5026 (Rewis et al., 2006).

Thomas Harder & Co.
Groundwater Consulting

Geology of Beaumont Basin

Figure 6

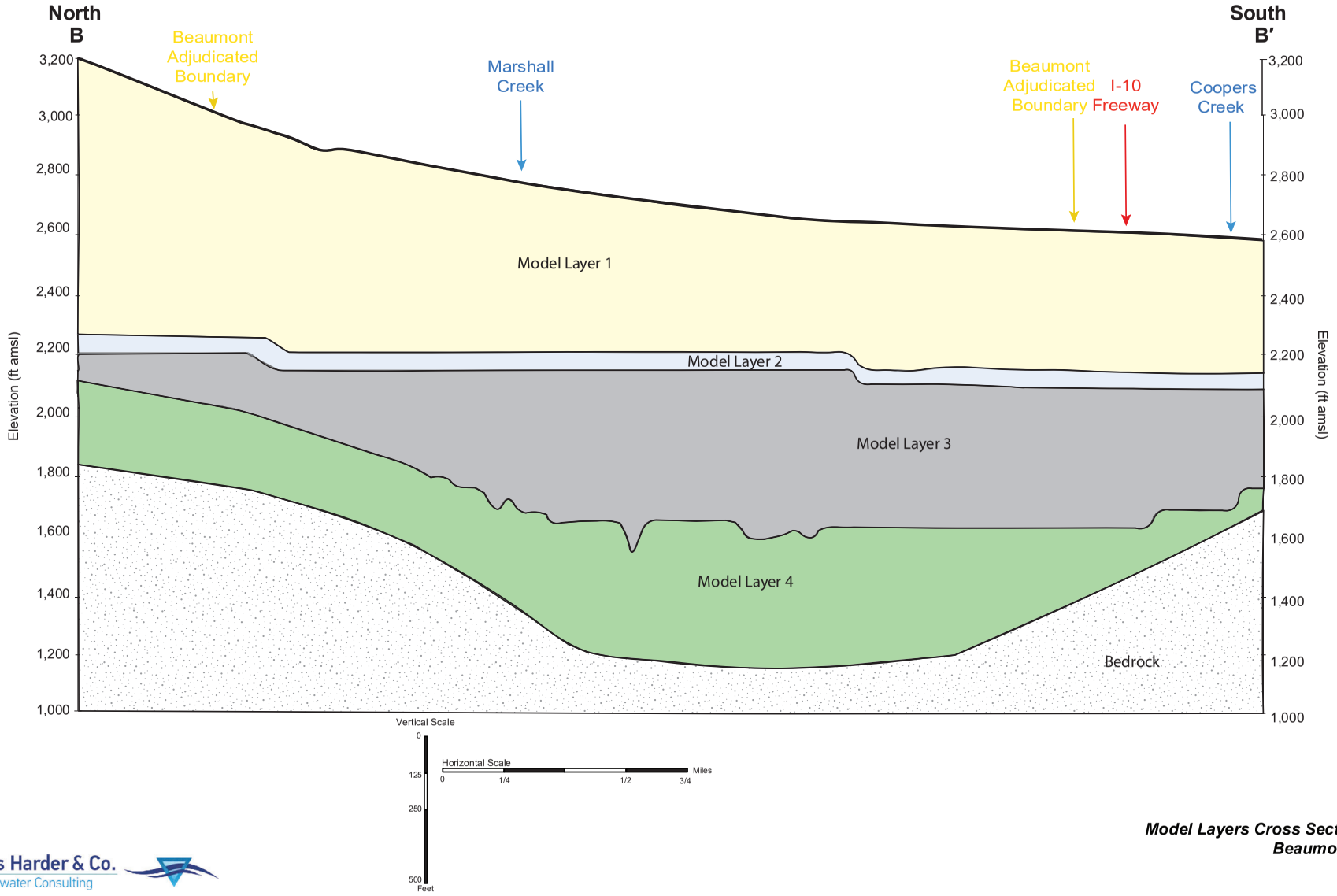


Vertical Scale
0
225
450
Feet

Horizontal Scale
0 3/4 1 1/2 Miles

Thomas Harder & Co.
Groundwater Consulting

Model Layers Cross Section A-A'
Beaumont Basin
Figure 7
July 2024



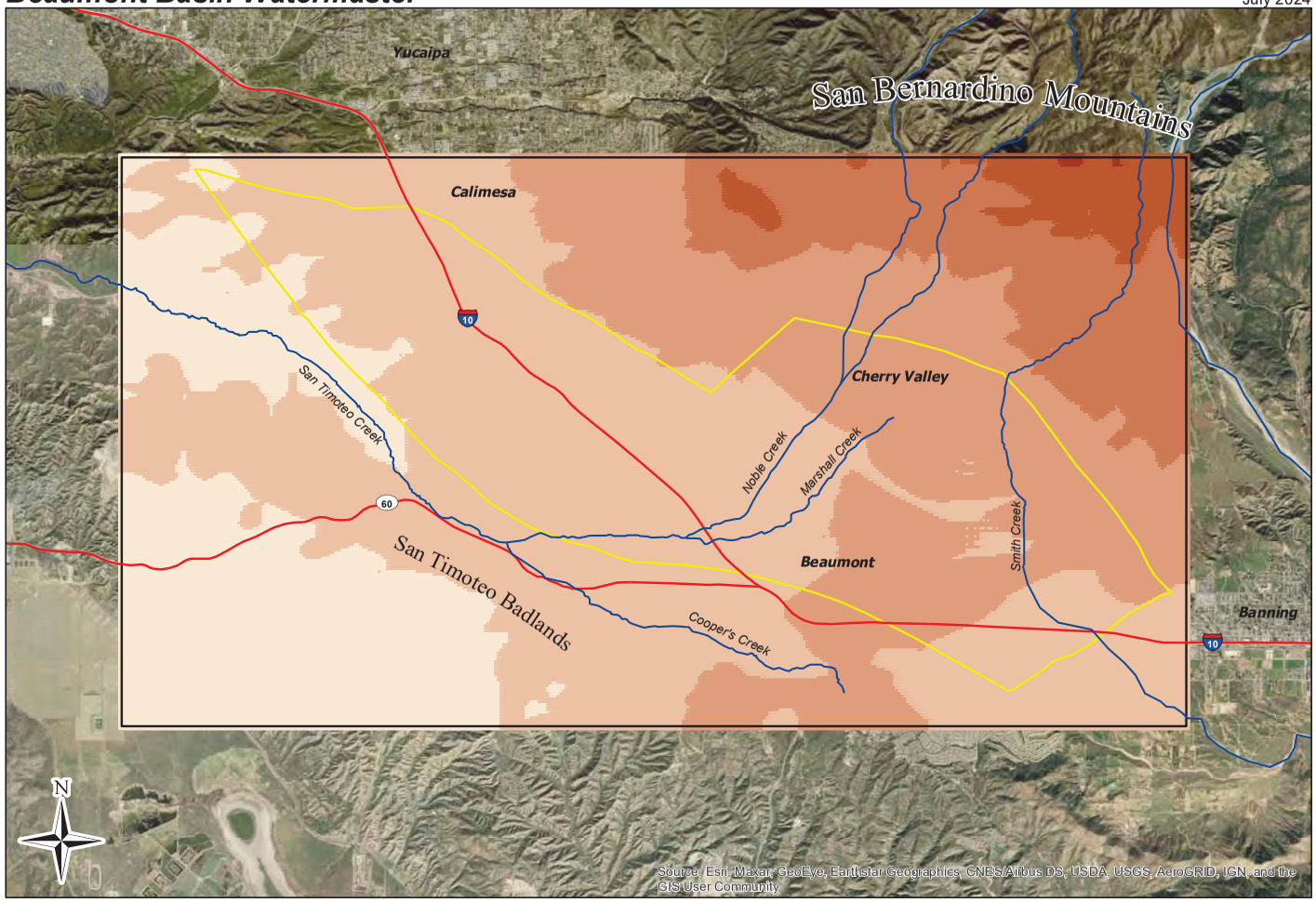
Model Layers Cross Section B-B'
Beaumont Basin
Figure 8
July 2024

Thomas Harder & Co.
Groundwater Consulting

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Layer Thickness (ft)
- 50 to 100
- 100 to 500
- 500 to 1000
- 1000 to 1500
- 1500 to 2000
- 2000 to 2100
- Study Area
- Beaumont Basin Adjudicated Area
- Creek
- Freeway/Highway

Layer 1 Thickness

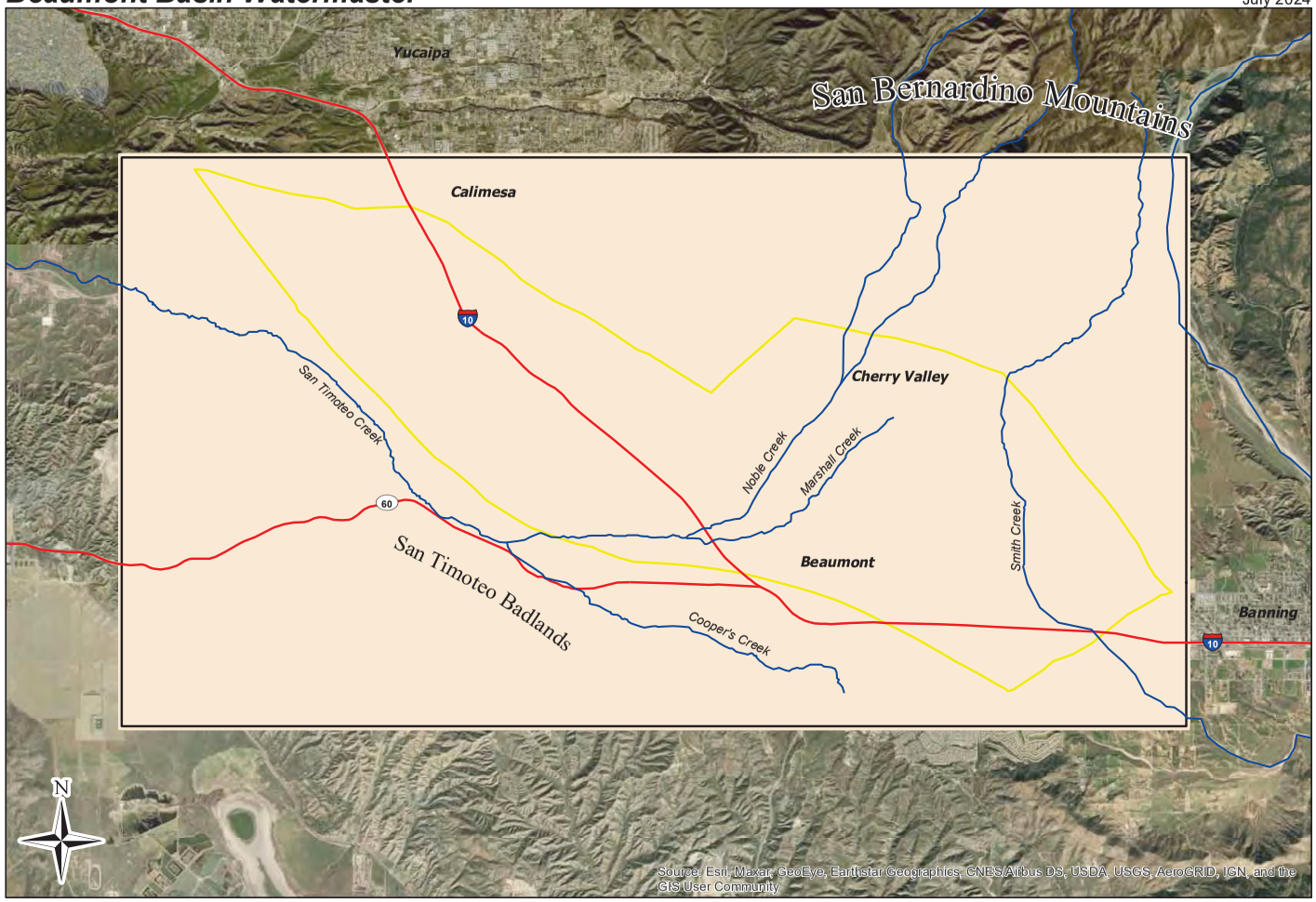
Thomas Harder & Co.
Groundwater Consulting

Figure 9a

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



Map Features

- Layer Thickness (ft)
  - 50
- Study Area
- Beaumont Basin Adjudicated Area
- Creek
- Freeway/Highway

0 0.5 1 2 Miles

NAD 83 State Plane Zone 6

Layer 2 Thickness

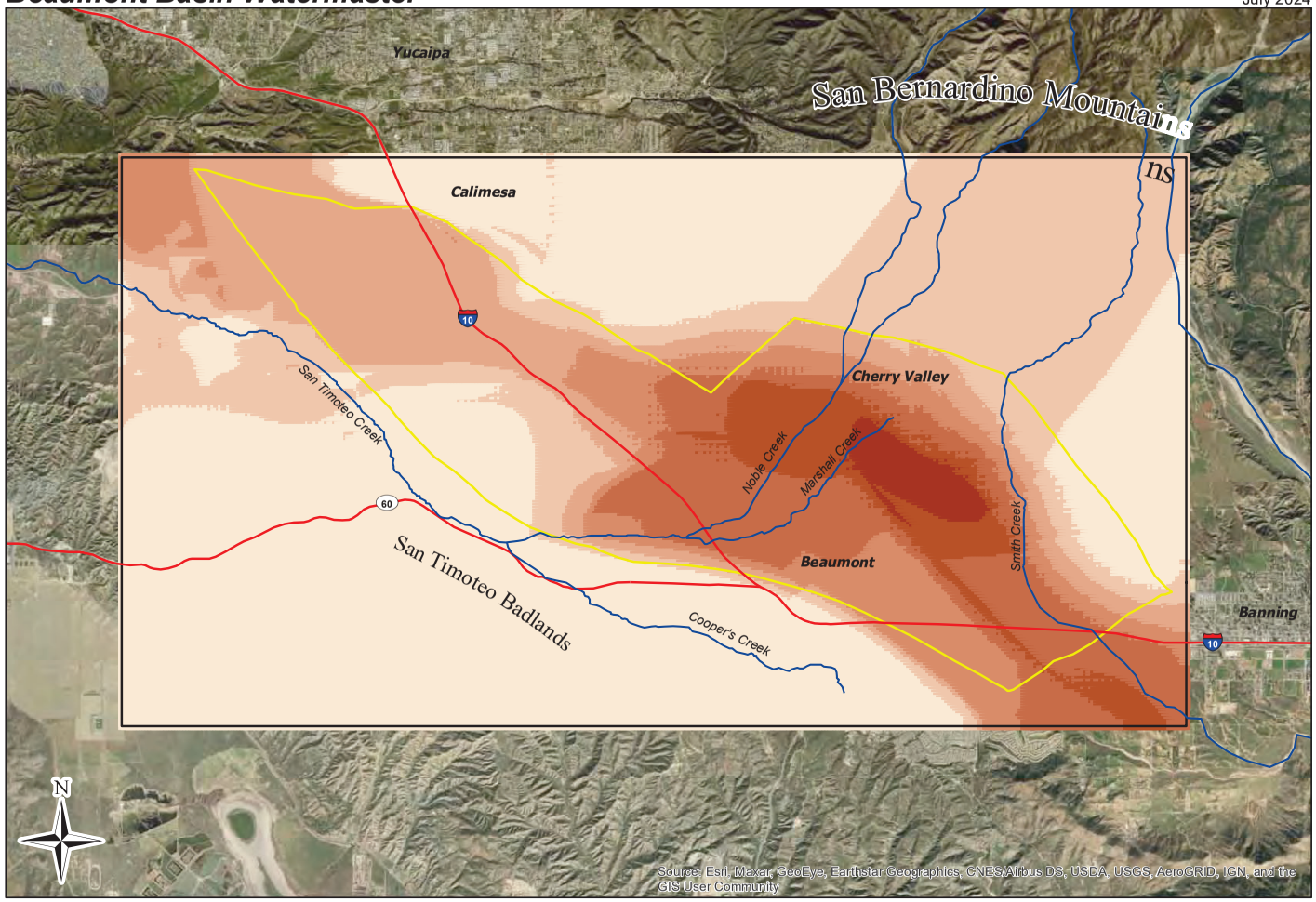
Thomas Harder & Co.
Groundwater Consulting

Figure 9b

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Layer Thickness (ft)
- 0 to 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500
- 500 to 600
- 600 to 700
- Study Area
- Beaumont Basin Adjudicated Area
- Creek
- Freeway/Highway

Layer 3 Thickness

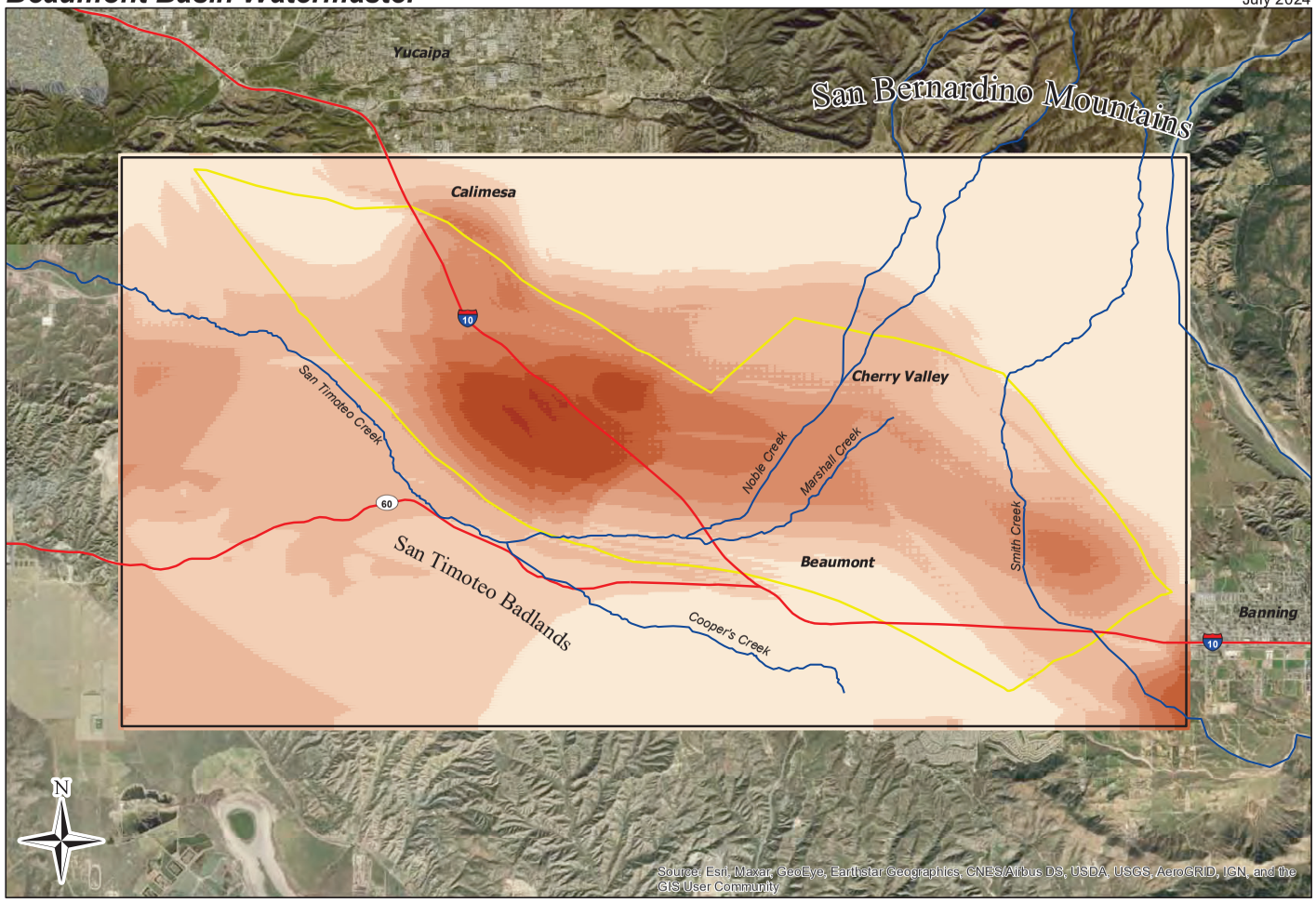
Thomas Harder & Co.
Groundwater Consulting

Figure 9c

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

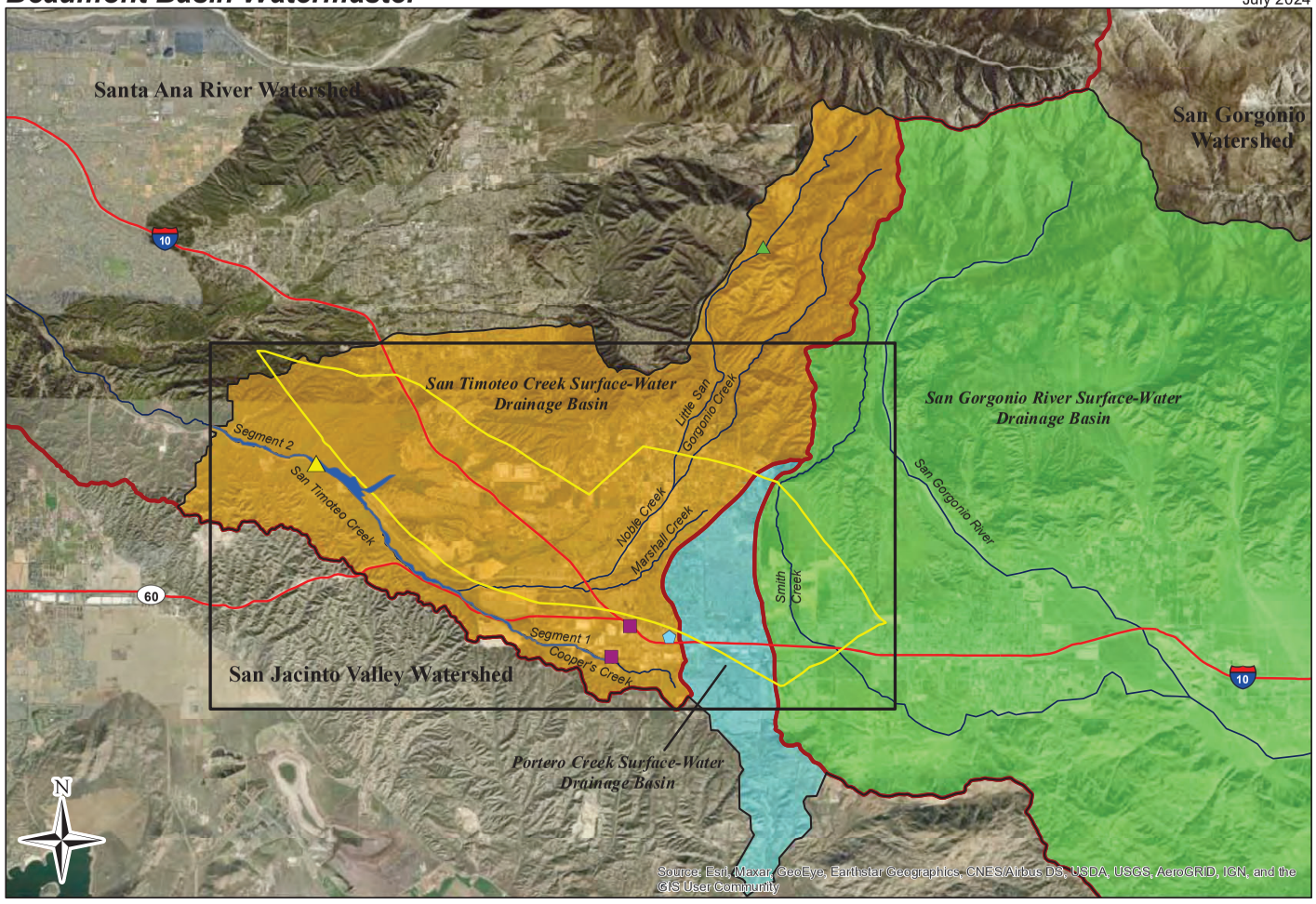
Layer Thickness (ft)
- 0 to 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500
- 500 to 600
- 600 to 700
- 700 to 800
- 800 to 900

Study Area
Beaumont Basin Adjudicated Area
Creek
Freeway/Highway

Layer 4 Thickness

Thomas Harder & Co.
Groundwater Consulting

Figure 9d



NAD 83 State Plane Zone 6

Map Features

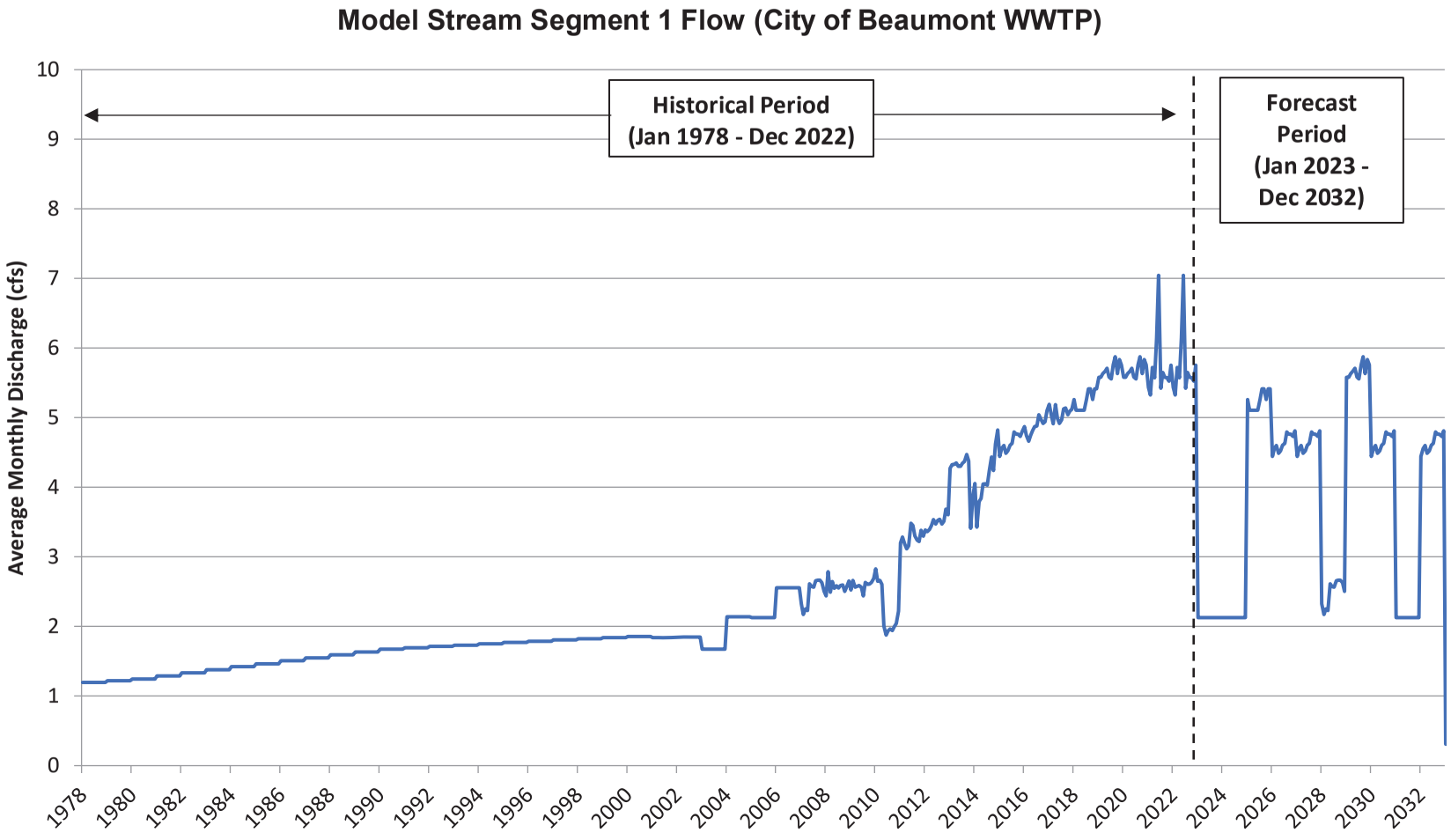
- Wastewater Treatment Plant Discharge Location
- Beaumont Precipitation Station
- Little San Gorgonio Creek Discharge Measurement Location
- San Timoteo Creek Discharge Measurement Location
- Creek
- Freeway/Highway
- San Timoteo Creek Surface-Water Drainage Basin
- San Gorgonio River Surface-Water Drainage Basin
- Portero Creek Surface-Water Drainage Basin
- Watershed
- Beaumont Basin Area Drainage Basin
- Riparian Area
- Study Area
- Beaumont Basin Adjudicated Area

Thomas Harder & Co.
Groundwater Consulting

Surface Water Features in the Beaumont Basin Area

Figure 10

Figure 11

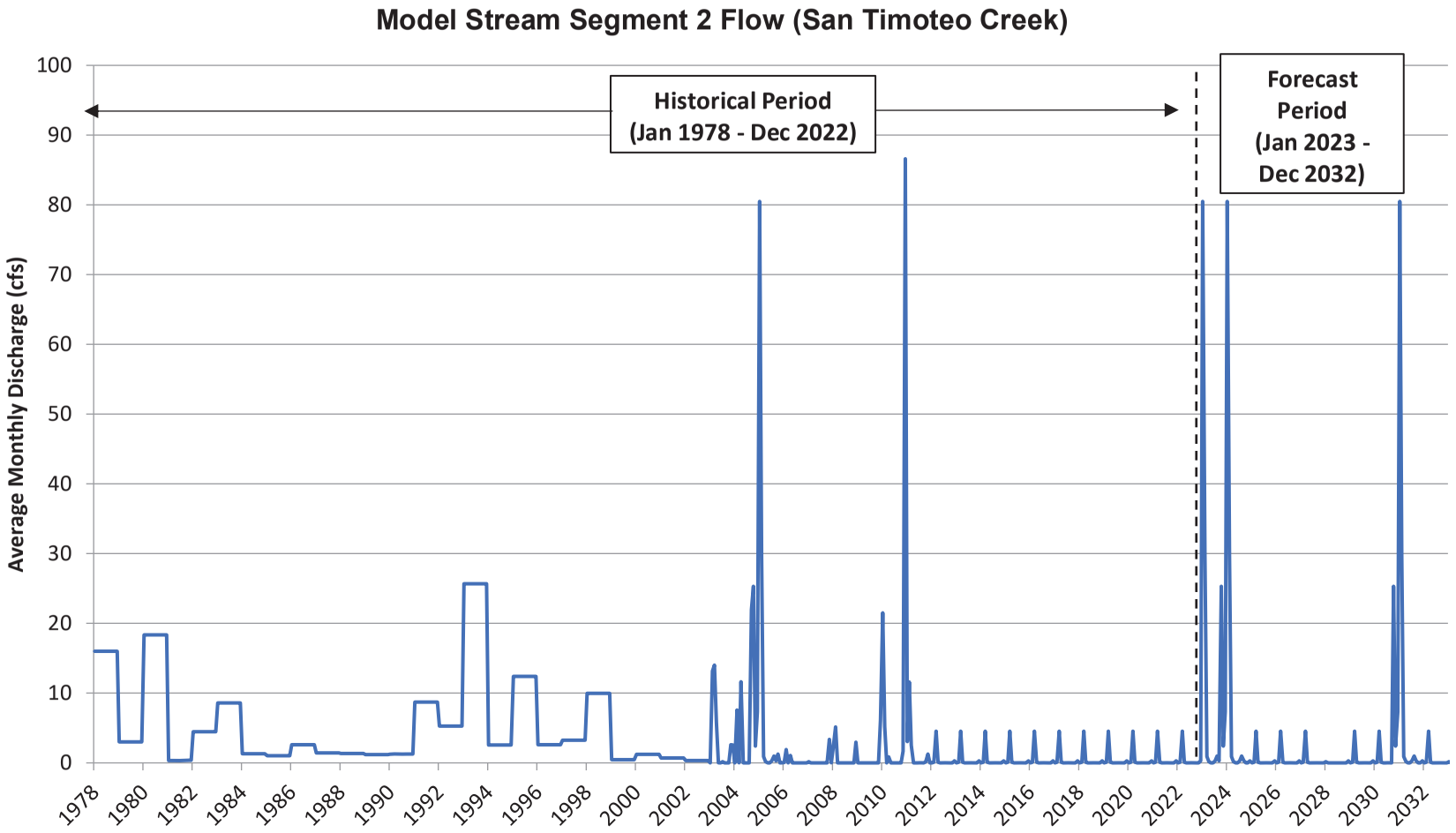


Notes: Historical period data comes from treated wastewater discharges to Coopers Creek by the City of Beaumont.
Forecast period wastewater recharge was determined using proxy years from the historical period (See Section 2.13).

Thomas Harder & Co.
Groundwater Consulting

July 2024

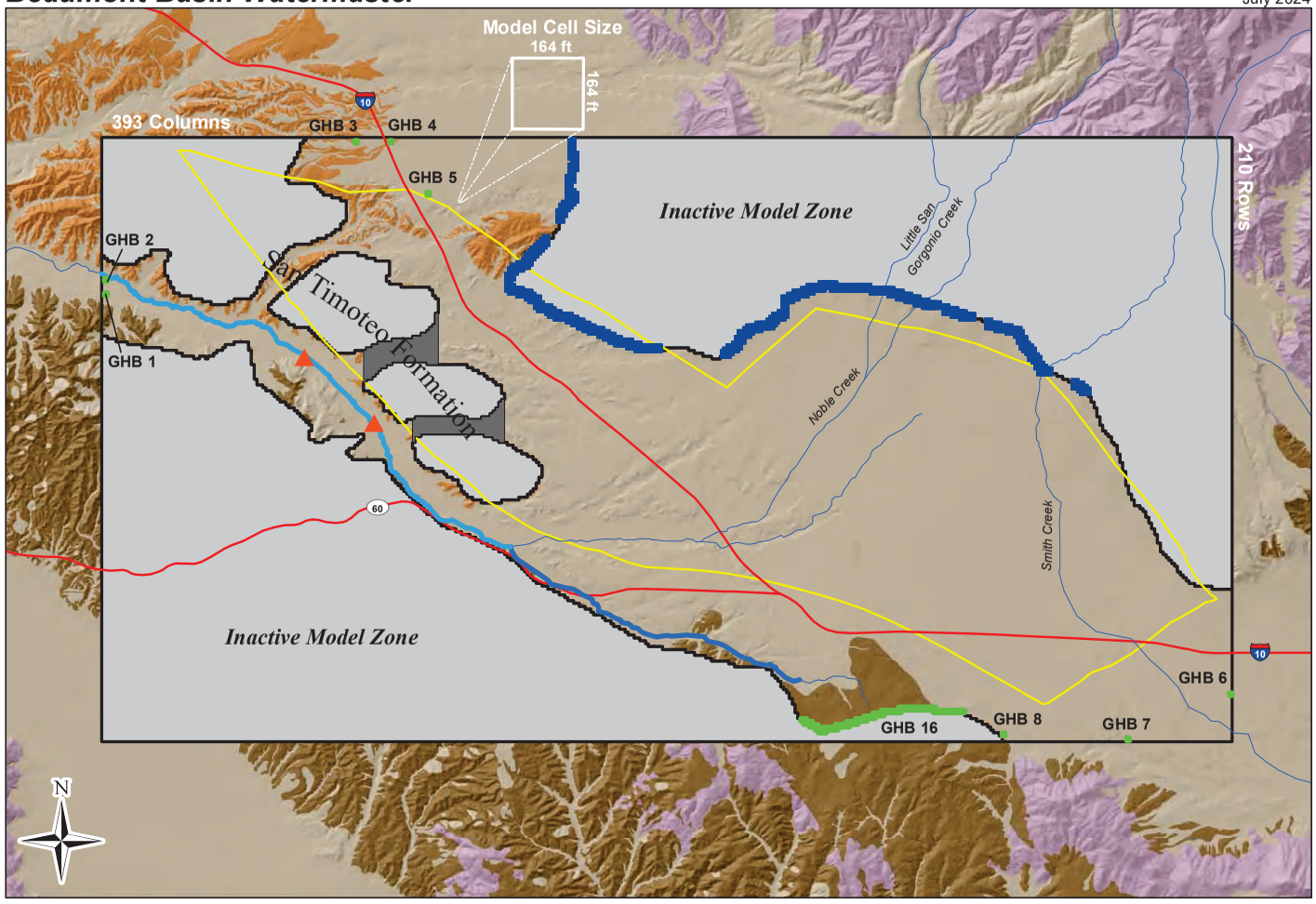
Figure 12



Notes: Historical period data for 1978-1985 was interpolated from the USGS Little San Gorgonio Creek gage.
Historical period data for 2002-2012 was measued by YVWD on San Timoteo Creek.
Forecast period wastewater recharge was determined using proxy years from the historical period (See Section 2.13).

Thomas Harder & Co.
Groundwater Consulting

July 2024



Map Features

- Model Stream Segment 2
- Model Stream Segment 1
- Boundary Recharge Cell
- General Head Boundary
- Model Drain Cells
- Model Drain Return Cells
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Active Model Zone
- Inactive Model Zone
- Beaumont Basin Adjudicated Area
- Creek
- Freeway/Highway

Model Boundary Conditions and Features

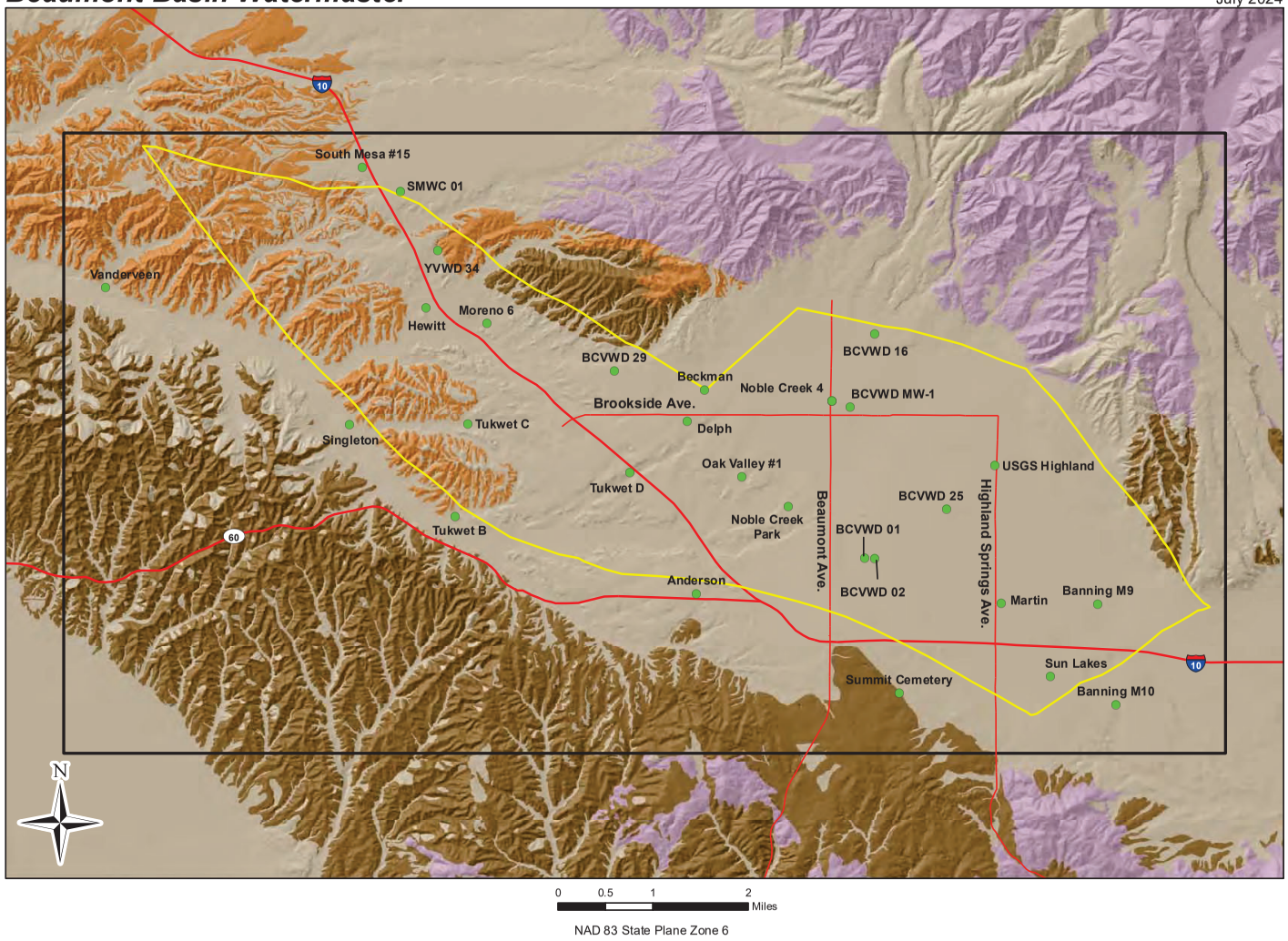
Figure 13

Thomas Harder & Co.
Groundwater Consulting

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



Map Features

- Calibration Well
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Study Area
- Beaumont Basin Adjudicated Area
- Major Street
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

Monitoring Wells Used for Model Calibration

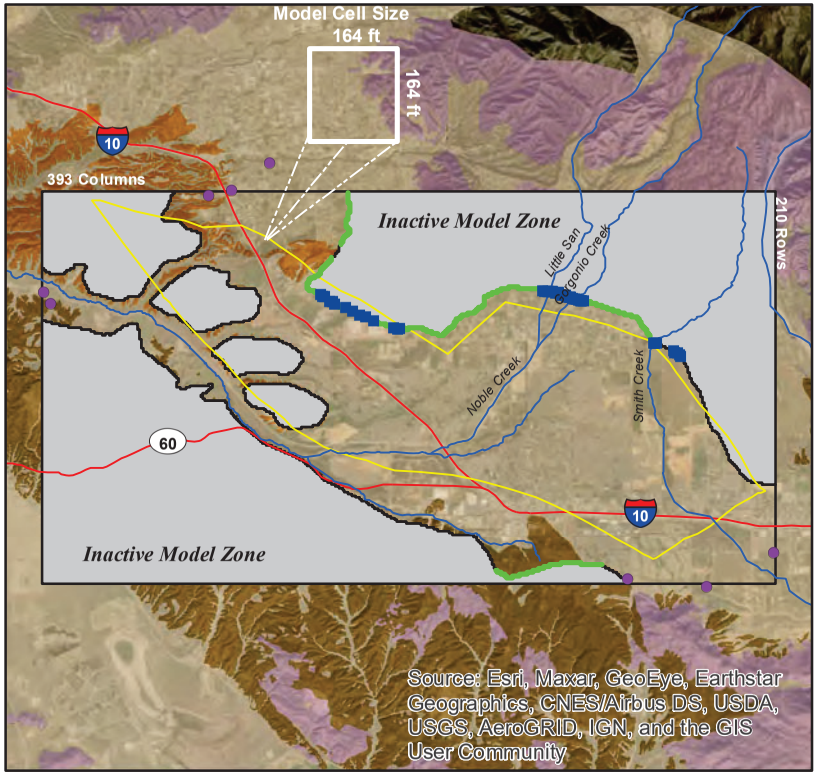
Figure 14

Beaumont Basin Watermaster

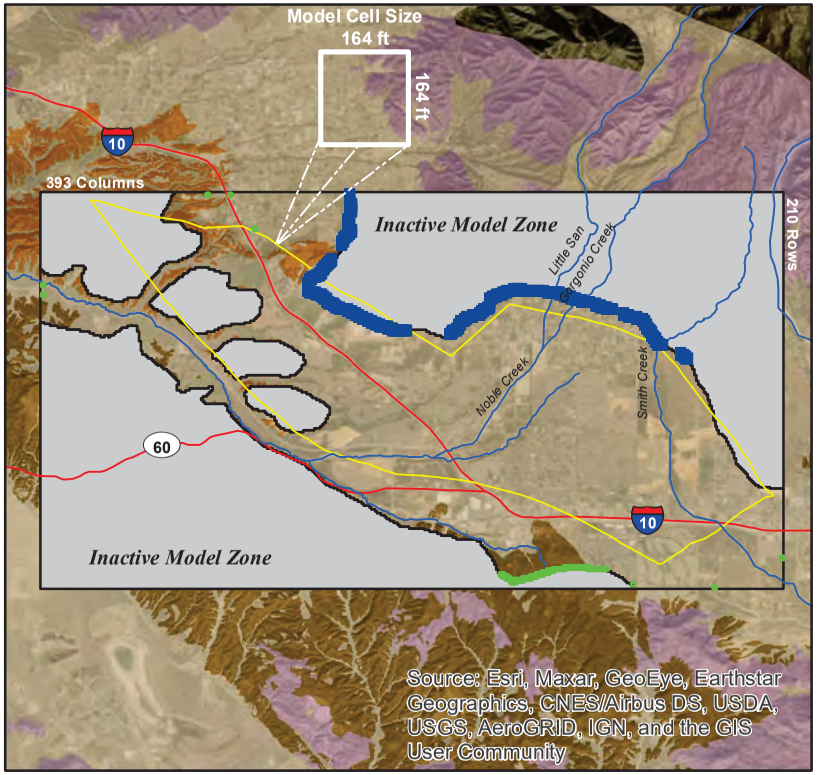
2023 Reevaluation of the Beaumont Basin Safe Yield

July 2024

2013 Model Update



2023 Model Update



Map Features

- Constant Head Cell
- Boundary Recharge Cell
- General Head Boundary
- Creek
- Freeway/Highway
- Active Model Zone
- Inactive Model Zone
- Beaumont Basin Adjudicated Area
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex

N

Thomas Harder & Co.
Groundwater Consulting

0 1.25 2.5 5 Miles

NAD 83 State Plane Zone 6

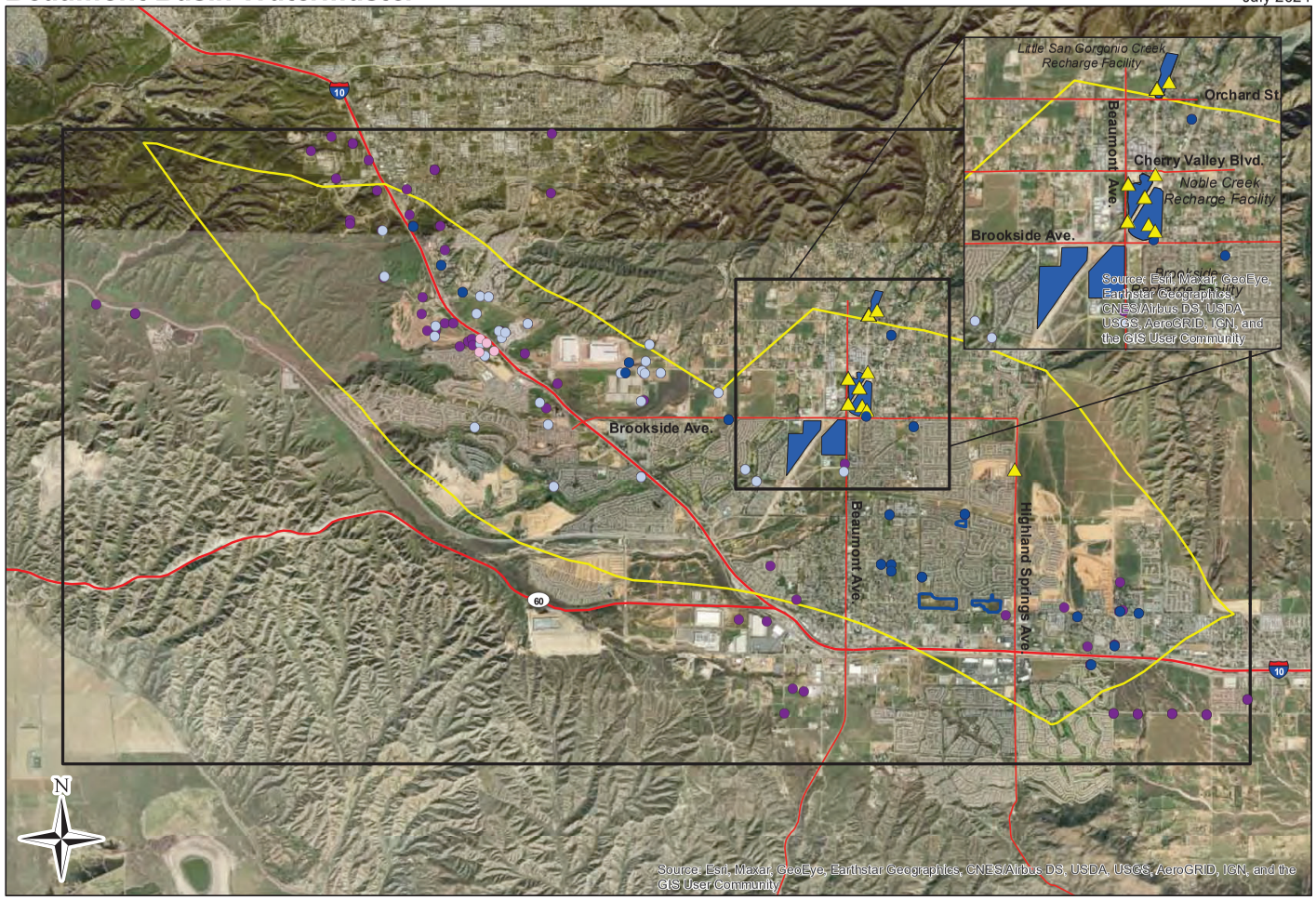
2023 Updates to Model Boundary Conditions

Figure 15

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



Map Features

- Appropriator Production Well
- Overlayer Production Well
- Other Production Well
- Injection Well
- Monitoring Well
- Study Area
- Recharge Facility
- Beaumont Basin Adjudicated Area
- City of Beaumont Stormwater Capture Basin
- Major Street
- Freeway/Highway

NAD 83 State Plane Zone 6

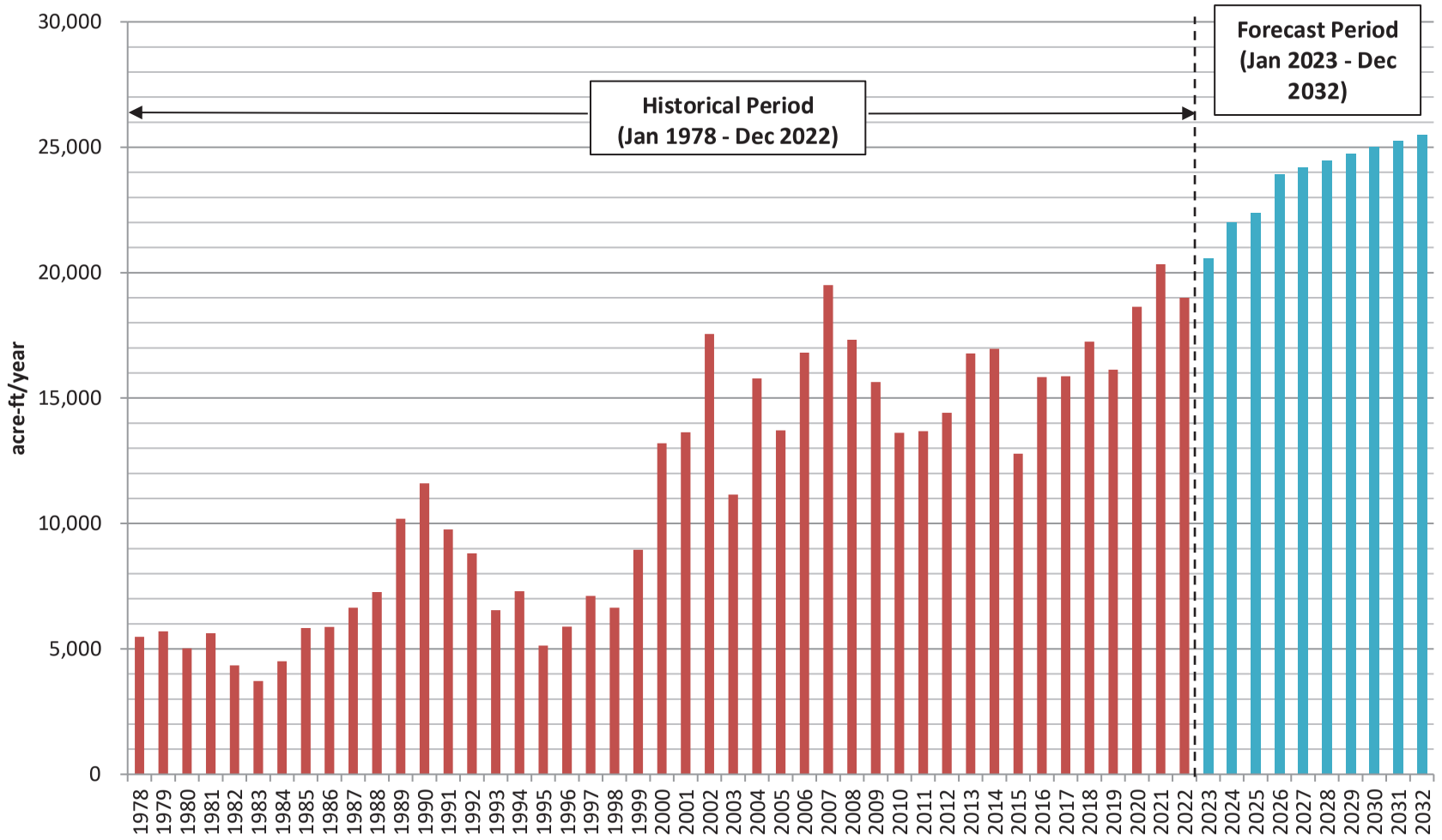
Thomas Harder & Co.
Groundwater Consulting

Groundwater Wells and Recharge Facilities

Figure 16

Figure 17

Beaumont Basin Groundwater Production and Safe Yield

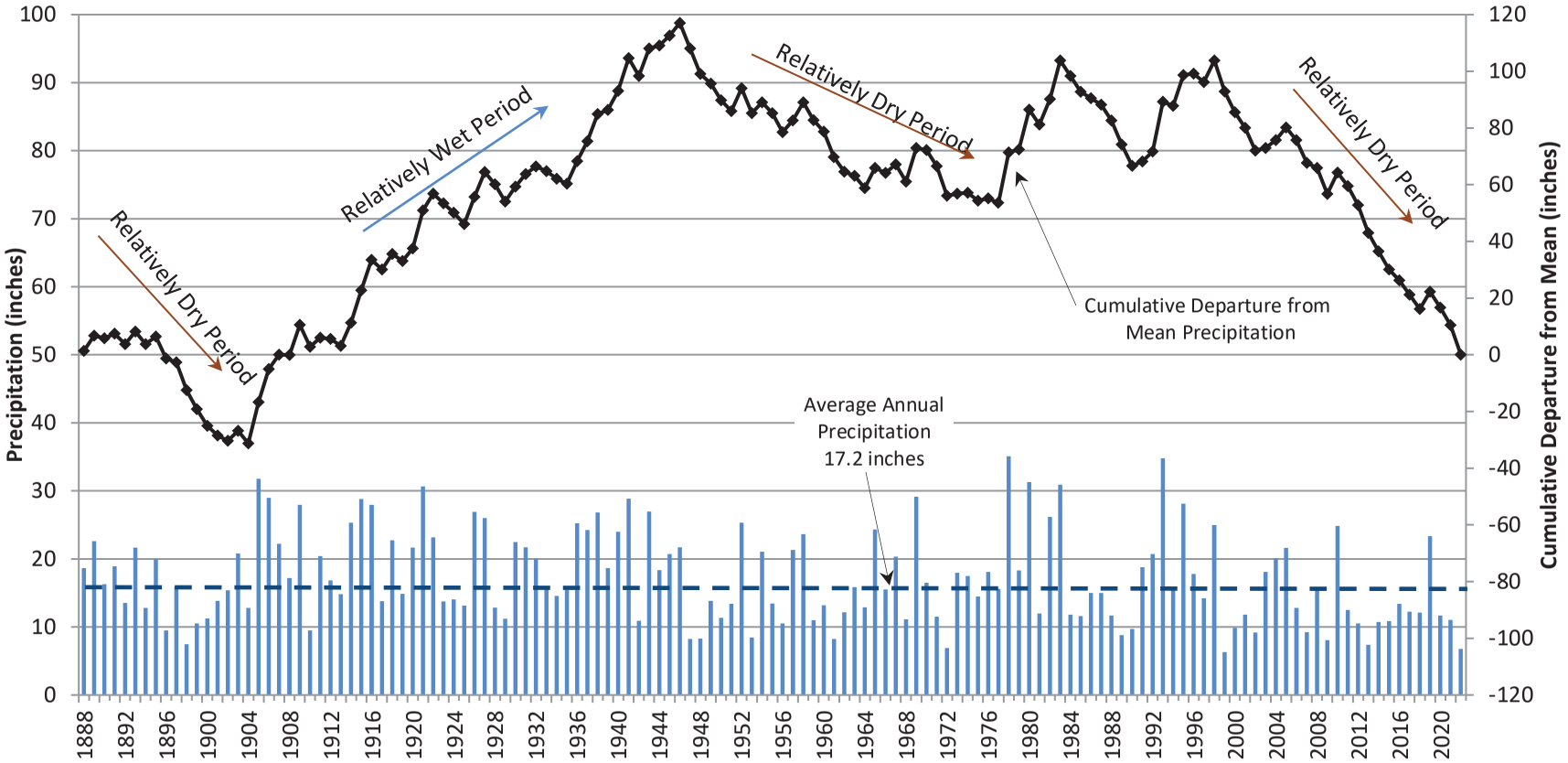


Thomas Harder & Co.
Groundwater Consulting

July 2024

Figure 18

Beaumont Annual Precipitation
1888 - 2022

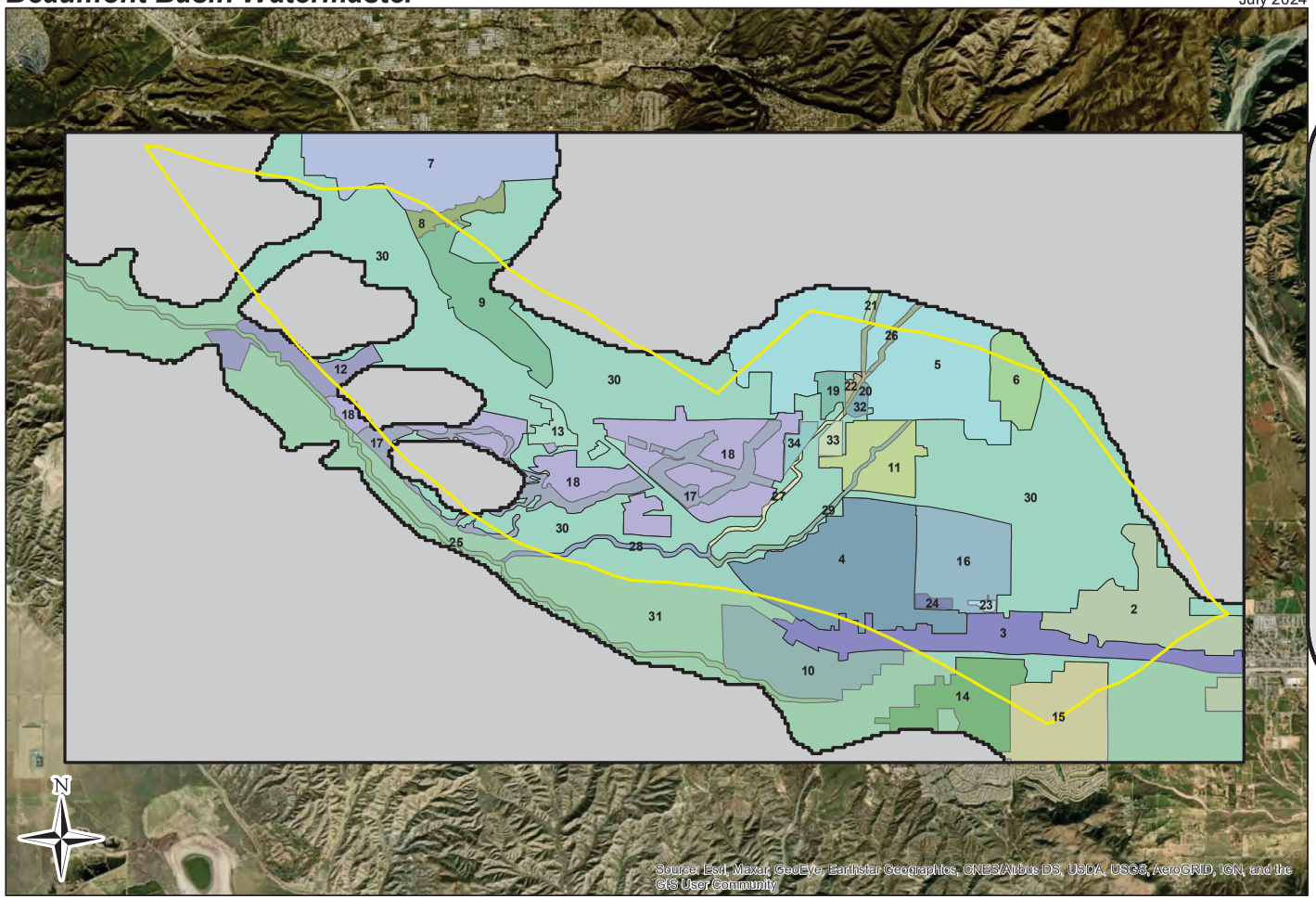


Source: Riverside County Flood Control Water Conservation District, Station Number 13 (2023)

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

RCH Zone #: Min: Max

- 2: 0.00005: 0.00008
- 3: 0.00004: 0.00005
- 4: 0.00021: 0.00031
- 5: 0.00031: 0.00047
- 6: 0.00021: 0.00031
- 7: 0.00016: 0.00025
- 8: 0.00059: 0.00089
- 9: 0.00015: 0.00023
- 10: 0.00005: 0.00008
- 11: 0.00008: 0.00012
- 12: 0.00006: 0.0001
- 13: 0.00005: 0.00008
- 14: 0.00016: 0.00024
- 15: 0.00007: 0.00011
- 16: 0.00003: 0.00004
- 17: 0.00008: 0.00012
- 18: 0.00002: 0.00003
- 19: 0.00027: 0.0004
- 20: 0: 0.00001
- 21: 0: 0.56362
- 22: 0: 4.21
- 23: 0.00008: 0.00012
- 24: 0.00001: 0.00001
- 25: 0.00001: 0.00001
- 26: 0.00124: 0.00187
- 27: 0.00072: 0.00108
- 28: 0.00001: 0.00002
- 29: 0.00398: 0.00596
- 30: 0.00027: 0.00041
- 31: 0.00027: 0.00041
- 32: 0: 1.03
- 33: 0: 0.313
- 34: 0: 0
- Active Model Zone
- Inactive Model Zone
- Beaumont Basin Adjudicated Area

Note: Units for the minimum and maximum recharge rates are in feet/day.

Thomas Harder & Co.
Groundwater Consulting

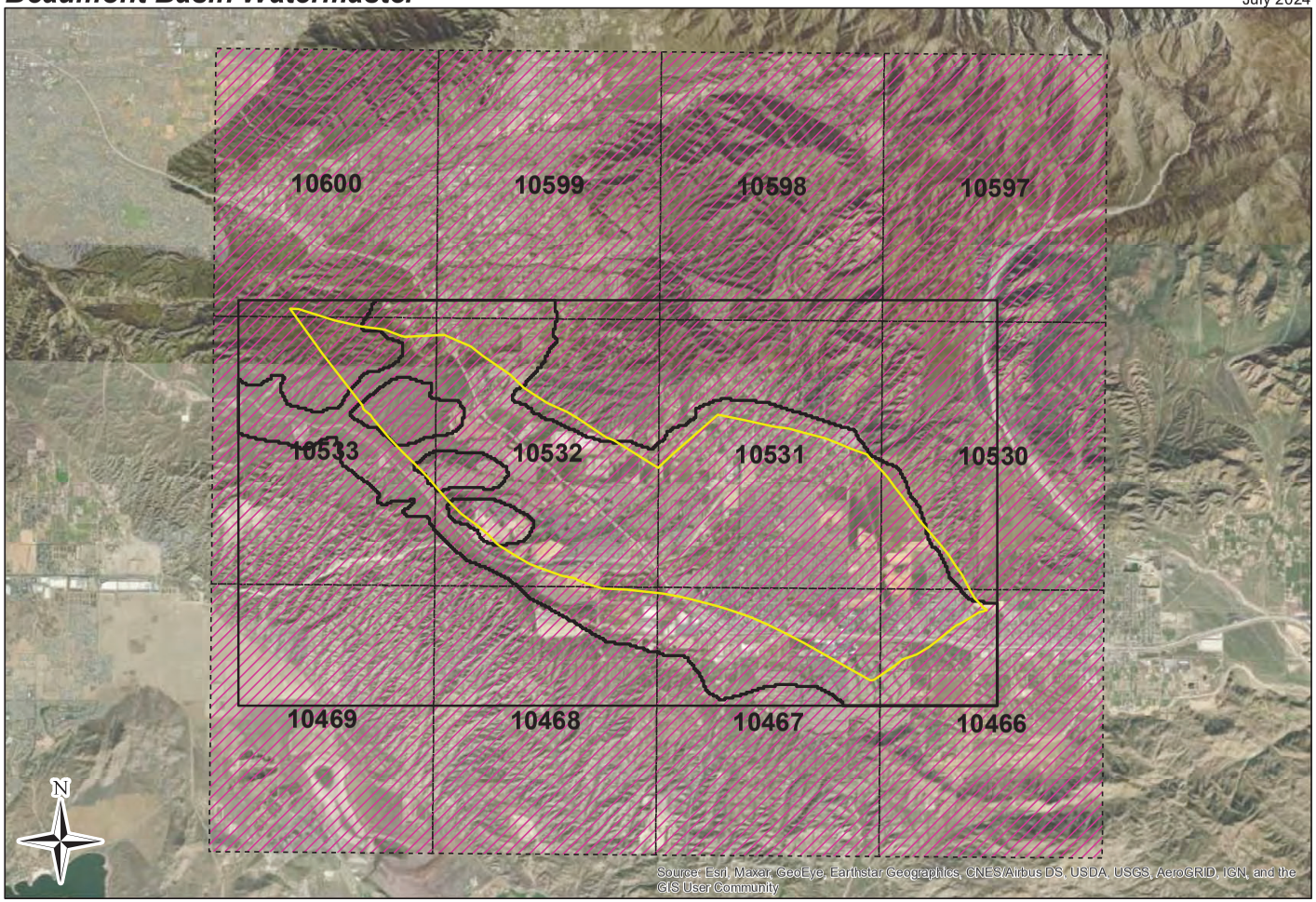
Recharge Zones Used in the Groundwater Flow Model

Figure 19

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

- DWR Climate Change Model Polygon
- Active Model Domain
- Beaumont Basin Adjudicated Area
- Study Area

Note: The number inside each DWR Climate Change Model Polygon denotes the Cell Identification Number of the California Department of Water Resources Variable Infiltration Capacity (VIC) model cell. DWR Climate Change Model Polygon from California Department of Water Resources. (n.d.). SGMA Data Viewer.

Climate Change Model Areas

Thomas Harder & Co. Groundwater Consulting

Figure 20

Beaumont Basin Watermaster

July 2024

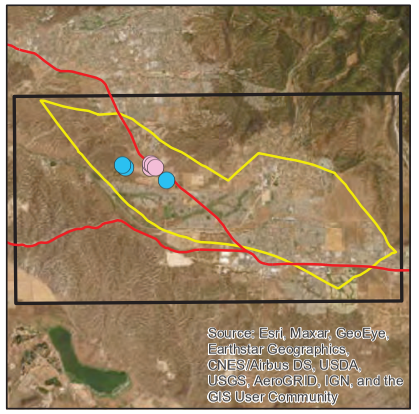
2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

- Injection Well
- Extraction Well
- Study Area
- Beaumont Basin Adjudicated Area
- Freeway/Highway



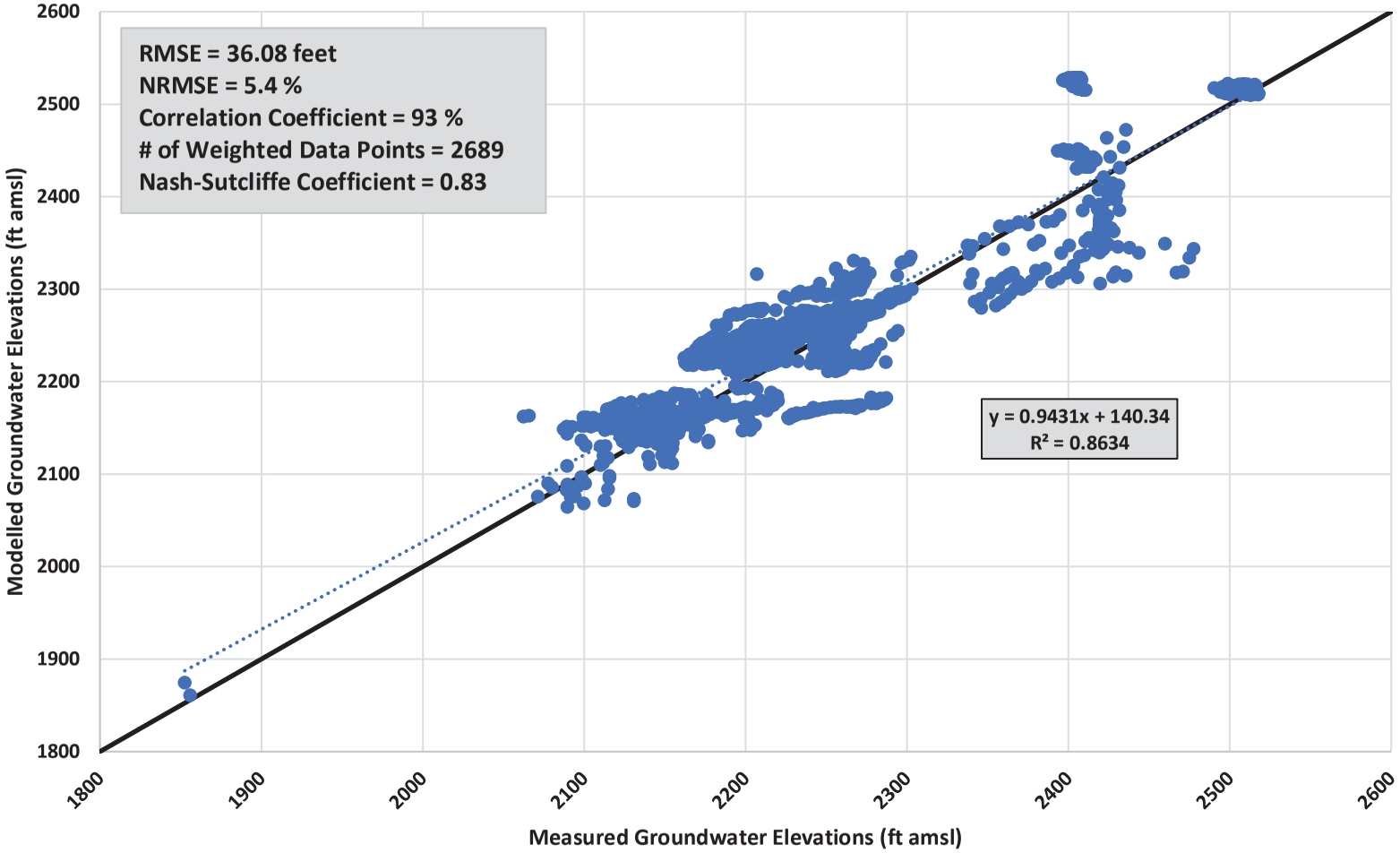
Thomas Harder & Co.
Groundwater Consulting

Yucaipa Valley Water District Proposed Aquifer Storage & Recovery Project Wells

Figure 21

Figure 22

Modeled vs. Measured Groundwater Elevations
All Model Layers

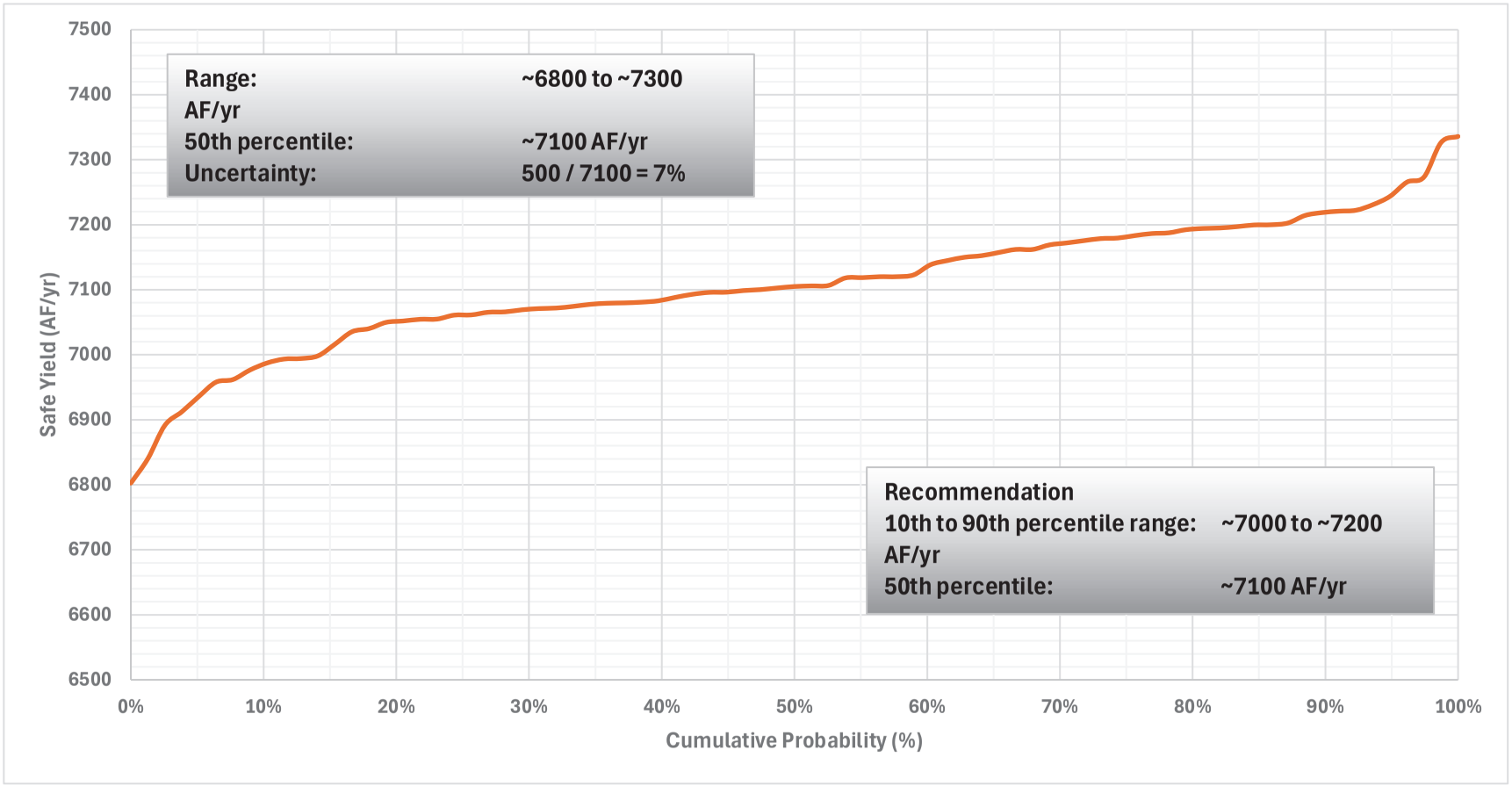


Thomas Harder & Co.
Groundwater Consulting

July 2024

Figure 23

Safe Yield vs. Cumulative Probability
1978 - 2032

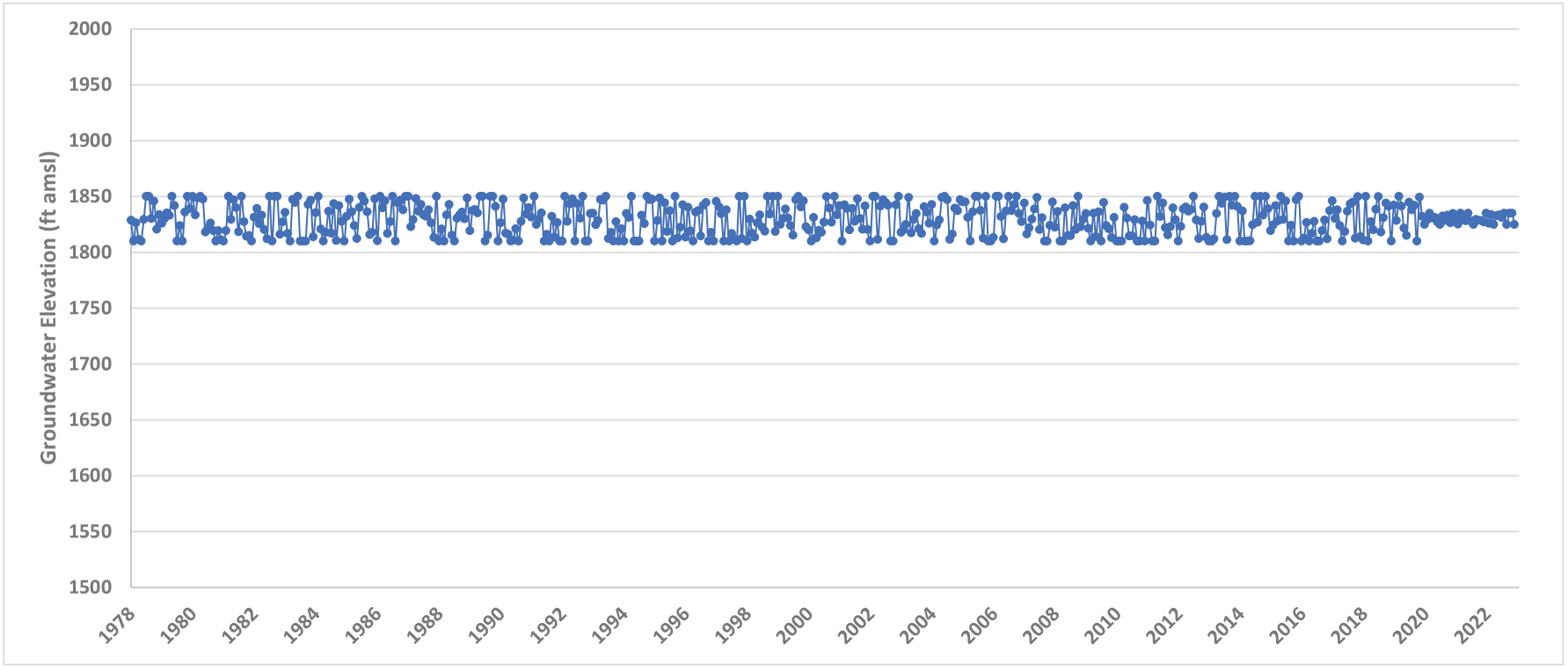


Appendices

Appendix A

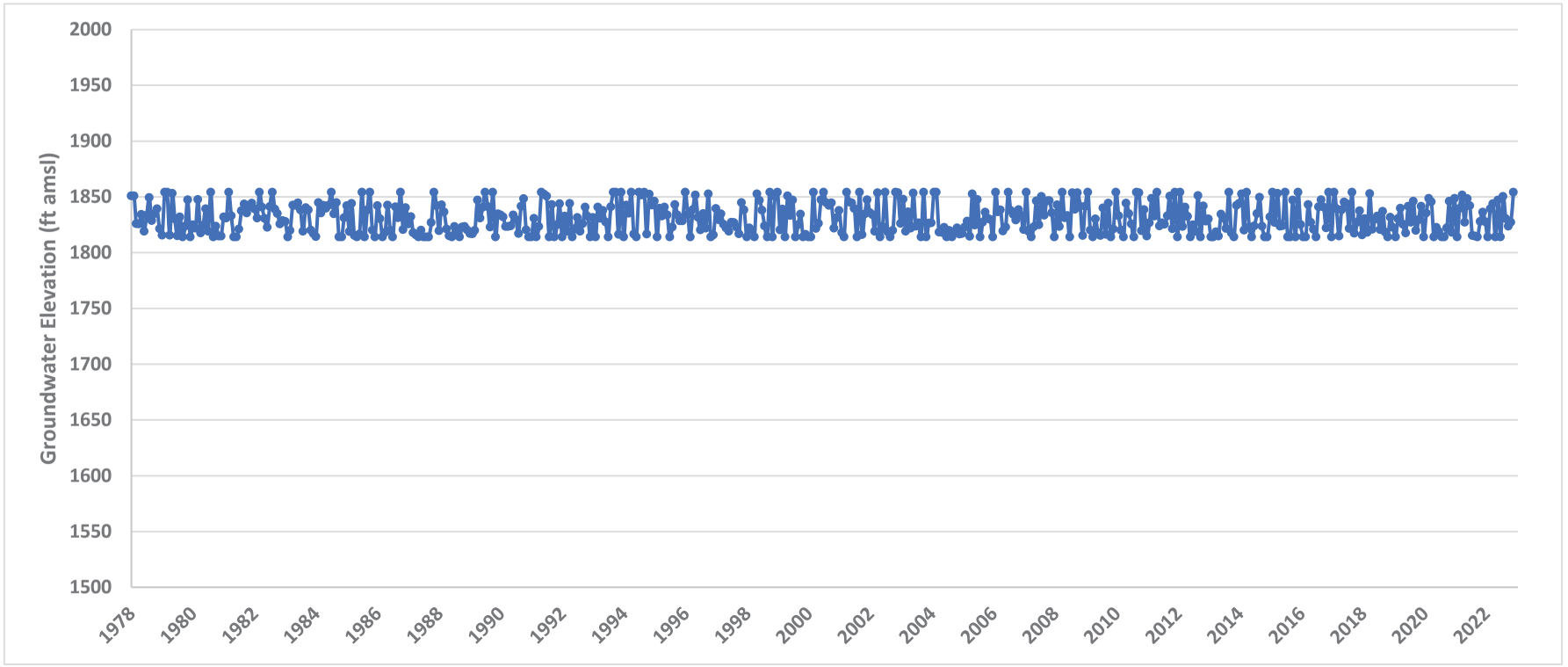
Model Boundary Condition Hydrographs

Boundary Condition Well Hydrograph
GHB 1 (Chester Well)



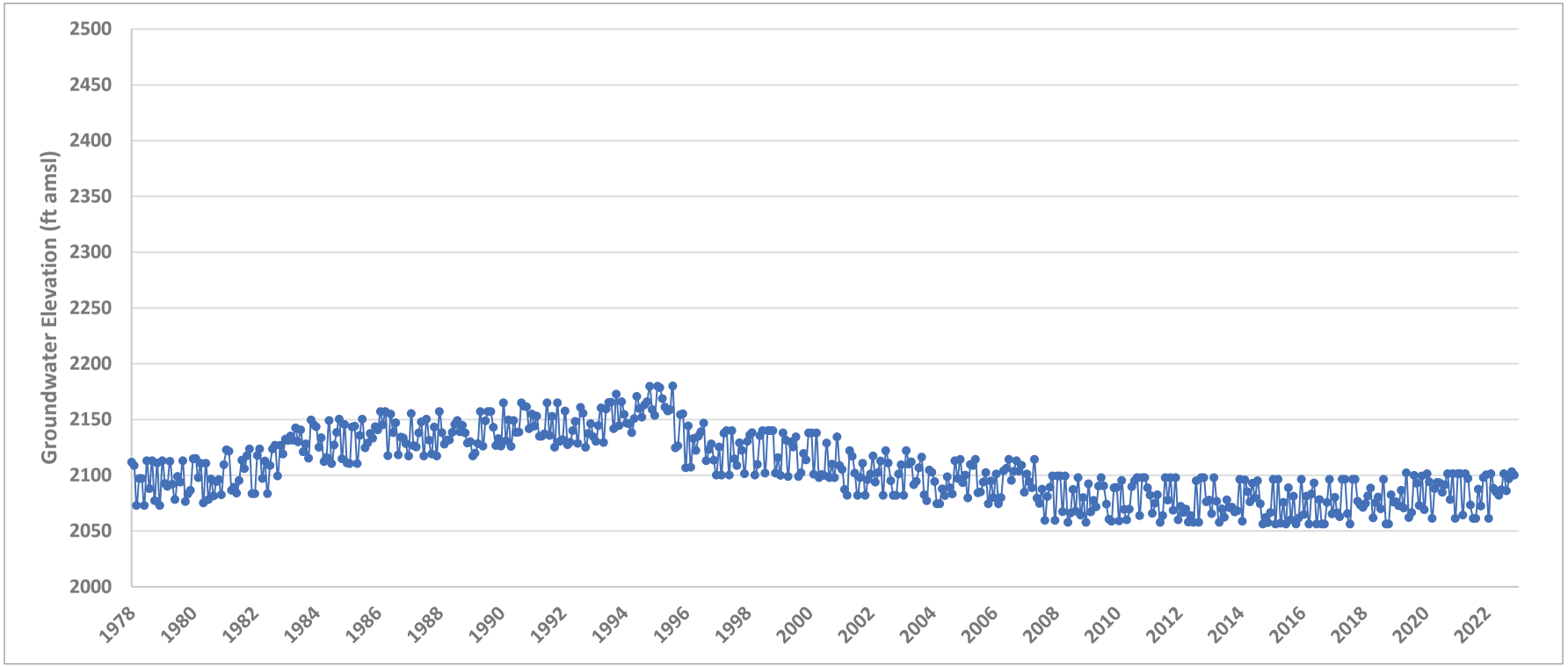
Notes: Groundwater elevations at this boundary well were selected based on observed data from Chester well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 2 (El Casco Schoolhouse Well)



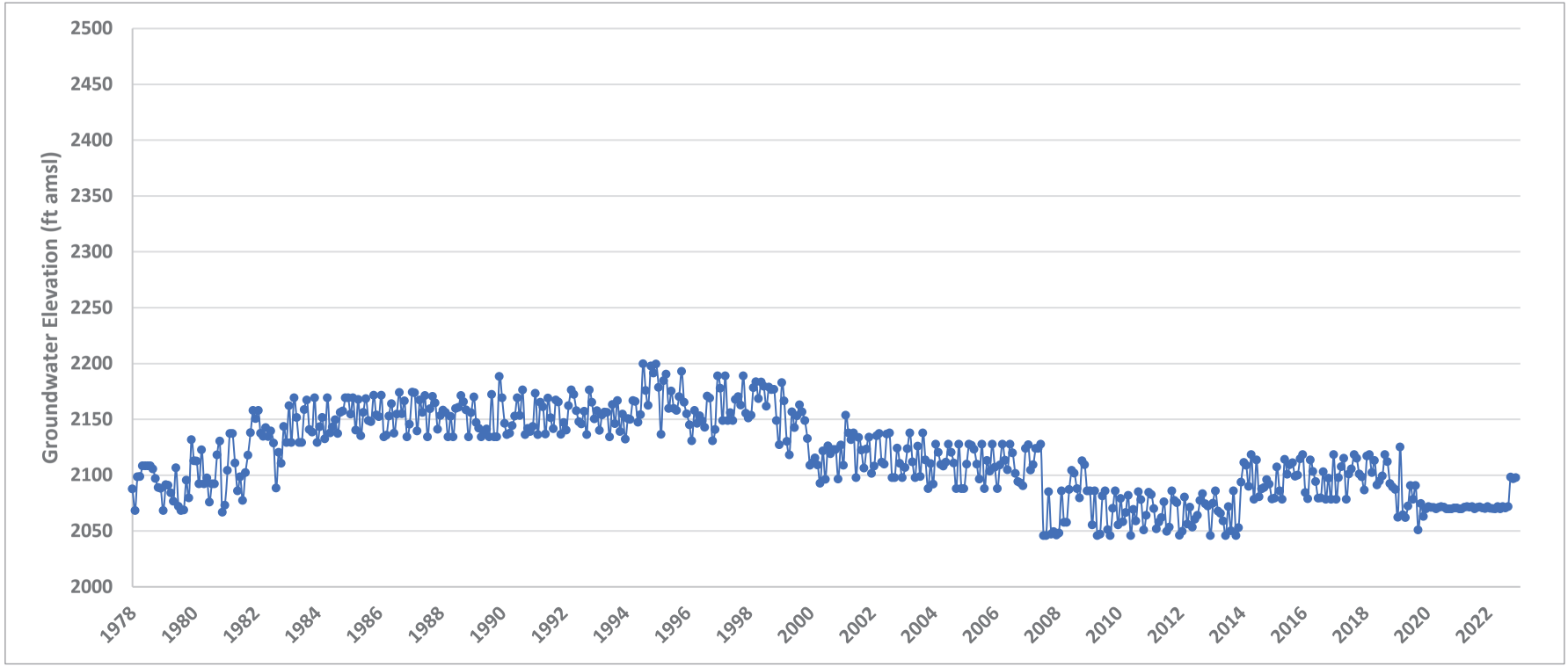
Notes: Groundwater elevations at this boundary well were selected based on observed data from El Casco Schoolhouse well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 3 (SMWC 07 Well)



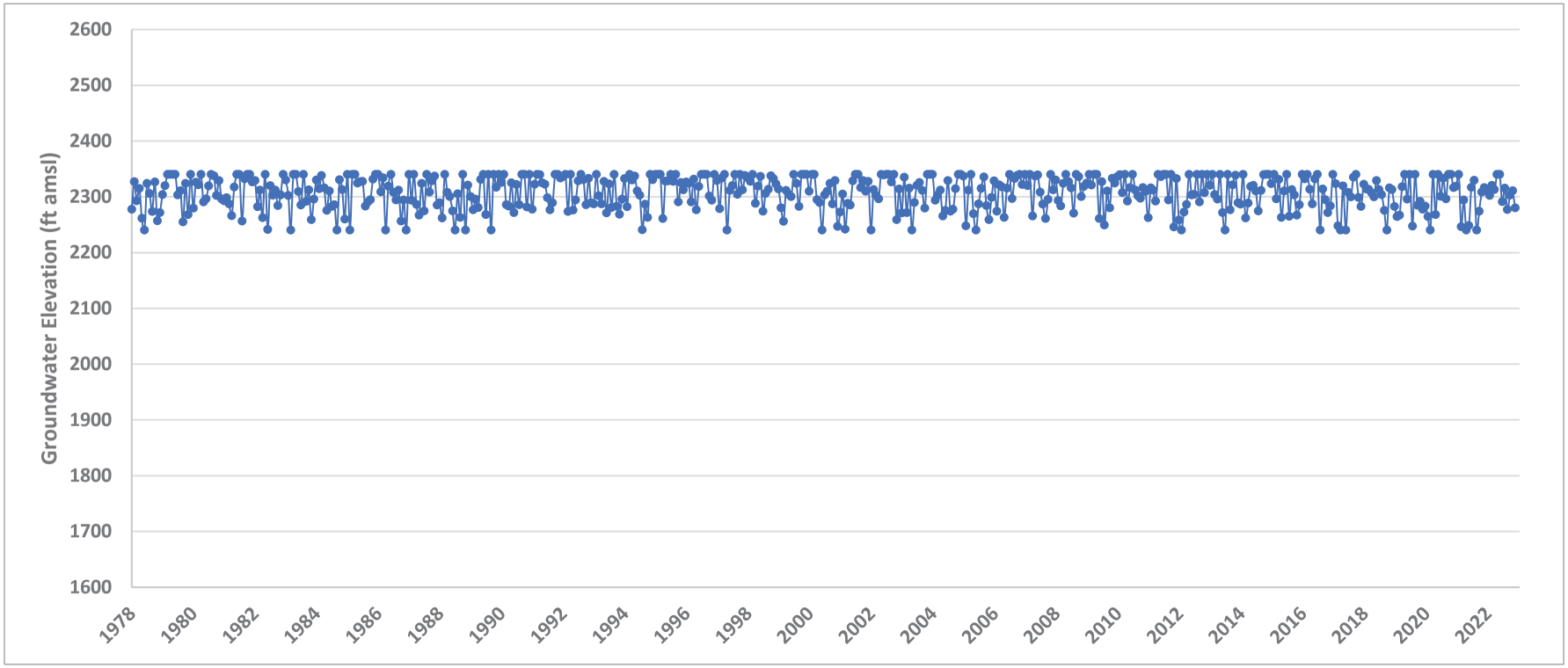
Notes: Groundwater elevations at this boundary well were selected based on observed data from SMWC 07 well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 4 (SMWC 11 Well)



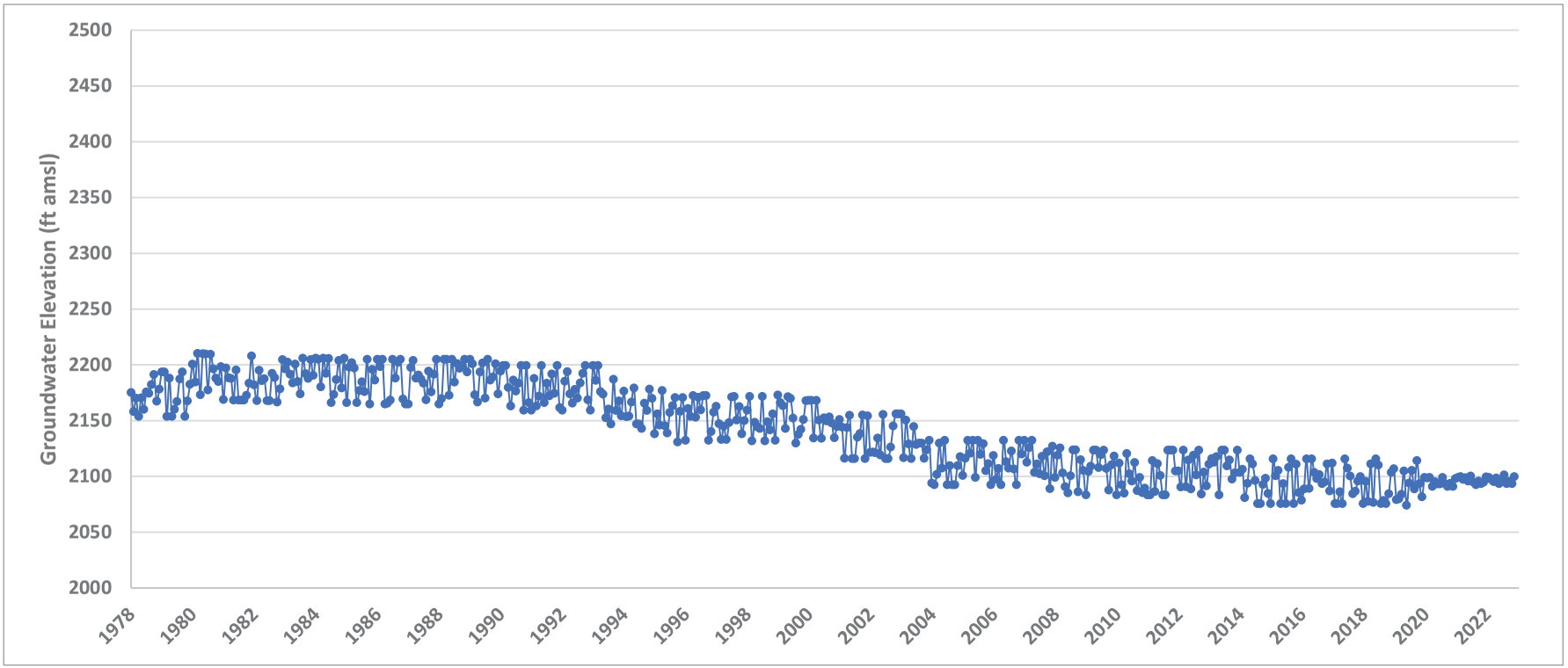
Notes: Groundwater elevations at this boundary well were selected based on observed data from SMWC 11 well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 5 (SMWC 01 Well)



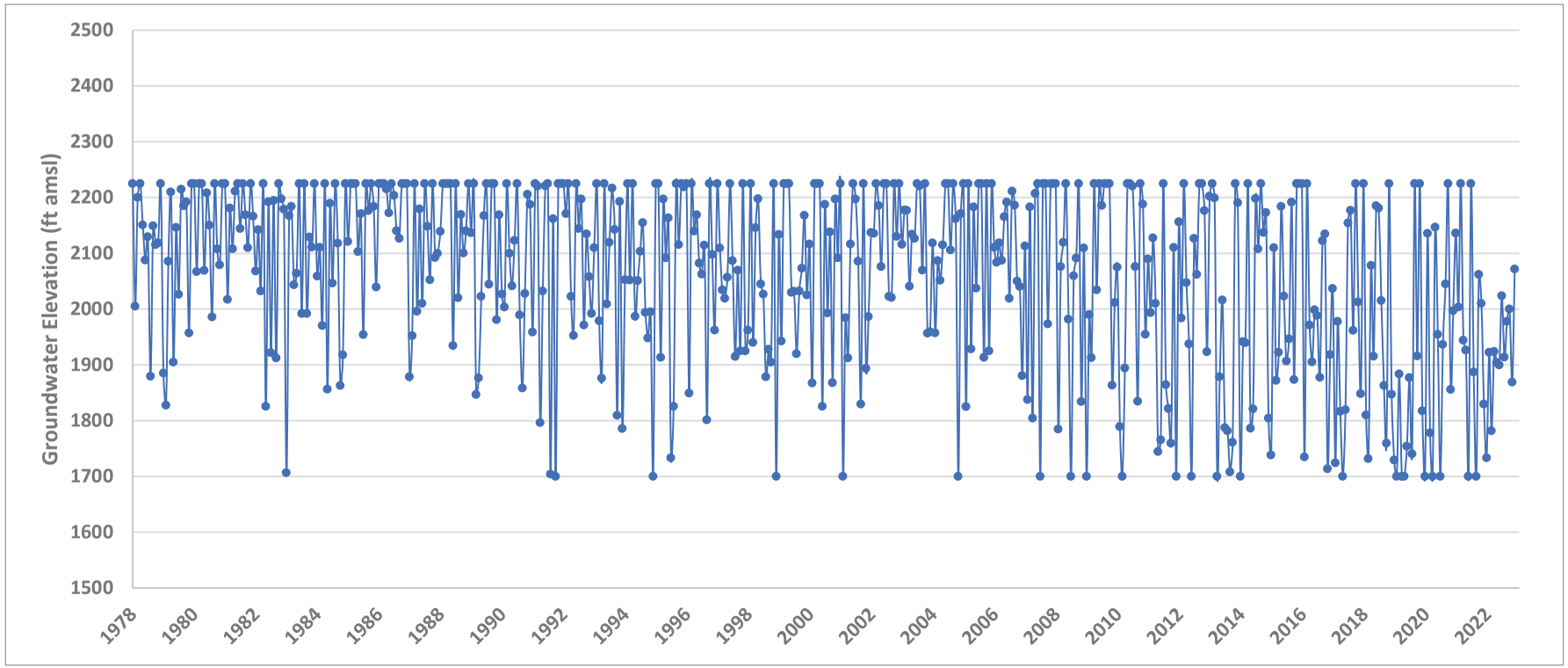
Notes: Groundwater elevations at this boundary well were selected based on observed data from SMWC 01 well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 6 (Banning CW #C5 Well)



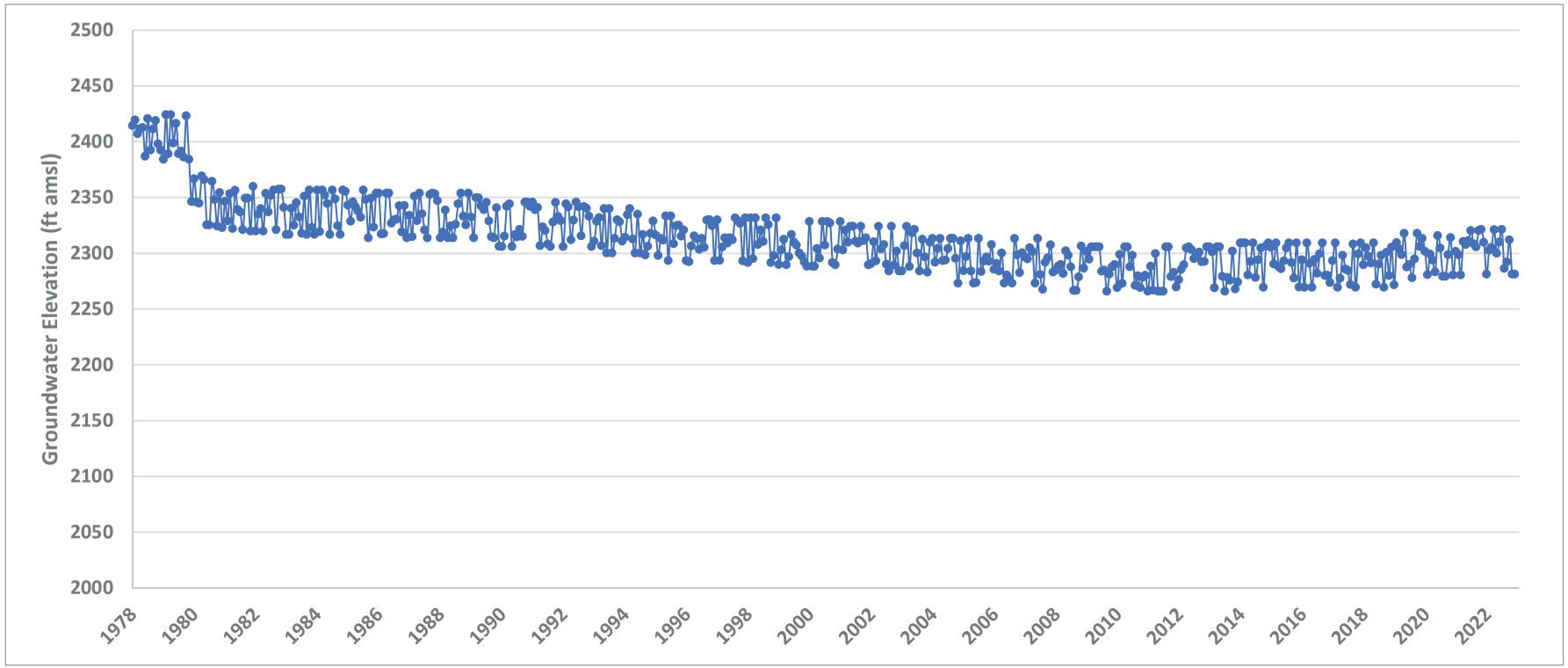
Notes: Groundwater elevations at this boundary well were selected based on observed data from Banning CW #C5 well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 7 (Banning M8 Well)



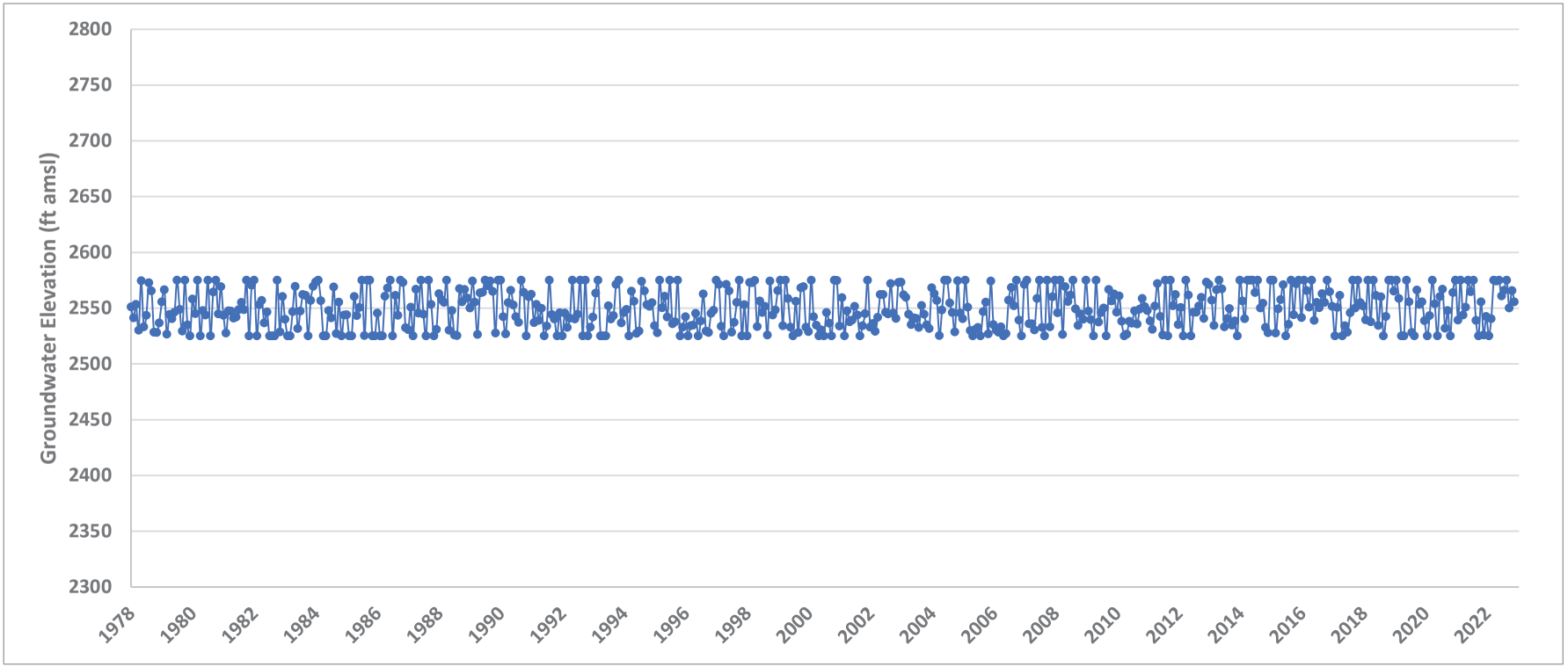
Notes: Groundwater elevations at this boundary well were selected based on observed data from Banning M8 well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 8 (3S/1W-14J02 Well)



Notes: Groundwater elevations at this boundary well were selected based on observed data from 3S/1W-14J02 well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

Boundary Condition Well Hydrograph
GHB 16 (Cemetery Well)



Notes: Groundwater elevations at this boundary well were selected based on observed data from Cemetery well.
The groundwater elevations bounds were allowed to vary based on model layering and reasonable expectations to get a decent calibration fit.

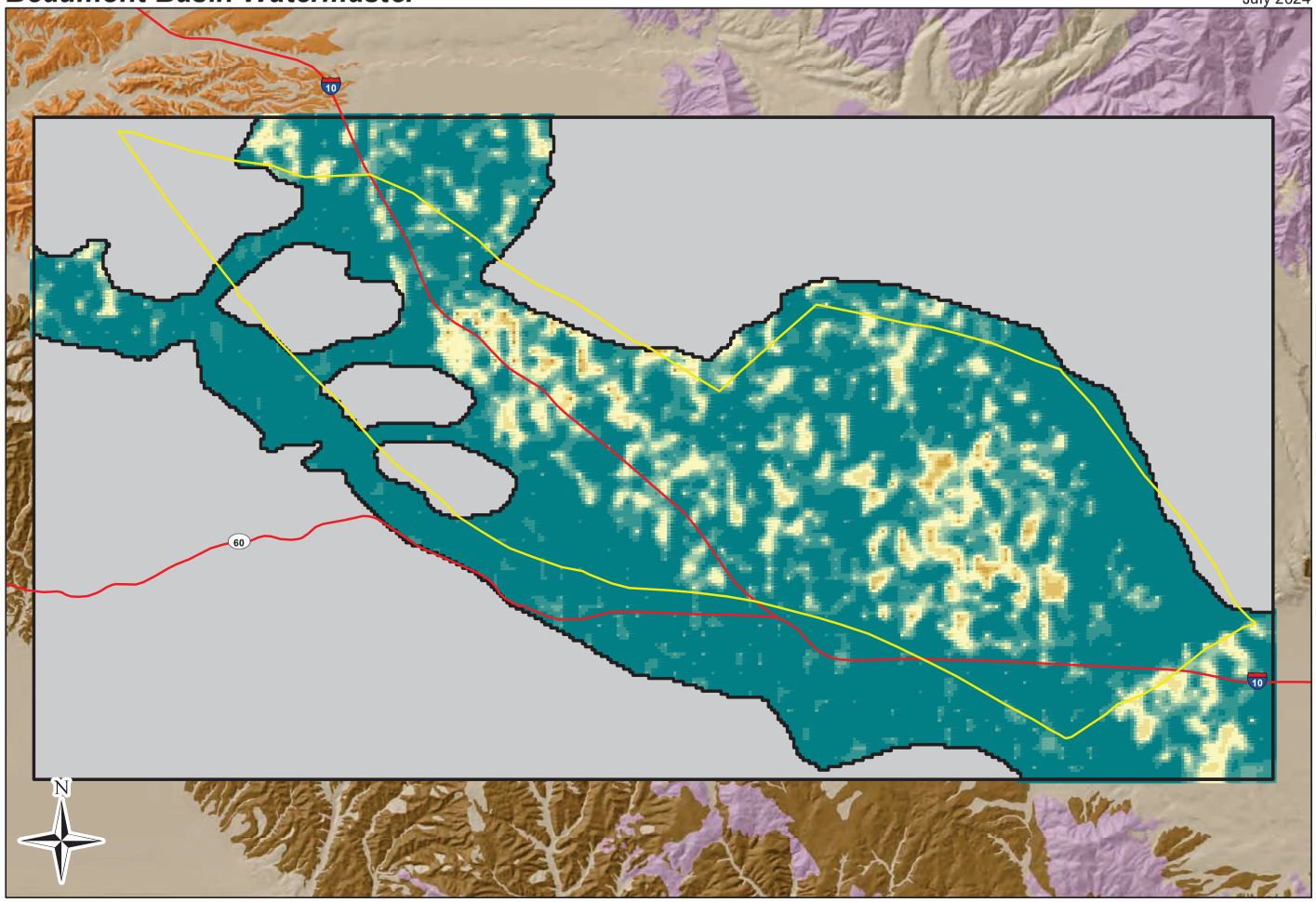
Appendix B

Model Parameters

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Horizontal Hydraulic Conductivity (ft/day)

- 0 to 20
- 20 to 40
- 40 to 60
- 60 to 80
- 80 to 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500
- 500 to 600
- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposits
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Horizontal Hydraulic Conductivity - Layer 1

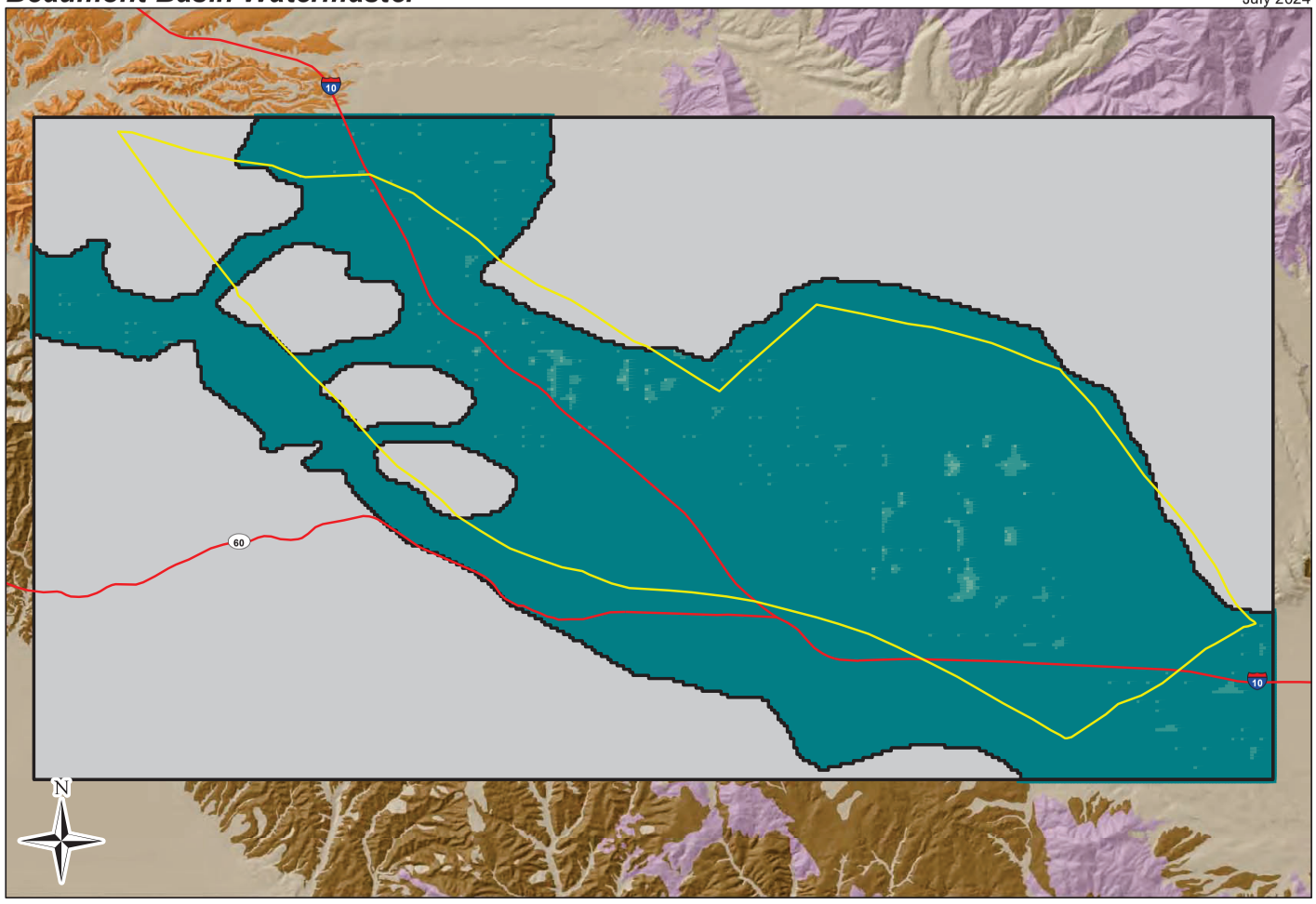
Appendix B-1

Thomas Harder & Co.
Groundwater Consulting

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Horizontal Hydaulic Conducticity (ft/day)

- 0 to 20
- 20 to 40
- 40 to 60
- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

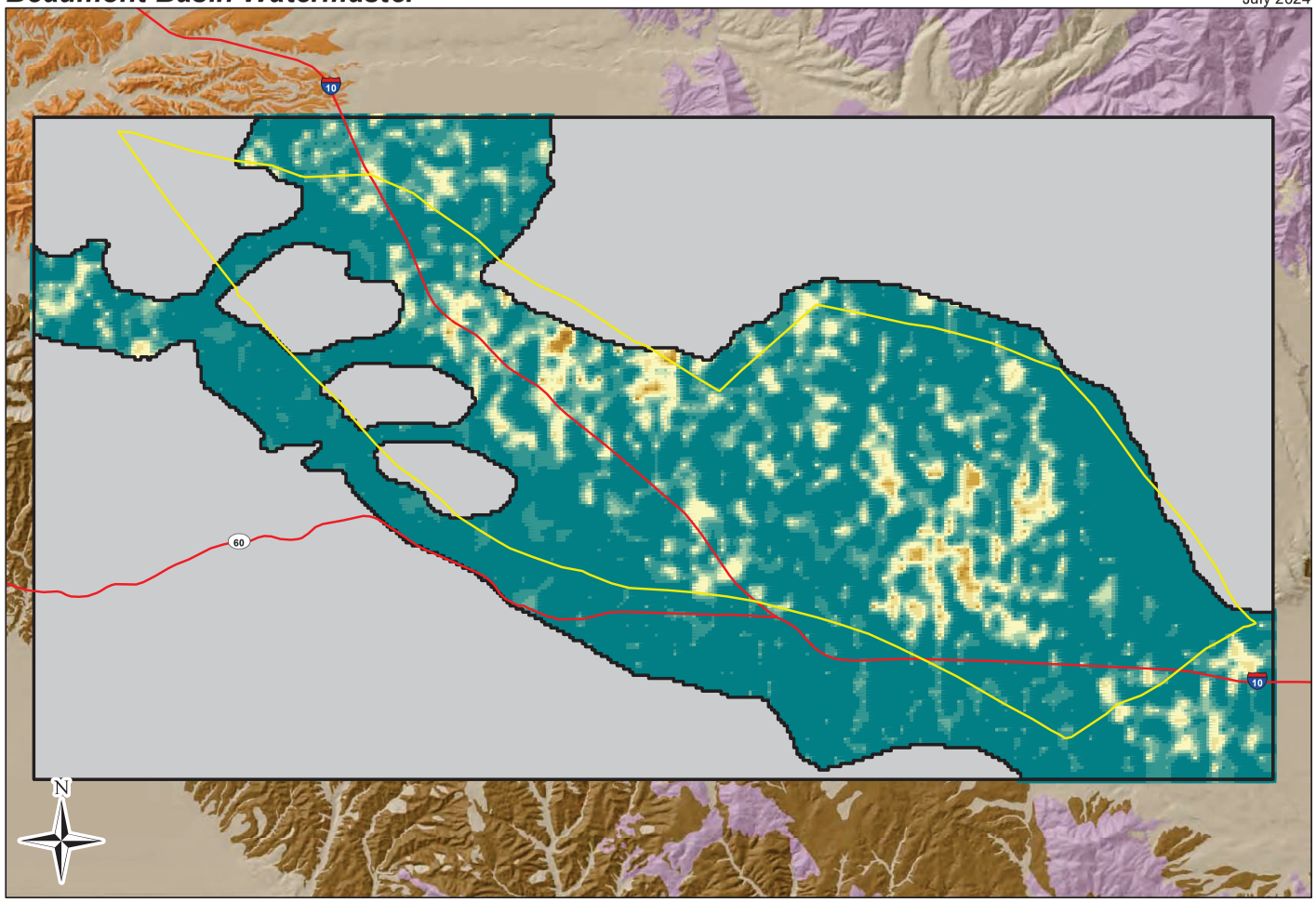
Horizontal Hydraulic Conductivity - Layer 2

Appendix B-2

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Horizontal Hydraulic Conductivity (ft/day)

- 0 to 20
- 20 to 40
- 40 to 60
- 60 to 80
- 80 to 100
- 100 to 200
- 200 to 300
- 300 to 400
- 400 to 500
- 500 to 600
- 600 +
- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposits
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

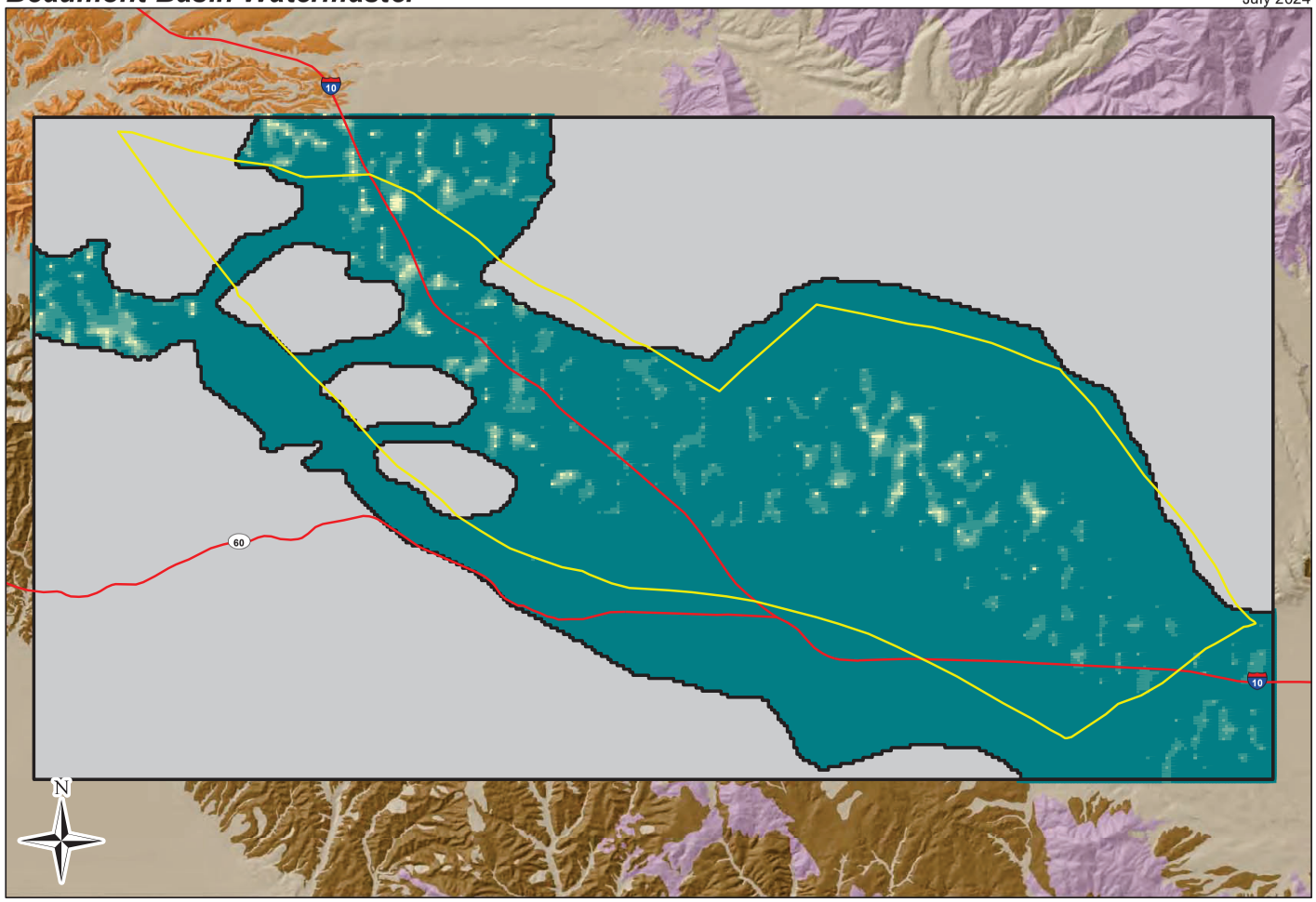
Horizontal Hydraulic Conductivity - Layer 3

Appendix B-3

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Horizontal Hydraulic Conductivity (ft/day)

- 0 to 20
- 20 to 40
- 40 to 60
- 60 to 80
- 80 to 100
- 100 to 200
- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

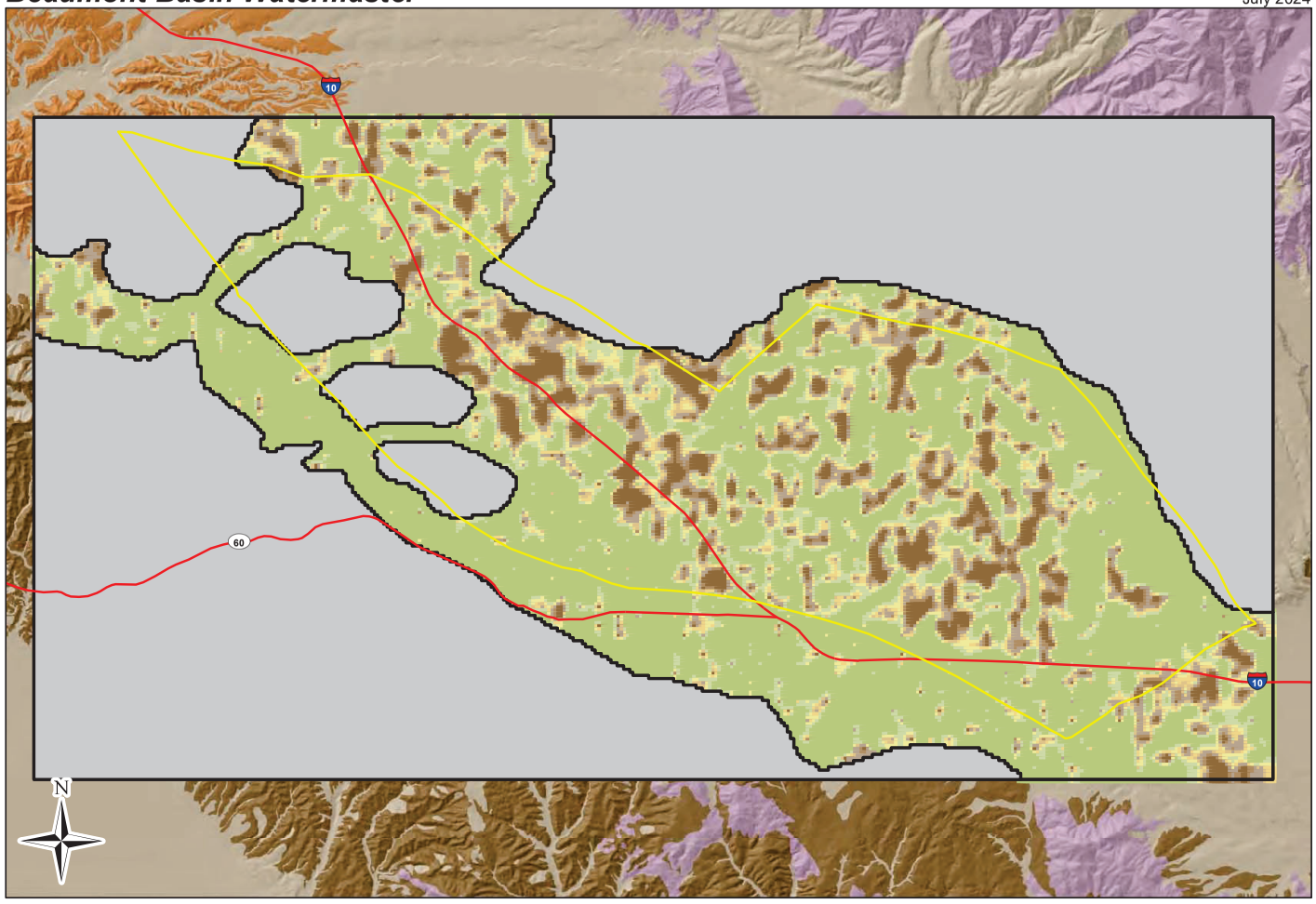
Horizontal Hydraulic Conductivity - Layer 4

Appendix B-4

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Vertical Hydraulic Conductivity (ft/day)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- 4 to 5
- 5 to 10
- 10 to 15
- 15 to 20

- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

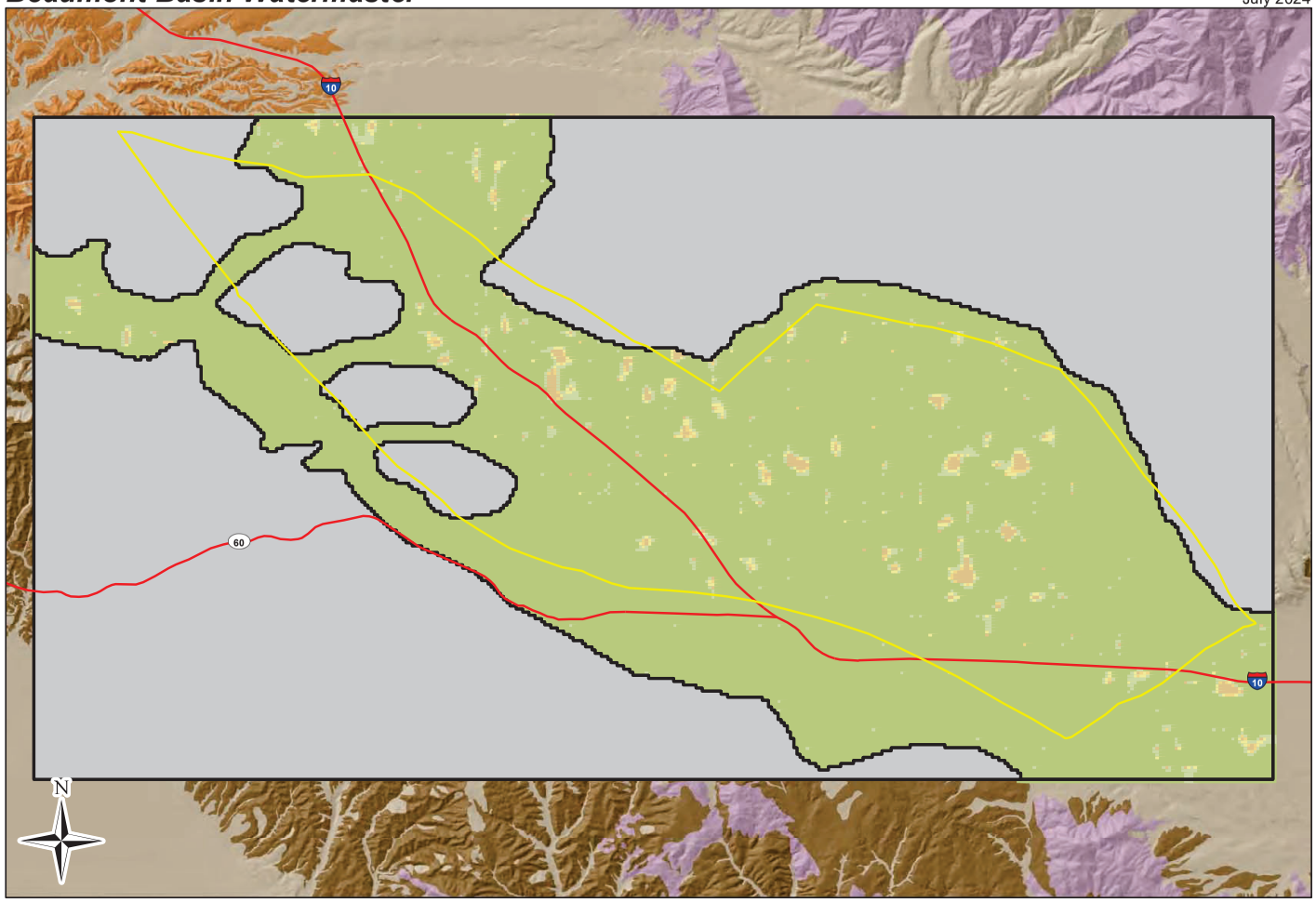
Vertical Hydraulic Conductivity - Layer 1

Appendix B-5

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Vertical Hydraulic Conductivity (ft/day)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- 4 to 5
- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

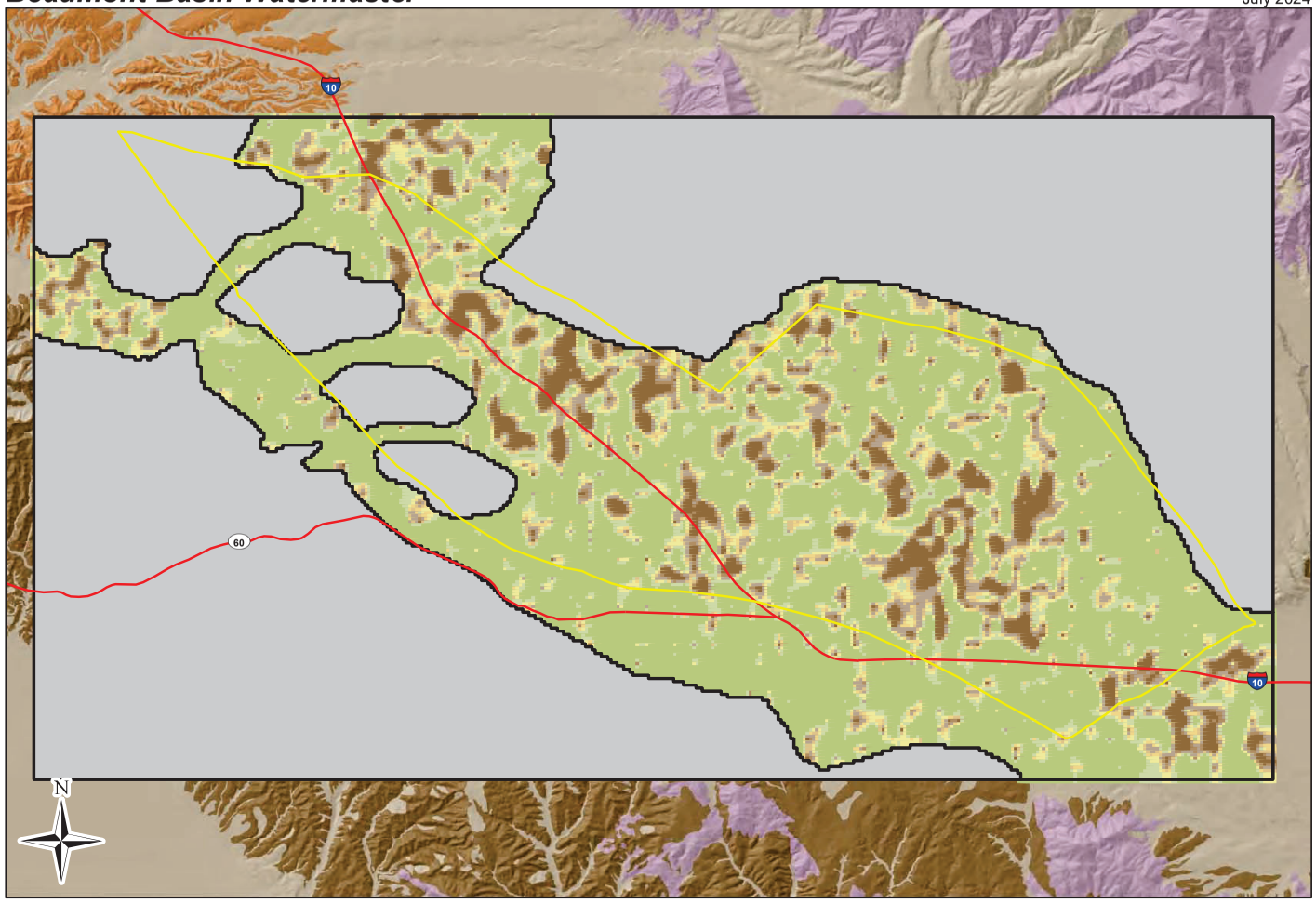
Vertical Hydraulic Conductivity - Layer 2

Appendix B-6

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Vertical Hydraulic Conductivity (ft/day)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- 4 to 5
- 5 to 10
- 10 to 15
- 15 to 20

- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

Vertical Hydraulic Conductivitiy - Layer 3

Appendix B-7

Beaumont Basin Watermaster

July 2024



NAD 83 State Plane Zone 6

Map Features

Vertical Hydraulic Conductivity (ft/day)

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- 4 to 5
- 5 to 10
- Active Model Zone
- Inactive Model Zone
- Surficial or Alluvial Deposists
- Pleistocene San Timoteo Deposits
- Tertiary San Timoteo and other Tertiary Sedimentary Deposits
- Crystalline Basement Complex
- Beaumont Basin Adjudicated Area
- Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

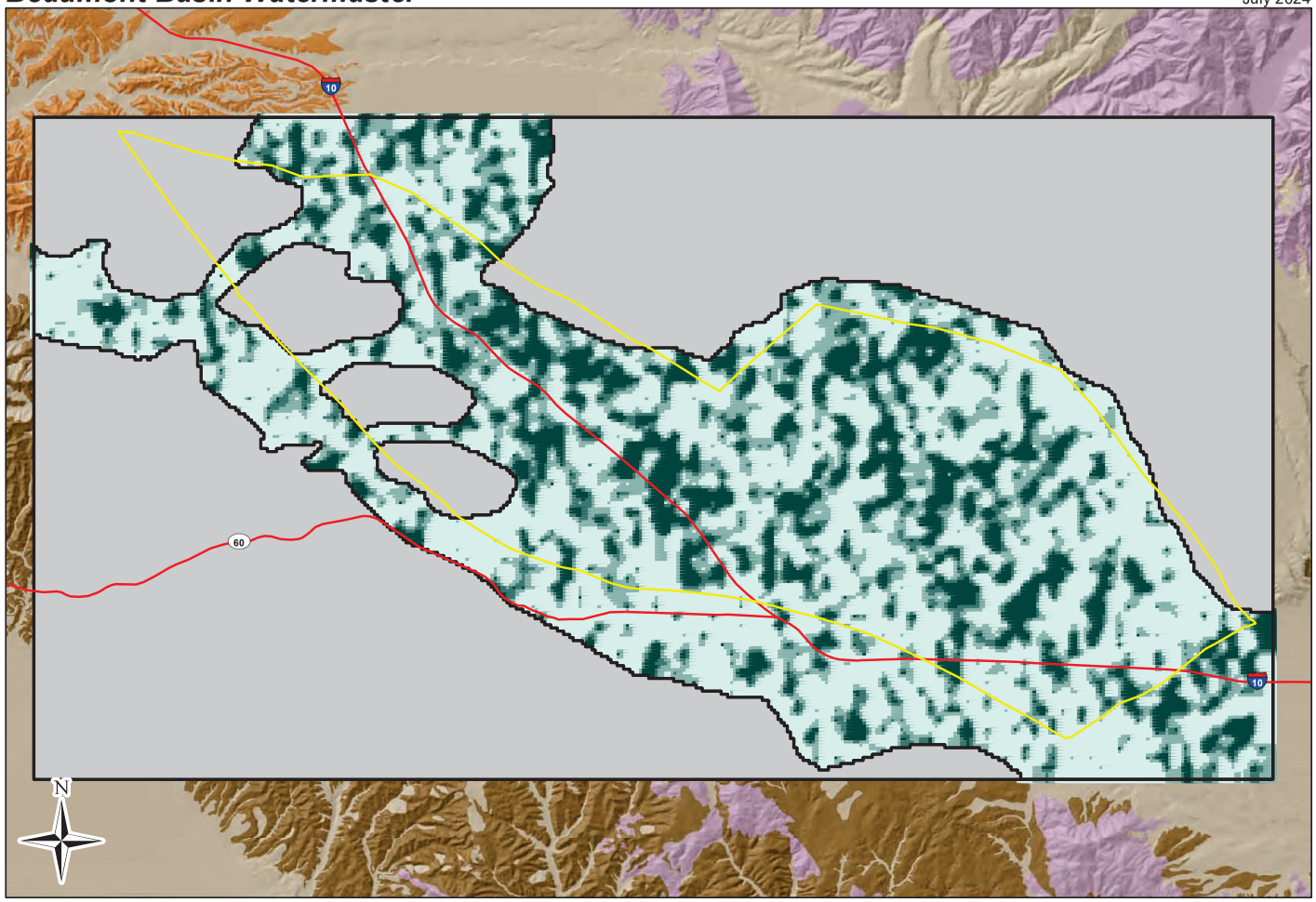
Vertical Hydraulic Conductivity - Layer 4

Appendix B-8

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Specific Yield
- 0.00 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40

Active Model Zone

Inactive Model Zone

Surficial or Alluvial Deposists

Pleistocene San Timoteo Deposits

Tertiary San Timoteo and other Tertiary Sedimentary Deposits

Crystalline Basement Complex

Beaumont Basin Adjudicated Area

Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

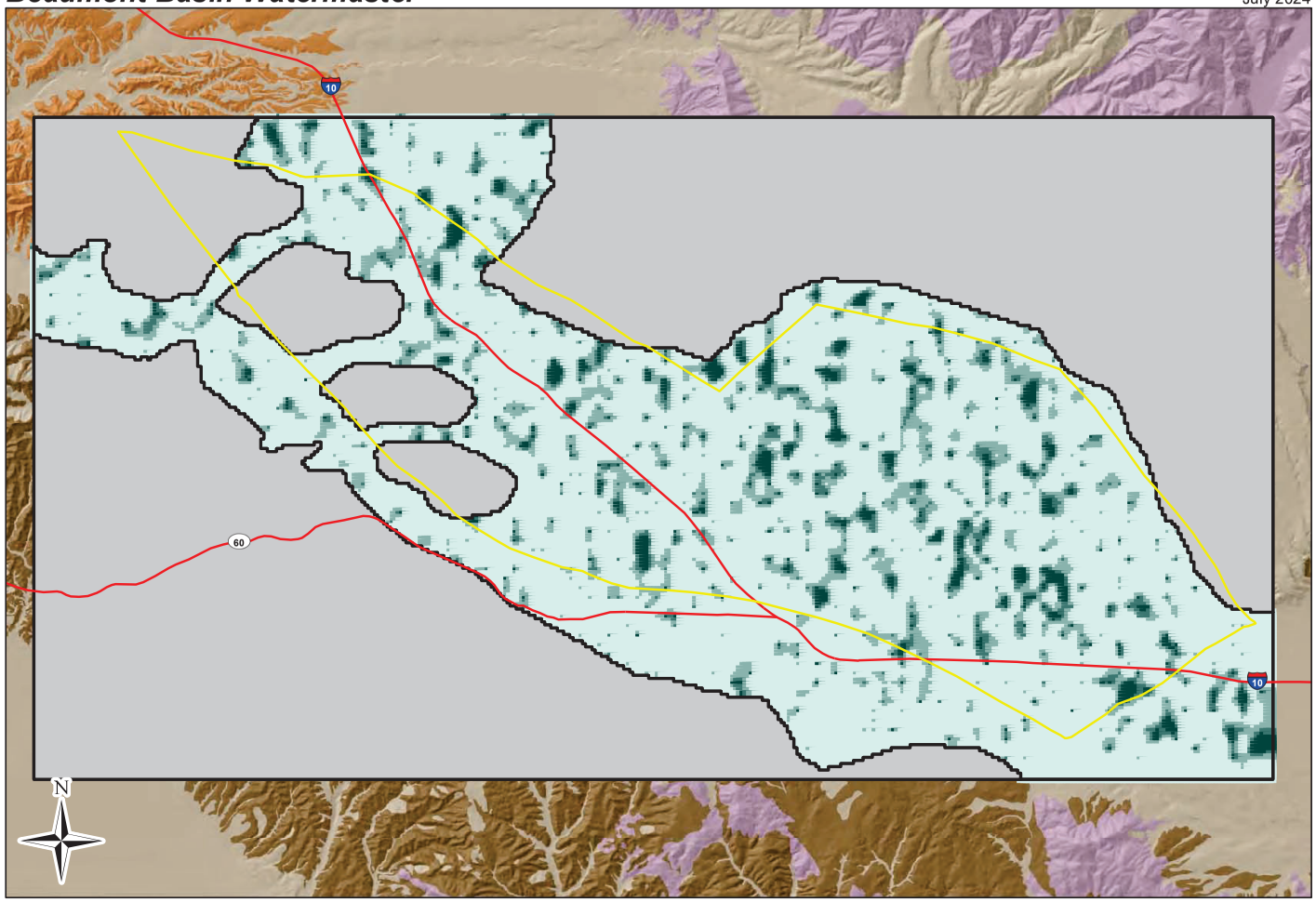
Specific Yield - Layer 1

Appendix B-9

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Specific Yield
- 0.00 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40

Active Model Zone

Inactive Model Zone

Surficial or Alluvial Deposists

Pleistocene San Timoteo Deposits

Tertiary San Timoteo and other Tertiary Sedimentary Deposits

Crystalline Basement Complex

Beaumont Basin Adjudicated Area

Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

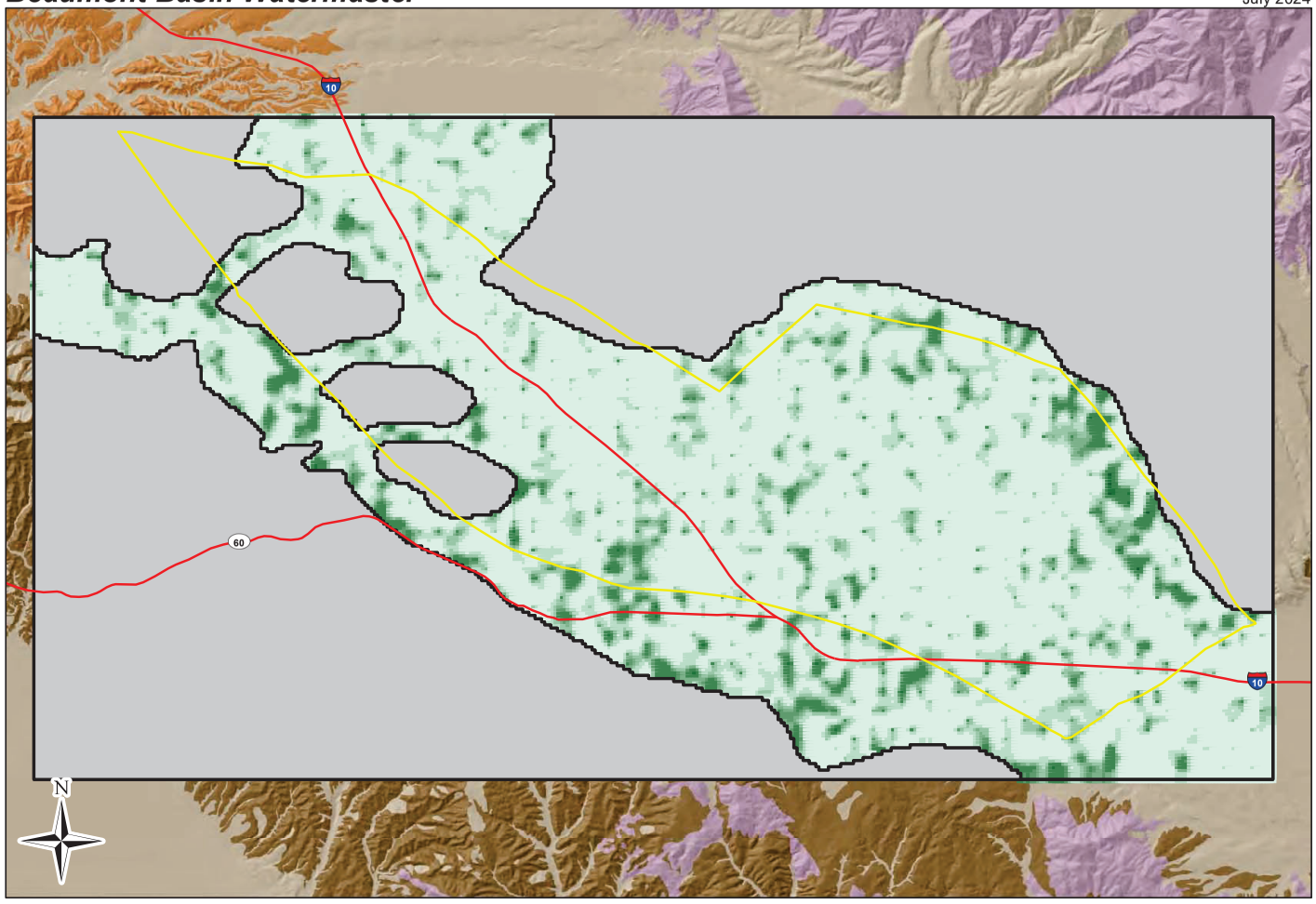
Specific Yield - Layer 2

Appendix B-10

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Specific Storage
- 0.00000 to 0.00002
- 0.00002 to 0.00004
- 0.00004 to 0.00006
- 0.00006 to 0.00008
- 0.00008 to 0.0001
- 0.0001 to 0.0005
- 0.0005 to 0.001
- 0.001 +

Active Model Zone
Inactive Model Zone
Surficial or Alluvial Deposits
Pleistocene San Timoteo Deposits
Tertiary San Timoteo and other Tertiary Sedimentary Deposits
Crystalline Basement Complex
Beaumont Basin Adjudicated Area
Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

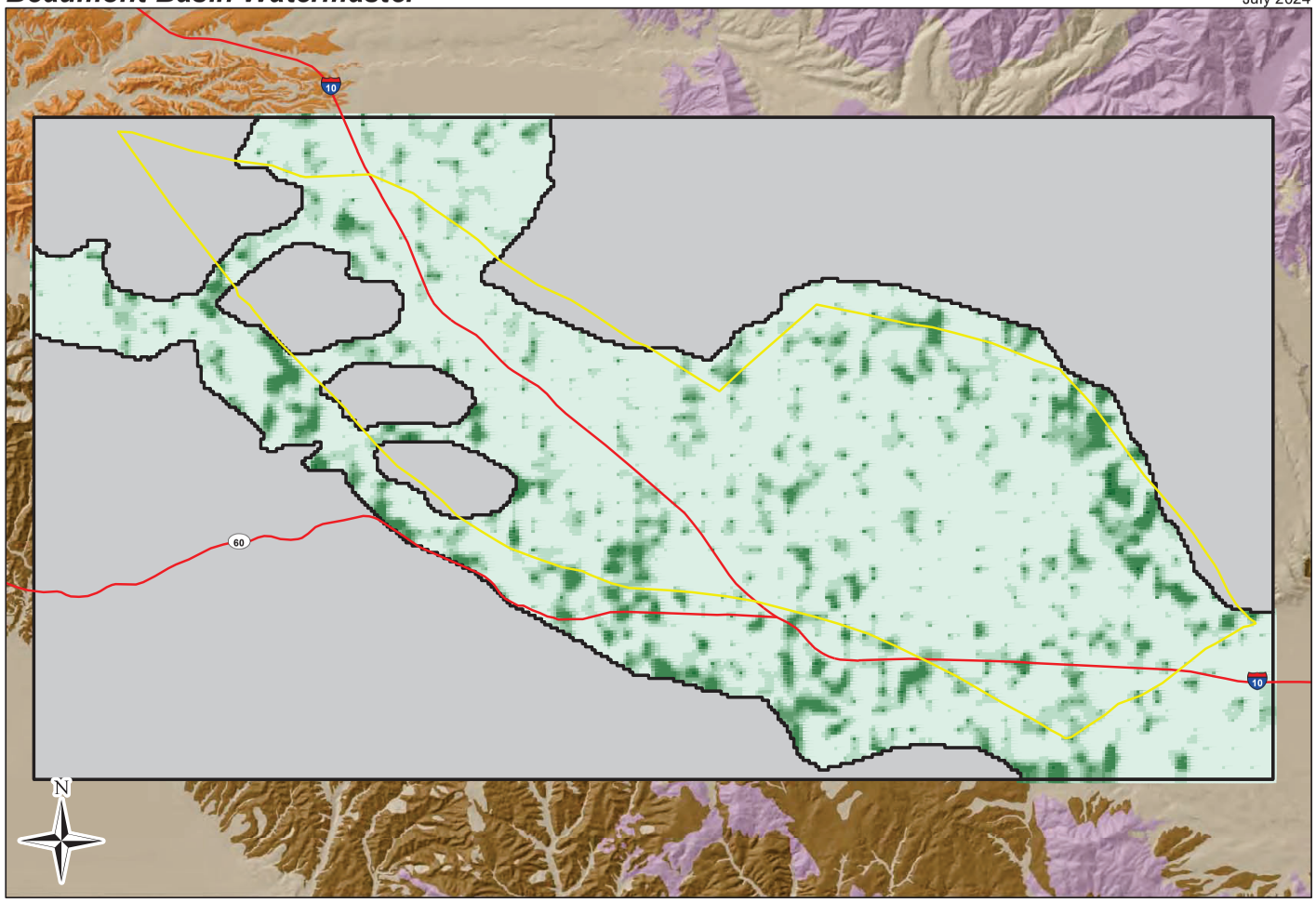
Specific Storage - Layer 3

Appendix B-11

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



NAD 83 State Plane Zone 6

Map Features

Specific Storage
- 0.0000 to 0.00002
- 0.00002 to 0.00004
- 0.00004 to 0.00006
- 0.00006 to 0.00008
- 0.00008 to 0.0001
- 0.0001 to 0.0005
- 0.0005 to 0.001
- 0.001 +

Active Model Zone
Inactive Model Zone
Surficial or Alluvial Deposits
Pleistocene San Timoteo Deposits
Tertiary San Timoteo and other Tertiary Sedimentary Deposits
Crystalline Basement Complex
Beaumont Basin Adjudicated Area
Freeway/Highway

Thomas Harder & Co.
Groundwater Consulting

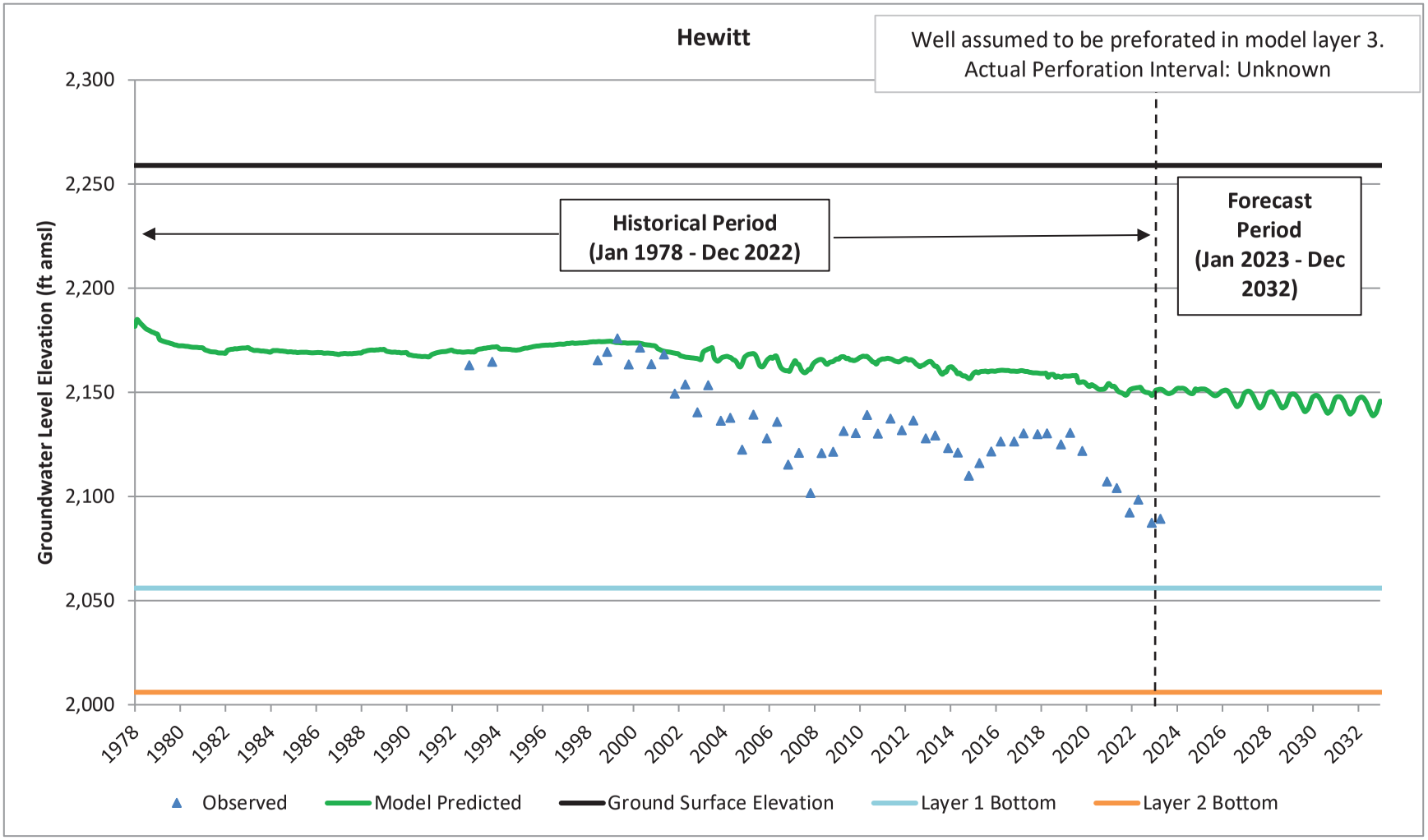
Specific Storage - Layer 4

Appendix B-12

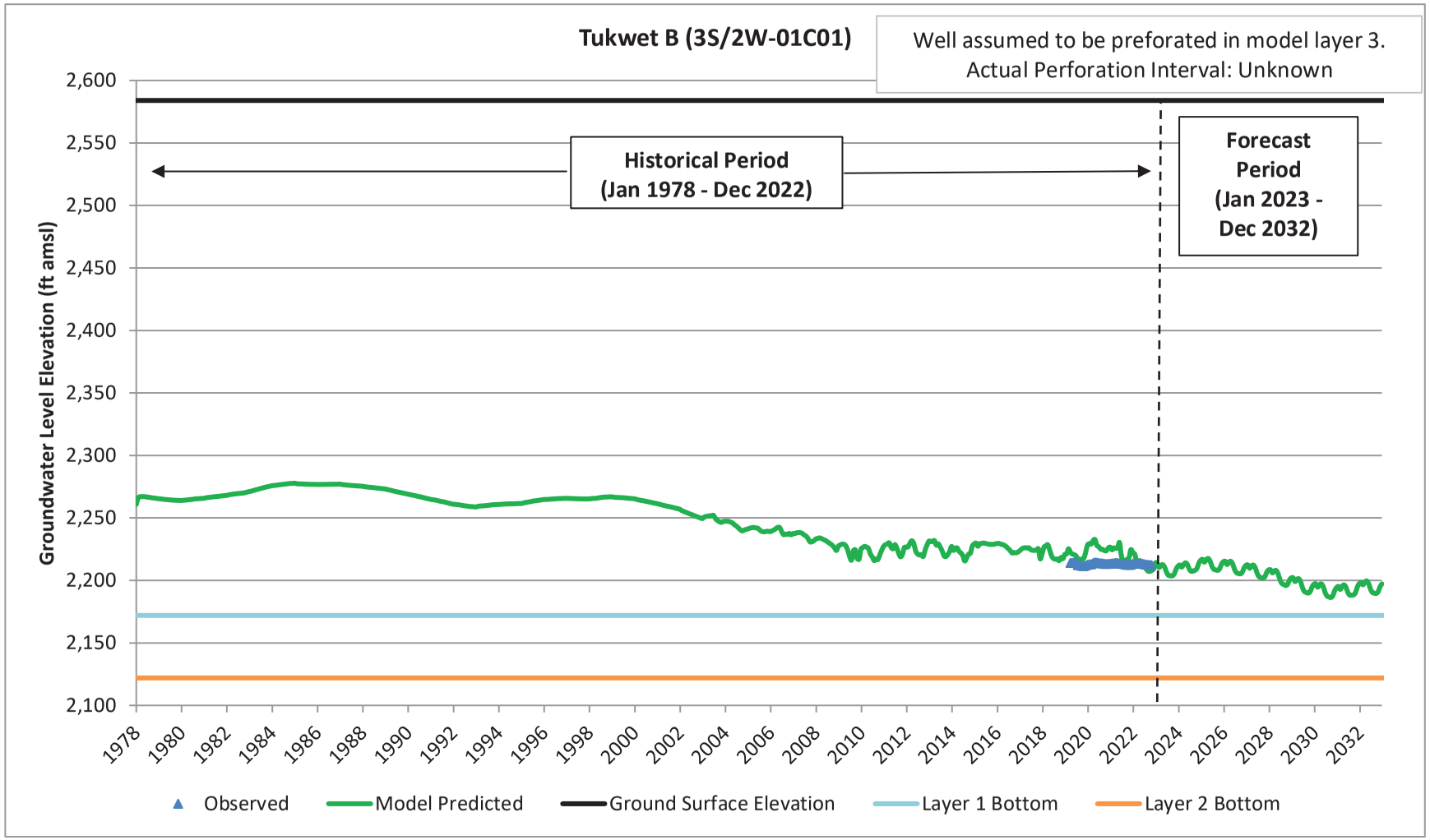
Appendix C

Model Calibration & Forecast Period Hydrographs at Calibration Targets

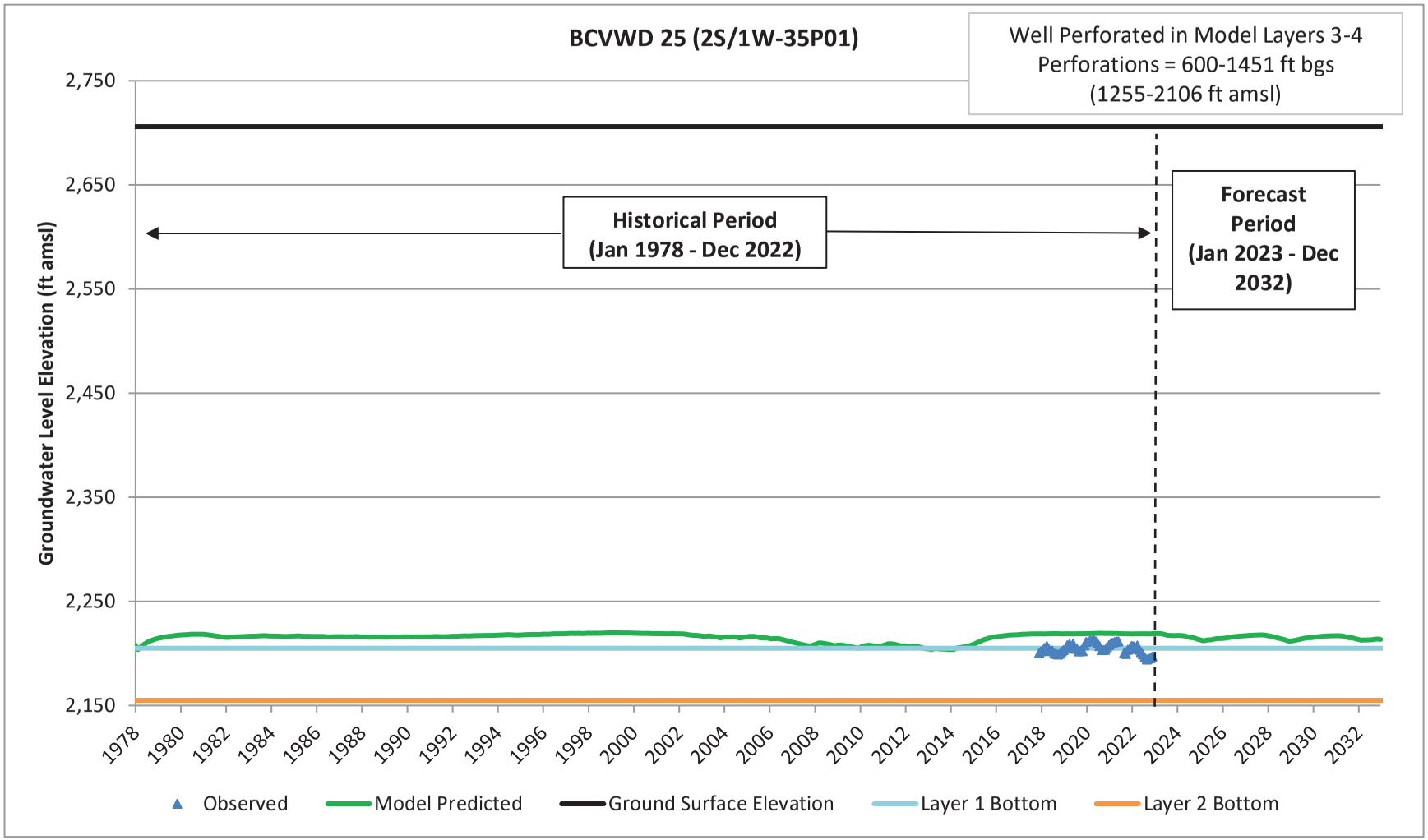
Model Calibration Hydrographs



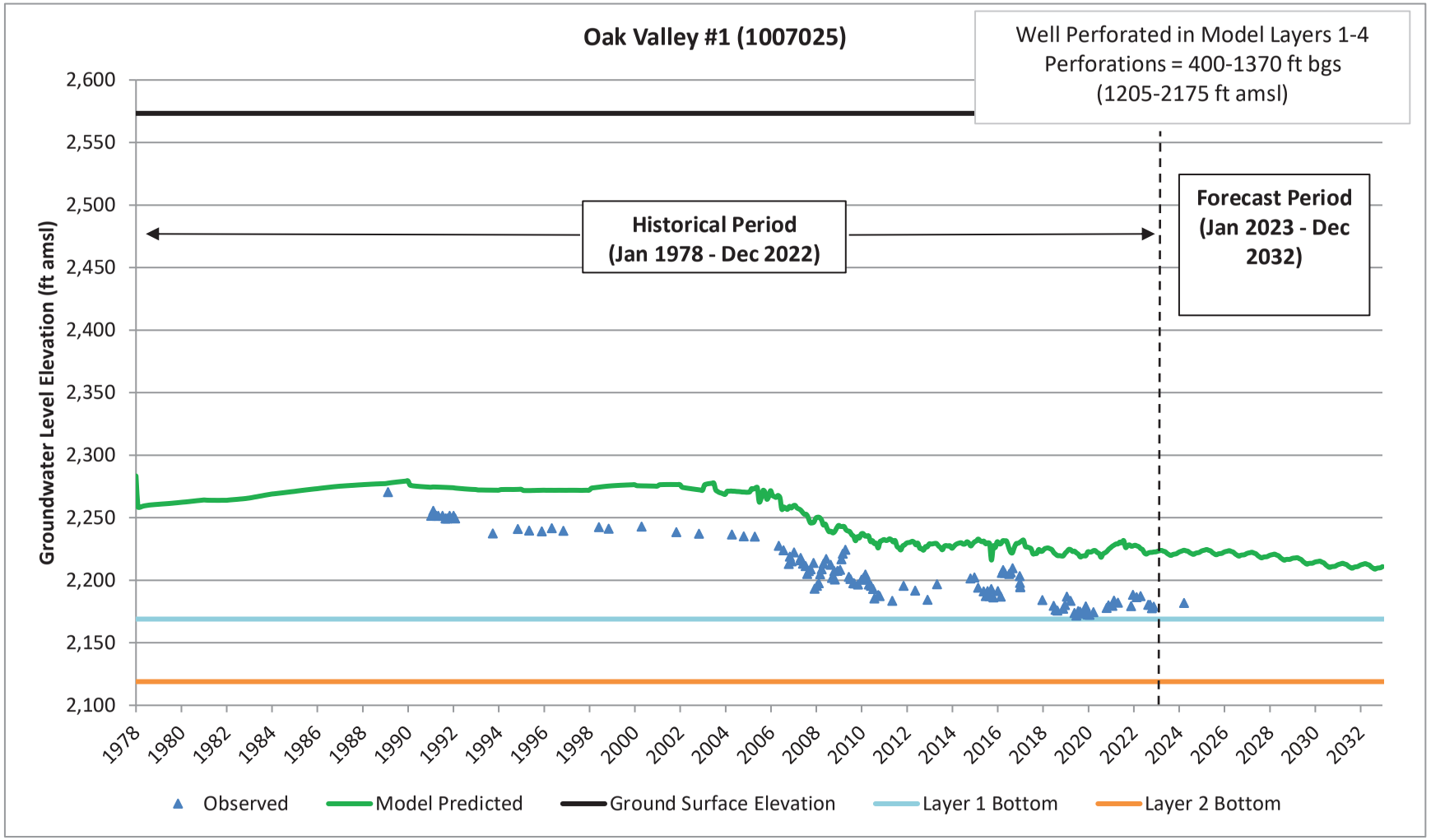
Model Calibration Hydrographs



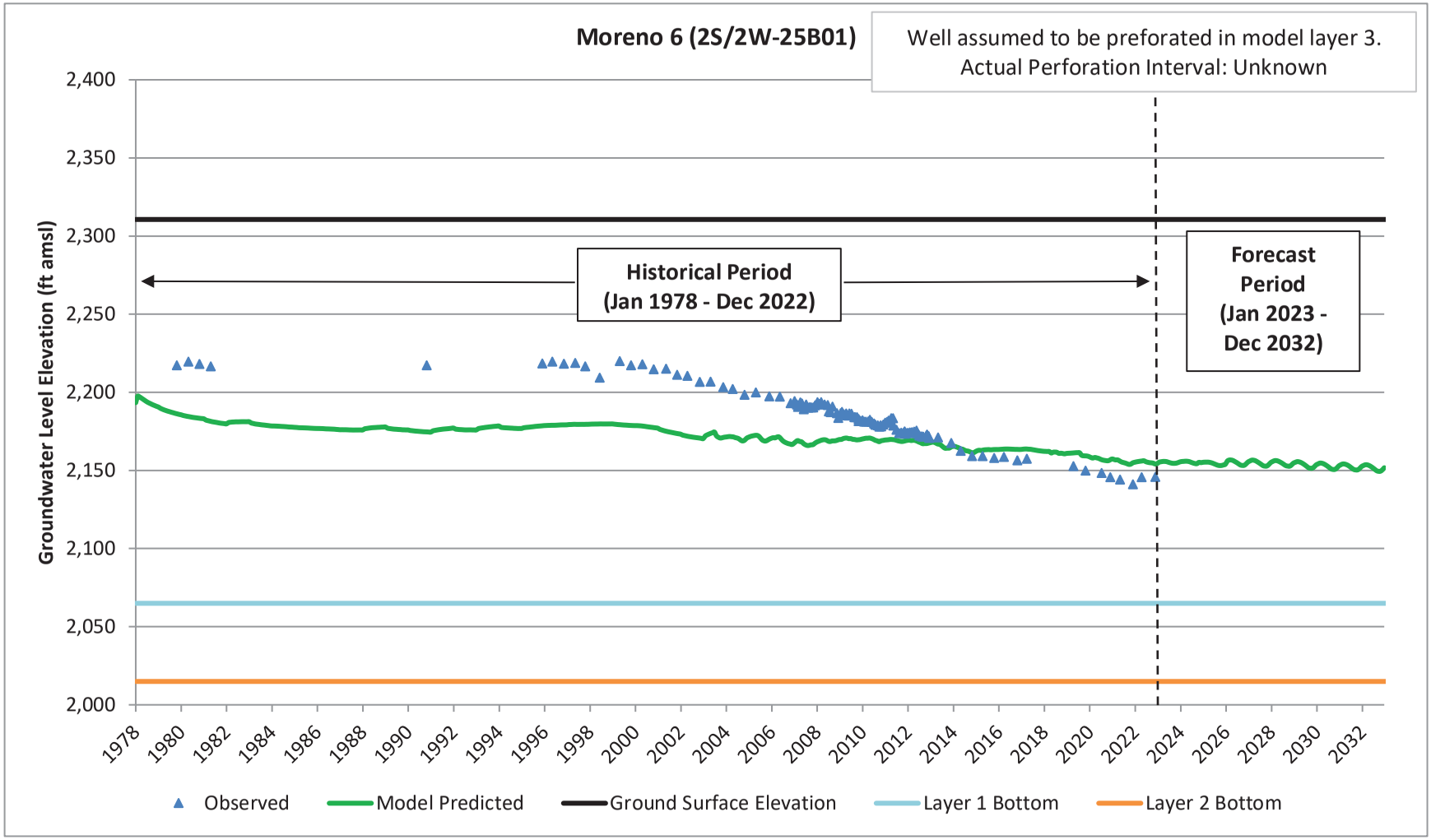
Model Calibration Hydrographs



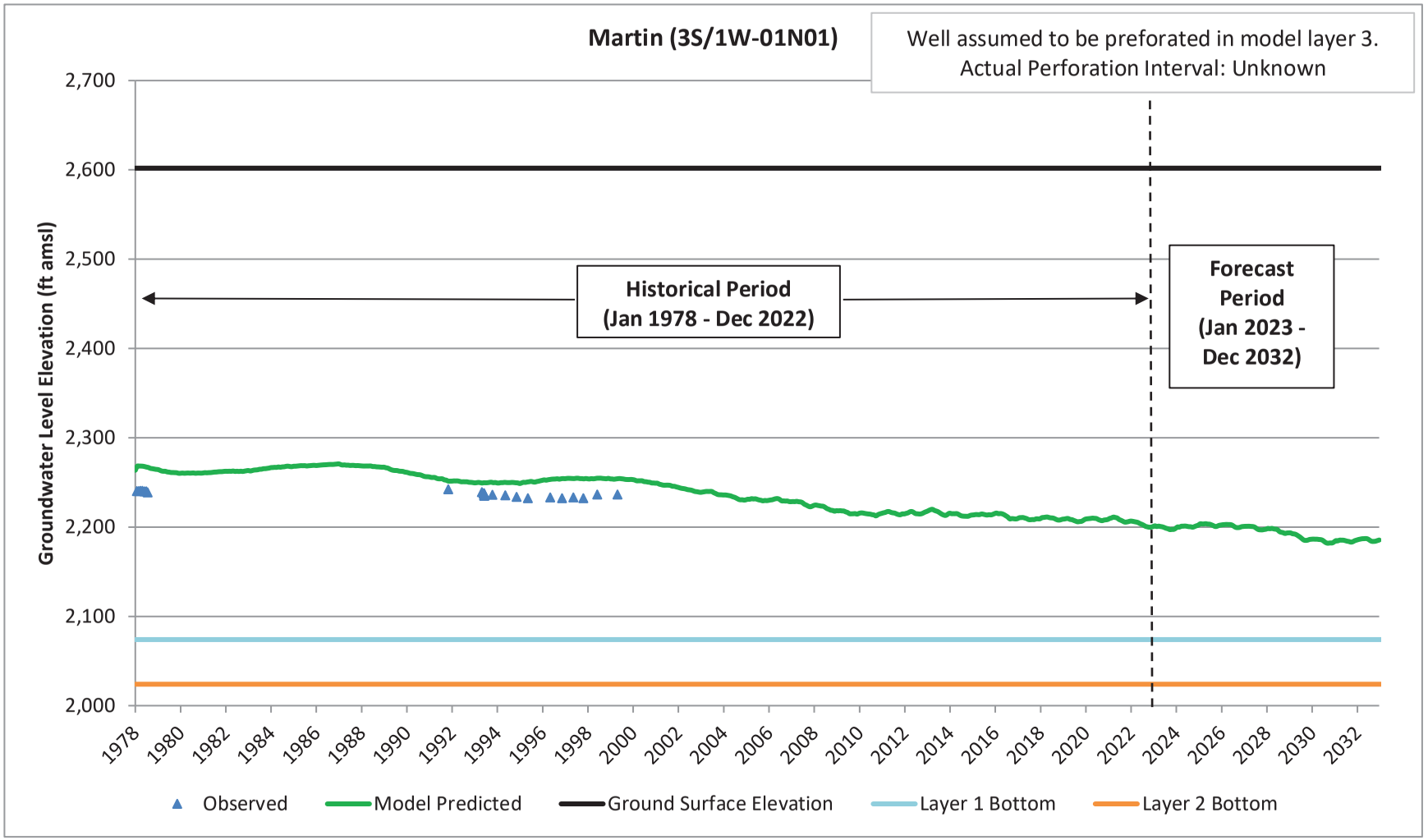
Model Calibration Hydrographs



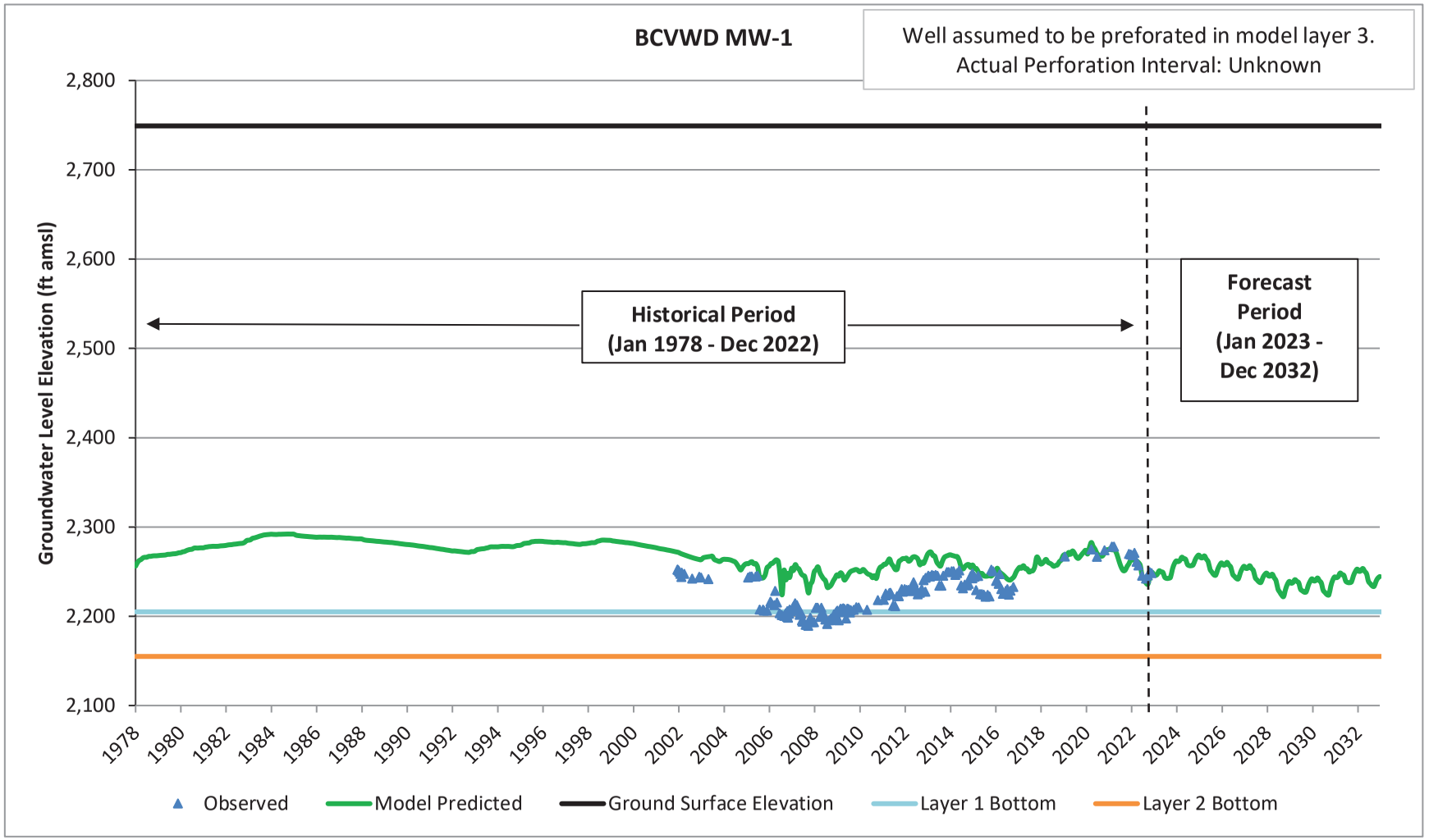
Model Calibration Hydrographs



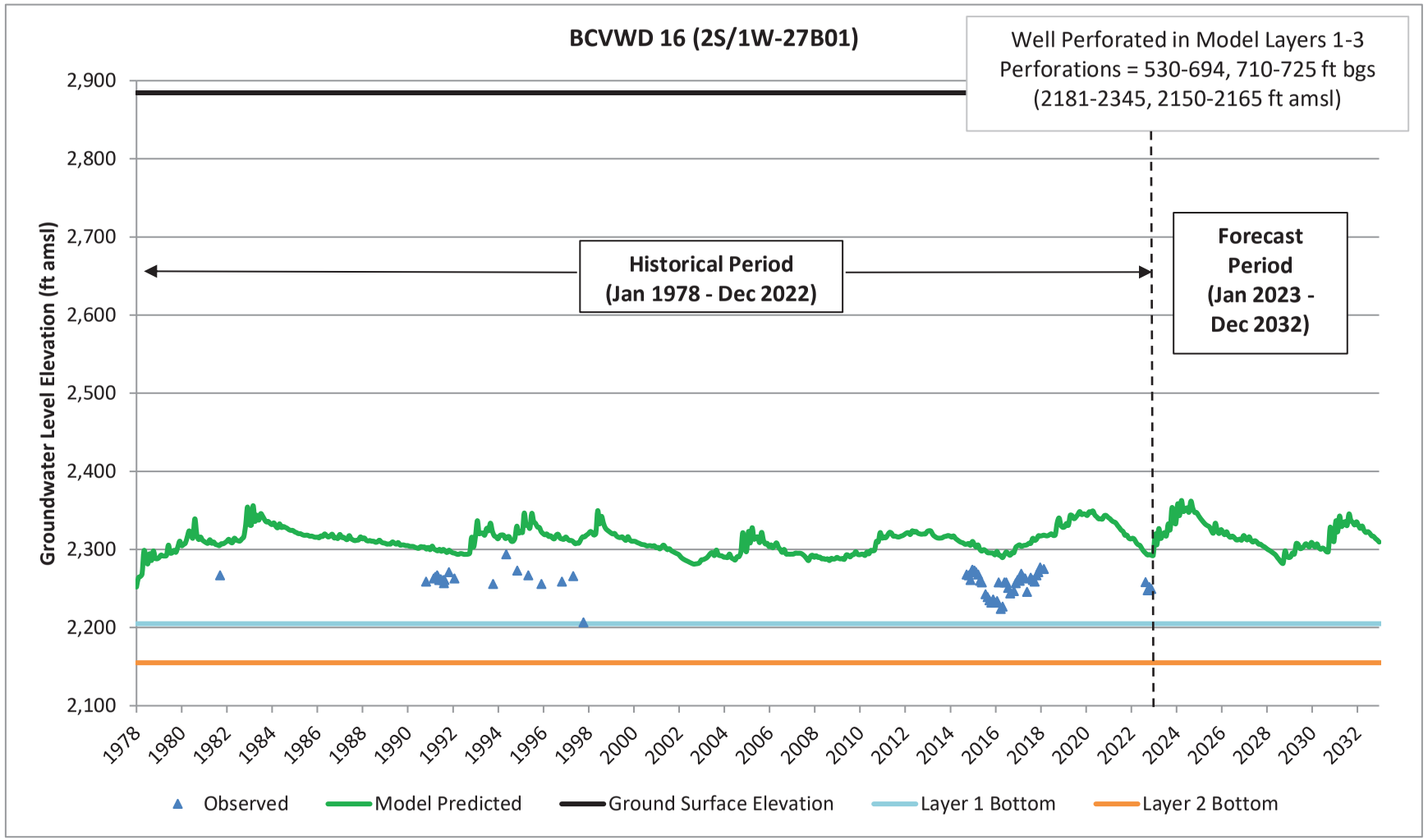
Model Calibration Hydrographs



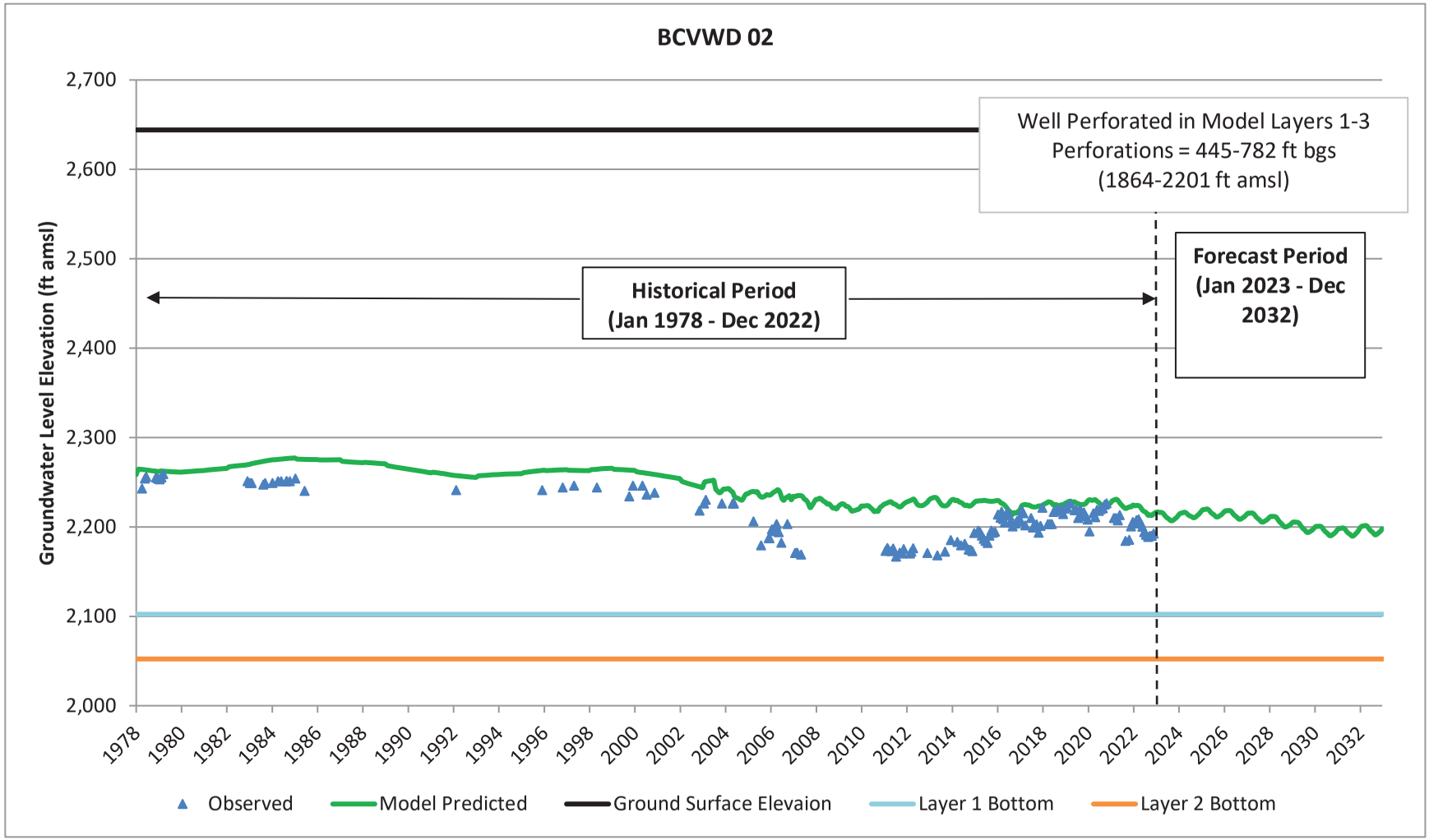
Model Calibration Hydrographs



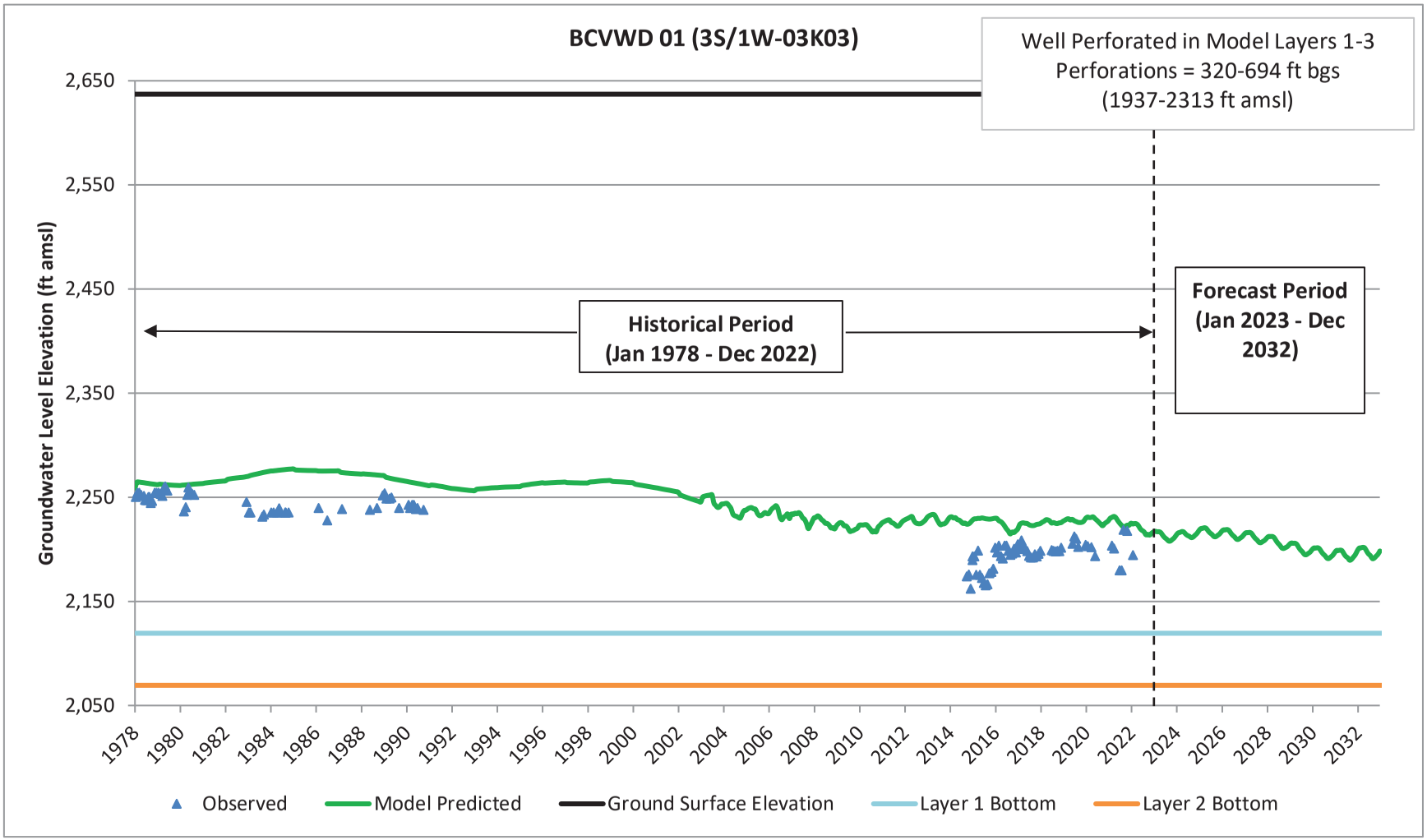
Model Calibration Hydrographs



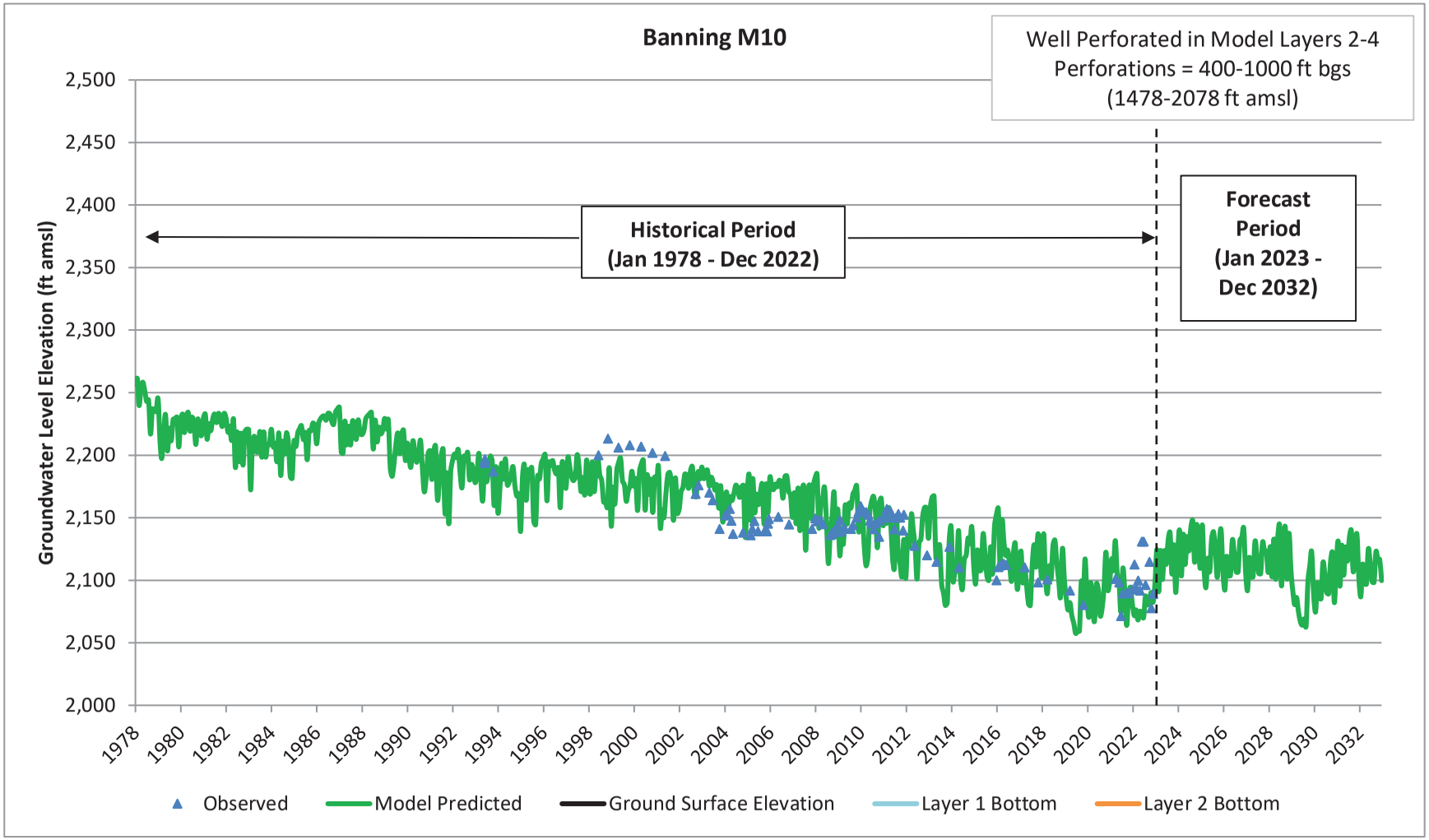
Model Calibration Hydrographs



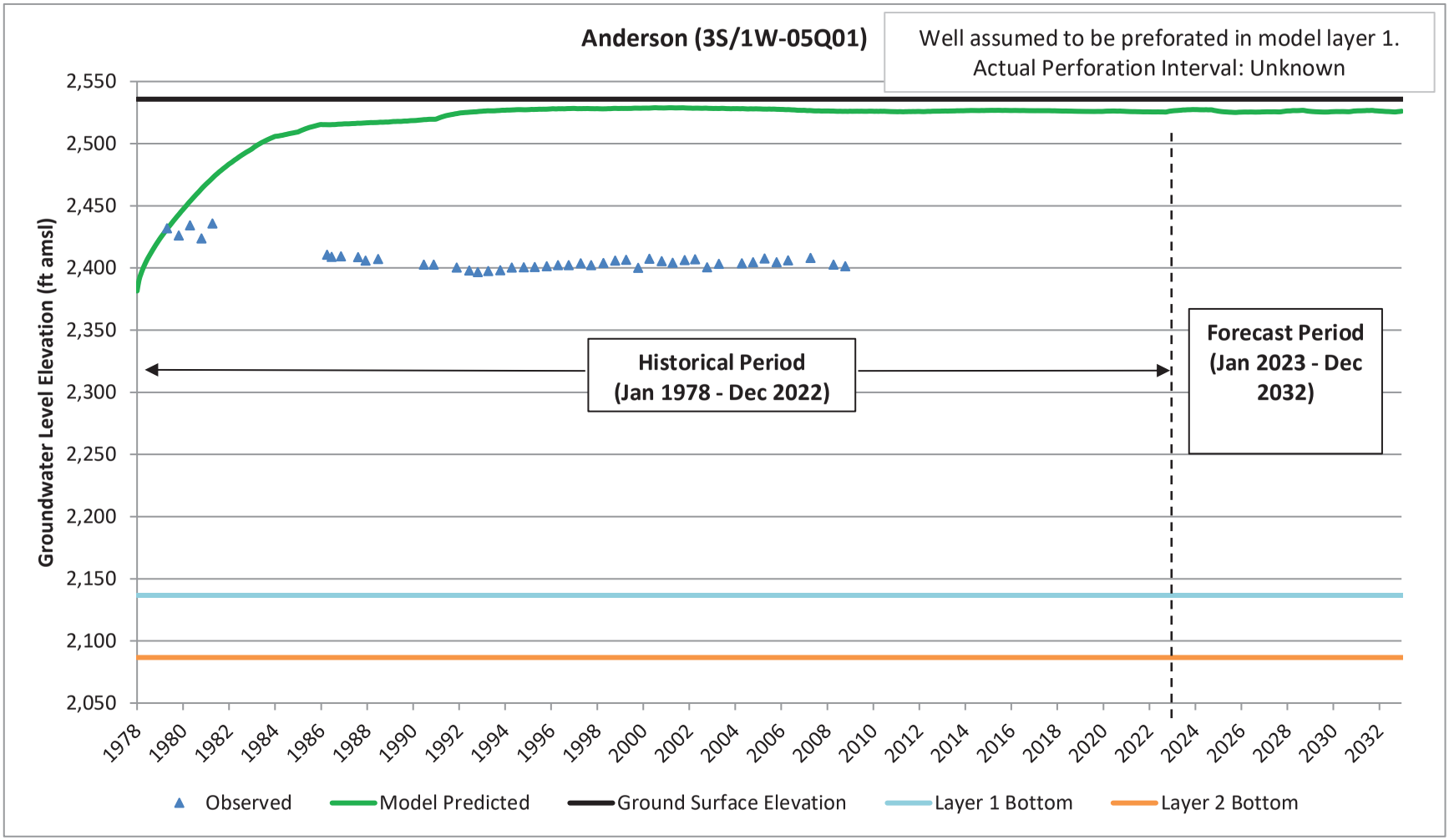
Model Calibration Hydrographs



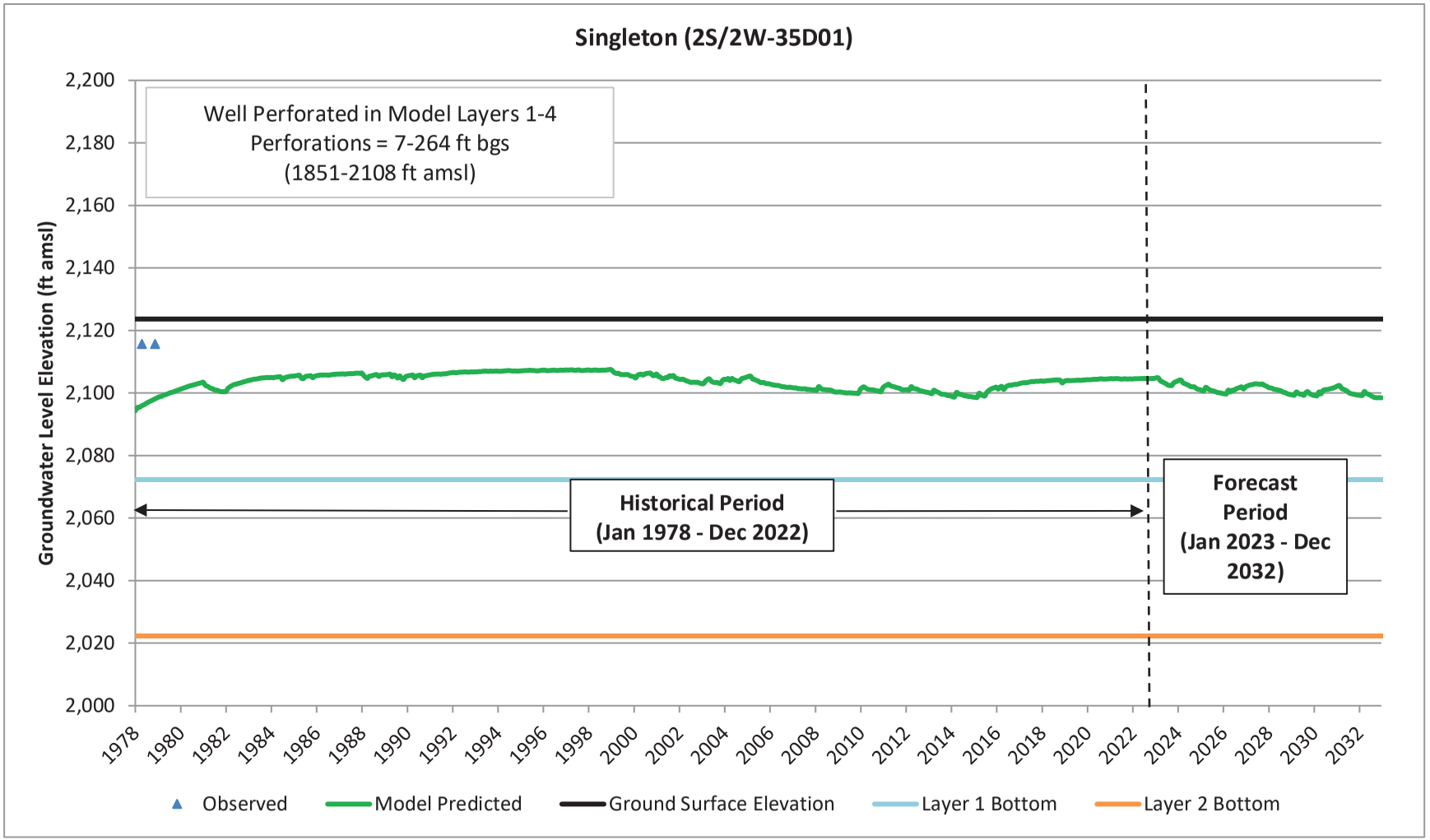
Model Calibration Hydrographs



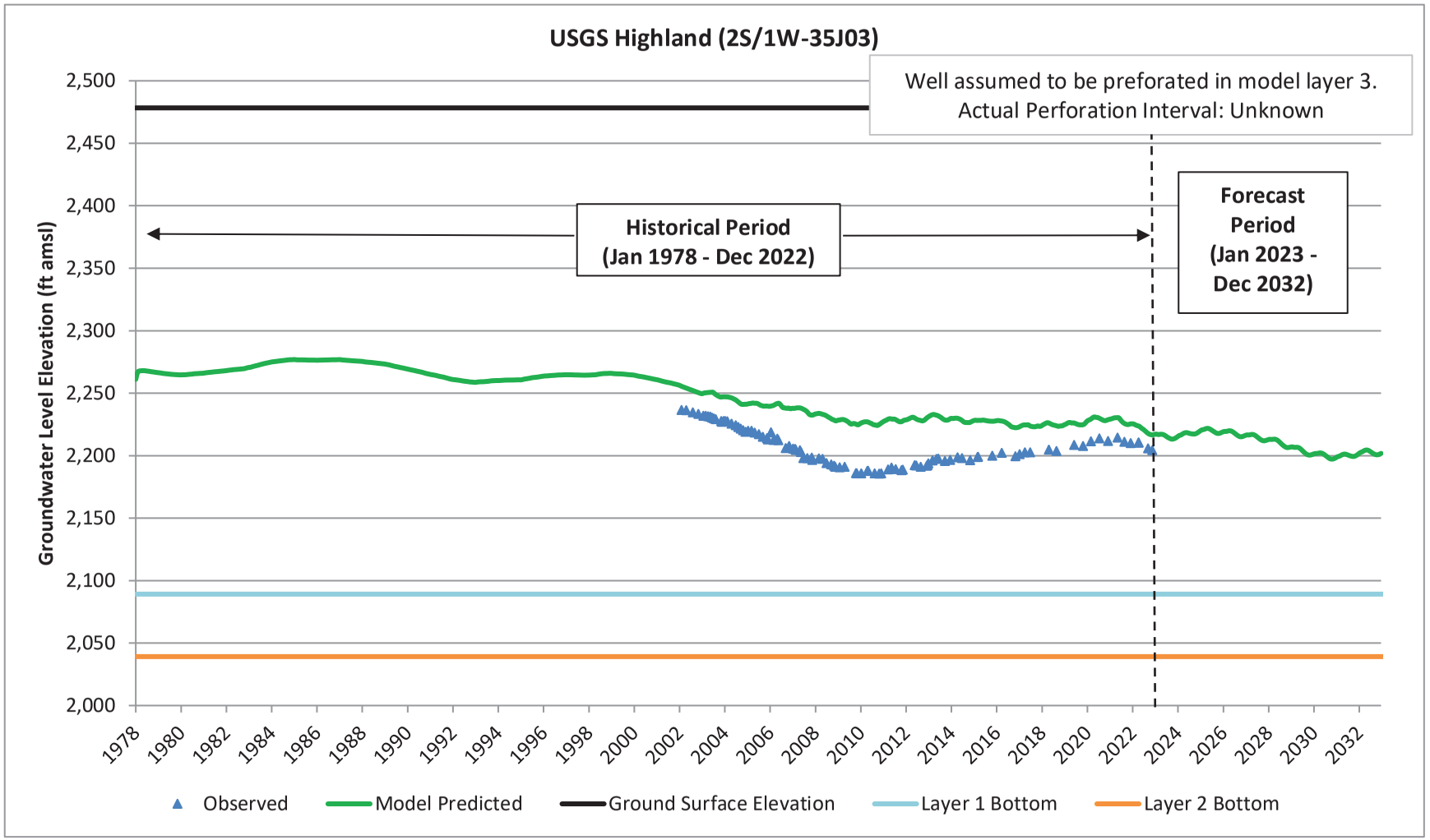
Model Calibration Hydrographs



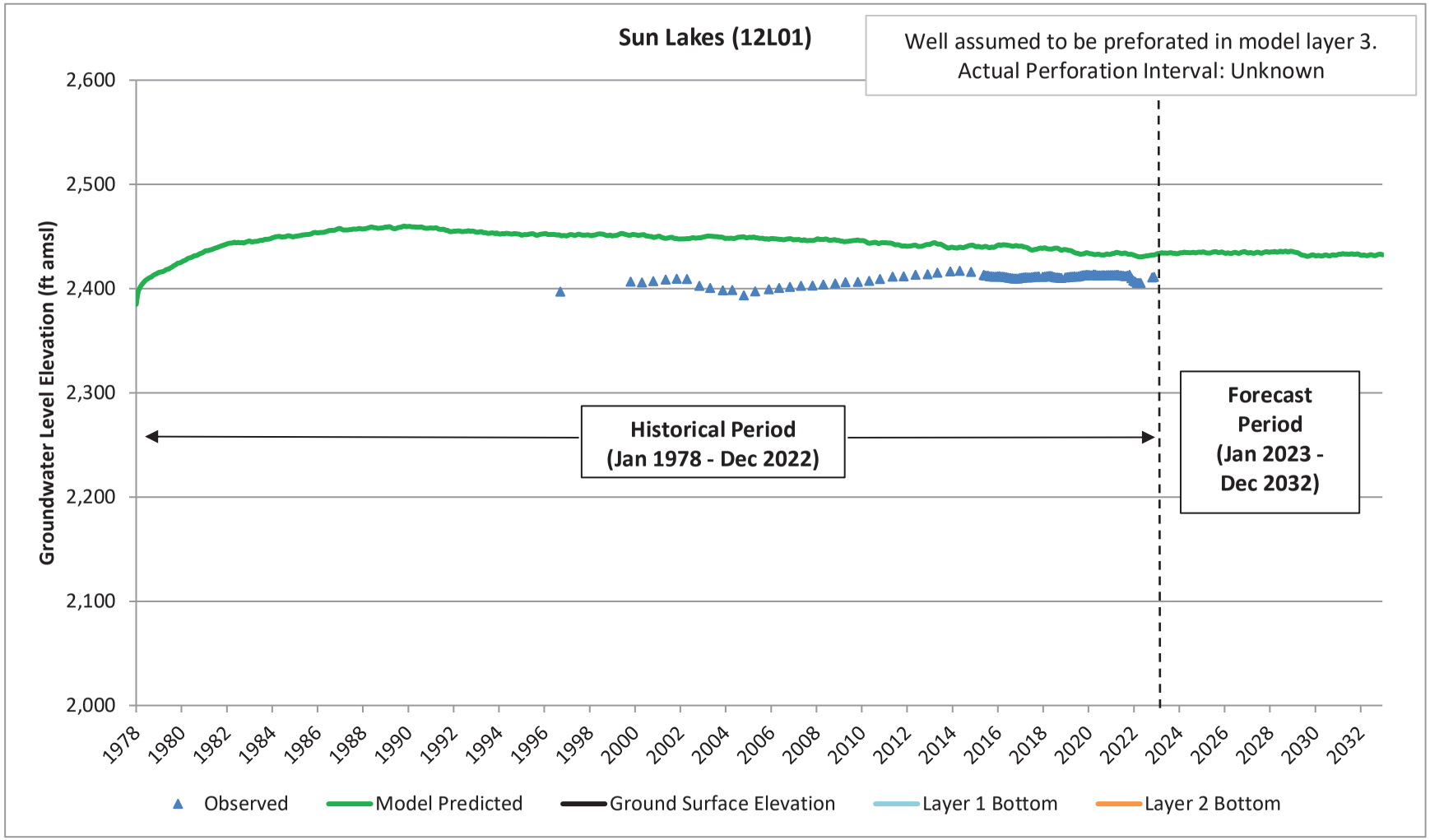
Model Calibration Hydrographs



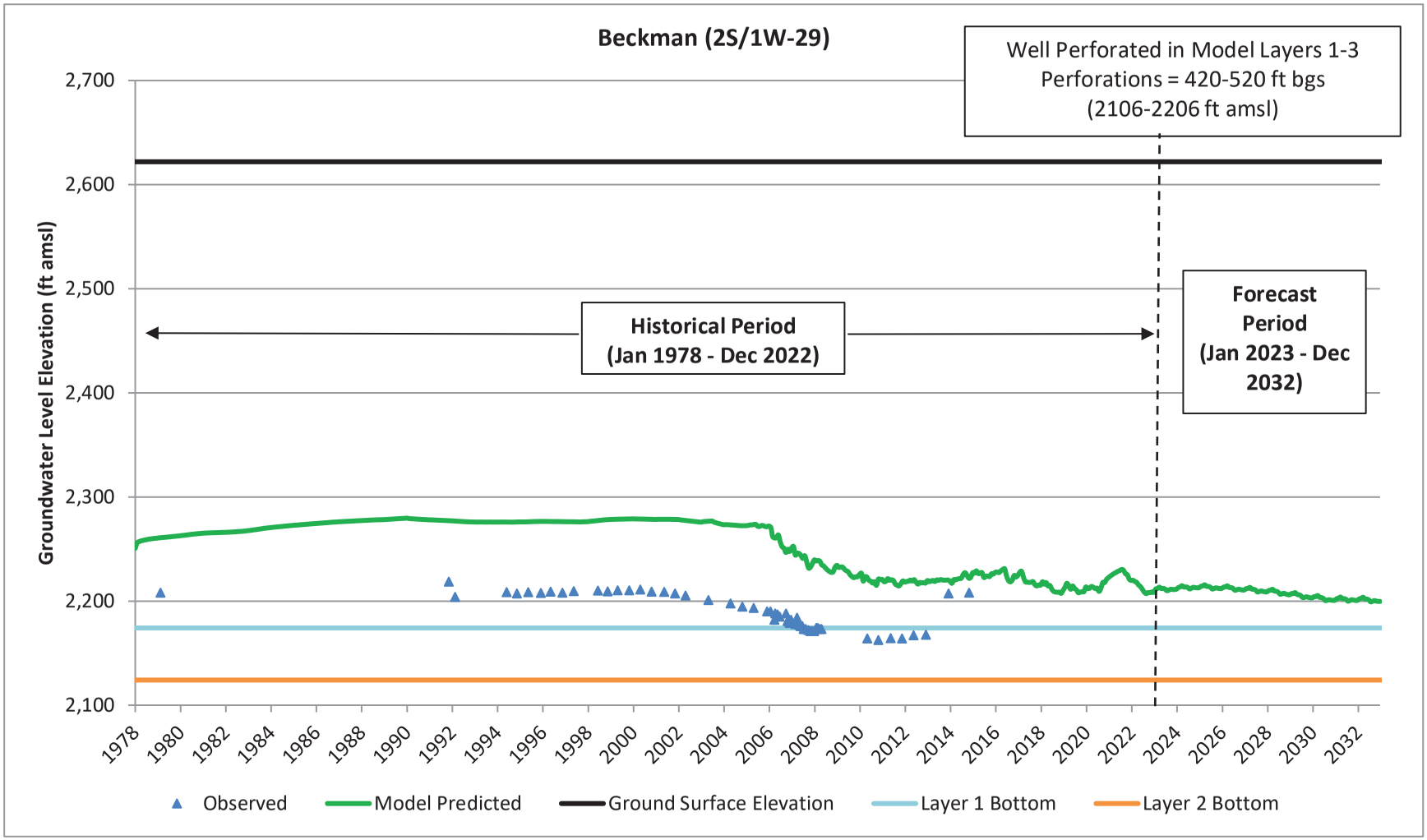
Model Calibration Hydrographs



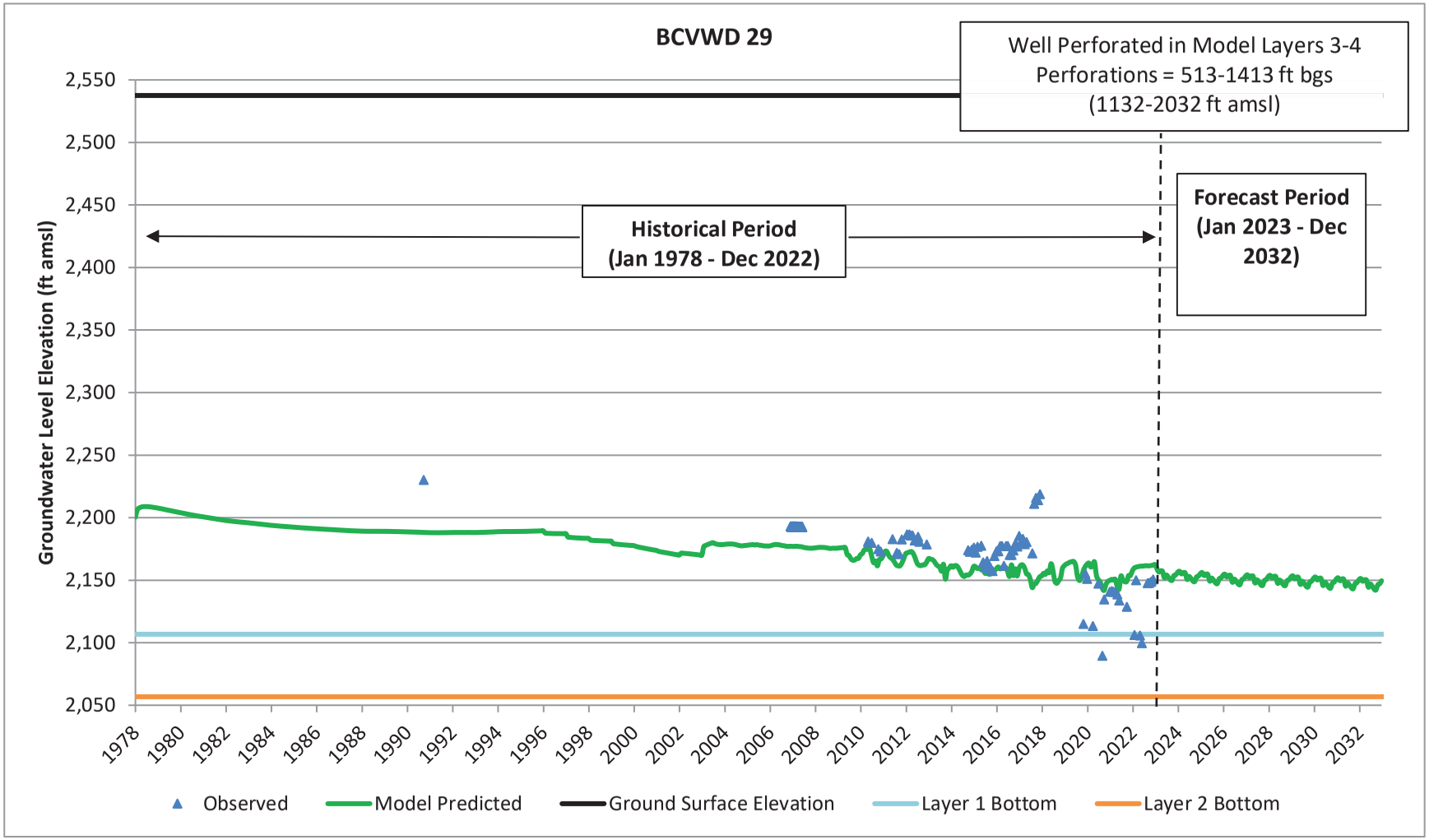
Model Calibration Hydrographs



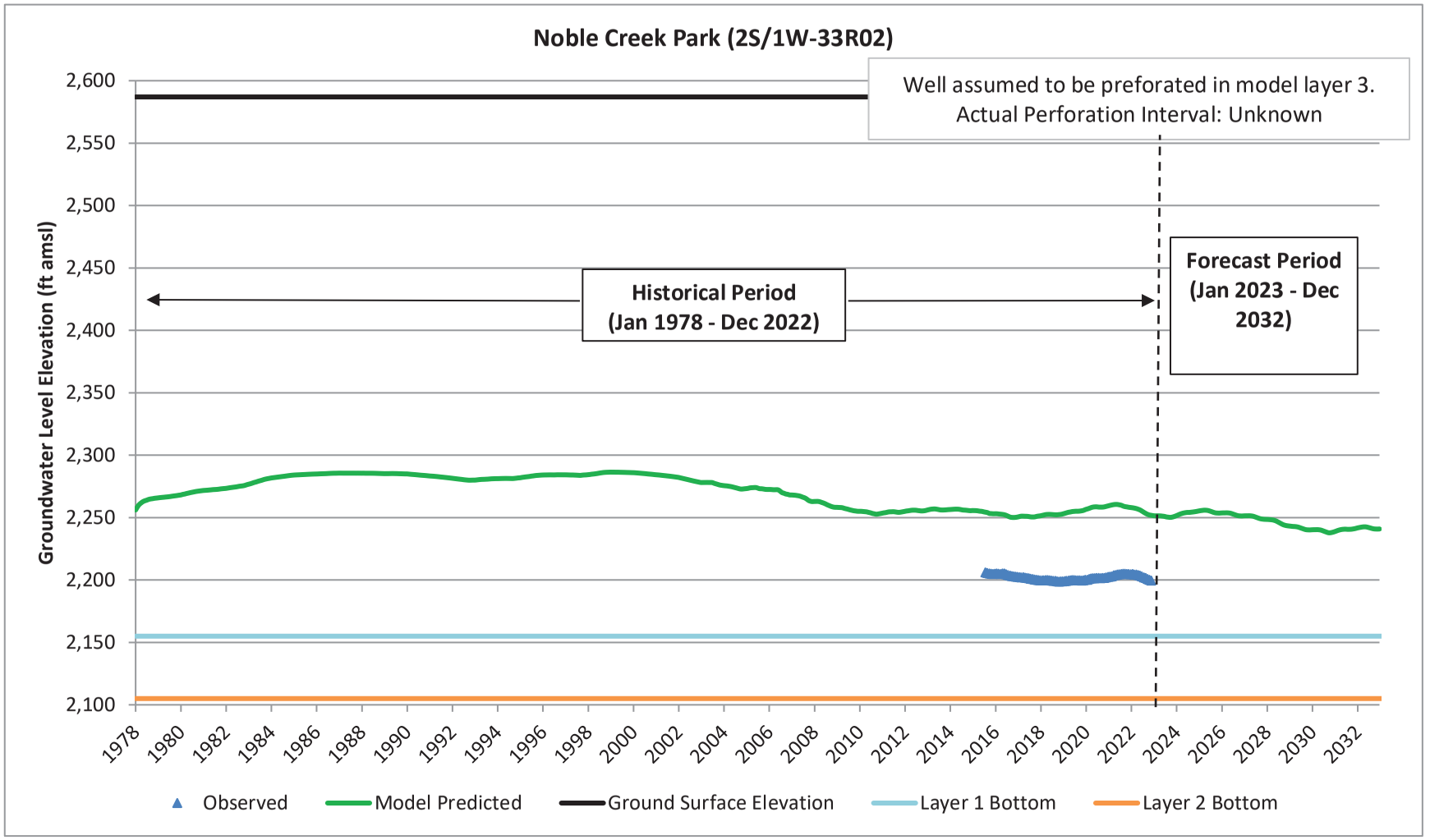
Model Calibration Hydrographs



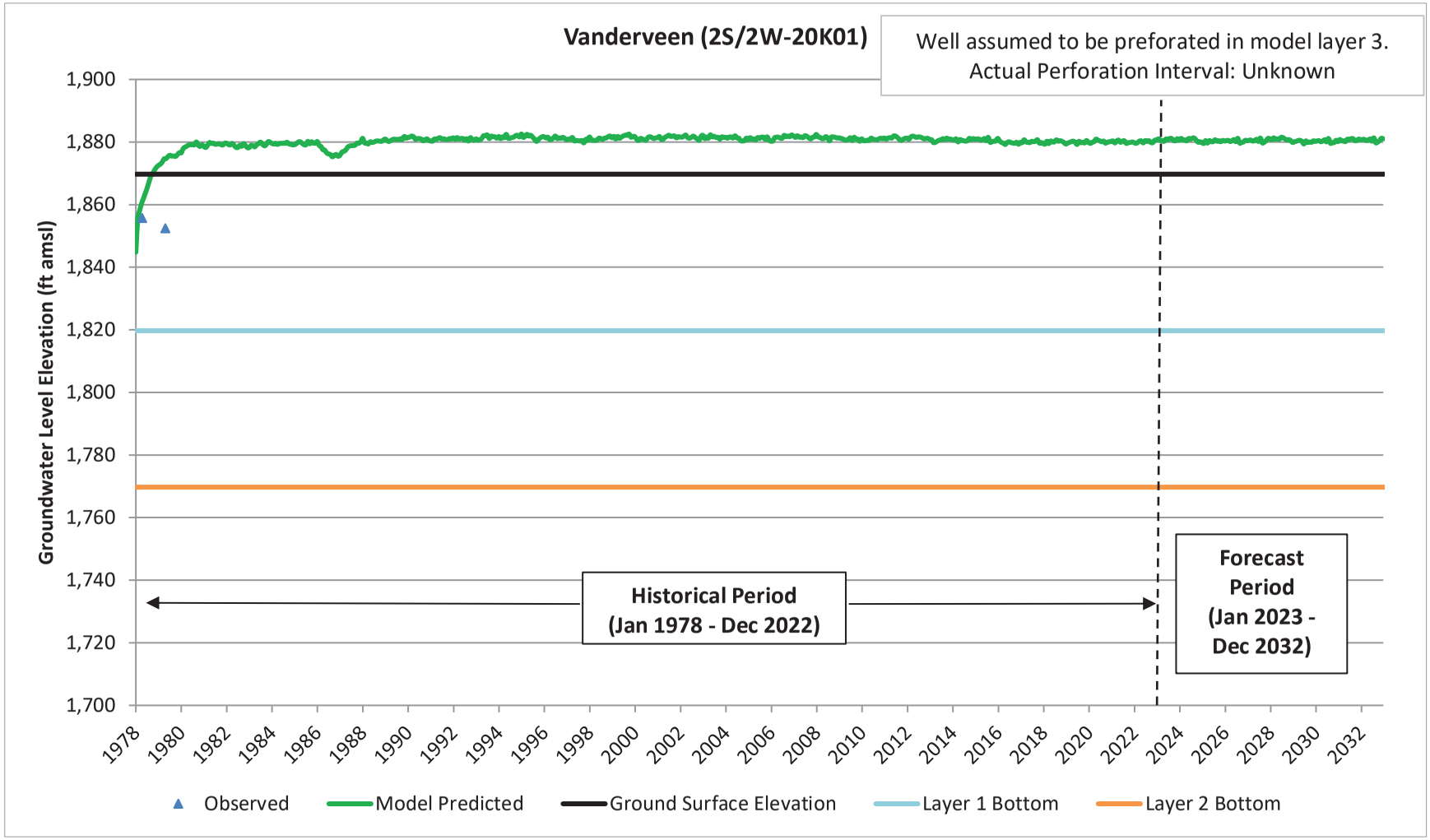
Model Calibration Hydrographs



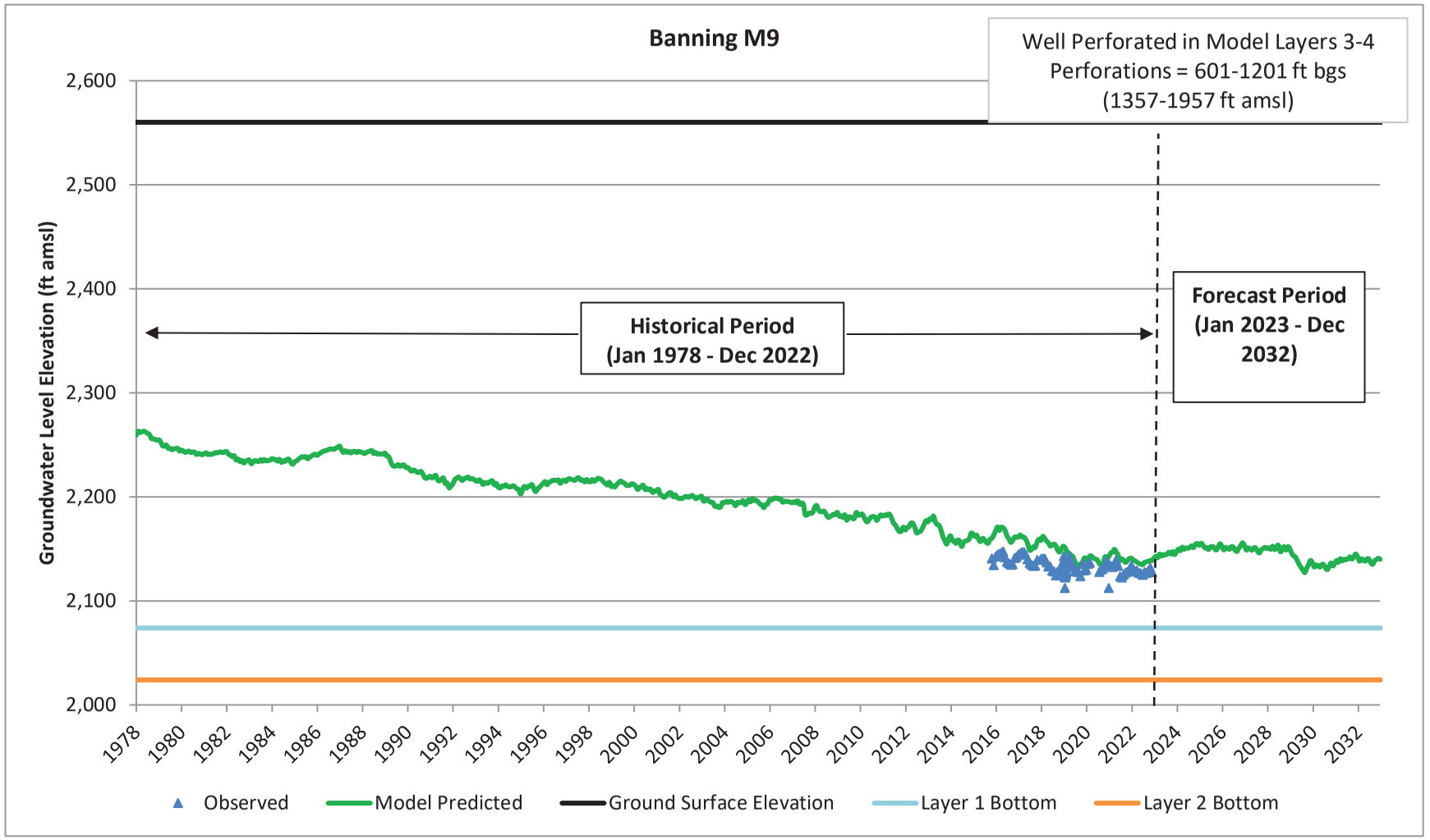
Model Calibration Hydrographs



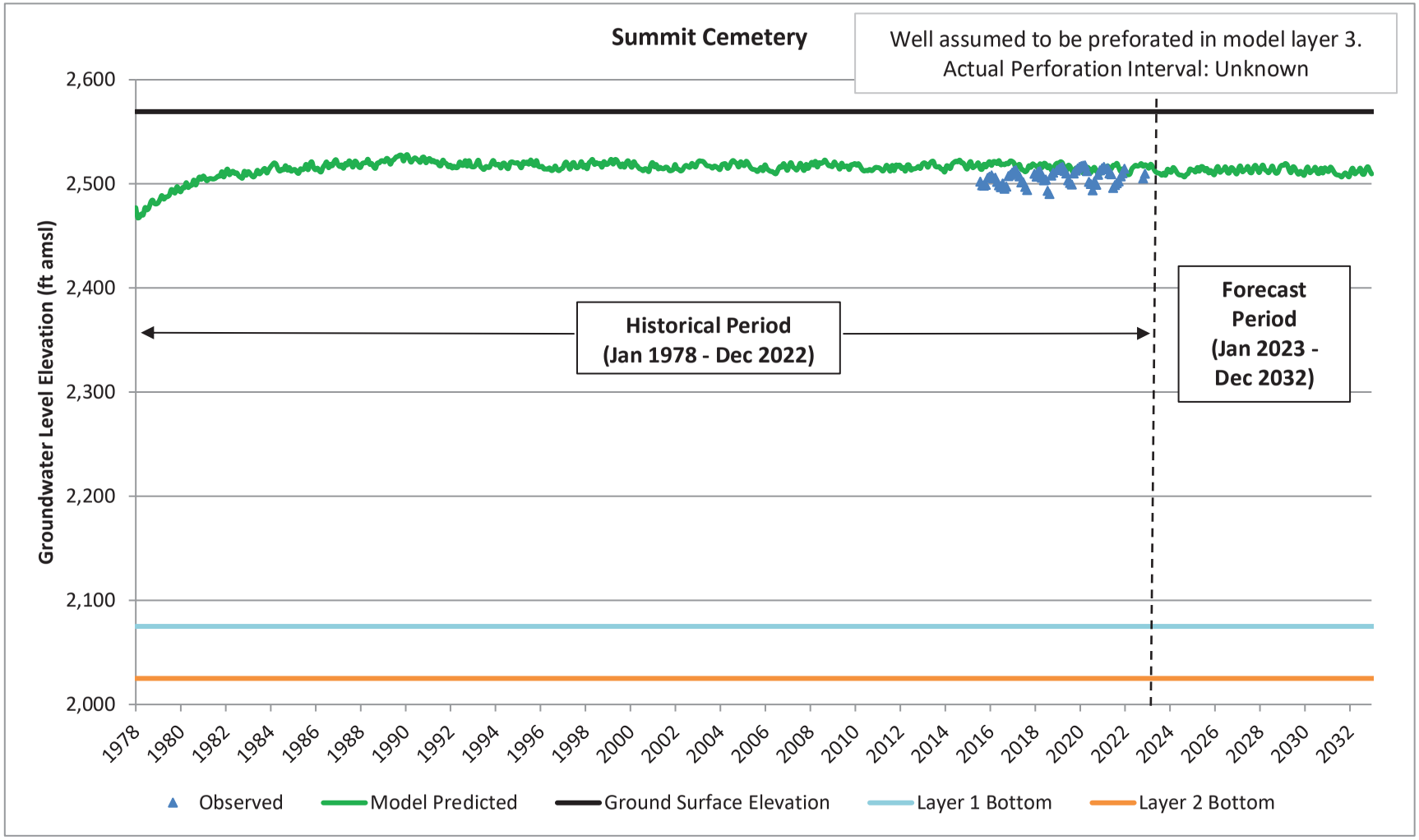
Model Calibration Hydrographs



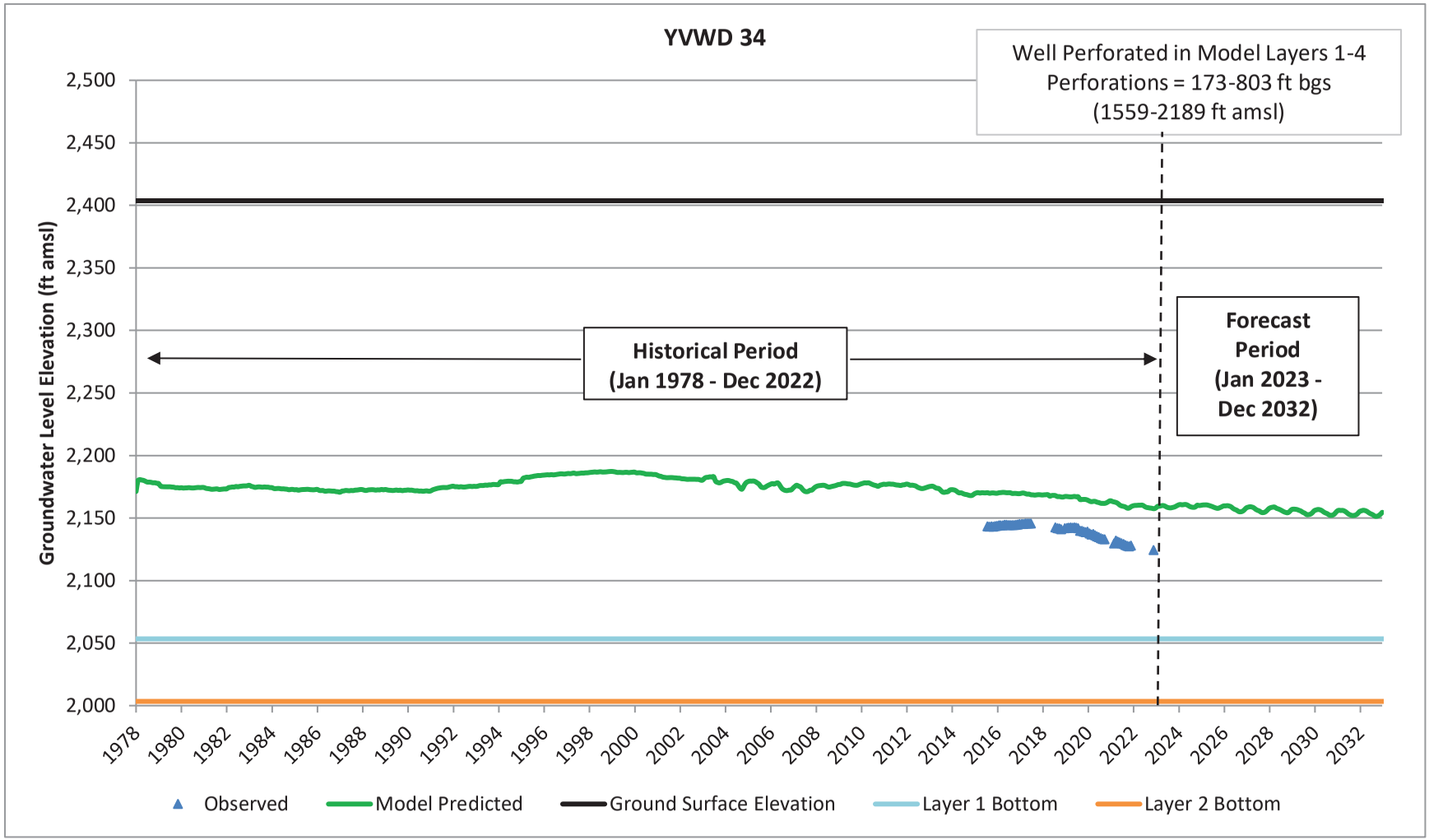
Model Calibration Hydrographs



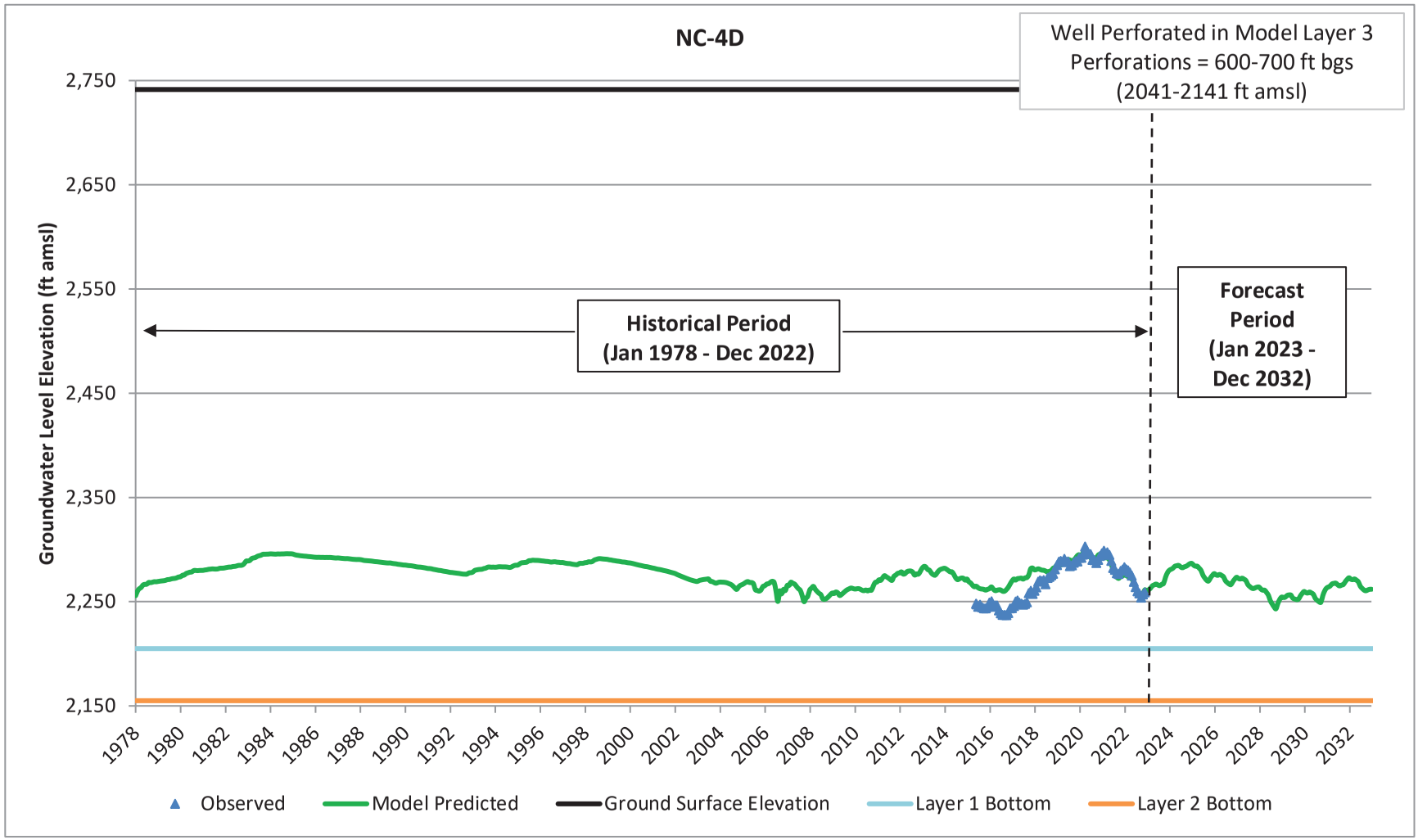
Model Calibration Hydrographs



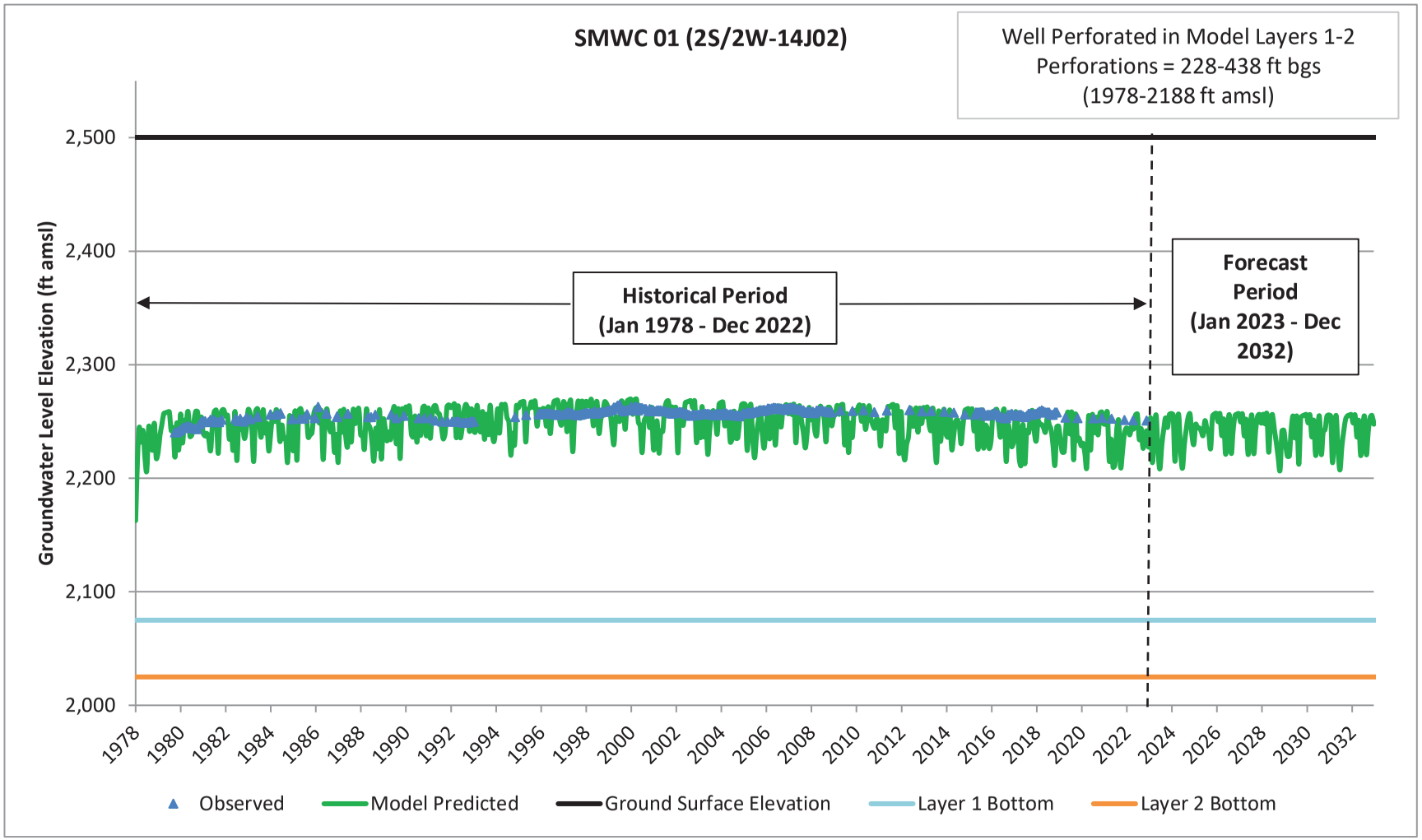
Model Calibration Hydrographs



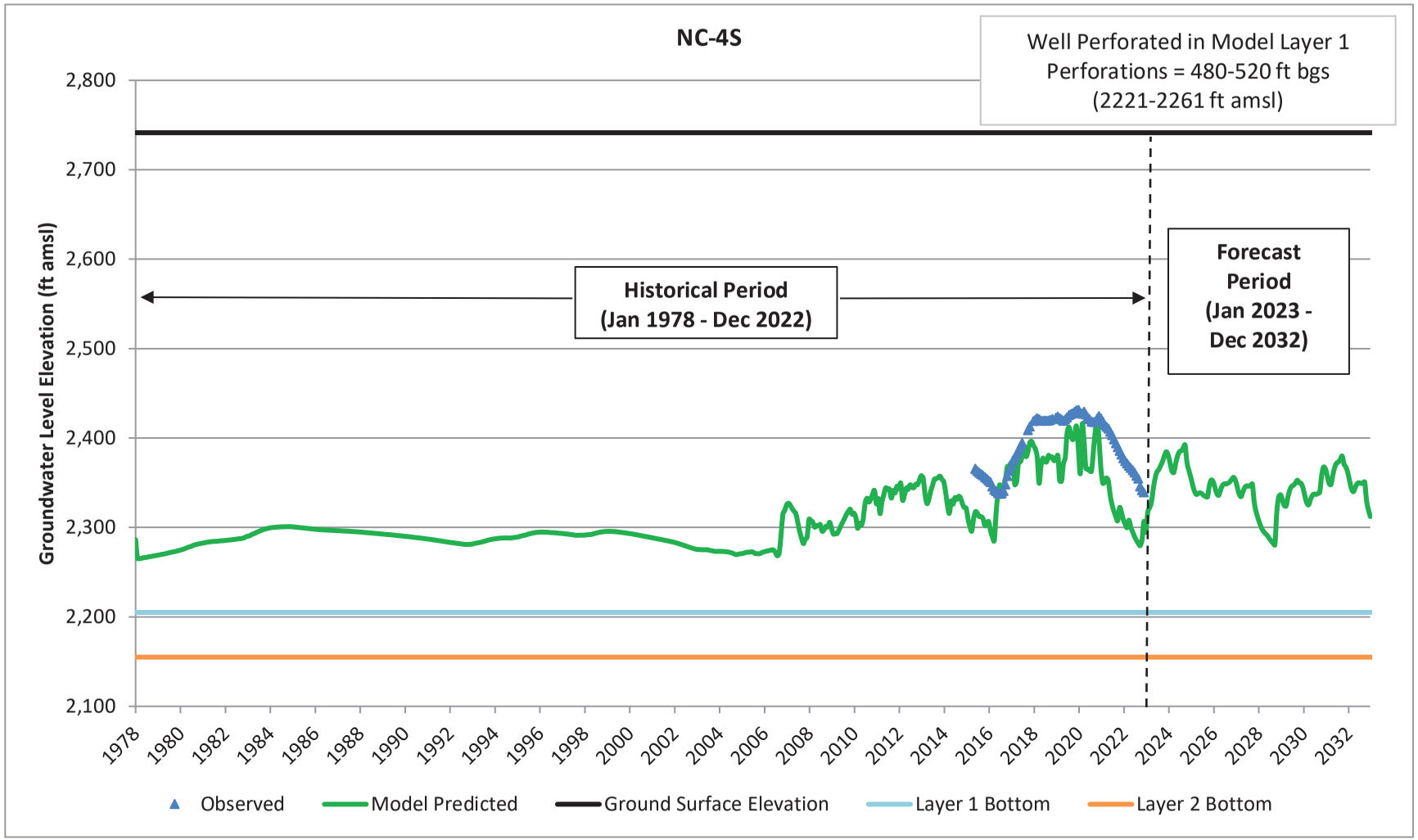
Model Calibration Hydrographs



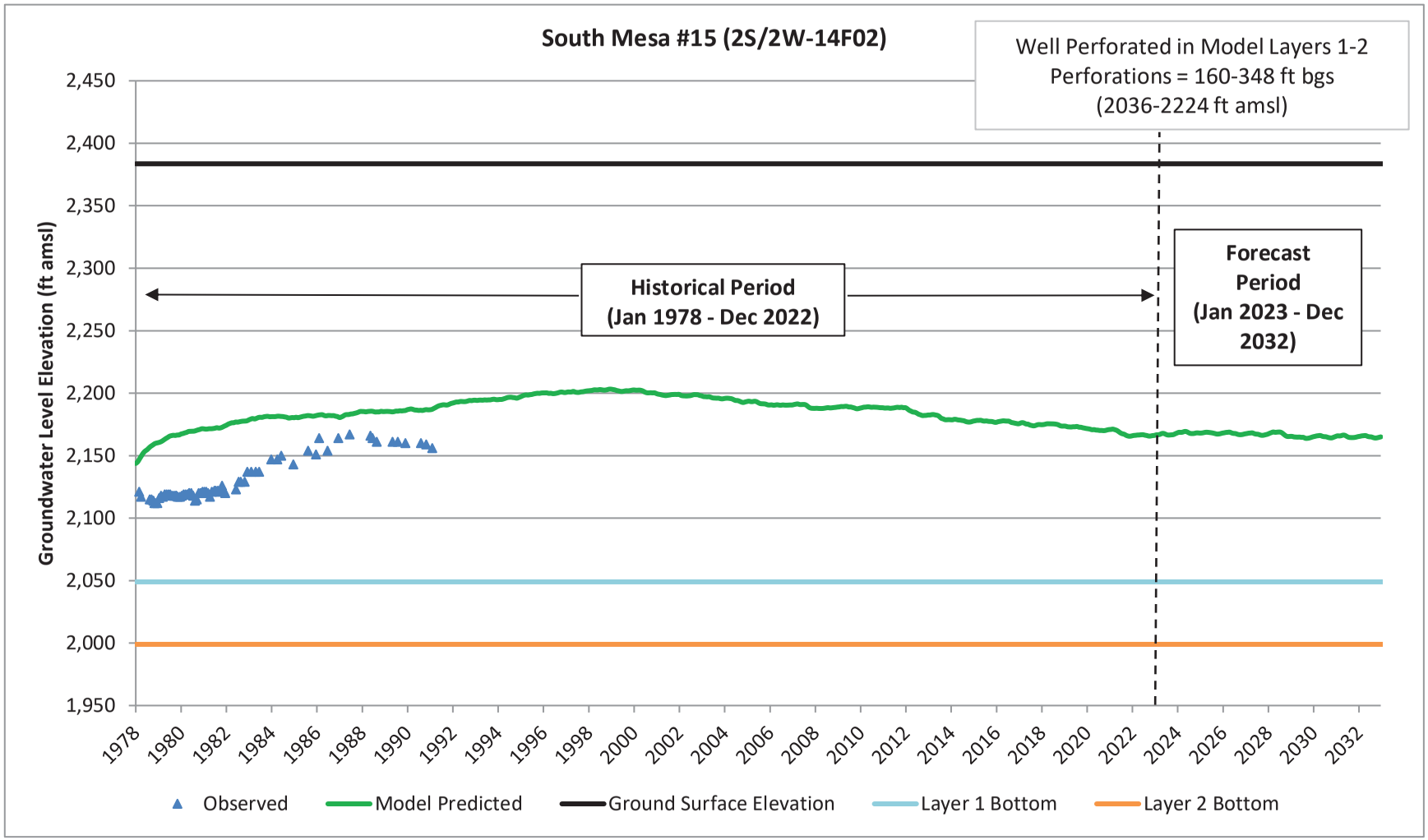
Model Calibration Hydrographs



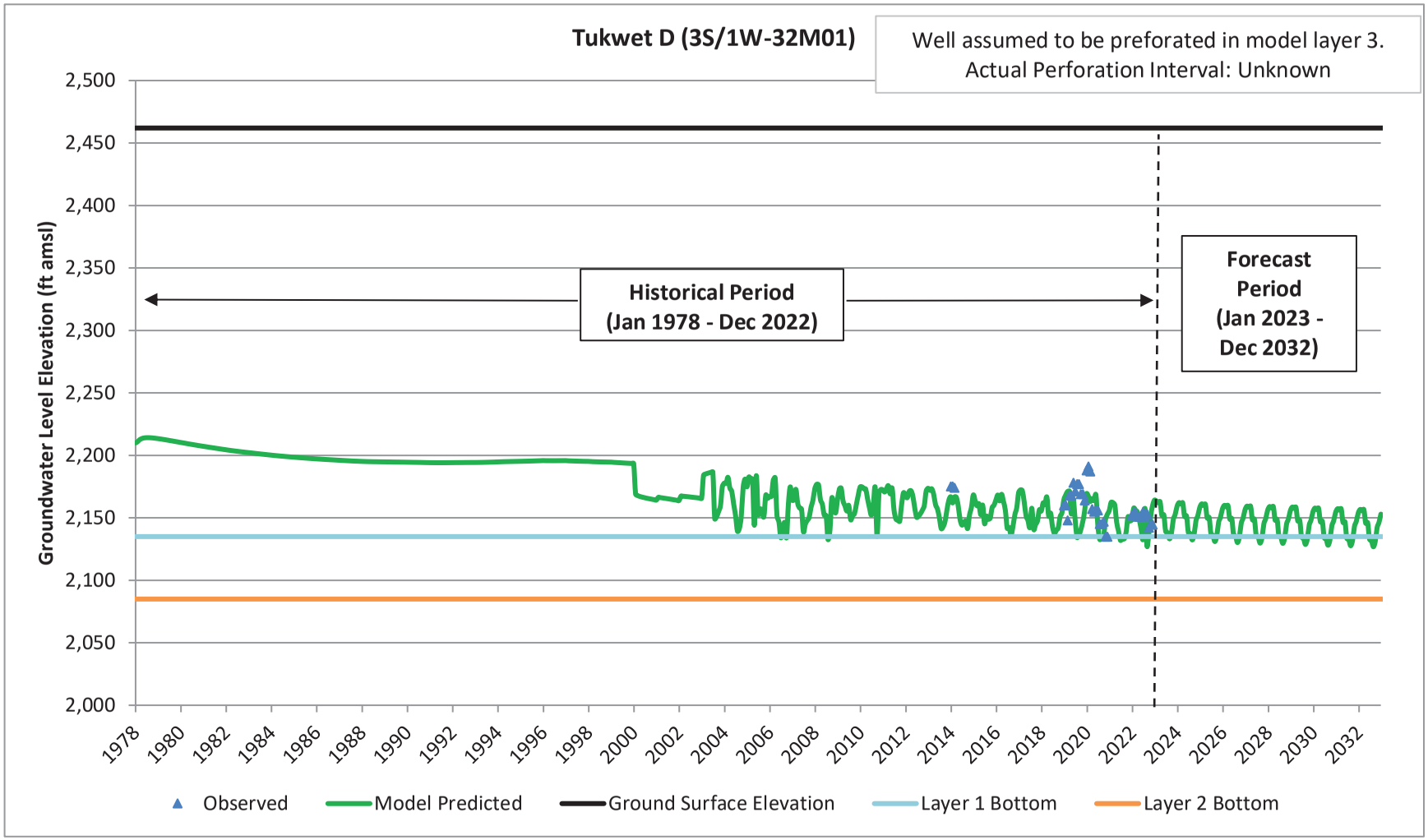
Model Calibration Hydrographs



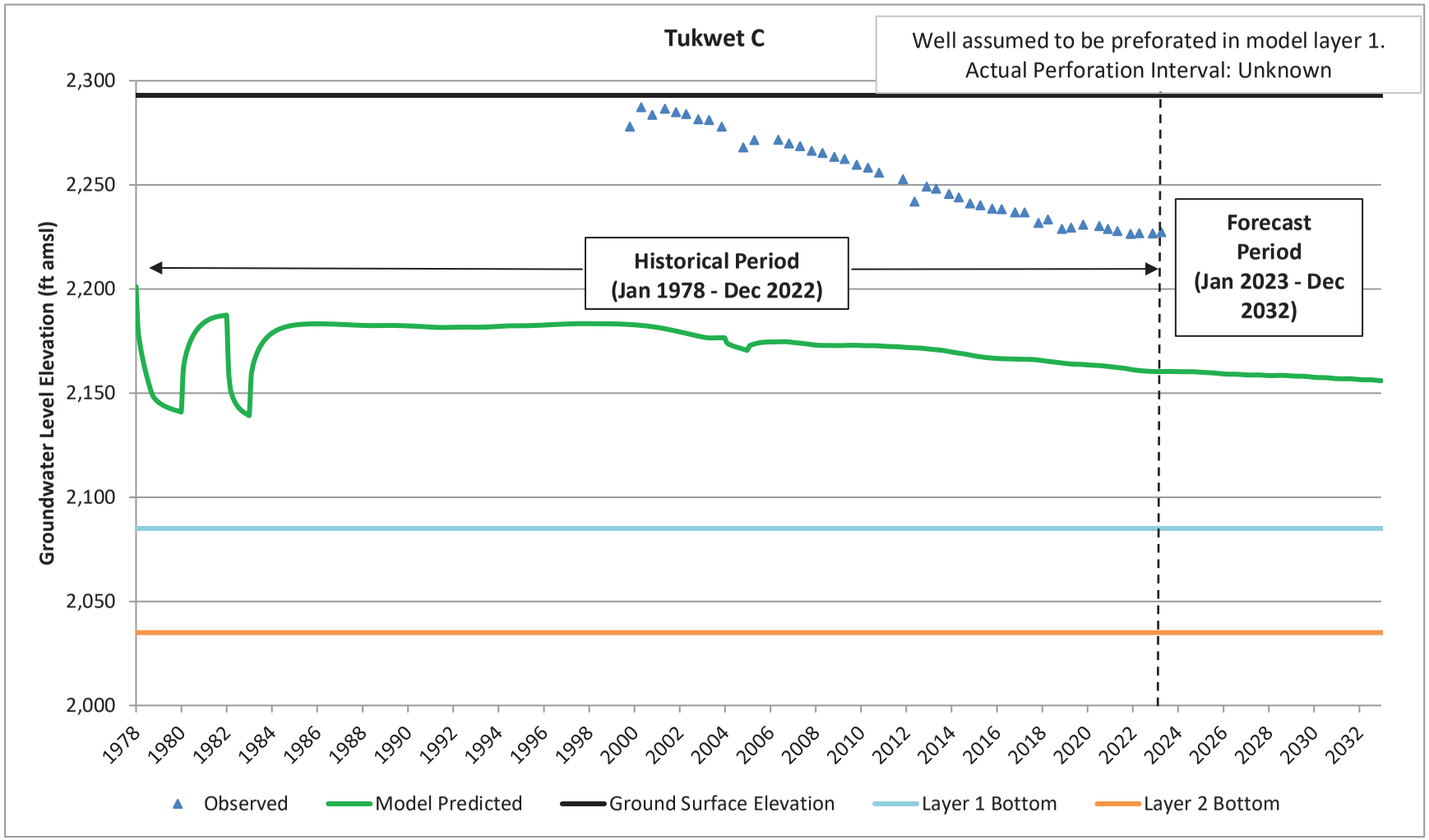
Model Calibration Hydrographs



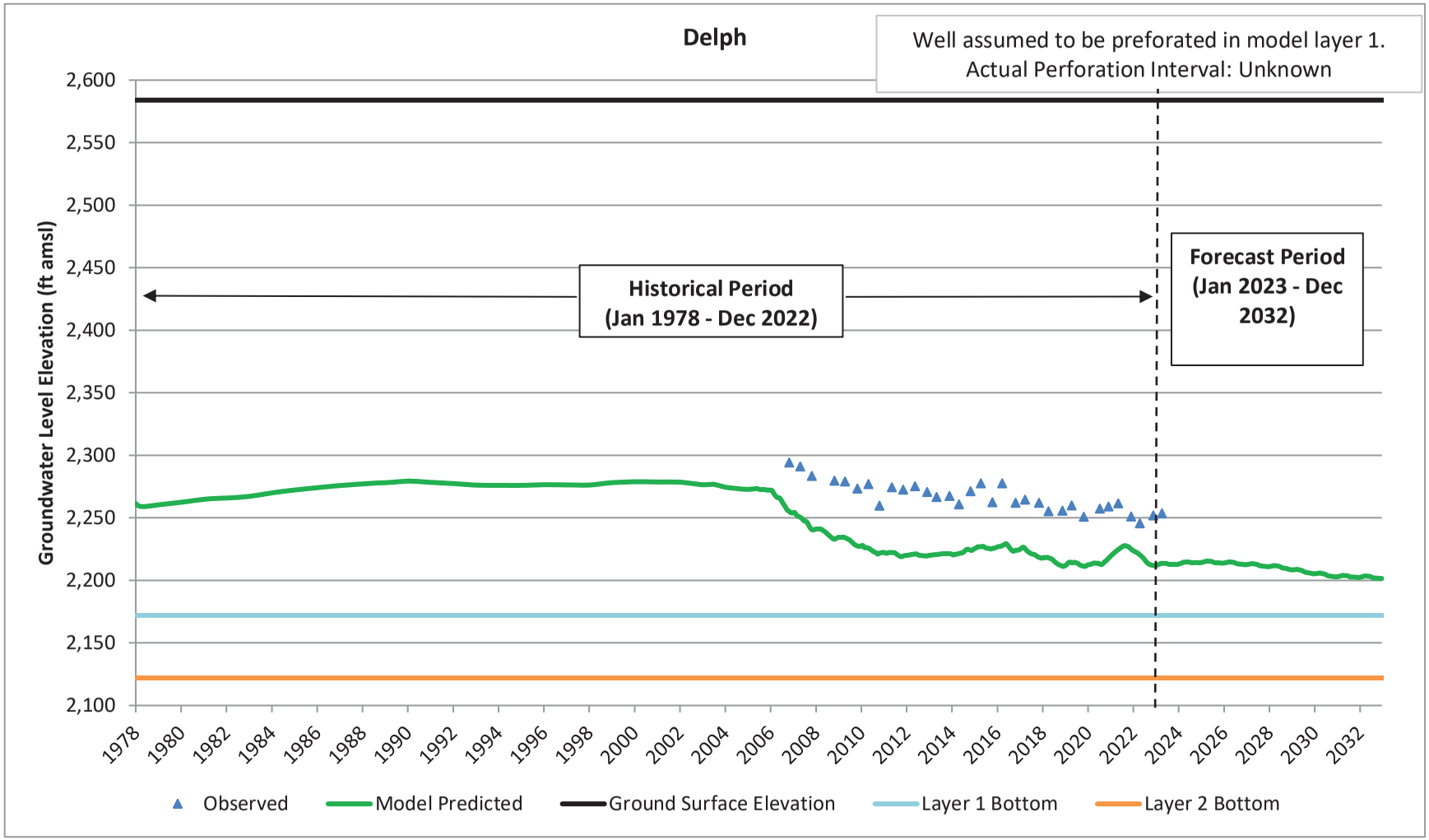
Model Calibration Hydrographs



Model Calibration Hydrographs



Model Calibration Hydrographs



Beaumont Basin Watermaster 2023 Safe Yield Redetermination
Summary of Dudek Comments to Draft Report Dated May 29, 2024

Comment No.	Page No.	Section No.	Section Title	Comment By	Comment	Response
1	8	1.3	Safe Yield Reevaluation Approach	S. Stuart	Fetter (1994) refers to Safe Yield as "the amount of naturally occurring ground water that can be withdrawn from an aquifer on a sustained basis, economically and legally, without impairing the native ground-water quality or creating an undesirable effect such as environmental damage." I interpret your equation 2 for ΔS to be the definition of Safe Yield.	We disagree with the commentor's interpretation. Equation 4 is the safe yield equation. Equation 2 is a water balance equation for "pre-developed conditions", meaning there are no anthropogenic effects such as those associated with pumping and artificial recharge.
2	8	1.3	Safe Yield Reevaluation Approach	S. Stuart	One outflow component missing from equation 2 is groundwater discharge to surface water.	We agree with the commentor. Equation 2 (and Equation 3) have been corrrected. That said, there are no simulated streamflow (SFR package) segments within the previous or updated versions of the Beaumont Basin (as noted in the report, the Beaumont Basin refers to the adjudicated basin area set forth in the 2004 Judgment). Therefore, neither streamflow inflow nor outflow appears as a component of the safe yield calculation given the configuration of the previous and updated models.
3	9	1.3	Safe Yield Reevaluation Approach	S. Stuart	Change the first word in the first paragraph from "Underdeveloped" to "Under developed"	We agree with the commentor. The text has been corrected.
4	9	1.3	Safe Yield Reevaluation Approach	S. Stuart	Equation 4 for Safe Yield is equation 2 but with the I_{rf} parameter remaining as one of the terms in ΔS. I don't believe I_{rf} should be a factor in calculating the Safe Yield.	We disagree with the commentor because I_{rf}: 1) is an actual (not contrived) part of the water budget and 2) is actual water that is available to be pumped.
5	10	1.3	Safe Yield Reevaluation Approach	S. Stuart	The following sentence is unclear: "The Safe Yield was estimated for the 10-yr period from 2013 to 2022 based on the historical and projected water balance for 1978 through 2032 from the calibrated model and Equation 4 above." In Section 5.0, however, it reads, "The Safe Yield is based on Equation 4 above and the average groundwater pumping, change in aquifer storage, and imported water recharge for the 1978 through 2032 period." Is the Safe Yield calculated for 2013-2022 or for 1978-2032? What do you mean by "average groundwater pumping"?	We agree with the commentor that the sentence is unclear. The sentences on page 10 and in Section 5 have been modified to read "The Safe Yield is based on Equation 4 above and represents the average of 55 annual safe yield values spanning the calendar years 1978 through 2032." The reference to "average pumping" has been removed as pumping was not averaged - it was simply a well-specific monthly model input based on values provided by the stakeholders.
6	12	2.0	Updates to the Groundwater Flow Model	S. Stuart	Please provide a description of the model and model construct, including model type (MODFLOW-2005, MODFLOW-USG, etc.), grid dimensions (n row x n col), grid spacing, number of layers, temporal constraints (simulation period, no of stress periods and lengths, timestep multiplier). It appears that you have the same active model domain in all 4 layers, is that correct?	An introductory paragraph has been added at the beginning of Section 2.0. The active model domain is the same for Layers 1 and 2 and different for Layers 3 and 4 (**see Figure RTC-6**). The differences in the active areas are largely associated with the western portion of the adjudicated area.
7	12	2.1	Updated Model Calibration Period	S. Stuart	There is a reference to the "previous model". Is this the model used for the 2013 redetermination? The first sentence reads the previous model was "updated with groundwater pumping, recharge, and imported water data through December 2021." Is this implying that these parameters were updated with actual data that replaced the projected values when developing the 2013 model?	Yes. The commentor's interpretation that actual groundwater pumping, recharge, and imported water data through 2021 were used to update the projected values from the 2013 model is correct. The text has been modified to be more clear on this issue.
8	12	2.1	Updated Model Calibration Period	S. Stuart	Is the calibration period January 1978 through December 2022?	Yes. A clarifying statement has been added as the last sentence of Section 2.1.
9	12	2.2	Created Uniform Stress Periods	S. Stuart	No mention of what the duration is for the uniform stress periods. Is it monthly (i.e., Jan is 31, Feb is 28/29, Mar is 31, Apr is 30, etc.)?	The stress periods are monthly as specified by the commentor. See the new introductory paragraph inserted at the beginning of Section 2.0 in response to Comment 6.
10	12	2.2	Created Uniform Stress Periods	S. Stuart	"Having uniform stress periods helps maintain numerical stability during the simulation by preventing abrupt changes in boundary conditions between time steps." - Did you employ timestep multipliers to vary the timestep lengths from shorter to longer lengths at the start of each stress period? That may improve stability.	Trial runs using various numbers of timesteps and associated multipliers did not notably improve stability.
11	13	2.3	Changed Model Layering	S. Stuart	At what depth, or range in depth, was the 50-ft low permeability layer placed?	The depth to the top of this layer (which is Layer 2) is provided in Figure 9a of the report. Figure 9a shows the thickness of Layer 1, which is identical to the depth to the top of Layer 2.

VII-A - Att 2

Beaumont Basin Watermaster 2023 Safe Yield Redetermination
Summary of Dudek Comments to Draft Report Dated May 29, 2024

Comment No.	Page No.	Section No.	Section Title	Comment By	Comment	Response
12	13	2.3	Changed Model Layering	S. Stuart	The concluding sentence indicates that model calibration "significantly improved" at well NC-4S. How did this new layer affect model calibration for wells screened in layers 3 and/or 4?	The following sentence has been added as the last sentence of Section 2.3: "*The model calibration at well NC-4D was largely unchanged and is acceptable, especially from 2019 onward (see Appendix C, page 23 of 87).* "
13	13	2.4	Updated the Model Solver	S. Stuart	MODFLOW 2005 is not a solver. Did you previously use the PCG, SIP or SOR solvers? I am assuming that the MODFLOW Newton is MODFLOW-NWT and you used the NWT solver?	The commentor is correct and Section 2.4 has been reworded accordingly. See the introductory paragraph added at the beginning of Section 2.0 in response to Comment 6. The previous model used the PCG solver.
14	14	2.5	Updated the Stream Simulation Package in the Model	S. Stuart	A reference is made to surface water flow measurements made by YVWD on a weekly basis from 2002 to 2012. Dudek collects biweekly measurements for the City of Beaumont at various points along Cooper's Creek and San Timoteo Creek for the Max Benefits program.	Comment noted. Please provide these data at your earliest convenience.
15	14	2.5	Updated the Stream Simulation Package in the Model	S. Stuart	The 2nd paragraph does state that "baseflow in San Timoteo Creek is sustained from treated wastewater discharges to Cooper's Creek by the City of Beaumont and groundwater discharge to the creek channel." This tends to corroborate the inclusion of a groundwater-surface water outflow component in the ΔS equation.	We agree with the commentor. See our reponse to Comment 2.
16	14	2.6	Modified Simulation Method for Groundwater Flow between No Flow Zones in the Western Model Domain	S. Stuart	"The narrow geometry of the active model domain in these areas resulted in numerical stability in the previous version of the model." - Was/Is the node spacing uniform throughout the model domain, including in the narrow alluvial channels? Do you have finer discretization of the grid in these areas?	The sentence is worded incorrectly and the text has been modified accordingly. The addition of the DRT package likely increased model stability as it provides a viable means by which groundwater can exit from the northwestern portion of the Beaumont Basin. As a side note, the original USGS model invoked the DRN package in this area (specifically, at the upstream portion of the channels, which was the limit of their active model domain). The extensive simulated faulting throughout the active model area and inclusion of additional model layers is the more likely cause of any instability during certain stress periods (and overall longer model runtimes). The instability is not considered to be significant with respect to the predication of interest (i.e., safe yield). The grid discretization is uniform throughout the model domain as noted in the Section 2.0 introduction included in the revised text prepared in response to Comment 6.
17	14	2.6	Modified Simulation Method for Groundwater Flow between No Flow Zones in the Western Model Domain	S. Stuart	"During periods when groundwater levels discharge at the land surface, the DRT package accounts for surface water infiltration back into the aquifer in the narrow channels." - Is this statement implying that groundwater that would have left the model domain as discharge to land surface is rerouted back into the flow domain as recharge via the DRT package? Where is the water routed for recharge? Is this accounted for in Table 4? Are there observations of groundwater discharging to land surface and infiltrating back into the aquifer?	The statement is incorrect and the text has been modified accordingly. The DRT outflows are combined with the "Subsurface Outflow out of the Adjudicated Area" in the original Table 4. A revised Table RTC-17, which clearly shows the DRT contribution to the overall water budget has been included with this submittal. We are not aware of any periods when groundwater discharges to the land surface (i.e., we are not aware of any springs in the narrow alluvial channels). As the commentor is likely aware, DRT (and DRN) objects can be placed at any depth and are commonly placed at the land surface to simulate springs. For the updated model, all drain cells were placed below the ground surface given the absence of observed springs. The depth of the drain cells range from approximately 20 to 200 feet with an average depth of approximately 65 feet. The drain depths were not adjusted by PEST during calibration. Attempts were made using CHD and GHB cells to simulate flow through these narrow alluvial channels and we found the DRT package did the best job. The DRT package, rather than the DRN package, was used to allow us to reintroduce the 'drain water' back into the model as opposed to the DRN package, which does not allow us to do so. The DRT water is rerouted to two locations located outside the adjudicated area to cell nodes intersecting San Timoteo Creek and west of the alluvial channel DRT objects as shown on revised Figure 13. As such, rerouted DRT water is not discharged as surface water.
18	15	2.8	Updated Model Calibration Targets	S. Stuart	Is the reason that the three calibration targets were removed because there is no water level data from 1978 to 2022?	Correct. The most recent data available for Powers, Phillips, and Wilkins are 1955, 1955, and 1975, respectively - all of which pre-date the start of the calibration period for the updated model (i.e., 1978).

Beaumont Basin Watermaster 2023 Safe Yield Redetermination
Summary of Dudek Comments to Draft Report Dated May 29, 2024

Comment No.	Page No.	Section No.	Section Title	Comment By	Comment	Response
19	15	2.9	Updated Model Boundary Conditions	S. Stuart	Do GHB 1, 2, 3, 4, 5, 6, 7, and 8 comprise one cell each? Are there no-flow boundaries between the GHB nodes (e.g., between GHB 6 and 7)? What is your initial condition? Water levels in 1978? Can you produce a figure that shows simulated hydraulic head contours for the initial condition?	GHB 1, 2, 3, 4, 5, 6, 7, and 8 are comprised of one cell each for the layers in which they are specified. Each location is defined in all 4 layers except GHB 7 (Layers 3 and 4 only) and GHB 8 (Layers 1, 2, and 3 only). By definition when using MODFLOW, the grid domain is a no-flow boundary unless otherwise specified so, yes, there are implicit no-flow cells between GHB 6 and 7 (and between GHB 1 and 2, GHB 2 and 3, and so on). Initial conditions are based on recursive simulations that used the January 1978 simulated heads as a starting point followed by calibration. Specifically, 3- to 5-year simulations were conducted and model-predicted heads for a month (stress period) within the 3- to 5-year timeframe (e.g., January 1983) was then used as the new initial condition (i.e., January 1978). The process was repeated a few times until percent discrepancies were reduced to stable and acceptable levels. The initial conditions 'STRT' array multiplier was then varied by PEST during calibration. Initial conditions for all 4 layers are included herein as **Figures RTC-19a, -19b, -19c, and -19d**. While the calibrated initial conditions were somewhat disappointing, particularly in the Cherry Valley area for this realization (flow is northward in the northeastern area of the model toward to the mountains), inspection of ZONEBUDGET output indicates the mountain front recharge boundaries rectify the issue within the first few months (approximately 6 stress periods) of the simulation.
20	15	2.9	Updated Model Boundary Conditions	S. Stuart	Are the boundary conditions shown in Figure 13 the same for all 4 model layers?	Yes, with the exceptions noted above in our response to Comment 19 and with the exception of Segment 16, which extends only through the top 3 model layers because Layer 4 is not present in this area.
21	15	2.9.2	Conversion of General Head Boundary Cells to Mountain Block Recharge Cells	S. Stuart	Changed all GHB nodes along northern model boundary to specified flux nodes. Interesting to compare mountain front recharge (MFR) between the 2013 and 2023 models. In 2013, MFR averaged about 2,880 AFY while it averaged 17 AFY in the 2023 model. Why the marked difference between the two models? Does MFR only happen in Layer 1? How did you calculate the specified flux for these recharge cells? What about MFR along southern boundary of active domain?	As shown on Figure 13, there are a limited number of boundary recharge (MFR) cells within the adjudicated area. These cells are associated almost exclusively with the western margin of the Singleton Hills (there are 2 or 3 MFR cells associated with Smith Creek in the northeastern portion of the active model area). Unliked the northeastern area, which is expected to receive significant MFR given its expected direct hydraulic connection to the San Benardino Mountains to the north - as evidenced by the presence of Little San Gorgonio and Noble Creeks - there is no compelling reason to expect significant MFR enters the adjudicated area along the western margin of the Singleton Hills. MFR from the San Bernardino Mountains largely appears as underflow in the water budget (except for the aforementioned Smith Creek cells) given the downgradient location of the adjudicated area boundary in this area relative to the boundary of active model area. MFR happens in all 4 layers and is a calibrated paramter. MFR along the southern boundary of the active model domain was assumed to be zero with groundwater flowing roughly parallel to the San Timoteo Creek.
22	16	2.11	Incorporated Additional Recharge Basins	T. Jones	in Section 2.1, TH&CO indicate that the model was previously updated to simulate conditions through 2021. Did that version of the model include the new recharge basins that are referenced here?	No. The previous model only included the western portion of the Noble Creek Recharge Facility and Little San Gorgonio Creek Recharge Facility. That is, the new recharge basins (i.e., the eastern portion of the Noble Creek Recharge Facility, along with the west and east basins associated with the Brookside Recharge Facility were not included in the previous model.
23	18	3.1	Climate and Precipitation Projection	T. Jones	the reference to a 50-year projection is confusing...it looks like the projection is only done over a 10 year time frame...	The updated model is configured for a 50-year projection (i.e., it extends through December 2072), except for the WEL and DRT packages, which were developed in the late stages of the update process. That is, all other MODFLOW-NWT 'stress packages' (i.e., GHB, MNW2, RCH, EVT, and SFR) contain input for 1140 stress periods to allow for simulation of the time period spanning January 1978 through December 2072. The WEL and DRT packages contain input only for 660 stress periods to allow for simulation of the time period spanning January 1978 through December 2032 - which is the time period of interest in accordance with the 2004 Judgment. The 50-year configuration was initially developed to be consistent with SGMA in the event the stakeholders were interested in longer projection periods.
24	20	4.0	Model Calibration	S. Stuart	Can you provide a record of calibration progress while modifying parameters manually before using PEST?	Possibly and only with some additional budget. The amount of budget needed will depend on our gaining a better understanding as to what the commentor would like us to provide.

Beaumont Basin Watermaster 2023 Safe Yield Redetermination
Summary of Dudek Comments to Draft Report Dated May 29, 2024

Comment No.	Page No.	Section No.	Section Title	Comment By	Comment	Response
25	20	4.0	Model Calibration	S. Stuart	Can you provide a table summarizing the range of values constraining each parameter modified during the PEST calibration and statistical results? Can you provide a map showing the spatial distribution of residuals for each calibration target at specific times in the simulation?	The answer to the first question is "yes" but it will take some additional budget as there are 137,379 parameters. In short, providing the ranges over which each parameter was allowed to roam is easy as this can be readily extracted from the PEST control file; however, providing the description of what each parameter represents will take some doing as it will require associating information in the control file with information in the various template files. Are there specific parameters you're interested in? The answer to the second question is a tentative "yes" as this information may be extractable from PEST 'res' (residual) file. Which times are you interested in? Our initial guess is that this may become a bit involved and require additional budget. Perhaps the information being sought can be obtained in a qualitative way by inspection of the calibration hydrographs provided in Appendix C of the report?
26	21	5.0	Analysis of Safe Yield	S. Stuart	It's confusing as to what Table 4 represents. Is it the water budget for the recalibrated model, or is it the water budget for one of the model realizations?	Table RTC-17, which has been modified in response to Comment 17 above to include DRT outflows, is the water budget for one realization of the updated (recalibrated) model. The realization used to develop Table RTC-17 is that which resulted in the 50th percentile safe yield value.
27	21	5.0	Analysis of Safe Yield	S. Stuart	Please provide a table summarizing the parameter constraints and statistical results for all 100 realizations. Were variations in parameter values made uniformly?	With respect to the request, see response to Comment 25. The constraints (lower and upper limits) are the same for all 100 realizations but the statistical results are not. We can provide the requested information and provide statistics but it will be at additional cost. Parameter variations for non-spatially-correlated ("non-pilot point") parameters were assumed to follow a lognormal distribution with the standard deviation set to focus the Monte Carlo sampling process coded into PEST within the lower and upper 95th percentiles. Spatially correlated ("pilot point") parameters, which are those associated with UPW package, were based on a covariance matrix based on the distance between pilot points along with an exponential variogram. A utility program within the PEST suite was incorporated within the overall setup to ensure internal consistency among pilot point parameters. That is, locations with high hydraulic conductivity generally had associated high values of specific yield and vertical conductivity and vice versa. Conversely, locations with high hydraulic conductivity generally had low values of specific storage and vice versa.
28	21	5.0	Analysis of Safe Yield	T. Jones	How is calibration assessed for these 100 realizations if hydrology is varied stochastically? Shouldn't the hydrology effect surface water availability for recharge, mountain front recharge, and precipitation recharge, which would, in-turn significantly effect model calibration?	Before answering the commentors two questions, some clarification is required and Sections 4 and 5 have been revised in effort to provide the clarification provided in this response. The initial ensemble consisted of 100 realizations; however, the final ensemble consisted of 79 realizations. The 21 realizations not included in the final ensemble were likely due to 'timed-out' runs. Timed-out runs occur when the runtime for a realization being conducted by a particular agent exceeds twice the average runtime of all previously completed runs conducted during the PEST iteration up to that point. The long runtime for a timed-out run is usually due to a difficult parameter field, an overworked operating system, or both. In short, the calibration can only be assessed for the 79 surviving realizations. That clarification aside, the calibration for the realizations (the 79 calibrated models in the final ensemble) is assessed in two ways: 1) the coefficient of variation of the objective functions (calculated as the ratio of standard deviation to the mean as reported in an output file generated by PEST) and 2) plotting the calibration hydrographs and calculating calibration statistics for the realizations the lowest objective function (i.e., the "best fit") and the highest objective function (i.e., the "worst fit"). With respect to the first way, the coefficient of variation is 2%, which means the fits for all 79 realizations are very similar. With respect to the second way, the NRMSE for the best and worst fit realizations is 5.3% and 5.6%, respectively. Regarding the second question, the recharge components listed by the commentor - like hydraulic conductivities and storage coefficients - are uncertain and can (and usually do) indeed affect model calibration. It is for this reason hydrology is allowed to vary within the PEST setup via the GHB and RCH packages, among others.

Beaumont Basin Watermaster 2023 Safe Yield Redetermination
Summary of Dudek Comments to Draft Report Dated May 29, 2024

Comment No.	Page No.	Section No.	Section Title	Comment By	Comment	Response
29	21	5.0	Analysis of Safe Yield	S. Stuart	The sentence, "To be considered for evaluation of Safe Yield, a realization would need to result in an acceptable model calibration in accordance with the criteria described in Section 4," may be rewritten to explain that the results of a realization are used to estimate the Safe Yield if the correlation coefficient between the simulated hydraulic heads and measured heads is 0.9 or greater, and/or the NRMSE of the residuals is 10% or less. As the sentence reads, it may be interpreted that you are recalibrating the model after every realization. Is an "acceptable" realization when both criteria are met, or just one?	See response to above comment and revised Sections 4 and 5.
30	23	6.0	Findings and Recommendations	S. Stuart	Are the numbers in the first bullet pulled from Table 4? The range in the change of storage from -14,233 AF to 10,574 AF is from Table 4, but the average of 4,251 AFY is not. I calculate an average change in storage of -1,548 AFY from 1978 to 2032. I also calculate an average change in storage from 2013 to 2022 at -3,312 AFY instead of the 2,150 AFY in the report.	Table RTC-17 has been modified in response to Comment 17. That said, it appears we had the average numbers wrong in the report.
31	23	6.0	Findings and Recommendations	S. Stuart	The 7,100 AFY Safe Yield estimate is based on "79 different realizations of the updated Beaumont Basin model". For each realization, did you calculate the average annualized safe yield from 1978 to 2032? I recommend providing a table summarizing the results for each realization. Does Table 4 reflect the water balance for the calibrated model, or one of the realizations? I calculate an average annualized safe yield of 7,186 AFY using the data in Table 4.	The answer to the first question is "yes" (see response to Comment 5). WIth respect to the recommendation, rather than a table, the safe yield results for the 79 realizations are shown as the cumulative probability curve (Figure 23). With respect to the second question, all 79 realizations are calibrated models (see response to Comment 28). The revised Table RTC-17 is based on the 50th percentile realization (see response to Comment 26) and results in a safe yield of 7,105 AF/yr (rounded to 7,100 AF/yr).
32		Table 2		T. Jones	How was the distribution of water year types determined? Is the 10-year projection average precipitation similar to the historical average?	Using precipitation data for 1998-2022, the historical years were classified as “very wet”, “wet”, “average”, “dry”, and “very dry” by calculating the ratio of measured precipitation for each year to the average precipitation (13.44 inches) over this time period (i.e., 1998-2022). For example, a year was classified as "very wet" if the precipitation was twice the average (i.e., had a ratio > 2.0), whereas if it was classified as "very dry" if the ratio was < 0.43). An average year was classified as those with a ratio between 0.66 and 1.40. These ratio "cutoff limits” were toggled such that approximately 20% of the years were classified as "very wet" or "wet", 50% were "average", and the remaining 30% was classified as "dry" or "very dry". The answer to the second question is "yes", as the 10-year projection precipitation is 13.48 inches (note: the 50-year projection precipitation is 12.66 inches).
33		Table 4		S. Stuart	Recommend removing the Wellbore Flow column in Inflows and adjusting the Groundwater Pumping by subtracting the wellbore flow so the Groundwater Pumping values reflect the actual pumping reported to the Watermaster (see Figure 1). Why the large discrepancy in simulated and measured pumping in 2016?	While we prefer to retain the "Wellbore Flow" column as it comes directly out of MODFLOW-NWT as a simulated value reported by ZONEBUDGET, we have made the recommended change. That said, in response to commentor's request, the revised Table RTC-17 includes a supplemental column showing the net groundwater pumping along with the values reported to the Watermaster. The low pumping in 2016 is associated with a data entry error. Specifically, the pumping for BCVWD 23 was entered twice: once for itself (which is correct), and again for BCVWD 3 (which is incorrect). BCVWD 3 did not pump in 2016. There was also a small discrepancy in pumping for the Plantation on the Lake well. The 50th percentile realization was rerun and the annualized safe yield value changed from 7105 AF/yr to 7097 AF/yr (also, the NRMSE was 5.4%).
34		Table 4		S. Stuart	Recommend breaking up the "Deep Infiltration of Precipitation and Runoff in Stream" column into three columns: (1) Deep infiltration of Precipitation, (2) Infiltrating Stream Flow, and (3) Return Flows. This will provide a better understanding of recharge in the basin.	The requested level of detail is not directly available from ZONEBUDGET output. The three components requested by the commentor are bundled into the recharge inflows reported by ZONEBUDGET. See our response to the commentor's question in Comment 36 below.

Beaumont Basin Watermaster 2023 Safe Yield Redetermination
Summary of Dudek Comments to Draft Report Dated May 29, 2024

Comment No.	Page No.	Section No.	Section Title	Comment By	Comment	Response
35		Table 4		S. Stuart	Subsurface Inflows vs. Subsurface Outflows: Subsurface inflow into the adjudicated basin is higher than subsurface outflows for all years except in 2017. The average subsurface flow is a positive 3,471 AF, meaning 3,471 AF more inflow than outflow. The 2013 had an average -1,683 AF for subsurface flow, which is more inline of what I would expect given the hydraulic gradients to the southeast and southwest in the basin. Where are the subsurface inflows into the basin? Can you provide a map with water level contours to indicate groundwater flow in/out of the basin? With Recharge from the Mountain Block only averaging 17 AFY, this leaves only the south central part of the basin or the boundary with the Yucaipa basin as the areas with subsurface inflow into the basin.	The revised Table RTC-17 shows a positive net underflow into the adjudicated area for all years spanning 1978 through 2032 with an average value of approximately 3,405 acre-ft. To more precisely answer the commentor's question, we divided the adjudication boundary into several segments as shown on Figure RTC-35. Realization 33 was coupled to ZONEBUDGET to assess the inflows through each of these segments. Roughly half of the inflow occurs through the Cherry Valley segment with the remaining inflow roughly equally distributed between the Yucaipa, Badlands, and Beaumont segments.
36		Table 4		S. Stuart	I find the annual inflow from deep infiltration of precipitation and runoff in streams to be remarkably consistent from 1978 to 2005 given the variability in annual rainfall in those years (see Figure 2). Subsequent years have more variability, but don't correlate well with rainfall. For instance, the highest recharge from deep infiltration of precipitation and runoff in streams is in 2017, which is 6 years into the drought and rainfall that year was below normal. How did you calculate deep infiltration by precipitation and stream flow infiltration for each of these years?	Based on past discussions with Herman Bouwer, for deep water tables, RCH doesn't necessarily correlate with precipitation and is generally pretty stable. That is, a thick vadose zone serves to dampen variable rates of applied water at the ground surface. In more recent years, and especially those after the basin became extensively developed and managed recharge in the Noble Creek facility began (i.e., 2006 onward), total RCH is more closely correlated with precipitation. Regarding the commentor's question, "deep infiltration by precipitation and stream flow infiltration" is the recharge as reported by ZONEBUDGET minus imported and injected water.
37		Table 4		S. Stuart	Recommend adding a column showing the annualized safe yield.	Table RTC-17 has been revised to include a column showing the annualized safe yield.
38		Figure 6		S. Stuart	Recommend extending the extents of A-A' and B-B' to the model domain boundaries, not just to the Beaumont Basin boundary.	The cross-sections have been extended as recommended by the commentor.
39		Figures 7 and 8		S. Stuart	Add where these cross-sections intersect with each other, Marshall Creek, Nobel Creek, BB boundary, other features.	The intersections have been identified on the cross-sections as recommended by the commentor.
40		Figure 19		S. Stuart	Can you provide a legend showing the range in recharge rates for each of the recharge zones?	The legend has been modified as requested by the commentor.
41		Appendix B		S. Stuart	Appendix B-11: I'm estimating a storage coefficient of approx. 0.01 or higher for Layer 3, which seems high for a confined aquifer. In looking at your calibration hydrographs, typically the model is overestimating heads. Is it possible that the relatively high storage values are keeping heads higher? A map showing calibration residuals and simulated head contours will help understand where most of the errors are.	The storage value estimated by the commentor is presumably the product of specific storage (Ss) and layer thickness. In our opinion, Ss is a more diagnostic parameter (and is directly used as input to MODFLOW) because it does not rely on thickness. From a process-based (a.k.a., physically-based) modeling standpoint, Ss is entirely based on aquifer compressibility assuming the specific weight of water is a constant and the product of porosity and water compressibility is negligible. Therefore, it is unclear what is meant by the phrase "... seems high for a confined aquifer" as Ss is only used for confined aquifers by MODFLOW and given its dependance on aquifer compressibility. That is, it seems to us that Ss is not dependent on the nature of confinement. Ss is generally inversely proportional to hydraulic conductivity (Kx) (i.e., silts and clays have high values of Ss compared to those for sands and gravels) and an IES utility code was incorporated into the overall setup to ensure compliance with this generalization. The maximum Ss value in Layer 3 is 1.4 x 10^{-3} ft^{-1}, which is within the range reported in the literature for silts and clays (approximately 3 x 10^{-4} ft^{-1} to 6 x 10^{-3} ft^{-1}; Anderson et al., 2015). In summary, storage values for a confined aquifer can exceed 0.01 for thick fine-grained (low Kx) deposits. Therefore, the commentor's protest can be rephrased as "I think your Kx values are too low and/or your layer is too thick". The answer to the commentor's question is: Anything is possible, and with the caveat that there could be lots of parameters (and/or combinations thereof) that are keeping heads higher. Some of these parameters may have been varied as part of the calibration process (e.g., Ss, Kx, Kz, fault permeabilities, recharge parameters, etc.) whereas others (e.g., layer thickness, assumed vertical orientation of all faults through all 4 model layers, faults reported by others but not in the model, etc.) may not have been included. A map could be prepared but errors can be also be understood by simply examining the calibration hydrographs.

Groundwater Budget for the Beaumont Basin Adjudicated Area (January 1978 - December 2032)

	Groundwater Inflows (acre-ft)								Groundwater Outflows (acre-ft)						(acre-ft)					
Year	Subsurface Inflow into the Adjudicated Area	"Channels" Inflow into the Adjudicated Area (DRT)	Imported Water for Recharge[a]	Imported Water for Injection[b]	Deep Infiltration of Precipitation and Runoff in Stream[c]	Recharge from the Mountain Block	Wellbore Flow[d]	Total Inflow[e]	Subsurface Outflow out of the Adjudicated Area	"Channels" Outflow out of the Adjudicated Area (DRT)	Total Subsurface Outflow[f]	Evapotran-spiration (ET)	Groundwater Pumping	Total Outflow[g]	Net Groundwater Pumping[h]	Annual Report Pumping[i]	Difference[j]	Percent Difference[k]	Change in Storage[l]	Annualized Safe Yield[m]
1978	11,318	0	0	0	3,279	46	1,178	15,820	(7,169)	(4,750)	(11,919)	0	(6,752)	(18,671)	5,575	N/A	N/A	N/A	(2,851)	2,724
1979	12,640	0	0	0	3,507	31	937	17,115	(8,170)	(2,483)	(10,654)	0	(6,738)	(17,391)	5,800	N/A	N/A	N/A	(276)	5,524
1980	15,055	0	0	0	3,419	47	719	19,240	(7,089)	(2,401)	(9,489)	0	(5,736)	(15,226)	5,017	N/A	N/A	N/A	4,014	9,031
1981	11,970	0	0	0	3,616	13	719	16,318	(6,637)	(2,327)	(8,964)	0	(6,341)	(15,305)	5,622	N/A	N/A	N/A	1,013	6,635
1982	14,024	0	0	0	3,600	29	707	18,360	(7,295)	(2,343)	(9,637)	0	(5,172)	(14,810)	4,465	N/A	N/A	N/A	3,551	8,016
1983	16,928	0	0	0	3,516	38	760	21,242	(8,057)	(2,337)	(10,394)	0	(4,479)	(14,873)	3,719	N/A	N/A	N/A	6,369	10,088
1984	12,514	0	0	0	3,700	10	724	16,949	(8,449)	(2,333)	(10,782)	0	(5,229)	(16,011)	4,505	N/A	N/A	N/A	938	5,443
1985	11,101	0	0	0	3,572	9	632	15,314	(7,214)	(2,306)	(9,520)	0	(6,464)	(15,984)	5,833	N/A	N/A	N/A	(670)	5,162
1986	11,173	0	0	0	3,692	10	598	15,474	(6,011)	(2,298)	(8,309)	0	(6,471)	(14,781)	5,873	N/A	N/A	N/A	693	6,566
1987	11,002	0	0	0	3,544	11	601	15,158	(7,221)	(2,287)	(9,508)	0	(7,240)	(16,748)	6,639	N/A	N/A	N/A	(1,590)	5,049
1988	10,528	0	0	0	3,738	10	576	14,852	(6,058)	(2,338)	(8,396)	0	(7,843)	(16,239)	7,267	N/A	N/A	N/A	(1,387)	5,881
1989	10,806	0	0	0	3,787	10	733	15,336	(6,066)	(2,316)	(8,381)	0	(10,924)	(19,305)	10,190	N/A	N/A	N/A	(3,969)	6,221
1990	10,796	0	0	0	3,795	8	729	15,330	(6,207)	(2,266)	(8,472)	0	(12,329)	(20,801)	11,599	N/A	N/A	N/A	(5,472)	6,128
1991	10,763	0	0	0	3,810	9	738	15,320	(6,783)	(2,300)	(9,083)	0	(10,497)	(19,580)	9,758	N/A	N/A	N/A	(4,260)	5,499
1992	12,031	0	0	0	3,778	24	701	16,534	(6,441)	(2,334)	(8,775)	0	(9,511)	(18,285)	8,810	N/A	N/A	N/A	(1,751)	7,059
1993	16,674	0	0	0	3,762	31	617	21,084	(7,370)	(2,368)	(9,738)	0	(7,157)	(16,895)	6,540	N/A	N/A	N/A	4,188	10,728
1994	14,501	0	0	0	3,769	30	614	18,914	(7,904)	(2,370)	(10,274)	0	(7,908)	(18,182)	7,294	N/A	N/A	N/A	732	8,026
1995	17,348	0	0	0	3,914	38	722	22,022	(8,187)	(2,403)	(10,590)	0	(5,859)	(16,448)	5,137	N/A	N/A	N/A	5,574	10,711
1996	12,728	0	0	0	3,802	9	715	17,254	(7,848)	(2,456)	(10,304)	0	(6,601)	(16,905)	5,886	N/A	N/A	N/A	349	6,234
1997	13,516	0	0	0	3,860	25	777	18,178	(8,056)	(2,476)	(10,532)	0	(7,887)	(18,419)	7,110	N/A	N/A	N/A	(241)	6,869
1998	17,156	0	0	0	4,016	35	884	22,090	(8,994)	(2,501)	(11,496)	0	(7,527)	(19,023)	6,643	N/A	N/A	N/A	3,068	9,711
1999	12,646	0	0	0	3,680	7	869	17,202	(7,889)	(2,489)	(10,379)	0	(9,820)	(20,198)	8,951	N/A	N/A	N/A	(2,996)	5,954
2000	11,648	0	0	0	3,916	8	849	16,422	(7,200)	(2,468)	(9,668)	0	(14,049)	(23,717)	13,200	N/A	N/A	N/A	(7,295)	5,905
2001	11,603	0	0	0	3,957	8	904	16,471	(7,407)	(2,367)	(9,774)	0	(14,538)	(24,313)	13,635	N/A	N/A	N/A	(7,842)	5,793
2002	11,278	0	0	0	3,870	9	829	15,987	(5,579)	(2,277)	(7,856)	0	(18,380)	(26,237)	17,552	N/A	N/A	N/A	(10,250)	7,301
2003	13,181	0	0	0	3,933	18	957	18,089	(5,686)	(2,301)	(7,987)	0	(12,107)	(20,094)	11,150	FY[m]	N/A	N/A	(2,005)	9,145
2004	14,892	0	0	0	4,033	22	805	19,752	(6,553)	(2,241)	(8,794)	0	(16,585)	(25,379)	15,780	FY	N/A	N/A	(5,627)	10,153
2005	18,994	0	0	0	3,920	32	785	23,731	(7,106)	(2,229)	(9,335)	0	(14,497)	(23,832)	13,713	FY	N/A	N/A	(101)	13,611
2006	14,645	0	3,501	0	4,242	5	826	23,220	(7,235)	(2,171)	(9,407)	0	(17,639)	(27,045)	16,813	FY	N/A	N/A	(3,825)	9,486
2007	12,101	0	4,501	0	4,170	4	825	21,601	(7,740)	(2,115)	(9,855)	0	(20,329)	(30,184)	19,503	FY	N/A	N/A	(8,583)	6,419
2008	12,520	0	3,933	0	4,764	12	736	21,964	(7,895)	(2,178)	(10,073)	0	(18,064)	(28,137)	17,328	FY	N/A	N/A	(6,173)	7,222
2009	12,884	0	5,482	0	4,788	10	766	23,930	(8,128)	(2,217)	(10,345)	0	(16,410)	(26,755)	15,644	FY	N/A	N/A	(2,825)	7,337
2010	14,003	0	7,065	0	5,270	15	754	27,106	(8,903)	(2,217)	(11,120)	0	(14,365)	(25,485)	13,611	FY	N/A	N/A	1,620	8,167
2011	15,546	0	8,779	0	5,001	20	792	30,138	(10,499)	(2,209)	(12,708)	0	(14,471)	(27,179)	13,679	13,940	(261)	-2%	2,959	7,859
2012	14,738	0	8,983	0	5,198	8	738	29,665	(10,208)	(2,175)	(12,383)	0	(15,149)	(27,532)	14,411	14,562	(151)	-1%	2,133	7,561
2013	13,750	0	8,634	0	4,447	5	834	27,669	(11,260)	(2,089)	(13,349)	0	(17,613)	(30,962)	16,779	17,113	(334)	-2%	(3,293)	4,852
2014	13,750	0	5,013	0	3,365	7	760	22,895	(10,423)	(1,997)	(12,421)	0	(17,717)	(30,138)	16,957	16,984	(27)	0%	(7,243)	4,701
2015	13,806	0	3,467	0	2,767	8	636	20,684	(9,943)	(1,982)	(11,925)	0	(13,421)	(25,346)	12,785	12,925	(140)	-1%	(4,662)	4,656
2016	13,860	0	10,796	0	4,624	11	690	29,981	(10,199)	(2,003)	(12,201)	0	(16,525)	(28,727)	15,835	13,777	2,058	15%	1,254	6,293
2017	13,116	0	14,940	0	6,294	10	751	35,111	(12,461)	(1,979)	(14,440)	0	(16,618)	(31,058)	15,867	15,867	0	0%	4,053	4,980
2018	14,450	0	12,621	0	4,367	12	736	32,187	(12,327)	(1,939)	(14,266)	0	(17,985)	(32,251)	17,249	17,279	(30)	0%	(64)	4,564
2019	16,732	0	14,153	0	6,512	19	828	38,245	(14,103)	(1,900)	(16,003)	0	(16,961)	(32,965)	16,133	15,892	241	2%	5,280	7,261
2020	15,652	0	11,469	0	5,908	9	812	33,849	(13,582)	(1,812)	(15,395)	0	(19,452)	(34,847)	18,640	18,636	4	0%	(997)	6,174
2021	15,027	0	2,504	0	1,750	4	700	19,985	(11,017)	(1,924)	(12,941)	0	(21,039)	(33,980)	20,339	19,938	401	2%	(13,995)	3,840
2022	15,166	0	1,811	0	2,321	5	762	20,065	(11,477)	(1,738)	(13,216)	0	(19,763)	(32,979)	19,001	19,479	(478)	-2%	(12,914)	4,276
2023	20,176	0	16,781	0	4,753	41	581	42,332	(9,068)	(1,756)	(10,824)	0	(21,138)	(31,962)	20,557	14,227	6,330[o]	44%	10,370	14,146
2024	20,765	0	13,496	0	4,098	32	578	38,969	(9,361)	(1,766)	(11,128)	0	(21,388)	(32,516)	20,810	N/A	N/A	N/A	6,453	13,767
2025	16,249	0	6,921	0	2,439	8	591	26,208	(9,812)	(1,951)	(11,762)	0	(21,822)	(33,584)	21,231	N/A	N/A	N/A	(7,376)	6,934
2026	15,404	0	10,034	2,000	1,303	9	2,753	31,503	(10,011)	(1,625)	(11,636)	0	(23,732)	(35,367)	20,979	N/A	N/A	N/A	(3,864)	5,080
2027	14,835	0	7,437	2,000	1,416	6	2,740	28,434	(10,103)	(1,599)	(11,703)	0	(23,973)	(35,676)	21,233	N/A	N/A	N/A	(7,242)	4,555
2028	14,181	0	4,801	2,000	1,708	9	2,750	25,448	(8,642)	(1,827)	(10,469)	0	(24,226)	(34,695)	21,476	N/A	N/A	N/A	(9,247)	5,428
2029	16,746	0	12,414	2,000	783	20	2,775	34,738	(11,330)	(1,753)	(13,083)	0	(24,497)	(37,580)	21,722	N/A	N/A	N/A	(2,842)	4,465
2030	16,562	0	12,020	2,000	1,555	17	2,735	34,889	(10,053)	(1,533)	(11,586)	0	(24,711)	(36,297)	21,976	N/A	N/A	N/A	(1,408)	6,548
2031	20,821	0	14,795	2,000	2,501	33	2,689	42,839	(8,793)	(1,725)	(10,517)	0	(24,888)	(35,406)	22,199	N/A	N/A	N/A	7,433	12,837
2032	16,336	0	7,437	2,000	1,423	6	2,710	29,912	(10,068)	(1,501)	(11,569)	0	(25,147)	(36,716)	22,437	N/A	N/A	N/A	(6,804)	6, 197
Average (1978 - 2022)	13,568	0	2,837	0	4,013	17	763	21,197	(8,401)	(2,289)	(10,690)	0	(12,181)	(22,872)	11,419	16,366	107	0	(1,675)	6,907
Average (1978 - 2032)	14,230	0	4,251	255	3,683	17	1,004	23,439	(8,642)	(2,183)	(10,824)	0	(14,249)	(25,073)	13,245	16,201	107	0	(1,634)	7,105

Notes:

[a] Values prior to 2023 are reported values provided by the stakeholders. Values from 2023 onward are based on anticipated deliveries off the State Water Project associated with forecasted precipitation.

[b] Values reported by YVWD.

[c] Includes deep percolation of precipitation and runoff in stream, channels (stream channels include Noble Creek and Marshall Creek), and return flows (e.g., landscaping, parks, golf courses, transmission losses, septic systems, etc.).

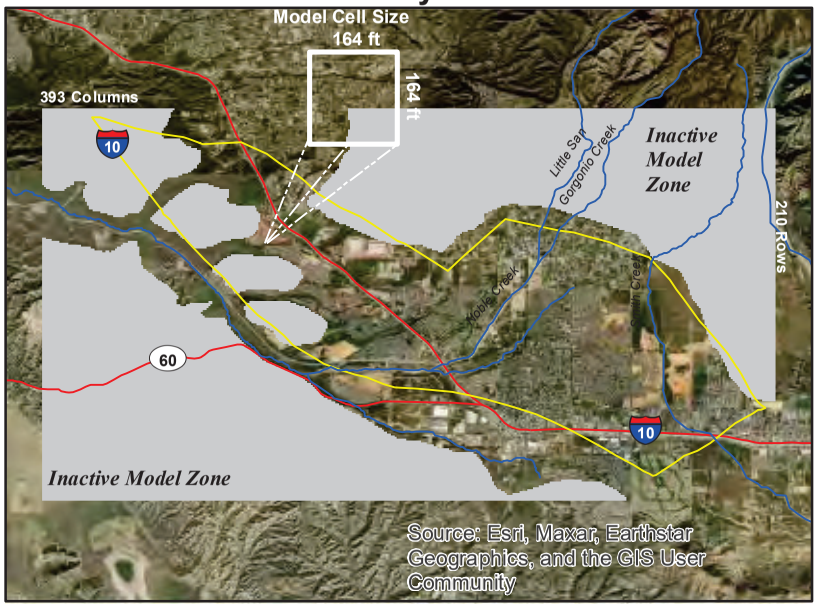
Groundwater Budget for the Beaumont Basin Adjudicated Area (January 1978 - December 2032)

	Groundwater Inflows (acre-ft)								Groundwater Outflows (acre-ft)						(acre-ft)					
Year	Subsurface Inflow into the Adjudicated Area	"Channels" Inflow into the Adjudicated Area (DRT)	Imported Water for Recharge[a]	Imported Water for Injection[b]	Deep Infiltration of Precipitation and Runoff in Stream[c]	Recharge from the Mountain Block	Wellbore Flow[d]	Total Inflow[e]	Subsurface Outflow out of the Adjudicated Area	"Channels" Outflow out of the Adjudicated Area (DRT)	Total Subsurface Outflow[f]	Evapotran-spiration (ET)	Groundwater Pumping	Total Outflow[g]	Net Groundwater Pumping[h]	Annual Report Pumping[i]	Difference[j]	Percent Difference[k]	Change in Storage[l]	Annualized Safe Yield[m]

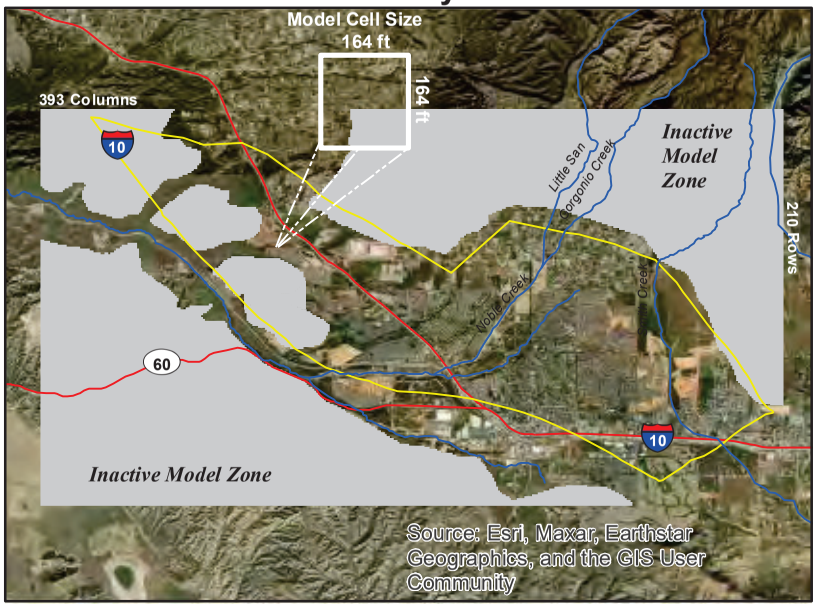
[d] Wellbore flow refers to the movement of water through the annular space between the well casing and the surrounding formation in a groundwater well.
[e] "Total Inflow" is the sum of all the groundwater inflows.
[f] Total Subsurface Outflow is the sum of "Subsurface Outflow" and "Channels Outflow".
[g] "Total Outflow" is the sum of "Total Subsurface Outflow", "Evapotranspiration", and "Groundwater Pumping".
[h] As all "Groundwater Pumping" values are presented as negative (parenthesized) values, "Net Groundwater Pumping" is calculated as: (Wellbore Flow + Groundwater Pumping) x -1.
[i] Values obtained from the Documents and Publications section of the Beaumont Basin Watermaster website.
[j] "Difference" = "Net Groundwater Pumping" - "Annual Report Pumping"
[k] "Percent Difference" = "Difference" / "Annual Report Pumping"
[l] As all "Total Outflow" values are presented as negative (parenthesized) values, the "Change in Storage" is calculated as "Total Inflow plus Total Outflow".
[m] Annualized Safe Yield is calculated as: Net Groundwater Pumping + Change in Storage - (Imported Water for Recharge + Imported Water for Injection).
[n] Annual Reports from 2003-2010 are reported on a fiscal year basis and therefore are not comparable.
[o] 2023 is part of the model forecast period hence the large discrepancy between model pumping and whats reported in the 2023 Annual Report.

July 2024

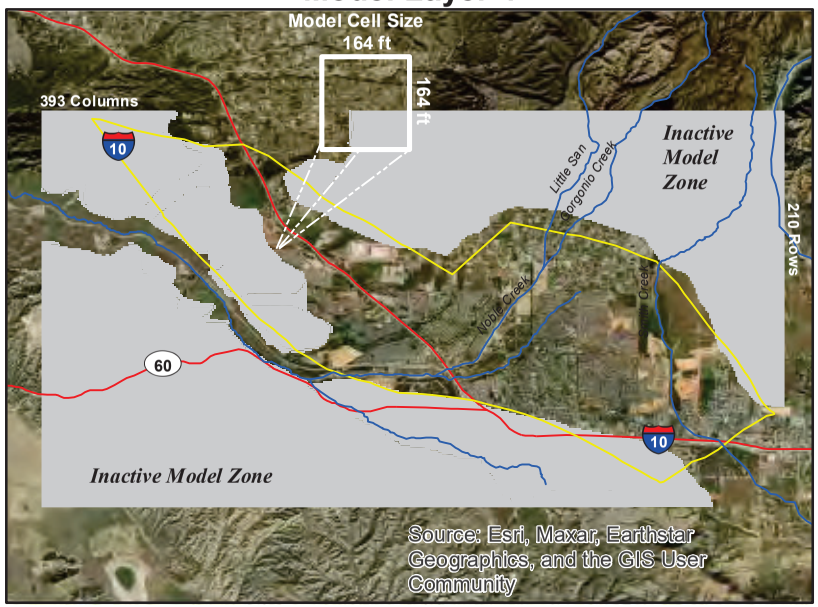
Model Layers 1-2



Model Layer 3



Model Layer 4



Map Features

- Beaumont Basin Adjudicated Area
- Inactive Model Zone
- Creek
- Freeway/Highway

N

Thomas Harder & Co.
Groundwater Consulting

0 1.25 2.5 5 Miles

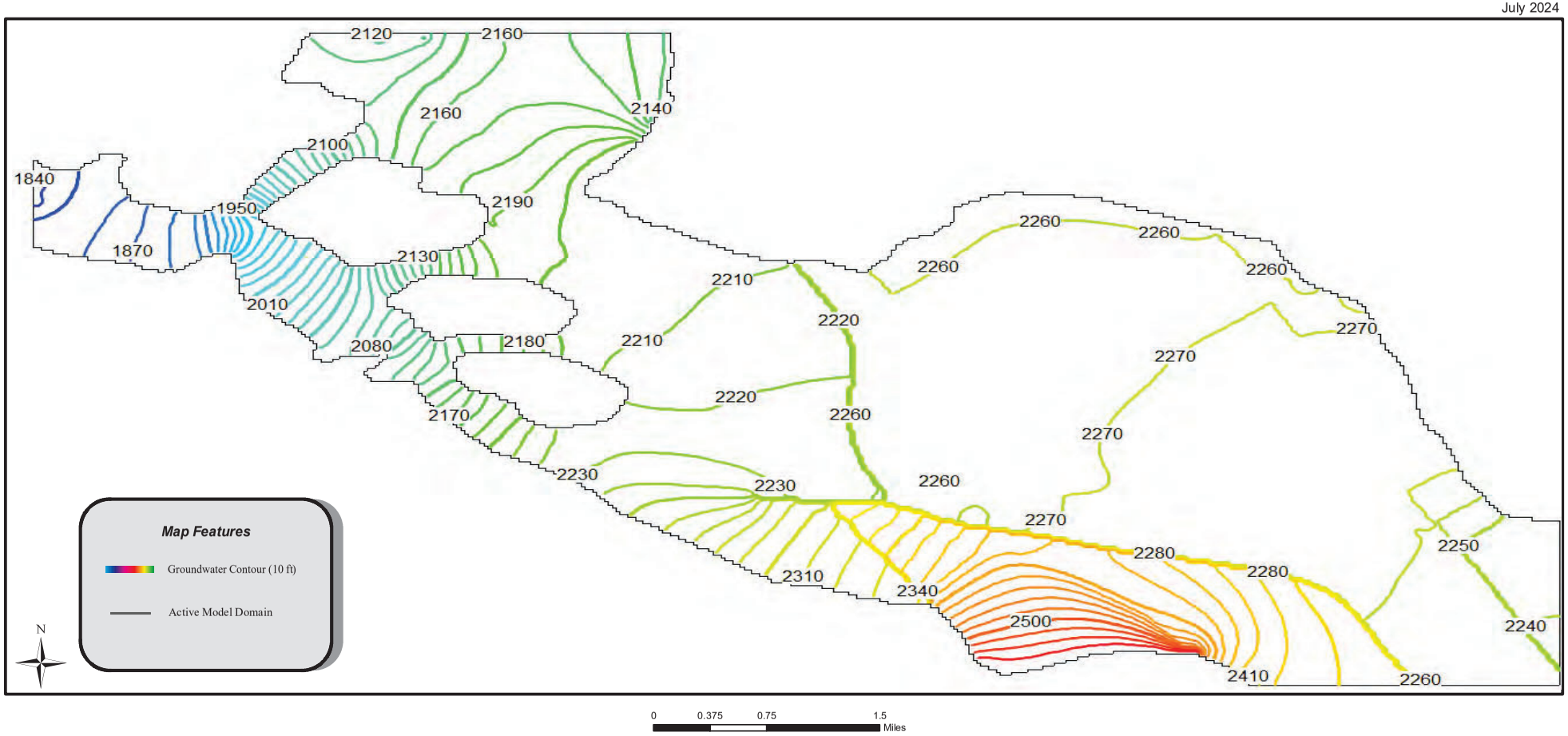
NAD 83 State Plane Zone 6

Model Active and Inactive Domain

Figure RTC-6

Beaumont Basin Watermaster

July 2024

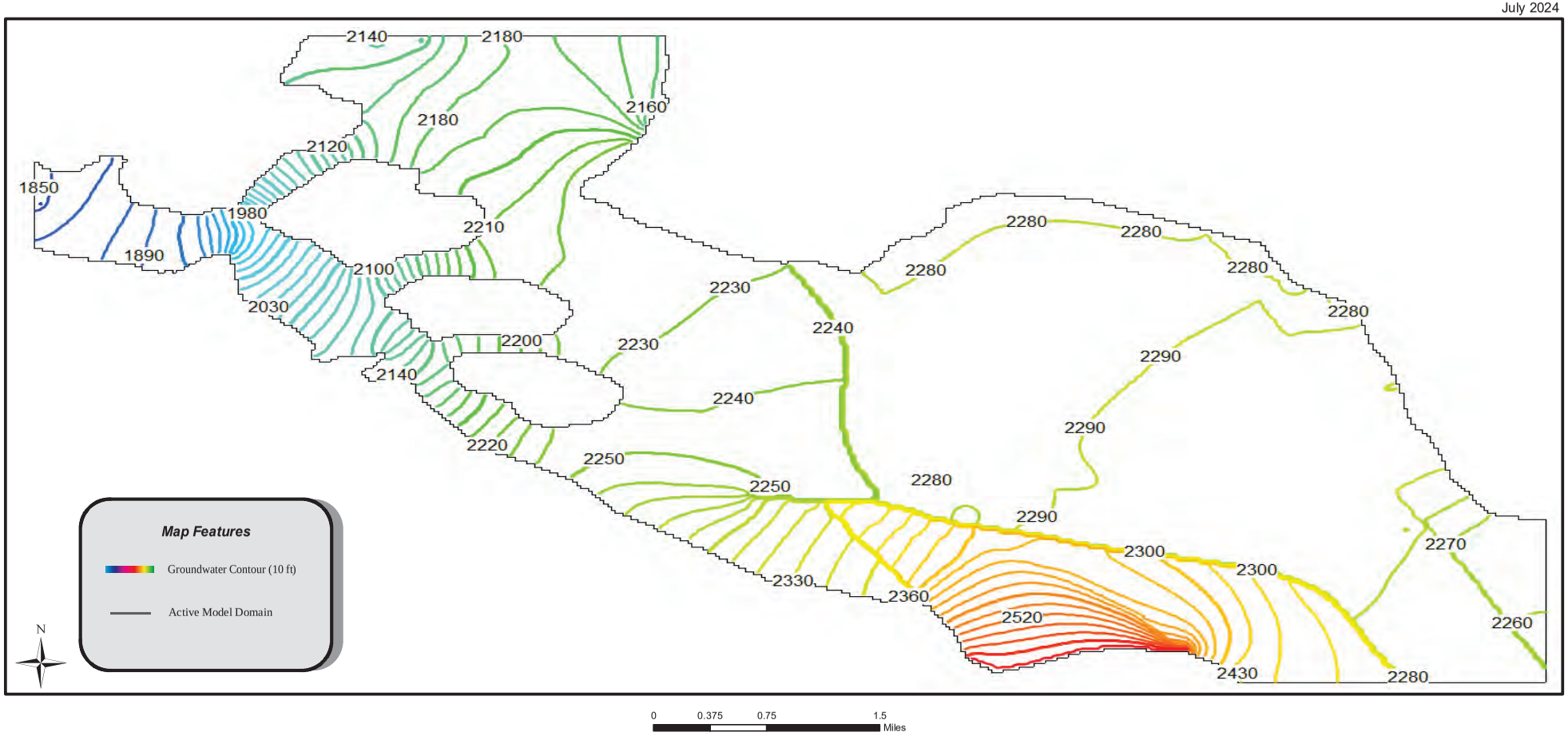


Thomas Harder & Co.
Groundwater Consulting

Initial Conditions for Layer 1

Figure RTC-19a

July 2024



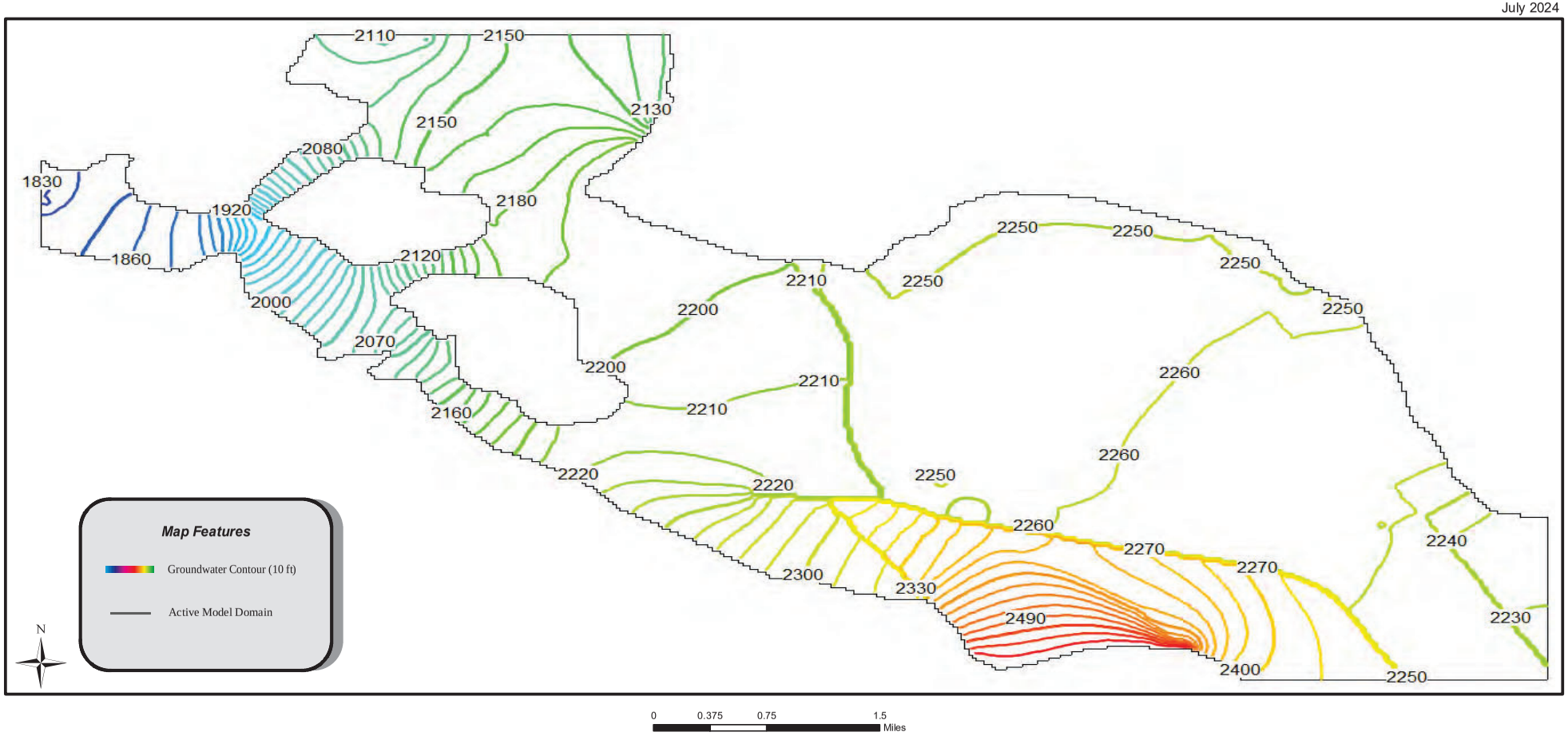
Thomas Harder & Co.
Groundwater Consulting

Initial Conditions for Layer 2

Figure RTC-19b

Beaumont Basin Watermaster

July 2024

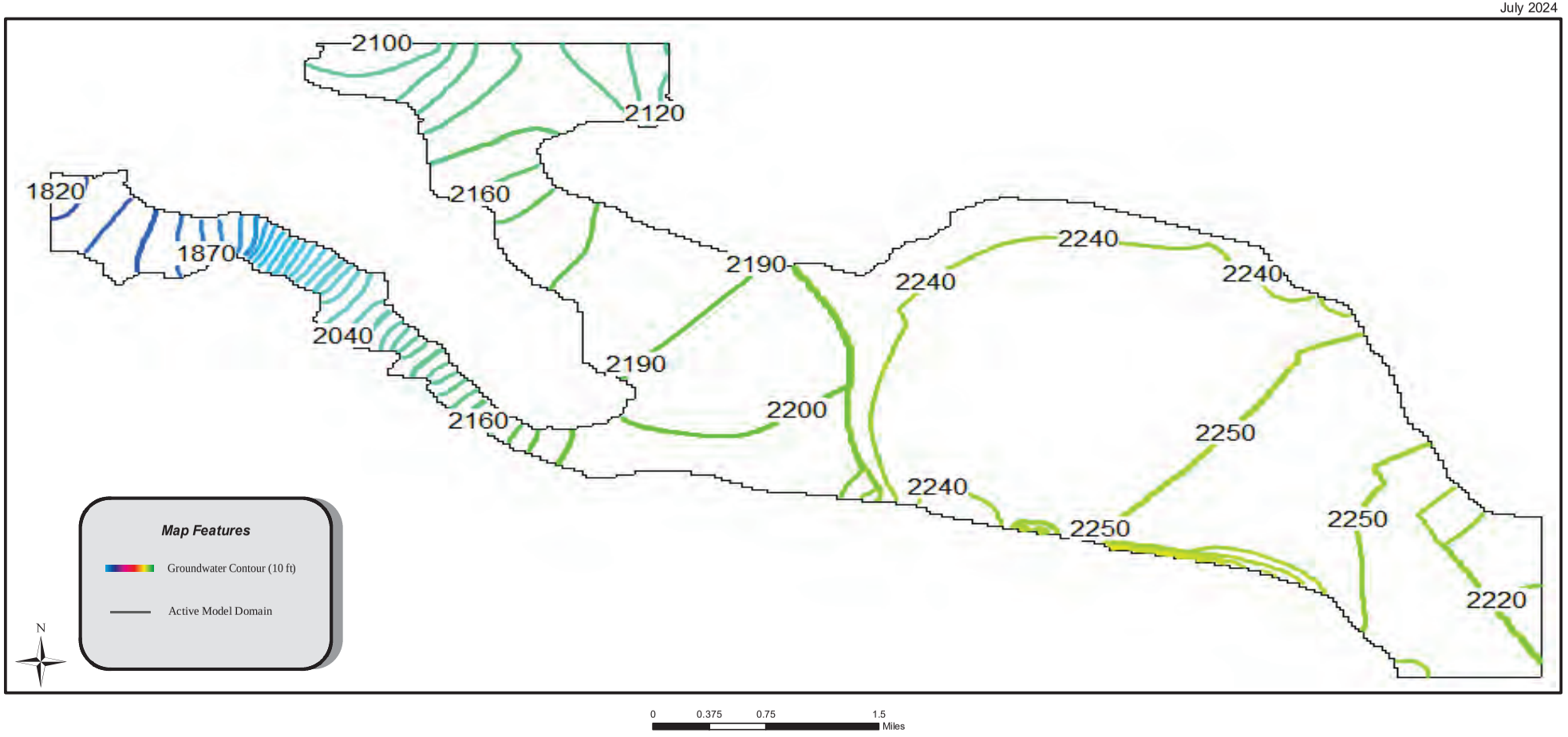


Thomas Harder & Co.
Groundwater Consulting

Initial Conditions for Layer 3

Figure RTC-19c

July 2024



Thomas Harder & Co.
Groundwater Consulting

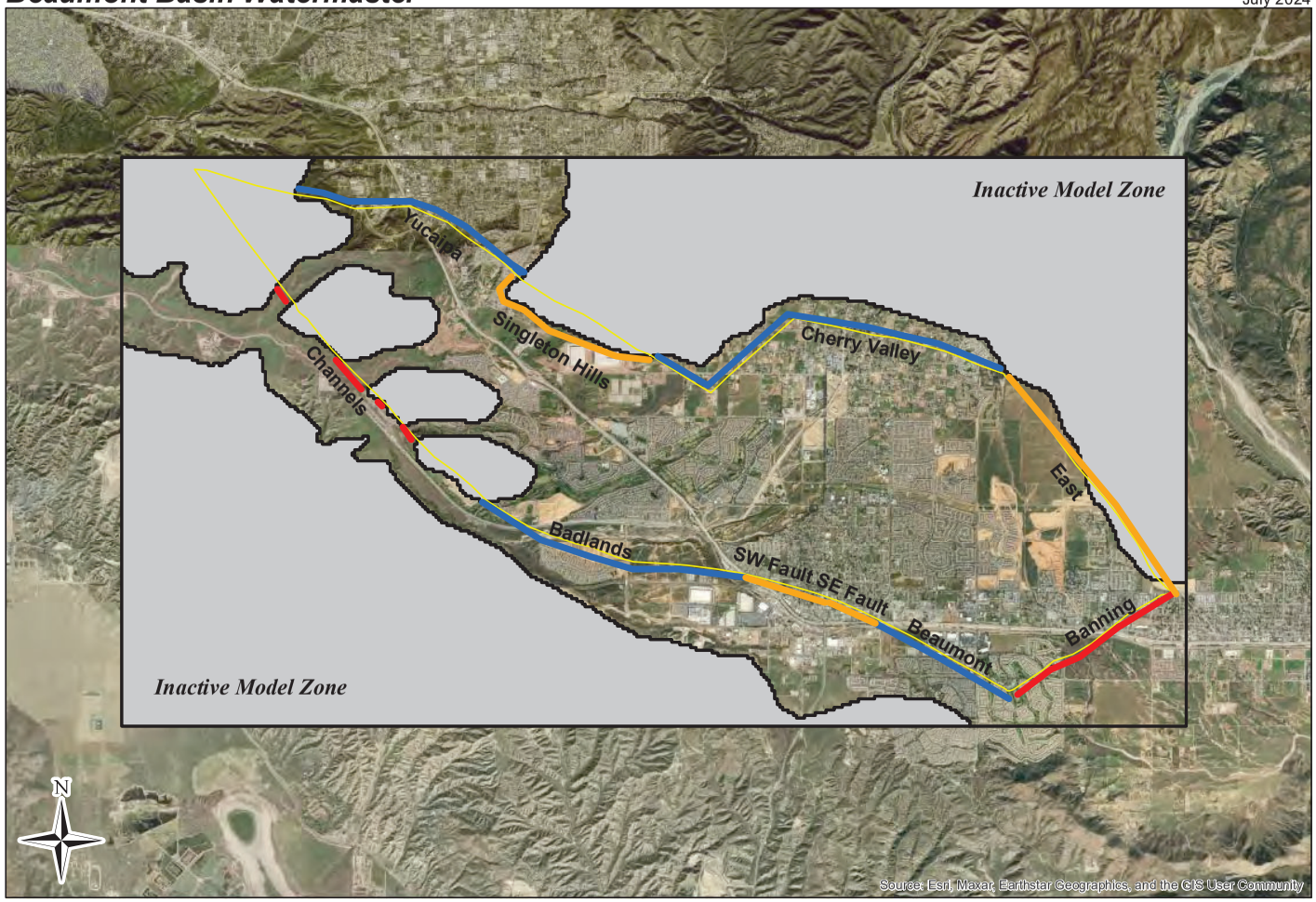
Initial Conditions for Layer 4

Figure RTC-19d

Beaumont Basin Watermaster

July 2024

2023 Reevaluation of the Beaumont Basin Safe Yield



0 0.5 1 2 Miles

NAD 83 State Plane Zone 6

Map Features

Groundwater low Direction

nflow

utflow

e li i le

tud Area

eaumont a in Ad udicated Area

Active Model one

nactive Model one

Thomas Harder & Co.
Groundwater Consulting

Beaumont Basin Inflow and Outflow Zones

Figure RTC-35

Beaumont Basin Watermaster

Update on Redetermining the Safe Yield of the Beaumont Basin

July 10, 2024

Thomas Harder & Co.
Groundwater Consulting

Overlying Parties Production Rights Allocation Based on Revised Safe Yield for the 2024-33 Period

Overlying Party to the 2003 Judgment	Initial Overlying Water Right through 2012	Overlying Water Right for the 2013-22 Period	Overlying Water Right for the 2023-32 Period	5-Year (2019-23) Average Production (ac-ft)	5-Year (2019-23) Running Average % of Water Right Based on 2023-32 Safe Yield
Sharondale Mesa Owners Association	200.0	154.91	164.16	111.0	67.6%
California Oak Valley Golf and Resort LLC	950.0	735.84	779.77	473.0	60.7%
Tukwet Canyon Golf Club	2,200.0	1,704.05	1,805.78	984.8	54.5%
Plantation on the Lake LLC	581.0	450.02	476.89	248.0	52.0%
Rancho Calimesa Mobile Home Park	150.0	116.18	123.12	29.5	23.9%
Gutierrez, Hector, et al.	10.0	7.75	8.21	1.4	17.3%
Darmont, Boris and Miriam	2.5	1.94	2.05	0.4	17.1%
Aldama, Nicolas and Amalia	7.0	5.42	5.75	0.9	15.0%
McAmis, Ronald L.	5.0	3.87	4.10	0.6	13.5%
Nikodinov, Nick	20.0	15.49	16.42	0.8	4.6%
Beckman, Walter M.	75.0	58.09	61.56	0.9	1.4%
Albor Properties III, LP	300.0	232.37	246.24	2.4	1.0%
Stearns, Leonard M. and Dorothy D.	200.0	154.91	164.16	0.7	0.4%
Sunny-Cal Egg and Poultry Company	1,439.5	1,114.99	1,181.55	4.3	0.4%
Merlin Properties	550.0	426.01	451.45	1.6	0.4%
Oak Valley Partners, LP [1]	1,806.0	1,398.87	1,482.38	0.5	0.0%
Roman Catholic Bishop of San Bernardino	154.0	119.28	126.40	0.0	0.0%
	8,650.0	**6,700.0**	**7,100.0**	**1,860.7**	**26.2%**

(1) - Under Resolution 17-02, adopted August 30, 2017, Oak Valley Partners LP (OVP) agreed to transfer its Overlying water rights to particular development parcels, intending to secure commitment from YVWD to provide water service to development phases of OVP's Summerwind Ranch Specific Plan (Project) located in the Beaumont Basin. As of the end of CY 2023, OVP has transferred 478.25 ac-ft of water rights to YVWD.

ITEM VII-B

BEAUMONT BASIN WATERMASTER

MEMORANDUM NO. 24-25

Date:	August 7, 2024
From:	Steven Stuart, Dudek
Subject:	Update on Revising the Beaumont Basin Watermaster Rules and Regulations
Recommendation:	For discussion purposes only

Mr. Stuart presented an update on revisions to the BBWM Rules and Regulations at the June 5, 2024 regular meeting. Mr. Stuart also sought clarification from the BBWM Committee on some statements in the Rules and Regulations. The following is a summary of the discussions at the June meeting:

1. Section 2.13 Interventions

   The last sentence of this section reads, “Interveners shall have no water rights under the Judgement (unless acquired from an Appropriator Party).”

   - Mr. Montoya (legal counsel) and Mr. Vela suggested deleting the last sentence in this section. Mr. Montoya recommended that the Rules and Regulations “say as little as possible on intervention.” Mr. Zoba suggested that the entire section on interventions be removed from the Rules and Regulations. Mr. Jaggers requested time to review the Judgement before making a final decision, but concurs with striking the last sentence.
   - Shall the entire section on interventions be stricken from the Rules and Regulations, or shall only the last sentence?

2. Section 4.3 Losses or Spills from the Basin

   Last sentence reads, “Supplemental Water stored pursuant to Groundwater Storage Agreements shall be lost prior to Basin water (i.e., unused operating safe yield) held in Storage by a Party to the Judgement.”

   - The question before the Committee on June 5 was “Does this imply that Stored Water is the first volume of water to be removed at the southern and western boundaries of the Basin?”
   - There was concurrence among Committee members to better understand basin losses before addressing this question. The last sentence in Section 4.3 will remain, but the Watermaster will make efforts to understand basin losses using the existing numerical model.

- Mr. Eckhart of SGPWA commented that he doesn't see how imported water brought in to the basin during the period of temporary surplus could be lost first. He also pointed out the Watermaster should coordinate with the San Gorgonio Pass GSA on basin losses to the east.
- Section 4.3 will remain as is, but may be modified later as we improve our understanding of basin losses, particularly in the eastern portion of the Beaumont Basin.

3. Definition of Stored Water

   "Stored Water" means Supplemental Water stored in the Beaumont Basin pursuant to a Groundwater Storage Agreement with the Watermaster.

   - "Stored Water" will include New Yield Water in its definition.

4. Discussion on revising Watermaster Forms and potentially merging Forms 7 and 8

   Mr. Stuart provided digital copies of the Watermaster Forms 1-8 to the Committee members on June 19, 2024 for their review and comments.

5. Timeline
   - Mr. Stuart commented at the June 5 meeting that he will address any comments on the suggested revisions to the Rules and Regulations and the Watermaster Forms at the July 10 and August 7 meetings.
   - Mr. Eckhart recommended that the Watermaster "walk through these recommended changes at a paced, deliberative manner along with workshops to fully vet how these rules may affect the basin and the various entities to holistically manage supplies."
   - The goal over the next few meetings is to receive and discuss the comments from the Watermaster Committee at publicly held special meetings to evaluate how suggested revisions to the Rules and Regulations will affect management of the Beaumont Basin.

ITEM VII-C

BEAUMONT BASIN WATERMASTER

MEMORANDUM NO. 24-26

Date:	August 7, 2024
From:	Hannibal Blandon, ALDA Inc.
Subject:	Revisions to the 2023 Consolidated Annual Report and Engineering Report
Recommendation:	Approve the Revisions to the Final 2023 Consolidated Annual and Engineering Report or Delay Finalizing the Report until the Beaumont Basin Safe Yield for the 2023-32 Period is Approved and a Corresponding Resolution is Adopted

A draft of the 2023 Consolidated Annual and Engineering Report was presented at the April 17, 2024 Regular meeting, comments were received and addressed at the June 5, 2024 when the final version of the report was approved. At the July 10, 2024 Special meeting, an update on the Safe Yield Reset of the Beaumont Basin was presented under Technical Memorandum 24-23 (See Attachment). As part of this discussion, a table was introduced comparing the initial overlying water rights through 2012 and revised overlying rights for the 10-year periods 2013-2022 and 2023-2032. The initial Overlying rights were based on the operating safe yield presented in the Judgment of 8,650 ac-ft/yr while subsequent Overlying rights were based on the estimated safe yield of 6,700 ac-ft/yr for the 2013-22 period and the currently proposed safe yield of 7,100 ac-ft/yr for the 2023-32 period. The water rights periods used in annual reports since CY 2013 are inconsistent with the 10-year periods presented at the July 10th, 2024 Special meeting. This inconsistency impacts extraction rights by Appropriators for CY 2018 and CY 2028 with all other years remaining unchanged.

A draft of the 2013 Annual Report was presented to the Executive Committee at the August 2014 Regular meeting for review and comment; a final report was approved at the December meeting. Resolution 2015-01, “A Resolution of the Beaumont Basin Watermaster Adopting the 2013 Reevaluation of the Beaumont Basin Safe Yield Report and Redetermination of the Safe Yield of the Beaumont Basin” (See Attachment), was adopted at the April, 2015 regular meeting, four months after the 2013 Annual Report was finalized. Through this resolution, the Safe Yield of the Beaumont Basin was redetermined to be 6,700 ac-ft/yr for the 10-year period between 2013 and 2022 (See Attachment). The 2013 Annual Report should have been corrected during the preparation of the 2014 Annual Report or subsequent annual reports; however, this unintended error remained uncorrected until now.

Table 3-6 of the 2013 Annual Report presented a summary of Unused Overlying Water while Table 3-7 documented the Allocation of Unused Overlying Water to Appropriators based on the percentages outlined in Exhibit C of the Judgment (See Attachment). The values presented in these tables for CY 2013 are based on the original Safe Yield of 8,650 ac-ft/yr and a groundwater production of 2,576.50 ac-ft. Groundwater production for that year was subsequently revised in the 2014 Annual Report and revised again, for the last time, in the 2017 Consolidated Annual and

Engineering Report at 2,284.61 ac-ft. These revisions resulted in an unused Overlying water Right of 6,365.39 ac-ft based on the original Safe Yield of 8,650 ac-ft/yr. The attached Table 3-7 of the 2017 report presents the revised Overlying production an allocation of unused Overlying water to Appropriators for CY 2018.

The allocation of unused Overlying water in CY 2013 should have been based on the Reevaluation of the Beaumont Basin Safe Yield of 6,700 ac-ft for the 2013-2022 period. This change results in the reduction of 1,950 ac-ft of unused Overlying water allocated to Appropriators for CY 2018, as presented in the table below. This table compares the original and revised allocations.

Appropriator Party	2018 Allocation Based on Initial Safe Yield of 8,650 ac-ft/yr	2018 Allocation Based on Revised Safe Yield of 6,700 ac-ft/yr
City of Banning	2,000.64	1,387.76
City of Beaumont	0.00	0.00
Beaumont CVWD	2,705.93	1,876.98
South Mesa WC	794.40	551.04
Yucaipa VWD	864.42	599.61
Total	6,365.39	4,415.39

The reduction in allocation to Appropriators for CY 2018 results in a similar reduction in their individual storage accounts for that year and subsequent years. The table below compares the amount of water in storage as of CY 2023 based on the original and revised allocations. The changes presented here do not impact SGPWA and Morongo Band of Mission Indians storage accounts. Overliers are also not impacted by this change since their level of production was significantly below their individual rights for CY 2013.

Appropriator Party	Water in Storage in CY 2023 Based on Initial Safe Yield of 8,650 ac-ft/yr for CY 2013	Water in Storage in CY 2023 Based on Revised Safe Yield of 6,700 ac-ft/yr for CY 2013
City of Banning	47,650.90	47,038.00
City of Beaumont	0.00	0.00
Beaumont CVWD	32,884.10	32,055.10
South Mesa WC	10,506.00	10,262.60
Yucaipa VWD	16,855.30	16,590.50
Total	107,896.30	105,946.30

A draft of the 2023 Consolidated Annual and Engineering Report was presented at the April 17, 2024 Regular meeting; comments were received and a final version was presented and approved at the June 5, 2024 Regular meeting. The 2023 report was completed and approved using the previous Reevaluation of the Beaumont Basin Safe Yield of 6,700 ac-ft/yr for the period 2013-2022. The calculation of unused Overlying water in the 2023 report should be based using the current, yet to be finalized and adopted by the Executive Committee, Reevaluation of the Beaumont Basin Safe Yield for the period 2023-2032, proposed as 7,100 ac-ft/yr.

This change would increase the amount of unused Overlying water in CY 2023 and allocation to Appropriators for CY 2028 by 400 ac-ft/yr from 5,704 ac-ft to 6,104 ac-ft cumulative. The attached Table 3-7, Summary of Unused Overlying Water and Allocation to Appropriators documents this

change. With regards to Overlying producers, there is no impact since their level of groundwater production is significantly less than their individual allocated right.

Based on the findings documented above, it is recommended that the Watermaster Committee approves the revisions to the Final 2023 Consolidated Annual and Engineering Report or delays finalizing the report until the safe yield for the 2023-32 period is approved and a corresponding resolution adopted.

A new section in the 2023 Consolidated Annual and Engineering Report has been included documenting the above discussed changes. Section 3.4.4.1 Revisions to Previous Annual Reports in Section 3.4.4 of the report is as follows.

3.4.4 Allocation of Unused Overlying Water

3.4.4.1 Revisions to Previous Annual Reports

The 2013 Annual Report was finalized in December 2014, four months prior to the formal adoption of the Revised Beaumont Basin Safe Yield by the Executive Committee under Resolution 2015-01. Through this resolution, the Beaumont Basin Safe Yield was adopted as 6,700 ac-ft/yr for the 2013-22 10-year period. In the 2013 Annual Report, the allocation of unused Overlying water in CY 2013 was estimated using the original Safe Yield of 8,650 ac-ft/yr and an overlying groundwater production of 2,576.50 ac-ft. Overlying groundwater production for that year was subsequently revised in the 2014 Annual Report and revised again, for the last time, in the 2017 Consolidated Annual and Engineering Report at 2,284.61 ac-ft resulting in an unused Overlying Water Right of 6,365.39 ac-ft.

The allocation of unused Overlying water in CY 2013 should have been based on the Reevaluation of the Beaumont Basin Safe Yield of 6,700 ac-ft for the 2013-2022 period. This change results in the reduction of 1,950 ac-ft of unused Overlying water allocated to Appropriators for CY 2018. The table below presents a comparison of the original and revised allocations.

Appropriator Party	2018 Allocation Based on Initial Safe Yield of 8,650 ac-ft/yr	2018 Allocation Based on Revised Safe Yield of 6,700 ac-ft/yr
City of Banning	2,000.64	1,387.76
City of Beaumont	0.00	0.00
Beaumont CVWD	2,705.93	1,876.98
South Mesa WC	794.40	551.04
Yucaipa VWD	864.42	599.61
Total	6,365.39	4,415.39

List of Attachments

1. July 10, 2024 – Technical Memorandum 24-23
2. Resolution 2015-01 – A Resolution of the Beaumont Basin Watermaster Adopting the 2013 Reevaluation of the Beaumont Basin Safe Yield Report and Redetermination of the Safe Yield of the Beaumont Basin
3. Tables 3-6 and 3-7 of the 2013 Annual Report
4. Table 3-7 of the 2017 Consolidated Annual and Engineering Report
5. Table 3-7 of the 2023 Consolidated Annual and Engineering Report

BEAUMONT BASIN WATERMASTER
MEMORANDUM NO. 24-23

Date: July 3, 2024

From: Thomas Harder, Thomas Harder & Co.

Subject: Update on the Safe Yield Reset of the Beaumont Basin

Recommendation: For Information and Discussion

At the June 2024 Committee meeting, TH&Co presented a recommended Safe Yield for the next ten years (2023 through 2032). The Safe Yield was redetermined using an updated version of the groundwater flow model of the Beaumont Basin that was previously developed for the 2013 Safe Yield redetermination. TH&Co has prepared a draft technical report to the Committee for review and consideration. The technical report includes:

- Updates to the Beaumont Basin Groundwater Flow Model Used to Estimate Safe Yield
- Assumptions for Future Basin Management Forecasts for Use in Model Analysis
- A Description of the Model Calibration
- A Summary of the Analysis of Safe Yield
- Findings and Recommendations

TH&Co is in the process of addressing comments from Dudek on the Safe Yield redetermination report and will be prepared to present the final report to the Beaumont Basin Watermaster Committee at the August meeting.

As reported in June, the recommended Safe Yield of the Beaumont Basin for 2023 to 2032 is 7,100 acre-ft/yr. This value is higher than the Safe Yield value for 2013 through 2022, which was 6,700 acre-ft/yr. Accordingly, the allocation of overlying production rights is different for the 2023 to 2032 period. At the request of the Watermaster Committee, we have prepared the attached table comparing the allocation of water rights among overlying parties for 2003 to 2012, 2013 to 2022, and 2023 to 2032. The table also shows the average annual overlying production for the last five-year period (2019 to 2023), which is 1,860.7 acre-ft. The five-year running average overlying production is approximately 26 percent of the updated 2023 to 2032 Beaumont Basin Safe Yield.

Overlying Parties Production Rights Allocation Based on Revised Safe Yield for the 2024-33 Period

Overlying Party to the 2003 Judgment	Initial Overlying Water Right through 2012	Overlying Water Right for the 2013-22 Period	Overlying Water Right for the 2023-32 Period	5-Year (2019-23) Average Production (ac-ft)	5-Year (2019-23) Running Average % of Water Right Based on 2023-32 Safe Yield
Sharondale Mesa Owners Association	200.0	154.91	164.16	111.0	67.6%
California Oak Valley Golf and Resort LLC	950.0	735.84	779.77	473.0	60.7%
Tukwet Canyon Golf Club	2,200.0	1,704.05	1,805.78	984.8	54.5%
Plantation on the Lake LLC	581.0	450.02	476.89	248.0	52.0%
Rancho Calimesa Mobile Home Park	150.0	116.18	123.12	29.5	23.9%
Gutierrez, Hector, et al.	10.0	7.75	8.21	1.4	17.3%
Darmont, Boris and Miriam	2.5	1.94	2.05	0.4	17.1%
Aldama, Nicolas and Amalia	7.0	5.42	5.75	0.9	15.0%
McAmis, Ronald L.	5.0	3.87	4.10	0.6	13.5%
Nikodinov, Nick	20.0	15.49	16.42	0.8	4.6%
Beckman, Walter M.	75.0	58.09	61.56	0.9	1.4%
Albor Properties III, LP	300.0	232.37	246.24	2.4	1.0%
Stearns, Leonard M. and Dorothy D.	200.0	154.91	164.16	0.7	0.4%
Sunny-Cal Egg and Poultry Company	1,439.5	1,114.99	1,181.55	4.3	0.4%
Merlin Properties	550.0	426.01	451.45	1.6	0.4%
Oak Valley Partners, LP [(1)]	1,806.0	1,398.87	1,482.38	0.5	0.0%
Roman Catholic Bishop of San Bernardino	154.0	119.28	126.40	0.0	0.0%
	8,650.0	**6,700.0**	**7,100.0**	**1,860.7**	**26.2%**

(1) - Under Resolution 17-02, adopted August 30, 2017, Oak Valley Partners LP (OVP) agreed to transfer its Overlying water rights to particular development parcels, intending to secure commitment from YVWD to provide water service to development phases of OVP's Summerwind Ranch Specific Plan (Project) located in the Beaumont Basin. As of the end of CY 2023, OVP has transferred 478.25 ac-ft of water rights to YVWD.

RESOLUTION NO. 2015 – 01

A RESOLUTION OF THE BEAUMONT BASIN WATERMASTER ADOPTING THE 2013 REEVALUATION OF THE BEAUMONT BASIN SAFE YIELD REPORT AND REDETERMINATION OF THE SAFE YIELD OF THE BEAUMONT BASIN

WHEREAS, the Stipulated Judgment filed February 4, 2004 establishing the Beaumont Basin Watermaster (Riverside Superior Court Case No. 389197) empowers Watermaster to adopt appropriate rules and regulations for the conduct of Watermaster affairs; and

WHEREAS, the Stipulated Judgment, per section VI.5.Y. requires Watermaster to redetermine the Safe Yield of the Beaumont Basin at least every 10 years beginning 10 years after the date of entry of the Stipulated Judgment; and

WHEREAS, a special projects committee, consisting of representatives from the City of Banning, the Beaumont-Cherry Valley Water District, the South Mesa Mutual Water Company, and the Yucaipa Valley Water District was commissioned to provide Watermaster with a recommendation concerning the redetermination of safe yield; and

WHEREAS, the special projects committee commissioned Thomas Harder & Co. in association with Alda, Inc. to prepare a report analyzing and recommending a redetermined Safe Yield as defined by Rule 4.1 of the Beaumont Basin Watermaster Rules and Regulations; and

WHEREAS, the special projects committee conducted several public workshops concerning the redetermination of the Safe Yield of the Beaumont Basin during which considered and analyzed studies and draft reports prepared by Thomas Harder & Co. in association with Alda, Inc., and also received and considered comments submitted by overlyers, appropriators and members of the public; and

WHEREAS, Thomas Harder & Co. in association with Alda, Inc. conducted studies and prepared a report entitled "Final 2013 Reevaluation of the Beaumont Basin Safe Yield" based on the projected water balance for the 10 year period between 2013 to 2022; and

WHEREAS, the Thomas Harder & Co. in association with Alda, Inc. report recommended the redetermined Safe Yield of the Beaumont Basin to be 6,700 acre-feet/yr for the next 10 years of operations within the Beaumont Basin; and

WHEREAS, the special projects committee has recommended to Watermaster that the Final 2013 Reevaluation of the Beaumont Basin Safe Yield report be approved and adopted, and that the redetermined Safe Yield of the Beaumont Basin be 6,700 acre-feet/yr;

NOW, THEREFORE, BE IT HEREBY RESOLVED BY THE BEAUMONT BASIN WATERMASTER that:

1. The Beaumont Basin Watermaster does accept and adopt the Final 2013 Reevaluation of the Beaumont Basin Safe Yield report; and
2. The Beaumont Basin Watermaster redetermines the Safe Yield of the Beaumont Basin to be 6,700 acre-feet/yr.

PASSED AND ADOPTED this 1st day of April, 2015.

Table 3-6

Summary of Unused Overlying Water - Calendar Year Accounting (ac-ft)

Watermaster Accounting Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Annual Overlying Water Right	4,325.0	8,650.0	8,650.0	8,650.0	8,650.0	8,650.0	8,650.0	8,650.0	8,650.0	8,650.0	8,650.0
Annual Overlying Production	2,440.8	3,576.3	3,292.6	3,596.7	3,306.5	2,871.6	2,838.2	2,285.0	2,259.1	2,360.9	2,576.5
Annual Deliveries by Appropriators			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unused Overlying Water Right	**1,884.2**	**5,073.7**	**5,357.4**	**5,053.3**	**5,343.5**	**5,778.4**	**5,811.8**	**6,365.0**	**6,390.9**	**6,289.1**	**6,073.5**

Table 3-7

Allocation of Unused Overlying Water -- Calendar Year Accounting (ac-ft)

Appropriator Party	Share of Safe Yield	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Banning, City of	31.43%	592.2	1,594.7	1,683.8	1,588.2	1,679.5	1,816.1	1,826.7	2,000.5	2,008.7	1,976.7	1,908.9
Beaumont, City of	0.00%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beaumont Cherry Valley Water District	42.51%	801.0	2,156.8	2,277.4	2,148.1	2,271.5	2,456.4	2,470.6	2,705.8	2,716.8	2,673.5	2,581.8
South Mesa Water Company	12.48%	235.2	633.2	668.6	630.6	666.9	721.1	725.3	794.3	797.6	784.9	758.0
Yucaipa Valley Water District	13.58%	255.9	689.0	727.5	686.2	725.6	784.7	789.2	864.4	867.9	854.1	824.8
Total	**100.00%**	**1,884.2**	**5,073.7**	**5,357.4**	**5,053.3**	**5,343.5**	**5,778.4**	**5,811.8**	**6,365.0**	**6,390.9**	**6,289.1**	**6,073.5**

Table 3-7
Summary of Unused Overlying Water and Allocation to Appropriators (ac-ft)

Accounting Year	Overlying Water Right	Overlying Production	Unused Overlying Water Right
2003	4,325	2,441	1,884
2004	8,650	3,576	5,074
2005	8,650	3,293	5,357
2006	8,650	3,597	5,053
2007	8,650	3,307	5,343
2008	8,650	2,872	5,778
2009	8,650	2,838	5,812
2010	8,650	1,976	6,674
2011	8,650	1,971	6,679
2012	8,650	2,085	6,565
2013	8,650	2,285	6,365
2014	6,700	2,219	4,481
2015	6,700	2,086	4,614
2016	6,700	1,937	4,763
2017	6,700	2,405	4,295

Allocation Year	City of Banning	City of Beaumont	Beaumont Cherry Valley WD	South Mesa Water Co.	Yucaipa Valley Water District	Total
2008	592	0	801	235	256	1,884
2009	1,595	0	2,157	633	689	5,074
2010	1,684	0	2,277	669	728	5,357
2011	1,588	0	2,148	631	686	5,053
2012	1,679	0	2,272	667	726	5,343
2013	1,816	0	2,456	721	785	5,778
2014	1,827	0	2,471	725	789	5,812
2015	2,097	0	2,837	833	906	6,674
2016	2,099	0	2,839	833	907	6,679
2017	2,063	0	2,791	819	891	6,565
2018	2,001	0	2,706	794	864	6,365
2019	1,408	0	1,905	559	609	4,481
2020	1,450	0	1,962	576	627	4,614
2021	1,497	0	2,025	594	647	4,763
2022	1,350	0	1,826	536	583	4,295

Table 3-7 (REVISED - Jul 30, 2024)

Summary of Unused Overlying Water and Allocation to Appropriators (ac-ft)

Accounting Year	Overlying Water Right	Overlying Production	Unused Overlying Water Right
2003	4,325	2,441	1,884
2004	8,650	3,576	5,074
2005	8,650	3,293	5,357
2006	8,650	3,597	5,053
2007	8,650	3,307	5,343
2008	8,650	2,872	5,778
2009	8,650	2,838	5,812
2010	8,650	1,976	6,674
2011	8,650	1,971	6,679
2012	8,650	2,085	6,565
2013	6,700	2,285	4,415
2014	6,700	2,219	4,481
2015	6,700	2,086	4,614
2016	6,700	1,936	4,764
2017	6,700	2,404	4,296
2018 [1]	6,700	2,220	4,480
2019	6,636	1,773	4,863
2020	6,505	1,912	4,594
2021	6,333	1,966	4,367
2022	6,222	2,135	4,087
2023	6,622	1,518	5,104

Allocation Year	City of Banning	City of Beaumont	Beaumont Cherry Valley WD	South Mesa Water Co.	Yucaipa Valley Water District	Total
2008	592	0	801	235	256	1,884
2009	1,595	0	2,157	633	689	5,074
2010	1,684	0	2,277	669	728	5,357
2011	1,588	0	2,148	631	686	5,053
2012	1,679	0	2,272	667	726	5,343
2013	1,816	0	2,456	721	785	5,778
2014	1,827	0	2,471	725	789	5,812
2015	2,097	0	2,837	833	906	6,674
2016	2,099	0	2,839	833	907	6,679
2017	2,063	0	2,791	819	891	6,565
2018	1,388	0	1,877	551	600	4,415
2019	1,408	0	1,905	559	609	4,481
2020	1,450	0	1,962	576	627	4,614
2021	1,497	0	2,025	595	647	4,764
2022	1,350	0	1,826	536	583	4,296
2023	1,408	0	1,904	559	608	4,480
2024	1,528	0	2,067	607	660	4,863
2025	1,444	0	1,953	573	624	4,594
2026	1,373	0	1,856	545	593	4,367
2027	1,285	0	1,737	510	555	4,087
2028	1,604	0	2,170	637	693	5,104

1.- At the October 4, 2023, YVWD submitted revised documentation supporting Form 5s transfers of Overlying water rights from Oak Valley Partners from 2018 through 2022 as follows: a) 2018, 0.11 ac-ft b) 2019, 63.96 ac-ft, c) 2020, 194.82 ac-ft, d) 2021, 366.77 ac-ft, and e) 2022, 478.25 ac-ft. Transfers for CY 2023 remain at the CY 2022 level since YVWD has not documented increasing delivery volumes. As a result, cummulative Overlying water rights have decreased by the listed quantities.

Item VII-D

Beaumont Basin Losses

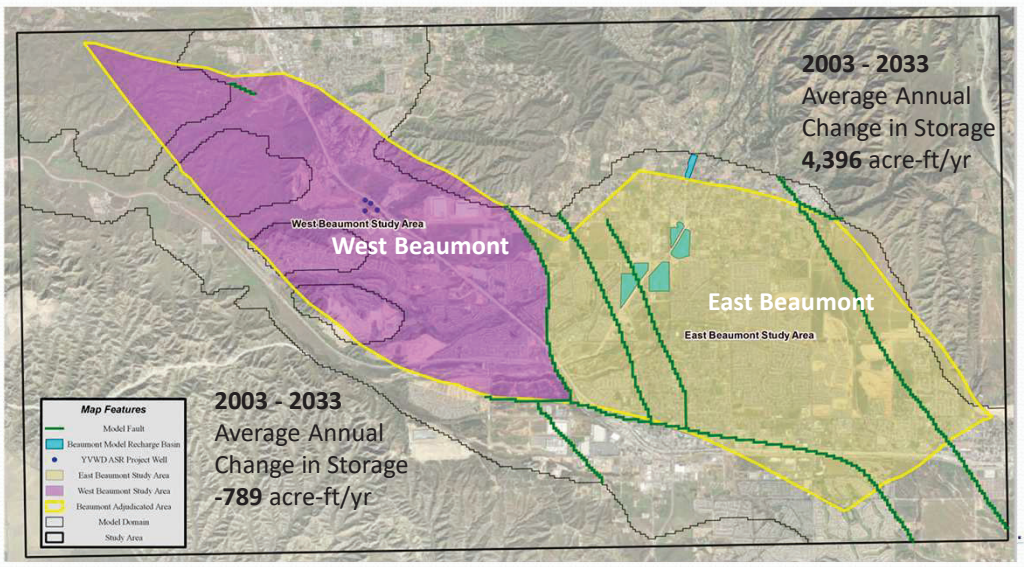
August 2024

Prepared for:
Beaumont Basin Watermaster

Thomas Harder & Co.
Groundwater Consulting

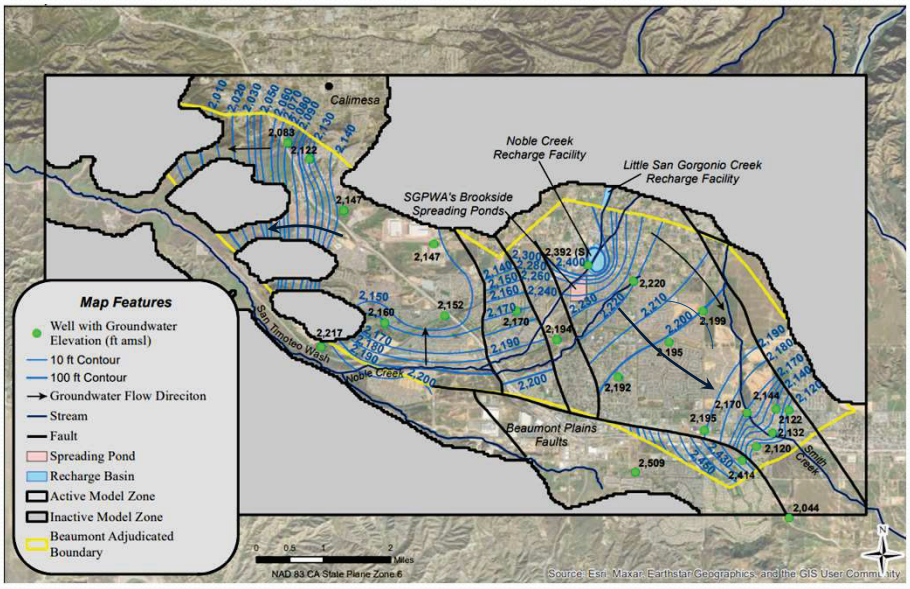
1

Separate Water Budgets Were Evaluated for the West and East Sides (Study Areas)



2

The Beaumont Basin is Not a Closed Basin – Groundwater Not Otherwise Captured is Free to Flow out of the Basin



Natural Groundwater Losses are Accounted for in the Safe Yield Estimates of the Basin

Groundwater Losses from Storage of Supplemental Water Have Not Been Accounted for to Date

Thomas Harder & Co.
Groundwater Consulting

3

The Influence of Managed Supplemental Recharge on Subsurface Outflow (Losses) Can Be Seen from the Water Budget

Groundwater Budget – Jan 1978 through Dec 2032

Inflows *Outflows* *Change in Storage*

Year	Groundwater Inflows (acre-ft)							Groundwater Outflows (acre-ft)				(acre-ft)
	Subsurface Inflow into the Adjudicated Area	Imported Water for Recharge[a]	Imported Water for Injection[b]	Deep Infiltration of Precipitation and Applied Water[c]	Recharge from the Mountain Block	Wellbore Flow[d]	Total Inflow	Subsurface Outflow out of the Adjudicated Area	Groundwater Pumping	Wellbore Flow[d]	Total Outflow	Change in Storage[e]
1978	11,585	0	0	3,364	43	1,502	16,494	(11,475)	0	(6,987)	(18,461)	(1,967)
1979	13,009	0	0	3,477	30	1,130	17,646	(10,005)	0	(6,831)	(16,836)	811
1980	15,496	0	0	3,409	43	947	19,895	(8,954)	0	(5,967)	(14,921)	4,974
1981	11,384	0	0	3,590	13	938	15,925	(8,388)	0	(6,561)	(14,949)	976
1982	14,597	0	0	3,600	33	1,001	19,231	(9,463)	0	(5,345)	(14,808)	4,423
1983	16,604	0	0	3,587	44	1,009	21,244	(9,702)	0	(4,726)	(14,428)	6,817
1984	11,850	0	0	3,693	10	978	16,531	(10,115)	0	(5,483)	(15,598)	933
1985	10,427	0	0	3,534	9	903	14,872	(9,352)	0	(6,735)	(16,087)	(1,215)
1986	10,450	0	0	3,705	9	850	15,014	(8,173)	0	(6,722)	(14,895)	120
1987	10,358	0	0	3,542	11	852	14,763	(8,971)	0	(7,490)	(16,461)	(1,698)
1988	10,003	0	0	3,676	10	789	14,478	(8,102)	0	(8,059)	(16,160)	(1,683)
1989	10,276	0	0	3,849	10	996	15,131	(7,903)	0	(11,187)	(19,090)	(3,960)
1990	10,224	0	0	3,790	9	969	14,992	(8,058)	0	(12,570)	(20,628)	(5,636)
1991	10,213	0	0	3,850	10	909	14,981	(8,222)	0	(10,667)	(18,889)	(3,908)
1992	11,616	0	0	3,804	24	861	16,306	(8,159)	0	(9,671)	(17,830)	(1,524)
1993	17,711	0	0	3,740	32	813	22,297	(9,396)	0	(7,355)	(16,751)	5,546
1994	14,432	0	0	3,804	28	844	19,108	(9,871)	0	(8,138)	(18,009)	1,099
1995	18,008	0	0	3,864	33	884	22,789	(10,057)	0	(6,020)	(16,078)	6,711
1996	12,440	0	0	3,813	9	889	17,150	(10,124)	0	(6,775)	(16,899)	251
1997	12,995	0	0	3,893	25	951	17,865	(10,024)	0	(8,060)	(18,084)	(219)
1998	17,076	0	0	3,946	42	1,066	22,130	(10,980)	0	(7,710)	(18,690)	3,441
1999	12,123	0	0	3,673	7	1,006	16,810	(9,614)	0	(9,957)	(19,571)	(2,761)
2000	10,908	0	0	3,871	9	943	15,731	(8,951)	0	(14,143)	(23,095)	(7,364)
2001	10,935	0	0	3,928	8	989	15,860	(8,862)	0	(14,624)	(23,486)	(7,626)
2002	10,748	0	0	3,831	8	886	15,474	(7,128)	0	(18,438)	(25,566)	(10,092)
2003	12,720	0	0	3,904	19	1,114	17,757	(7,393)	0	(12,266)	(19,659)	(1,902)
2004	13,985	0	0	4,099	20	923	19,028	(7,919)	0	(16,703)	(24,622)	(5,594)
2005	19,121	0	0	3,886	32	983	24,022	(8,822)	0	(14,694)	(23,516)	506
2006	14,246	3,501	0	4,283	6	1,089	23,125	(9,591)	0	(17,901)	(27,492)	(4,367)
2007	11,395	4,501	0	4,285	4	1,056	21,242	(9,751)	0	(20,559)	(30,309)	(9,067)
2008	11,760	3,933	0	4,830	13	936	21,471	(9,613)	0	(18,264)	(27,876)	(6,405)
2009	12,023	5,482	0	4,815	9	922	23,252	(9,560)	0	(16,565)	(26,125)	(2,873)
2010	13,314	7,065	0	5,379	15	933	26,706	(10,533)	0	(14,547)	(25,080)	1,626
2011	14,983	8,779	0	5,130	21	989	29,902	(12,113)	0	(14,668)	(26,781)	3,121
2012	13,432	8,983	0	5,065	8	916	28,404	(11,885)	0	(15,327)	(27,212)	1,192
2013	12,610	8,634	0	4,273	4	1,017	26,538	(12,579)	0	(17,798)	(30,377)	(3,839)
2014	12,624	5,013	0	3,348	7	934	21,926	(11,979)	0	(17,896)	(29,875)	(7,949)
2015	13,123	3,467	0	2,711	8	770	20,079	(11,625)	0	(13,556)	(25,181)	(5,102)
2016	13,062	10,796	0	4,968	11	778	29,615	(11,334)	0	(16,615)	(27,949)	1,666
2017	12,183	14,940	0	6,762	11	910	34,806	(13,618)	0	(16,779)	(30,397)	4,409
2018	13,635	12,621	0	4,332	12	873	31,474	(13,369)	0	(18,120)	(31,489)	(15)
2019	16,208	14,153	0	6,595	19	981	37,956	(14,699)	0	(17,116)	(31,814)	6,142
2020	14,647	11,469	0	5,911	9	956	32,991	(14,442)	0	(19,595)	(34,037)	(1,045)
2021	14,052	2,504	0	1,735	5	839	19,134	(12,188)	0	(21,179)	(33,367)	(14,233)

x Co.
ing

4

The Influence of Managed Supplemental Recharge on Subsurface Outflow (Losses) Can Be Seen from the Water Budget

Groundwater Budget – Jan 1978 through Dec 2032

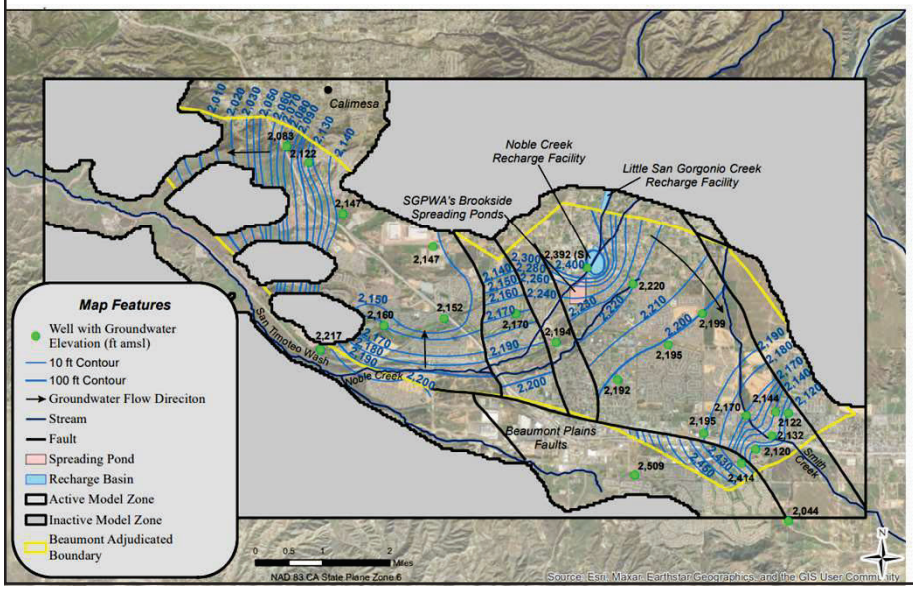
	Groundwater Inflows (acre-ft)							Groundwater Outflows (acre-ft)				(acre-ft)
Year	Subsurface Inflow into the Adjudicated Area	Imported Water for Recharge[a]	Imported Water for Injection[b]	Deep Infiltration of Precipitation and Runoff in Stream[c]	Recharge from the Mountain Block	Wellbore Flow[d]	Total Inflow	Subsurface Outflow out of the Adjudicated Area	Evapotran-spiration (ET)	Groundwater Pumping	Total Outflow	Change in Storage[e]
2002	10,748	0	0	3,831	8	886	15,474	(7,128)	0	(18,438)	(25,566)	(10,092)
2003	12,720	0	0	3,904	19	1,114	17,757	(7,393)	0	(12,266)	(19,659)	(1,902)
2004	13,985	0	0	4,099	20	923	19,028	(7,919)	0	(16,703)	(24,622)	(5,594)
2005	19,121	0	0	3,886	32	983	24,022	(8,822)	0	(14,694)	(23,516)	506
2006	14,246	3,501	0	4,283	6	1,089	23,125	(9,591)	0	(17,901)	(27,492)	(4,367)
2007	11,395	4,501	0	4,285	4	1,056	21,242	(9,751)	0	(20,559)	(30,309)	(9,067)
2008	11,760	3,933	0	4,830	13	936	21,471	(9,613)	0	(18,264)	(27,876)	(6,405)
2009	12,023	5,482	0	4,815	9	922	23,252	(9,560)	0	(16,565)	(26,125)	(2,873)
2010	13,314	7,065	0	5,379	15	933	26,706	(10,533)	0	(14,547)	(25,080)	1,626
2011	14,983	8,779	0	5,130	21	989	29,902	(12,113)	0	(14,668)	(26,781)	3,121
2012	13,432	8,983	0	5,065	8	916	28,404	(11,885)	0	(15,327)	(27,212)	1,192
2013	12,610	8,634	0	4,273	4	1,017	26,538	(12,579)	0	(17,798)	(30,377)	(3,839)
2014	12,624	5,013	0	3,348	7	934	21,926	(11,979)	0	(17,896)	(29,875)	(7,949)
2015	13,123	3,467	0	2,711	8	770	20,079	(11,625)	0	(13,556)	(25,181)	(5,102)
2016	13,062	10,796	0	4,968	11	778	29,615	(11,334)	0	(16,615)	(27,949)	1,666
2017	12,183	14,940	0	6,762	11	910	34,806	(13,618)	0	(16,779)	(30,397)	4,409
2018	13,635	12,621	0	4,332	12	873	31,474	(13,369)	0	(18,120)	(31,489)	(15)
2019	16,208	14,153	0	6,595	19	981	37,956	(14,699)	0	(17,116)	(31,814)	6,142
2020	14,647	11,469	0	5,911	9	956	32,991	(14,442)	0	(19,595)	(34,037)	(1,045)
2021	14,052	2,504	0	1,735	5	839	19,134	(12,188)	0	(21,179)	(33,367)	(14,233)

As Managed Recharge Increases, Subsurface Outflow Increases

Thomas Harder & Co. Groundwater Consulting

5

Factors Affecting Storage Losses in the Beaumont Basin



- Location of Storage
- Volume of Storage
- Time of Storage
- Location of Extraction
- Extraction Amounts

Thomas Harder & Co. Groundwater Consulting

6

Potential Issues Associated with Storage Losses in the Beaumont Basin

- **Location of Extraction**
  - If you store water on the east side of the basin, can you extract it from the west side?
  - If yes, are there limits to the volume that can be extracted?
  - Is there an acceptable groundwater level impact on overlyer wells from extracting stored water?

Thomas Harder & Co. Groundwater Consulting

7

Potential Issues Associated with Storage Losses in the Beaumont Basin

- **Time of Storage**
  - Is there a limit to how long you can store water?
- **Extraction Amounts**
  - Are there limits to how much stored water can be extracted at any time?

Thomas Harder & Co. Groundwater Consulting

8

Issues Associated with Storage Losses in the Beaumont Basin

- **Other**
  - How Do We Account for Managed Recharge by SGPWA in the Adjudicated Area for Use Outside the Adjudicated Area?
  - Are Storage Accounts Associated with Unused Overlyer Production Subject to Losses?

Thomas Harder & Co. Groundwater Consulting

9

Questions

Thomas Harder & Co. Groundwater Consulting

10

Beaumont Basin Watermaster

Analysis of Conditions that Could Produce Undesirable Results in the Beaumont Basin

July 10, 2024

Thomas Harder & Co.
Groundwater Consulting

Proposed Analysis of Basin Management Scenarios to Identify Potential Undesirable Results

- **Purpose**: To Develop a Plausible Range of Basin hydrological Conditions to Stress the Basin and Assess the Potential for Undesirable Results
- **Method**: Analyze Scenario Using the Updated Calibrated Groundwater Flow Model of the Basin and Assess the Potential for Adverse Groundwater Level Impacts on Beneficial Uses and Users of Groundwater
- **Goal**: To Establish A Basis for Identifying Significant and Unreasonable Conditions that Would Be Considered Undesirable Results and to Provide a Planning Tool for Future Projects and Management Actions

Based on TH&Co Proposed Scope of Work dated May 28, 2024

Thomas Harder & Co.
Groundwater Consulting

Proposed Analysis of Basin Management Scenarios Would Be Compared Against a Baseline Scenario

- **Baseline**
  - Based on Safe Yield Redetermination Future Projection
    - Supplemental Recharge Based on a Proxy of Historical Availability Between 2012 and 2023
    - Appropriator Pumping Based on Urban Water Management Plan Projections
    - Hydrology Based on Historical Conditions Projected Into the Future After Adjusting for Climate Change
    - Overlyer Production Based on 2022 Pumping
  - Already Analyzed As Part of the Safe Yield Redetermination

Thomas Harder & Co.
Groundwater Consulting

Potential Basis for Establishing Hydrology Scenarios

Table 1: Precipitation / Availability of Imported Water Proxy Water Years for the Forecast Scenarios

Forecast Water Year	Scenario 1 (Worst Case)	Scenario 2	Scenario 3	Baseline
2023	WY 2018 (dry)	WY 2019 (wet)	WY 2019 (wet)	WY 2005 (very wet)
2024	WY 2007 (very dry)	WY 2018 (dry)	WY 2018 (dry)	WY 2005 (very wet)
2025	WY 2018 (dry)	WY 2007 (very dry)	WY 2007 (very dry)	WY 2018 (dry)
2026	WY 2018 (dry)	WY 2018 (dry)	WY 2018 (dry)	WY 2015 (average)
2027	WY 2007 (very dry)	WY 2019 (wet)	WY 2019 (wet)	WY 2015 (average)
2028	WY 2019 (wet)	WY 2018 (dry)	WY 2018 (dry)	WY 2007 (very dry)
2029	WY 2018 (dry)	WY 2015 (average)	WY 2015 (average)	WY 2019 (wet)
2030	WY 2007 (very dry)	WY 2018 (dry)	WY 2018 (dry)	WY 2015 (average)
2031	WY 2015 (average)	WY 2007 (very dry)	WY 2007 (very dry)	WY 2005 (very wet)
2032	WY 2018 (dry)	WY 2015 (average)	WY 2019 (wet)	WY 2015 (average)

WY 2005 = very wet
WY 2019 = wet
WY 2015 = average
WY 2018 = dry and
WY 2007 = very dry

Thomas Harder & Co.
Groundwater Consulting

Other Assumptions for Model Scenarios

- Overlier Pumping – Assumed to be 1.25 times the Average of pumping from 2018 - 2023
- Appropriator Pumping – Same as Baseline

Thomas Harder & Co.
Groundwater Consulting

Other Assumptions for Model Scenarios

- YVWD Recharge and Recovery Operations
  - Scenario 1 (worst case): The four injection wells do not go into operation (i.e., 0 acre-feet per year) but the demand supplied by the extraction wells continues at 2,000 acre-ft/yr
  - Scenario 2: The four injection wells do not go into operation (i.e., 0 acre-feet per year) but the demand supplied by the extraction wells continues at half of design capacity or 1,000 acre-ft/yr
  - Scenario 3: The four injection wells do not go into operation (i.e., 0 acre-feet per year) but the demand supplied by the extraction wells continues at 500 acre-ft/yr.

Thomas Harder & Co.
Groundwater Consulting

Scope of Work

1. Define the forecast scenarios
2. Modify model input files to simulate the forecast scenarios
3. Conduct the model runs
4. Analyze, illustrate, and tabulate the model results, and
5. Prepare and submit draft technical memorandum of the results

Thomas Harder & Co.
Groundwater Consulting

Questions/Discussion

Thomas Harder & Co.
Groundwater Consulting