## Initial Study/ Environmental Assessment

# 2020 Tehama-Colusa Canal Authority In-Basin Water Transfers

## California


U.S. Department of the Interior
Bureau of Reclamation
Sacramento, California

Tehama-Colusa Canal Authority
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# Chapter 1 Introduction

This Initial Study (IS) and Environmental Assessment (EA) for water transfers in contract year 2020[1] was prepared by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and the Tehama-Colusa Canal Authority (TCCA). This joint IS/EA document satisfies (1) the California Environmental Quality Act (CEQA), and the Governor's Office of Planning and Research regulations to implement CEQA (Sections 15000-15387 of the California Code of Regulations); and (2) the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [USC] §4231 et seq.), the Council of Environmental Quality (CEQ) implementing regulations (40 Code of Federal Regulations [CFR] §1500-1508), the Department of the Interior's NEPA regulations (43 CFR Part 46). Reclamation is the federal lead agency responsible for NEPA review, through the EA, for the proposed 2020 TCCA water transfers, and the TCCA is the state lead agency responsible for CEQA review, through the IS, for the proposed 2020 TCCA water transfers.

This IS/EA describes the potential direct, indirect, and cumulative effects of transferring water from willing sellers, resulting from actions taken by the sellers to make water available for transfer, to the Member Units of the TCCA. The sellers hold water rights on northern California waterways or contracts with the United States (U.S.) (for Base Supply[2] and Central Valley Project (CVP) Water[3] ["Project Water"]). This IS/EA also identifies mitigation measures that have been incorporated to minimize or avoid project-related impacts. The water transfers included in this document are only those involving Base Supply or CVP facilities. These water transfers would require approval from Reclamation, which necessitates compliance with NEPA. These water transfers would also require CEQA compliance for the buyers and sellers.

Other water transfers not involving the TCCA and its Member Units could occur during the same time period. The San Luis & Delta-Mendota Water Authority (SLDMWA) and Reclamation completed an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) on Long-Term Water Transfers from 2015 to 2024 (Reclamation and SLDMWA 2015). The document has been updated in the Revised Draft Environmental Impact Report/ Supplemental Draft Environmental Impact Statement (RDEIR/SDIEIS) for transfers from 2019 to 2024 (Reclamation and SLDMWA 2019). The RDEIR/SDEIS includes some of the same water sources as this IS/EA, but the water would be transferred to different potential buyers; that is, the

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[1] Water Service Contract Year is March 1, 2020 through February 28, 2021. Sacramento River Settlement Contract Year is April 1, 2020 through October 31, 2020.

[2] Article 1(b) of the Sacramento River Settlement Contract defines Base Supply as the quantity of Surface Water established in Articles 3 and 5 which may be diverted by the Contractor from its Source of Supply each month during the period April through October of each Year without payment to the United States for such quantities diverted.

[3] Article 1(n) of the Sacramento River Settlement Contract defines Project water as all Surface Water diverted or scheduled to be diverted each month during the period April through October of each Year by the Contractor from its Source of Supply which is in excess of the Base Supply.

sellers have only the amounts of water listed in Chapter 2 available for transfer, but the water could be purchased by SLDMWA or TCCA members. SLDMWA may purchase water from sources in addition to those described in Chapter 2. Also, State Water Project (SWP) contractors may engage in water transfers to augment supply.

## 1.1 Background

The Member Units of the TCCA may experience water shortages in 2020 and are soliciting willing sellers to transfer surface water to them. A number of entities that use surface water from the Sacramento River have expressed interest in transferring water to Member Units of the TCCA. The TCCA would negotiate with these sellers, on behalf of the Member Units, to identify potential transfers of water and the specifics of each transfer arrangement, which, collectively, constitute the "proposed project" to be addressed under CEQA. The TCCA and these willing sellers are using this IS/EA to inform decision-makers and the public of the potential environmental effects of the proposed water transfers and determine whether the transfers may result in significant environmental impacts that warrant the preparation of an EIR under CEQA.

To facilitate the transfer of water throughout the State, Reclamation is considering whether it should approve and facilitate water transfers between willing sellers and buyers when Base Supply or CVP facilities are involved. Reclamation will not take part in the transfer negotiation process, nor will Reclamation develop a "program" to connect buyers and sellers. Reclamation would focus on the approval and facilitation of individual transfers of water involving Base Supply or involving CVP facilities; these transfers constitute the "proposed action" to be addressed under NEPA. Reclamation is using this IS/EA to evaluate the potential environmental effects of the proposed action and determine whether it may result in significant environmental impacts.

Transfers of water would occur from sellers in the Sacramento River area to buyers that divert Project Water[4] from the Tehama-Colusa or Corning Canals (Canals). The Project Water is diverted from the Sacramento River at the Red Bluff Pumping Plant. Construction of the Red Bluff Pumping Plant was completed in 2012 and includes a fish screen and pumping capacity of up to 2,000 cubic feet per second (cfs) into the Canals (with potential future capacity of 2,500 cfs) (TCCA 2012). Water made available for transfer would be released from Shasta Reservoir, typically at the same times as it would have been released to the sellers, but it would be diverted by TCCA at the Red Bluff Pumping Plant. Depending on the requested delivery schedule and fishery conditions in the Sacramento River, Reclamation may reoperate CVP facilities to change the pattern of water releases from storage. Reclamation would only consider these operational changes if they would not adversely affect downstream conditions for fish or the ability to meet flow and water quality standards. Reclamation would review and approve, as appropriate, proposed water transfers in accordance with the Interim Guidelines for Implementation of the Water Transfer Provisions of the Central Valley Project Improvement Act (Title XXXIV of Public Law 102-575) (Reclamation 1993), the Sacramento River Settlement Contracts and state and federal law. Much of this information has been compiled in the *DRAFT Technical*

[4] Article 1(u) of the Water Service Contract defines Project Water as all water that is developed, diverted, stored, or delivered by the Secretary in accordance with the statutes authorizing the Project and in accordance with the terms and conditions of water rights acquired pursuant to California law.

*Information for Preparing Water Transfer Proposals (Water Transfer White Paper)* (Reclamation and DWR 2019) as a useful guide for those entities interested in transferring water.

## 1.2 Need for the Proposal and Project Objectives

Hydrologic conditions and precipitation are unpredictable. As of January 27, 2020, the seasonal average rainfall to date has been 66 percent of the historic seasonal average (DWR 2020). If the following months have little rain and snowfall, water year 2020[5] could be a dry year. During past dry conditions in 2008-2009 and 2013-2015, CVP water made available for diversion (as defined in Article 3 of the Water Service Contract) by Member Units of the TCCA was constrained (pursuant to Article 12 of the Water Service Contract), and users are concerned that supplies in 2020 could be similarly limited. While it is too early in the 2020 water year to estimate the amount of Project Water the CVP can make available, the constraints on water made available for diversion in past years have caused concern for the TCCA Member Units that they may not have adequate supplies to maintain their permanent crops in 2020.

If Reclamation reduces water supplies in contract year 2020, the Member Units of the TCCA may be in need of up to 36,685 acre-feet (AF) of water to irrigate permanent crops to prevent potential long-term impacts of allowing these crops to die. Reclamation's need is to review and approve, if appropriate, the transfer of Base Supply that may require the use of CVP facilities, consistent with state and federal law, the Sacramento River Settlement Contract, and the Interim Guidelines for Implementation of the Water Transfer Provisions of the Central Valley Project Improvement Act (Title XXXIV of Public Law 102-575) (Reclamation 1993).

## 1.3 Document Structure

To consider environmental impacts of the Proposed Action pursuant to both NEPA and CEQA, Chapter 3 includes the analysis of possible effects to resources using an initial study checklist adapted from the CEQA Guidelines, Appendix G. While CEQA requires a determination of significance for each impact discussed in an IS based on the significance criteria, NEPA does not require this for an EA. For NEPA, preparation of an EIS is triggered if a federal action has the potential to "significantly affect the quality of the human environment," which is based on the significance of the whole of the action. The significance thresholds used in this IS/EA are used to assess the significance of the action per CEQA Guidelines, while the accompanying analysis considers the context and intensity of any effects of the action as required by NEPA. The CEQA Checklist does not incorporate all discussions required by Department of the Interior Regulations, Executive Orders, and Reclamation guidelines when preparing environmental documentation; Chapter 4 includes these additional discussions.

[5] Water Year 2020 is the twelve month period starting October 1, 2019 through September 30, 2020.

# Chapter 2
# Alternatives

## 2.1 No Action

For the No Action Alternative, the TCCA, on behalf of the Member Units, during contract year 2020, would not buy water from willing sellers that required Reclamation approval in order to transfer water to the Member Units. Agricultural and urban water users could experience shortages in contract year 2020. If supplies are constrained, users may take alternative water supply actions in response to shortages, including increased groundwater pumping, cropland idling, reduction of landscape irrigation or permanent crop irrigation, or water rationing. Water users may also seek to transfer water from other sellers not listed in this document, which may require additional NEPA or CEQA analysis. In the absence of transfers, growers may not have enough water to meet demands, and some permanent crops could be lost.

Normally, there may be subtle differences in the No Action Alternative and existing conditions, and the baseline from a NEPA and CEQA perspective would be slightly different. In those circumstances, there would be a discussion of the No Action Alternative for NEPA purposes, and the Proposed Action and Proposed Project (referred to herein as the Proposed Action) would be compared to the No Action Alternative to determine significance of the action. 43 CFR part 46.310(b) reinforces that responsible officials only need to consider the Proposed Action when there are no unresolved conflicts associated with use of the resource, and there is no need to look at the No Action Alternative. For this IS/EA, the No Action Alternative would not differ from existing conditions as described in this document, and no further discussion of effects of the No Action Alternative are necessary as the effects are discussed in terms of changes to the existing condition.

## 2.2 Proposed Action/Proposed Project

The Proposed Action and Proposed Project is the sale and transfer of Base Supply in contract year 2020 from willing sellers to Member Units of the TCCA. Reclamation has approval authority over transfers of Base Supply or transfers of water that involve the use of CVP facilities.

The Proposed Action includes potential transfers of up to 36,685 AF of Base Supply from 22 entities, listed in Table 2-1 and shown in Figure 2-1, to Member Units of the TCCA. The quantities in Table 2-1 summarize the maximum potential transfer quantities. Transfers or exchanges of Project Water for contract years 2016 through 2020 are covered by the Accelerated Water Transfer and Exchange Program EA/Finding of No Significant Impact (FONSI) (Reclamation 2016). The Proposed Action only includes potential transfer of Base Supply of up to 36,685 AF. These water transfers also include transfers of water between "common landowners" that own land in multiple water districts that may want to move water from one district to another to preserve permanent crops. Table 2-1 shows potential upper limits for transfers of water if Sacramento River Settlement Contractors receive 100 percent of the Contract Total[1], or if the Contract Total is reduced by 25 percent. This list represents those agencies with whom the TCCA may negotiate the transfer of water. For analytical purposes, the full 36,685 AF is assumed to be available; however, it is not possible to determine which negotiations would be successful, what combination of sellers would ultimately transfer water to Member Units of the TCCA, or how much water would ultimately be transferred to Member Units of the TCCA. For this reason, modeling and environmental analysis considers the quantities provided in Table 2-1 for 100 percent of the Contract Total in order to display the impacts that would be associated with the transfer of water from each seller. The potential water made available for transfer adds up to more than the Member Units of the TCCA's transfer demand of 36,685 AF, so the analysis provides a conservative description of potential environmental impacts by assessing impacts of all potential water transfers. Member Units of the TCCA, however, would only acquire a subset of these water transfers. As discussed in Chapter 1, the Long-Term Water Transfers EIS/EIR includes some of the same water sources as other transfer-related environmental documents, but the sellers would not sell the same quantities to multiple sources (just one buyer).

Reclamation would evaluate each proposal individually, as it is received, to determine if it meets the terms of the Settlement Contract and state and federal law. Reclamation has followed this process in past years when approving the transfer of water (such as when approving water transfers in 2013, 2014, and 2015). Reclamation may reoperate CVP facilities to change the pattern of water releases from storage to deliver water made available for transfer to Member Units of the TCCA.

### 2.2.1 Sellers

Table 2-1 lists agencies that have expressed interest in making water available for transfer in 2020, the maximum amount of water to be transferred if Sacramento River Settlement Contractors receive 100 percent of the Contract Total or if the Contract Total is reduced by 25 percent, and the method by which the sellers could make water available for transfer. Many agencies are uncertain about which method of making water available for transfer would be used, and have therefore included potential upper limits in Table 2-1 for both methods evaluated in this IS/EA. While the entity making water available could use one or both methods for making water available or may shift the volume of water made available during a particular period, the overall amount of water transferred would not exceed the maximum volumes listed in Table 2-1. As discussed above, these transfer volumes are assessed in this IS/EA to allow the transfer of water to move forward if Reclamation does not declare contract year 2020 a Critical Year. This analysis is conservative because these greater water transfer volumes would have greater potential for environmental impact than the lessor transfer volumes based on water supplies of 75 percent. Because the hydrology for the remainder of the water year is uncertain, Table 2-1 also shows the maximum transfer volumes for each method of making water available if the Contract Total is reduced by 25 percent in a Critical Year.

[1] Contract Total is defined as the sum of the Base Supply and Project Water available for diversion by the Contractor for the period April 1 through October 31.

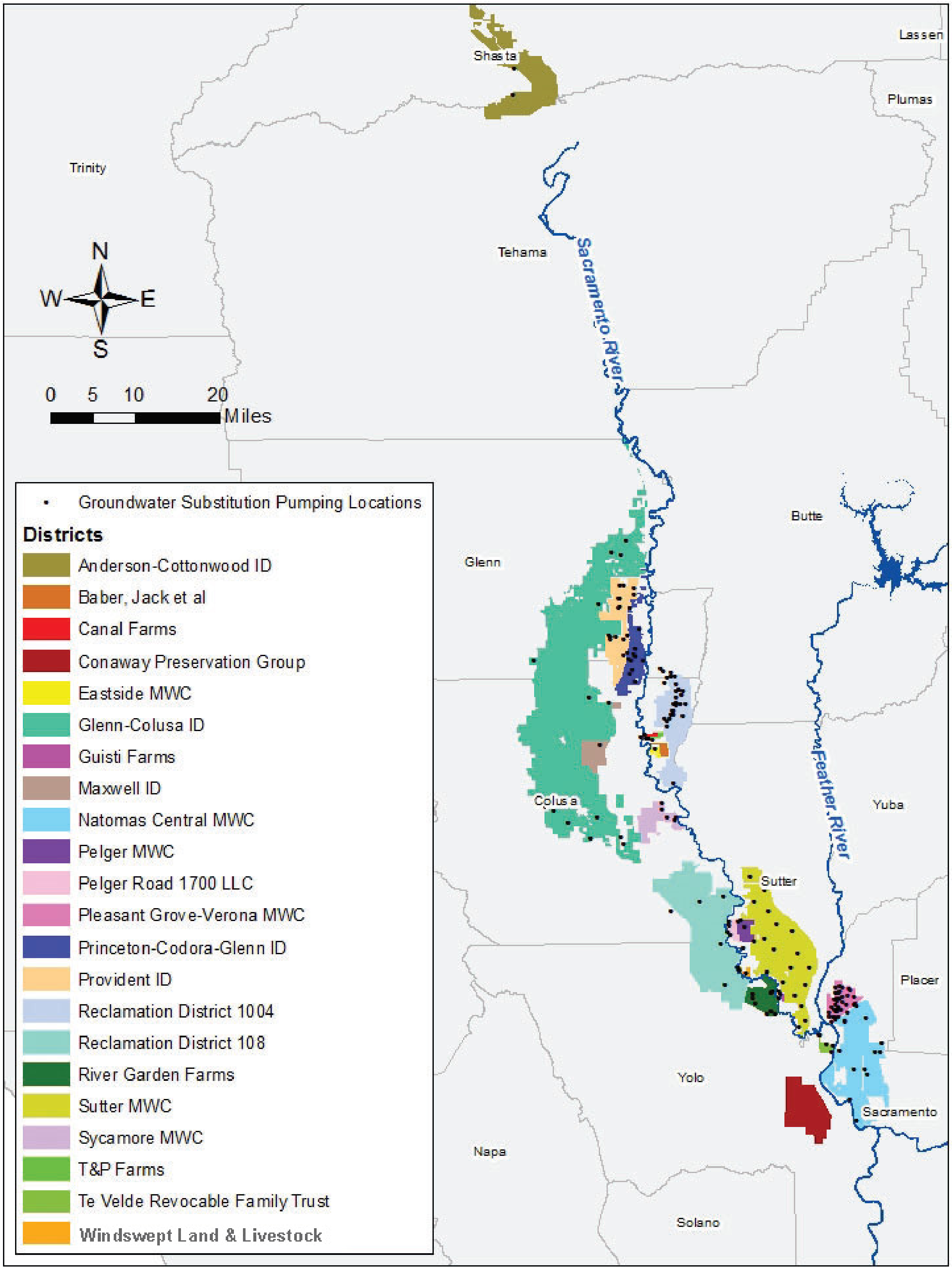


**Figure 2-1. Potential Selling Entities**

**Table 2-1. Potential Methods of Making Water Available for Transfer by Seller (Upper Limits in AF)**

| Water Agency | 100 Percent of Contract Total (Upper Limits in AF) | | | 75 Percent of Contract Total (Upper Limits in AF) | | |
|---|---|---|---|---|---|---|
| | Groundwater Substitution | Cropland Idling/ Crop Shifting | Maximum Transfer Volume | Groundwater Substitution | Cropland Idling/ Crop Shifting | Maximum Transfer Volume |
| Anderson-Cottonwood Irrigation District | 4,800 | 0 | 4,800 | 4,800 | 0 | 4,800 |
| Baber, Jack, et al. | 0 | 2,310 | 2,310 | 0 | 2,310 | 2,310 |
| Canal Farms | 1,000 | 635 | 1,000 | 1,000 | 635 | 1,000 |
| Conaway Preservation Group | 0 | 21,350 | 21,350 | 0 | 16,014 | 16,014 |
| Eastside Mutual Water Company | 2,230 | 1,846 | 2,230 | 2,000 | 1,481 | 2,000 |
| Giusti Farms | 1,000 | 0 | 1,000 | 1,000 | 0 | 1,000 |
| Glenn-Colusa Irrigation District | 11,300 | 33,000 | 44,300 | 11,300 | 33,000 | 44,300 |
| Maxwell Irrigation District | 3,000 | 5,000 | 8,000 | 3,000 | 5,000 | 8,000 |
| Natomas Central Mutual Water Company | 20,000 | 0 | 20,000 | 20,000 | 0 | 20,000 |
| Pelger Mutual Water Company | 4,670 | 2,538 | 4,670 | 4,000 | 1,903 | 4,000 |
| Pelger Road 1700 LLC | 5,200 | 0 | 5,200 | 5,200 | 0 | 5,200 |
| Pleasant Grove-Verona Mutual Water Company | 15,000 | 9,000 | 15,000 | 15,000 | 9,000 | 15,000 |
| Princeton-Codora-Glenn Irrigation District | 6,600 | 6,600 | 13,200 | 6,600 | 6,600 | 13,200 |
| Provident Irrigation District | 10,000 | 9,900 | 19,900 | 10,000 | 9,900 | 19,900 |
| Reclamation District 108 | 15,000 | 20,000 | 35,000 | 15,000 | 20,000 | 35,000 |
| Reclamation District 1004 | 7,175 | 20,000 | 27,175 | 5,400 | 15,000 | 20,400 |
| River Garden Farms | 10,000 | 10,000 | 16,000 | 10,000 | 10,000 | 16,000 |
| Sutter Mutual Water Company | 18,000 | 18,000 | 36,000 | 15,000 | 10,000 | 25,000 |
| Sycamore Mutual Water Company | 8,000 | 7,000 | 15,000 | 8,000 | 7,000 | 15,000 |
| T&P Farms | 1,200 | 890 | 1,200 | 1,170 | 667 | 1,170 |
| Te Velde Revocable Family Trust | 7,094 | 6,975 | 5,387 | 2,925 | 1,548 | 4,473 |
| Windswept Land & Livestock | 2,000 | 0 | 2,000 | 2,000 | 0 | 2,000 |
| **Total[1]** | **153,269** | **172,047** | **300,722** | **138,599** | **150,058** | **275,767** |

Note:
[1] These totals cannot be added together. Agencies could make water available through groundwater substitution, cropland idling, or a combination of the two; however, they will not make the full quantity available through both methods. Table 2-1 reflects the total upper limit for each agency.

The majority of the surface water would be transferred between April and September, subject to contract limitation as specified in Article 3(c)(2) of the Settlement Contract, but a small amount of water could also be transferred in October to provide irrigation after harvest, when needed. If water is delivered in October, the overall amount of water made available would not change. If water is made available in October, the overall totals from April through October would still stay within the upper limits provided in Table 2-1.

### 2.2.2 Buyers

Table 2-2 identifies entities that may be interested in buying water made available for transfer. Not all of these potential buyers may end up actually purchasing water from the sellers. Purchase decisions depend on a number of factors, including, but not limited to, hydrology, water demands, availability of other supplies, and transfer costs. Reclamation may be asked to reoperate the CVP to deliver the water made available for transfer, and the reoperation could be limited based on specific hydrologic conditions, biological conditions, or water quality issues. Reclamation cannot guarantee that it will be able to reoperate the CVP at specific times to accommodate water transfers.

**Table 2-2. Potential Buyers**

| Member Units of the TCCA |
|---|
| Corning Water District |
| Cortina Water District |
| Davis Water District |
| Dunnigan Water District |
| 4-M Water District |
| Glenn Valley Water District |
| Glide Water District |
| Kanawha Water District |
| Lagrande Water District |
| Westside Water District |

### 2.2.3 Potential Methods of Making Water Available for Transfer

This IS/EA analyzes transfers of water made available from groundwater substitution and cropland idling/crop shifting actions, which are further described below. No other methods of making water available for transfer are covered by the evaluation in this IS/EA.

Reclamation will only approve water transfers that are consistent with provisions of state and federal law that protect against injury to third parties as a result of water transfers. Several important principles include requirements that the water transfer will not violate the provisions of federal or state law, will have no significant adverse effect on the ability of the CVP to deliver Project Water, will be limited to water that would have been consumptively used or irretrievably lost to beneficial use, and will not adversely affect water supplies for fish and wildlife purposes. Also, Settlement Contractors must transfer water consistent with their Settlement Contracts. Reclamation would not approve water transfers for which these basic principles have not been met.

In 2020, some water transfers may be accomplished through forbearance agreements. Under such agreements, a Settlement Contractor would forbear (i.e., temporarily suspend) the diversion of some of their Base Supply, which in the absence of forbearance, would have been diverted during 2020 for use on lands within the Settlement Contractor's service area. This forbearance would be undertaken in a manner that allows Reclamation to pick up and deliver the forborne water supply as Project Water to Member Units of the TCCA. A forbearance agreement would not change the way that water is made available for transfer, conveyed to buyers, or used by the buyers; therefore, it would not change the environmental effects of the water transfer.

Additional information about water rights protection and water transfers is located at http://www.waterboards.ca.gov/waterrights/water_issues/programs/water_transfers/docs/watertransferguide.pdf in a State Water Resource Control Board (SWRCB) staff document titled *A Guide to Water Transfers - Draft* (SWRCB 1999).

#### *2.2.3.1 Groundwater Substitution*

Transfer of water made available through groundwater substitution actions occur when sellers choose to pump groundwater in lieu of diverting surface water supplies, thereby making the surface water available for transfer. Sellers making water available for transfer through groundwater substitution actions are agricultural users. Water could be made available for transfer by the agricultural users during the irrigation season of April through September. Some small amount of water could be made available for transfer in October when needed.

The conveyance infrastructure used to deliver water made available for transfer, to the Member Units of the TCCA, would depend on the seller's location. Some sellers, like Glenn-Colusa Irrigation District (ID), utilize existing conveyance facilities that also deliver Project Water to Member Units of the TCCA. These conveyance facilities are used to deliver water to Glenn-Colusa ID from the Tehama-Colusa Canal. During a transfer, the deliveries to the sellers would be reduced and additional water would stay in the TCCA area. Most of the agencies making water available for transfer through groundwater substitution actions typically divert surface water from the Sacramento River downstream of the Red Bluff Pumping Plant and the Tehama-Colusa Canal. Delivering water to the TCCA at the Red Bluff Pumping Plant instead of downstream users on the Sacramento River could reduce flow in the Sacramento River between the diversion points. Reclamation would work closely with the TCCA to make sure that these water transfers do not affect the flow requirements in the Sacramento River. Because the TCCA diversion is downstream from the Sacramento River temperature control point, potential changes in flows would not affect temperature compliance in the Sacramento River.

Water made available through groundwater substitution actions would temporarily decrease levels in groundwater basins near the participating wells. Water produced from wells initially comes from groundwater storage. Groundwater storage would refill (or "recharge") over time, which affects surface water sources. Groundwater pumping captures some groundwater that would otherwise discharge to streams as baseflow and can also induce recharge from streams. Once pumping ceases, this stream depletion continues, replacing the pumped groundwater slowly over time until the depleted storage fully recharges. Therefore, the amount of water actually transferred is less than the substitution pumping volume. The Proposed Action includes measures that would reduce the amount of water that Member Units of the TCCA actually receive by an estimated 13 percent depletion factor to mitigate any adverse impacts associated with groundwater/surface water interaction.

### *2.2.3.2 Cropland Idling/Crop Shifting*

Cropland idling actions would make water available for transfer that would have otherwise been consumptively used absent the transfer. Typically, the proceeds from the water transfer would pay growers to idle land that they would have otherwise placed into production. Rice has been the crop idled most frequently in previous transfer programs and is the crop that could be idled to make water available for transfer in contract year 2020.

The quantity of water made available for transfer through cropland idling actions would be calculated based on the evapotranspiration of applied water (ETAW). ETAW is the portion of applied surface water that is evaporated from the soil and plant surfaces and actually used by the crop. For 2020, this IS/EA only analyzes cropland idling from rice crops, which have an ETAW of 2.9 AF/acre (Reclamation and DWR 2019).

For a transfer of water made available through a crop shifting action, water is made available when farmers shift from growing a higher water use crop to a lower water use crop. The difference between the ETAW values would be the amount of water that can be transferred. Transfers of water in 2020 could include water made available by shifting from rice to a crop with a lower water use. Table 2-3 provides a listing of the estimated ETAW values for crops suitable for shifting.

**Table 2-3. Estimated ETAW Values for Crops Suitable for Shifting**

| Crop | ETAW (AF/acre) |
|---|---|
| Alfalfa[1] | 1.7 (July – Sept) |
| Bean | 1.5 |
| Corn | 1.8 |
| Cotton | 2.3 |
| Melon | 1.1 |
| Milo | 1.6 |
| Onion | 1.1 |
| Pumpkin | 1.1 |
| Sugar Beets | 2.5 |
| Sunflower | 1.4 |
| Tomato | 1.8 |
| Vine Seed/ Cucurbits | 1.1 |
| Wild Rice | 2.0 |

*Source: Reclamation and DWR 2019*

Notes:

[1] Only alfalfa grown in the Sacramento Valley floor north of the American River will be allowed to be a crop which is eligible to make water available for transfer based on crop shifting. Fields must be disced on, or prior to, the start of the transfer period. Alfalfa acreage in the foothills or mountain areas is not eligible for transfer.

Water made available through cropland idling or crop shifting actions would be available at the beginning of the season (April or May) and would be available for transfer on the same pattern as it would otherwise have been used by the crop. Water would be delivered to the Member Units of the TCCA on pattern; that is, in the same volume and at the same time as it would have been consumptively used by the crop, absent the transfer. While the IS/EA analyzes cropland idling transfers from multiple sources, the total amount of water made available through cropland idling actions would not be more than 36,685 AF, which equates to 12,650 acres of rice land idled.

Consistent with the provisions contained in Water Code Section 1018, potential sellers are encouraged to incorporate measures into their crop idling actions to protect habitat value in the area to be idled. Idled land cannot be irrigated during the transfer season, but vegetation that is supported only through precipitation or that has begun to senesce may remain on the idled fields. Excessive vegetation supported by seepage from irrigation supplies or shallow groundwater would result in a decrease in the amount of water made available for transfer through cropland idling actions.

Crop shifting may reduce potential environmental effects that are more likely associated with cropland idling. The agencies interested in making water available for transfer through crop shifting actions are also interested in making water available for transfer through cropland idling actions but are not sure of the distribution between the two methods. To be conservative that the potential impacts are fully addressed, this IS/EA analyzes the effects as if all water made available for transfer was made available from crop idling actions because crop idling actions have the greater potential for effects.

## 2.3 Environmental Setting

The environmental setting, in which implementation of the No Action Alternative or Proposed Action would occur, is summarized below for resources that could be affected by the transfer of water. Additional details regarding relevant existing environmental conditions are provided in Chapter 3 within the analysis of potential impacts.

### 2.3.1 Aesthetics

The Central Valley of California is primarily agricultural in nature, with Interstate 5 running from north to south through the valley floor. Views in the region from most major roadways and scenic routes are of agricultural fields or urban landscapes. The mix of orchard and row crop types, fallow fields, rice, and other irrigated crops and dry fields create the visual character for most of the project area. Urban centers, such as Sacramento and Redding break up the farmland that dominates the views in the Central Valley, creating some major nighttime light sources near the city centers.

### 2.3.2 Biological Resources

The project area includes the Sacramento watershed. Natural communities associated with the Sacramento River include valley/foothill riparian and natural seasonal wetland. In the Sacramento Valley, seasonally flooded agriculture, in particular rice fields, provide important foraging habitat for a variety of wildlife species. There are approximately 500,000 acres of rice fields in the Sacramento Valley which, along with natural wetlands, support millions of waterfowl along the Pacific Flyway (USDA 2019). Flooded agriculture within the Sacramento Valley accounts for approximately 57 percent of food resources available to waterfowl (Petrie and Petrick 2010). Rice fields also provide foraging, resting, breeding, and wintering habitat for shorebirds and wading birds, and foraging habitat for raptors. These habitats are also important for foraging, refuge, and dispersal for reptiles, amphibians, and mammals. Migratory birds protected by the Migratory Bird Treaty Act also rely on agriculture for habitat in the Central Valley.

Special-status wildlife species with potential to occur in the project area are listed in Appendix B. As described in the appendix, five species have potential to be affected by rice idling and are further evaluated in Chapter 3. This includes the following species: giant garter snake (GGS) (*Thamnophis gigas*), pacific pond turtle (*Actinemys marmorata*), greater sandhill crane (*Grus canadensis tabida*), black tern (*Chlidonias niger*), and tricolored blackbird (*Agelaius tricolor*). The following listings apply to the above species under the Federal and California Endangered Species Acts (ESA): GGS – listed as threatened under the Federal and California ESAs (CDFW 2015a); Pacific Pond Turtle – species is under review for listing under the Federal ESA and considered a State Species of Concern by CDFW (CDFW 2019); Greater Sandhill Crane – listed as threatened under the California ESA and is fully protected under the California Fish and Game Code (CDFW 2015a; CDFW 2015b); Black Tern – listed as a State Species of Concern (CDFW 2019); and Tricolored Blackbird – species is under review for federal listing under the Federal ESA and is listed as threatened under the California ESA.

Appendix B also summarizes fish species of management concern within the project area. The California drought from 2011 through 2015 resulted in limited water storage and a corresponding reduction of the cold water pool in Shasta Reservoir. The drought resulted in elevated temperatures in the upper reaches of the Sacramento River, which contributed to low survival rates for wild juvenile winter-run Chinook salmon in 2014 and 2015 (SWRCB 2015). The National Marine Fisheries Service (NMFS) has identified Sacramento River winter-run Chinook salmon as a "Species in the Spotlight" because it is one of the eight most at-risk species in the country (NMFS 2016). In 2015, NMFS developed a five-year action plan (2016-2020) to identify priority actions to help the species.

The Sacramento River Temperature Management Plan, which is required annually, guides the release of water from Shasta Reservoir to maintain healthy fisheries during summer and fall when temperatures rise. In 2015 and 2016, Reclamation, in coordination with NMFS, United States Fish and Wildlife Service (USFWS), California Department of Water Resources (DWR), California Department of Fish and Wildlife (CDFW), and the SWRCB, modified the previous Shasta Temperature Management Plans in an attempt to better utilize the current cold-water resource and manage the seasonal temperature risks to winter-run Chinook salmon. These plan updates incorporated lessons learned from drought years in 2014 and 2015 to improve temperatures for winter-run. Water Year 2017 was one of the wettest years on record for the CVP. Considering these conditions, 2017-2019 operations focused on a balanced approach that maintained a reasonable temperature target to protect the winter-run Chinook salmon, while ensuring that the cold water was available to be utilized throughout the season (Reclamation 2017, 2018, 2019).

Special-status plant species with potential to occur are listed in Appendix C. Based on the analysis presented in the appendix, no special-status plants would be affected by the project.

### 2.3.3 Geology and Soils

The Central Valley consists of mostly flat terrain associated with low gradient river valleys. There are some earthquake faults in the region, but earthquakes are generally associated with coastal California, west of the Central Valley. Strong seismic shaking is not common in the Central Valley, and liquefaction and other seismic-related ground failure are not major hazards in the region. Landslides and other hazards associated with unstable soil are uncommon due to the flat terrain. Dust from agricultural activities, such as plowing, grading, and discing, is a common occurrence in the Central Valley agricultural area, including the project area, and is a normal part of the agriculture practice in the region.

### 2.3.4 Greenhouse Gas Emissions

The greenhouse gas (GHG) analysis focuses on the following three pollutants: carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). The other two pollutant groups commonly evaluated in various GHG reporting protocols, hydrofluorocarbons and perfluorocarbons, are not expected to be emitted in large quantities because of the Proposed Action and are not discussed further in this section.

Agricultural emissions represented approximately eight percent of California's GHG emissions in 2017 (CARB 2019a). Agricultural emissions represent the sum of emissions from agricultural energy use (from pumping and farm equipment), agricultural residue burning, agricultural soil management (the practice of using fertilizers, soil amendments, and irrigation to optimize crop yield), enteric fermentation (fermentation that takes place in the digestive system of animals), histosols (soils that are composed mainly of organic matter) cultivation, manure management, and rice cultivation.

### 2.3.5 Air Quality

Air quality in California is regulated by the U.S. Environmental Protection Agency (USEPA), the California Air Resources Board (CARB), and locally by Air Pollution Control Districts (APCDs) or Air Quality Management Districts (AQMDs). The following air districts regulate air quality within the project study area: Colusa County APCD, Feather River AQMD, Glenn County APCD, Sacramento Metropolitan AQMD, Shasta County AQMD, Tehama County APCD and Yolo/Solano AQMD.

In the Sacramento Valley Air Basin, ozone ($O_3$), inhalable particulate matter ($PM_{10}$), and fine particulate matter ($PM_{2.5}$) are pollutants of concern because ambient concentrations of these pollutants exceed the California Ambient Air Quality Standards (CAAQS). Additionally, ambient $O_3$ and $PM_{2.5}$ concentrations exceed the National Ambient Air Quality Standards (NAAQS), while $PM_{10}$ and carbon monoxide (CO) concentrations recently attained the NAAQS and are designated maintenance. Table 2-4 summarizes the attainment status for the counties located in the Sacramento Valley.

The Sacramento Valley Air Basin is bounded by the North Coast Ranges on the west and the Northern Sierra Nevada Mountains on the east, forming a bowl-shaped valley. The Sacramento

Valley has a Mediterranean climate, which is characterized by hot dry summers and mild rainy winters.

Most of the predominant land use in the sellers' service area is agricultural. Farming practices, including land preparation and harvest, contribute to pollutant emissions, primarily particulate matter. Groundwater pumping with diesel and natural gas-fueled engines also emits air pollutants through exhaust. The primary pollutants emitted by diesel pumps are nitrogen oxides (NOx), volatile organic compounds (VOC), CO, $PM_{10}$, and $PM_{2.5}$; NOx and VOCs are precursors to $O_3$ formation.

**Table 2-4. State and Federal Attainment Status**

| County | $O_3$ CAAQS | $PM_{2.5}$ CAAQS | $PM_{10}$ CAAQS | $O_3$ NAAQS | $PM_{2.5}$ NAAQS | $PM_{10}$ NAAQS | CO NAAQS |
|---|---|---|---|---|---|---|---|
| Colusa | A | A | N | A | A | A | A |
| Glenn | A | A | N | A | A | A | A |
| Sacramento | N | A | N | N [3] | N [5] | M | M |
| Shasta | N | A | A | A | A | A | A |
| Sutter | A | A | N | N [2,3] | N [5] | A | A |
| Tehama | N | U | N | A[4] | A | A | A |
| Yolo | N-T | U | N | N [3] | N [5] | A | M |

*Source: 17 California Code of Regulations §60200-60210; 40 CFR 81; CARB 2019b; USEPA 2019*

Notes:

[1] Nonattainment/transitional areas are defined as those areas that during a single calendar year, the State standards were not exceeded more than three times at any monitoring location within the area

[2] The Sacramento Metro nonattainment area for Sutter County is defined as the "portion south of a line connecting the northern border of Yolo County to the southwestern tip of Yuba County and continuing along the southern Yuba County border to Placer County" (40 CFR 81.305)

[3] 8-hour $O_3$ classification = moderate

[4] The Tuscan Buttes portion of Tehama County is classified as marginal non-attainment; however, the Project area is located within the attainment region of Tehama County (USEPA 2019).

[5] Designated moderate nonattainment under the 2006 $PM_{2.5}$ NAAQS.

Key:

A = attainment (background air quality in the region is less than (has attained) the ambient air quality standards)

CO = carbon monoxide

N = nonattainment (background air quality exceeds the ambient air quality standards)

N-T = nonattainment/transitional (a subcategory of nonattainment where an area is close to attainment, has only two days exceeding standards, and is projected to meet standards within three years)

$O_3$ = ozone

$PM_{10}$ = inhalable particulate matter

$PM_{2.5}$ = fine particulate matter

U = unclassified/attainment (area does not have enough monitors to determine the background concentrations; treated the same as attainment)

## 2.3.6 Hydrology and Water Quality

### *2.3.6.1 Surface Water*

The Sacramento River flows south for 447 miles through the northern Central Valley and enters the Delta from the north. The major tributaries to the Sacramento River are the Feather, Yuba, and American rivers. Reclamation owns and operates the CVP, which has major reservoirs on the Sacramento River (Shasta Reservoir) and the American River (Folsom Reservoir).

#### *2.3.6.2 Surface Water Quality*

While surface water quality in the Sacramento River system is generally good, several water bodies within the area of analysis have been identified as impaired by certain constituents of concern and appear on the most recent 303(d) list of impaired waterways under the Clean Water Act (SWRCB 2018).

#### *2.3.6.3 Groundwater*

**Redding Area Groundwater Basin**

Historically, groundwater levels have remained stable within the Redding Area Groundwater Basin. Seasonal fluctuations in groundwater levels are generally less than five feet and can be up to 16 feet during drought years (Anderson-Cottonwood ID 2011). During the recent drought from 2012 to 2016 (Mount et al. 2019), water levels in the Redding Area Groundwater Basin, and in particular the Anderson subbasin, decreased up to 18 feet. Groundwater levels have shown some recovery during recent wet conditions in water year (WY) 2017 and below normal conditions in WY 2018 in the Anderson subbasin (see Change in Groundwater Level Change Map-Spring 2015 to Spring 2019 in Appendix D, pp. D-8 through D-10). Groundwater levels in the Anderson subbasin have recovered to spring 2016 levels but not to pre-drought levels (i.e., spring 2011 levels). It should be noted that groundwater level declines discussed above were due to five consecutive drought years and only one wet year where partial recovery occurred. This is consistent with historic patterns of drawdown and recovery. Appendix D includes groundwater monitoring data in the Anderson-Cottonwood ID area (the potential selling entity in the Redding Basin).

*Land Subsidence.* In the Redding Area Groundwater Basin, DWR has measured less than 0.2 feet of subsidence between 2008 and 2017 (DWR 2019a).

*Groundwater Quality.* Groundwater in the Redding Area Groundwater Basin area of analysis is typically of good quality, as evidenced by its low total dissolved solids (TDS) concentrations, which range from 70 to 360 milligrams per liter (mg/L) (DWR 2003). Areas of high salinity (poor water quality), are generally found on the western basin margins, where the groundwater is in contact with marine sedimentary rock. Elevated levels of iron, manganese, nitrate, and high TDS have been detected in some areas (DWR 2003). Localized high concentrations of boron have been detected in the southern portion of the basin (DWR Northern District 2002).

**Sacramento Valley Groundwater Basin**

The Sacramento Valley Groundwater Basin includes portions of Tehama, Glenn, Butte, Yuba, Colusa, Placer, and Yolo Counties. Under normal hydrologic conditions, groundwater accounts for less than 30 percent of the annual supply used for agricultural and urban purposes within the Sacramento Valley.

Groundwater levels in the northern Sacramento Valley Groundwater Basin have declined over the last 15 years (spring 2004 to spring 2019) mostly due to the persistent dry weather conditions since 2006 (see Change in Groundwater Elevation Map-Spring 2004 to Spring 2019 in Appendix D, pp. D-2 through D-4). On average, in the shallow, intermediate, and deep aquifer zones, groundwater elevations have declined 4.0, 6.1, and 12.8 feet, respectively (see Plates 1S-B, 1I-B, and 1D-B showing change in groundwater levels between Spring 2004 and Spring 2019 in Appendix D). These decreases in groundwater levels have caused wells to go dry in parts of the valley, particularly during the driest years of 2014 and 2015. Water Year 2017 was classified as one of the wettest years on record since 1983. On average, spring 2017 groundwater levels across the state recovered in comparison to spring 2016 levels. About 5.4 percent of the monitored wells showed an increase of greater than 25 feet between spring 2016 and spring 2017, and approximately 56.7 percent of the wells showed a change of less than 5 feet (includes increase or decrease) between spring 2016 and spring 2017 (DWR 2017).

Groundwater levels in the northern Sacramento Valley Groundwater Basin show an increase of 4.6, 4.9, and 2.1 feet in the shallow, intermediate, and deep aquifer zones between spring 2018 and spring 2019 (see Plates 1S-A, 1I-A and 1D-A in Appendix D). Water Year 2019 was not a dry year but precipitation trends for the year were below average. On average, spring 2019 groundwater levels across the state showed minimal increases in comparison to Spring 2018 groundwater levels (see Groundwater Level Change- Spring 2018 to Spring 2019 in Appendix D, pp. D-11 through D-13). About 16 percent of the monitored wells showed an increase in groundwater levels between 5 to 25 feet and 68.8 percent of the wells showed an increase of less than 5 feet (DWR 2019b). In comparison, groundwater levels between Spring 2015 and Spring 2018 showed more recovery with 22.4 percent of the wells statewide indicating an increase of 5 to 25 feet between Spring 2015 and Spring 2018. A large concentration of these wells are in the southern portion of the Sacramento Valley Groundwater Basin. About 14 percent of the monitored wells showed a decrease in groundwater levels between 5 to 25 feet and 54.3 percent of the wells showed a change of less than 5 feet (includes increase or decrease) (DWR 2018).

In summary, groundwater levels in the Sacramento Valley Groundwater Basin are showing continued recovery with some wells showing an increase in groundwater levels in comparison to Spring 2015 levels but not to pre-drought levels. Past groundwater trends are indicative of groundwater levels declining moderately during extended droughts and recovering to pre-drought levels after subsequent wet periods. Appendix D includes groundwater well monitoring data to further characterize groundwater levels in the Sacramento Valley Groundwater Basin near the potential selling entities.

Appendix I includes monitoring data reports from the 2015 transfer period. Groundwater level hydrographs in Appendix I show groundwater levels at the participating pumping wells and near-by monitoring wells. Groundwater level trends during the 2015 transfer season indicate substantial declines in groundwater levels during the transfer period (up to 200 feet of decline at some participating pumping wells). However, groundwater levels recovered to pre-transfer levels within one to three months following transfers.

*Land Subsidence.* Historically, greater than one foot of land subsidence has occurred in the eastern portion of Yolo County and the southern portion of Colusa County, owing to groundwater extraction and geology. Due to groundwater withdrawal over several decades, between 0.3 to 1.1 feet of land subsidence has been recorded east of the town of Zamora between 2008 and 2019 (DWR 2020a). In Yolo County within Conaway Ranch, DWR measured land subsidence at approximately 0.2 of a foot from 2012 to 2013 and an additional 0.6 of a foot from 2013 to 2014 (DWR 2020b). In comparison, slightly less than 0.1 of a foot of subsidence occurred over the previous 22 years (1991-2012). Since 2014, ground surface elevations have rebounded to pre-2012 levels at this station, however there is some decline at a slower rate with approximately 0.1 of a foot of subsidence recorded since 2015 (DWR 2020b). The area between

Zamora, Knights Landing, and Woodland has been most affected (Yolo County 2012). In Colusa County, approximately 2.14 feet of subsidence was measured in the Arbuckle area between 2008 and 2017 (DWR 2019c). In Glenn and Sutter counties, ground surface displacement was measured between 0.4 to 0.6 of a foot from 2008 through 2017 and 0.2 to 0.4 of a foot from 2008 through 2019 (DWR 2020c). Subsidence in these regions are generally related to groundwater pumping and subsequent consolidation of loose aquifer sediments.

*Groundwater Quality.* Groundwater quality in the Sacramento Valley Groundwater Basin is sufficient for municipal, agricultural, domestic, and industrial uses. However, some localized groundwater quality issues exist in the basin including occurrences of saltwater intrusion, elevated levels of nitrates, naturally occurring boron, and other introduced chemicals (DWR 2003). The Groundwater Ambient Monitoring and Assessment (GAMA) Program studied 49 wells in 2017. Established benchmarks for drinking water were utilized to provide context for evaluating the quality of groundwater. A concentration above the maximum contamination level (MCL) is defined as high, while moderate concentrations are less than the MCL[2]. The GAMA study found one or more inorganic constituents present at high concentrations in about ten percent of the sampled groundwater wells, with arsenic present in high concentrations and hexavalent chromium present in moderate concentrations. In addition, manganese or iron was present at high concentrations in about 16 percent of the groundwater wells and about 12 percent of the sampled wells had moderate concentrations of nitrate. Organic constituents were not present in high concentrations in the groundwater resources (USGS and SWRCB 2019).

### 2.3.7 Noise

Noise is generally measured in decibels (dB), which are measured on a logarithmic scale so that each increase in ten dB equals a doubling of loudness. The letter “A” is added to the abbreviation (dBA) to indicate an “A-weighted” scale, which filters out very low and very high frequencies that cannot be heard by the human ear. A Community Noise Survey conducted in Glenn County indicated that typical noise levels in noise sensitive areas, including rural areas, are relatively quiet and fall in the range of 48 dB to 60 dB Ldn[3] (Glenn County 1993). These noise levels would be similar to conditions in the other counties.

The buyers and sellers’ areas are primarily agricultural; major noise sources include traffic, railroad operations, airports, industrial operations, farming operations, and fixed noise sources. Typical noise levels created by a range of farm equipment are presented in Table 2-5.

**Table 2-5. Typical Noise Levels Associated with Farm Equipment**

| Equipment | Distance (feet) | Sound Level (dB) |
|---|---|---|
| Diesel Wheel Tractor | | |
| - with Disc | 150 | 72-75 |
| - with Furrow | 50 | 69-79 |
| Weed Sprayer (1-cylinder) | 50 | 74-75 |
| Aero Fan 391 Speed Sprayer | 200 | 74-76 |
| Diesel Engine | 50 | 75-85 |

*Source: Brown-Buntin Associates, Inc. in Glenn County 1993; Key: dB = decibel*

[2] Moderate concentrations are less than benchmark, but greater than one-half (for inorganic constituents) or one-tenth (for organic constituents) of the benchmark

[3] The day-night average sound level (Ldn) is the average noise level, expressed in decibels, over a 24-hour period.

# Chapter 3
# Environmental Impacts

The following sections use the checklist from Appendix G of the CEQA Guidelines as a template to assess potential environmental effects under both CEQA and NEPA. The discussion for each resource focuses on potential impacts; resources that would not be affected are briefly discussed. Since the project area is not near state responsibility areas or lands classified as very high fire hazard severity zones, Section XX,Wildfires from Appendix G of the CEQA Guidelines is not discussed in this Chapter.

**I. AESTHETICS**

-- Except as provided in Public Resources Code Section 21099, would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Have a substantial adverse effect on a scenic vista? | ☐ | ☐ | ☐ | ☒ |
| b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway? | ☐ | ☐ | ☐ | ☒ |
| c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced form publicly accessible vantage point.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality? | ☐ | ☐ | ☒ | ☐ |
| d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area? | ☐ | ☐ | ☐ | ☒ |

**a, b, d) No Impact.** The Proposed Action would not affect any scenic vista, damage scenic resources, or create a new light source. The Proposed Action would not affect scenic vistas relative to rivers or reservoirs because there would be no changes beyond historical or seasonal fluctuations in flows or water levels. The Proposed Action does not include any construction or new structures that could damage scenic resources (i.e., trees, rock outcroppings, historic buildings, etc.) or produce notable sources of light or glare.

**c) Less than Significant.** Water made available for transfer through cropland idling actions under the Proposed Action would temporarily increase the amount of idled lands in the sellers' area (in a non-urbanized area). However, the amount of potentially idled cropland under the Proposed Action would be limited when compared to the amount of active cropland in the area. Idled lands, visually similar to fallowed fields, are typical features of agricultural landscapes as part of normal cultivation practices. The crop pattern resulting from the Proposed Action would likely be indistinguishable from those under normal cropping patterns. This impact would be less than significant as there would be no substantial changes or degradation to the visual character or quality of the sites and their surroundings.

**II. AGRICULTURE AND FOREST RESOURCES**:
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:

| | **Potentially Significant Impact** | **Less Than Significant with Mitigation Incorporation** | **Less Than Significant Impact** | **No Impact** |
|---|---|---|---|---|
| a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use? | ☐ | ☐ | ☐ | ☒ |
| b) Conflict with existing zoning for agricultural use, or a Williamson Act contract? | ☐ | ☐ | ☐ | ☒ |
| c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))? | ☐ | ☐ | ☐ | ☒ |
| d) Result in the loss of forest land or conversion of forest land to non-forest use? | ☐ | ☐ | ☐ | ☒ |

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use? | ☐ | ☐ | ☐ | ☒ |

**a, b) No Impact.** One-year water transfers under the Proposed Action would temporarily take land out of production in sellers' area, but would not affect the long-term agricultural uses of the land. Cropland idling for a single year would be similar to fallowing a field under a normal crop rotation and would not convert any land to non-agricultural use. Cropland idling would not affect Williamson Act contracts or the long-term designations of Prime Farmland or other Farmland Mapping and Monitoring Program classifications.

**c, d) No Impact.** The Proposed Action would have no impact to existing forest lands or timber, as the proposed water transfer methods do not pertain to such lands or resources.

**e) No Impact.** The Proposed Action could result in increased cropland idling and could temporarily take land out of production. Temporary cropland idling would not convert any agricultural land to non-agricultural use. The Proposed Action would not affect existing forest land, and would therefore not convert any forest land to non-forest use.

**III. AIR QUALITY**

Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Conflict with or obstruct implementation of the applicable air quality plan? | ☐ | ☒ | ☐ | ☐ |
| b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard? | ☐ | ☐ | ☒ | ☐ |
| c) Expose sensitive receptors to substantial pollutant concentrations? | ☐ | ☐ | ☒ | ☐ |
| d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people? | ☐ | ☐ | ☒ | ☐ |

**a) Less than Significant with Mitigation Incorporation**

**Proposed Action:** The air districts associated with the counties of Shasta, Tehama, Glenn, Butte, Colusa, Sutter, and Yuba comprise the Northern Sacramento Valley Planning Area (NSVPA). The NSVPA has jointly committed to preparing and adopting an Air Quality Attainment Plan (AQAP) to achieve and maintain healthful air in these counties. The Sacramento Metropolitan AQMD and the Yolo/Solano AQMD have also adopted various air quality plans for the pollutants for which they are currently designated nonattainment. As part of these plans, several control measures were adopted by the various counties to attain and maintain air quality standards. These control measures are then promulgated in the rules and regulations at each air district; therefore, if a Proposed Action is consistent with the air districts' and State regulations, then the project is in compliance with the AQAP. The air quality impacts from actions taken to make water available for transfer are associated with the actions taken to reduce consumptive use.

The Proposed Action would use a combination of electric, diesel, and propane driven groundwater pumps depending on the specific water agency. All diesel-fueled engines are subject to CARB's Airborne Toxic Control Measure (ATCM) for Stationary Ignition Engines (17 California Code of Regulations [CCR] 93115). The ATCM does not expressly prohibit the use of diesel engines for agricultural purposes; therefore, diesel engines may be used for groundwater pumping under the Proposed Action as long as they are replaced when required by the compliance schedule. All pumps proposed to be used by the water agencies would operate in compliance with all rules and regulations at the federal, state, and local levels, including the ATCM.

As part of the planning efforts, several of the air districts developed significance thresholds for mass daily or annual emission rates of criteria pollutants to assess whether a proposed action would violate air quality standards or contribute substantially to an existing or projected air quality violation. Colusa, Glenn, and Shasta counties do not have published significance thresholds; therefore, the threshold used to define a "major source" in the Clean Air Act (100 tons per year) was used to evaluate significance. Table 3-1 summarizes the significance thresholds used by each air district and the general conformity *de minimis* thresholds.

**Table 3-1. CEQA and General Conformity Operational Significance Thresholds**

| Air District | VOC | NOx | CO | SOx | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|
| Sacramento Metropolitan AQMD | 65 lbs/day | 65 lbs/day | -- | -- | 80 lbs/day | 82 lbs/day |
| Yolo-Solano AQMD | 10 tpy | 10 tpy | -- | -- | 80 lbs/day | -- |
| Feather River AQMD | 25 lbs/day | 25 lbs/day | -- | -- | 80 lbs/day | -- |
| De Minimis Threshold (General Conformity) | 100 tpy | 100 tpy | 100 tpy | 100 tpy | 100 tpy | 100 tpy |

*Source: Feather River AQMD 2010; Sacramento Metropolitan AQMD 2015; Yolo-Solano AQMD 2007, 40 CFR 93.153(b).*
Key:
-- = no threshold; AQMD = air quality management district; CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; $PM_{10}$ = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; tpy = tons per year; VOC = volatile organic compounds

In addition to the CEQA significance thresholds, the federal general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct and indirect emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain *de minimis* amounts (40 CFR 93.153). Conformity means that such federal actions must be consistent with a state implementation plan's (SIP's) purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards.

Groundwater substitution pumping could increase air emissions in the seller area. Cropland idling actions could reduce vehicle exhaust emissions, but increase fugitive dust emissions. Cropland idling actions could offset some of the emissions from groundwater substitution pumping, but cropland idling actions may not occur up to the upper limits and therefore cannot be counted on to reduce impacts of groundwater substitution pumping. This section only analyzes impacts from groundwater substitution pumping to estimate the maximum potential emissions that could occur under the Proposed Action.

Table E-3 through Table E-8 in Appendix E summarizes the maximum daily emissions that would be estimated to occur in each water agency subject to a daily significance threshold. Table E-9 through Table E-14 in Appendix E summarizes the annual emissions that would occur in each water agency subject to an annual significance threshold. Significance was determined for individual water agencies.

As shown Appendix E, Pleasant Grove-Verona Mutual Water Company and Sutter Mutual Water Company would exceed the daily VOC and NOx thresholds for the Feather River AQMD (Tables E-3 and E-4). The other sellers would be below the daily and annual emissions thresholds. The following mitigation measure would reduce the severity of the air quality impacts:

- AQ-1 – Selling agency would reduce pumping at diesel wells to reduce emissions to below the thresholds. If an agency is making water available for transfer through cropland idling and groundwater substitution actions in the same year, the reduction in vehicle emissions can partially offset groundwater substitution pumping at a rate of 4.25 AF of water produced by idling to one acre-foot of groundwater pumped (Byron & Buck 2009). Agencies may also decide to replace old diesel wells with cleaner (i.e., higher emission tier) diesel pumps or electric wells to reduce emission below the thresholds.

  Any selling agency with potentially significant emissions, as determined by this IS/EA, will be required to submit information, prior to making water available for transfer through groundwater substitution actions, that documents the wells that would be pumped to stay below the thresholds. The selling agency must also maintain recordkeeping logs that document the specific engine to be used for making water available for transfer through groundwater substitution actions, the power rating (hp), and applicable emission factors. Emission calculations for daily emissions will be completed for comparison to the significance thresholds determined for each selling agency. In the annual report, the selling agencies will be required to submit documentation specifying that the wells would only be pumped in accordance with the transfer proposals. Mitigated emissions for VOC and NOx are provided in Tables E-5 and E-6 of Appendix E. Implementation of the above mitigation measure would reduce VOC and NOx emissions to less than significant, but the water made available for transfer through groundwater substitution actions from diesel wells would be limited to a smaller amount than described in Chapter 2.

As discussed above, in addition to the CEQA significance thresholds, the federal general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct and indirect emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain *de minimis* amounts (40 CFR 93.153). Figure E-1 in Appendix E shows the CO maintenance area; Figure E-2 in Appendix E shows the $O_3$ nonattainment area; Figure E-3 in Appendix E shows the $PM_{10}$ maintenance area; and Figure E-4 in Appendix E shows the $PM_{2.5}$ nonattainment area.

Because the mitigation measures would be a requirement of project implementation, mitigated emissions for the Proposed Action were compared to the general conformity *de minimis* thresholds, where only NOx exceeded de minims thresholds. Table E-1 in Appendix E summarizes the general conformity applicability evaluation.

**b) Less than Significant**

**Proposed Action:** The majority of counties affected by the Proposed Action are located in areas designated nonattainment for the $PM_{10}$ CAAQS. Additionally, Sacramento, Shasta, and Tehama Counties are designated nonattainment for the $O_3$ CAAQS, while Yolo County is designated nonattainment-transitional for the $O_3$ CAAQS. Nonattainment status represents a cumulatively significant impact within the area. $O_3$ is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to $O_3$ formation include volatile organic compounds (VOCs) and nitrogen oxides (NOx); therefore, the significance thresholds established by the air districts for VOC and NOx are intended to maintain or attain the $O_3$ CAAQS and NAAQS.

As previously discussed, the general conformity regulations apply to nonattainment and maintenance areas and are intended to demonstrate that a federal action would comply with the SIP and would not cause the air quality in the region to be degraded. Therefore, if the total of direct and indirect emissions is less than the general conformity *de minimis* thresholds, then the project would not be cumulatively considerable because the ambient air quality standards would continue to be maintained. As shown in Appendix E, Table E-57, emissions that would occur in the nonattainment and maintenance areas in the region are less than the general conformity *de minimis* thresholds.

However, emissions would also occur in air districts that are in attainment of the NAAQS and CAAQS. Therefore, the cumulative impact of the engines operating within the individual air districts were compared to a significance threshold of 100 tons per year. This threshold was selected because it is the threshold at which a permitted source would be categorized as a major source. The threshold is therefore considered to be sufficient to evaluate if the total emissions from a project could cause the air quality standards to be exceeded.

As shown in Table 3-2, total criteria pollutant emissions would not exceed the cumulative emissions threshold in either the Colusa County or Glenn County APCDs. In addition, only electric engines are proposed to be operated in the Shasta County and Yolo/Solano AQMDs. Because emissions would neither exceed the general conformity *de minimis* threshold in nonattainment or maintenance areas, nor the major source threshold in attainment areas, emissions from the project would not be cumulatively considerable.

**Table 3-2. Cumulative Emissions in Attainment Areas**

| Air District | VOC (tpy) | NOx (tpy) | CO (tpy) | SOx (tpy) | $PM_{10}$ (tpy) | $PM_{2.5}$ (tpy) |
|---|---|---|---|---|---|---|
| Colusa County APCD | 6 | 42 | 15 | 5 | 1 | 1 |
| Feather River AQMD[1] | <1 | 1 | 1 | <1 | <1 | <1 |
| Glenn County APCD | 5 | 64 | 14 | 4 | 1 | 1 |

Notes:

[1] Sutter County, which is located within the Feather River AQMD, is partially located in the Sacramento Metro $O_3$ nonattainment region and partially located within an $O_3$ attainment area. Pelger Mutual Water Company is the only water agency with non-electric engines located in the attainment portion of Sutter County. Therefore, this table only summarizes emissions from Pelger Mutual Water Company because all other water agencies with engines in Sutter County are applicable to the general conformity regulations.

Key:

APCD = air pollution control district; CO = carbon monoxide; NOx = nitrogen oxides; PM10 = inhalable particulate matter; PM2.5 = fine particulate matter; SOx = sulfur oxides; tpy = tons per year; VOC = volatile organic compounds

### c) Less than Significant

**Proposed Action**: The proposed engines would either be remotely located in rural areas or would be located on existing agricultural land. The engines would not be located within one-quarter mile of a sensitive receptor. Additionally, emissions from individual engines would not exceed any district’s significance criteria. Therefore, air quality impacts would be less than significant.

### d) Less than Significant

**Proposed Action:** The use of diesel engines during groundwater substitution pumping may generate near-field odors that are considered a nuisance. Diesel equipment emits a distinctive odor that may be considered offensive to certain individuals. The local air districts have rules (e.g., Sacramento Metropolitan AQMD Rule 402) that prohibit emissions that could cause nuisance or annoyance to a considerable number of people. All water agencies would operate their engines in compliance with the local rules and regulations. Therefore, the proposed operation of any diesel-fueled engines would have a less than significant impact associated with the creation of objectionable odors affecting a substantial number of people.

**IV. BIOLOGICAL RESOURCES**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service? | ☐ | ☒ | ☐ | ☐ |
| b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in City or regional plans, policies, regulations or by the California Department of | ☐ | ☒ | ☐ | ☐ |

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| Fish and Wildlife or US Fish and Wildlife Service? | | | | |
| c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means? | ☐ | ☒ | ☐ | ☐ |
| d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites? | ☐ | ☒ | ☐ | ☐ |
| e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? | ☐ | ☐ | ☒ | ☐ |
| f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? | ☐ | ☐ | ☒ | ☐ |

## a) Less than Significant Impact with Mitigation Incorporation

### Proposed Action:

### Fishery Resources

Under the Proposed Action, water made available for transfer would be released from Shasta Reservoir based on agricultural irrigation patterns and in compliance with the SWRCB Water Rights Orders 90-5 and 91-1. The Orders establish in-stream temperature criteria to manage the cold water storage within Shasta Reservoir and make cold water releases from Shasta Reservoir to provide suitable habitat temperatures for winter-run Chinook salmon, spring-run Chinook salmon, California Central Valley steelhead, and the Southern Distinct Population Segment of North American green sturgeon in the Sacramento River between Keswick Dam and Bend Bridge, while retaining sufficient carryover storage to manage for the following year's winter-run Chinook salmon cohort. In addition, to the extent feasible, another objective is to manage for suitable temperatures and stabilize flows for naturally-spawning fall-run/late-fall-run Chinook salmon for cold water storage and releases to protect winter-run Chinook salmon and other listed species.

Water made available for transfer to Member Units of the TCCA would be delivered on the same pattern as it would have been diverted by the sellers in the absence of transfers, unless changes are requested to aid implementation of the Temperature Management Plan. Based on the delivery pattern, the largest volume of water made available for transfer would be in June. Sacramento River flows would slightly decrease from the TCCA point of diversion at the Red Bluff Pumping Plant to the point of diversion of the seller, located downstream (except for Anderson-

Cottonwood ID's point of diversion), during the transfer period. The largest change in flow could be approximately 180 cfs in June. For comparison, flows in the Sacramento River near Colusa from 2009 to 2019 averaged 8,413 cfs in June (DWR 2019a). The transfers would not affect flows downstream of the point where water would have been diverted if a transfer did not occur; therefore, flows into the Delta would not be affected. The changes of up to 180 cfs in Sacramento River flows (1.6 percent of June 2019 flows) would not be substantial enough to affect special-status fish species. Adult migration by special-status fish species, including Chinook salmon, steelhead, and green sturgeon, would not be affected by slightly decreased flows. This magnitude of flow decrease would not reduce spawning habitat availability and incubation, increase redd dewatering or juvenile stranding, or reduce the suitability of habitat conditions during juvenile rearing of these species. In addition, Reclamation would continue to comply with the SWRCB Orders under a Temperature Management Plan to meet temperature requirements in the Sacramento River.

During 2014 and 2015, Reclamation worked with the resource agencies to modify operations to take advantage of the water made available for transfer. Some of the water made available for transfer was held in Shasta Reservoir and delivered to buyers later in the year. This action was accomplished with cooperation from transferring parties as part of the Temperature Management Plan; and allowed more water to stay in Shasta Reservoir which helped maintain the cold water pool for use later into the season to help winter-run salmon. This action could be taken again in 2020 if it would help meet temperature objectives for sensitive fish species. Because the decrease in flow in the Sacramento River would be minor, and temperatures would be maintained to protect winter-run Chinook salmon and other listed species, impacts to special-status aquatic species in the Sacramento River would be less-than-significant. Reclamation frequently coordinates with USFWS and NMFS on CVP and SWP operations relative to special-status fish species.

*Groundwater Substitution* Water made available through groundwater substitution actions under the Proposed Action would reduce groundwater levels and potentially deplete surface water flows in rivers and creeks (see Section IX (b)). Surface water depletions in the Sacramento and American rivers as a result of making water available through groundwater substitution action would not be substantial, nor would they be of sufficient magnitude to affect special-status fish species. Reduced surface water flows in smaller creeks could affect special-status fish species. Based on a review of field sampling data and reports, this analysis concluded that there is no evidence of the presence of special status fish species in the following creeks and any streamflow depletion would have no effects on special-status fish species (CDFW 2019): Walker Creek, French Creek, Willow Creek, South Fork Willow Creek, Funks Creek, Stone Corral Creek, Lurline Creek, Cortina Creek, Sand Creek, Sycamore Slough (Colusa County), Wilkins Slough Canal, Honcut Creek, North Honcut Creek, South Honcut Creek, and Dry Creek (tributary of Bear River).

The Proposed Action could have an adverse impact on fish habitat if it resulted in decreased flows to a degree that would substantially affect riverine, riparian, or wetland habitats in a river or stream, or interfere with fish movement or access to or from areas where the fish spawn. This degree of decreased flow is measured as both a minimum change in flow of one cfs and a ten percent change in mean flow (where quantitative flow data were available). A qualitative assessment was applied in instances where quantitative flow data were not available. The one cfs minimum flow threshold was used as a conservative measure of detectability by a fish. The ten percent threshold was used to determine measurable flow changes based on several major environmental documents in the Central Valley related to fisheries (Trinity River Mainstem Fishery Restoration Record of Decision, December 19, 2000; San Joaquin River Agreement Record of Decision in March 1999; Freeport Regional Water Project Record of Decision, January 4, 2005; Lower Yuba Accord EIR/EIS). If either of these thresholds were reached, further evaluation of fishery impacts was conducted to determine adverse impacts.

For creeks with the presence of special-status fish species, the groundwater modeling estimated there would be a less than one cfs reduction in average monthly flow in Big Chico Creek, Stony Creek, Salt River, Little Chico Creek, and Putah Creek. A flow reduction of one cfs or less is not of sufficient magnitude to affect special-status fish species.

There would be reductions in flows greater than one cfs in Colusa Basin Drain, Coon Creek, Eastside Cross Canal, Cache Creek and Butte Creek. Historical stream flow information from the U.S. Geological Survey was gathered, where available and used as the measure of baseline flow. For locations for which historical flow data were unavailable, a quantitative analysis was not possible; thus a qualitative discussion of potential impacts is included for these locations.

Based on available historical flow data, reductions in stream flows in Colusa Basin Drain and Butte Creek would be less than ten percent of monthly average stream flows. In Colusa Basin Drain, monthly decreases in flows due to the Proposed Action would range from zero percent to 0.1 percent of monthly historical flows from 1998 to 2018. In Butte Creek, monthly decreases in flows due to the Proposed Action would range from 0.01 percent to 0.2 percent of monthly historical flows from 2007 to 2018. These flow changes would be small, and the habitat for special-status species in these waterbodies would not be substantially affected by the Proposed Action.

In Cache Creek, a decrease in flow of over one cfs would occur in January and February following transfers of water made available through groundwater substitution actions based on groundwater modeling. The decreases in flows due to the Proposed Action could be greater than 10 percent of monthly historical average in below normal or dry year types when flows in the creek are below 20 cfs. In low flow conditions, there is no passable connection for fish between the Delta and mouth of Cache Creek (Sacramento River Watershed Program 2010). Impacts to special-status fish species in Cache Creek would be less than significant.

Historical flow data were limited for Coon Creek; data were available for two years from 2003 to 2005. Based on the Sacramento Valley Hydrologic Index, 2003 and 2005 were above normal years and 2004 was a below normal year. Between 2003 and 2005, December through March flows ranged from 50 cfs to 200 cfs. Flows in April and May ranged from 20 to 40 cfs (Bergfeld, pers. comm., 2014). Based on the groundwater modeling, a reduction in flow of over one cfs would occur in February, March, April, and May following the transfers. If Coon Creek flows are at the low end of the range, there could be a slightly greater than ten percent reduction in flows in March and April. This calculation represents a worst case scenario because baseline flows used in this calculation are at the low end of existing flow data range during 2003-2005. If the calculation included the mid- or high end of the range for baseline flows identified above, the reduction due to the Proposed Action would be less than ten percent. Therefore, this flow reduction would likely occur less frequently than assumed. As a result, it is concluded that effects of the Proposed Action to fisheries resources in Coon Creek would be less than significant.

Historical flow data were not available for East Side/Cross Canal. The East Side/Cross Canal serves as a flood management structure with a major levee on the west side of the canal that intercepts all of the flow from the watersheds north of the community of Pleasant Grove in Sutter County, including Coon Creek, Markham Ravine, and Auburn Ravine. The canal collects flood waters, natural flows, and agricultural return flows and has a design capacity of up to 16,000 cfs (DWR 2010). Riparian vegetation is generally absent due to periodic levee maintenance and herbicide applications on adjacent farmlands. However, the channel does have a variety of rooted aquatic vegetation, such as cattails, and riparian shrubs including willows. The area provides a variety of habitats for fish and numerous other wildlife species (County of Placer 2002). The Cross Canal is the outlet channel for all of the flows from the watersheds intercepted by the East Side Canal and those from the south, including Curry Creek, and Pleasant Grove Creek (County of Placer 2002). The groundwater model estimates up to a 14.6 cfs reduction in flow in August and 12.9 cfs reduction in flow in September. Based on the number of water bodies that drain into the East Side/Cross Canal and the large design capacity of the canal, it is unlikely that a 12.9 to 14.6 cfs reduction would substantially reduce the limited fish habitat in the canal. As a result, it is concluded that effects of the Proposed Action to fisheries resources in East Side/Cross Canal would be less than significant.

**Terrestrial Resources**

*Cropland Idling* The following is a discussion of effects of rice idling actions on special-status wildlife species that are present in the sellers' area. Additional special-status animal and plant species have the potential to occur in the project area, but would not be affected by the Proposed Action. Appendices B and C list special-status animal and plant species, respectively, that could be present in the project area and the reason for the no effect determination. As described in Section 2.3.3, the following five special-status species have potential to be affected by rice idling and are further evaluated below: GGS, pacific pond turtle, greater sandhill crane, black tern, and tricolored blackbird.

Rice idling could affect special-status species that use rice fields for forage, cover, nesting, breeding, or resting. Under the Proposed Action, a maximum of 12,650 acres of rice could be idled in Colusa, Glenn, Sutter, and Yolo counties based on the proposed transfer volumes in Table 2-3 and an ETAW of 2.9 acre-feet per acre for rice. Table 3-3 shows the annual harvested rice acreages in each county from 2008 to 2018.

**Table 3-3. Annual Harvested Rice Acreage by County in Sellers' Area**

| Year | Glenn | Colusa | Sutter | Yolo | Total |
|---|---|---|---|---|---|
| 2008 | 77,770 | 150,200 | 92,344 | 30,057 | 350,371 |
| 2009 | 89,483 | 152,400 | 109,766 | 36,593 | 388,242 |
| 2010 | 88,209 | 154,000 | 115,000 | 41,400 | 398,609 |
| 2011 | 84,900 | 149,000 | 112,000 | 42,500 | 388,400 |
| 2012 | 84,800 | 150,000 | 116,000 | 40,500 | 391,300 |
| 2013 | 85,300 | 149,000 | 116,000 | 38,400 | 388,700 |
| 2014 | 73,300 | 111,000 | 75,900 | 39,300 | 299,500 |
| 2015 | 60,400 | 100,200 | 92,400 | -- | 253,000 |

| Year | Glenn | Colusa | Sutter | Yolo | Total |
|---|---|---|---|---|---|
| 2016 | 73,700 | 149,000 | 119,000 | 32,000 | 373,700 |
| 2017 | 73,700 | 134,900 | 78,200 | -- | 286,800 |
| 2018 | 80,300 | 139,600 | 107,600 | -- | 327,500 |
| Average (2008-2018) | 79,260 | 139,600 | 103,110 | 37,594 | 349,647 |

*Source: U.S. Department of Agriculture (USDA) 2008-2017, USDA 2019*

Rice harvested acreage in California decreased in 2014 and 2015 due to the drought and water restrictions. In 2016, rice harvested acreage increased 33 percent compared to 2015 acreages (USDA 2016). In 2017, rice harvested acreage decreased 7 percent compared to 2016. This decrease is largely due to higher prices for competing commodities (USDA 2017). Rice harvested acreage rebounded in 2018 and increased by 14 percent compared to 2017 (USDA 2019).

#### *Giant Garter Snake*

Rice idling actions could affect the GGS that use flooded rice fields for foraging and protective cover habitat during the summer months. GGS require water during their active phase, extending from spring until fall. During the winter months, GGS are dormant and occupy burrows in upland areas. While the preferred habitat of GGS is natural wetland areas with slow moving water, GGS use rice fields and their associated water supply and tail water canals as habitat, particularly where natural wetland habitats are not available. Because of the historic loss of natural wetlands, rice fields and their associated canals and drainage ditches have become important habitat for GGS.

Rice idling would affect available habitat for GGS. The GGS displaced from idled rice fields would need to find other areas to live. This displacement may lead to indirect effects such as increased risk of predation, reduced food availability, increased competition, reduced condition prior to the start of the overwintering period, and potentially reduced fecundity. Because GGS in rice fields are within an active rice growing region that experiences variability in rice production and farming activities, they are already subject to these risks. If water levels in major canals in the sellers' areas decrease, GGS may have more limited aquatic habitat and options for movement through the areas.

The USGS is leading a multi-year giant garter snake study to assess the effects of rice idling on occupancy dynamics of GGS in the Sacramento Valley (USGS 2017). The primary purpose of the study is to examine the effects of water transfers, particularly rice idling, on GGS distribution and occupancy, and to assess the effectiveness of the measures that could reduce effects on GGS. During the first year of the study (May 2016 through September 2016), the primary objective was to determine whether sites associated with active and fallowed rice fields differ in the probability of GGS occurrence. Distribution, occurrence, and detection probability of GGS were also evaluated for several other biological variables, including the percent cover of submerged vegetation, capture rate of fish, and capture rate of frogs. The first year of surveys (May to September 2016) included 83 sample sites across 5 survey basins (American, Butte, Colusa, Sutter, and Yolo). The study found 91 snakes at 51 sites. Related to rice production, preliminary results for 2016 indicate that there is a positive correlation between occupancy of GGS and the presence of rice within a 1, 2, and 3 kilometer buffer distance from survey sites. The probability of occurrence appears to level off at its highest when there is at least 60 percent rice within a 3 kilometer buffer (USGS 2017). The USGS study also suggests that GGS are most likely to occur within areas of historical tule marsh, and the likelihood of encountering them drops substantially with distance from these areas of historical habitat (Halstead et al. 2014).

Additional studies have been and are currently being conducted to gather information on the distribution and occurrence of GGS in rice lands. Studies conducted by CDFW and USGS have documented GGS in portions of the rice-producing regions of the Sacramento Valley, particularly the Colusa Basin. USGS has conducted trapping surveys of GGS at the Sacramento National Wildlife Refuge (NWR) Complex, and GGS were observed at each of the NWRs in the region (Colusa, Delevan, and Sacramento). It is likely that GGS occur outside of refuge lands in the adjacent rice production areas (Reclamation 2018).

No more than 3.6 percent of average annual rice acreage from 2008 to 2018 would be affected by the Proposed Action. However, rice idling to make water available for transfer could have significant effects on GGS if idling occurs in (or near) areas with known populations of GGS or in areas that provide suitable aquatic habitat for GGS. Implementation of Mitigation Measure VEG and WILD-1 (presented at the end of this section) would reduce these effects by minimizing idling of lands adjacent to natural habitats and refuges and corridors between the areas with high likelihood of GGS occurrence. Implementation of the mitigation measure would also protect movement corridors for GGS by maintaining at least two feet of water in major irrigation ditches and drainage canals, keeping emergent aquatic vegetation intact for GGS escape cover and foraging. By maintaining water in agricultural ditches, GGS could successfully relocate to find alternate forage, cover, and breeding areas during idling events. The mitigation measure also includes voluntary training, by sellers, to continue GGS best management practices, including educating maintenance personnel to recognize and avoid contact with GGS, cleaning only one side of a conveyance channel per year, and implementing other measures to enhance habitat for GGS.

Incorporation of Mitigation Measure VEG and WILD-1 would reduce impacts of rice idling under the Proposed Action to a less than significant impact on GGS because it would avoid or reduce the potential indirect impacts associated with loss of habitat and displacement of GGS. Therefore, potential effects on GGS from making water available for transfer through cropland idling actions would be less than significant after mitigation.

#### *Pacific Pond Turtle*

Pacific pond turtles also utilize rice fields and associated ditches and drains for foraging and dispersal. As with GGS, cropland idling would affect available habitat for pond turtles and displaced turtles could be affected by increased risk of predation, reduced food availability, increased competition, reduced reproductive success, and potentially reduced fecundity. Pond turtles are likely to utilize some of the same natural areas, including wildlife refuges, and major irrigation ditches and drainage canals as GGS populations in the project area.

While no more than 3.6 percent of average annual rice acreage from 2008 to 2018 would be affected by the Proposed Action, cropland idling to make water available for transfer could have significant effects on pond turtles associated with direct loss of aquatic habitat and indirect effects of displacement as mentioned previously. Implementation of Mitigation Measure VEG and WILD-1 would reduce these effects by minimizing idling of lands adjacent to natural habitats and refuges and protecting movement corridors for pond turtles by maintaining at least two feet of water in major irrigation ditches and drainage canals.

Incorporation of Mitigation Measure VEG and WILD-1 would reduce impacts of cropland idling under the Proposed Action to a less than significant impact on pond turtles because it would avoid or reduce the potential indirect impacts associated with loss of habitat and displacement of pond turtles. Therefore, potential effects to the pacific pond turtle from making water available for transfer through cropland idling actions would be less than significant after mitigation.

#### *Black Tern*

Black terns utilize flooded rice fields and associated emergent vegetation in the spring and summer for foraging and nesting. Rice idling and crop shifting associated with water transfers could result in loss of this aquatic habitat for black terns. Because the decisions regarding rice idling/shifting would have already been made prior to the onset of the black tern's breeding season (May through August), black terns returning to the area would be able to select appropriate nesting sites for that year. The maximum amount of rice idling would be 12,650 acres, which is approximately 3.6 percent of the average acreage (349,647 acres) of rice harvested in the project vicinity. Therefore, foraging and nesting habitat would be available in active rice fields nearby. In addition, Mitigation Measure VEG and WILD-1 prohibits rice idling/shifting adjacent to important habitat areas for black terns. Therefore, potential effects to the black tern associated with cropland idling actions would be less than significant after mitigation.

#### *Sandhill Crane*

Sandhill cranes utilize cropland in the project area for foraging in winter, exhibiting high site fidelity (Zeiner et al. 1990), typically returning to the same location each year to winter. Idling rice fields or crop shifting within areas that sandhill cranes historically return to may affect their wintering distribution patterns due to reduced forage availability on idled or crop shifted fields. Although the birds would disperse as their main food source diminishes, rice idling or crop shifting could affect the timing of dispersal and could negatively affect those individuals that have not had sufficient time to prepare for winter migration. There may be localized significant effects to some birds that use historic roost sites near and bordering rice fields, if those fields have been idled. Overall, the effects to migratory birds would be small because the maximum reduction in rice production would be within the historic range of variation Implementation of Mitigation Measure VEG and WILD-1 prohibits rice idling/shifting adjacent to important habitat areas for sandhill crane. Therefore, potential effects to sandhill crane associated with rice idling actions would be less than significant after mitigation.

#### *Tricolored Blackbird*

Tricolored blackbirds forage in rice fields near their nesting colonies. Although the rice plants are not tall or sturdy enough to support nests, the seasonally flooded fields provide resources required for breeding colony locations, which consist of open access to water and suitable foraging space with insect prey. The primary concern for the tricolored blackbird's association with rice fields is the use of the habitat as a source of insects and waste grain forage. Tricolored blackbirds may use rice fields year-round and would also use emergent vegetation in return ditches and irrigation canals associated with the seasonally flooded fields. The rice agriculture cycle provides insect forage in the flooded fields during the summer and waste grain forage over winter. Rice idling could affect the population's foraging distribution behavior and patterns and could reduce foraging and breeding habitat for this species. However, since cropland idling would be dispersed within the seller service area, impacts to tricolored blackbird foraging habitat would be less than significant. Additionally, implementation of Mitigation Measure VEG and WILD-1 prohibits rice idling/shifting adjacent to important habitat areas for tricolored blackbird. Therefore, potential effects to tricolored blackbird associated with rice idling actions would be less than significant after mitigation.

#### *Migratory Birds*

Many other migratory bird species use seasonally flooded agricultural land for nesting and forage habitat during the summer rearing season. In addition, many raptors forage in summer or winter over rice fields, preying on various wildlife, including waterfowl. A reduction in migratory bird habitat or the number of waterfowl or other prey could affect local populations.

As discussed for special-status bird species previously, the decisions regarding crop shifting/idling would have already been made prior to the onset of most migratory bird species' breeding season (May through August), such that migratory birds returning to the area would be able to select appropriate nesting sites for that year. The maximum amount of rice idling would be 12,650 acres, which is approximately 3.6 percent of the average acreage (349,647 acres) of rice harvested in the project vicinity. Therefore, foraging and nesting habitat would be available in active rice fields nearby. In addition, Mitigation Measure VEG and WILD-1 prohibits rice idling/shifting adjacent to important habitat areas for migratory birds. Therefore, potential effects to migratory birds associated with rice idling actions would be less than significant after mitigation.

For the millions of birds that use rice fields during winter migration, this approximately 3.6 percent of the average planted acreage (349,647) reduction in crops planted is not expected to affect the amount of post-harvest flooded agriculture that provides important winter forage for migratory birds, particularly waterfowl and shorebirds. Farmers in the Sacramento Valley only flood-up a fraction of the cropland planted; typically around 60 percent in normal water years (Miller et al 2010, Central Valley Joint Venture 2006) and as little as 15 percent in critically dry years (Buttner 2014). The decision on whether to flood is not based on what was produced for the year but instead is determined by the availability of fall and winter water. Growers divert a separate water supply, pursuant to state water rights, in fall and winter for rice decomposition. Particularly during drier years (when transfers occur), the amount of land flooded is limited by availability of fall water supply rather than the amount of land that was planted during the irrigation season. Because the Proposed Action does not include transfers of water that would otherwise be used for rice decomposition or otherwise affect the availability of fall and winter water, it would not change the availability of water for post-harvest flooding and therefore would not result in a reduction of winter foraging and resting habitat for migrating birds.

#### *Mitigation Measure VEG and WILD-1: Protect Existing Habitat for Wildlife*

Mitigation Measure VEG and WILD-1 includes measures to avoid potentially significant impacts to terrestrial species associated with cropland idling transfers and reduce any potential impacts to less than significant:

1. As part of the review and approval process for proposed water transfers, Reclamation will have access to the land to verify how the water for transfer is being made available and to verify that actions to protect the giant garter snake are being implemented.
2. Movement corridors for aquatic species (including pond turtle and giant garter snake) include major irrigation and drainage canals. The water seller will keep adequate water in major irrigation and drainage canals. Canal water depths should be similar to years when transfers do not occur or, where information on existing water depths is limited, at least two feet of water will be considered sufficient.
3. Maintaining water in smaller drains and conveyance infrastructure supports key habitat attributes such as emergent vegetation for giant garter snake escape cover and foraging habitat. If cropland idling/shifting occurs, Reclamation will work with sellers to document that adequate water remains in drains and canals. Documentation may include flow records, photo documentation, or other means of documentation subject to approval by Reclamation and USFWS.
4. Fields abutting or immediately adjacent to areas with known important giant garter snake populations (Appendix G) will not be permitted to participate in cropland idling/shifting transfers. Important giant garter snake populations are defined for purposes of this mitigation measure as populations previously identified by biologists from USFWS, USGS, and possibly contract biologists. These populations of giant garter snakes were identified early on as identified in previous consultations and are in, or connected to, areas that are considered public or protected. Most of these areas have specific management plans for giant garter snakes either for mitigation or as wildlife refuges. One factor influencing the importance of these areas is that they can provide a refuge for snakes independent of rice production. Fields abutting or immediately adjacent to the following areas are considered important giant garter snake habitat:
   - Little Butte Creek between Llano Seco and Upper Butte Basin Wildlife Area
   - Butte Creek between Upper Butte Basin and Gray Lodge Wildlife areas
   - Colusa Basin drainage canal between Delevan and Colusa National Wildlife Refuges
   - Gilsizer Slough
   - Colusa Drainage Canal
   - Land side of the Toe Drain along the Sutter Bypass
   - Willow Slough and Willow Slough Bypass in Yolo County
   - Hunters and Logan Creeks between Sacramento and Delevan National Wildlife Refuges
   - Lands in the Natomas Basin
5. At the end of the water transfer year, Reclamation will prepare an annual monitoring report that contains the following:
   a. Maps of rice production and all cropland idling actions within the seller district that occurred within the range of potential transfer methods analyzed.

   b. Results of current scientific research, summary of monitoring pertinent to water transfer actions, and new giant garter snake detections.
   c. Discussion of conservation measure effectiveness.
   d. Cumulative history of crop idling and crop shifting specifically to make water available for transfers within the sellers' area.

   The report will be submitted to the USFWS and CDFW no later than January 31, of the year following the year in which the transfer occurred.

6. Reclamation will establish annual meetings with the Service to discuss the contents and findings of the annual report. These meetings will be scheduled following the distribution of the monitoring report and prior to the last day of February.
7. If, upon Reclamation's review of monitoring reports or other scientific literature, it appears that the Project is having unanticipated effects on the giant garter snake, Reclamation will contact the Service to discuss the information available and effectiveness of Project conservation measures.
8. Reclamation will monitor the effectiveness of the conservation measures by funding giant garter snake distribution and occupancy research. The research, conducted by USGS, includes annual sampling of giant garter snake within the action area and focuses on their distribution and occupancy dynamics. The research is designed to evaluate the effectiveness of the conservation measures to maintain giant garter snake occupancy at sites making water available for transfer in accordance with this IS/EA.

**b, c) Less than Significant Impact with Mitigation Incorporation**

**Proposed Action:** Under the Proposed Action, Reclamation would deliver the water made available for transfer to the Member Units of the TCCA on the same pattern that it would have been diverted by the seller if no transfer occurred. This operation would result in a small change in flow between the Red Bluff Pumping Plant and the point where water would have been diverted by the seller absent the transfer. The largest change in flow would be about 180 cfs in June (if the Settlement Contractors receive 100 percent of the Contract Total). Flows in the Sacramento River near Colusa from 2009 to 2019 averaged 8,413 cfs in June (DWR 2019a). The water transfers would not affect flows downstream of the point where water would have been diverted if a transfer did not occur, so flows into the Delta would not be affected. The Proposed Action would result in minor effects to any riparian habitat near the rivers. There would not be any dewatering of root zones to such an extent to cause die back of riparian tree and shrub foliage, branches or entire plants. Impacts would be less than significant.

As discussed in (a), water made available for transfer through groundwater substitution actions could result in streamflow depletion in rivers and creeks, which could directly impact natural communities by changing the timing and volume of flows within rivers. Natural communities potentially affected include valley/foothill riparian, managed and natural seasonal wetlands. In the Sacramento and American rivers, there would be minor changes in flow due to transfers and there would be no associated effects to natural communities.

An initial screening evaluation of modeled flows in several smaller creeks was conducted. If the flow reduction caused by implementing the transfer would be one cfs or less, then no further analysis was required because the effect was considered too small to have a substantial effect on natural communities and terrestrial species. Based on these criteria, the evaluation concluded that impacts to natural communities in the following waterways are less than significant: Deer Creek, Antelope Creek, Paynes Creek, Seven Mile Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Auburn Ravine, Honcut Creek, Freshwater Creek, Funks Creek, Stony Creek, Putah Creek, Spring Valley Creek, Dry Creek (tributary to Bear River), Walker Creek, North Fork Walker Creek, Big Chico Creek, Little Chico Creek, and the South Fork of Willow Creek.

If flow reductions were estimated greater than one cfs in one month, then a second screening evaluation was conducted to evaluate effects to natural communities. Similar to the fisheries analysis described above, flow reductions greater than a ten percent change in mean monthly flow was assumed to have a potential impact to natural communities and required further evaluation.

There would be reductions in flows greater than one cfs in Colusa Basin Drain, Coon Creek, Eastside Cross Canal, Cortina Creek, Cache Creek, Butte Creek, Lower Sycamore Slough, Willow Creek, and Stone Corral Creek, which could affect natural communities.

Based on available stream flow data, mean monthly reductions in flow in Colusa Basin Drain and Butte Creek would be less than ten percent; therefore, reductions in stream flow would not be substantial enough to affect natural communities and impacts would be less than significant.

Measured flow data was not available for Stone Corral Creek. Glenn-Colusa Irrigation District supplements flows to Stone Corral Creek during the irrigation season and fall months by releasing irrigation water; therefore, flows would be maintained and would not affect natural communities. Impacts to Stone Corral Creek would be less than significant.

As described above, historical flow data were limited for Coon Creek. If Coon Creek flows are at the low end of the range of available data, there could be a slightly greater than ten percent reduction in flows in March and April because the model shows a reduction of flows of 5.7 cfs in March and 4.3 cfs in April. This calculation represents a worst case scenario because baseline flows used in this calculation are at the low end of existing flow data range during 2003-2005. If the calculation included the mid- or high end of the range for baseline flows, the reduction due to the Proposed Action would be less than ten percent. Therefore, a large percentage of flow reduction would occur less frequently. As a result, it is concluded that effects of the Proposed Action to natural communities at Coon Creek would be less than significant.

Historical flow data were not available for East Side/Cross Canal. As described above, the East Side/Cross Canal is an actively managed flood management structure that collects flood waters, natural flows, and agricultural return flows from several water bodies. Riparian vegetation is generally absent due to periodic levee maintenance and herbicide applications on adjacent farmlands. However, the channel does have a variety of rooted aquatic vegetation, such as cattails, and riparian shrubs including willows. The groundwater model estimates up to a 14.6 cfs reduction in flow in August and 12.9 cfs reduction in flow in September. Because vegetation is managed near the canal, natural communities would not be affected. Aquatic vegetation in the canal would not be affected because the canal is a large flood facility that collects substantial drainage and a 12.9 to14.6 cfs decrease would not likely be of a magnitude to affect vegetation in the canal. As a result, it is concluded that effects of the Proposed Action to natural communities in East Side/Cross Canal would be less than significant.

In Cache Creek, monthly decreases in flows due to the Proposed Action would range from zero percent to 12.7 percent of monthly historic flows from 2008 to 2018. The decrease of 12.7 percent occurs only once in August, when Cache Creek average stream flow is low, about 1.5 cfs, and the Proposed Action would decrease flows by about 0.19 cfs. The reduction in stream flow would be so small that it would not likely affect riparian natural communities.

Historical flow data are not available for Lower Sycamore Slough, Cortina Creek, and Willow Creek. The percentage change in flow in these streams due to the Proposed Action could not be determined. Flow reductions as the result of groundwater declines would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1 because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. With implementation of Mitigation Measure GW-1, effects to natural communities would be less than significant.

Cropland idling to make water available for transfer would result in idling of approximately 3.6 percent of the average planted rice acreage (349,647) in the seller area. Additionally, cropland idling would only reduce agricultural diversions by the amount of water consumptively used by the crop (when planted), and the remaining water that typically runs off as tailwater would still remain in the agricultural delivery system (canals and waterways leading into the fields). As a result, wetlands would continue to receive irrigation tail water flows. The incremental effect to wetlands under the Proposed Action would be less than significant.

**d) Less Than Significant Impact with Mitigation Incorporation**

**Proposed Action:** For species that use irrigated rice fields and drainage ditches for habitat, such as GGS and pacific pond turtle, these species would need to relocate to other suitable habitat and could be exposed to a number of potential impacts associated with the need to relocate, as described above. Idling rice may affect the species' ability to move from one place to another if the movement corridor is dry and does not support vegetation for cover and refuge. This impact could be potentially significant. Mitigation Measure VEG and WILD-1 would require sellers to maintain at least two feet of water in major irrigation canals/ drainage canals and prohibits crop idling of rice fields abutting established wildlife refuges. Mitigation Measure VEG and WILD-1 also prohibits transfers from areas with important GGS populations, thereby maintaining protected habitats and movement corridors for use by several populations of GGS and pacific pond turtle. Therefore, impacts would be less than significant after mitigation.

**e, f) Less Than Significant Impact**

**Proposed Action:** Cropland idling to make water available for transfer under the Proposed Action would not conflict with the conservation objectives of the plan because of the limited amount of crop acreage that would be idled compared to the amount of active cropland available.

Water transfers under the Proposed Action would have a less than significant impact on the natural communities that are covered in the plan because of the temporary nature of the transfers and the minimal changes in flows and reservoir levels associated with water transfers, as described above for Impacts b and c. The small change in flows would not adversely affect riparian habitat or wetlands associated with the Sacramento River, Shasta Reservoir, or small streams or have adverse effects to special-status species covered that use these habitats. Mitigation Measure GW-1 also requires sellers to address third-party impacts from in lieu groundwater pumping to make surface water available for transfer, specifically in areas where groundwater subbasins include conservation banks or preserves for GGS. The Proposed Action would not conflict with Habitat Conservation Plan (HCP) and Natural Community Conservation Plan (NCCP) provisions. Impacts would be less than significant.

**V. CULTURAL RESOURCES**
– Would the project

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5? | ☐ | ☐ | ☐ | ☒ |
| b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to State CEQA §15064.5? | ☐ | ☐ | ☐ | ☒ |
| c) Disturb any human remains, including those interred outside of formal cemeteries? | ☐ | ☐ | ☐ | ☒ |

**a-c) Proposed Action.** The decline of water surface elevations in Shasta Reservoir would be the result of the operation of those reservoirs to fulfill downstream regulatory requirements. Reclamation and DWR will release water from the CVP and SWP reservoirs to meet the operational requirements of the Biological Opinions on the Continued Long-term Operations of the CVP/SWP and D1641. Diversions of water, that were made available for transfer through cropland idling/shifting or groundwater substitution actions, would not result in the release of any additional water from Shasta Reservoir.

There would be no ground disturbing activities, land alteration, or construction proposed that could disturb historical or archeological resources associated with the Proposed Action. Thus, there would be no disturbance impacts to existing or potential burial sites, cemeteries, or human remains interred outside of formal cemeteries.

A Reclamation archaeologist was consulted in 2015 to ensure the Proposed Action would have no adverse impact on any historic properties. The Proposed Action evaluated in this IS/EA is similar to the Proposed Action evaluated in 2015 (Reclamation 2015). It was determined that water transfers does not have the potential to cause effects on historic properties, if present, and Reclamation had no further obligation under National Historic Preservation Act Section 106, pursuant to 36 CFR Part 800.3(a)(1). This determination still applies to the action.

**VI. ENERGY**
– Would the project

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation? | ☐ | ☐ | ☒ | ☐ |
| b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency? | ☐ | ☐ | ☐ | ☒ |

## a) Less than Significant Impact

**Proposed Action**: Making water available for transfer through groundwater substitution actions would involve increased energy use for the groundwater pumps. This pumping would not be a wasteful use of energy and would not result in significant impacts.

**b) No Impact.** California has a "Renewable Energy Program" focused on development of new utility-level renewable energy sources and rebates for consumers installing facilities. California also has an "Energy Efficiency Strategic Plan" that includes goals to improve agricultural irrigation energy efficiency and improve use of renewable energy (California Public Utilities Commission 2008). Proposed Action would not result in the construction of new facilities, so they would not conflict with these statewide plans or local general plans.

**VII. GEOLOGY AND SOILS**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: | | | | |
| i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42. | ☐ | ☐ | ☐ | ☒ |
| ii) Strong seismic ground shaking? | ☐ | ☐ | ☐ | ☒ |
| iii) Seismic-related ground failure, including liquefaction? | ☐ | ☐ | ☐ | ☒ |

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| iv) Landslides? | ☐ | ☐ | ☐ | ☒ |
| b) Result in substantial soil erosion or the loss of topsoil? | ☐ | ☐ | ☒ | ☐ |
| c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? | ☐ | ☒ | ☐ | ☐ |
| d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property? | ☐ | ☐ | ☐ | ☒ |
| e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water? | ☐ | ☐ | ☐ | ☒ |
| f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature? | ☐ | ☐ | ☐ | ☒ |

**a) No Impact.** There are no new facilities or construction proposed, and no existing facilities fall within an Alquist-Priolo Earthquake Fault Zone, as shown in the Interim Revision of Special Publication 42 of the Division of Mines and Geology, Fault Rupture Zones in California (California Department of Conservation 2007). Therefore, the Proposed Action would not expose people or structures to impacts related to fault rupture, ground shaking, ground failure, liquefaction, or landslides.

**b) Less than Significant**

**Proposed Action**: Increased cropland idling in the Sacramento Valley to make water available for transfer is not likely to substantially increase erosion of sediments. Buyers are likely to use transferred water on permanent crops (such as orchards). The soils underlying these fields have a low risk of erosion due to wind; therefore, continued cultivation is not likely to substantially increase erosion.

**c) Less than Significant with Mitigation Incorporation.** The project area is underlain by clay and is located in flat terrain. No new construction or ground disturbing actions are proposed that could result in on- or off-site landslide, lateral spreading, liquefaction, or collapse.

Water made available for transfer through groundwater substitution actions could reduce groundwater levels in the seller areas, which could decrease pore-water pressure and result in a loss of structural support for clay and silt beds. This loss of structural support could result in lowering of the ground surface elevation (land subsidence). Groundwater-pumping related land subsidence is analyzed in more detail in the groundwater section of Hydrology and Water Quality (Section X). The analysis finds that the potential for land subsidence from increased groundwater pumping (under the Proposed Action) could be significant if groundwater levels fall below historic low water levels. Significant impacts would be reduced to less than significant with Mitigation Measure GW-1. Therefore, the effect on potential land subsidence after mitigation would be less than significant.

**d, e, f) No Impact.** There are no expansive soils known to exist in the project area. There are no septic tanks or alternative waste water disposal systems proposed or required. The Proposed Action does not include new construction, and thus no new waste water generation or risk of affecting paleontological resources. Therefore, there would be no impact resulting from the implementation of the Proposed Action.

**VIII. GREENHOUSE GAS EMISSIONS**
- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment? | ☐ | ☐ | ☒ | ☐ |
| b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases? | ☐ | ☐ | ☒ | ☐ |

**a, b) Less than Significant**

**Proposed Action**: This analysis estimates emissions using available emissions data and information on fuel type, engine size (hp), and annual transfer amounts included in the proposed alternatives. Existing emissions data used in the analysis includes:

- Diesel and natural gas fuel emission factors from The Climate Registry (TCR 2019a)
- Electric utility $CO_2$ emission factors from TCR (2019b)
- Emissions & Generation Resource Integrated Database (eGRID) $CH_4$ and $N_2O$ emission factors from USEPA (USEPA 2018)
- "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping" (Byron Buck & Associates 2009)

In 2009, Byron Buck & Associates completed a comparison of the relative reduction in emissions due to cropland idling activities versus groundwater substitution pumping. Byron Buck & Associates estimated the gallons of fuel consumed by farm equipment that would be reduced per acre idled and the average quantity of fuel consumed by groundwater pumping. It was assumed that an agency would need 4.25 AF of water produced by idling to offset the equivalent emissions of one AF of groundwater pumped (Byron Buck & Associates 2009). Using this ratio, the expected reductions in vehicular exhaust emissions from cropland idling were estimated.

Each GHG contributes to climate change differently, as expressed by its global warming potential (GWP). GHG emissions are discussed in terms of $CO_2$ equivalent ($CO_2e$) emissions, which express, for a given mixture of GHG, the amount of $CO_2$ that would have the same GWP over a specific timescale. $CO_2e$ is determined by multiplying the mass of each GHG by its GWP. This analysis uses the GWP from the Intergovernmental Panel and Climate Change Fourth Assessment Report (Forster et al. 2007) for a 100-year time period to estimate $CO_2e$. This approach is consistent with the federal GHG Reporting Rule (40 CFR 98), as effective on January 1, 2014 (78 Federal Register 71904) and California's 2000-2014 GHG Emission Inventory Technical Support Document (CARB 2016). The GWPs used in this analysis are 25 for $CH_4$ and 298 for $N_2O$.

CARB uses a threshold of 25,000 metric tons $CO_2e$ per year as a threshold for including facilities in its cap-and-trade regulation (17 CCR 95800-96023). Because the goal of the regulation is to reduce GHG emissions statewide, this threshold was deemed appropriate to assess significance.

In the seller area, groundwater substitution pumping could increase GHG emissions while cropland idling could reduce vehicle exhaust emissions. Cropland idling could offset some of the emissions from groundwater substitution pumping, but the quantity of water made available for transfer under each method could be much less than what is included in Table 2-1. Therefore, impacts were evaluated for the full volume of water made available through groundwater substitution actions, without regard for any potential offsets from idled land. Table F-1 in Appendix F summarizes the GHG emissions associated with the Proposed Action. Appendix F, Climate Change Analysis Emission Calculations also provides detailed GHG Emission calculations.

Emissions from groundwater substitution would be up to 10,334 metric tons $CO_2e$ per year (detailed calculations are provided in Appendix F), which is lower than the CARB cap-and-trade threshold of 25,000 metric tons $CO_2e$ per year. As a result, the Proposed Action would not conflict with any plan, policy, or regulation adopted for the purpose of reducing GHG emissions and impacts would be less than significant.

**IX. HAZARDS AND HAZARDOUS MATERIALS**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials? | ☐ | ☐ | ☐ | ☒ |

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment? | ☐ | ☐ | ☐ | ☒ |
| c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school? | ☐ | ☐ | ☐ | ☒ |
| d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment? | ☐ | ☐ | ☐ | ☒ |
| e) For a project located within an airport use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area? | ☐ | ☐ | ☐ | ☒ |
| f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan? | ☐ | ☐ | ☐ | ☒ |
| g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires? | ☐ | ☐ | ☐ | ☒ |

**a-g) No Impact.** The Proposed Action would not involve the transport or use of hazardous materials, nor change in any way, public exposure to hazards or hazardous materials. The Proposed Action would not occur on a hazardous materials site and therefore would not create a risk to the public or environment. The Proposed Action would not affect a public airport or private air strip. The Proposed Action would not interfere with an adopted emergency response plan or emergency evacuation plan. There are no new structures or buildings included in the Proposed Action; therefore, no people or structures would be exposed to a significant risk of loss, injury or death, such as wildland fires, as a result of implementation.

**X. HYDROLOGY AND WATER QUALITY**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Violate any water quality standards or waste discharge requirements s or otherwise substantially degrade surface or ground water quality? | ☐ | ☐ | ☒ | ☐ |
| b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin? | ☐ | ☒ | ☐ | ☐ |
| c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surface, in a manner which would: | | | | |
| i. Result in substantial erosion or siltation on- or off-site? | ☐ | ☐ | ☒ | ☐ |
| ii. Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site? | ☐ | ☐ | ☐ | ☒ |
| iii. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff? | ☐ | ☐ | ☐ | ☒ |
| iv. impede or redirect flood flows? | ☐ | ☐ | ☐ | ☒ |
| d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation? | ☐ | ☐ | ☐ | ☒ |
| e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?? | ☐ | ☐ | ☒ | ☐ |

## a) Less than Significant

**Proposed Action**: Under the Proposed Action, Reclamation would deliver the water made available for transfer to Member Units of the TCCA on the same pattern as it would have been diverted by the seller if no transfer occurred. This operation would result in a small change in flow between the Red Bluff Pumping Plant and the point where water would have been diverted by the seller absent the transfer. The largest change in flow could be approximately 180 cfs in June. For comparison, flows in the Sacramento River near Colusa from 2009 to 2019 averaged 8,413 cfs in June (DWR 2019a). The water transfers would not affect flows downstream of the point where water would have been diverted if a transfer did not occur, therefore flows into the

Delta would not be affected. Changes in flows would not violate any existing water quality standards or worsen any water quality and flow standard violation.

**b) Less than Significant with Mitigation Incorporation**

**Proposed Action**: Groundwater pumped in-lieu of diverting surface water could affect groundwater hydrology. The potential effects could be short-term declines in local groundwater levels, interaction with surface water, and land subsidence. Potential effects to water quality are discussed in Section (e) below.

Increased groundwater substitution pumping could result in temporary declines of groundwater levels. Groundwater substitution pumping could occur from April through October and the pumped groundwater would be used for crop irrigation within the seller's area. Declining groundwater levels resulting from increased groundwater substitution pumping could cause: (1) increased groundwater pumping costs due to increased pumping depth; (2) decreased yield from groundwater wells due to reduction in the saturated thickness of the aquifer; (3) decline of the groundwater table to a level below the vegetative root zone, which could result in environmental effects; and 4) third-party impacts to neighboring wells.

Some of the surface water made available for transfer through groundwater substitution pumping actions would be delivered to users within the same groundwater basin, and therefore could offset the groundwater substitution pumping associated with the Proposed Action. The amount of offset is uncertain, so to be conservative, the analysis considers impacts to groundwater without this offset.

**Groundwater Levels**

***Redding Area Groundwater Basin***. Municipal, industrial, and agricultural water demands in the Redding Area Groundwater Basin are approximately eight million AF per year (DWR 2003). Groundwater is a major source of water supply within the Redding Area Groundwater Basin watershed. The exact quantity of groundwater that is pumped from the Redding Area Groundwater Basin is unknown; however, it is estimated that approximately 50,000 AF of water is pumped annually from domestic, municipal, industrial, and agricultural production wells (CH2M Hill 2003 as cited in Anderson-Cottonwood ID 2011). This magnitude of pumping represents approximately six percent of the average annual runoff (850,000 AF) in the basin. Agricultural, industrial, and municipal groundwater users in the Redding Area Groundwater Basin pump primarily from deeper continental deposits; whereas, domestic groundwater users in the basin generally pump from shallower deposits (Anderson-Cottonwood ID 2011).

Some of the surface water made available for transfer through groundwater substitution actions would originate from the Redding Area Groundwater Basin (Anderson and Enterprise subbasins) in Shasta County through actions taken by Anderson-Cottonwood ID. DWR conducted a statewide groundwater basin assessment and prioritized Anderson and Enterprise subbasins as medium priority due to strong surface water and groundwater interaction in the area and concerns over endangered Sacramento River salmon runs (DWR 2019b). According to the timeline set forth by California's Sustainable Groundwater Management Act (SGMA), medium priority basins are required to have groundwater sustainability plans (GSP) developed by

January 31, 2022. The Enterprise-Anderson Groundwater Sustainability Agency (GSA) is currently working on developing a GSP for the Anderson and Enterprise subbasins.

The proposed Anderson-Cottonwood ID transfer would withdraw up to 4,800 AF per year of groundwater from production wells (see Table H-1 in Appendix H for details on number of wells and pumping capacity). Unlike other transfers of water made available through groundwater substitution actions, Anderson-Cottonwood ID's proposed transfer was not simulated in the Sacramento Valley Groundwater Model (SACFEM2013) because the model area does not include the Redding Area Groundwater Basin. However, Anderson-Cottonwood ID has tested operation of the wells proposed for groundwater substitution under the Proposed Action in the past at similar production rates and has observed no substantial impacts on groundwater levels or groundwater supplies (Anderson-Cottonwood ID 2013). Additionally, Anderson-Cottonwood ID used the same wells for groundwater substitution transfers in 2013, 2014 and 2015. Groundwater monitoring conducted in the vicinity of the production wells indicates groundwater levels recovered to pre-transfer levels soon after transfers occurred (Anderson-Cottonwood ID 2014, MBK Engineers 2016). Based on the results of the aquifer tests and monitoring data collected as part of previous transfers, water made available for transfer through groundwater substitution actions are unlikely to have significant effects on groundwater levels. Because of the uncertainty of how groundwater levels could change, especially during a very dry year, Anderson-Cottonwood ID will implement the Monitoring Program and Mitigation Plan discussed below under Mitigation Measure GW-1.

***Sacramento Valley Groundwater Basin.*** In the Sacramento Valley, past trends indicate groundwater levels decline moderately during extended droughts and recover to pre-drought levels after subsequent wet periods (see Appendix D). As defined by Assembly Bill 1152, DWR and other monitoring entities extensively monitor groundwater levels in the Basin. Some of the surface water made available for transfer through groundwater substitution actions would originate from the Sacramento Valley Groundwater Basin (Colusa, Sutter, Yolo and the North American subbasin). DWR conducted a statewide groundwater basin assessment and prioritized the Sutter subbasin as medium priority; the Colusa, Yolo and the North American subbasins have been prioritized as high priority (DWR 2019b). GSPs for all four subbasins are under development.

Groundwater drawdown impacts associated with the groundwater substitution pumping that would occur under the Proposed Action were evaluated using the SACFEM2013 groundwater model. The model simulated the changes in groundwater levels from water transfers during water year 1976, which was selected because it was a critically dry year and presents what could occur under very dry conditions. The effects of concurrent groundwater substitution pumping from 187 wells that are part of the Proposed Action have been modeled to estimate effects to groundwater resources. Appendix H, Groundwater Modeling Results, summarizes (1) key characteristics of the SACFEM2013 groundwater model; (2) simulated drawdown of groundwater levels under September 1977 hydrologic conditions; and (3) groundwater head hydrographs at 34 selected locations and seven simulated model layers (varying depths throughout the model) at or near the seller service areas.

Figure 3-1 shows the change in groundwater levels at Location 21 at varying groundwater depths to illustrate the simulated groundwater drawdown and recovery process within the Sacramento

Valley. Location 21 was selected because most areas in the model exhibit smaller drawdown changes than those shown in Location 21 (see simulated drawdown shown in Figures H-1 through H-4 in Appendix H). Location 21 is near Sycamore Mutual Water Company (MWC) and is in the northwestern portion of the Sacramento Valley approximately four miles from the Sacramento River and Butte Creek intersection and two miles from the Sacramento River and Sycamore Creek intersection. Approximately 60 percent of the pumping near Sycamore MWC (8,000 AF) was concentrated in aquifer model layers 5 and 6 (approximately 480 to 910 ft bgs). The pumping in aquifer layers 5 and 6 resulted in approximately 10 feet of drawdown due to the Proposed Action, as compared to Baseline conditions. Most of the recovery near the pumping zone occurs in the year following the transfer event. Recovery at the water table was more gradual. Groundwater recovery is highly dependent on (1) hydrology of the years following the transfer; (2) proximity of a transfer well to surface water; (3) pumping in the year following the transfer; and (4) aquifer properties. Appendix H, Groundwater Modeling Results, includes simulated groundwater head hydrographs for locations throughout the Sacramento Valley.

Groundwater substitution pumping under the Proposed Action could result in temporary drawdown. Model results show that increased groundwater pumping due to the Proposed Action could cause localized declines of groundwater levels, or cones of depression, which in some instances extend beyond the boundaries of the seller areas (see simulated drawdown Figures H-1 through H-4 in Appendix H). Groundwater substitution pumping could result in groundwater declines in excess of seasonal variation and these effects on non-participating wells could be significant. To reduce these significant effects to less than significant, the Mitigation Measure GW-1 specifies that transferring agencies establish monitoring and mitigation programs for transfers based on groundwater substitution actions. The requirements of GW-1 would require monitoring of groundwater levels within the local pumping area and if effects occurred, the participating seller agencies in the Sacramento Valley Groundwater Basin would compensate non-participating well owners for effects or reduce pumping until the groundwater basin recharges as specified in GW-1. Mitigation Measure GW-1 would reduce the impacts to less than significant.

**Groundwater/Surface Water Interaction**

The implementation of groundwater substitution pumping can lower the groundwater table and may change the relative difference between the groundwater and surface water levels. This change could reduce the amount of surface water, as compared to pre-pumping conditions, due to two mechanisms. The mechanisms are:

- Induced leakage. Lowering the groundwater table causes a condition where the groundwater table is lower than the surface water level. This condition causes leakage out of a surface water body and could also increase percolation rates on irrigated lands.

- Interception of groundwater. A pumping well used for groundwater substitution pumping can intercept groundwater that would have discharged to the surface water absent the pumping.

Because these mechanisms may result in a depletion of streamflow, the volume of water actually transferred is not the same as the volume of groundwater pumped through a substitution action. The amount of water that can justifiably be considered to be transferred is the volume of substitution pumping less the amount of induced leakage and the amount of intercepted groundwater flow. The Proposed Action includes measures that would reduce the amount of water made available for transfer and which the Member Units of the TCCA receive by an estimated 13 percent depletion factor to prevent any adverse impacts associated with groundwater/surface water interaction.[1] This would mitigate potential stream depletion as a result of the Proposed Action. Additionally, the potential effects to fish and riparian vegetation from decreased streamflows are assessed in the Biological Resources section.

**Land Subsidence**

Excessive groundwater extraction from unconfined and confined aquifers could lower groundwater levels and decrease pore-water pressure in the aquifer. The reduction in pore-water pressure could result in a loss of structural support within clay and silt beds in the aquifer. The loss of structural support could cause the compression of clay and silt beds resulting in a lowering of the ground surface elevation (land subsidence). The compression of fine-grained deposits, such as clay and silt, is largely permanent. Infrastructure damage and alteration of drainage patterns are possible consequences of land subsidence.

***Redding Area Groundwater Basin.*** There is potential for subsidence in some areas of the Redding Area Groundwater Basin if groundwater levels were substantially lowered. The portion of the Redding Area Groundwater Basin west of the Sacramento River is composed of the Tehama Formation. The Tehama Formation has exhibited subsidence in Yolo County. This same formation occurs in the Redding Area Groundwater Basin and could be conducive to subsidence.

The potential for subsidence as a result of the Proposed Action is small since the groundwater substitution pumping is small compared to overall pumping in the region. While the potential for subsidence is minimal, Anderson-Cottonwood ID will implement the Monitoring Program and Mitigation Plan described below under Mitigation Measure GW-1, which includes subsidence monitoring. The subsidence monitoring will measure changes in the ground surface elevation, and will help determine whether subsidence is short-term or long-term. The monitoring and mitigation actions would verify that this impact would be less than significant.

***Sacramento Valley Groundwater Basin.*** Most areas of the Sacramento Valley Groundwater Basin have not experienced land subsidence that has caused impacts to the overlying land. As discussed in Chapter 2, portions of Colusa and Yolo counties have experienced subsidence and subsidence has also been measured at Conaway Ranch (Yolo County). Subsidence in this region is generally related to groundwater pumping and subsequent consolidation of loose aquifer sediments. The Proposed Action does not include a groundwater substitution action within Conaway Ranch. Groundwater substitution pumping within the Sacramento Valley Groundwater Basin could increase the potential for land subsidence to cause significant impacts when groundwater levels fall below historic low water levels. Significant impacts would be reduced to less than significant with Mitigation Measure GW-1. Therefore, the effect on potential land

[1] The following formulas are from the DRAFT Technical Information for Preparing Water Transfer Proposals (Water Transfer White Paper) (Reclamation and DWR 2019):

- (Transfer Year Groundwater Substitution Pumping)- Baseline Groundwater Pumping) = Gross Transfer Pumping
- Gross Transfer Pumping- (Estimate Streamflow Reduction) = (Surface Water Made Available for Transfer).

subsidence in the Sacramento Valley Groundwater Basin after mitigation would be less than significant.

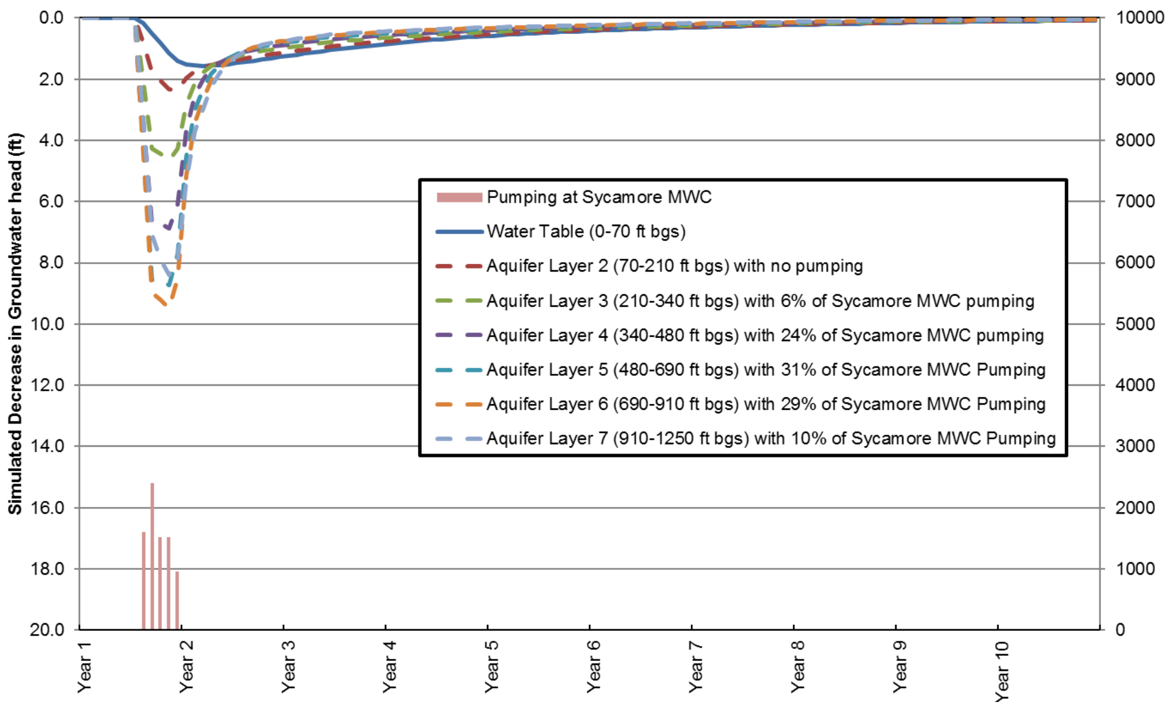


**Figure 3-1. Simulated Change in Groundwater Head at Location 21 (See Figure H-1 for Location) under the Proposed Action**

***Mitigation Measure GW-1: Monitoring Program and Mitigation Plan***

The objective of Mitigation Measure GW-1 is to avoid potentially significant adverse environmental effects from groundwater level declines such as (1) impacts to other legal users of water; (2) land subsidence; (3) adverse effects to groundwater-dependent vegetation; or (4) migration of reduced quality groundwater. The mitigation measure also requires prompt corrective action so that impacts discussed previously will be reduced to less than significant in the event unanticipated effects occur. The measure accomplishes this by monitoring groundwater levels and land subsidence in the period during which groundwater is being pumped in-lieu of diverting the surface water. Additionally, the mitigation plan identifies necessary preventative action measures if monitoring shows that identified trigger points are reached during transfer-related pumping.

Reclamation will verify that sellers implement the monitoring program and mitigation plan to avoid potentially significant adverse effects of transfer-related groundwater extraction. In addition, each entity making surface water available for transfer through groundwater substitution actions must confirm that the proposed groundwater pumping will be compatible with state and local regulations and GMPs. As GSPs are developed by GSAs, potential sellers must confirm that the proposed pumping and the following Monitoring Program and Mitigation Plan, verified by Reclamation, is compatible with applicable GSPs.

### *Well Review Process*

Potential sellers must submit well data for Reclamation review as part of the transfer approval process. The *DRAFT Technical Information for Preparing Water Transfer Proposals (Water Transfer White Paper)* (Reclamation and DWR 2019) can be consulted to understand the information that is necessary for Reclamation to approve a transfer.

### *Monitoring Program*

Potential sellers must complete and implement a monitoring program subject to Reclamation's approval that shall include, at a minimum, the following components:

#### Monitoring Well Network

The monitoring program shall incorporate a sufficient number of monitoring wells, as determined by Reclamation, to accurately characterize groundwater levels from the appropriate aquifers and their response in the area before, during, and after transfer-related substitution pumping takes place. Depending on local conditions, additional groundwater level monitoring may be required near ecological resource areas. It should be noted that monitoring well networks have been established for some of the participating pumping wells (those wells being used in-lieu of diverting surface water that is being made available for transfer) that have also participated in water transfers in previous years. For wells that have not participated in water transfers previously, the sellers would identify, in the transfer proposal, suitable monitoring wells as defined below for review and approval by Reclamation. If a suitable monitoring well(s) is not identified for a participating pumping well, the well will not be allowed to participate in a water transfer until a suitable monitoring well(s) is identified.

The monitoring well network would include the participating pumping well and a suitable groundwater level monitoring well(s) in the vicinity of the participating pumping well(s). Suitable monitoring well(s) would: (1) be within a two-mile radius of the seller's groundwater substitution pumping well; (2) be located within the same Bulletin 118 subbasin as the groundwater substitution pumping well; and (3) have a screen depth(s) in the same aquifer level (shallow, intermediate, or deep) as the groundwater substitution pumping well. Wells with short historic records could be considered, but short records (that do not extend to 2014 or earlier) could limit the transfer because the historic low would not reflect the persistent dry conditions from 2011 to 2015. In this situation, the lowest groundwater level for the short period of record would be used, but because the groundwater level would likely be higher than the historic low during the prior drought period, the groundwater level triggers (described below) would be more restrictive (i.e., the lowest recorded groundwater level could be reached more quickly during transfer-related groundwater substitution pumping than occurred in the short period of record when groundwater levels were higher).

Monitoring requirements at the participating groundwater substitution pumping well and suitable monitoring well(s) would detect impacts to third parties and land subsidence. Monitoring and mitigation for impacts to groundwater dependent deep-rooted vegetation and migration of reduced quality groundwater are discussed below under "Other Monitoring".

#### Groundwater Level Monitoring

Sellers will collect measurements of groundwater levels in both the participating wells (those wells being used in-lieu of diverting surface water that is being made available for transfer) and monitoring wells. Groundwater level measurements will be used to identify potential concerns for both third-party impacts and inelastic (irreversible) subsidence based on the identified trigger points. Groundwater level monitoring will include measurements before, during, and after transfer-related substitution pumping. The seller will measure groundwater levels as follows:

- Prior to transfer: Groundwater levels will be measured in both the participating pumping well(s) and the monitoring well(s) monthly from March in the year of the proposed transfer-related substitution pumping until the start of the transfer pumping. Monitoring will also be conducted on the day that the transfer pumping begins, prior to the pump being turned on.

- During transfer-related substitution pumping: Groundwater levels will be measured, in both the participating pumping well(s) and the monitoring well(s), weekly throughout the pumping period.

- Post-transfer pumping: Groundwater levels will be measured, in both the participating well(s) and the monitoring well(s), weekly, for one month after the end of transfer-related pumping, after which groundwater levels will be measured monthly through March of the year following the end of the pumping.

**Groundwater Level Triggers**

The primary criteria used to identify potentially significant impacts to groundwater levels are the basin management objectives (BMOs) set by GMPs. In the Sacramento Valley, Shasta, Tehama, Glenn, Butte, Colusa, Sutter, Yuba, Nevada, Placer, Sacramento and Yolo counties have established GMPs to provide guidance in managing the resource.

In areas where quantitative BMO groundwater level triggers exist, sellers will manage groundwater levels to these triggers and initiate the mitigation plan (discussed below) if groundwater levels reach the trigger. In areas where quantitative BMOs do not exist, sellers will manage groundwater levels to maintain them above the identified historic low groundwater level (trigger) and will initiate the mitigation plan (discussed below) if groundwater levels reach the trigger. Most of the quantitative BMOs within the Seller Service Area are tied to historic low groundwater levels. Therefore, the use of historic low groundwater levels in areas without quantitative BMOs is consistent with the approach for areas with quantitative BMOs. As part of a seller's transfer proposal subject to Reclamation's review and approval, the seller will need to identify the monitoring wells and the specific groundwater level trigger for each well (established through the local BMO or the historic low groundwater level for that well).

Groundwater level declines due to pumping occur initially at the pumping well and then propagate outward from that location. The magnitude of groundwater level decline caused by pumping also decreases with increasing distance from the pumping well. Therefore, groundwater level declines caused by transfer-related substitution pumping would be measured first at the pumping well and subsequently at the monitoring well. The decline would be greatest at the participating well and lower at the monitoring well. Therefore, it is likely that groundwater levels in the participating well would decline to the historic low level sooner than at the monitoring well(s). The monitoring well(s) would provide information surrounding the participating well to avoid potential cumulative impacts.

### Other Monitoring

*Groundwater Quality*

For municipal sellers, the comprehensive water quality testing requirements of Title 22 are considered sufficient for the water transfer monitoring program. Agricultural sellers shall measure specific conductance in samples from each participating production well. Samples shall be collected when the seller first initiates pumping, monthly during the pumping period, and at the termination of transfer-related pumping.

*Groundwater Pumping Measurements*

All groundwater wells pumping to replace surface water made available for transfer shall be configured with a permanent instantaneous and totalizing flow meter capable of accurately measuring well discharge rates and volumes. Flow meters will be installed and calibrated in accordance with manufacturer's recommendations and the relevant documentation will be submitted by the seller to Reclamation. Flow meter readings will be recorded just prior to initiation of transfer-related substitution pumping and no less than monthly throughout the duration of the pumping period, as close as practical to the last day of the month. Readings will also be recorded just after cessation of pumping.

*Shallow Groundwater-Level Monitoring for Deep-Rooted Vegetation*

To avoid significant effects to vegetation and allow sellers to modify actions before significant effects occur, sellers will monitor groundwater level data to verify that significant adverse effects to deep-rooted vegetation are avoided. This monitoring is only required in areas with deep-rooted vegetation (i.e., oak trees and riparian trees that would have tap roots greater than 10 feet deep) within a one-half mile radius of the participating well and areas where groundwater levels are between 10 to 25 feet below ground surface prior to starting transfer-related pumping. This monitoring is not required in areas with no deep-rooted vegetation (i.e., oak trees and riparian trees that would not have tap roots greater than 10 feet deep) within one-half mile of the participating wells or in areas where vegetation is located along waterways or irrigated fields that will continue to have water during the period of transfer.

In their transfer proposal to Reclamation, the seller would be required to identify if monitoring for deep-rooted vegetation is a requirement. Existing resources such as DWR's groundwater dependent ecosystem maps (https://gis.water.ca.gov/app/NCDatasetViewer/) or any existing biological survey data in the area, and aerial imagery (e.g. Google Maps) could be used to identify deep rooted vegetation near the participating pumping well.

If deep-rooted vegetation is identified near the participating well, a groundwater level monitoring well with the following requirements would need to be identified and monitored: (1) monitoring well is within a one-half mile radius of the deep-rooted vegetation; and (2) monitoring well would measure shallow groundwater level changes (within the interval between 10 to 25 feet below ground surface). The participating pumping well can function as the monitoring well if the previously mentioned requirements are met. If monitoring data at the monitoring well indicate that groundwater levels have dropped below root zones of deep-rooted vegetation (i.e., more than 10 feet, where groundwater was 10 to 25 feet below ground surface prior to starting the surface-water transfer), the seller must implement actions set forth in the mitigation plan. However, if historic data show that groundwater levels in the area have typically fluctuated by more than this amount annually during the proposed transfer period, then the transfer may be allowed to proceed. Prior to transfer pumping, the seller must submit to Reclamation historic data showing groundwater fluctuations in the area of the deep-rooted vegetation..

If no monitoring wells with the requirements discussed in the previous paragraph exist, monitoring would be based on visual observations by a qualified plant ecologist/certified arborist of the health of these areas of deep-rooted vegetation until it is feasible to obtain or install shallow groundwater monitoring. Monitoring of these areas would include a pre-pumping vegetation assessment within a half-mile radius of the pumping well followed by an assessment near the end of the pumping season but prior to fall/autumn leaf-drop. The assessment of post-pumping impacts on deep-rooted vegetation will be conducted by a qualified plant ecologist/arborist and will take into account the existing health conditions of the vegetation prior to pumping, species present, size-class of trees, and rainfall data from the previous water years. If the qualified plant ecologist/certified arborist determines, based on site-specific circumstances, that groundwater pumping has caused significant adverse impacts to deep-rooted vegetation (that is, any loss of the deep-rooted vegetation), the seller must implement restoration actions set forth in the mitigation plan. Findings from the pre-pumping and post pumping assessment will be reported to Reclamation.

**Coordination Plan**

The monitoring program will include a plan to coordinate the collection and organization of monitoring data. This plan will describe how input from third-party well owners will be incorporated into the monitoring program and will include a plan for communication with Reclamation as well as other decision makers and third parties.

Additionally, Reclamation, Member Units of the TCCA, and potential seller(s) will coordinate closely with potentially affected third parties to collect and monitor groundwater data. If a third party expects that it may be affected by a proposed transfer, that party should contact Reclamation and the seller with its concern. The burden of collecting groundwater data will not be the responsibility of the third party. If warranted, additional groundwater level monitoring to address the third-party's concern may be incorporated into the monitoring and mitigation plans required by Mitigation Measure GW-1.

**Evaluation and Reporting**

The monitoring program will describe the method of reporting monitoring data. At a minimum, sellers will provide data summary tables to Reclamation, both during and after transfer-related substitution pumping. Post-transfer reporting will continue through March of the year following the transfer. Sellers will provide a final summary report to Reclamation evaluating the effects of the water transfer. The final report will identify transfer-related effects on groundwater and surface water (both during and after pumping), and the extent of effects, if any, on local groundwater users. It shall include groundwater-level contour maps for the area in which the transfer-related pumping is located, showing pre-transfer groundwater levels, groundwater levels at the end of the transfer period, and recovered groundwater levels in March of the year following the transfer. Groundwater level contour maps for different aquifer depths should also be included where data are available. The summary report shall also identify the extent of transfer-related effects, if any, to ecological resources such as fish, wildlife, and vegetation resources.

***Mitigation Plan***

Potential sellers must complete and implement a mitigation plan to avoid potentially significant groundwater impacts and ensure prompt corrective action in the event unanticipated effects occur. This plan must document the planned actions if there are unanticipated impacts to groundwater resources or groundwater-dependent vegetation. This plan must be submitted to Reclamation as part of the transfer approval process.

**Groundwater Resource Mitigation**

If groundwater level triggers are reached at the participating pumping well(s) or the suitable monitoring well (s) (either BMO triggers or historic low groundwater levels), transfer-related pumping would stop from the participating pumping well that reached the trigger. Transfer-related pumping would be stopped when the trigger is first reached at either the participating pumping well(s) or the suitable monitoring well(s). Transfer-related pumping could not continue from this well (in the same year or a future year) until groundwater levels recovered to above the groundwater level trigger. Implementation of the mitigation plan thus avoids any potentially significant groundwater impacts. Other corrective actions could include:

- Lowering of pumping bowls in non-transferring wells affected by substitution pumping.
- Reimbursement to non-transferring third parties for significant increases in their groundwater pumping costs due to the groundwater substitution pumping action, as compared with their costs absent the transfer.
- Reimbursement to non-transferring third parties for modifications to infrastructure that may be affected.
- Other appropriate actions based on local conditions.

**Deep-Rooted Vegetation Mitigation**

If shallow groundwater level monitoring suggests that groundwater levels have dropped below root zones of deep-rooted vegetation (i.e., more than 10 feet, where groundwater was 10 to 25 feet below ground surface prior to starting the transfer-related pumping), the seller must stop transfer-related pumping at the participating pumping well and cannot resume pumping until groundwater levels have recovered to levels above the root zones. However, if historic data at the location indicate shallow groundwater levels typically declined during the transfer period and remained below the root zone then the transfer may be allowed to proceed.

In areas where visual monitoring is conducted to monitor health of deep-rooted vegetation, the seller must stop transfer-related pumping at the participating well if the qualified plant ecologist/arborist, determines a loss or substantial risk of loss of vegetation.

If adverse impacts to deep-rooted vegetation occur, the seller will perform restoration activities by replanting similar vegetation at a 1:1 ratio (for every 1 inch diameter at breast height (dbh) lost, 1 inch in dbh will be planted. For example if 12-inch dbh of oak is lost then the seller would have to plant a 12-gallon oak sapling at around 1-inch dbh. Therefore, the seller would plant more trees than lost.). The seller will plant, irrigate, maintain, and monitor restoration of vegetation for three years to replace the loss(es). All plantings will be fitted with exclusion cages or other suitable protection from herbivores. Plantings will be irrigated for three years or until the survival criterion is met. If 75% of the plants survive at the end of the three -year monitoring period, the revegetation will be considered successful. If the survival criterion is not met at the end of the monitoring period, planting and monitoring will be repeated after mortality causes have been identified and corrected. Annual monitoring reports, prepared by a qualified plant ecologist/arborist, will document the status of the plantings and recommendations for remediation as necessary. The monitoring reports will be provided to the seller and Reclamation by August 31 following each year of monitoring (generally July 1 through June 30) to allow time for additional planting activities, if necessary.

Transfer-related pumping could not continue at the subject well while vegetation restoration activities consistent with the requirements above are ongoing (i.e. three years or until the survival criterion is met). Transfer-related pumping at the subject well could not resume after restoration unless the seller provides evidence that resuming pumping will not affect deep-rooted vegetation (such as data from the installation of a new shallow groundwater level monitoring well within a one-half mile radius of the deep-rooted vegetation that indicates stable shallow groundwater levels at less than ten feet).

**c (i) Less than Significant**

**Proposed Action**: The Proposed Action could include cropland idling, which has the potential to increase sediment erosion into nearby waterways. Growers would implement measures to prevent the loss of topsoil. Additionally, the rice crop cycle and the soil textures in the sellers' areas reduce the potential for erosion due to wind in this region. The process of rice cultivation includes incorporating the leftover rice straw into the soils after harvest through discing. Once dried, the combination of decomposed straw and clay texture soils typically produces a hard, crust-like surface. If left undisturbed, this surface texture would remain intact throughout the summer, when erosion due to wind would be expected to occur, until winter rains begin. This surface type would not be conducive to soil loss from erosion due to wind. During the winter rains, the hard, crust-like surface typically remains intact and the amount of sediment transported through winter runoff would not be expected to increase. Therefore, there would be little-to-no increase in sediment transport or siltation resulting from erosion due to wind or due to winter runoff from idled rice fields under the Proposed Action and the resultant impact would be less than significant.

**c(ii), c(iii), c(iv), d) No Impact**. The Proposed Action would not involve any actions that would result in flooding or create runoff water that would exceed the capacity of existing drainage systems, impede or redirect flood flows or provide a substantial source of polluted runoff.

**e) Less Than Significant.** Changes in groundwater levels and the potential change in groundwater flow directions could cause a change in groundwater quality through a number of mechanisms. One mechanism is the potential mobilization of areas of poorer quality water, drawn down from shallow zones, or drawn up into previously unaffected areas. Changes in groundwater gradients and flow directions could also cause (or speed) the lateral migration of poorer quality water.

**Proposed Action:**

***Redding Area Groundwater Basin.*** Groundwater in the Redding Area Groundwater Basin is typically of good quality, as evidenced by its low TDS concentrations, which range from 70 to 360 mg/L. Areas of high salinity (poor water quality), are generally found on the western basin margins, where the groundwater is derived from marine sedimentary rock. Elevated levels of iron, manganese, nitrate, and high TDS have been detected in some areas (DWR 2003).

Groundwater extraction under the Proposed Action would be limited to withdrawals during April through October of the 2020 contract year. Since groundwater in the Redding area is of good quality, adverse effects from the migration of reduced groundwater quality would be anticipated to be minimal.

***Sacramento Valley Groundwater Basin.*** Groundwater quality in the Sacramento Valley Groundwater Basin is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. However, there are some localized groundwater quality issues in the basin. Arsenic was detected above the MCL in 22 percent of the primary aquifers within the Sacramento Valley. Nutrient concentration within the central Sacramento Valley region was above the MCLs in about three percent of the primary aquifers. In the southern portion of the basin, nutrients were detected above the MCLs in about one percent of the primary aquifers (Bennett et al. 2011).

Groundwater extraction under the Proposed Action would be limited to withdrawals during the irrigation season of the 2020 contract year. Extraction near areas of reduced groundwater quality would not be expected to result in a permanent change to groundwater quality conditions. Consequently, effects from the migration of reduced groundwater quality would be less than significant.

**XI. LAND USE AND PLANNING**
- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Physically divide an established community? | ☐ | ☐ | ☐ | ☒ |
| b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect? | ☐ | ☐ | ☐ | ☒ |

**a, b) No Impact.** The Proposed Action would not involve any construction or new structures that could divide a community or conflict with land use plans, policies, or zoning.

**XII. MINERAL RESOURCES**
– Would the project

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? | ☐ | ☐ | ☐ | ☒ |
| b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan? | ☐ | ☐ | ☐ | ☒ |

**a, b) No Impact.** The Proposed Action do not require construction or other activities that would result in the loss of availability of known mineral resources or mineral resource recovery sites.

**XIII. NOISE**
- Would the project result in:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? | ☐ | ☐ | ☒ | ☐ |
| b) Generation of excessive groundborne vibration or groundborne noise levels? | ☐ | ☐ | ☐ | ☒ |
| c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels? | ☐ | ☐ | ☐ | ☒ |

**a) Less Than Significant.** The Proposed Action would result in the temporary operation of existing electric, diesel, and propane driven wells that would result in temporary increases in noise levels. All the wells would be located in rural areas, which are generally in a farm setting with typical noise from agricultural operations. The wells would be operated by a willing landowner; therefore, any localized noise levels would be approved by the landowner. Noise impacts from increased well operation would be less than significant.

**b, c) No Impact.** The Proposed Action would not result in groundborne vibration or noise and would not result in noise near a public or private airport. The Proposed Action would only rely on existing facilities and equipment. No new construction activities would be associated with the

Proposed Action and no ground-disturbing actions with the potential to generate groundborne vibrations would occur. Certain wells may be located within an airport land use plan, but there would be no new permanent residents or workers near the wells that could be affected by any plane noise. For private airstrips, the Proposed Action would not expose people in the vicinity to excessive noise levels.

**XIV. POPULATION AND HOUSING**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)? | ☐ | ☐ | ☐ | ☒ |
| b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere? | ☐ | ☐ | ☐ | ☒ |

**a) No Impact.** The Proposed Action would not induce population growth. Water transfers would help reduce water shortages, and would not increase the maximum acreage under production or require more farm workers to meet labor demands. No housing would be constructed, demolished, or replaced as a result of water transfers.

**b) No Impact.** The Proposed Action would not include construction, demolition, or other activities that could displace existing housing or people and necessitate the construction of replacement housing.

**XV. PUBLIC SERVICES**
Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Fire protection? | ☐ | ☐ | ☐ | ☒ |
| b) Police protection? | ☐ | ☐ | ☐ | ☒ |
| c) Schools? | ☐ | ☐ | ☐ | ☒ |
| d) Parks? | ☐ | ☐ | ☐ | ☒ |
| e) Other governmental facilities (including roads)? | ☐ | ☐ | ☐ | ☒ |

**a-e) No Impact.** The Proposed Action would not create new demand for public services or require any existing public facilities to be altered. Water made available for transfer would be transported using existing conveyance facilities and pumping stations, and would not require the use of area roads, so there would be no impact to roads or other government facilities. Transferred water would not affect the supplies available to municipalities or other jurisdictions for fire protection, parks, or school use. Therefore, there would be no impact to public services or public facilities as a result of this project.

**XVI. RECREATION**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated? | ☐ | ☐ | ☐ | ☒ |
| b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment? | ☐ | ☐ | ☐ | ☒ |

**a, b) No Impact.** The Proposed Action would not affect any recreation facilities or require construction or expansion of recreation facilities.

**XVII. TRANSPORTATION**
– Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Cause a conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities? | ☐ | ☐ | ☐ | ☒ |
| b) Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)? | ☐ | ☐ | ☐ | ☒ |
| c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? | ☐ | ☐ | ☐ | ☒ |
| d) Result in inadequate emergency access? | ☐ | ☐ | ☐ | ☒ |

**a-d) No Impact.** The Proposed Action would not create new demand on transportation services. The Proposed Action has no construction activities that would increase the traffic on roads in the project area. The amount of water transferred would be less than what is supplied during normal water years, and so would not create an increase in farm activity in the buyer’s area that could increase traffic. There would neither be an impact to the level of service or air traffic patterns in the project area, nor would there be an increase in hazards due to design features, inadequate emergency access or parking capacity, or conflict with adopted policies supporting alternative transportation.

**XVIII. TRIBAL CULTURAL RESOURCES**
-- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feather, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is: | | | | |
| i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or | ☐ | ☐ | ☐ | ☒ |
| ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe. | ☐ | ☐ | ☐ | ☒ |

**a) No Impact.** The Proposed Action would not include ground disturbing activities, land alteration, or construction proposed that could disturb tribal cultural resources.

**XIX. UTILITIES AND SERVICE SYSTEMS**
- Would the project:

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Require or result in the relocation or construction of new or expanded water, wastewater treatment, or storm water drainage, electrical power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects? | ☐ | ☐ | ☐ | ☒ |

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years? | ☐ | ☐ | ☐ | ☒ |
| c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments? | ☐ | ☐ | ☐ | ☒ |
| d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals? | ☐ | ☐ | ☐ | ☒ |
| e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste? | ☐ | ☐ | ☐ | ☒ |

**a-e) No Impact.** The Proposed Action would not create new demand on utilities or service systems. There would be no impact to utility or service systems resulting from implementing the Proposed Action. Transfers of water would not require the construction of new water or wastewater treatment facilities, as all transferred water would use existing facilities. There would be no increase in demand for wastewater treatment facilities that could exceed existing capacities, and no new storm water drainage facilities would be required under the Proposed Action.

Water made available for transfer would be within the existing entitlements and resources, and no new water supplies for the sellers would be required. Buyers would also not require new water supplies as the transferred water would provide agricultural water in lieu of the limited surface water supplies.

There would be no solid waste generated as a result of the Proposed Action, and therefore, no landfill would be required. Thus, there would be no impact to utilities or other service systems as a result of the Proposed Action.

**XXI. MANDATORY FINDINGS OF SIGNIFICANCE –**

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number | ☐ | ☒ | ☐ | ☐ |

| | Potentially Significant Impact | Less Than Significant with Mitigation Incorporation | Less Than Significant Impact | No Impact |
|---|---|---|---|---|
| or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory? | | | | |
| b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)? | ☐ | ☒ | ☐ | ☐ |
| c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly? | ☐ | ☐ | ☐ | ☒ |

**a) Less than Significant with Mitigation Incorporation.** The Proposed Action would not have substantial incremental effects to habitat or species relative to the conditions that would occur in response to the dry hydrologic conditions. Mitigation Measures VEG and WILD-1 and GW-1 would reduce potential special-status species impacts to less than significant. The Proposed Action would not degrade the quality of the environment or eliminate examples of California history or prehistory.

**b) Less than Significant with Mitigation Incorporation.** This cumulative impacts analysis identifies past, present and reasonably foreseeable future projects with the potential to contribute to cumulative effects, when combined with the Proposed Action. Appendix J summarizes the cumulative projects analyzed in this IS/EA. The conditions with these projects, including the Proposed Action, are referred to as the cumulative condition. Information used in this cumulative impacts analysis is based on the best information available at this time.

The Proposed Action could have potential cumulatively considerable impacts to air quality, biological resources, and groundwater resources. The cumulative analysis for these resources follows. The Proposed Action would not have cumulatively considerable impacts to other resources evaluated in this IS/EA.

**Air Quality**

All counties affected by the Proposed Action are located in areas designated nonattainment for the $PM_{10}$ CAAQS. Additionally, Sacramento, Shasta, Tehama, and Yolo Counties are designated nonattainment for the $O_3$ CAAQS and Sutter County is designated nonattainment-transitional for the $O_3$ CAAQS. Nonattainment status represents a cumulatively significant impact within the area. $O_3$ is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to $O_3$ formation include volatile organic compounds and nitrogen oxides; therefore, the significance thresholds established by the air districts for VOC and NOx are intended to maintain or attain the $O_3$ CAAQS and NAAQS.

As previously discussed, the general conformity regulations apply to nonattainment and maintenance areas and are intended to demonstrate that a federal action would comply with the state implementation plan and would not cause the air quality in the region to be degraded. Therefore, if the total of direct and indirect emissions is less than the general conformity de minimis thresholds, then the project would not be cumulatively considerable because the ambient air quality standards would continue to be maintained. Furthermore, if total emissions in attainment areas are less than 100 tons per year, the threshold for a "major source" in the New Source Review regulations, then emissions would not be cumulatively considerable.

As discussed in Section III Air Quality, total emissions would not exceed the general conformity de minimis thresholds in nonattainment and maintenance areas or the major source threshold in attainment areas. Therefore, air quality impacts would not be cumulatively considerable.

**Biological Resources**

The Proposed Action would result in a slight decrease in Sacramento River flows from the Red Bluff Pumping Plant to the sellers' points of diversion. Transfers from the cumulative projects discussed in Appendix J would result in increased flows downstream of the sellers' points of diversion to the Delta. Detailed analysis in the Long-Term Water Transfers EIS/EIR and subsequent RDEIR/SDEIS concluded that cumulative change in flow due to transfers would not reduce the suitability of habitat conditions during adult immigration by Chinook salmon, steelhead, and green sturgeon (Reclamation and SLDMWA 2015, Reclamation and SLDMWA 2019). This magnitude of cumulative flow change would also not appreciably reduce spawning habitat availability and incubation, increase redd dewatering or juvenile stranding, or reduce the suitability of habitat conditions during juvenile rearing for these sensitive fish species because the increase in flow is so small compared to baseline flows. Other special-status fish species, including hardhead and Sacramento splittail would also not be affected by small changes in river flow.

The Proposed Action includes up to 12,650 acres of rice idling in Glenn, Colusa, Yolo, and Sutter counties. As discussed in Appendix J, some of same sellers could also make water available for transfer to other agencies, including, TCCA, East Bay Municipal Utility District (MUD), SWP contractors receiving water from the North Bay Aqueduct, and south of Delta buyers, including SLDMWA and Metropolitan Water District of Southern California. Additionally, some of the sellers (Sacramento River Settlement Contractors) could also make water available to meet flow measures as part of the Voluntary Agreements. However, the upper limit for rice idling would be limited to 60,693 acres based on the limits in the Long-Term Water Transfers Biological Assessment (Reclamation 2018). Other SWP sellers not analyzed in this document could also transfer water. However, sellers for the SWP transfers are located in the Feather River Basin and there would be minimal geographical overlap between SWP transfers and sellers under Proposed Action. Consequently, transfers under the cumulative condition would result in the idling of more rice fields than those included in the Proposed Action. The actual quantity of water transferred in a given year, as evidenced by past dry years, would likely be less than the maximum quantities in Table J-2.

As described under IV. Biological Resources, rice fields provide habitat for GGS, pacific pond turtle, and migratory birds. For the GGS and pacific pond turtle, rice idling could result in reduced forage and cover habitat, hindered movement, and increased predation risk. For migratory birds, rice idling could reduce nesting, foraging, and rearing habitat. Additional rice idled under the cumulative condition could increase these effects relative to the Proposed Action.

Mitigation Measure VEG and WILD-1 includes best management practices to reduce potential effects to special-status species, including GGS and pacific pond turtle, and migratory birds. Other water transfers facilitated by Reclamation and DWR using Federal and State facilities would be required to have similar measures in place to protect special-status species. As a result, cumulative impacts to these species would not be expected to be significant. Further, Mitigation Measure VEG and WILD-1 would reduce potential effects of the Proposed Action on special-status species under cumulative conditions, such that the Proposed Action's contribution to any such impacts would be minimal.

Water made available through groundwater substitution actions under the cumulative condition would also result in streamflow depletion and potentially affect flows for fish and natural communities. The transfers included in the cumulative impacts analysis (Table J-1 in Appendix J) include some of the same sellers that make water available for transfer to other agencies. However, the quantity of transfers would be limited to the quantity in Chapter 2. Other SWP transfers included in Table J-1 are generally in different areas of the Sacramento Valley than those included in the Proposed Action and would not substantially increase streamflow depletion in any one area. As a result, any losses in stream flows would be minor and effects to fisheries or natural communities would be less than significant under the cumulative condition.

**Groundwater Resources**

The reduction in recharge due to the decrease in precipitation and runoff in the past drought years in addition to the increase in the quantity of water made available for transfer through groundwater substitution actions transfers would lower groundwater levels. The groundwater modeling for the Proposed Action suggests that groundwater substitution pumping associated with the Proposed Action could result in significant effects to groundwater resources. Implementation of Mitigation Measure GW-1, however, will avoid any potentially significant effects on groundwater resources, and reduce impacts from transfer-related pumping to less than significant. With implementation of Mitigation Measure GW-1, the Proposed Action's incremental contribution to groundwater resources impacts is insubstantial and would not be cumulatively considerable As discussed in Appendix J, the additional water made available for transfer through groundwater substitution actions, in the cumulative condition are in different areas of the Sacramento Valley (focused in the Feather and American River areas rather than the Sacramento River area); therefore, this addition to the cumulative condition is not likely to cause a significant cumulative impact.

Other groundwater substitution transfers facilitated by Reclamation and DWR using Federal and State facilities would be required to have measures similar to Mitigation Measure GW-1 to protect groundwater resources. Reclamation will not approve and/or facilitate transfers if appropriate monitoring and mitigation programs are not in place and are not implemented. Monitoring and mitigation programs would reduce cumulative groundwater effects. Reclamation will verify that monitoring and mitigation are appropriately implemented and effects to groundwater do not occur. Coordination of groundwater programs in the Sacramento Valley would also minimize and avoid the potential for cumulative effects to groundwater resources. DWR is involved in multiple groundwater programs in the Sacramento Valley, including monitoring programs. Reclamation will work with DWR to track program activities, collect and combine data, and assess potential groundwater effects. Because of the required groundwater monitoring and mitigation for transfer approval and agency coordination, the Proposed Action would not result in a cumulatively considerable contribution to effects on groundwater.

**c) No Impact**. The Proposed Action would not result in environmental effects that cause substantial adverse impacts to human beings. Effects in the sellers' area would be temporary, occurring only in 2020, and do not present a substantial risk to water supplies to human beings. The Proposed Action would provide additional water to the buyers' area, which would benefit agricultural production and the regional economies in the buyers' area. There would be no long-term effects of the Proposed Action. The Proposed Action would be used to meet anticipated water supply shortages within the service area of the Member Units of the TCCA during drought conditions and would not permanently increase the Contract Total of the Member Units of the TCCA. Therefore, there would be no contribution to growth-inducing impacts.

# Chapter 4 Other Reclamation Environmental Compliance Requirements

In addition to resources analyzed in Chapter 3, Department of the Interior Regulations, Executive Orders, and Reclamation guidelines require a discussion of the following additional items when preparing environmental documentation.

## 4.1 Indian Trust Assets (ITAs)

ITAs are defined as legal interests in property held in trust by the U.S. government for Indian tribes or individuals, or property protected under U.S. law for federally recognized Indian tribes or individuals. ITAs can include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with a reservation or Rancheria. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the U.S. The following ITAs overlay the boundaries of the Sacramento Valley Groundwater Basin: Auburn Rancheria, Chico Rancheria, Colusa Rancheria, Cortina Rancheria, Paskenta Rancheria, and Rumsey Rancheria.

Groundwater substitution is the only method of making water available, under the Proposed Action, that could affect ITAs. Auburn Rancheria, Cortina Rancheria, and Rumsey Rancheria lie on the border of the basin where groundwater levels would be less affected by proposed groundwater substitution pumping. Groundwater modeling in the Sacramento Valley Groundwater Basin shows that there would be essentially no effect to groundwater table elevations from groundwater substitution pumping near the Chico Rancheria and Paskenta Rancheria sites (see Figure H-5 in Appendix H). The Colusa Rancheria is near an area of potential drawdown; however, the drawdown is on the opposite side of the river from the Colusa Rancheria. The changes in groundwater levels near the Colusa Rancheria would be negligible and would not affect groundwater pumping within Colusa Rancheria

The Redding Rancheria falls within the Redding Groundwater Basin, which is where Anderson-Cottonwood ID would make water available through groundwater substitution actions. The groundwater evaluation concludes that, although there would not be significant effects to groundwater elevations in the Redding Groundwater Basin based on past pump tests, and that Anderson-Cottonwood ID would develop and implement a Monitoring Program and Mitigation Plan because of the uncertainty of changes in groundwater levels in a critical water year. As a result, there would be no effects to the Redding Rancheria.

Because groundwater substitution pumping would not affect groundwater table elevations near the ITA sites, the Proposed Action would not affect ITAs.

## 4.2 Indian Sacred Sites

As defined by Executive Order 13007: Indian Sacred Sites, a sacred site "means any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." The affected environment for the Proposed Action does not include Federal land; therefore, there is no potential for Indian Sacred Sites to be affected by the Proposed Action.

## 4.3 Environmental Justice

Executive Order 12898 directs federal agencies to address disproportionately high and adverse human health and environmental effects on minority and low-income populations. Minority populations are American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic individuals in the affected environment that either: a) exceed 50 percent, or b) these populations are meaningfully greater[1] than the minority population percentage in the state (Federal Interagency Working Group on Environmental Justice and NEPA Committee 2016). Low-income populations in an affected area are identified based on the poverty thresholds from the Bureau of the Census Current Population Reports, Series P-60 on Income and Poverty.

California is a diverse state and Table 4-1 shows the minority population in the project study area (Glenn, Colusa, Sutter and Yolo counties) is similar to that of the State of California as a whole. During the 2013-2017 study period, the racial category with the highest percent of population in the project study area is white alone (70.5%). The ethnic category in the table of Hispanic or Latino represents those who self-identify themselves as "other Spanish, Hispanic, or Latino" on the census questionnaire. Yolo County had the highest percent of the population that self-identify as Hispanic or Latino of those in the project study area.

Table 4-1 also shows that the percent of low-income persons or families is not meaningfully greater than that of the rest California. Yolo County had the highest percent of families living below the poverty threshold.

Based on the data in Table 4-1 and a "meaningfully greater" analysis of percentages compared to the State of California, no minority or low-income populations are present in the study area that would be adversely affected by the proposal as described in this IS/EA. Therefore, the proposed action is not subject to the provisions of Executive Order 12898 and no further environmental justice analysis is required.

[1] Meaningfully Greater is a term used in "Appendix A, Text of Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Annotated with Proposed Guidance on terms" which is attached to CEQ's Environmental Justice Guidance under the National Environmental Policy Act (CEQ 1997).

**Table 4-1 Demographic characteristics of the Project Study Area, 2013-2017**

| | Glenn, Colusa, Sutter, and Yolo | California |
|---|---|---|
| Population, Numbers | 357,602 | 38,982,847 |
| White alone | 252,207 | 23,607,242 |
| Black or African American alone | 7,689 | 2,263,222 |
| American Indian alone | 3,025 | 292,018 |
| Asian alone | 44,790 | 5,503,672 |
| Native Hawaii & Pacific Is. alone | 1,579 | 152,027 |
| Some other race alone | 27,733 | 5,329,952 |
| Two or more races | 20,609 | 1,834,714 |
| Hispanic or Latino (of any race) | 119,643 | 15,105,860 |
| Poverty Prevalence, Numbers | | |
| People below Poverty | 63,874 | 5,773,408 |
| Families below Poverty | 9,137 | 983,740 |
| Percent of Total | | |
| White alone | 70.5 | 60.6 |
| Black or African American alone | 0.2 | 5.8 |
| American Indian alone | 0.8 | 0.7 |
| Asian alone | 12.5 | 14.1 |
| Native Hawaii & Pacific Is. alone | 0.4 | 0.4 |
| Some other race alone | 7.8 | 13.7 |
| Two or more races | 5.8 | 4.7 |
| Hispanic or Latino (of any race) | 33.5 | 38.8 |
| Poverty Prevalence, Percent | | |
| People below Poverty | 17.9 | 15.1 |
| Families below Poverty | 11.2 | 11.1 |

Sources: U.S. Census Bureau 2013-2017
* Average of American Community Survey Office statistics used from 2013-2017

# 4.4 Consultation and Coordination

## 4.4.1 Agencies and Persons Consulted

Reclamation consulted with the following agencies in preparing this IS/EA.

- Tehama Colusa Canal Authority
- U.S. Fish and Wildlife Service

# Appendix A

# Supplemental Material

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# Appendix A Supplemental Material

## A.1 List of Preparers

**Table A-1.**
**Lead NEPA and CEQA Agencies**

| Preparers | Agency | Participation |
|---|---|---|
| Jeff Sutton | Tehama-Colusa Canal Authority | Lead CEQA Agency Project Manager |
| Russ Grimes | Reclamation | Chief, Environmental Compliance and Habitat Conservation |
| Sheryl Looper | Reclamation | Deputy Regional Resources Manager |

**Table A-2.**
**Consultants**

| Name | Qualifications | Background/Expertise | Participation |
|---|---|---|---|
| **CDM Smith** | | | |
| Anusha Kashyap | M.S. Environmental Engineering<br>8 years experience | Environmental Engineer | Project Manager, Technical Review, Primary Author: Groundwater |
| Gina Veronese | M.S. Agricultural and Resource Economics<br>16 years experience | Water Resources Planner | Technical Review |
| Laura Lawson | B.S. Environmental Studies: Natural Resource Management and Conservation<br>3 years experience | Water Resources Planner | Deliverable Support, Primary Author: Biological Resources, Air Quality, and GHG |
| Abbie Woodruff | M.S. Urban and Environmental Planning<br>4 years experience | Water Resources Planner | Primary Author: Hydrology and Water Quality and Cumulative Impacts |
| Gwen Pelletier, ENV SP | M.S. Environmental Studies<br>16 years experience | Environmental Scientist | Technical Review:: Air Quality and Climate Change |
| Jennifer Jones | M.S. Environmental Science<br>20 years experience | Environmental Scientist | Technical Review: Biological Resources |

Key:
ENV SP = Envision Sustainability Professional
P.E. = Professional Engineer

# A.2 Acronyms

| | |
|---|---|
| AF | acre-feet |
| APCD | Air Pollution Control District |
| AQAP | Air Quality Attainment Plan |
| AQMD | Air Quality Management District |
| ATCM | Airborne Toxic Control Measure |
| bgs | below ground surface |
| BMO | basin management objective |
| C2VSim | Central Valley Groundwater-Surface Water Simulation Model |
| CAAQS | California Ambient Air Quality Standard |
| CARB | California Air Resources Board |
| CCR | California Code of Regulations |
| CDFW | California Department of Fish and Wildlife |
| CEQ | Council of Environmental Quality |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| $CH_4$ | methane |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| CVHM | Central Valley Hydrologic Model |
| CVP | Central Valley Project |
| CVPIA | Central Valley Project Improvement Act |
| dB | decibel |
| dBA | A-weighted decibel |
| dbh | diameter at breast height |
| DWR | Department of Water Resources |
| EA | Environmental Assessment |
| EDD | Employment Development Department |
| eGRID | Emissions & Generation Resource Integrated Database |
| EIS/EIR | Environmental Impact Statement/Environmental Impact Report |
| ESA | Endangered Species Acts |
| ETAW | evapotranspiration of applied water |
| GAMA | Groundwater Ambient Monitoring and Assessment |
| GGS | giant gartersnake |
| GHG | greenhouse gas |
| GIS | geographic information system |

| | |
|---|---|
| GMP | Groundwater Management Plan |
| GPS | global positioning system |
| GSP | Groundwater Sustainability Plan |
| GWP | global warming potential |
| HCP | Habitat Conservation Plan |
| hp | horsepower |
| ID | Irrigation District |
| IS | Initial Study |
| ITA | Indian Trust Asset |
| Ldn | day-night average sound level |
| MCL | maximum contaminant level |
| mg/L | milligrams per liter |
| MUD | Municipal Utility District |
| MWC | Mutual Water Company |
| $N_2O$ | nitrous oxide |
| NAAQS | National Ambient Air Quality Standard |
| NCCP | Natural Community Conservation Plan |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOx | nitrogen oxides |
| NRCS | Natural Resources Conservation Service |
| NSVPA | Northern Sacramento Valley Planning Area |
| $O_3$ | ozone |
| $PM_{10}$ | inhalable particulate matter |
| $PM_{2.5}$ | fine particulate matter |
| Reclamation | U.S. Department of the Interior, Bureau of Reclamation |
| ROD | Record of Decision |
| SACFEM2013 | Sacramento Valley Groundwater Model |
| SGMA | Sustainable Groundwater Management Act |
| SIP | state implementation plan |
| SLDMWA | San Luis & Delta-Mendota Water Authority |
| SRTTG | Sacramento River Temperature Task Group |
| SWP | State Water Project |
| SWRCB | State Water Resources Control Board |
| TCCA | Tehama-Colusa Canal Authority |
| TCR | The Climate Registry |
| TDS | total dissolved solids |
| USC | United States Code |

| | |
|---|---|
| USDA | U.S. Department of Agriculture |
| USEPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VOC | volatile organic compound |
| WY | water year |
| YSRCP | Yuba-Sutter Regional Conservation Plan |

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## Chapter 4 – Other Reclamation Environmental Compliance Requirements

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# Appendix B

# Special Status Wildlife Species with Potential to Occur

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**Special Status Species With Potential to Occur**

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Invertebrates** | | | | | | |
| **Conservancy fairy shrimp** *Branchinecta conservation* | E | -- | Northern two-thirds of the Central Valley. It ranges from Vina Plains of Tehama County; Sacramento NWR in Glenn County; Jepson Prairie Preserve and surrounding area east of Travis Air Force Base, Solano County; Mapes Ranch west of Modesto, Stanislaus County. | Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grass or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands. | Has been collected from early December to early May. | None. Occurrences have been documented within the Seller Service Area. Suitable habitat occurs within the project area. No impacts to vernal pool or other habitats occupied by this species are anticipated. The species is not likely to occur to occur in crop fields and canals due to lack of suitable habitat. |
| **Lange's metalmark butterfly** *Apodemia mormo langei* | E | -- | Restricted to sand dunes along the southern bank of the Sacramento-San Joaquin River. Within Contra Costa County, it is currently found only at Antioch Sand Dunes. | Inhabits stabilized dunes along the San Joaquin river and is endemic to Antioch sand dunes, Contra Costa county. The butterfly's primary host plant is Eriogonum nudum var. auriculatum. It feeds on nectar of other wildflowers, as well as host plant. | Breeding season is August -September, Larvae hatch during rainy months. | None. No CNDDB occurrences have been documented within the Seller Service Area, In addition, no impacts to sand dunes are anticipated. |
| **San Bruno elfin butterfly** *Callophrys mossii bayensis* | E | -- | Found in vicinity of San Bruno mountains, San Mateo County (ESSIG 2012b). | Found in coastal, mountainous areas with grassy ground cover. Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is Sedum spathulifolium. | Year round | None. No occurrences have been documented in the Seller Service Area and suitable habitat is not present in the area. No impacts are anticipated to mountainous areas near San Bruno. Therefore no impacts to the species are expected. |
| **Valley elderberry longhorn beetle** *Desmocerus californicus dimorphus* | T,X | -- | Central Valley and surrounding foothills below 3,000 feet elevation. | Dependent on elderberry shrubs (host plant) as a food source. Potential habitat is shrubs with stems 1 inch in diameter within Central Valley. | Year round for host plant and exit holes; March-June for adults | None. Elderberry shrubs will not be impacted, therefore no impact to beetles will occur. |
| **Vernal pool fairy shrimp** *Branchinecta lynchi* | T,X | -- | Endemic to the Central Valley, Central Coast Mountains, and South Coast Mountains of California. It ranges from the Stillwater Plain in Shasta County through most of the length of the Central Valley to Paisley in Tulare County, and along the central Coast Range from northern Solano County to Pinnacles National Monument in San Benito County. Disjunct populations were also reported to occur in San Luis Obispo County, Santa Barbara County, and Riverside County. | Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grassed or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands. | Has been collected from early December to early May. | None. Occurrences have been documented in the Seller Service areas. Crop fields and canals are not likely to support this species due to lack of suitable habitat. The project is not expected to impact vernal pools or natural wetlands.Therefore, no impacts to the species are expected. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Vernal pool tadpole shrimp** *Lepidurus packardi* | E,X | -- | Endemic to the Central Valley of California, with the majority of the populations occurring in the Sacramento Valley. This species has also been reported from the Sacramento River Delta to the east side of San Francisco Bay, and from a few scattered localities in the San Joaquin Valley from San Joaquin County to Madera County | Found in a variety of natural and artificial seasonally ponded habitat types including: vernal pools, swales, ephemeral drainages, stock ponds, reservoirs, ditches, backhoe pits, and ruts caused by vehicular activities. | Has been collected from early December to early May. | None. Occurrences have been documented in the Seller Service area. Suitable habitat is present in the project area. Crop fields and canals are not likely to support this species due to lack of suitable habitat. The project is not expected to impact vernal pools or natural wetlands. Therefore, no impacts to the species are expected. |
| **Amphibians** | | | | | | |
| **California tiger salamander** *Ambystoma californiense* | T,X | T, WL | Found in annual grassland habitat, grassy understories of valley-foothill hardwood habitats, and uncommonly along stream courses in valley-foothill riparian habitats. Occurs from near Petaluma, Sonoma Co., east through the Central Valley to Yolo and Sacramento Counties and south to Tulare Co.; and from the vicinity of San Francisco Bay south to Santa Barbara County. | Lives in vacant or mammal-occupied burrows, occasionally other underground retreats, throughout most of the year, in grassland, savanna, or open woodland habitats. Lays eggs on submerged stems and leaves, usually in shallow ephemeral or semi permanent pools and ponds that fill during heavy winter rains, sometimes in permanent ponds; breeding takes place in fish free pools and ponds. | Migrates up to about 2 km between terrestrial habitat and breeding pond. Migrations may occur from November through April. | None. Occurrences have been documented within the Seller Service Areas. Suitable habitat may occur within the project area, but will not be impacted by the project. Cropland idling has the potential to improve habitat for the species. |
| **Foothill yellow-legged frog** *Rana boylii* | -- | CT, SSC | This species is known from the Pacific drainages from Oregon to the upper San Gabriel River, Los Angeles County, California, including the coast ranges and Sierra Nevada foothills in the United States. | This species inhabits partially shaded, rocky streams at low to moderate elevations, in areas of chaparral, open woodland, and forest. | Year round | None. Occurrences have been documented within the Seller Service Area. Suitable habitat is present within the project area. However, the project is not expected to impact any suitable rocky stream and woodland habitats. No impact to the species is expected. |
| **Western spadefoot** *Spea hammondii* | -- | SSC | This species occurs in the Central Valley and bordering foothills of California and along the Coast Ranges into northwestern Baja California, Mexico. | Lowlands to foothills, grasslands, open chaparral, pine-oak woodlands. Prefers shortgrass plains, sandy or gravelly soil. It is fossorial and breeds in temporary rain pools and slow-moving streams that do not contain bullfrogs, fish, or crayfish. | Year round. Usually in underground burrows most of year, but will travel several meters on rainy nights. Movement is rarely extensive. | None. Occurrences have been documented from Seller Service Areas. Suitable habitat is present in the project area. The project will not impact suitable upland habitat types. The species is not likely to occur in crop fields or canals due to the presence of predatory fish, bullfrogs etc. Cropland idling has the potential to improve habitat for the species. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Reptiles** | | | | | | |
| **Giant garter snake** *Thamnophis gigas* | T | T | Sacramento and San Joaquin Valleys from Butte County in the north to Kern County in the south. | Primarily associated with marshes, sloughs, and irrigation ditches. Generally absent in larger rivers. | Year round | High. In recent years, there have been 34 occurrences of this species in the Seller Service Area. Suitable habitat is present within the Seller Service Areas. Suitable habitat in the Seller Service Area is intermittent based on normal variation in cropping. Impacts may include reduction in suitable aquatic habitat within the Seller Service Area. Conservation measures are in place to maintain aquatic habitat corridors within irrigation ditches. |
| **Western pond turtle/ Pacific pond turtle** *Actinemys marmorata* | -- | SSC | Ranged from extreme western Washington and British Columbia to northern Baja California, mostly to the west of the Cascade-Sierra crest. | The western pond turtle occupies a wide variety of wetland habitats including rivers and streams (both permanent and intermittent), lakes, ponds, reservoirs, permanent and ephemeral shallow wetlands, abandoned gravel pits, stock ponds, and sewage treatment. | Year round | High. Suitable habitat occurs within the project area. Pond turtles may occur in ditches, canals, rice fields, etc. In recent years, there have been numerous occurrence of this species in the Seller Service Area. Impacts may include reduction in suitable aquatic habitat within the Seller Service Area. Conservation measures are in place to maintain aquatic habitat corridors within irrigation ditches. |
| **Birds** | | | | | | |
| **American peregrine falcon** *Falco peregrinus anatum* | D, MNBMC | D, FP | Throughout California. | Breeds in woodland, forest and coastal habitats on protected cliffs and ledges. Riparian areas and coastal and inland wetlands are important habitats yearlong especially during the non-breeding season. | Year round | None. Crop fields may provide suitable foraging habitat for the species, but birds could relocate to other habitat areas in the vicinity. No nesting habitat will be affected by the project. |
| **Bald eagle** *Haliaeetus leucocephalus* | D, BGEPA | E, FP | Throughout California. | Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance. | Year round | None. Occurrences have been documented within the Seller Service Area and both areas provide suitable habitat. No impacts to suitable nesting habitat are anticipated. Crop fields represent marginal foraging habitat. Birds would be able to relocate to other suitable habitat areas in the vicinity if fields were fallowed. Environmental commitments limit the amount of land that can be fallowed in a given county. |
| **Bank swallow** *Riparia riparia* | -- | T | A neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. Breeding population in California occurs along banks of the Sacramento and Feather rivers in the northern Central Valley. | Requires vertical banks and cliffs with fine-textured or sandy soils near streams, rivers, ponds, lakes, and the ocean for nesting. Feeds primarily over grassland, shrub land, savannah, and open riparian areas during breeding season and over grassland, brushland, wetlands, and cropland during migration. | March-mid-September | None. Known within the Seller Service Areas. No suitable nesting habitat (i.e. cliffs along rivers) will be affected from small changes in river flow. There is potential that the project would reduce the area of cropland habitat used for foraging during migration (wetlands and croplands) due to changes in water application. However, fallow cropland would still providing suitable foraging habitat, and birds could forage at other croplands in the vicinity. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Black tern** *Chlidonias niger* | -- | **SSC** | Common spring and summer visitor to fresh emergent wetlands of California. | Uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields. In migration, some take coastal routes and forage offshore. | April-September | Moderate. No occurrences have been documented within either the Buyer or Seller Service Areas. However, suitable habitat is present within the project area (i.e. rice fields) and the project area is within the known range for the species. Water transfers could reduce suitable habitat for the species within the Seller Service Area. Conservation strategies are in place that would reduce potential impacts to this species to negligible. |
| **Burrowing owl** *Athene cunicularia* | -- | **SSC** | Central and southern coastal habitats, Central Valley, Great Basin, and deserts. | Open annual grasslands or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Dependent upon burrowing mammals (especially California ground squirrel) for burrows. | Year round | None. Occurrences have been documented within Seller Service Area. Suitable habitat occurs within the project area. Agricultural ditches may be suitable habitat for burrowing owl burrow and nesting activity. Water transfers would not affect the suitability of habitat for burrowing owl in the project area. |
| **California black rail** *Laterallus jamaicensis coturniculus* | -- | **T, FP** | Pacific coast of California, along the lower Colorado River. During breeding season, the species can be found north of San Francisco | Tidal marshes and freshwater marshes, inhabit the drier portions of wetlands with vegetation dominated by fine-stemmed bulrush or grasses. | Year round | None. There are CNDDB records within Sacramento, Sutter, and Yolo counties. However, suitable habitat is unlikely to be impacted by water transfers. |
| **California clapper rail** *Rallus longirostris obsoletus* | **E** | -- | Common locally around San Francisco, Monterey, and Morro bay. | Found in salt-water and brackish marshes traversed by tidal sloughs. The bird is associated with abundant growths of pickle weed, but feeds on mud-bottomed sloughs. | Year round. Non-migratory in coastal wetlands. Juveniles may disperse to freshwater wetlands late summer and autumn. | None. No occurrences have been documented within the Seller Service Area. Suitable habitat does not occur within the project area. Transfers are not expected to impact any suitable habitat (i.e. salt-water marshes). |
| **California least tern** *Sterna antillarum browni* | **E** | -- | Nests along the coast from San Francisco Bay south to northern Baja California. Migratory in California. Breeding colonies in Southern California near marine and estuarine shores. In SF Bay found near salt ponds and estuarine shores. | Breeds on bare or sparsely vegetated, flat substrates, sand beaches, alkali flats, landfills or paved areas. Feeds in shallow, estuarine waters. | Late April in southern California to mid-May in northern California. Winters south of California. Absent from mid-October to late April. | None. No occurrences have been documented in the Seller Service Area. Suitable habitat is not found within the project area. No impacts are expected to suitable foraging or breeding habitat (i.e. sand beaches, alkali flats). |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Cooper's hawk** *Accipiter cooperii* | -- | WL | Throughout California | Frequents landscapes where wooded areas occur in patches and groves. Often uses patchy woodlands and edges with snags for perching. Dense stands with moderate crown-depths used for nesting. | Year round | None. Occurrences have been documented in Seller Service Area. Suitable habitat occurs within the project area. No potential impacts to preferred foraging or nesting habitat are anticipated. |
| **Double-crested cormorant** *Phalacrocorax auritus* | -- | WL | Along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters. Uncommon from San Luis Obispo County south and very rare to the north. Common on Colorado River reservoirs and common in the Central Valley. | Open water with offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or even transmission lines. Requires undisturbed nest-sites beside water, on islands or mainland. Uses wide rock ledges on cliffs; rugged slopes; and live or dead trees, especially tall ones. Found on inland lakes, fresh, and estuarine waters. | Year round along coastal regions. Winters inland. | None. No occurrences have been documented within the project area. No negative impacts to foraging or breeding habitat are expected. |
| **Ferruginous hawk** *Buteo regalis* | -- | WL | Winter resident and migrant at lower elevations and open grasslands in Modoc Plateau, Central Valley, and Coast ranges. Common winter resident of grassland and agriculture areas in southwestern California. Casual in northeast in summer. | Found in open grasslands, sagebrush flats, desert scrub, low foothills and fringes of pinyon-juniper habitats. | Migratory. Present in CA from Sept. to mid-April. | None. Occurrences have been documented in Sacramento County. Suitable habitat occurs within the project area. No potential impacts to preferred habitat are anticipated. |
| **Golden eagle** *Aquila chrysaetos* | BGEPA | FP | Throughout California | Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance. | Year round | None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat occurs within the project area. No impacts to nesting habitat are expected. |
| **Grasshopper sparrow** *Ammodramus savannarum* | -- | SSC | Throughout California's coastline and central valley | Breeds in open grasslands, prairies, hayfields, and pastures, typically with some bare gound. | Year round | None. There are CNDDB records of this species in Sacramento and Yolo counties. This species is unlikely to breed within dense crop fields, and therefore is unlikely to be affected by water transfers. |
| **Greater sandhill crane** *Grus canadensis tabida* | -- | T, FP | Breeds only in Siskiyou, Modoc and Lassen counties and in Sierra Valley, Plumas and Sierra counties. Winters primarily in the Sacramento and San Joaquin valleys from Tehama south to Kings Counties. | In summer, this race occurs in and near wet meadow, shallow lacustrine, and fresh emergent wetland habitats. Frequents annual and perennial grassland habitats, moist croplands with rice or corn stubble, and open, emergent wetlands. It prefers relatively treeless plains. | Migration southward is September-October and northward is March-April. | Moderate. No occurrences have been documented within the project area, but occurrences have been recorded in Butte and Sutter Counties. Suitable foraging and winter roosting habitat is present within the project area (i.e. rice fields). Water transfers could reduce suitable habitat for the species within the Seller Service Area. Conservation strategies are in place for this species and birds will have other suitable wintering sites available. |
| **Least bell's vireo** *Vireo bellii pusillus* | E | E | California to northern Baja. | Inhabits low, dense riparian growth along water or along dry parts of intermittent streams. Typically associated with willow, cottonwood, baccharis, wild blackberry, or mesquite in desert localities. | March-August | None. No occurrences have been documented in the Buyer Service Area. Suitable habitat may occur within the project action area. The project is not expected to impact any suitable willow or dense riparian habitat due to small changes in river flow, therefore no impacts to the species are anticipated. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Merlin** *Falco columbarius* | -- | WL | Occurs in most of the western half of California below 3,900 ft. Rare in Mojave Desert and Channel Islands. | Frequents coastlines, open grasslands, savannahs, woodlands, lakes, wetlands, edges, and early successional stages. Ranges from annual grasslands to ponderosa pine and montane hardwood-conifer habitats. | Winter migrant from September-May | None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in project area. Foraging habitat may be altered, but Transfers would not decrease suitability. No negative impacts are anticipated. |
| **Mountain plover** *Charadrius montanus* | -- | SSC | Found in Central Valley from Sutter and Yuba counties southward, foothill valleys west of San Joaquin Valley, Imperial Valley, plowed fields of Los Angeles and western San Bernardino County, and central Colorado river valley. Does not breed in California. | Found in short grasslands, freshly plowed fields, newly sprouting grain fields, and sod farms. Prefers grazed areas and areas with burrowing rodents. | Winter resident Sept. - March. | None. Occurrences have been documented in Seller Service Area. Suitable habitat occurs within the project area. Foraging habitat may be affected, but Transfers would not reduce suitability and individuals can relocate to other habitats within the area. |
| **Northern goshawk** *Accipiter gentilis* | -- | SSC | Throughout California | Nests in mature and old-growth forests with a majority of closed canopy. | Year round | None. There are two CNDDB occurrences in Glenn County. Suitable habitat is not present in the project area (i.e. old-growth forests). Water transfers would not affect this species. |
| **Northern harrier** *Circus cyaneus* | -- | SSC | Throughout lowland California, concentrated in the Central Valley and coastal valleys. | Breeds in annual grasslands and wetlands. Prefers marshes and grasslands for foraging and nesting. Also uses agricultural fields for nesting and foraging, although nests may be destroyed by agricultural activities. | Year round | None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in project area. Foraging and breeding habitat may be affected, but fallow fields would still represent suitable habitat. Birds can relocate to other habitats within the area. |
| **Northern spotted owl** *Strix occidentalis caurina* | T,X | -- | Distributed through the Cascade Range, coastal ranges, and as far south as Marin County. | Associated with forests characterized by dense canopy closer of mature and old-growth tree, abundant logs, and live trees with broken tops. | Year round | None. There are no occurrences of this species in the Seller Service Area. In addition, suitable habitat for the species is not present in the project area. This species will not be impacted by water transfers. |
| **Osprey** *Pandion haliaetus* | -- | WL | Northern California from Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County. | Associated strictly with large, fish-bearing waters, primarily in ponderosa pine through mixed conifer habitats. | Year round | None. Occurrences have been documented in Seller Service Area. Suitable habitat occurs within the project area. Water transfers would be subject to flow requirements. Therefore no impacts to foraging area expected. No impacts to nesting sites are anticipated. |
| **Prairie falcon** *Falco mexicanus* | -- | WL | Found from southeastern deserts northwest throughout Central Valley and inner Coast Ranges and Sierra Nevada. Mostly absent from northern coastal fog belt. Not found in upper elevation of Sierra Nevada. | Inhabits dry, open level or hilly terrain. Breeds on cliffs, forages far afield. Annual grassland to alpine meadows, but primarily perennial grasslands, rangeland, agricultural fields and desert scrub. | Permanent resident. Northern migrants winter in California. Upslope in summer, down slope in winter. | None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present within the project area. Foraging habitat (i.e. agricultural fields) may be altered, but Transfers would not reduce suitability. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Purple martin** *Progne subis* | -- | SSC | In south, found on the coast and interior mountain ranges. Absent from higher desert regions. In north, found on coast and inland to Modoc and Lassen counties. Absent from higher slopes of Sierra Nevada. Current breeding populations are known from western Santa Clara and Alameda counties, and western Placer County. | Inhabits woodlands, low elevation coniferous forest of Douglas-fir, ponderosa pine and Monterey pine. Uses open habitats during migration, including grassland, wet meadows, and fresh emergent wetlands. | Summer resident throughout California. | Low. CNDDB occurrences have been documented in Sacramento County. This species is restricted to fairly limited nesting sites with suitable cavities free of brood parasites. When wetlands are unavailable, rice fields may represent relatively high quality foraging habitat. This habitat may be slightly reduced by Transfers, but the species can relocate to other suitable habitat in the vicinity. Crop idling limitations are in place in the environmental commitments. |
| **Saltmarsh common yellowthroat** *Geothlypis trichas sinuosa* | -- | SSC | Resident and summer visitor in San Francisco Bay area. Winter south along coast to San Diego county. Found in No. CA in summer months. | Found in fresh and salt water marshes. Requires thick, continuous cover to water surface for foraging and tall grasses, tulle and willows for nesting. | Year-round in southern California and San Francisco Bay, Summer resident in northern California. | None. Occurrences have been documented in the Seller Service area and suitable habitat may be present in the project area. Not known from rice fields. Water transfers would not affect suitable breeding or foraging habitat. |
| **Song sparrow ("Modesto" population)** Melospiza melodia | -- | SSC | Distributed through the Central Valley from Butte to Stanislaus counties | Enormous variety of open habitats, including tidal marshes, arctic grasslands, desert scrub, chapparral agricultural fields, forest edges, and deciduous woodlands. | Year round. Breeds from mid-March to early August | None. Occurrences have been documents in the Seller Service area and suitable habitat may be present, i.e. agricultural fields. This species has a wide range of suitable habitat and therefore birds can relocate to other habitats within the area. |
| **Suisun song sparrow** *Melospiz melodia maxillaris* | -- | SSC | Endemic, restrict to Suisun Marsh from Carquinez Strait east to the confluence of the Sacramento and San Joaquin rivers near Antioch. Highest numbers near Benicia State Park and Martinez shoreline. | Resident of brackish-water marshes. Inhabits cattails, tulles, sedges, and salicornia. | Year round. Non-migratory. Breeds early March to July. | None. Occurrences have been documented in Sacramento County and suitable habitat may be present in the project area. However, no impacts are expected to brackish-water marshes. |
| **Swainson's hawk** *Buteo swainsoni* | MNBMC | T | Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley. | Nests in mature trees, including valley oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain and row crop fields. | Spring and Summer; small wintering population in the Delta | None. CNDDB occurrences have been documented within both the Seller Service Area. Suitable habitat is present within the project area. The project may alter the composition of foraging habitat in the Seller Service Areas, but these areas would still be suitable for the species, and additional habitats in the vicinity would be available. No impacts to riparian breeding habitat are expected from small changes in river flow. |
| **Tricolored blackbird** *Agelaius tricolor* | -- | T, SSC | A resident in California found throughout the Central Valley and in coastal districts from Sonoma County south. | Breeds near fresh water, preferably in emergent wetlands with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, tall herbs. Feeds in grassland and cropland habitats. | Year round | Moderate. In recent years, CNDDB occurrences have been documented in the Seller Service Area. Suitable habitat is present within the project area. Foraging habitat may be affected by the project. Environmental commitments limit cropland idling and birds can relocate to other adjacent foraging habitats within the area. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Western snowy plover** *Charadrius alexandrinus nivosus* | T | SSC | Along the west coast states, with inland nesting taking place at the Salton Sea, Mono Lake, and at isolated sites on the shores of alkali lakes in northeastern California, in the Central Valley, and southeastern deserts. | Nests, feeds, and takes cover on sandy or gravelly beaches along the coast, on estuarine salt ponds, alkali lakes, and at the Salton Sea. | Migration is from July-March (some year round populations). | None. Occurrences have been documented in Yolo County. There is a CNDDB occurrence in Yolo County, however this species is not likely to occur in rice fields. Suitable habitat may occur within the project area. However, Transfers are not expected to impact any suitable breeding or foraging habitat (i.e. sandy beaches or estuarine salt ponds). |
| **Western yellow-billed cuckoo** *Coccyzus americanus* | T,PX | E | Uncommon to rare summer resident in scattered locations throughout California. Breeding population along Colorado river, Sacramento and Owen Valley, along South Fork of Kern River, Santa Ana River and Amargosa River. May be present along San Luis Rey River. | Deciduous riparian thickets or forests with dense, low-level or understory foliage, and which abut on slow-moving watercourses, backwaters, or seeps. Willow almost always a dominant component of the vegetation. In Sacramento Valley, also utilizes adjacent orchards, especially of walnut. Nests in sites with some willows, dense low-level or understory foliage, high humidity, and wooded foraging spaces. | Summer migration is from June-September. | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present within the project area. However this species is not likely to occur in crop fields due to lack of suitable foraging and roosting habitat (i.e. dense riparian thickets). No impacts are anticipated to riparian breeding habitat due to small changes in river flow. |
| **White-faced ibis** *Plegadis chihi* | -- | WL | Uncommon summer resident in sections of southern California, a rare visitor in the Central Valley, and is more widespread in migration. | Feeds in fresh emergent wetlands, shallow lacustrine waters, muddy grounds of wet meadows, and irrigated or flooded pastures and croplands. Nests in dense, fresh emergent wetlands. | Present in California from April-October. | Low. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. Low potential impact to foraging habitat in the Seller Service Area. No potential impacts are expected to roosting habitat. Can relocate to other habitats within the area. Environmental committments would limit acreage of allowable cropland idling. |
| **White-tailed kite** *Elanus leucurus* | MNBMC | FP | Central Valley, coastal valleys, San Francisco Bay area, and low foothills of Sierra Nevada. | Savanna, open woodlands, marshes, partially cleared lands and cultivated fields, mostly in lowland situations (Tropical to Temperate zones). | Year round | None. CNDDB occurrences have been documented in the Seller Service Area. Suitable habitat is present within the project area. Foraging habitat may be altered, but will still be suitable for the species. No potential impacts to breeding habitat are anticipated. |
| **Yellow-headed blackbird** *Xanthocephalus xanthocephalus* | -- | SSC | Breeds in deep-water, emergent wetlands throughout nonforested regions of western North America. | Breed and roost in freshwater wetlands with dense, emergent vegetation such as cattails. They often forage in fields, typically wintering in large, open agricultural areas. | Year round | Low. Suitable habitat is present within the project area. Foraging habitat may be affected by the project. Environmental commitments limit cropland idling and birds can relocate to other adjacent foraging habitats within the area. |
| **Mammals** | | | | | | |
| **American badger** *Taxidea taxus* | -- | SSC | Throughout California. | Found in dry, open stages of most shrub, forest, and herbaceous habitats with friable soils. | Year round. Permanent resident except in North Coast area. | None. Occurrences have been documented in Seller Service Area and suitable habitat is present within the project area. Suitable habitats are not expected to be impacted. |
| **Fisher- West Coast DPS** *Pekania pennanti* | PT | T, SSC | Found throughout Washington, Oregon, and California | Late-successional coniferous or mixed forests, with relatively large diameter trees, high canopy closure, large trees (hardwood and conifer) with cavities, and large down wood. | Year round. | None. Occurrences have been documented in Glenn and Colusa counties. Suitable habitat is not present and will not be impacted due to water transfers. |
| **Humboldt marten** *Martes caurina humboldtensis* | -- | CE, SSC | Found in the northern counties of California along the Oregon state border | Largest patches of old-growth and late-mature forests and serpentine habitat. | Year round. | None. There is one occurrence of this species in the Seller Service Area. Suitable habitat is not present within the project area. The species is not likely to be impacted by water transfers. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Marysville California kangaroo rat** *Dipodomys californicus eximius* | -- | SSC | Known only from the Sutter Buttes area in Sutter County | Friable soils in chaparral and valley & foothill grasslands | Year round. | None. There are two occurrences of this species in Sutter County. Suitable habitat is not present within the project area. The species is not likely to be impacted by water transfers. |
| **Pallid bat** *Antrozous pallidus* | -- | SSC | Throughout California, except for high Sierra Nevada from Shasta to Kern counties, northwestern corner of state from Del Norte & western Siskiyou county. To northern Mendocino County. | Found in deserts, grasslands, scrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. | Year round. | None. Occurrences have been documented within the Seller Service Area. Suitable habitat may occur within the project area. No impacts would occur to suitable habitat. |
| **Riparian brush rabbit** *Sylvilagus bachmani riparius* | E | -- | Isolated populations on Caswell Memorial State Park on the Stanislaus River and along an overflow channel of the San Joaquin River. | Riparian thickets | Year round | None. No CNDDB records of this species have been documented in the project area. Suitable habitat is present in the project area, however, no potential impacts are expected to suitable habitat (i.e. riparian thickets). |
| **Salt-marsh harvest mouse** *Reithrodontomys raviventris* | E | E, FP | Found in San Francisco Bay and its tributaries. | Found in saline emergent wetlands. Pickle weed is the primary habitat for the species. Requires higher grassland areas for flood escape. | Year round. | None. One CNDDB occurrence has been documented in the Seller Service Area and suitable habitat may be present in the project area. Transfers would not impact saline wetlands and salt marshes. |
| **San Joaquin kit fox** *Vulpes macrotis mutica* | E | T | Found only in the Central Valley area of California. Kit foxes currently inhabit suitable habitat in the San Joaquin valley and in surrounding foothills of the Coast Ranges, Sierra Nevada, and Tehachapi Mountains; from southern Kern County north to Contra Costa, Alameda, and San Joaquin counties on the west; and near La Grange, Stanislaus County on the east. | Found in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub. Build dens for cover. Some agricultural areas may support these foxes. | Year round (mostly nocturnal, but often active during daytime in cool weather) | None. No occurrences have been documented within the Seller Service Area. Suitable habitat, i.e. agricultural fields is present within the project area. However due to the lack of local occurrences, the proposed project is not likely to impact this species. |
| **Townsend's big-eared bat** *Corynorhinus townsendii* | -- | SSC | Along the California coastline | Habitat associations include coniferous forests, deserts, native prairies, riparian communties, active agricultural areas, and coastal habitat types. Populations centers occuring in areas dominated by exposed, cavity forming rock and/or historic mining districts. | Year round. | None. There are CNDDB records for this species in Yolo and Colusa counties. Appropriate rock formations are not present in the project area and will not be impacts by water tranfsers. |
| **Western mastiff bat** *Eumops perotis californicus* | -- | SSC | Found in southeastern San Joaquin Valley and Coastal ranges from Monterey County southward through southern California and from the coast eastward to Colorado Desert. | Found in open, semi-arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, and chaparral. Roost in crevices in cliff faces, high buildings, trees and tunnels. | Year round | None. There is one CNDDB occurrence in the Seller Service Area and suitable habitat is present within the project area. No impacts are anticipated to feeding or roosting habitat. |
| **Western red bat** *Lasiurus blossevillii* | -- | SSC | Occurs from Shasta County to Mexican border, west of Sierra Nevada/Cascade crest and deserts. Winters in western lowlands and coastal regions south of SF bay. Not found in desert areas. | Found in trees 2-40ft above ground, from sea level up through mixed conifer forests. Prefers habitat edges and mosaics with trees. Feeds over a wide variety of habitats including grasslands, scrublands and croplands. | Year round. Migrates in spring (March-May) and autumn (Sept.-Oct). Migrates between summer and winter range | None. Occurrences have been documented in the Seller Service Area and suitable habitat is present within the project area. No impacts to roosting habitat are anticipated. Transfers could alter the configuration of foraging habitat, but would not reduce suitability. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Fish** | | | | | | |
| **Chinook Salmon (Winter-run)** *Oncorhynchus tshawytscha* | E | E | Distributed throughout northern California | Utilizing both fresh and salt water habitats, this species requires spawning sites within the stream or iver where water velocity, depth, and gravel size are optimal for the incubation of developing eggs. | Spawning December - Early August | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. However, flow reductions as a result of this project would be low and would not affect this species. |
| **Chinook Salmon (Spring-run)** *Oncorhynchus tshawytscha* | T | T | Distributed throughout northern California | Same as described in Chinook Salmon (Winter-run) | Spawning Late March - September | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. However, flow reductions as a result of this project would be low and would not affect this species. |

| Common Name Scientific Name | Federal Special Status* | State Special Status* | Distribution | Habitat Association | Seasonal Occurrence | Potential For Impact |
|---|---|---|---|---|---|---|
| **Central Valley Steelhead** *Oncorhynchus mykiss* | T | -- | Native to streams along the Pacific coast of North America | Populations inhabit small headwater streams, large rivers, lakes, or reservoirs; often in cool clear lakes and cool swift streams with silt-free substrate. Usually requires a gravel riffle for successful spawning. | Year round | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. However, flow reductions as a result of this project would be low and would not affect this species. |
| **Green sturgeon** *Acipenser medirostris* | T | -- | Throughout northern and central California; Humboldt Bay, San Francisco Bay and Delta, Monterey Bay, Sacramento, Feather, and Yuba Rivers. | Utilizing both freshwater and saltwater habitat, Green Sturgeon spawn in deep pools, in large turbulent freshwater river mainstems. | Year round | None. No occurrences have been documented in the Seller Service Area. In addition, flow reductions as a result of this project would be low and would not affect this species. |
| **Hardhead** *Mylopharodon conocephalus* | -- | SSC | Widely distributed in streams at low to mid-elevations in the Sacramento-San Joaquin and Russian River drainages. | Found at low to mid-elevations in relatively undisturbed habitats of larger streams with high water quality. In the Sacramento River, however, they are common in both the mainstream and tributaries up to approximately 5,000 feet in elevation. | Year round | None. No occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. However, flow reductions as a result of this project would be low and would not affect this species. |
| **Sacramento splittail** *Pogonichthys macrolepidotus* | -- | SSC | Largely confined to the Delta, Suisun Bay, Suisun Marsh, Napa River, Petaluma River, and other parts of the San Francisco Estuary, while spawning on upstream floodplains and channel edges. | Adapted to estuarine life so thet are tolerant of a wide range of salinities and temperatures. Require a rising hydrograph for upstream migration and flooded vegetation for spawning and rearing areas for their early life history stages. | Year round | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. However, flow reductions as a result of this project would be low and would not affect this species. |
| **Chinook Salmon (Fall/late-fall run)** *Oncorhynchus tshawytscha* | -- | SSC | Found primarily in the Sacramento River. | Same as described in Chinook Salmon (Winter-run) | Spawning in July - December | None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. However, flow reductions as a result of this project would be low and would not affect this species. |

T = listed as threatened under the federal Endangered Species Act

C = Candidate for listing as threatened or endangered

SC = species of concern; formerly Category 2 candidate for federal listing

BGEPA = Bald and Golden Eagle Protection Act

MNBMC = Fish and Wildlife Service: Migratory Nongame Birds of Management Concern

-- = no designations

X = critical habitat

PX = proposed critical habitat

D = delisted

**State**

E = listed as endangered under the California Endangered Species Act

T = listed as threatened under the California Endangered Species Act

PT- listed as proposed threatened under Federal Endangered Species Act

CE = candidate endangered under the California Endangered Species Act

FP = fully protected under the California Fish and Game Code

SSC = species of special concern

D= delisted

WL = Watch List

-- = no designations

# Appendix C

# Special Status Plant Species with Potential to Occur

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| Common Name<br>Scientific name | Special Status*<br>(F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Adobe-lily**<br>*Fritillaria pluriflora* | -/-/ 1B | Butte, Colusa, Glenn, Lake, Napa, Solano, Tehama, and Yolo Counties | Often adobe, chaparral, cismontane woodland, and valley/ foothill grassland | February-April | None. Not likely to occur in crop fields, no suitable habitat present. |
| **Ahart's dwarf rush**<br>*Juncus leiospermus* var. *ahartii* | -/-/ 1B | Butte, Calaveras, Placer, Sacramento, Tehama, and Yuba Counties. | Valley and foothill grassland (mesic). | March-May | None. Not likely to occur in crop fields, no suitable habitat present. |
| **Alkali milk-vetch**<br>*Astragalus tener var. tener* | -/-/ 1B | Central western California including Yolo County. | Subalkaline flats and areas around vernal pools. | March-June | None. Not likely to occur in crop fields, no suitable habitat present (i.e. subalkali flats). |
| **Anthony Peak lupine**<br>*Lupinus antoninus* | -/-/ 1B | Colusa, Lake, Mendocino, Tehama, and Trinity Counties | Rocky lower and upper montane coniferous forest | May-July | None. Not likely to occur in crop fields, no suitable habitat present (i.e. coniferous forest). |
| **Antioch Dunes evening-primrose**<br>*Oenothera deltoides* ssp. *howellii* | E,X/E/ 1B | Found only in Contra Costa and Sacramento Counties. | Occurs in inland dunes. | March-September | None. Not likely to occur in crop fields, no suitable habitat present. |
| **Baker's navarretia**<br>*Navarretia leucocephala ssp. bakeri* | -/-/1B | Colusa, Glenn, Lake, Lassen, Mendocino, Marin, Napa, Solano, Sonoma, Sutter, Tehama, and Yolo Counties. | Cismontane woodland, meadows and seeps, vernal pools, valley and foothill grassland, lower montane coniferous forest. Vernal pools and swales, adobe or alkaline soils from 5 - 950m. | April - July | None. The CNDDB contains records of this species within the Seller Service Area. It is very unlikely that Baker's navarretia would establish in rice fields, given the lack of adobe or alkaline soils. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **bearded popcornflower** *Plagiobothrys hystriculus* | -/-/1B | Napa, Solano, and Yolo Counties. | Vernal pools, valley and foothill grassland in wet sites from 10-50m. This species is only known from a few very limited occurrences at the edges of vernal pools, such as at Jepson Prairie and in the Montezuma Hills. | April - May | None. Previous records of bearded popcorn-flower exist within the Seller Service Area. This species is not expected to occur in rice fields. No vernal pools or grassland habitats would be affected by the proposed Transfers. |
| **bent-flowered fiddleneck** *Amsinckia lunaris* | -/-/1B | Alameda, Contra Costa, Colusa, Lake, Marin, Napa, San Benito, Santa Clara, Santa Cruz, San Mateo, Sonoma, and Yolo Counties. | Cismontane woodland, valley and foothill grassland from 50 - 500m. | March - June | None. Bent-flowered fiddleneck has been previously documented within the Buyer Service Area. Although suitable habitat occurs within the area of analysis, none would be affected by the proposed actions. |
| **big-scale balsamroot** *Balsamorhiza macrolepis* | -/-/1B | Alameda, Butte, Colusa, El Dorado, Lake, Mariposa, Napa, Placer, Santa Clara, Solano, Sonoma, Tehama, and Tuolumne Counties. | Valley and foothill grassland, cismontane woodland. Sometimes on serpentine. 35 - 1000m | March - June | None. This species has been previously documented within both the Buyer Service Areas. However, it is not expected to occur in rice fields due to lack of suitable habitat. |
| **Boggs Lake hedge-hyssop** *Gratiola hetersepela* | -/-/1B | Dispersed throughout the Sacramento and Central Valley. Also in Oregon. | Marsh's, swamps, and vernal pools (clay). | April-August | None. There is a CNDDB occurrence within Sacramento County. Suitable habitat is present but has low potential to occur. No effects anticipated from small changes in river flow. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Bolander's horkelia** *Horkelia bolanderi* | -/-/1B | Colusa, Lake, and Mendocino counties | The edges and vernally mesic areas of chaparral, lower montane coniferous forest, meadows and seeps, and valley/ foothill grassland. | May-August | None. There is a CNDDB occurrence within Colusa County. However, it is not expected to occur in rice fields due to lack of suitable habitat and no effects are anticipated from small changes in river flow. |
| **Brittlescale** *Atriplex depressa* | -/-/1B | Western Central Valley and valleys of adjacent foothills. | Alkali grassland, alkali meadow, alkali scrub, and vernal pools. | April-October | There is a CNDDB occurrence within Glenn, Colusa, and Yolo counties, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. alkali and vernal pools). |
| **Burke's Goldfields** *Lasthenia burkei* | E/-/- | Lake, Mendocino, Napa, and Sonoma counties | Meadows and seeps (mesic), and vernal pools | April-June | None. Although suitable habitat may be present, no CNDDB occurrences were reported in the Seller Service Area. No effects anticipated from small changes in river flow. |
| **Butte County Meadowfoam** *Limnanthes floccosa ssp. californica* | E/-/- | Butte County | Valley and foothill grassland (mesic) and vernal pools | March-May | None. Suitable habitat is not present and no CNDDB occurrences were reported in the Seller Service Area. No effects anticipated from small changes in river flow. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **California alkali grass** *Puccinellia simplex* | -/-/1B | Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Lake, Los Angeles, Madera, Merced, Napa, San Bernardino, Santa Clara, Santa Cruz, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo counties | Alkaline, vernally mesic sinks, flats, and lake margins of chenopod scrub, meadows and seeps, valley and foothill grasslands, and vernal pools | March-May | None. CNDDB records exist for the Seller Service Area. Transfers are not expected to impact suitable habitat for this species. |
| **caper-fruited tropidocarpum** *Tropidocarpum capparideum* | -/-/1B | Alameda, Contra Costa, Fresno, Glenn, Monterey, Santa Clara, San Joaquin, and San Luis Obispo Counties. | Valley and foothill grassland in alkaline clay 0 - 455m asl. | March - April | None. CNDDB records exist in Glenn County. Transfers are not expected to impact suitable habitat for this species. |
| **Cobb Mountain lupine** *Lupinus sericatus* | -/-/1B | Colusa, Lake, Napa, and Sonoma Counties | Broadleafed upland forest, chaparral, cismontane woodland, and lower montane coniferous forest | March-June | None. There is a CNDDB occurrence within Colusa County, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. coniferous forest). |
| **Colusa grass** *Neostapfia colusana* | T,X/E/1B | Southern Sacramento Valley, and northern San Joaquin Valley. | Vernal pools. | May-July | None. There is a CNDDB occurrence within Glenn and Colusa counties, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. vernal pools). |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Colusa layia** *Layia septentrionalis* | -/-/1B | Colusa, Glenn, Lake, Mendocino, Napa, Sonoma, Sutter, Tehama, and Yolo Counties. | Chaparral, cismontane woodland, valley and foothill grassland. Scattered colonies in fields and grassy slopes in sandy or serpentine soil 145 - 1095m asl. | April - May | None. CNDDB records exist for the Seller Service Area. Transfers are not expected to impact suitable habitat for this species given that rice fields do not provide appropriate conditions. |
| **Contra Costa Goldfields** *Lasthenia conjugens* | E/-/- | San Francisco Bay Delta Regions, and scattered coastal areas. | Cismontane woodlands, playas, valley and foothill grasslands, and vernal pools. Often occurs in vernal pools, swales, and low depressions in open grassy areas 1 - 445m asl. | March-June | None. Suitable habitat is not present and no CNDDB occurrences were reported in the Seller Service Area. No effects anticipated from small changes in river flow. |
| **Contra Costa Wallflower** *Erysimum capitatum var. angustatum* | E,X/-/- | Contra Costa County | Inland dunes. Stabilized dunes of sand and clay near Antioch along the San Joaquin River 3 - 20m asl. | March - July | None. Suitable habitat is not present and no CNDDB occurrences were reported in the Seller Service Area. No effects anticipated from small changes in river flow. |
| **Coulter's goldfields** *Lasthenia glabrata ssp. coulteri* | -/-/1B | Colusa, Kern, Los Angeles, Merced, Orange, Riverside, Santa Barbara, San Bernardino, San Diego, San Luis Obispo, Tehama, Tulare, Ventura, and Yolo counties | Marshes and swamps, playas, and vernal pools | February-June | None. CNDDB records exist in Colusa and Glenn counties. Transfers are not expected to impact suitable habitat for this species. |
| **Crampton's tuctoria (Solano grass)** *Tuctoria mucronata* | E,X/E/1B | Located only in Yolo and Solano Counties. | Valley and foothill grassland (mesic), and vernal pools. | April-August | None. Not likely to occur in crop fields, no suitable habitat present. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Deep-scarred cryptantha** *Cryptantha excavata* | -/-/1B | Colusa, Lake, Mendocino, and Yolo counties | Sandy and gravelly portions of cismontane woodland | April-May | None. There are CNDDB records of this species within Yolo and Colusa counties. However, it is not expected to occur in rice fields due to lack of suitable habitat and no effects are anticipated from small changes in river flow. |
| **Delta tule pea** *Lathyrus jepsonii var. jepsonii* | -/-/1B | Contra Costa, Napa, Sacramento, San Joaquin, Solano, Sonoma and Yolo Counties. | Marshes and swamps (freshwater and brackish) | May-July | None. This species has been previously documented within the Seller Service Area. No impacts to suitable habitat is anticipated. |
| **Diamond-petaled California poppy** *Eschscholzia rhombipetala* | -/-/1B | Alameda, Contra Costa, Colusa, San Joaquin, San Luis Obispo, Stanislaus Counties. | Valley and foothill grassland. Alkaline clay slopes and flats. 0 - 975m asl. | March - April | None. This species has been previously documented in Colusa County. No impacts to suitable habitat are anticipated. |
| **Drymaria-like western flax** *Hesperolinon drymarioides* | -/-/1B | Colusa, Glenn, Lake, Napa, and Yolo Counties | Serpentinite closed-cone coniferous forest, chaparral, cismontane woodland, and valley and foothill grassland. | May-August | None. There are CNDDB occurrences in Glenn and Colusa counties, however this species is not likely to occur in crop fields due |
| **Dwarf soaproot** *Chlorogalum pomeridianum var. minus* | -/-/1B | Alameda, Colusa, Glenn, Lake, Santa Clara, San Luis Obispo, Sonoma, and Tehama Counties | Chaparral (serpentinite) | May-August | None. There are CNDDB records in Glenn and Colusa counties; however not likely to occur in crop fields, no suitable habitat will be impacted. |
| **El Dorado bedstraw** *Galium californicum ssp. sierrae* | E/-/- | El Dorado County | Gabbroic chaparral, cismontane woodland, and lower montane coniferous forest | May-June | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |

| Common Name<br>Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Ferris' milk-vetch**<br>*Astragalus tener* var. *ferrisae* | -/-/1B | Sacramento Valley. | Subalkaline flats and areas around vernal pools. | March-June | None. Although there are CNDDB occurrences within the Seller Service Area, the species is not likely to occur in crop fields, no suitable habitat will be impacted. |
| **Fleshy Owl's-clover**<br>*Castilleja campestris ssp. succulenta* | T,X/-/- | Fresno, Madera, Merced, Mariposa, San Joaquin, and Stanislaus Counties | Vernal pools, oftern acidic | March-May | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **green jewelflower**<br>*Streptanthus hesperidis* | -/-/1B | Colusa, Glenn, Lake, Napa, Sonoma, and Yolo Counties | Serpentinite, rocky chaparral and cismontane woodlands | May-July | None. There are CNDDB records in Glenn and Yolo counties; however not likely to occur in crop fields, no suitable habitat will be impacted. |
| **Greene's narrow-leaved daisy**<br>*Erigeron greenei* | -/-/1B | Colusa, Lake, Napa, and Sonoma Counties | Serpentinite or volcanic chaparral | May-September | None. There are CNDDB records in Colusa County; however not likely to occur in crop fields, no suitable habitat is present. |
| **Greene's tuctoria**<br>*Tuctoria greeni* | E/SSC/1B | Butte, Colusa, Fresno, Glenn, Madera, Merced, Modoc, Shasta, San Joaquin, Stanislaus, Tehama, and Tulare Counties. | Vernal pools. | May-July | There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. vernal pools). |
| **Hairy Orcutt grass**<br>*Orcuttia pilosa* | E/E/1B | Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento counties. | Vernal pools. | May-September | None. There is a CNDDB occurrence within Butte and Glenn counties, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. vernal pools). |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Hall's harmonia** *Harmonia hallii* | -/-/1B | Colusa, Lake, Napa, and Yolo Counties | Serpentinite chaparral | April-June | None. CNDDB records exist for the Seller Service Area. Transfers are not expected to impact suitable habitat for this species. |
| **Hartweg's golden sunburst** *Pseudobahia bahiifolia* | E/-/1B | Fresno, Madera, Merced, Stanislaus, Tuolumne, and Yuba counties | Clay and often acidic, cismontane woodland, and valley and foothill grassland | March-April | None. CNDDB records exist within Sutter County. Transfers are not expected to impact suitable habitat for this species. |
| **Heartscale** *Atriplex cordulata* | -/-/1B | Western Central Valley and valleys of adjacent foothills. | Alkali grasslands, alkali meadows, and alkali scrub. | May-October | None. There is a CNDDB occurrence within Butte, Colusa, Yolo, and Glenn counties, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. alkali areas). |
| **Heckard's pepper-grass** *Lepidium latipes* var. *heckardii* | -/-/1B | Glenn, Solano, and Yolo Counties. | Valley and foothill grassland alkaline flats. | March-May | None. There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. alkali flats). |
| **Hoover's cryptantha** *Cryptantha hooveri* | -/-/1A | Contra Costa, Kern, Madera, Stanislaus Counties. | Valley and foothill grassland in coarse sand up to 150m asl. | April - May | None. Hoover's cryptantha has been observed within the Seller Service Area. No impacts to suitable habitat for this species are anticipated. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Hoover's spurge** *Chamaesyce hooveri* | T/-/ 1B | Scattered in Glenn, Butte, Colusa, Merced, Stanislaus, Tehama, and Tulare Counties. | Vernal pools. | July-September | None. There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. vernal pools). |
| **Indian valley brodiaea** *Broiaea coronaria* ssp. *rosea* | -/E/1B | Scattered in Glenn, Lake, Colusa, and Tehama Counties. | Closed cone coniferous forest, chaparral, valley and foothill grasslands (serpentinite). | May-June | None. There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat. |
| **Ione (incl. Irish Hill) Buckwheat** *Eriogonum apricum (incl. var. prostratum)* | E/-/- | Amador and Sacramento Counties | Chaparral | July-October | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **Ione Manzanita** *Arctostaphylos myrtifolia* | T/-/- | Amador and Calaveras counties | Acidic, ione soil, clay or sandy chaparral and cismontane woodland | November-March | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **Jepson's coyote-thistle** *Eryngium jepsonii* | -/-/1B | Alameda, Amador, Calaveras, Contra Costa, Fresno, Napa, San Mateo, Solano, Stanislaus, Tuolumne, and Yolo counties | Clay soils of valley and foothill grassland and vernal pools | April-August | None. The species has been observed within the Seller Service Area. No impacts to suitable habitat for this species are anticipated. |
| **Jepson's leptosiphon** *Leptosiphon jepsonii* | -/-/1B | Lake, Napa, Sonoma, and Yolo counties | Usually volcanic soils of chaparral, cismontane woodland, and valley and foothill grassland | March-May | None. The species has been observed within Yolo County. No impacts to suitable habitat for this species are anticipated. |
| **Jepson's milk-vetch** *Astragalus rattanii var. jepsonianus* | -/-/1B | Colusa, Glenn, Lake, Napa, Tehama, and Yolo counties. | Chaparral, cismontane woodland, valley and foothill grassland, often serpentinite. | April-June | None. There are CNDDB occurrences, however this species is not likely to occur in crop fields due to lack of suitable habitat. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Keck's checkerbloom** *Sidalcea keckii* | E/-/1B | Colusa, Fresno, Merced, Napa, Solano, Tulare, and Yolo counties. | Cismontane woodlands, foothill and valley grasslands (serpentinite). | April-May | None. Thereare CNDDB occurrences, however this species is not likely to occur in crop fields due to lack of suitable habitat. |
| **Klamath sedge** *Carex klamathensis* | -/-/1B | Colusa, Lake, and Tehama counties | Serpentinite chaparral, cismontane woodland, and meadows/ seeps | -- | None. Klamath sedge has been recorded by the CNDDB within the Seller Service Area. No impacts would occur to suitable habitat. |
| **Konocti manzanita** *Arctostaphylos manzanita ssp. elegans* | -/-/1B | Colusa, Glenn, Humbodlt, Lake, Mendocino, Napa, Shasta, Sonoma, Tehama, and Trinity counties | Volcanic soils of chaparral, cismontane woodland, and lower montane coniferous forest | January-July | None. There is a CNDDB occurrence within Glenn and Colusa counties, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. coniferous |
| **Large-flowered fiddleneck** *Amsinckia grandiflora* | E/-/- | Alameda, Contra Costa, and San Joaquin Counties. | Cismontane woodland, valley and foothill grassland. Annual grassland in various soils 275 - 550m asl. | April - May | None. Large-flowered fiddleneck has been recorded by the CNDDB within the Seller Service Area. No impacts would occur to suitable habitat. |
| **Layne's Butterweed** *Senecio layneae* | T/-/1B | El Dorado, Placer, Tuolumne, and Yuba counties | Serpentinite or gabbroic, rocky soils of chaparral and cismontane woodland | April-August | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **Legenere** *Legenere limosa* | SC/-/1B | Sacramento Valley and south of the North Coast Ranges. | Vernal pools. | May-June | None. Not likely to occur in crop fields, no suitable habitat present (i.e. vernal pools) |

| Common Name<br>Scientific name | Special Status*<br>(F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Lone buckwheat**<br>*Eriogonum apricum* var. *apricum* | E/E/1B | Found in Amador and Sacramento Counties. | Chaparral. | July-October | None. There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat (chaparral). |
| **Marsh checkerbloom**<br>*Sidalcea oregana* ssp. *hydrophila* | -/-/1B | Glenn, Lake, Mendocino, and Napa Counties. | Meadows and seeps, and riparian forest. | June-August | None. There are CNDDB records of this species within the Seller Service Area. Not likely to establish in crop fields and no effects anticipated from small changes in river flow. |
| **Mason's lilaeopsis**<br>*Lilaeopsis masonii* | -/R/1B | Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, Solano, and Yolo Counties. | Freshwater and brackish marshes, riparian scrub. Tidal zones, in muddy or silty soil formed through river deposition or river bank erosion 0 - 10m asl. Populations may be ephemeral, using | April - November | None. Previous records of this species exist within the Buyer Service Area. This species is not expected to establish within rice fields. |
| **Milo Baker's lupine**<br>*Lupinus milo-bakeri* | -/T/1B | Glenn and Mendocino Counties. | Cismontane woodlands, foothill and valley grasslands. | June-September | None. There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat. |
| **Oregon fireweed**<br>*Epilobium oreganum* | -/-/1B | Del Norte, El Dorado, Glenn, Humboldt, Mendocino, Nevada, Placer, Shasta, Siskiyou, Tehama, and Trinity counties | Mesic soils of bogs, fens, lower montane coniferous forest, meadows, seeps, and upper montane coniferous forest | June-September | None. CNDDB records of this species exist within Glenn County. Suitable habitat is not present and species is not likely to be impacted by water transfers. |
| **Palmate-bracted bird's-beak**<br>*Chloropyron palmatum* | E/E/1B | Found in Glenn and Colusa Counties and within the Central Valley. | Alkali meadow, alkali scrub, valley and grasslands. | May-October | None. CNDDB records of this species exist for the Seller Service Area. Not likely to occur in rice fields; no suitable habitat is present (i.e. alkali areas). |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Pappose tarplant** *Centromadia parryi ssp. parryi* | -/-/1B | Butte, Colusa, Glenn, Lake, Napa, San Mateo, Solano, Sonoma, and Yolo counties | Often alkaline soils of chaparral, coastal prairie, meadows and seeps, marshes and swamps, and valley and foothill grassland | May-November | None. There are occurrences within Glenn, Colusa, and Yolo counties. This species is not expected to establish within rice fields. |
| **Pincushion navarretia** *Navarretia myersii ssp. myersii* | -/-/1B | Amamdor, Calaveras, Merced, Placer, and Sacramento Counties. | Vernal pools (often acidic). | May | None. Previously documented in Sacramento County. No vernal pools would be affected by Transfers. |
| **Pine Hill ceanothus** *Ceanothus roderickii* | E/-/- | El Dorado County | Serpentinite or gabbroic soils of chaparral and cismontane woodland | April-June | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **Pine Hill flannelbush** *Fremonodendron californicum ssp. decumbens* | E/-/- | El Dorado, Nevada, and Yuba counties | Rocky, Gabbroic or serpentinite soils of chaparral and cismontane woodland | April-July | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **pink creamsacs** *Castilleja rubicundula var. rubicundula* | -/-/1B | Butte, Contra Costa, Colusa, Glenn, Lake, Napa, Santa Clara, and Shasta counties | Serpentinite soils of chapparal, cismontane woodland, meadows and seeps, and valley and foothill grassland habitat | April-June | None. CNDDB records of the species have been documented in Yolo, Colusa, and Glenn counties. The species is not likely to occur within crop fields and is not anticipated to be affected by transfering water. |
| **Porter's navarretia** *Navarretia paradoxinota* | -/-/1B | Colusa, Lake, and Napa counties | Serpentinite, openings, vernally mesic, and drainages of meadows and seeps | May-July | None. There is a CNDDB record in Colusa County, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. meadows |

| Common Name<br>Scientific name | Special Status*<br>(F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Recurved larkspur**<br>*Delphinium recurvatum* | -/-/1B | Disbursed throughout the Sacramento and Central Valley. | Chenopod scrub, cismontane, valley and foothill grasslands (alkali). | March-June | None. There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. alkali soil). |
| **Red mountain catchfly**<br>*Silene campanulata* ssp. *campanulata* | -/E/1B | Found in Colusa, Glenn, Mendocino, Shasta, Tehama, and Trinity Counties. | Chaparral and lower montane coniferous forest, usually sepentinite and rocky. | April-July | There is a CNDDB occurrence in Colusa County, however this species is not likely to occur in crop fields due to lack of suitable habitat. |
| **red-flowered bird's-foot trefoil**<br>*Acmispon rubriflorus* | -/-/1B | Colusa, Stanislaus, and Tehama counties | Cismontane woodland and valley and foothill grassland | April-June | None. CNDDB records of this species exist within Colusa County. Suitable habitat is not present and species is not likely to be impacted by water transfers. |
| **Sacramento orcutt grass**<br>*Orcuttia viscida* | E,X/E/1B | Valley grasslands and freshwater wetlands. | Vernal pools. | May-June | None. There is a CNDDB occurrence, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. vernal pools). |
| **saline clover**<br>*Trifolium hydrophilum* | -/-/1B | California's Central coast and Bay Area. | Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites 0 - 300m asl. | April - June | None. Records of saline clover exist within the Seller Service Areas. Rice fields may represent marginally suitable habitat for this species, even so this species is unlikely to be affected by water |
| **San Joaquin spearscale**<br>*Atriplex joaquiniana* | -/-/1B | Western Central Valley and valleys of adjacent foothills. | Alkali grasslands, and alkali scrub. | April-September | None. There are CNDDB records within the Seller Service Area, however the species is not likely to occur in crop fields, no suitable habitat present (i.e. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Sanford's arrowhead** *Sagittaria sanfordii* | -/-/1B | Central Valley. | Freshwater marshes, shallow streams, and ditches. | May-August | None. Suitable habitat on present in ditches; not yet detected. Not likely to establish in crop fieldsand no effects anticipated from small changes in river flow. |
| **Scabrid alpine tarplant** *Anisocarpus scabridus* | -/-/1B | Colusa, Humboldt, Lake, Mendocino, Shasta, Tehama, and Trinity counties | Metamorphic, rocky soils of upper montane coniferous forest | June-September | None. There is a CNDDB record in Colusa County, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. montane coniferous forest) |
| **Serpentine cryptantha** *Cryptantha dissita* | -/-/1B | Colusa, Lake, Mendocino, Napa, Shasta, Siskiyou, and Sonoma counties | Chaparral (serpentinite) | April-June | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **Shining navarretia** *Navarretia nigelliformis ssp. radians* | -/-/1B | Alameda, Contra Costa, Fresno, Merced, Monterey, San Benito, San Joaquin, and San Luis Obispo Counties. | Cismontane woodland, valley and foothill grassland, and vernal pools 200 - 1000m asl. Known from grassland, and may not necessarily occur in vernal pools. | April - July | None. There are previous CNDDB records of shining navarettia exist for the Seller Service Area. This species is unlikely to establish within rice fields due to lack of suitable habitat (i.e., vernal pools and native grassland) |
| **Silky cryptantha** *Cryptantha crinita* | -/-/1B | Glenn, Shasta, and Tehama counties | Gravelly streambeds of cismontane woodland, lower montane coniferous forest, riparian forest, riparian woodland, and valley and foothill grassland | April-May | None. There is a previous CNDDB record in Glenn County. The species is not likely to occur in crop fields, no suitable habitat present (i.e. gravelly streambeds). |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Slender Orcutt grass** *Orcuttia tenuis* | T,X/E/1B | Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento Counties | Vernal pools. | May-July | None. There are CNDDB occurrences, however this species is not likely to occur in crop fields due to lack of suitable habitat (i.e. vernal pools). |
| **Small-flowered calycadenia** *Calycadenia micrantha* | -/-/1B | Colusa, Humboldt, Lake, Monterey, Napa, and Trinity counties | Roadsides, rocky, talus, scree and sparsely vegetated areas of chaparral, meadows, and valley and foothill grassland | June-September | None. There is a single CNDDB occurrence in Colusa County. Suitable habitat for this species is not likely to be impacted by water transfers. |
| **Snow Mountain buckwheat** *Eriogonum nervulosum* | -/-/1B | Colusa, Glenn, Lake, Napa, Sonoma, and Yolo Counties | Chaparral (serpentinite) | June-September | None. The CNDDB contains records of this species within the Seller Service Area. It is very unlikely that Baker's navarretia would establish in rice fields, given the lack of chaparral. |
| **Snow Mountain willowherb** *Epilobium nivium* | -/-/1B | Colusa, Glenn, Lake, Mendocino, Tehama, and Trinity | Rocky chaparral and upper montane coniferous forest | June-October | None. Snow mountain willowherb has been recorded by the CNDDB within the Seller Service Area. No impacts would occur to suitable habitat. |
| **Soft salty bird's beak** *Chloropyron molle* ssp. *Molle* | E/R/1B | Contra Costa, Marin, Napa, Sacrmaneto, Solano, and Sonoma counties | Marshes and swamps | June-November | None. There is a single CNDDB occurrence in Sacramento County. Suitable habitat for this species is not likely to be impacted by water transfers. |

| Common Name Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Stebbins' Morning-glory** *Calystegia stebbinsii* | E/-/- | El Dorado and Nevada counties | Gabbroic and serpentinite soils of chaparral and cismontane woodland | April-June | None. There are no CNDDB records in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present. |
| **Stony Creek spurge** *Euphorbia ocellata ssp. rattanii* | -/-/1B | Glenn and Tehama counties | Chaparral, riparian scrub, and valley and foothill grassland | May-October | None. There are multiple CNDDB occurrences in Glenn County. However this species is not likely to occur within crop fields and is not likely to be impacted. |
| **Suisun Marsh aster** *Symphyotrichum lentum* | -/-/1B | Contra Costa, Napa, Sacramento, San Joaquin, Solano, and Yolo Counties. | Saline and freshwater marshes and swamps. Most often seen along sloughs with Phragmites, Scirpus, blackberry, Typha, etc. at 0-3m asl. | May - November | None. This species has been previously documented in Sacramento and Yolo counties. This species is not expected to occur within rice fields given |
| **Tehama County western flax** *Hesperolinon tehamense* | -/-/1B | Alameda, Glenn, Lake, Napa, Stanislaus, and Tehama counties | Serpentinite chaparral and cismontane woodland | May-July | None. Previously documented in Glenn County. No chaparral and cismontane woodland habitat would be affected by Transfers. |
| **Three-fingered morning-glory** *Calystegia collina ssp. tridactylosa* | -/-/1B | Colusa, Glenn, Lake, Mendocino, and Sonoma counties | Serpentinite, rocky, gravelly, openings of chaparral and Cismontane woodlands. | April-June | None. There is a single occurrence in Colusa County. Not likely to occur in crop fields, no suitable habitat is present. |
| **Toren's grimmia** *Grimmia torenii* | -/-/1B | Contra Costa, Colusa, Lake, Mendocino, Monterey, Santa Cruz, and San Mateo counties | Chaparral, cismontane woodland, and lower montane coniferous forests with openings, rocky, boulder and rock walls. | -- | None. There are no CNDDB occurrences within the Seller Service Area. This species is not likely to occur in crop fields, no suitable habitat present (i.e. boulder and rock walls). |

| Common Name<br>Scientific name | Special Status* (F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|
| **Tuolumne button-celery**<br>*Eryngium pinnatisectum* | -/-/1B | Amador, Calaveras, Sacramento, Sonoma, and Tuolumne counties | Cismontane woodlands, lower montane coniferous forest, and vernal pools | May- August | None. There is a single occurrence of this species in Sacramento County. Not likely to occur in crop fields, no suitable habitat present (i.e. vernal pools). |
| **Veiny monardella**<br>***Monardella venosa*** | -/-/1B | Butte, Sutter, Tuolumne, and Yuba counties | Clay soils of cismontane woodland and valley/foothill grasslands | May-July | None. There is a single occurrence of this species in Sutter County. Not likely to occur in crop fields, no suitable habitat present. |
| **Vernal pool smallscale**<br>*Atriplex persistens* | -/-/1B | Colusa, Madera, Merced, Solano, Stanislaus, and Tulare counties | Vernal pools | June, August, September, October | None. There are CNDDB occurrences in the Seller Service Area. Not likely to occur in crop fields, no suitable habitat present (i.e. vernal pools). |
| **Woolly rose-mallow**<br>*Hibiscus lasiocarpos var. occidentalis* | -/-/1B | Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo Counties. | Marshes and swamps (freshwater). Moist, freshwater-soaked river banks and low peat islands in sloughs. Known from the Delta watershed 0 - 150m asl. | June - September | None. Previously observed in the Seller Service Area. Not likely to establish in rice fields given the lack of suitable habitat (marsh and swamp). This species is sensitive to habitat disturbance and agricultural |

***Status explanations:**
x= critical habitat

**F=Federal**
E=Endangered
T=Threatened
SC= Special Concern

**S=State**
E=Endangered
T=Threatened
SSC=Species of Special Concern

| Common Name<br>Scientific name | Special Status*<br>(F/S/CNPS) | Distribution | Habitat Association | Blooming Period | Potential Impact |
|---|---|---|---|---|---|

**CNPS=California Native Plant Society**
1B=Rare, threatened, or endangered in California and elsewhere
2=Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere
3=Plants about which we need more information - A review list

# Appendix D

# Groundwater Existing Conditions

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# Appendix D
# Groundwater Existing Conditions

This appendix includes the following figures:

1. Spring 2004 to Spring 2019 change in groundwater elevation in shallow (<200 feet bgs), intermediate (200-600 feet bgs), and deep (>600 feet bgs) wells. These figures were retrieved from DWR's Groundwater Open Data Portal (https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps)

2. Spring 2011 to Spring 2019 change in groundwater elevation in shallow (<200 feet bgs), intermediate (200-600 feet bgs), and deep (>600 feet bgs) wells. These figures were retrieved from DWR's Groundwater Open Data Portal (https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps)

3. Spring 2015 to Spring 2019 change in groundwater elevation in shallow (<200 feet bgs), intermediate (200-600 feet bgs), and deep (>600 feet bgs) wells. These figures were retrieved from DWR's Groundwater Open Data Portal (https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps)

4. Spring 2018 to Spring 2019 change in groundwater elevation in shallow (<200 feet bgs), intermediate (200-600 feet bgs), and deep (>600 feet bgs) wells. These figures were retrieved from DWR's Open Data Portal (https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps)

5. Groundwater monitoring data for wells within the seller districts. DWR's CASGEM website and was used to obtain the monitoring data. The process to query out the groundwater level data is explained below.

Direction to manually lookup groundwater level data from DWR's CASGEM website:

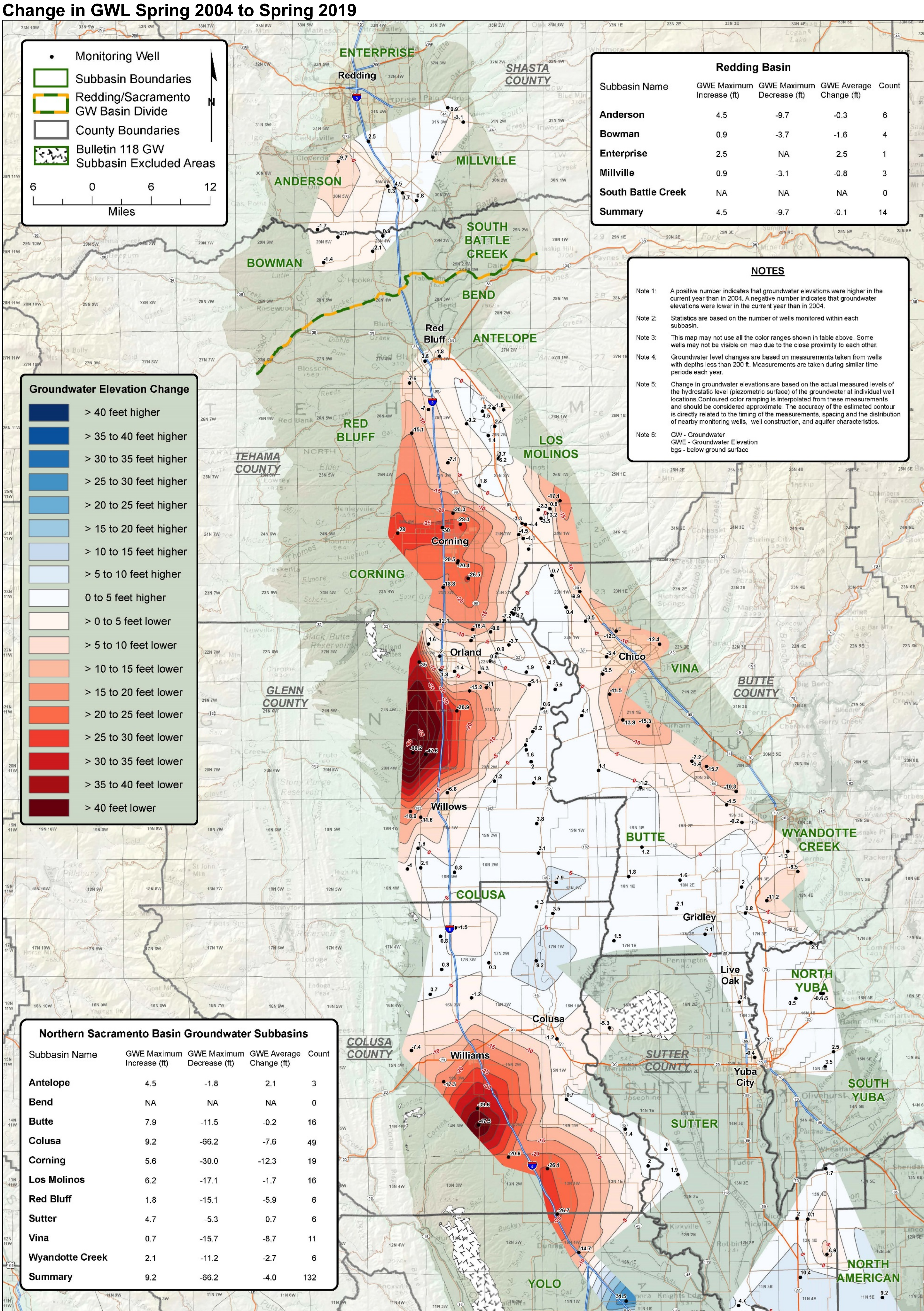
Example Well 29N04W15E002M

1. Go to CASGEM Public Login website: http://www.water.ca.gov/groundwater/casgem/online_system.cfm (setup login if not previously done)

2. Select Well Information> State Well Number. Input well number (29N04W15E002M for this example)

3. Go to Well Details: View> View Hydrograph

## Change in GWL Spring 2004 to Spring 2019




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| Anderson | 4.5 | -9.7 | -0.3 | 6 |
| Bowman | 0.9 | -3.7 | -1.6 | 4 |
| Enterprise | 2.5 | NA | 2.5 | 1 |
| Millville | 0.9 | -3.1 | -0.8 | 3 |
| South Battle Creek | NA | NA | NA | 0 |
| Summary | 4.5 | -9.7 | -0.1 | 14 |

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| Antelope | 4.5 | -1.8 | 2.1 | 3 |
| Bend | NA | NA | NA | 0 |
| Butte | 7.9 | -11.5 | -0.2 | 16 |
| Colusa | 9.2 | -66.2 | -7.6 | 49 |
| Corning | 5.6 | -30.0 | -12.3 | 19 |
| Los Molinos | 6.2 | -17.1 | -1.7 | 16 |
| Red Bluff | 1.8 | -15.1 | -5.9 | 6 |
| Sutter | 4.7 | -5.3 | 0.7 | 6 |
| Vina | 0.7 | -15.7 | -8.7 | 11 |
| Wyandotte Creek | 2.1 | -11.2 | -2.7 | 6 |
| Summary | 9.2 | -66.2 | -4.0 | 132 |

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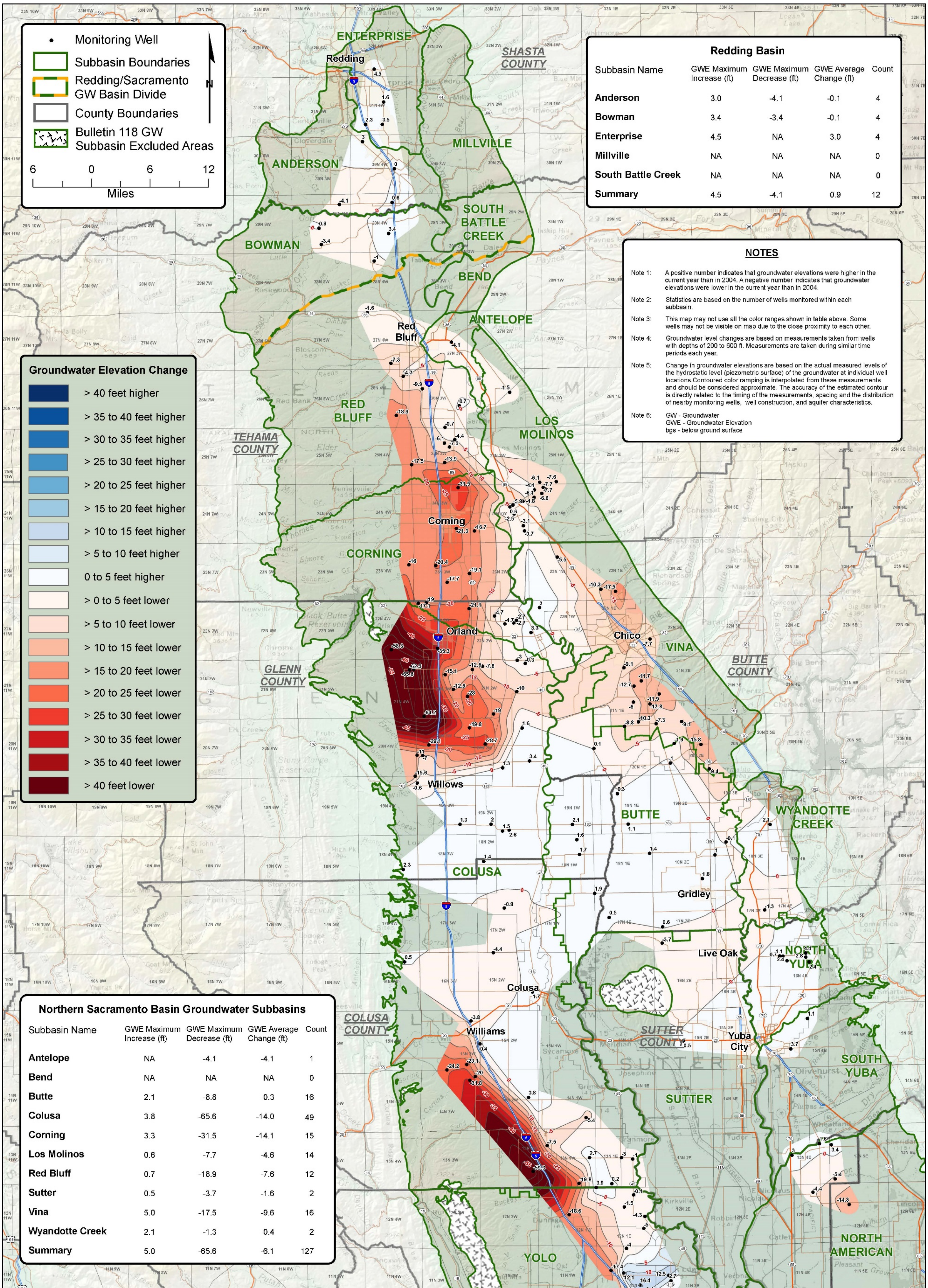
**NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2004 TO SPRING 2019**
**SHALLOW WELL DEPTHS**
(Well depths less than 200 ft deep bgs)

**PLATE 1S-B**

Date: July 2019
BY: G. Lewis

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 3.0 | -4.1 | -0.1 | 4 |
| **Bowman** | 3.4 | -3.4 | -0.1 | 4 |
| **Enterprise** | 4.5 | NA | 3.0 | 4 |
| **Millville** | NA | NA | NA | 0 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 4.5 | -4.1 | 0.9 | 12 |

**NOTES**

Note 1: A positive number indicates that groundwater elevations were higher in the current year than in 2004. A negative number indicates that groundwater elevations were lower in the current year than in 2004.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 200 to 600 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | NA | -4.1 | -4.1 | 1 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 2.1 | -8.8 | 0.3 | 16 |
| **Colusa** | 3.8 | -65.6 | -14.0 | 49 |
| **Corning** | 3.3 | -31.5 | -14.1 | 15 |
| **Los Molinos** | 0.6 | -7.7 | -4.6 | 14 |
| **Red Bluff** | 0.7 | -18.9 | -7.6 | 12 |
| **Sutter** | 0.5 | -3.7 | -1.6 | 2 |
| **Vina** | 5.0 | -17.5 | -9.6 | 16 |
| **Wyandotte Creek** | 2.1 | -1.3 | 0.4 | 2 |
| **Summary** | 5.0 | -65.6 | -6.1 | 127 |

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## NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2004 TO SPRING 2019

### INTERMEDIATE WELL DEPTHS

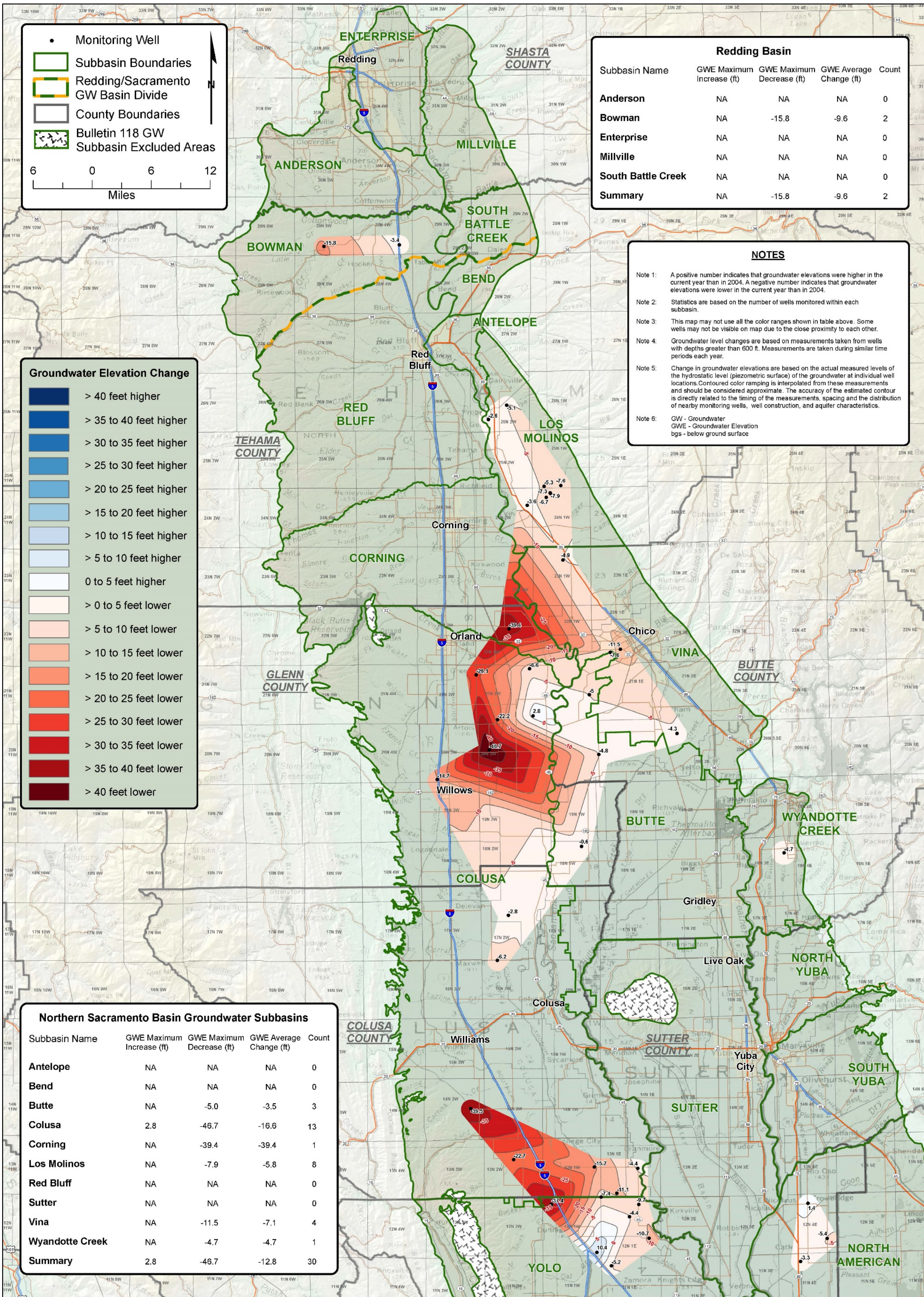
(Well depths greater than 200 ft and less than 600 ft deep bgs)

**PLATE 1I-B**

Date: July 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| Anderson | NA | NA | NA | 0 |
| Bowman | NA | -15.8 | -9.6 | 2 |
| Enterprise | NA | NA | NA | 0 |
| Millville | NA | NA | NA | 0 |
| South Battle Creek | NA | NA | NA | 0 |
| Summary | NA | -15.8 | -9.6 | 2 |

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| Antelope | NA | NA | NA | 0 |
| Bend | NA | NA | NA | 0 |
| Butte | NA | -5.0 | -3.5 | 3 |
| Colusa | 2.8 | -46.7 | -16.6 | 13 |
| Corning | NA | -39.4 | -39.4 | 1 |
| Los Molinos | NA | -7.9 | -5.8 | 8 |
| Red Bluff | NA | NA | NA | 0 |
| Sutter | NA | NA | NA | 0 |
| Vina | NA | -11.5 | -7.1 | 4 |
| Wyandotte Creek | NA | -4.7 | -4.7 | 1 |
| Summary | 2.8 | -46.7 | -12.8 | 30 |

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## NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2004 TO SPRING 2019

**DEEP WELLS**

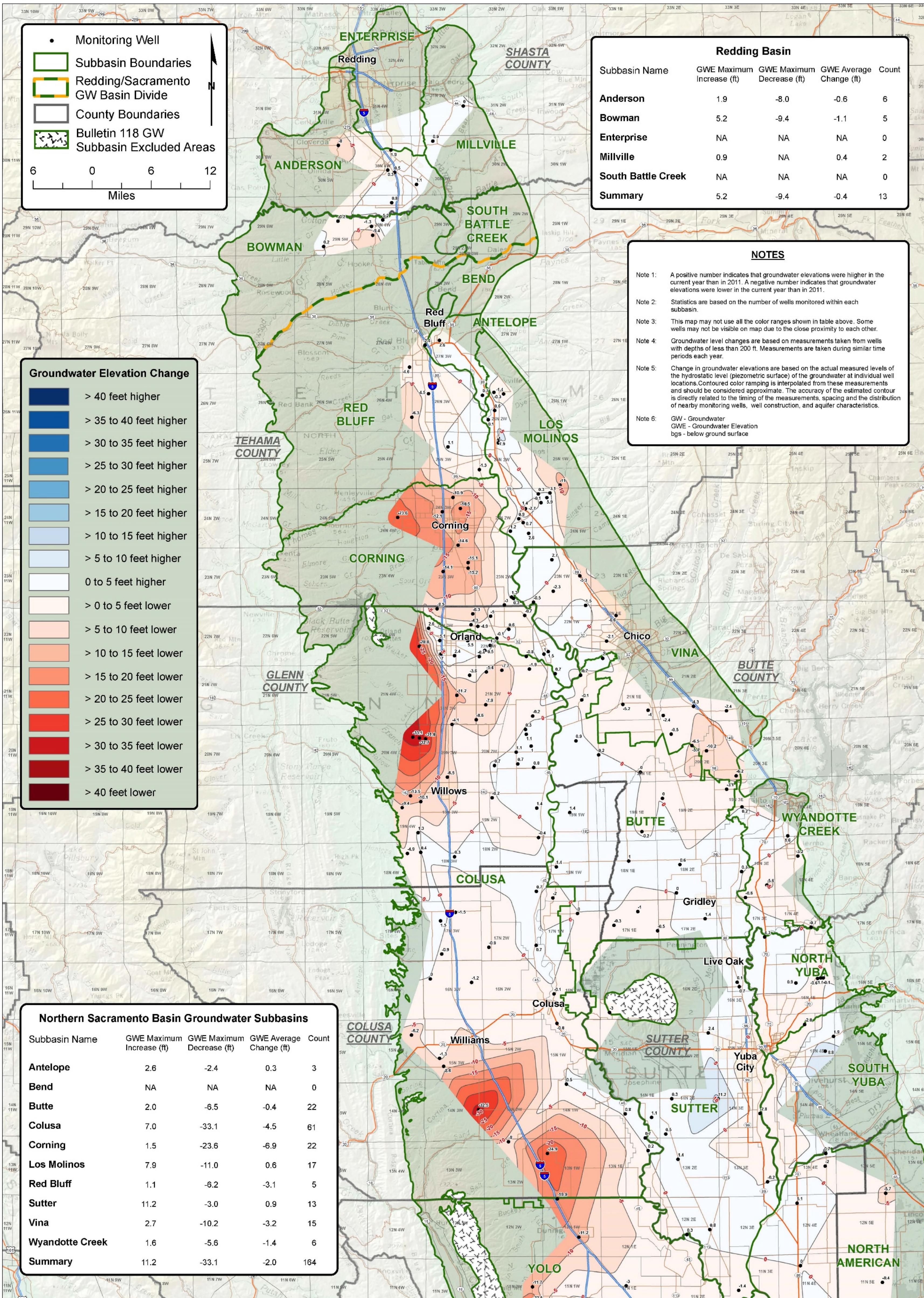
(Well depths greater than 600 ft bgs)

**PLATE 1D-B**

Date: May 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 1.9 | -8.0 | -0.6 | 6 |
| **Bowman** | 5.2 | -9.4 | -1.1 | 5 |
| **Enterprise** | NA | NA | NA | 0 |
| **Millville** | 0.9 | NA | 0.4 | 2 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 5.2 | -9.4 | -0.4 | 13 |

**NOTES**

Note 1: A positive number indicates that groundwater elevations were hiigher in the current year than in 2011. A negative number indicates that groundwater elevations were lower in the current year than in 2011.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of less than 200 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | 2.6 | -2.4 | 0.3 | 3 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 2.0 | -6.5 | -0.4 | 22 |
| **Colusa** | 7.0 | -33.1 | -4.5 | 61 |
| **Corning** | 1.5 | -23.6 | -6.9 | 22 |
| **Los Molinos** | 7.9 | -11.0 | 0.6 | 17 |
| **Red Bluff** | 1.1 | -6.2 | -3.1 | 5 |
| **Sutter** | 11.2 | -3.0 | 0.9 | 13 |
| **Vina** | 2.7 | -10.2 | -3.2 | 15 |
| **Wyandotte Creek** | 1.6 | -5.6 | -1.4 | 6 |
| **Summary** | 11.2 | -33.1 | -2.0 | 164 |

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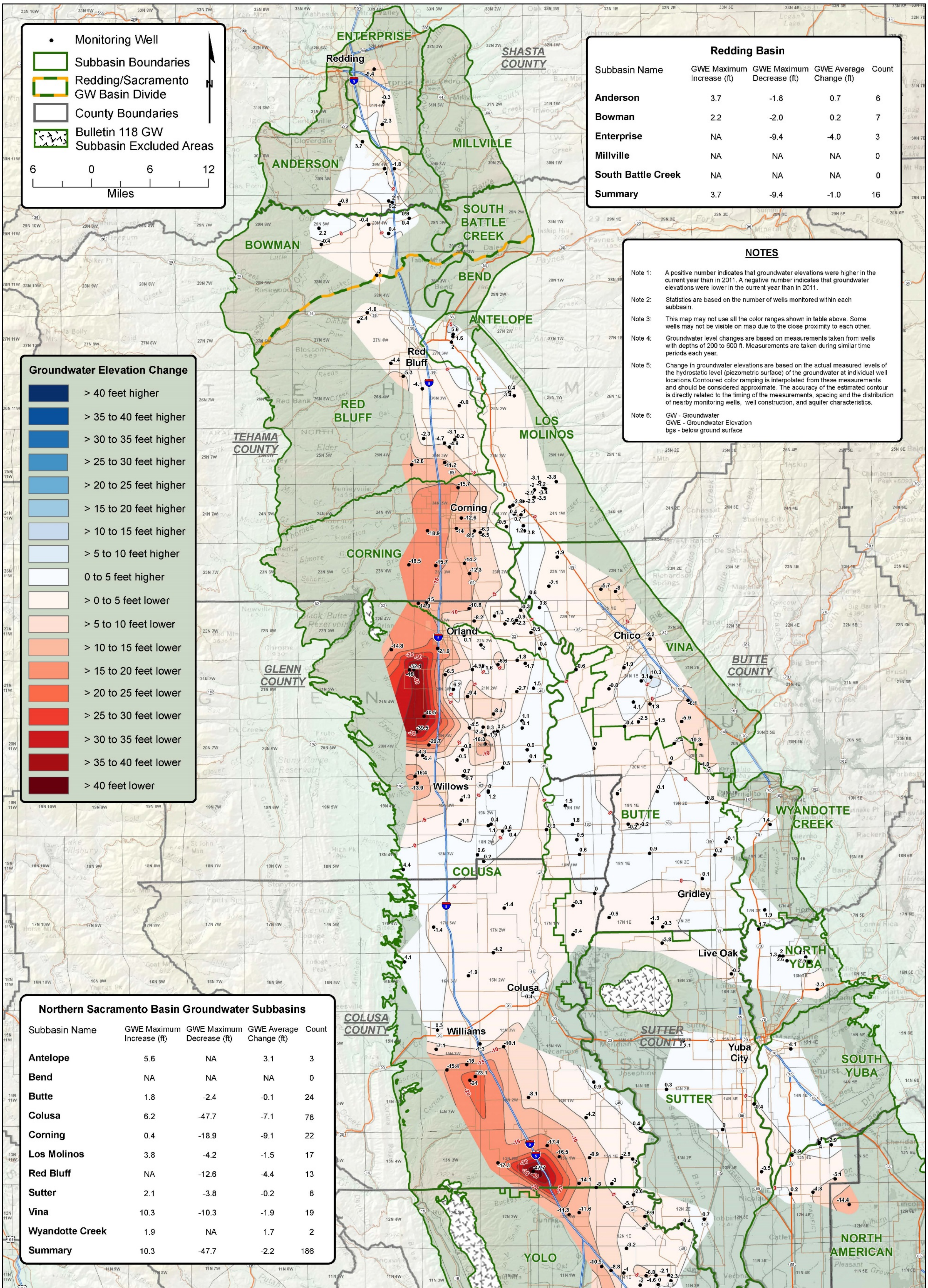
**NORTHERN SACRAMENTO VALLEY**
**CHANGE IN GROUNDWATER ELEVATION MAP**
**SPRING 2011 TO SPRING 2019**
**SHALLOW WELL DEPTHS**
(Well depths less than 200 ft deep bgs)

**PLATE 1S-D**

Date: July 2019

BY: G. Lewis

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 3.7 | -1.8 | 0.7 | 6 |
| **Bowman** | 2.2 | -2.0 | 0.2 | 7 |
| **Enterprise** | NA | -9.4 | -4.0 | 3 |
| **Millville** | NA | NA | NA | 0 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 3.7 | -9.4 | -1.0 | 16 |

**NOTES**

Note 1: A positive number indicates that groundwater elevations were higher in the current year than in 2011. A negative number indicates that groundwater elevations were lower in the current year than in 2011.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 200 to 600 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | 5.6 | NA | 3.1 | 3 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 1.8 | -2.4 | -0.1 | 24 |
| **Colusa** | 6.2 | -47.7 | -7.1 | 78 |
| **Corning** | 0.4 | -18.9 | -9.1 | 22 |
| **Los Molinos** | 3.8 | -4.2 | -1.5 | 17 |
| **Red Bluff** | NA | -12.6 | -4.4 | 13 |
| **Sutter** | 2.1 | -3.8 | -0.2 | 8 |
| **Vina** | 10.3 | -10.3 | -1.9 | 19 |
| **Wyandotte Creek** | 1.9 | NA | 1.7 | 2 |
| **Summary** | 10.3 | -47.7 | -2.2 | 186 |

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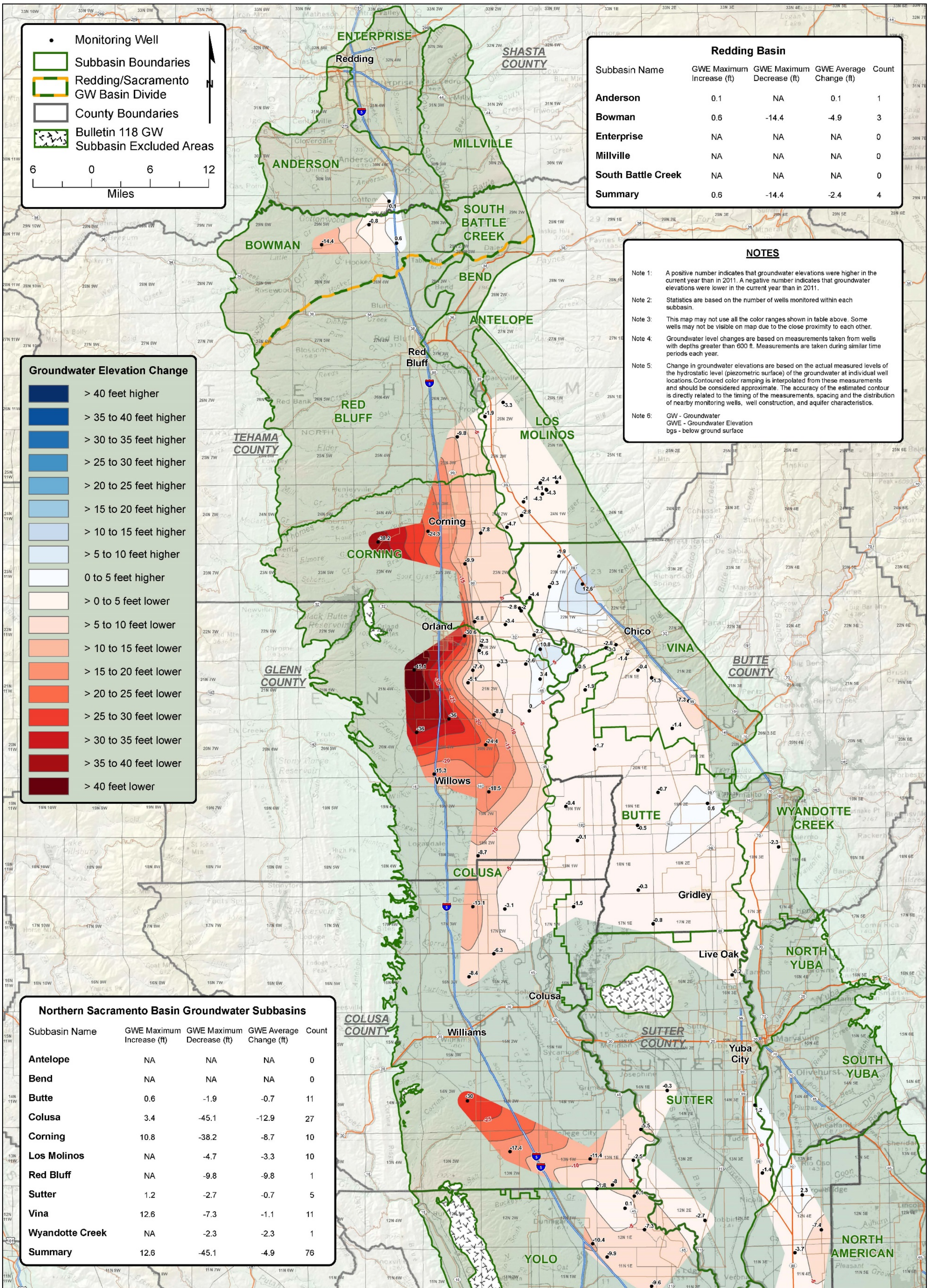
**NORTHERN SACRAMENTO VALLEY**
**CHANGE IN GROUNDWATER ELEVATION MAP**
**SPRING 2011 TO SPRING 2019**
**INTERMEDIATE WELL DEPTHS**
(Well depths greater than 200 ft and less than 600 ft deep bgs)

**PLATE 1I-D**

Date: July 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 0.1 | NA | 0.1 | 1 |
| **Bowman** | 0.6 | -14.4 | -4.9 | 3 |
| **Enterprise** | NA | NA | NA | 0 |
| **Millville** | NA | NA | NA | 0 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 0.6 | -14.4 | -2.4 | 4 |

**NOTES**

Note 1: A positive number indicates that groundwater elevations were higher in the current year than in 2011. A negative number indicates that groundwater elevations were lower in the current year than in 2011.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths greater than 600 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | NA | NA | NA | 0 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 0.6 | -1.9 | -0.7 | 11 |
| **Colusa** | 3.4 | -45.1 | -12.9 | 27 |
| **Corning** | 10.8 | -38.2 | -8.7 | 10 |
| **Los Molinos** | NA | -4.7 | -3.3 | 10 |
| **Red Bluff** | NA | -9.8 | -9.8 | 1 |
| **Sutter** | 1.2 | -2.7 | -0.7 | 5 |
| **Vina** | 12.6 | -7.3 | -1.1 | 11 |
| **Wyandotte Creek** | NA | -2.3 | -2.3 | 1 |
| **Summary** | 12.6 | -45.1 | -4.9 | 76 |

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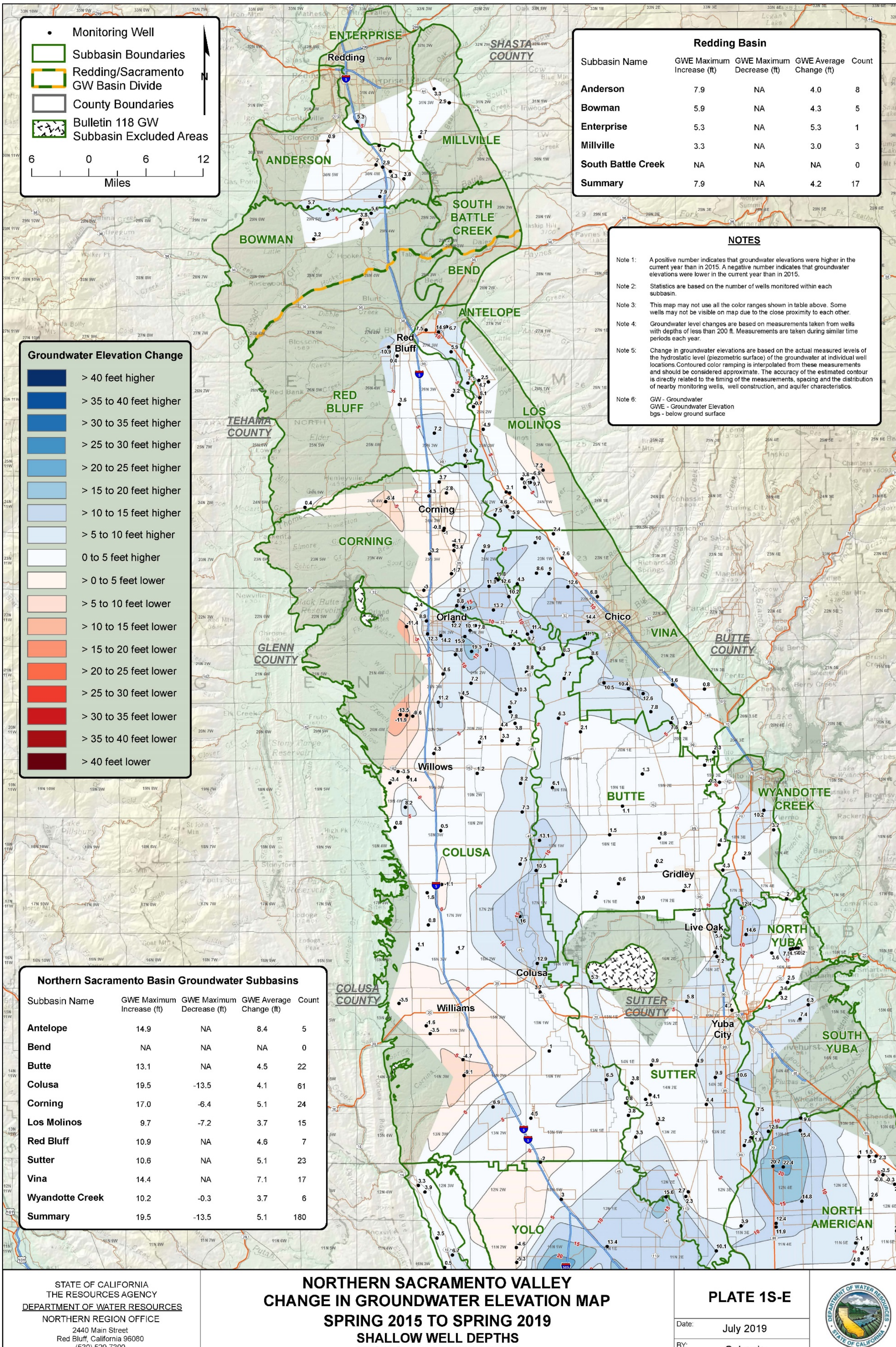
**NORTHERN SACRAMENTO VALLEY**
**CHANGE IN GROUNDWATER ELEVATION MAP**
**SPRING 2011 TO SPRING 2019**
**DEEP WELLS**
(Well depths greater than 600 ft bgs)

**PLATE 1D-D**

Date: May 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps



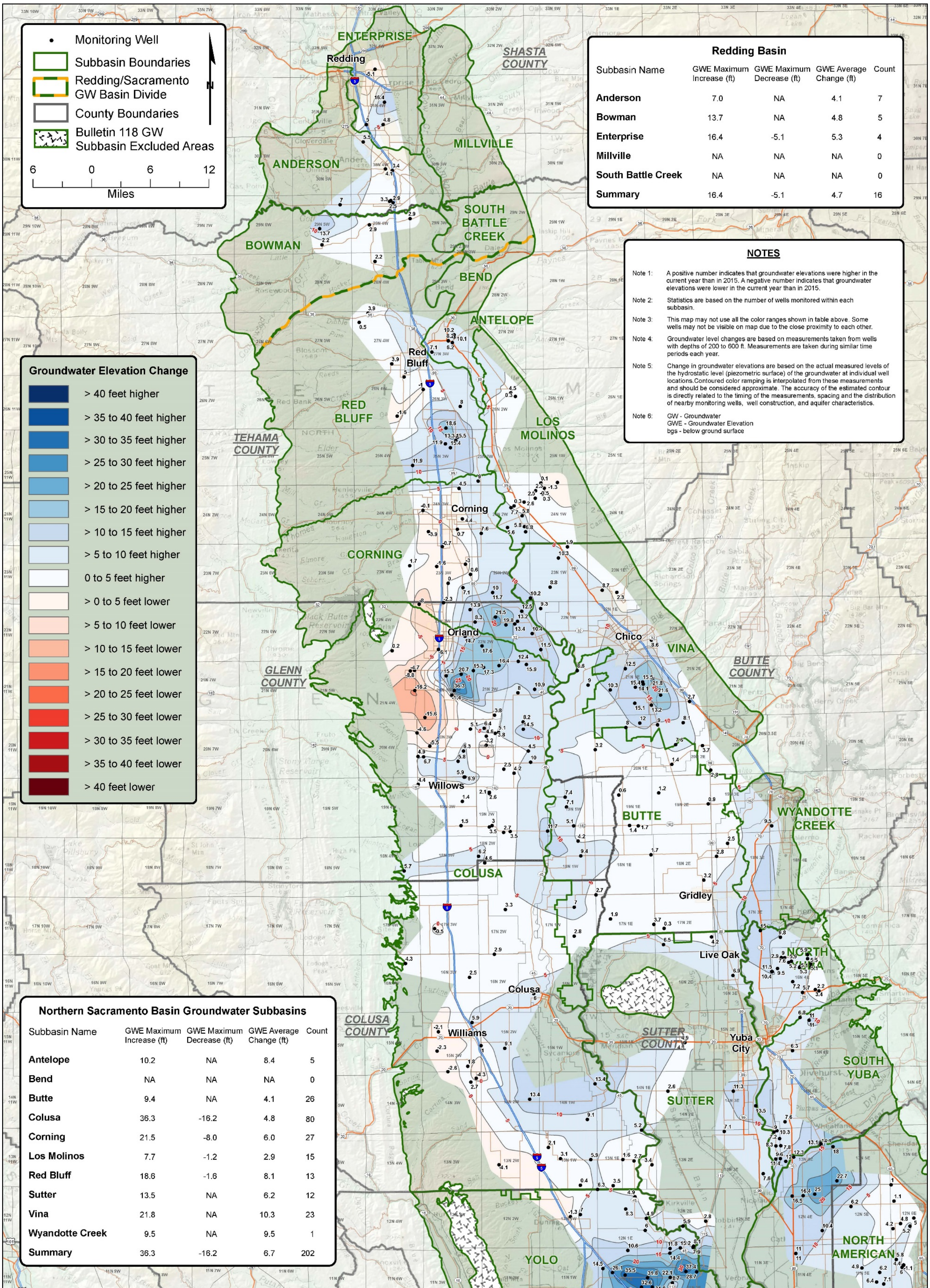

Redding Basin

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| Anderson | 7.9 | NA | 4.0 | 8 |
| Bowman | 5.9 | NA | 4.3 | 5 |
| Enterprise | 5.3 | NA | 5.3 | 1 |
| Millville | 3.3 | NA | 3.0 | 3 |
| South Battle Creek | NA | NA | NA | 0 |
| Summary | 7.9 | NA | 4.2 | 17 |

Northern Sacramento Basin Groundwater Subbasins

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| Antelope | 14.9 | NA | 8.4 | 5 |
| Bend | NA | NA | NA | 0 |
| Butte | 13.1 | NA | 4.5 | 22 |
| Colusa | 19.5 | -13.5 | 4.1 | 61 |
| Corning | 17.0 | -6.4 | 5.1 | 24 |
| Los Molinos | 9.7 | -7.2 | 3.7 | 15 |
| Red Bluff | 10.9 | NA | 4.6 | 7 |
| Sutter | 10.6 | NA | 5.1 | 23 |
| Vina | 14.4 | NA | 7.1 | 17 |
| Wyandotte Creek | 10.2 | -0.3 | 3.7 | 6 |
| Summary | 19.5 | -13.5 | 5.1 | 180 |

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 7.0 | NA | 4.1 | 7 |
| **Bowman** | 13.7 | NA | 4.8 | 5 |
| **Enterprise** | 16.4 | -5.1 | 5.3 | 4 |
| **Millville** | NA | NA | NA | 0 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 16.4 | -5.1 | 4.7 | 16 |

**NOTES**

Note 1: A positive number indicates that groundwater elevations were higher in the current year than in 2015. A negative number indicates that groundwater elevations were lower in the current year than in 2015.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 200 to 600 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | 10.2 | NA | 8.4 | 5 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 9.4 | NA | 4.1 | 26 |
| **Colusa** | 36.3 | -16.2 | 4.8 | 80 |
| **Corning** | 21.5 | -8.0 | 6.0 | 27 |
| **Los Molinos** | 7.7 | -1.2 | 2.9 | 15 |
| **Red Bluff** | 18.6 | -1.6 | 8.1 | 13 |
| **Sutter** | 13.5 | NA | 6.2 | 12 |
| **Vina** | 21.8 | NA | 10.3 | 23 |
| **Wyandotte Creek** | 9.5 | NA | 9.5 | 1 |
| **Summary** | 36.3 | -16.2 | 6.7 | 202 |

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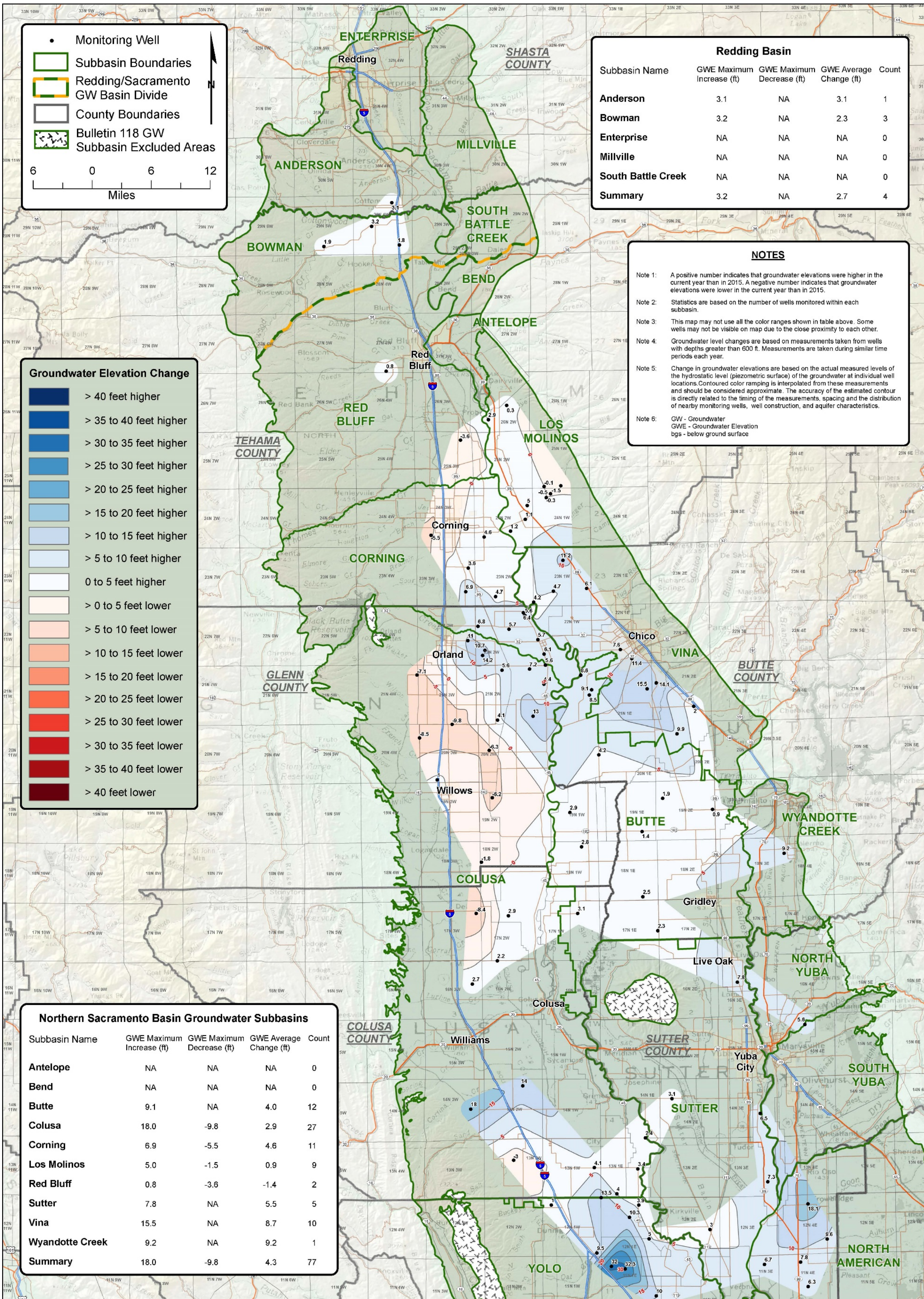
**NORTHERN SACRAMENTO VALLEY**
**CHANGE IN GROUNDWATER ELEVATION MAP**
**SPRING 2015 TO SPRING 2019**
**INTERMEDIATE WELL DEPTHS**
(Well depths greater than 200 ft and less than 600 ft deep bgs)

**PLATE 1I-E**

Date: July 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 3.1 | NA | 3.1 | 1 |
| **Bowman** | 3.2 | NA | 2.3 | 3 |
| **Enterprise** | NA | NA | NA | 0 |
| **Millville** | NA | NA | NA | 0 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 3.2 | NA | 2.7 | 4 |

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | NA | NA | NA | 0 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 9.1 | NA | 4.0 | 12 |
| **Colusa** | 18.0 | -9.8 | 2.9 | 27 |
| **Corning** | 6.9 | -5.5 | 4.6 | 11 |
| **Los Molinos** | 5.0 | -1.5 | 0.9 | 9 |
| **Red Bluff** | 0.8 | -3.6 | -1.4 | 2 |
| **Sutter** | 7.8 | NA | 5.5 | 5 |
| **Vina** | 15.5 | NA | 8.7 | 10 |
| **Wyandotte Creek** | 9.2 | NA | 9.2 | 1 |
| **Summary** | 18.0 | -9.8 | 4.3 | 77 |

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## NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2015 TO SPRING 2019

**DEEP WELLS**

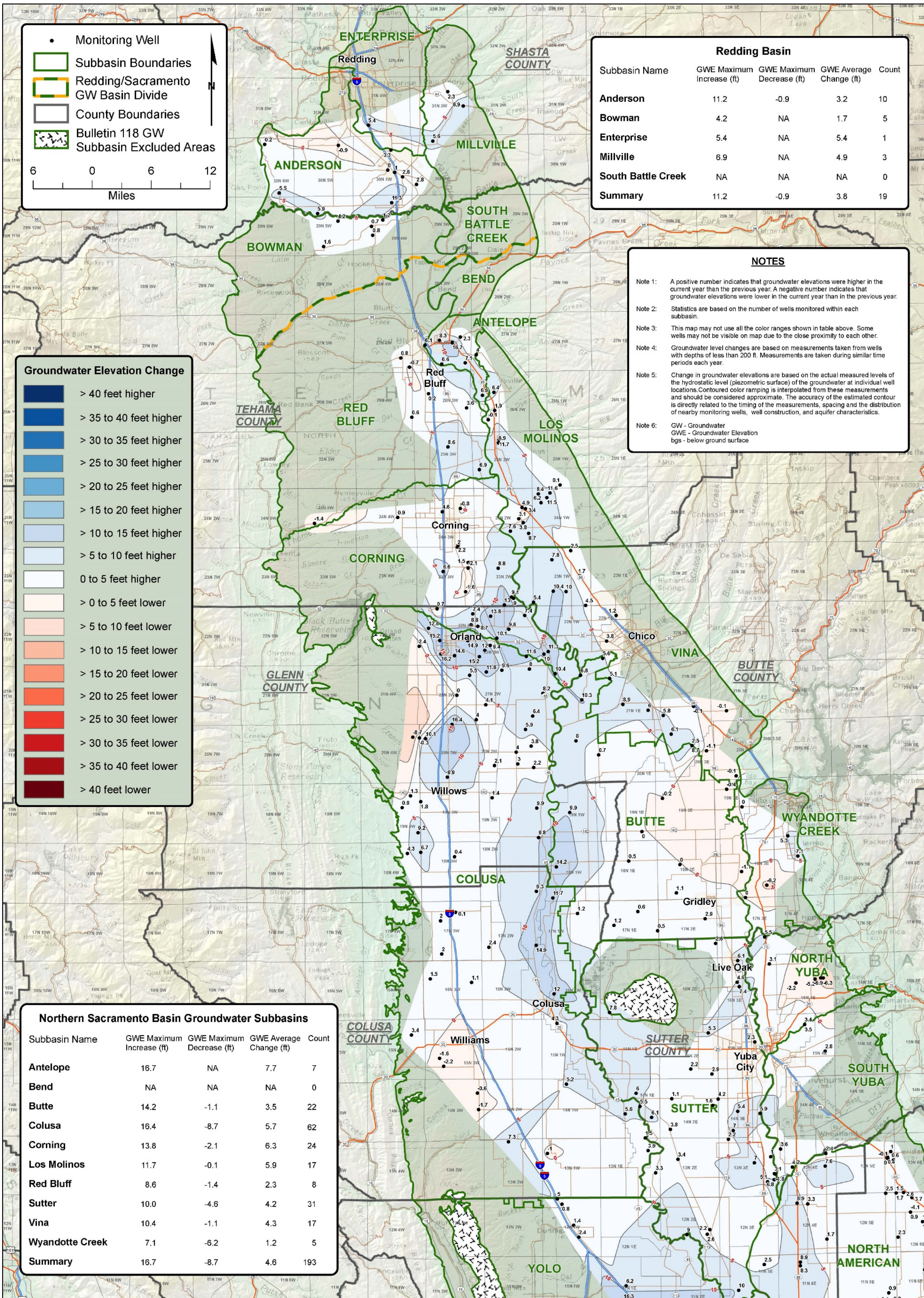
(Well depths greater than 600 ft bgs)

**PLATE 1D-E**

Date: May 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 11.2 | -0.9 | 3.2 | 10 |
| **Bowman** | 4.2 | NA | 1.7 | 5 |
| **Enterprise** | 5.4 | NA | 5.4 | 1 |
| **Millville** | 6.9 | NA | 4.9 | 3 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 11.2 | -0.9 | 3.8 | 19 |

**NOTES**

Note 1: A positive number indicates that groundwater elevations were higher in the current year than the previous year. A negative number indicates that groundwater elevations were lower in the current year than in the previous year.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of less than 200 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | 16.7 | NA | 7.7 | 7 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 14.2 | -1.1 | 3.5 | 22 |
| **Colusa** | 16.4 | -8.7 | 5.7 | 62 |
| **Corning** | 13.8 | -2.1 | 6.3 | 24 |
| **Los Molinos** | 11.7 | -0.1 | 5.9 | 17 |
| **Red Bluff** | 8.6 | -1.4 | 2.3 | 8 |
| **Sutter** | 10.0 | -4.6 | 4.2 | 31 |
| **Vina** | 10.4 | -1.1 | 4.3 | 17 |
| **Wyandotte Creek** | 7.1 | -6.2 | 1.2 | 5 |
| **Summary** | 16.7 | -8.7 | 4.6 | 193 |

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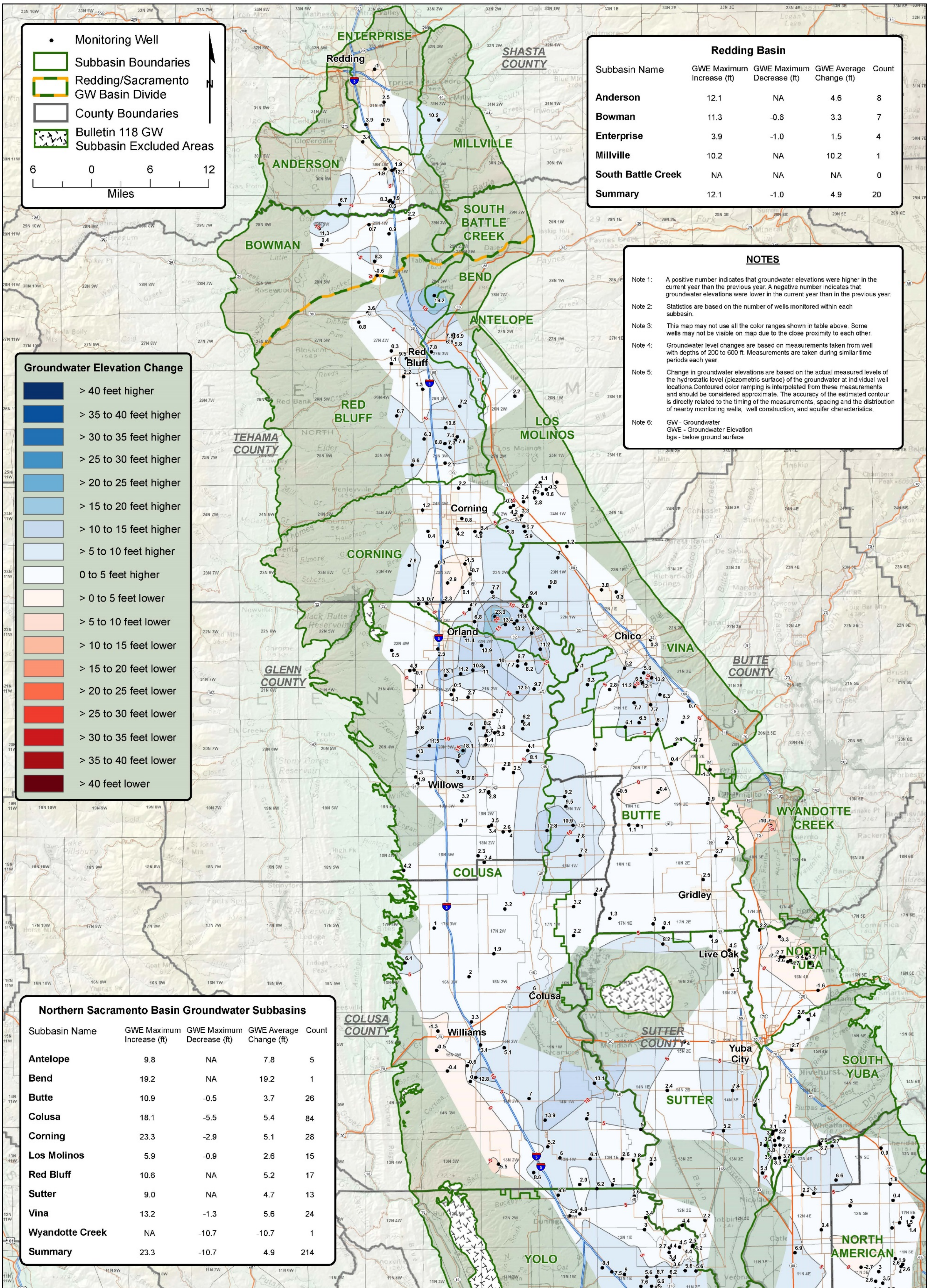
**NORTHERN SACRAMENTO VALLEY**
**CHANGE IN GROUNDWATER ELEVATION MAP**
**SPRING 2018 TO SPRING 2019**
**SHALLOW WELL DEPTHS**
(Well depths less than 200 ft deep bgs)

**PLATE 1S-A**

Date: July 2019

BY: G. Lewis

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




**Redding Basin**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 12.1 | NA | 4.6 | 8 |
| **Bowman** | 11.3 | -0.6 | 3.3 | 7 |
| **Enterprise** | 3.9 | -1.0 | 1.5 | 4 |
| **Millville** | 10.2 | NA | 10.2 | 1 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 12.1 | -1.0 | 4.9 | 20 |

**Northern Sacramento Basin Groundwater Subbasins**

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | 9.8 | NA | 7.8 | 5 |
| **Bend** | 19.2 | NA | 19.2 | 1 |
| **Butte** | 10.9 | -0.5 | 3.7 | 26 |
| **Colusa** | 18.1 | -5.5 | 5.4 | 84 |
| **Corning** | 23.3 | -2.9 | 5.1 | 28 |
| **Los Molinos** | 5.9 | -0.9 | 2.6 | 15 |
| **Red Bluff** | 10.6 | NA | 5.2 | 17 |
| **Sutter** | 9.0 | NA | 4.7 | 13 |
| **Vina** | 13.2 | -1.3 | 5.6 | 24 |
| **Wyandotte Creek** | NA | -10.7 | -10.7 | 1 |
| **Summary** | 23.3 | -10.7 | 4.9 | 214 |

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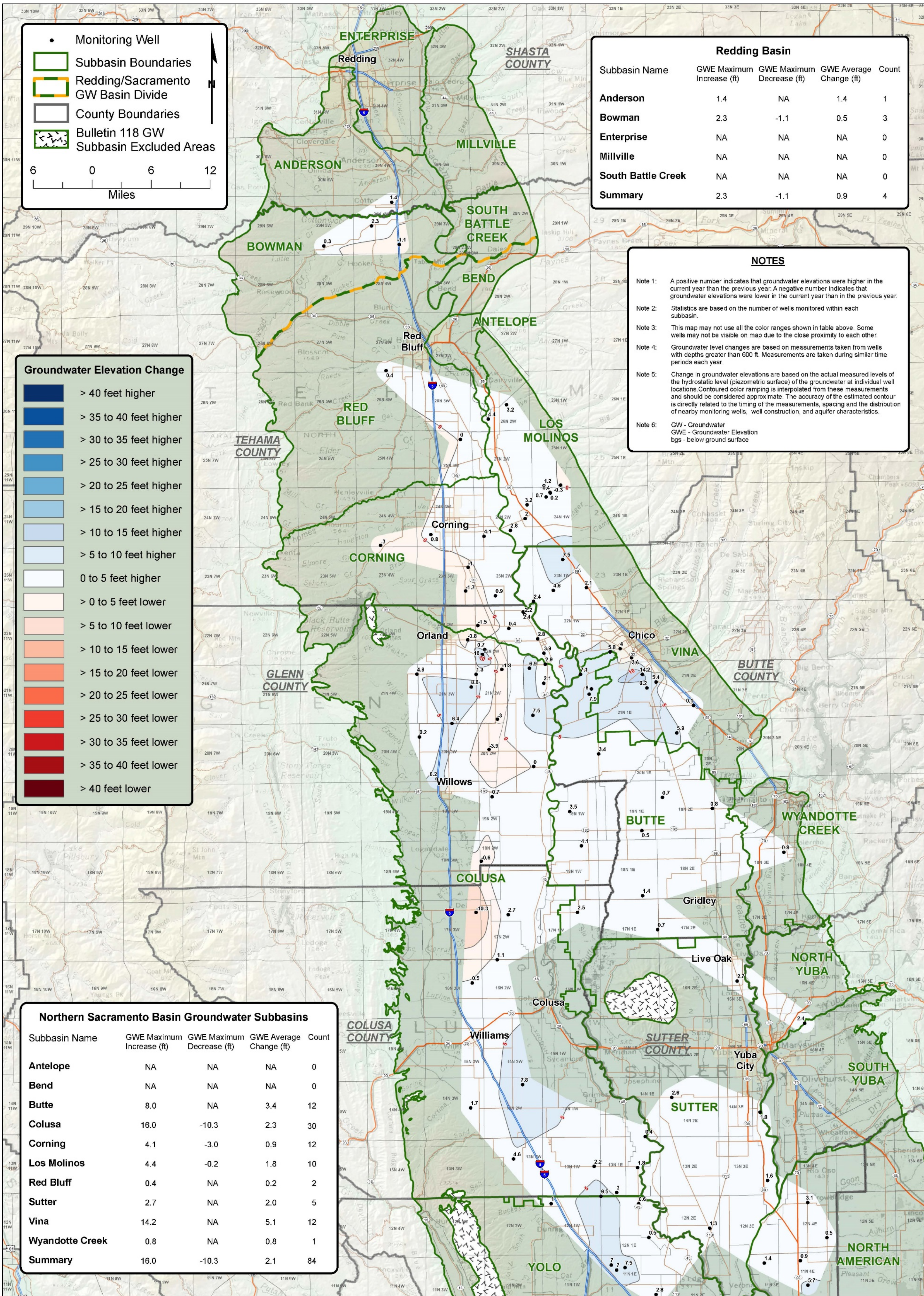
**NORTHERN SACRAMENTO VALLEY**
**CHANGE IN GROUNDWATER ELEVATION MAP**
**SPRING 2018 TO SPRING 2019**
**INTERMEDIATE WELL DEPTHS**
(Well depths greater than 200 ft and less than 600 ft deep bgs)

**PLATE 1I-A**

Date: July 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps




## Redding Basin

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Anderson** | 1.4 | NA | 1.4 | 1 |
| **Bowman** | 2.3 | -1.1 | 0.5 | 3 |
| **Enterprise** | NA | NA | NA | 0 |
| **Millville** | NA | NA | NA | 0 |
| **South Battle Creek** | NA | NA | NA | 0 |
| **Summary** | 2.3 | -1.1 | 0.9 | 4 |

## NOTES

Note 1: A positive number indicates that groundwater elevations were higher in the current year than the previous year. A negative number indicates that groundwater elevations were lower in the current year than in the previous year.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths greater than 600 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

## Northern Sacramento Basin Groundwater Subbasins

| Subbasin Name | GWE Maximum Increase (ft) | GWE Maximum Decrease (ft) | GWE Average Change (ft) | Count |
|---|---|---|---|---|
| **Antelope** | NA | NA | NA | 0 |
| **Bend** | NA | NA | NA | 0 |
| **Butte** | 8.0 | NA | 3.4 | 12 |
| **Colusa** | 16.0 | -10.3 | 2.3 | 30 |
| **Corning** | 4.1 | -3.0 | 0.9 | 12 |
| **Los Molinos** | 4.4 | -0.2 | 1.8 | 10 |
| **Red Bluff** | 0.4 | NA | 0.2 | 2 |
| **Sutter** | 2.7 | NA | 2.0 | 5 |
| **Vina** | 14.2 | NA | 5.1 | 12 |
| **Wyandotte Creek** | 0.8 | NA | 0.8 | 1 |
| **Summary** | 16.0 | -10.3 | 2.1 | 84 |

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# NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2018 TO SPRING 2019

## DEEP WELLS

(Well depths greater than 600 ft bgs)

**PLATE 1D-A**

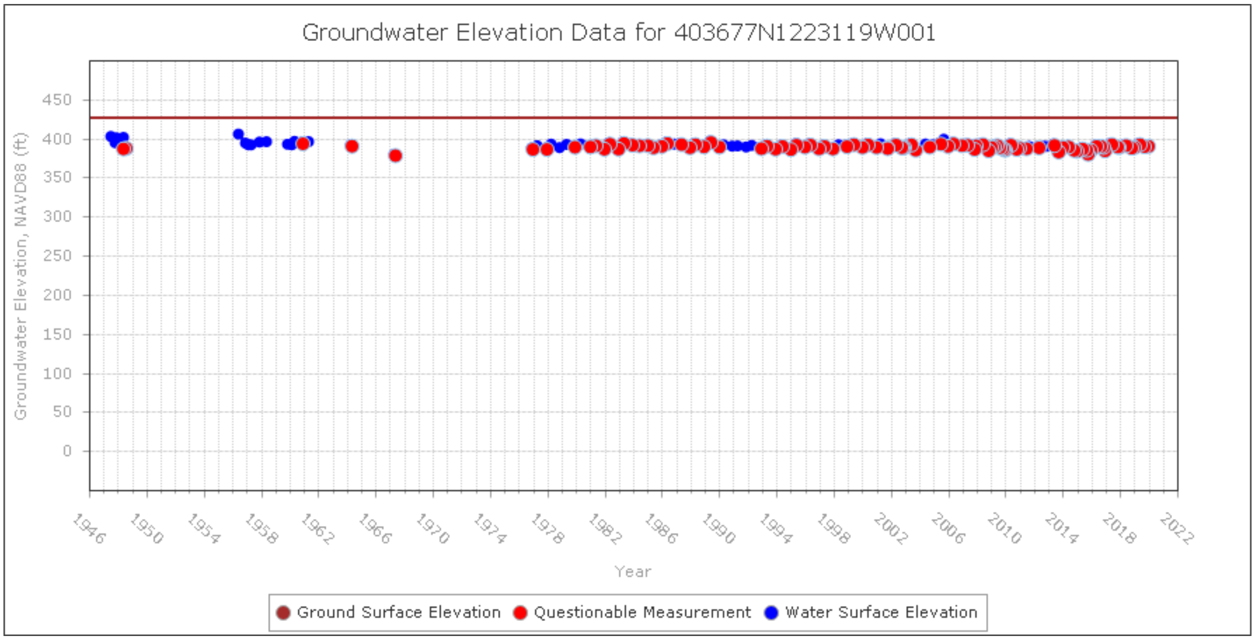
Date: May 2019

BY: A. Scholzen

https://data.ca.gov/dataset/northern-sacramento-valley-groundwater-elevation-change-maps

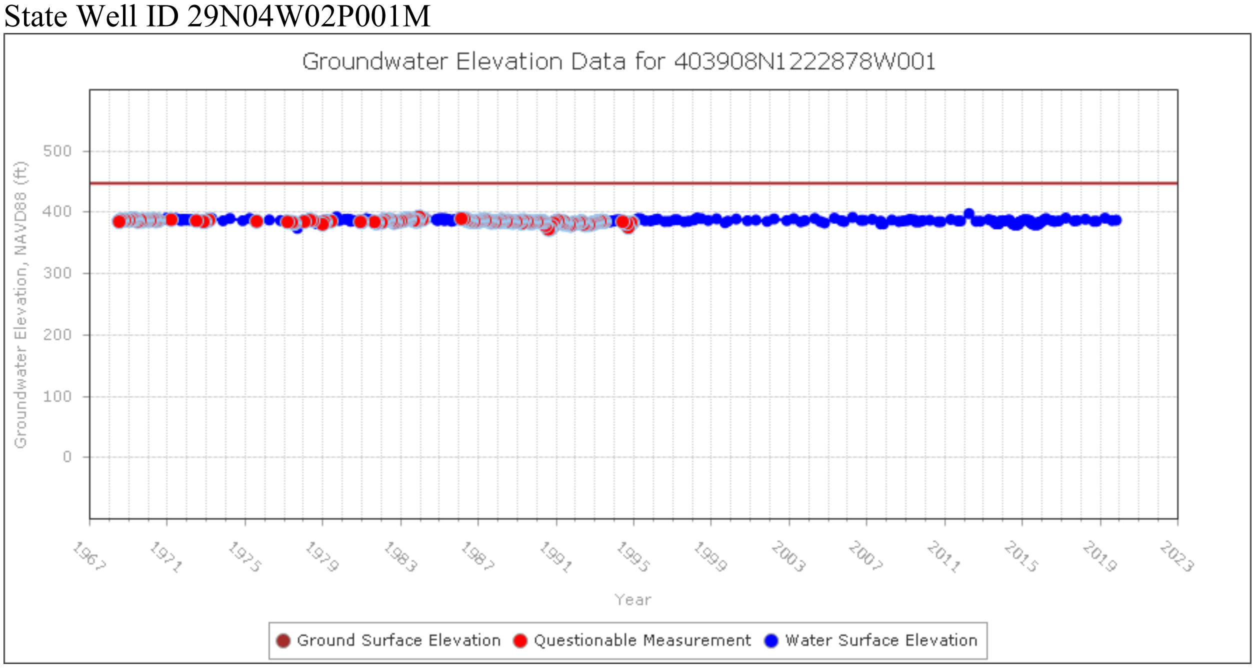
## Anderson-Cottonwood Irrigation District

State Well ID 29N04W15E002M




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

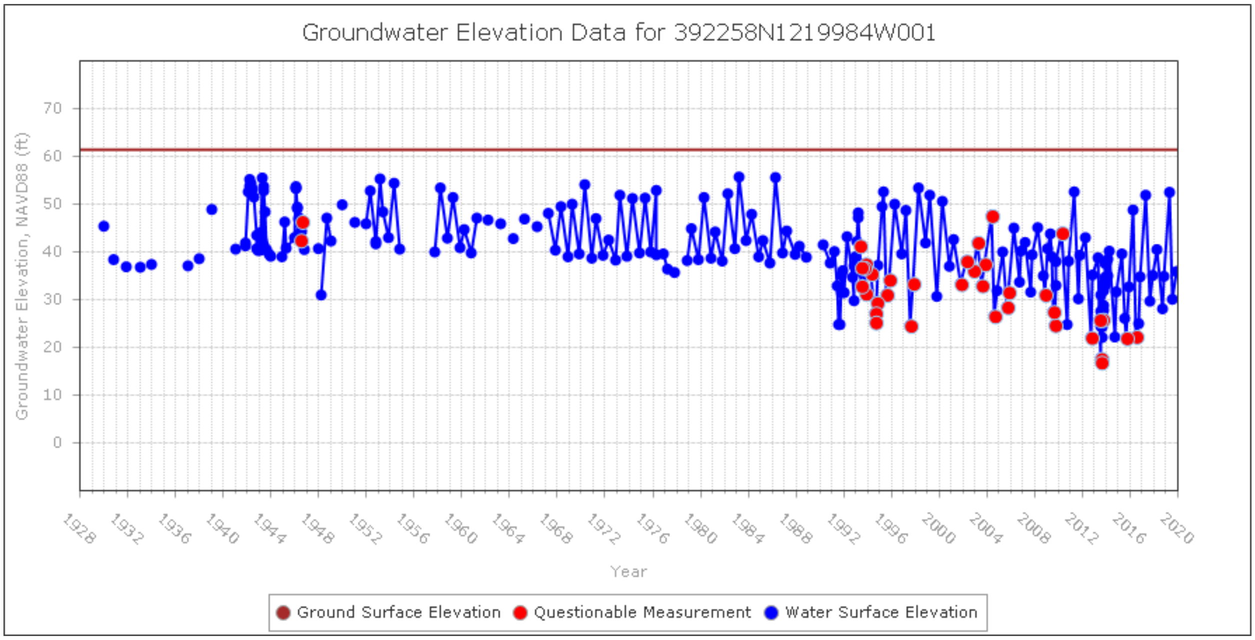
State Well ID 29N04W02P001M




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

## Eastside Mutual Water Company

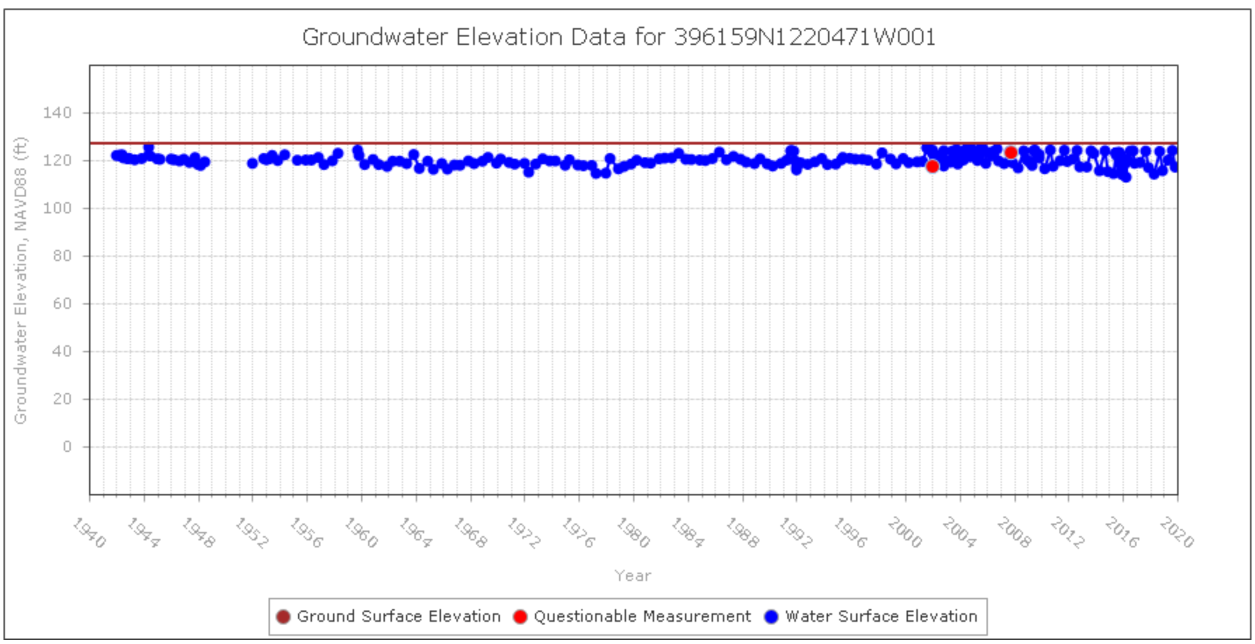
State Well ID 16N01W20F001M




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

## Glenn-Colusa Irrigation District

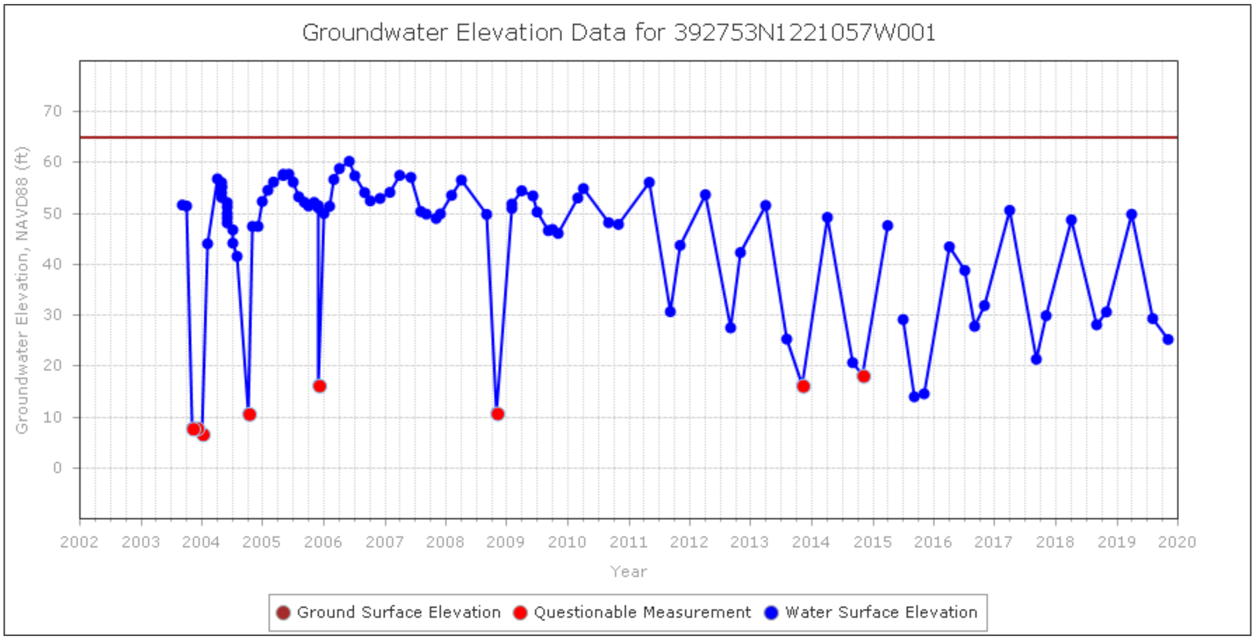
State Well ID 20N02W02J001M




*Source: DWR's CASGEM website.*
Note: Well number in the title of the figure is the CASGEM Well Number.

## Maxwell Irrigation District

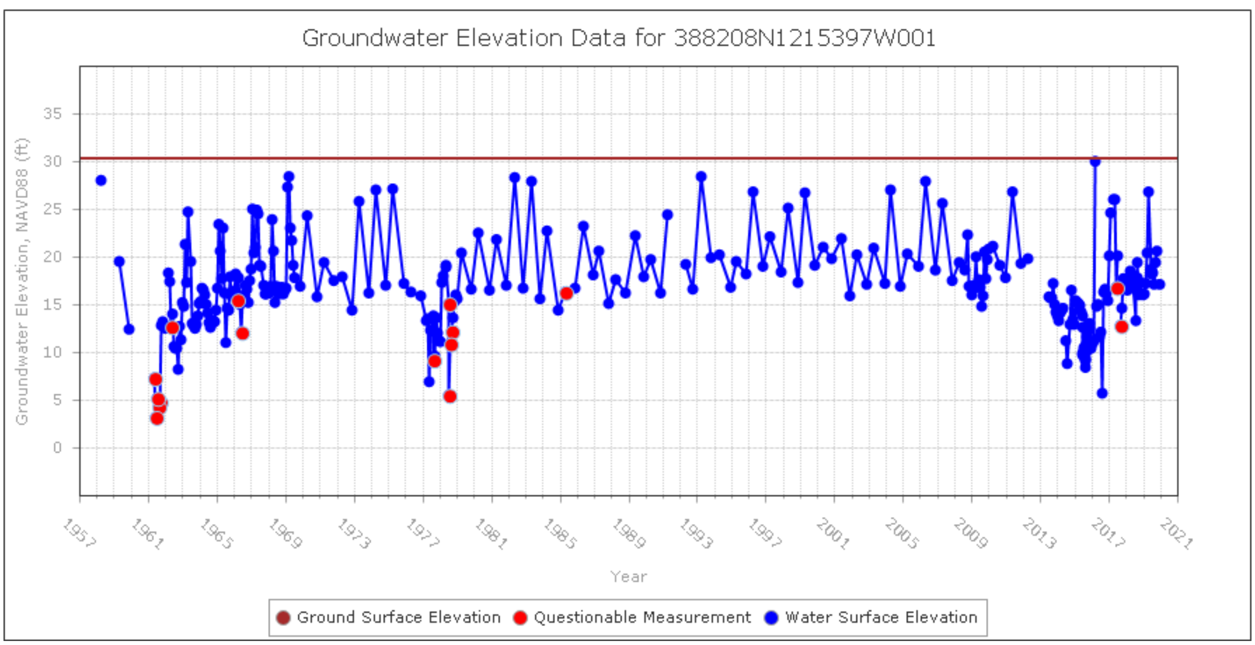
State Well ID 16N02W05B001M (Deep well; Depth=797 feet)




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

## Natomas Central Mutual Water Company

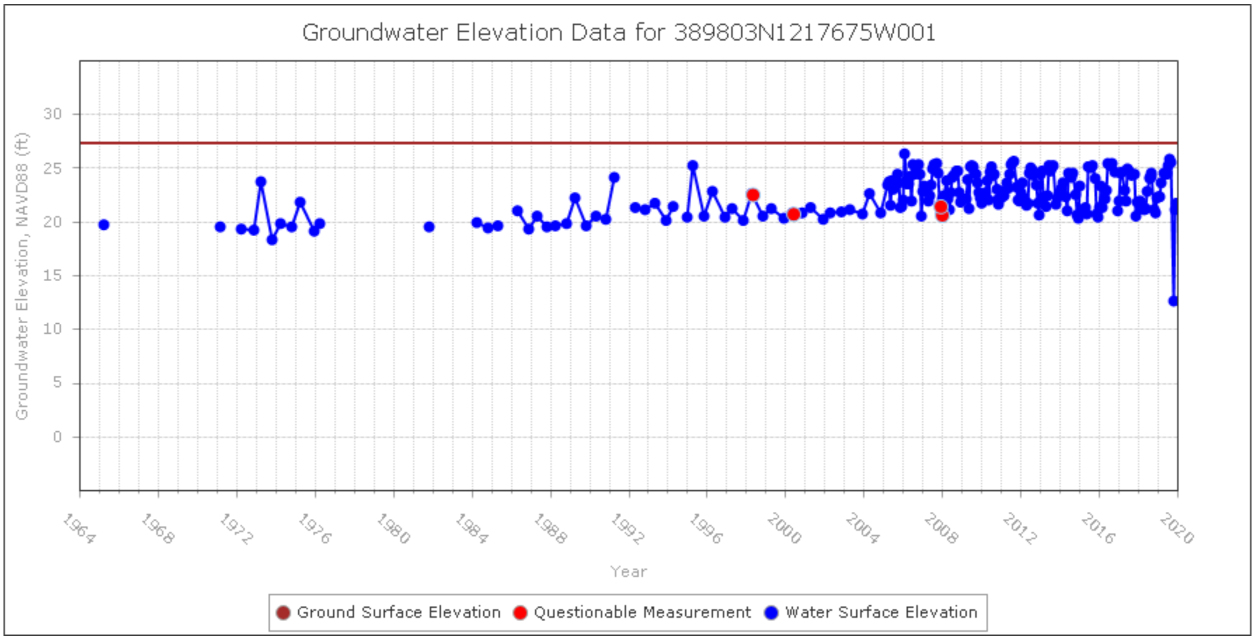
State Well ID 11N04E09D002M




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

## Pelger Mutual Water Company

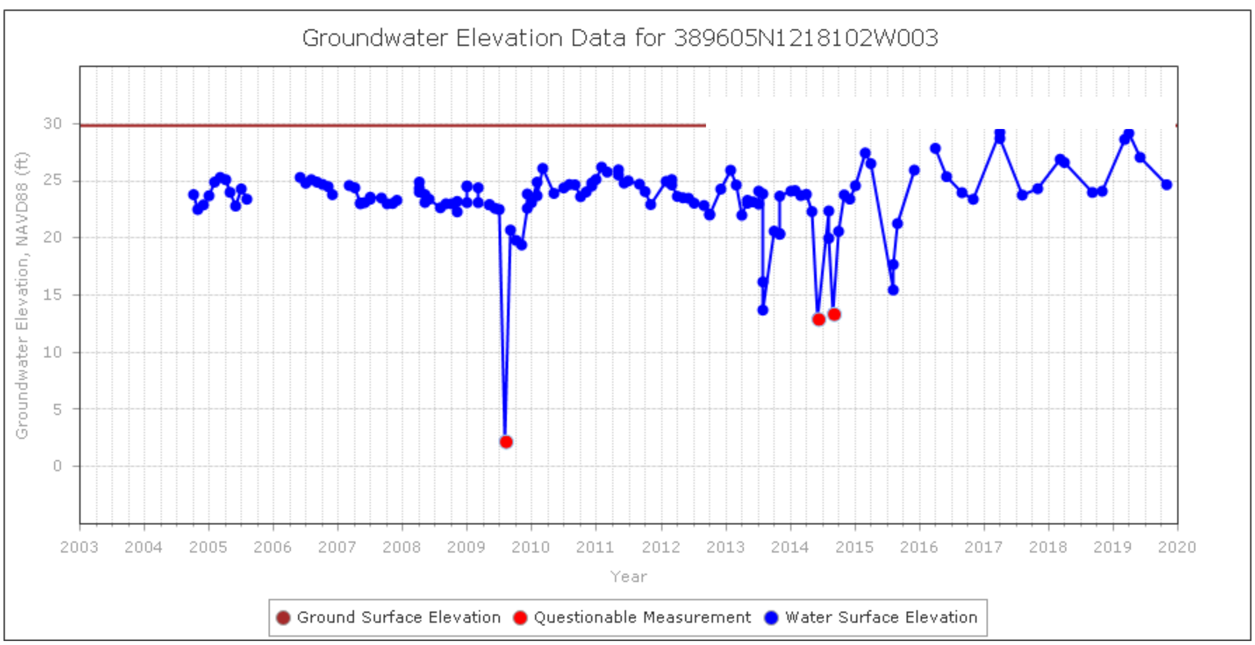
State Well ID 13N02E17A001M




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

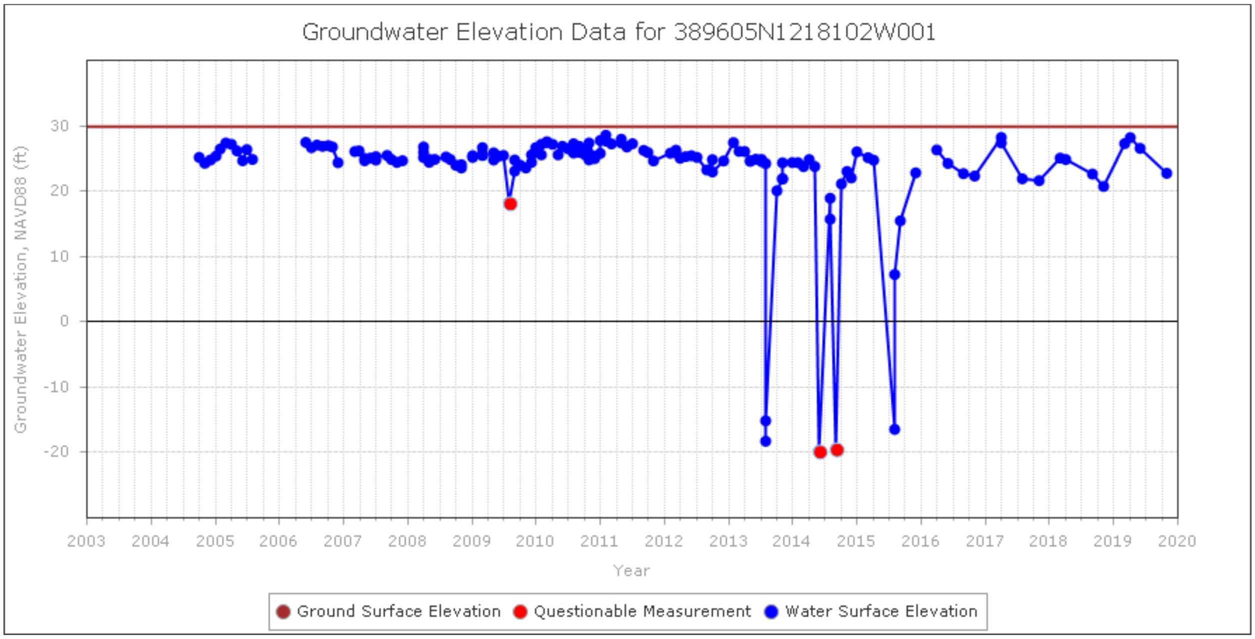
## Pelger Road 1700 LLC

State Well ID 13N01E24G004M (Shallow well; Depth=100 feet)




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

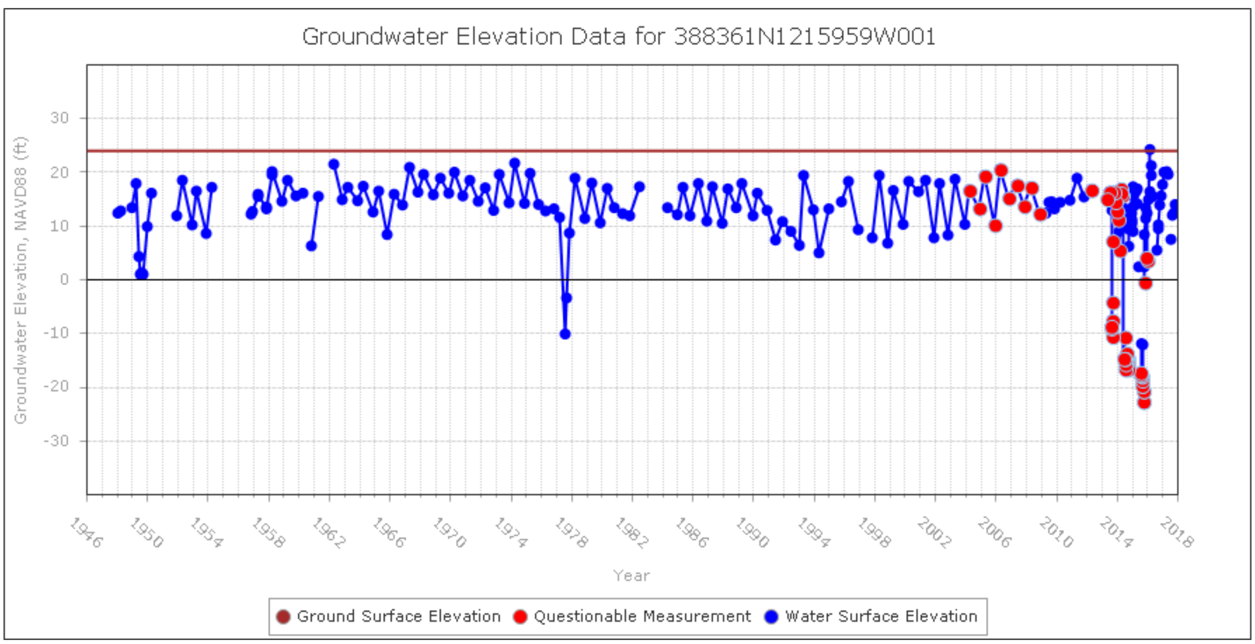
State Well ID 13N01E24G002M (Deep well; Depth=310 feet)




*Source: DWR's CASGEM website.*
*Note: Well number in the title of the figure is the CASGEM Well Number.*

## Pleasant Grove-Verona Mutual Water Company

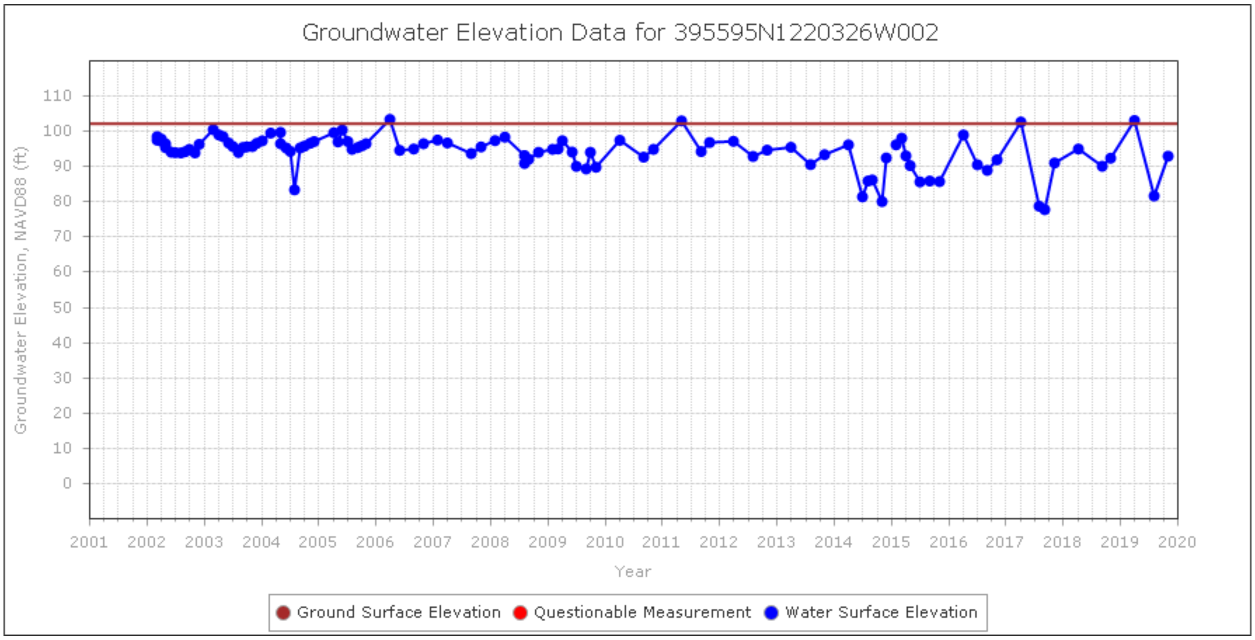
State Well ID 11N03E01D001M




*Source: DWR's CASGEM website.*
Note: Well number in the title of the figure is the CASGEM Well Number.

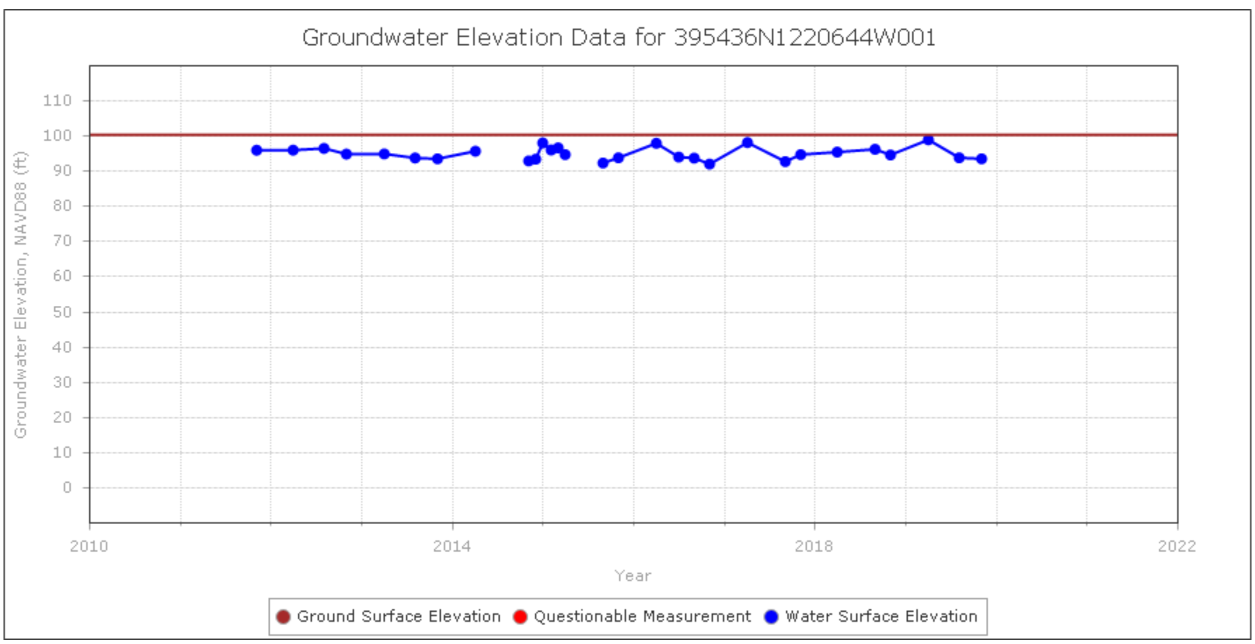
## Princeton-Codora-Glenn Irrigation District and Provident Irrigation District

State Well ID 20N02W25F002M (Depth= 513 ft)



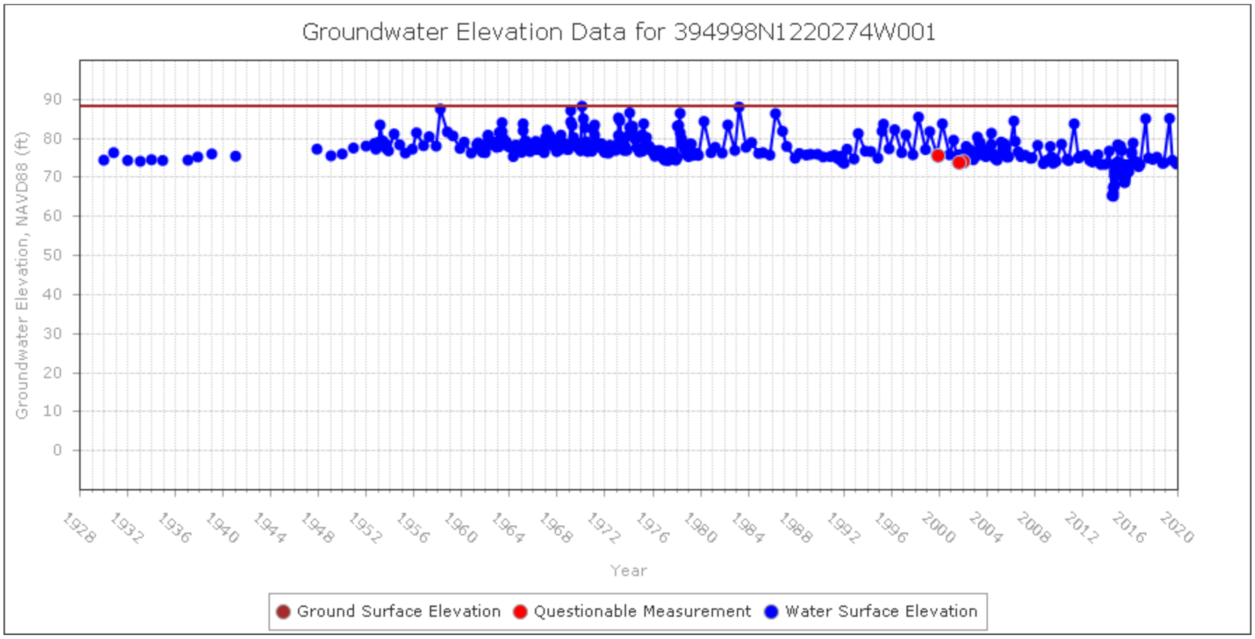

*Source: DWR's CASGEM website.*
Note: Well number in the title of the figure is the CASGEM Well Number.

State Well ID 20N02W34J001M




*Source: DWR's CASGEM website.*
Note: Well number in the title of the figure is the CASGEM Well Number.

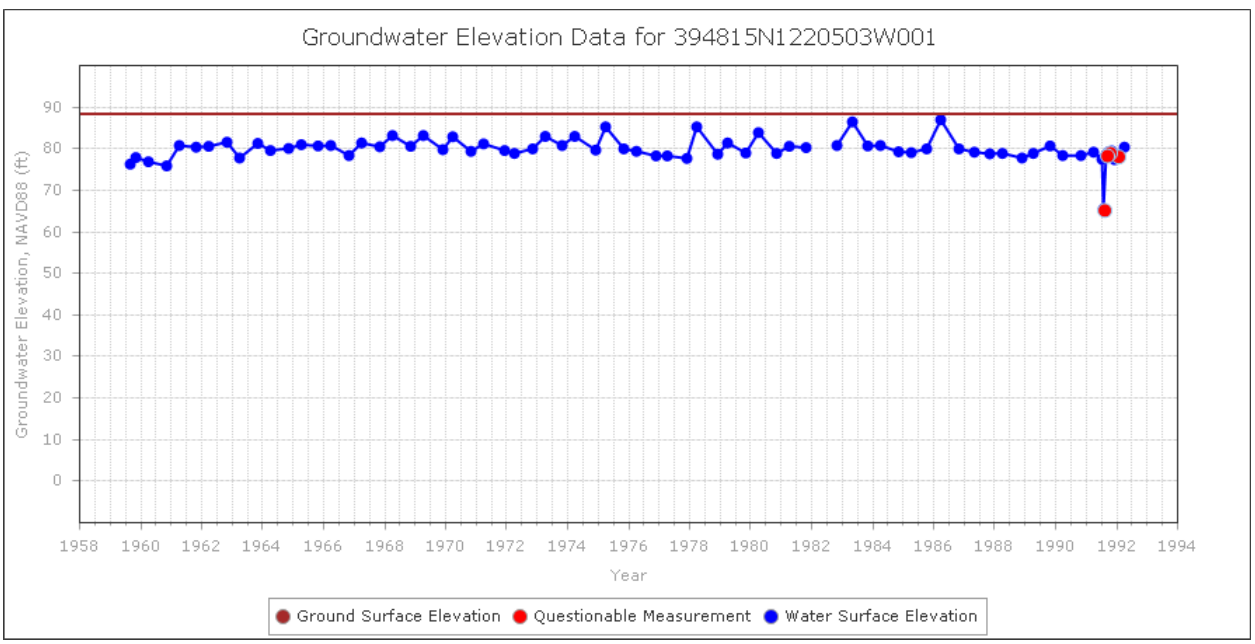
State Well ID 19N02W13J001M




*Source: DWR's CASGEM website.*
Note: Well number in the title of the figure is the CASGEM Well Number

## Provident Irrigation District

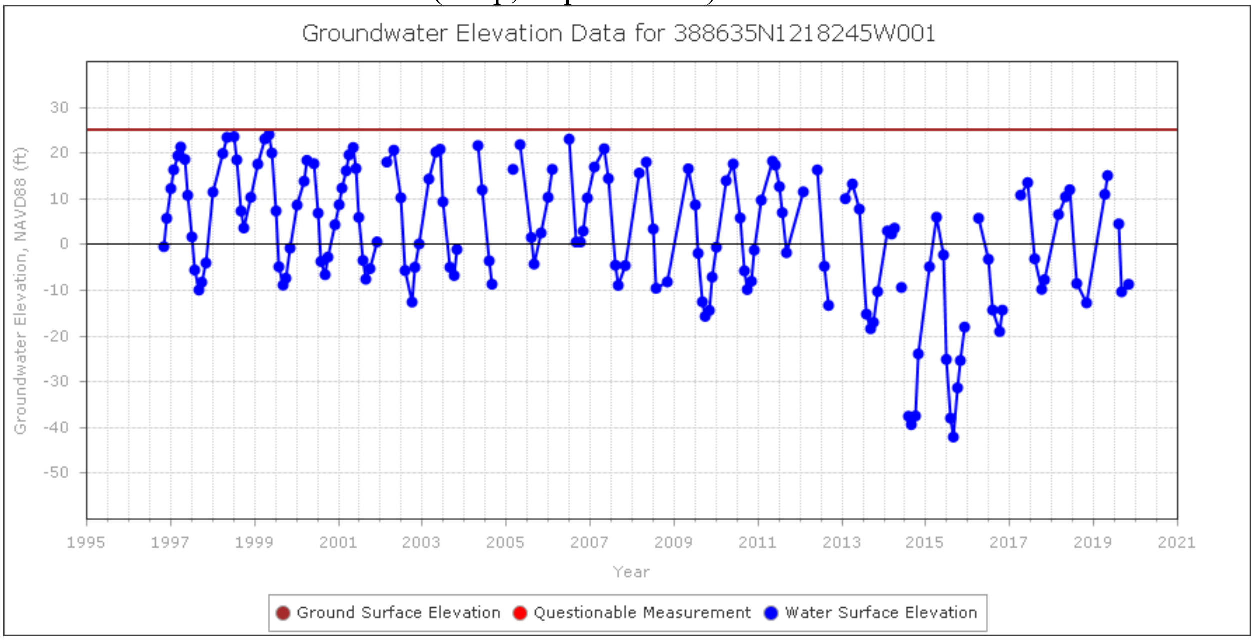
State Well ID 19N02W23Q002M




*Source: DWR's CASGEM website.*
Note: Well number in the title of the figure is the CASGEM Well Number.

**Reclamation District 108**

State Well ID 12N01E26A001M (Deep; Depth= 670 ft)

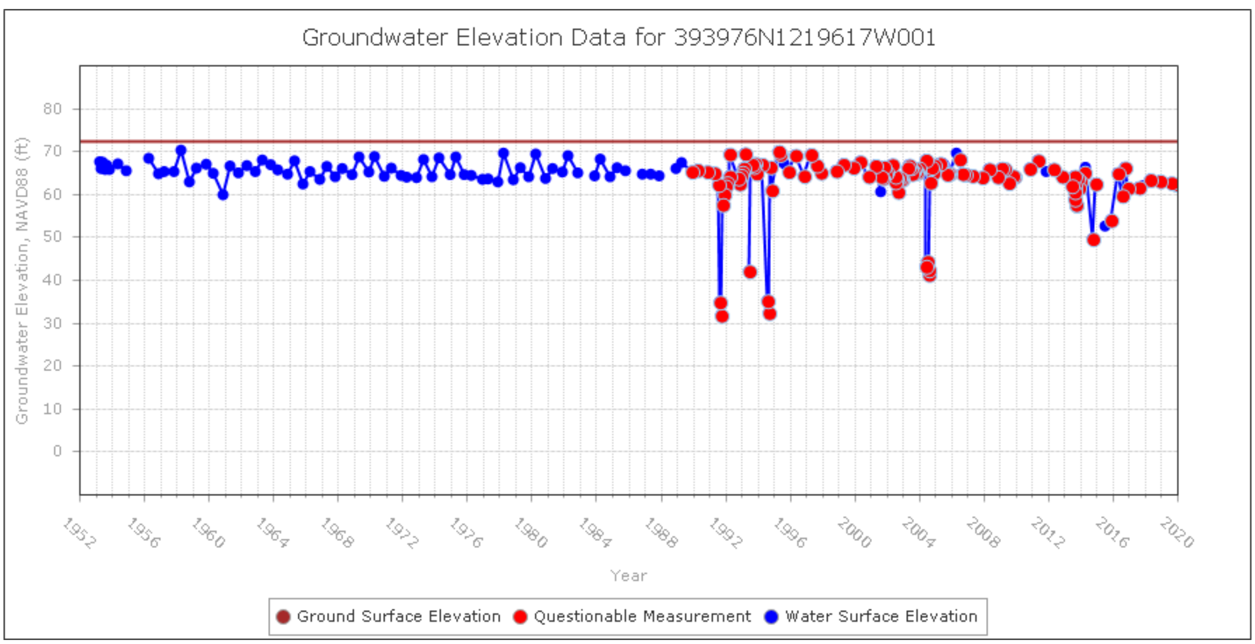



*Source: DWR's CASGEM website.*

Note: Well number in the title of the figure is the CASGEM Well Number.

**Reclamation District 1004**

State Well ID 18N01W22L001M

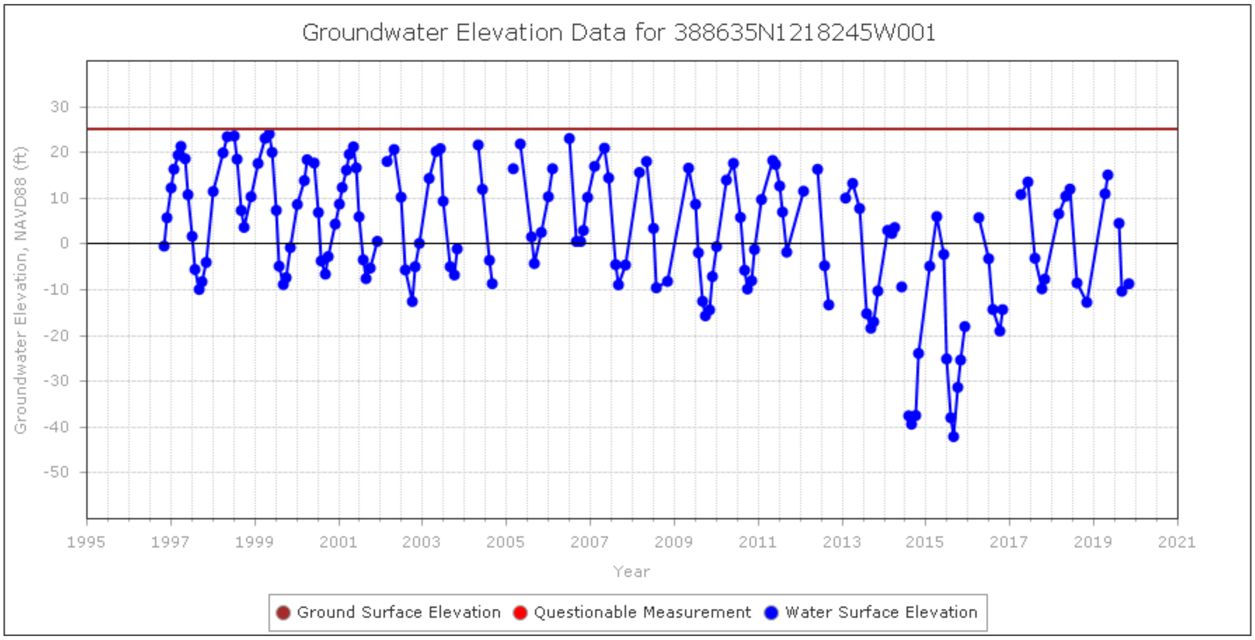



*Source: DWR's CASGEM website.*

Note: Well number in the title of the figure is the CASGEM Well Number.

## River Garden Farms

State Well ID 12N01E26A001M (Deep Well; Depth = 670 ft)

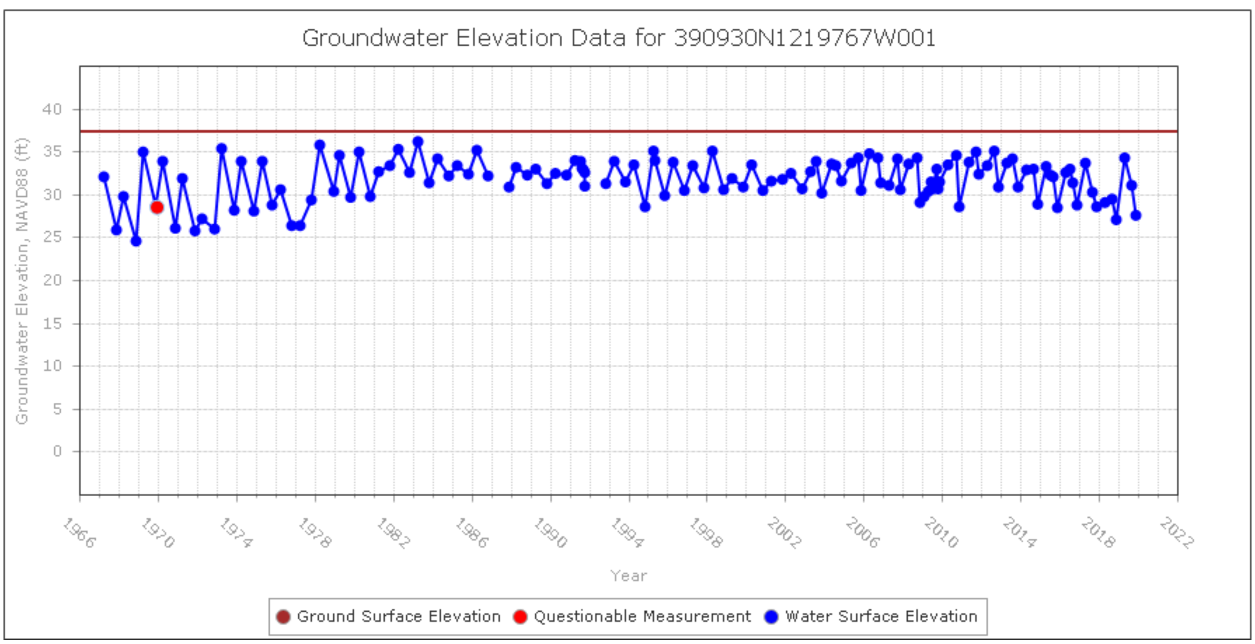



*Source: DWR's CASGEM website.*

Note: Well number in the title of the figure is the CASGEM Well Number.

## Sycamore Mutual Water Company

State Well ID 14N01W04K003M (Shallow Well; Depth= 73 ft)

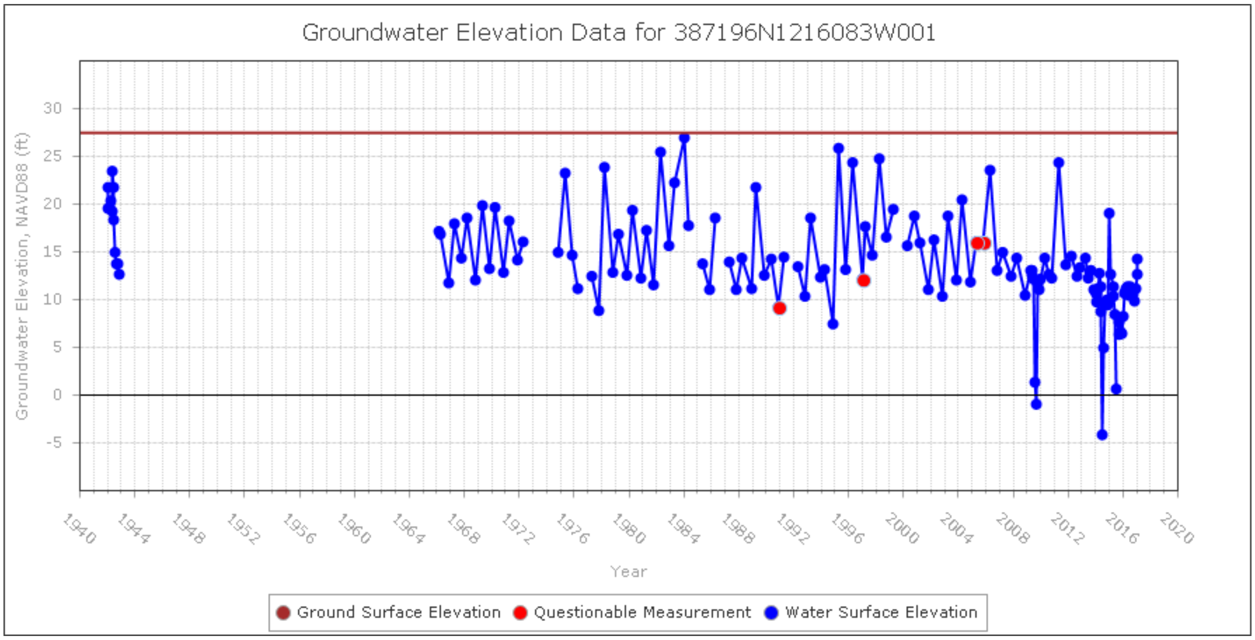



*Source: DWR's CASGEM website.*

Note: Well number in the title of the figure is the CASGEM Well Number.

**Te Velde Revocable Family Trust**

State Well ID 10N03E14C001M




*Source: DWR's CASGEM website.*

Note: Well number in the title of the figure is the CASGEM Well Number.

# Appendix E

# Air Quality Calculations

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**Table E-1. General Conformity Applicability Evaluation (Unmitigated Emissions)**

| County/ Nonattainment Area | Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| | Sacramento Metro[1] | Sacramento Metro[1] | Sacramento Area[2] | Sacramento[3,4] | Sacramento Co. | Sacramento[4] |
| Colusa | n/a | n/a | n/a | n/a | n/a | n/a |
| Glenn | n/a | n/a | n/a | n/a | n/a | n/a |
| Sacramento | 0.0 | 2.9 | 0.1 | 1.4 | 0.0 | 0.0 |
| Shasta | n/a | n/a | n/a | n/a | n/a | n/a |
| Sutter[5] | 4.2 | 28.7 | n/a | 6.3 | n/a | 1.0 |
| Tehama | n/a | n/a | n/a | n/a | n/a | n/a |
| Yolo | 0.0 | 0.0 | 0.0 | 0.0 | n/a | 0.0 |
| Total | 4.2 | 31.6 | 0.1 | 7.7 | 0.0 | 1.0 |
| Classification | Severe-15 | Severe-15 | Maintenance | PM2.5 Precursor | Maintenance | Nonattainment |
| De Minimis Threshold (tpy) | 25 | 25 | 100 | 100 | 100 | 100 |
| Exceed? | No | Yes | No | No | No | No |

Note:

[1]The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

[2]The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

[3]All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

[4]The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

[5]VOC and NOx emissions are excluded from Cranmore Farms, Pelger Mutual Water Company, and Reclamation District 1004 because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

**Table E-2. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)**

| Water Agency | County | VOC | NOx |
|---|---|---|---|
| Pelger Road 1700 LLC | Sutter | All Electric | All Electric |
| Pelger Mutual Water Company | Sutter | 0.0 | 0.8 |
| Reclamation District 1004 | Sutter | No Engines | No Engines |
| **Total** | | **0.0** | **0.8** |

## Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

### Table E-3. Daily VOC Emissions (Unmitigated)

| Water Agency | Daily VOC Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 1.54 | | | | | | | 1.54 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 58.76 | | | | | | | 58.76 |
| Glenn-Colusa Irrigation District | 11.95 | 2.99 | | | | | | 14.94 |
| Guisti Farms | | | | | 3.02 | | | 3.02 |
| Maxwell Irrigation District | 2.48 | | | | | | | 2.48 |
| Natomas Central Mutual Water Company | | | 0.08 | | 0.32 | | | 0.40 |
| Pelger Mutual Water Company | | | | | 0.99 | | | 0.99 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 30.27 | | | 30.27 |
| Princeton-Codora-Glenn Irrigation District | 6.58 | 20.89 | | | | | | 27.47 |
| Provident Irrigation District | No Engines | 54.54 | | | | | | 54.54 |
| Reclamation District 1004 | 34.81 | 2.95 | | | No Engines | | | 37.76 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 34.59 | | | 34.59 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **116.13** | **81.37** | **0.08** | **0.00** | **69.19** | **0.00** | **0.00** | **266.76** |

Key:
VOC = volatile organic compounds

### Table E-4. Daily NOx Emissions (Unmitigated)

| Water Agency | Daily NOx Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 3.08 | | | | | | | 3.08 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 30.18 | | | | | | | 30.18 |
| Glenn-Colusa Irrigation District | 147.33 | 36.83 | | | | | | 184.17 |
| Guisti Farms | | | | | 6.03 | | | 6.03 |
| Maxwell Irrigation District | 47.21 | | | | | | | 47.21 |
| Natomas Central Mutual Water Company | | | 31.01 | | 11.55 | | | 42.56 |
| Pelger Mutual Water Company | | | | | 18.76 | | | 18.76 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 271.10 | | | 271.10 |
| Princeton-Codora-Glenn Irrigation District | 81.17 | 253.40 | | | | | | 334.58 |
| Provident Irrigation District | No Engines | 672.56 | | | | | | 672.56 |
| Reclamation District 1004 | 444.92 | 36.38 | | | No Engines | | | 481.31 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 198.10 | | | 198.10 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **753.91** | **999.18** | **31.01** | **0.00** | **505.55** | **0.00** | **0.00** | **2,289.64** |

Key:
NOx = nitrogen oxides

## Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

### Table E-5. Daily CO Emissions (Unmitigated)

| Water Agency | Daily CO Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 6.17 | | | | | | | 6.17 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 57.02 | | | | | | | 57.02 |
| Glenn-Colusa Irrigation District | 31.75 | 7.94 | | | | | | 39.68 |
| Guisti Farms | | | | | 12.07 | | | 12.07 |
| Maxwell Irrigation District | 43.49 | | | | | | | 43.49 |
| Natomas Central Mutual Water Company | | | 0.79 | | 2.53 | | | 3.31 |
| Pelger Mutual Water Company | | | | | 24.68 | | | 24.68 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 137.13 | | | 137.13 |
| Princeton-Codora-Glenn Irrigation District | 17.49 | 61.96 | | | | | | 79.45 |
| Provident Irrigation District | No Engines | 144.93 | | | | | | 144.93 |
| Reclamation District 1004 | 127.07 | 7.84 | | | No Engines | | | 134.91 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 236.79 | | | 236.79 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **282.98** | **222.66** | **0.79** | **0.00** | **413.19** | **0.00** | **0.00** | **919.62** |

Key:
CO = carbon monoxide

### Table E-6. Daily SOx Emissions (Unmitigated)

| Water Agency | Daily SOx Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 20.30 | | | | | | | 20.30 |
| Glenn-Colusa Irrigation District | 9.74 | 2.44 | | | | | | 12.18 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 15.48 | | | | | | | 15.48 |
| Natomas Central Mutual Water Company | | | 14.77 | | 3.36 | | | 18.12 |
| Pelger Mutual Water Company | | | | | 6.15 | | | 6.15 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 35.33 | | | 35.33 |
| Princeton-Codora-Glenn Irrigation District | 5.37 | 19.38 | | | | | | 24.75 |
| Provident Irrigation District | No Engines | 44.48 | | | | | | 44.48 |
| Reclamation District 1004 | 38.74 | 2.41 | | | No Engines | | | 41.15 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 57.24 | | | 57.24 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **89.63** | **68.70** | **14.77** | **0.00** | **102.08** | **0.00** | **0.00** | **275.18** |

Key:
SOx = sulfur oxides

## Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

### Table E-7. Daily PM10 Emissions (Unmitigated)

| Water Agency | Daily PM10 Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.02 | | | | | | | 0.02 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.26 | | | | | | | 3.26 |
| Glenn-Colusa Irrigation District | 2.31 | 0.58 | | | | | | 2.88 |
| Guisti Farms | | | | | 0.03 | | | 0.03 |
| Maxwell Irrigation District | 2.48 | | | | | | | 2.48 |
| Natomas Central Mutual Water Company | | | 0.13 | | 0.07 | | | 0.20 |
| Pelger Mutual Water Company | | | | | 1.48 | | | 1.48 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 7.84 | | | 7.84 |
| Princeton-Codora-Glenn Irrigation District | 0.87 | 2.74 | | | | | | 3.60 |
| Provident Irrigation District | No Engines | 8.02 | | | | | | 8.02 |
| Reclamation District 1004 | 6.66 | 0.39 | | | No Engines | | | 7.05 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 7.22 | | | 7.22 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **15.59** | **11.73** | **0.13** | **0.00** | **16.65** | **0.00** | **0.00** | **44.10** |

Key:
PM10 = inhalable particulate matter

### Table E-8. Daily PM2.5 Emissions (Unmitigated)

| Water Agency | Daily PM2.5 Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.02 | | | | | | | 0.02 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.21 | | | | | | | 3.21 |
| Glenn-Colusa Irrigation District | 2.25 | 0.56 | | | | | | 2.81 |
| Guisti Farms | | | | | 0.03 | | | 0.03 |
| Maxwell Irrigation District | 2.48 | | | | | | | 2.48 |
| Natomas Central Mutual Water Company | | | 0.13 | | 0.07 | | | 0.20 |
| Pelger Mutual Water Company | | | | | 1.48 | | | 1.48 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 7.69 | | | 7.69 |
| Princeton-Codora-Glenn Irrigation District | 0.85 | 2.67 | | | | | | 3.52 |
| Provident Irrigation District | No Engines | 7.83 | | | | | | 7.83 |
| Reclamation District 1004 | 6.56 | 0.38 | | | No Engines | | | 6.94 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 7.22 | | | 7.22 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **15.37** | **11.44** | **0.13** | **0.00** | **16.49** | **0.00** | **0.00** | **43.44** |

Key:
PM2.5 = fine particulate matter

## Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

### Table E-9. Annual VOC Emissions (Unmitigated)

| Water Agency | Annual VOC Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.12 | | | | | | | 0.12 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.20 | | | | | | | 3.20 |
| Glenn-Colusa Irrigation District | 1.11 | 0.28 | | | | | | 1.39 |
| Guisti Farms | | | | | 0.28 | | | 0.28 |
| Maxwell Irrigation District | 0.15 | | | | | | | 0.15 |
| Natomas Central Mutual Water Company | | | 0.01 | | 0.03 | | | 0.04 |
| Pelger Mutual Water Company | | | | | 0.04 | | | 0.04 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.48 | | | 1.48 |
| Princeton-Codora-Glenn Irrigation District | 0.41 | 1.30 | | | | | | 1.71 |
| Provident Irrigation District | No Engines | 3.52 | | | | | | 3.52 |
| Reclamation District 1004 | 1.42 | 0.12 | | | No Engines | | | 1.54 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 2.41 | | | 2.41 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **6.42** | **5.22** | **0.01** | **0.00** | **4.24** | **0.00** | **0.00** | **15.89** |

Key:
VOC = volatile organic compounds

### Table E-10. Annual NOx Emissions (Unmitigated)

| Water Agency | Annual NOx Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.25 | | | | | | | 0.25 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 1.64 | | | | | | | 1.64 |
| Glenn-Colusa Irrigation District | 13.70 | 3.43 | | | | | | 17.13 |
| Guisti Farms | | | | | 0.56 | | | 0.56 |
| Maxwell Irrigation District | 2.88 | | | | | | | 2.88 |
| Natomas Central Mutual Water Company | | | 2.88 | | 1.07 | | | 3.96 |
| Pelger Mutual Water Company | | | | | 0.79 | | | 0.79 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 13.25 | | | 13.25 |
| Princeton-Codora-Glenn Irrigation District | 5.06 | 15.81 | | | | | | 20.87 |
| Provident Irrigation District | No Engines | 43.44 | | | | | | 43.44 |
| Reclamation District 1004 | 18.10 | 1.48 | | | No Engines | | | 19.58 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 13.82 | | | 13.82 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **41.64** | **64.15** | **2.88** | **0.00** | **29.49** | **0.00** | **0.00** | **138.17** |

Key:
NOx = nitrogen oxides

## Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

### Table E-11. Annual CO Emissions (Unmitigated)

| Water Agency | Annual CO Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.50 | | | | | | | 0.50 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.11 | | | | | | | 3.11 |
| Glenn-Colusa Irrigation District | 2.95 | 0.74 | | | | | | 3.69 |
| Guisti Farms | | | | | 1.12 | | | 1.12 |
| Maxwell Irrigation District | 2.65 | | | | | | | 2.65 |
| Natomas Central Mutual Water Company | | | 0.07 | | 0.23 | | | 0.31 |
| Pelger Mutual Water Company | | | | | 1.03 | | | 1.03 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 6.70 | | | 6.70 |
| Princeton-Codora-Glenn Irrigation District | 1.09 | 3.86 | | | | | | 4.96 |
| Provident Irrigation District | No Engines | 9.36 | | | | | | 9.36 |
| Reclamation District 1004 | 5.17 | 0.32 | | | No Engines | | | 5.49 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 16.52 | | | 16.52 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **15.47** | **14.28** | **0.07** | **0.00** | **25.61** | **0.00** | **0.00** | **55.44** |

Key:
CO = carbon monoxide

### Table E-12. Annual SOx Emissions (Unmitigated)

| Water Agency | Annual SOx Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 1.11 | | | | | | | 1.11 |
| Glenn-Colusa Irrigation District | 0.91 | 0.23 | | | | | | 1.13 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 0.94 | | | | | | | 0.94 |
| Natomas Central Mutual Water Company | | | 1.37 | | 0.31 | | | 1.69 |
| Pelger Mutual Water Company | | | | | 0.26 | | | 0.26 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.73 | | | 1.73 |
| Princeton-Codora-Glenn Irrigation District | 0.33 | 1.21 | | | | | | 1.54 |
| Provident Irrigation District | No Engines | 2.87 | | | | | | 2.87 |
| Reclamation District 1004 | 1.58 | 0.10 | | | No Engines | | | 1.67 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 3.99 | | | 3.99 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **4.87** | **4.41** | **1.37** | **0.00** | **6.29** | **0.00** | **0.00** | **16.94** |

Key:
SOx = sulfur oxides

## Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

### Table E-13. Annual PM10 Emissions (Unmitigated)

| Water Agency | Annual PM10 Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 0.18 | | | | | | | 0.18 |
| Glenn-Colusa Irrigation District | 0.21 | 0.05 | | | | | | 0.27 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 0.15 | | | | | | | 0.15 |
| Natomas Central Mutual Water Company | | | 0.01 | | 0.01 | | | 0.02 |
| Pelger Mutual Water Company | | | | | 0.06 | | | 0.06 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.38 | | | 0.38 |
| Princeton-Codora-Glenn Irrigation District | 0.05 | 0.17 | | | | | | 0.22 |
| Provident Irrigation District | No Engines | 0.52 | | | | | | 0.52 |
| Reclamation District 1004 | 0.27 | 0.02 | | | No Engines | | | 0.29 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.50 | | | 0.50 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **0.87** | **0.76** | **0.01** | **0.00** | **0.96** | **0.00** | **0.00** | **2.60** |

Key:
PM10 = inhalable particulate matter

### Table E-14. Annual PM2.5 Emissions (Unmitigated)

| Water Agency | Annual PM2.5 Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 0.18 | | | | | | | 0.18 |
| Glenn-Colusa Irrigation District | 0.21 | 0.05 | | | | | | 0.26 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 0.15 | | | | | | | 0.15 |
| Natomas Central Mutual Water Company | | | 0.01 | | 0.01 | | | 0.02 |
| Pelger Mutual Water Company | | | | | 0.06 | | | 0.06 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.38 | | | 0.38 |
| Princeton-Codora-Glenn Irrigation District | 0.05 | 0.17 | | | | | | 0.22 |
| Provident Irrigation District | No Engines | 0.51 | | | | | | 0.51 |
| Reclamation District 1004 | 0.27 | 0.02 | | | No Engines | | | 0.28 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.50 | | | 0.50 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **0.86** | **0.74** | **0.01** | **0.00** | **0.95** | **0.00** | **0.00** | **2.56** |

Key:
PM2.5 = fine particulate matter

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Anderson-Cottonwood Irrigation District | | |
| Transfer Volume | 2,400 acre-feet | (Apr-Jun) | |
| | 2,400 acre-feet | (Jul-Sep) | |
| | 4,800 acre-feet/year | | |

Peak Pumping by Transfer Period
800 AF/month
800 AF/month

**Table E-15. Anderson-Cottonwood Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Shasta | 0 | 2 | 0 | 0 | 2 |
| Tehama | 0 | 0 | 0 | 0 | 0 |
| Total | 0 | 2 | 0 | 0 | 2 |

**Table E-16. Anderson-Cottonwood Irrigation District Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate | | Transfer Volume | | Operations | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (gpm) | (% of Total) | (AF/month) | (AF/year) | (hours/day) | (hours/year) |
| Barney Street | Shasta | Electric | 2012 | 200 | n/a | 5,500 | 85% | 677 | 4,062 | 22 | 4,010 |
| Crowley Gulch | Shasta | Electric | 2012 | 50 | n/a | 1,000 | 15% | 123 | 738 | 22 | 4,010 |
| | | | | | **Total** | **6,500** | **100%** | **800** | **4,800** | **43** | **8,021** |
| | | | | | **Total (Shasta County)** | **6,500** | **100%** | **800** | **4,800** | **43** | **8,021** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Shasta | Tehama |
|---|---|---|
| PM10 | A | A |
| PM2.5 | A | A |
| O3 | A | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
800 AF/month
5,840 gallons/minute
90% peak pump rate

Conversion Factors

| | |
|---|---|
| 1 lb = | 453.6 g |
| 1 ton = | 2,000 lbs |
| 1 kW = | 1.34 hp |
| 1 day = | 24 hours |
| 1 month = | 31 days |
| 1 hour = | 60 minutes |
| 1 acre-foot = | 325,851 gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

### Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Canal Farms | | |
| Transfer Volume | 575 acre-feet | (Apr-Jun) | |
| | 425 acre-feet | (Jul-Sep) | |
| | 1,000 acre-feet/year | | |

Peak Pumping by Transfer Period
192 AF/month
142 AF/month

**Table E-17. Canal Farms Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 2 | 0 | 1 | 3 |
| Total | 0 | 2 | 0 | 1 | 3 |

**Table E-18. Canal Farms Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (MMBtu/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dennis Well North | Colusa | Electric | unknown | 125 | n/a | 3,500 | 29% | 56 | 292 | 3 | 453 | n/a |
| Dennis Well South | Colusa | Electric | unknown | 125 | n/a | 3,500 | 29% | 56 | 292 | 3 | 453 | n/a |
| East Well | Colusa | Propane | unknown | 250 | n/a | 5,000 | 42% | 80 | 417 | 3 | 453 | 288 |
| **Total** | | | | | | **12,000** | **100%** | **192** | **1,000** | **8** | **1,358** | **288** |
| **Total (Colusa County)** | | | | | | **12,000** | **100%** | **192** | **1,000** | **8** | **1,358** | **288** |

| Well | Emission Factors (g/hp-hr) VOC | NOx | CO | Emission Factors (lb/MMBtu) SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dennis Well North | | | | | | | | | | | | | | | | | | |
| Dennis Well South | | | | | | | | | | | | | | | | | | |
| East Well | 1.0 | 2.0 | 4.0 | 0.000588 | 0.00999 | 0.00999 | 1.54 | 3.08 | 6.17 | 0.00 | 0.02 | 0.02 | 0.12 | 0.25 | 0.50 | 0.000085 | 0.0014 | 0.0014 |
| **Total** | | | | | | | **1.54** | **3.08** | **6.17** | **0.00** | **0.02** | **0.02** | **0.12** | **0.25** | **0.50** | **0.000085** | **0.0014** | **0.0014** |
| **Total (Colusa County)** | | | | | | | **1.54** | **3.08** | **6.17** | **0.00** | **0.02** | **0.02** | **0.12** | **0.25** | **0.50** | **0.000085** | **0.0014** | **0.0014** |

Note: Natural gas emission factors used for propane.
Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Colusa |
|---|---|
| PM10 | A |
| PM2.5 | A |
| O3 | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
192 AF/month
1,399 gallons/minute
12% peak pump rate

Legend
(blue) Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
(green) Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 bhp-hr = | 2,542.5 | Btu |
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Eastside Mutual Water Company | | Peak Pumping by Transfer Period |
| Transfer Volume | 1,067 acre-feet | (Apr-Jun) | 634 AF/month |
| | 1,163 acre-feet | (Jul-Sep) | 443 AF/month |
| | 2,230 acre-feet/year | | |

**Table E-19. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 2 | 0 | 0 | 0 | 2 |
| Total | 2 | 0 | 0 | 0 | 2 |

**Table E-20. Eastside Mutual Water Company Criteria Pollutant Emissions**

| | Well Location | | | Power Rating | Emission | Pump Rate | | Transfer Volume | | Operations | | Fuel Consumption | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (pounds per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Well** | **(County)** | **Fuel Type** | **Model Year** | **(hp)** | **Tier** | **(gpm)** | **(% of Total)** | **(AF/month)** | **(AF/year)** | **(hours/day)** | **(hours/year)** | **(gal/yr)** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| ATW-1 | Colusa | Diesel | 2006 | 215 | T3 | 2,500 | 45% | 288 | 1,014 | 20 | 2,202 | 26,559 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 1.43 | 27.16 | 25.02 | 8.91 | 1.43 | 1.43 | 0.08 | 1.48 | 1.36 | 0.49 | 0.08 | 0.08 |
| ATW-2 | Colusa | Diesel | 2002 | 275 | T2 | 3,000 | 55% | 346 | 1,216 | 20 | 2,202 | 33,971 | 4.7 | 0.2 | 2.6 | 0.93 | 0.15 | 0.15 | 57.33 | 3.02 | 32.00 | 11.39 | 1.83 | 1.78 | 3.12 | 0.16 | 1.74 | 0.62 | 0.10 | 0.10 |
| | | | | | **Total** | **5,500** | **100%** | **634** | **2,230** | **40** | **4,404** | **60,531** | | | | | | | **58.76** | **30.18** | **57.02** | **20.30** | **3.26** | **3.21** | **3.20** | **1.64** | **3.11** | **1.11** | **0.18** | **0.18** |
| | | | | | **Total (Colusa County)** | **5,500** | **100%** | **634** | **2,230** | **40** | **4,404** | **60,531** | | | | | | | **58.76** | **30.18** | **57.02** | **20.30** | **3.26** | **3.21** | **3.20** | **1.64** | **3.11** | **1.11** | **0.18** | **0.18** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Colusa |
|---|---|
| PM10 | A |
| PM2.5 | A |
| O3 | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
634 AF/month
4,631 gallons/minute
84% peak pump rate

Legend
[shaded] Emission factors based on NMHC+NOx standard

Conversion Factors

| | |
|---|---|
| 1 lb = | 453.6 g |
| 1 ton = | 2,000 lbs |
| 1 kW = | 1.34 hp |
| 1 day = | 24 hours |
| 1 month = | 31 days |
| 1 hour = | 60 minutes |
| 1 acre-foot = | 325,851 gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | |
|---|---|---|---|---|
| Agency | Glenn-Colusa Irrigation District | | | Peak Pumping by Transfer Period |
| Transfer Volume | 5,650 acre-feet | (Apr-Jun) | | 1,883 AF/month |
| | 5,650 acre-feet | (Jul-Sep) | | 1,883 AF/month |
| | 11,300 acre-feet/year | | | |

**Table E-21. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 1 | 6 | 0 | 0 | 7 |
| Colusa | 4 | 6 | 0 | 0 | 10 |
| Total | 5 | 12 | 0 | 0 | 17 |

**Table E-22. Glenn-Colusa Irrigation District Criteria Pollutant Emissions**

| | Well Location | | | Power Rating | Emission | Pump Rate | | Transfer Volume | | Operations | | Fuel Consumption | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (pounds per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well | (County) | Fuel Type | Model Year | (hp) | Tier | (gpm) | (% of Total) | (AF/month) | (AF/year) | (hours/day) | (hours/year) | (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| 15-3-22H-3 | Colusa | Diesel | unknown | 121 | T0 | 800 | 2% | 45 | 269 | 10 | 1,826 | 12,398 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.99 | 36.83 | 7.94 | 2.44 | 0.58 | 0.56 | 0.28 | 3.43 | 0.74 | 0.23 | 0.05 | 0.05 |
| 17-2-6B-1 | Colusa | Electric | unknown | 121 | n/a | 3,000 | 9% | 168 | 1,009 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| GRS-22H-1 | Glenn | Electric | unknown | 121 | n/a | 2,300 | 7% | 129 | 774 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| GRS-34N-1 | Glenn | Diesel | unknown | 121 | T0 | 2,500 | 7% | 140 | 841 | 10 | 1,826 | 12,398 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.99 | 36.83 | 7.94 | 2.44 | 0.58 | 0.56 | 0.28 | 3.43 | 0.74 | 0.23 | 0.05 | 0.05 |
| GRS-35A-2 | Glenn | Electric | unknown | 121 | n/a | 4,300 | 13% | 241 | 1,446 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| GRS-84A-1 | Glenn | Electric | unknown | 121 | n/a | 2,500 | 7% | 140 | 841 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| Haymen | Colusa | Diesel | unknown | 121 | T0 | 2,250 | 7% | 126 | 757 | 10 | 1,826 | 12,398 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.99 | 36.83 | 7.94 | 2.44 | 0.58 | 0.56 | 0.28 | 3.43 | 0.74 | 0.23 | 0.05 | 0.05 |
| LaCroix 1 | Glenn | Electric | unknown | 121 | n/a | 850 | 3% | 48 | 286 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| LaCroix 2 | Glenn | Electric | unknown | 121 | n/a | 850 | 3% | 48 | 286 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| LaCroix 3 | Glenn | Electric | unknown | 121 | n/a | 850 | 3% | 48 | 286 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| Lagrande | Colusa | Diesel | unknown | 121 | T0 | 3,000 | 9% | 168 | 1,009 | 10 | 1,826 | 12,398 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.99 | 36.83 | 7.94 | 2.44 | 0.58 | 0.56 | 0.28 | 3.43 | 0.74 | 0.23 | 0.05 | 0.05 |
| Reister 1 | Colusa | Electric | unknown | 121 | n/a | 850 | 3% | 48 | 286 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| Reister 2 | Colusa | Electric | unknown | 121 | n/a | 850 | 3% | 48 | 286 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| Reister 3 | Colusa | Electric | unknown | 121 | n/a | 850 | 3% | 48 | 286 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| Reister 4 | Colusa | Electric | unknown | 121 | n/a | 850 | 3% | 48 | 286 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| Vann 1 | Colusa | Diesel | unknown | 121 | T0 | 3,000 | 9% | 168 | 1,009 | 10 | 1,826 | 12,398 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.99 | 36.83 | 7.94 | 2.44 | 0.58 | 0.56 | 0.28 | 3.43 | 0.74 | 0.23 | 0.05 | 0.05 |
| Vann 2 | Colusa | Electric | unknown | 121 | n/a | 4,000 | 12% | 224 | 1,345 | 10 | 1,826 | n/a | | | | | | | | | | | | | | | | | | |
| | | | | | **Total** | **33,600** | **100%** | **1,883** | **11,300** | **167** | **31,050** | **61,992** | | | | | | | **14.94** | **184.17** | **39.68** | **12.18** | **2.88** | **2.81** | **1.39** | **17.13** | **3.69** | **1.13** | **0.27** | **0.26** |
| | | | | | **Total (Glenn County)** | **14,150** | **42%** | **793** | **4,759** | **69** | **12,785** | **12,398** | | | | | | | **2.99** | **36.83** | **7.94** | **2.44** | **0.58** | **0.56** | **0.28** | **3.43** | **0.74** | **0.23** | **0.05** | **0.05** |
| | | | | | **Total (Colusa County)** | **19,450** | **58%** | **1,090** | **6,541** | **98** | **18,264** | **49,593** | | | | | | | **11.95** | **147.33** | **31.75** | **9.74** | **2.31** | **2.25** | **1.11** | **13.70** | **2.95** | **0.91** | **0.21** | **0.21** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Glenn | Colusa |
|---|---|---|
| PM10 | A | A |
| PM2.5 | A | A |
| O3 | A | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
1,883 AF/month
13,747 gallons/minute
41% peak pump rate

Legend
[shaded cell] Engine power rating equal to average horsepower of all wells in GCID's well database

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | |
|---|---|---|---|---|
| Agency | Guisti Farms | | | Peak Pumping by Transfer Period |
| Transfer Volume | 500 | acre-feet | (Apr-Jun) | 167 AF/month |
| | 500 | acre-feet | (Jul-Sep) | 167 AF/month |
| | 1,000 | acre-feet/year | | |

**Table E-23. Guisti Farms Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 0 | 0 | 0 | 2 | 2 |
| Total | 0 | 0 | 0 | 2 | 2 |

**Table E-24. Guisti Farms Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Guisti Well 1 | Sutter | Propane | 2015 | 150 | n/a | 3,200 | 50% | 83 | 500 | 5 | 849 | 7,141 |
| Guisti Well 2 | Sutter | Propane | 2015 | 150 | n/a | 3,200 | 50% | 83 | 500 | 5 | 849 | 7,141 |
| | | | | | **Total** | **6,400** | **100%** | **167** | **1,000** | **9** | **1,697** | **14,282** |
| | | | | | **Total (Sutter County)** | **6,400** | **100%** | **167** | **1,000** | **9** | **1,697** | **14,282** |

| Well | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Guisti Well 1 | 1.0 | 2.0 | 4.0 | 0.000588 | 0.00999 | 0.00999 | 1.51 | 3.02 | 6.03 | 0.00 | 0.02 | 0.02 | 0.14 | 0.28 | 0.56 | 0.000095 | 0.0016 | 0.0016 |
| Guisti Well 2 | 1.0 | 2.0 | 4.0 | 0.000588 | 0.00999 | 0.00999 | 1.51 | 3.02 | 6.03 | 0.00 | 0.02 | 0.02 | 0.14 | 0.28 | 0.56 | 0.000095 | 0.0016 | 0.0016 |
| **Total** | | | | | | | **3.02** | **6.03** | **12.07** | **0.00** | **0.03** | **0.03** | **0.28** | **0.56** | **1.12** | **0.00019** | **0.0032** | **0.0032** |
| **Total (Sutter County)** | | | | | | | **3.02** | **6.03** | **12.07** | **0.00** | **0.03** | **0.03** | **0.28** | **0.56** | **1.12** | **0.00019** | **0.0032** | **0.0032** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
167 AF/month
10 gallons/minute
0% peak pump rate

Legend
[shaded cell] Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008

Conversion Factors

| | | |
|---|---|---|
| 1 bhp-hr = | 2,542.5 | Btu |
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

### Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Maxwell Irrigation District | | Peak Pumping by Transfer Period |
| Transfer Volume | 1,000 acre-feet | (Apr-Jun) | 595 AF/month |
| | 2,000 acre-feet | (Jul-Sep) | 762 AF/month |
| | 3,000 acre-feet/year | | |

**Table E-25. Maxwell Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 2 | 0 | 0 | 0 | 2 |
| Total | 2 | 0 | 0 | 0 | 2 |

**Table E-26. Maxwell Irrigation District Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MainWell | Colusa | Diesel | 2,006 | 215 | T3 | 3,800 | 50% | 381 | 1,500 | 18 | 2,144 | 25,857 |
| TuttleWell | Colusa | Diesel | 2,006 | 215 | T3 | 3,800 | 50% | 381 | 1,500 | 18 | 2,144 | 25,857 |
| | | | | | **Total** | **7,600** | **100%** | **762** | **3,000** | **35** | **4,288** | **51,715** |
| | | | | | **Total (Colusa County)** | **7,600** | **100%** | **762** | **3,000** | **35** | **4,288** | **51,715** |

| Well | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|
| MainWell | 0.1 | 2.8 | 2.6 | 0.93 | 0.14925 | 0.15 |
| TuttleWell | 0.1 | 2.8 | 2.6 | 0.93 | 0.14925 | 0.15 |
| **Total** | | | | | | |
| **Total (Colusa County)** | | | | | | |

| Well | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MainWell | 1.24 | 23.61 | 21.74 | 7.74 | 1.24 | 1.24 | 0.08 | 1.44 | 1.33 | 0.47 | 0.08 | 0.08 |
| TuttleWell | 1.24 | 23.61 | 21.74 | 7.74 | 1.24 | 1.24 | 0.08 | 1.44 | 1.33 | 0.47 | 0.08 | 0.08 |
| **Total** | **2.48** | **47.21** | **43.49** | **15.48** | **2.48** | **2.48** | **0.15** | **2.88** | **2.65** | **0.94** | **0.15** | **0.15** |
| **Total (Colusa County)** | **2.48** | **47.21** | **43.49** | **15.48** | **2.48** | **2.48** | **0.15** | **2.88** | **2.65** | **0.94** | **0.15** | **0.15** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Colusa |
|---|---|
| PM10 | A |
| PM2.5 | A |
| O3 | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
762 AF/month
5,562 gallons/minute
73% peak pump rate

Legend
(green) Engine information assumed to be equivalent to Eastside MWC because it is the adjacent water district.
(orange) Emission factors based on NMHC+NOx standard

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | |
|---|---|---|---|---|
| Agency | Natomas Central Mutual Water Company | | | Peak Pumping by Transfer Period |
| Transfer Volume | 10,000 acre-feet | (Apr-Jun) | | 3,333 AF/month |
| | 10,000 acre-feet | (Jul-Sep) | | 3,333 AF/month |
| | 20,000 acre-feet/year | | | |

### Table E-27. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sacramento | 3 | 6 | 0 | 0 | 9 |
| Sutter | 1 | 14 | 0 | 0 | 15 |
| Total | 4 | 20 | 0 | 0 | 24 |

### Table E-28. Natomas Central Mutual Water Company Criteria Pollutant Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L-1 | Sutter | Diesel | 2013 | 120 | T4I | 1,600 | 4% | 125 | 748 | 14 | 2,538 | 17,085 | 0.09 | 3.2 | 0.7 | 0.93 | 0.02 | 0.02 | 0.32 | 11.55 | 2.53 | 3.36 | 0.07 | 0.07 | 0.03 | 1.07 | 0.23 | 0.31 | 0.01 | 0.01 |
| L-2 | Sutter | Electric | unknown | 30 | n/a | 1,900 | 4% | 148 | 888 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-3 | Sutter | Electric | unknown | 125 | n/a | 1,300 | 3% | 101 | 607 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-4 | Sutter | Electric | unknown | 125 | n/a | 1,300 | 3% | 101 | 607 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-6 | Sutter | Electric | unknown | 125 | n/a | 2,000 | 5% | 156 | 935 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-7 | Sutter | Electric | unknown | 125 | n/a | 1,200 | 3% | 93 | 561 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-8 | Sutter | Electric | unknown | 125 | n/a | 2,800 | 7% | 218 | 1,308 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-9 | Sutter | Electric | unknown | 125 | n/a | 1,500 | 4% | 117 | 701 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-10 | Sutter | Electric | unknown | 125 | n/a | 1,000 | 2% | 78 | 467 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-11 | Sutter | Electric | unknown | 125 | n/a | 1,500 | 4% | 117 | 701 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| L-12 | Sutter | Electric | unknown | 125 | n/a | 1,500 | 4% | 117 | 701 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| MAP | Sacramento | Electric | unknown | 125 | n/a | 2,000 | 5% | 156 | 935 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| Ose-1 | Sacramento | Diesel | 2013 | 200 | T4I | 1,800 | 4% | 140 | 841 | 14 | 2,538 | 28,474 | 0.003 | 1.7 | 0.03 | 0.93 | 0.01 | 0.01 | 0.02 | 10.23 | 0.18 | 5.59 | 0.06 | 0.06 | 0.00 | 0.95 | 0.02 | 0.52 | 0.01 | 0.01 |
| Ose-2 | Sacramento | Electric | unknown | 150 | n/a | 1,600 | 4% | 125 | 748 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| Perry | Sacramento | Electric | unknown | 125 | n/a | 2,000 | 5% | 156 | 935 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| Spangler | Sutter | Electric | unknown | 80 | n/a | 2,400 | 6% | 187 | 1,121 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| TNBC Frazer | Sutter | Electric | unknown | 125 | n/a | 2,000 | 5% | 156 | 935 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| TNBC Bennett North | Sutter | Electric | unknown | 125 | n/a | 2,000 | 5% | 156 | 935 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| TNBC Atkinson | Sutter | Electric | unknown | 125 | n/a | 1,800 | 4% | 140 | 841 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| TNBC Fisherman's Lake | Sacramento | Electric | unknown | 125 | n/a | 1,500 | 4% | 117 | 701 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| TNBC Silva Dairy | Sacramento | Electric | unknown | 125 | n/a | 1100 | 3% | 86 | 514 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| TNBC Betts | Sacramento | Electric | unknown | 125 | n/a | 1,500 | 4% | 117 | 701 | 14 | 2,538 | n/a | | | | | | | | | | | | | | | | | | |
| Dhaliwal | Sacramento | Diesel | 2013 | 180 | T4I | 2,500 | 6% | 195 | 1,168 | 14 | 2,538 | 25,627 | 0.003 | 1.7 | 0.03 | 0.93 | 0.01 | 0.01 | 0.02 | 9.20 | 0.16 | 5.03 | 0.05 | 0.05 | 0.00 | 0.86 | 0.02 | 0.47 | 0.01 | 0.00 |
| Willey | Sacramento | Diesel | 2012 | 148 | T4I | 3,000 | 7% | 234 | 1,402 | 14 | 2,538 | 21,071 | 0.01 | 2.6 | 0.10 | 0.93 | 0.003 | 0.003 | 0.04 | 11.57 | 0.45 | 4.14 | 0.01 | 0.01 | 0.00 | 1.08 | 0.04 | 0.38 | 0.00 | 0.00 |
| **Total** | | | | | | **42,800** | **100%** | **3,333** | **20,000** | **327** | **60,907** | **92,257** | | | | | | | **0.40** | **42.56** | **3.31** | **18.12** | **0.20** | **0.20** | **0.04** | **3.96** | **0.31** | **1.69** | **0.02** | **0.02** |
| **Total (Sacramento County)** | | | | | | **17,000** | **40%** | **1,324** | **7,944** | **123** | **22,840** | **75,172** | | | | | | | **0.08** | **31.01** | **0.79** | **14.77** | **0.13** | **0.13** | **0.01** | **2.88** | **0.07** | **1.37** | **0.01** | **0.01** |
| **Total (Sutter County)** | | | | | | **25,800** | **60%** | **2,009** | **12,056** | **205** | **38,067** | **17,085** | | | | | | | **0.32** | **11.55** | **2.53** | **3.36** | **0.07** | **0.07** | **0.03** | **1.07** | **0.23** | **0.31** | **0.01** | **0.01** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sacramento | Sutter |
|---|---|---|
| PM10 | M | A |
| PM2.5 | N | M |
| O3 | N | N |

*Engines subject to ATCM.*

Peak Month
3,333 AF/month
24,332 gallons/minute
57% peak pump rate

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

### Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | | |
|---|---|---|---|---|---|
| Agency | Pelger Mutual Water Company | | | Peak Pumping by Transfer Period | |
| Transfer Volume | 2,000 acre-feet | (Apr-Jun) | | 1,189 | AF/month |
| | 2,670 acre-feet | (Jul-Sep) | | 1,017 | AF/month |
| | 4,670 acre-feet/year | | | | |

**Table E-29. Pelger Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 1 | 2 | 0 | 0 | 3 |
| Total | 1 | 2 | 0 | 0 | 3 |

**Table E-30. Pelger Mutual Water Company Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PMWC#1 | Sutter | Electric | unknown | 150 | n/a | 3,100 | 25% | 293 | 1,149 | 24 | 2,013 | n/a | | | | | | | | | | | | | | | | | | |
| Well 1 Tucker | Sutter | Electric | unknown | 75 | n/a | 3,100 | 25% | 293 | 1,149 | 24 | 2,013 | n/a | | | | | | | | | | | | | | | | | | |
| Well 2 Flopet | Sutter | Diesel | 2,008 | 125 | T3 | 2,100 | 17% | 198 | 778 | 24 | 2,012 | 14,109 | 0.1 | 2.8 | 3.7 | 0.93 | 0.22 | 0.22 | 0.99 | 18.76 | 24.68 | 6.15 | 1.48 | 1.48 | 0.04 | 0.79 | 1.03 | 0.26 | 0.06 | 0.06 |
| Well 3 Klein | Sutter | Electric | unknown | 150 | n/a | 4,300 | 34% | 406 | 1,594 | 24 | 2,013 | n/a | | | | | | | | | | | | | | | | | | |
| | | | | | **Total** | **12,600** | **100%** | **1,190** | **4,670** | **96** | **8,051** | **14,109** | | | | | | | **0.99** | **18.76** | **24.68** | **6.15** | **1.48** | **1.48** | **0.04** | **0.79** | **1.03** | **0.26** | **0.06** | **0.06** |
| | | | | | **Total (Sutter County)** | **12,600** | **100%** | **1,190** | **4,670** | **96** | **8,051** | **14,109** | | | | | | | **0.99** | **18.76** | **24.68** | **6.15** | **1.48** | **1.48** | **0.04** | **0.79** | **1.03** | **0.26** | **0.06** | **0.06** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
1,189 AF/month
8,681 gallons/minute
69% peak pump rate

Legend
(shaded) Emission factors based on NMHC+NOx standard

Conversion Factors
1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Pelger Road 1700 LLC | | |
| Transfer Volume | 2,600 acre-feet | (Apr-Jun) | |
| | 2,600 acre-feet | (Jul-Sep) | |
| | 5,200 acre-feet/year | | |

Peak Pumping by Transfer Period
867 AF/month
867 AF/month

**Table E-31. Pelger Road 1700 LLC Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 0 | 4 | 0 | 0 | 4 |
| Total | 0 | 4 | 0 | 0 | 4 |

**Table E-32. Pelger Road 1700 LLC Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| North Well | Sutter | Electric | unknown | 125 | n/a | 3,500 | 28% | 239 | 1,433 | 12 | 2,224 |
| South Well | Sutter | Electric | unknown | 125 | n/a | 3,000 | 24% | 205 | 1,228 | 12 | 2,224 |
| Well #3 | Sutter | Electric | unknown | 125 | n/a | 3,100 | 24% | 212 | 1,269 | 12 | 2,224 |
| Well #4 | Sutter | Electric | unknown | 125 | n/a | 3,100 | 24% | 212 | 1,269 | 12 | 2,224 |
| | | | | | **Total** | **12,700** | **100%** | **867** | **5,200** | **48** | **8,895** |
| | | | | | **Total (Sutter County)** | **12,700** | **100%** | **867** | **5,200** | **48** | **8,895** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
867 AF/month
6,326 gallons/minute
50% peak pump rate

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | |
|---|---|---|---|
| Agency | Pleasant Grove-Verona Mutual Water Company | | Peak Pumping by Transfer Period |
| Transfer Volume | 8,000 acre-feet | (Apr-Jun) | 4,757 AF/month |
| | 7,000 acre-feet | (Jul-Sep) | 2,667 AF/month |
| | 15,000 acre-feet/year | | |

**Table E-33. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 13 | 20 | 0 | 2 | 35 |
| Total | 13 | 20 | 0 | 2 | 35 |

**Table E-34. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) - diesel (MMBtu/yr) - propane |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kelly 190 Field Well #2 | Sutter | Electric | unknown | 30 | n/a | 2,000 | 2% | 110 | 348 | 10 | 946 | n/a |
| Kelly Windmill Field Well #2 | Sutter | Electric | 2002 | 62 | n/a | 2,000 | 2% | 110 | 348 | 10 | 946 | n/a |
| Kelly Windmill North Field Well | Sutter | Propane | 2014 | 133 | T2 | 1,750 | 2% | 97 | 305 | 10 | 946 | 320 |
| Kelly306 | Sutter | Electric | unknown | 60 | n/a | 2,600 | 3% | 144 | 453 | 10 | 946 | n/a |
| MLF Clubhouse B Well | Sutter | Electric | unknown | 300 | n/a | 2,500 | 3% | 138 | 436 | 10 | 946 | n/a |
| MLF Marsh Well | Sutter | Electric | unknown | 300 | n/a | 2,500 | 3% | 138 | 436 | 10 | 946 | n/a |
| MLF Monster Well | Sutter | Electric | unknown | 60 | n/a | 3,100 | 4% | 171 | 540 | 10 | 946 | n/a |
| MLF Well #1 | Sutter | Electric | unknown | 30 | n/a | 2,000 | 2% | 110 | 348 | 10 | 946 | n/a |
| MLF Well #16 | Sutter | Electric | unknown | 50 | n/a | 1,700 | 2% | 94 | 296 | 10 | 946 | n/a |
| MLF Well#11 | Sutter | Diesel | 2004 | 250 | T2 | 4,200 | 5% | 232 | 732 | 10 | 946 | 13,270 |
| MLF Well#12/17 | Sutter | Electric | unknown | 50 | n/a | 1,500 | 2% | 83 | 261 | 10 | 946 | n/a |
| MLF Well#13&#15 | Sutter | Electric | 2000 | 215 | n/a | 4,800 | 6% | 265 | 836 | 10 | 946 | n/a |
| MLF Well#2B | Sutter | Electric | 2000 | 300 | n/a | 2,500 | 3% | 138 | 436 | 10 | 946 | n/a |
| Nicholas 72-Acre Field North | Sutter | Electric | unknown | 40 | n/a | 5,000 | 6% | 276 | 871 | 10 | 946 | n/a |
| Nicholas 72-Acree Field South | Sutter | Diesel | 2002 | 62 | T1 | 2,000 | 2% | 110 | 348 | 10 | 946 | 3,296 |
| Nicholas BBC Well | Sutter | Electric | unknown | 30 | n/a | 2,500 | 3% | 138 | 436 | 10 | 946 | n/a |
| Nicholas Filipino Camp South | Sutter | Diesel | 2002 | 62 | T1 | 2,000 | 2% | 110 | 348 | 10 | 946 | 3,296 |
| Nicholas Filipino Camp#2 | Sutter | Electric | unknown | 40 | n/a | 2,000 | 2% | 110 | 348 | 10 | 946 | n/a |
| Nicholas Johnston Field Well #2 | Sutter | Electric | unknown | 40 | n/a | 2,000 | 2% | 110 | 348 | 10 | 946 | n/a |
| Nicholas Sand Field Well | Sutter | Diesel | 2002 | 62 | T2 | 2,000 | 2% | 110 | 348 | 10 | 946 | 3,296 |
| RiverRanch#19 | Sutter | Diesel | 2008 | 99 | T3 | 2,500 | 3% | 138 | 436 | 10 | 946 | 5,255 |
| S&O#16 | Sutter | Electric | 2014 | 159 | n/a | 2,000 | 2% | 110 | 348 | 10 | 946 | n/a |
| S&O#17 | Sutter | Diesel | 1999 | 101 | T0 | 3,000 | 3% | 166 | 523 | 10 | 946 | 5,361 |
| S&O#18A | Sutter | Diesel | 1999 | 101 | T0 | 2,250 | 3% | 124 | 392 | 10 | 946 | 5,361 |
| S&O#19 | Sutter | Diesel | 2007 | 215 | T3 | 1,800 | 2% | 99 | 314 | 10 | 946 | 11,412 |
| S&O#20 | Sutter | Propane | 2014 | 154 | n/a | 2,150 | 2% | 119 | 375 | 10 | 946 | 370 |
| Willey#1 | Sutter | Diesel | 2000 | 168 | T1 | 2,250 | 3% | 124 | 392 | 10 | 946 | 8,917 |
| Willey#2 | Sutter | Diesel | unknown | 250 | T2 | 3,000 | 3% | 166 | 523 | 10 | 946 | 13,270 |
| Willey#3 | Sutter | Electric | unknown | 75 | n/a | 3,000 | 3% | 166 | 523 | 10 | 946 | n/a |
| Willey#4 | Sutter | Diesel | 1974 | 150 | T0 | 2,000 | 2% | 110 | 348 | 10 | 946 | 7,962 |
| Will-Lee Well#30 | Sutter | Diesel | 2000 | 100 | T2 | 2,500 | 3% | 138 | 436 | 10 | 946 | 5,308 |
| Will-Lee Well#31 | Sutter | Electric | unknown | 50 | n/a | 2,500 | 3% | 138 | 436 | 10 | 946 | n/a |
| Will-Lee Well#32 | Sutter | Electric | unknown | 300 | n/a | 2,500 | 3% | 138 | 436 | 10 | 946 | n/a |
| Will-Lee Well#33 | Sutter | Electric | unknown | 75 | n/a | 2,500 | 3% | 138 | 436 | 10 | 946 | n/a |
| Will-Lee Well#4A | Sutter | Diesel | 2000 | 160 | T1 | 1,500 | 2% | 83 | 261 | 10 | 946 | 8,493 |
| | | | | | **Total** | **86,100** | **100%** | **4,757** | **15,000** | **339** | **33,115** | **95,188** |
| | | | | | **Total (Sutter County)** | **86,100** | **100%** | **4,757** | **15,000** | **339** | **33,115** | **95,188** |

| Well | Emission Factors (g/bhp-hr) - diesel and VOC, NOx, and CO for propane (lb/MMBtu) - SOx, PM10, and PM2.5 for propane | | | | | | Daily Emissions (pounds per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Kelly 190 Field Well #2 | | | | | | | | | | | | | | | | | | |
| Kelly Windmill Field Well #2 | | | | | | | | | | | | | | | | | | |
| Kelly Windmill North Field Well | 1.0 | 2.0 | 4.0 | 5.88E-04 | 9.99E-03 | 9.99E-03 | 2.84 | 5.68 | 11.35 | 0.00 | 0.03 | 0.03 | 0.14 | 0.28 | 0.55 | 0.00 | 0.00 | 0.00 |
| Kelly306 | | | | | | | | | | | | | | | | | | |
| MLF Clubhouse B Well | | | | | | | | | | | | | | | | | | |
| MLF Marsh Well | | | | | | | | | | | | | | | | | | |
| MLF Monster Well | | | | | | | | | | | | | | | | | | |
| MLF Well #1 | | | | | | | | | | | | | | | | | | |
| MLF Well #16 | | | | | | | | | | | | | | | | | | |
| MLF Well#11 | 0.2 | 4.7 | 2.6 | 0.93 | 0.15 | 0.15 | 1.31 | 24.96 | 13.93 | 4.96 | 0.80 | 0.80 | 0.06 | 1.22 | 0.68 | 0.24 | 0.04 | 0.04 |
| MLF Well#12/17 | | | | | | | | | | | | | | | | | | |
| MLF Well#13&#15 | | | | | | | | | | | | | | | | | | |
| MLF Well#2B | | | | | | | | | | | | | | | | | | |
| Nicholas 72-Acre Field North | | | | | | | | | | | | | | | | | | |
| Nicholas 72-Acree Field South | 1.1 | 6.9 | 3.0 | 0.93 | 0.30 | 0.29 | 1.51 | 9.10 | 4.01 | 1.23 | 0.40 | 0.39 | 0.07 | 0.44 | 0.20 | 0.06 | 0.02 | 0.02 |
| Nicholas BBC Well | | | | | | | | | | | | | | | | | | |
| Nicholas Filipino Camp South | 1.1 | 6.9 | 3.0 | 0.93 | 0.30 | 0.29 | 1.51 | 9.10 | 4.01 | 1.23 | 0.40 | 0.39 | 0.07 | 0.44 | 0.20 | 0.06 | 0.02 | 0.02 |
| Nicholas Filipino Camp#2 | | | | | | | | | | | | | | | | | | |
| Nicholas Johnston Field Well #2 | | | | | | | | | | | | | | | | | | |
| Nicholas Sand Field Well | 0.3 | 5.3 | 3.7 | 0.93 | 0.30 | 0.29 | 0.37 | 7.05 | 4.94 | 1.23 | 0.40 | 0.39 | 0.02 | 0.34 | 0.24 | 0.06 | 0.02 | 0.02 |
| RiverRanch#19 | 0.2 | 3.3 | 3.7 | 0.93 | 0.30 | 0.29 | 0.37 | 7.04 | 7.88 | 1.96 | 0.63 | 0.62 | 0.02 | 0.34 | 0.39 | 0.10 | 0.03 | 0.03 |
| S&O#16 | | | | | | | | | | | | | | | | | | |
| S&O#17 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.46 | 30.30 | 6.53 | 2.00 | 0.47 | 0.46 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| S&O#18A | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 2.46 | 30.30 | 6.53 | 2.00 | 0.47 | 0.46 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| S&O#19 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 0.68 | 13.01 | 11.98 | 4.27 | 0.68 | 0.68 | 0.03 | 0.64 | 0.59 | 0.21 | 0.03 | 0.03 |
| S&O#20 | 1.0 | 2.0 | 4.0 | 5.88E-04 | 9.99E-03 | 9.99E-03 | 3.29 | 6.57 | 13.14 | 0.00 | 0.04 | 0.04 | 0.16 | 0.32 | 0.64 | 0.00 | 0.00 | 0.00 |
| Willey#1 | 1.1 | 6.9 | 3.0 | 0.93 | 0.22 | 0.21 | 4.09 | 24.61 | 10.86 | 3.33 | 0.79 | 0.77 | 0.20 | 1.20 | 0.53 | 0.16 | 0.04 | 0.04 |
| Willey#2 | 0.2 | 4.7 | 2.6 | 0.93 | 0.15 | 0.15 | 1.31 | 24.96 | 13.93 | 4.96 | 0.80 | 0.78 | 0.06 | 1.22 | 0.68 | 0.24 | 0.04 | 0.04 |
| Willey#3 | | | | | | | | | | | | | | | | | | |
| Willey#4 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 3.65 | 45.01 | 9.70 | 2.98 | 0.70 | 0.69 | 0.18 | 2.20 | 0.47 | 0.15 | 0.03 | 0.03 |
| Will-Lee Well#30 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.21 | 0.53 | 9.98 | 7.96 | 1.98 | 0.47 | 0.46 | 0.03 | 0.49 | 0.39 | 0.10 | 0.02 | 0.02 |
| Will-Lee Well#31 | | | | | | | | | | | | | | | | | | |
| Will-Lee Well#32 | | | | | | | | | | | | | | | | | | |
| Will-Lee Well#33 | | | | | | | | | | | | | | | | | | |
| Will-Lee Well#4A | 1.1 | 6.9 | 3.0 | 0.93 | 0.22 | 0.21 | 3.89 | 23.44 | 10.34 | 3.17 | 0.75 | 0.73 | 0.19 | 1.15 | 0.51 | 0.16 | 0.04 | 0.04 |
| **Total** | | | | | | | **30.27** | **271.10** | **137.13** | **35.33** | **7.84** | **7.69** | **1.48** | **13.25** | **6.70** | **1.73** | **0.38** | **0.38** |
| **Total (Sutter County)** | | | | | | | **30.27** | **271.10** | **137.13** | **35.33** | **7.84** | **7.69** | **1.48** | **13.25** | **6.70** | **1.73** | **0.38** | **0.38** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
4,757 AF/month
34,722 gallons/minute
40% peak pump rate

Legend
- (blue) Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
- (orange) Emission factors based on NMHC+NOx standard
- (purple) Emission factor from AP-42 because emission standards for pollutant not available for emissions tier

Conversion Factors

| | | |
|---|---|---|
| 1 bhp-hr = | 2,542.5 | Btu |
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | | |
|---|---|---|---|---|---|
| Agency | Princeton-Codora-Glenn Irrigation District | | | Peak Pumping by Transfer Period | |
| Transfer Volume | 2,500 | acre-feet | (Apr-Jun) | 1,640 | AF/month |
| | 4,100 | acre-feet | (Jul-Sep) | 1,640 | AF/month |
| | 6,600 | acre-feet/year | | | |

**Table E-35. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 7 | 3 | 0 | 0 | 10 |
| Colusa | 2 | 1 | 0 | 0 | 3 |
| Total | 9 | 4 | 0 | 0 | 13 |

**Table E-36. Princeton-Codora-Glenn Irrigation District Criteria Pollutant Emissions**

| | Well Location | | | Power Rating | Emission | Pump Rate | | Transfer Volume | | Operations | | Fuel Consumption | Emission Factors (g/bhp-hr) | | | | | | Daily Emissions (pounds per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well | (County) | Fuel Type | Model Year | (hp) | Tier | (gpm) | (% of Total) | (AF/month) | (AF/year) | (hours/day) | (hours/year) | (gal/yr) | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Joel Mann | Glenn | Diesel | unknown | 180 | T0 | 3,500 | 9% | 145 | 585 | 7 | 907 | 9,163 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.29 | 40.59 | 8.75 | 2.68 | 0.43 | 0.42 | 0.21 | 2.53 | 0.55 | 0.17 | 0.03 | 0.03 |
| D.Withrow | Glenn | Diesel | unknown | 180 | T0 | 1,000 | 3% | 42 | 167 | 7 | 907 | 9,163 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.29 | 40.59 | 8.75 | 2.68 | 0.43 | 0.42 | 0.21 | 2.53 | 0.55 | 0.17 | 0.03 | 0.03 |
| Chrisman | Glenn | Diesel | unknown | 180 | T0 | 2,000 | 5% | 83 | 334 | 7 | 907 | 9,163 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.29 | 40.59 | 8.75 | 2.68 | 0.43 | 0.42 | 0.21 | 2.53 | 0.55 | 0.17 | 0.03 | 0.03 |
| D.Schmidt | Glenn | Diesel | 2013 | 180 | T4I | 3,000 | 8% | 125 | 501 | 7 | 907 | 9,163 | 0.14 | 0.3 | 2.6 | 0.93 | 0.01 | 0.01 | 0.41 | 0.86 | 7.54 | 2.68 | 0.04 | 0.04 | 0.03 | 0.05 | 0.47 | 0.17 | 0.00 | 0.00 |
| Argo B | Glenn | Diesel | unknown | 200 | T0 | 3,000 | 8% | 125 | 501 | 7 | 907 | 10,182 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.66 | 45.10 | 9.72 | 2.98 | 0.48 | 0.47 | 0.23 | 2.81 | 0.61 | 0.19 | 0.03 | 0.03 |
| Argo C | Glenn | Diesel | unknown | 200 | T0 | 3,000 | 8% | 125 | 501 | 7 | 907 | 10,182 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.66 | 45.10 | 9.72 | 2.98 | 0.48 | 0.47 | 0.23 | 2.81 | 0.61 | 0.19 | 0.03 | 0.03 |
| F. Gomes | Colusa | Diesel | unknown | 180 | T0 | 2,500 | 6% | 104 | 418 | 7 | 907 | 9,163 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.29 | 40.59 | 8.75 | 2.68 | 0.43 | 0.42 | 0.21 | 2.53 | 0.55 | 0.17 | 0.03 | 0.03 |
| Jones Well | Glenn | Electric | 2012 | 200 | n/a | 3,500 | 9% | 145 | 585 | 7 | 907 | n/a | | | | | | | | | | | | | | | | | | |
| M. Cota | Colusa | Diesel | unknown | 180 | T0 | 3,000 | 8% | 125 | 501 | 7 | 907 | 9,163 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.29 | 40.59 | 8.75 | 2.68 | 0.43 | 0.42 | 0.21 | 2.53 | 0.55 | 0.17 | 0.03 | 0.03 |
| Zoller A | Glenn | Diesel | unknown | 180 | T0 | 3,000 | 8% | 125 | 501 | 7 | 907 | 9,163 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 3.29 | 40.59 | 8.75 | 2.68 | 0.43 | 0.42 | 0.21 | 2.53 | 0.55 | 0.17 | 0.03 | 0.03 |
| Clark #1 | Glenn | Electric | unknown | 200 | n/a | 4,000 | 10% | 166 | 668 | 7 | 907 | n/a | | | | | | | | | | | | | | | | | | |
| Clark #2 | Glenn | Electric | unknown | 200 | n/a | 4,000 | 10% | 166 | 668 | 7 | 907 | n/a | | | | | | | | | | | | | | | | | | |
| J. Southam | Colusa | Electric | unknown | 200 | n/a | 4,000 | 10% | 166 | 668 | 7 | 907 | n/a | | | | | | | | | | | | | | | | | | |
| **Total** | | | | | | **39,500** | **100%** | **1,640** | **6,600** | **95** | **11,797** | **84,507** | | | | | | | **27.47** | **334.58** | **79.45** | **24.75** | **3.60** | **3.52** | **1.71** | **20.87** | **4.96** | **1.54** | **0.22** | **0.22** |
| **Total (Glenn County)** | | | | | | **30,000** | **76%** | **1,246** | **5,013** | **73** | **9,074** | **66,180** | | | | | | | **20.89** | **253.40** | **61.96** | **19.38** | **2.74** | **2.67** | **1.30** | **15.81** | **3.86** | **1.21** | **0.17** | **0.17** |
| **Total (Colusa County)** | | | | | | **9,500** | **24%** | **394** | **1,587** | **22** | **2,722** | **18,327** | | | | | | | **6.58** | **81.17** | **17.49** | **5.37** | **0.87** | **0.85** | **0.41** | **5.06** | **1.09** | **0.33** | **0.05** | **0.05** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Glenn | Colusa |
|---|---|---|
| PM10 | A | A |
| PM2.5 | A | A |
| O3 | A | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
1,640 AF/month
11,971 gallons/minute
30% peak pump rate

Legend
[shaded cell] Tier 4 Exhaust Emission Standards, Phase-In (100<=hp<=175, 2012-2014 model year)

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

### Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | |
|---|---|---|---|---|
| Agency | Provident Irrigation District | | | Peak Pumping by Transfer Period |
| Transfer Volume | 4,000 acre-feet | (Apr-Jun) | | 2,400 AF/month |
| | 6,000 acre-feet | (Jul-Sep) | | 2,400 AF/month |
| | 10,000 acre-feet/year | | | |

**Table E-37. Provident Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 13 | 3 | 0 | 0 | 16 |
| Colusa | 0 | 0 | 0 | 0 | 0 |
| Total | 13 | 3 | 0 | 0 | 16 |

**Table E-38. Provident Irrigation District Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weller62V | Glenn | Diesel | unknown | 200 | T0 | 2,000 | 4% | 96 | 400 | 8 | 1,086 | 12,187 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 4.23 | 52.14 | 11.23 | 3.45 | 0.56 | 0.54 | 0.27 | 3.37 | 0.73 | 0.22 | 0.04 | 0.04 |
| L Hansen#1 | Glenn | Diesel | unknown | 200 | T0 | 3,800 | 8% | 182 | 760 | 8 | 1,086 | 12,187 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 4.23 | 52.14 | 11.23 | 3.45 | 0.56 | 0.54 | 0.27 | 3.37 | 0.73 | 0.22 | 0.04 | 0.04 |
| L Hansen#2 | Glenn | Diesel | unknown | 200 | T0 | 4,500 | 9% | 216 | 900 | 8 | 1,086 | 12,187 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 4.23 | 52.14 | 11.23 | 3.45 | 0.56 | 0.54 | 0.27 | 3.37 | 0.73 | 0.22 | 0.04 | 0.04 |
| K Hansen#1 | Glenn | Diesel | unknown | 200 | T0 | 2,600 | 5% | 125 | 520 | 8 | 1,086 | 12,187 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 4.23 | 52.14 | 11.23 | 3.45 | 0.56 | 0.54 | 0.27 | 3.37 | 0.73 | 0.22 | 0.04 | 0.04 |
| K Hansen#2 | Glenn | Electric | unknown | 120 | n/a | 3,500 | 7% | 168 | 700 | 8 | 1,086 | n/a | | | | | | | | | | | | | | | | | | |
| E Weller | Glenn | Diesel | unknown | 200 | T0 | 2,500 | 5% | 120 | 500 | 8 | 1,086 | 12,187 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 4.23 | 52.14 | 11.23 | 3.45 | 0.56 | 0.54 | 0.27 | 3.37 | 0.73 | 0.22 | 0.04 | 0.04 |
| Weller#4 | Glenn | Electric | unknown | 120 | n/a | 3,500 | 7% | 168 | 700 | 8 | 1,086 | n/a | | | | | | | | | | | | | | | | | | |
| Calvert | Glenn | Diesel | unknown | 150 | T0 | 3,000 | 6% | 144 | 600 | 8 | 1,086 | 9,140 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 3.17 | 39.10 | 8.43 | 2.59 | 0.61 | 0.60 | 0.20 | 2.53 | 0.54 | 0.17 | 0.04 | 0.04 |
| D. Alves | Glenn | Diesel | unknown | 165 | T0 | 3,000 | 6% | 144 | 600 | 8 | 1,086 | 10,054 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 3.49 | 43.01 | 9.27 | 2.84 | 0.67 | 0.66 | 0.23 | 2.78 | 0.60 | 0.18 | 0.04 | 0.04 |
| D. Kennedy | Glenn | Electric | unknown | 120 | n/a | 3,000 | 6% | 144 | 600 | 8 | 1,086 | n/a | | | | | | | | | | | | | | | | | | |
| G. Clark #1 | Glenn | Diesel | unknown | 200 | T0 | 3,000 | 6% | 144 | 600 | 8 | 1,086 | 12,187 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 4.23 | 52.14 | 11.23 | 3.45 | 0.56 | 0.54 | 0.27 | 3.37 | 0.73 | 0.22 | 0.04 | 0.04 |
| M. Jones #1 | Glenn | Diesel | unknown | 275 | T0 | 3,000 | 6% | 144 | 600 | 8 | 1,086 | 16,757 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 5.81 | 71.69 | 15.45 | 4.74 | 0.76 | 0.75 | 0.38 | 4.63 | 1.00 | 0.31 | 0.05 | 0.05 |
| M. Jones #2 | Glenn | Diesel | unknown | 250 | T0 | 3,000 | 6% | 144 | 600 | 8 | 1,086 | 15,234 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 5.29 | 65.17 | 14.04 | 4.31 | 0.70 | 0.68 | 0.34 | 4.21 | 0.91 | 0.28 | 0.04 | 0.04 |
| Perez and Perez | Glenn | Diesel | unknown | 200 | T0 | 3,200 | 6% | 154 | 640 | 8 | 1,086 | 12,187 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 4.23 | 52.14 | 11.23 | 3.45 | 0.56 | 0.54 | 0.27 | 3.37 | 0.73 | 0.22 | 0.04 | 0.04 |
| S. Jones #1 | Glenn | Diesel | unknown | 170 | T0 | 3,200 | 6% | 154 | 640 | 8 | 1,086 | 10,359 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 3.59 | 44.32 | 9.55 | 2.93 | 0.69 | 0.68 | 0.23 | 2.86 | 0.62 | 0.19 | 0.04 | 0.04 |
| S. Jones #2 | Glenn | Diesel | unknown | 170 | T0 | 3,200 | 6% | 154 | 640 | 8 | 1,086 | 10,359 | 1.1 | 14.1 | 3.0 | 0.93 | 0.22 | 0.21 | 3.59 | 44.32 | 9.55 | 2.93 | 0.69 | 0.68 | 0.23 | 2.86 | 0.62 | 0.19 | 0.04 | 0.04 |
| **Total** | | | | | | **50,000** | **100%** | **2,400** | **10,000** | **135** | **17,379** | **157,213** | | | | | | | **54.54** | **672.56** | **144.93** | **44.48** | **8.02** | **7.83** | **3.52** | **43.44** | **9.36** | **2.87** | **0.52** | **0.51** |
| **Total (Glenn County)** | | | | | | **50,000** | **100%** | **2,400** | **10,000** | **135** | **17,379** | **157,213** | | | | | | | **54.54** | **672.56** | **144.93** | **44.48** | **8.02** | **7.83** | **3.52** | **43.44** | **9.36** | **2.87** | **0.52** | **0.51** |
| **Total (Colusa County)** | | | | | | **0** | **0%** | **0** | **0** | **0** | **0** | **0** | | | | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Glenn | Colusa |
|---|---|---|
| PM10 | A | A |
| PM2.5 | A | A |
| O3 | A | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
2,400 AF/month
17,519 gallons/minute
35% peak pump rate

Legend
(blue) Information on engine not available; therefore, engine assumed to be diesel as worst-case.
(green) Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | | |
|---|---|---|---|---|
| Agency | Reclamation District 108 | | | Peak Pumping by Transfer Period |
| Transfer Volume | 7,500 | acre-feet | (Apr-Jun) | 2,500 AF/month |
| | 7,500 | acre-feet | (Jul-Sep) | 2,500 AF/month |
| | 15,000 | acre-feet/year | | |

**Table E-39. Reclamation District 108 Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 3 | 0 | 0 | 3 |
| Yolo | 0 | 2 | 0 | 0 | 2 |
| Total | 0 | 5 | 0 | 0 | 5 |

**Table E-40. Reclamation District 108 Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well #4 Huff | Colusa | Electric | unknown | 250 | n/a | 4,000 | 21% | 524 | 3,141 | 23 | 4,265 | n/a |
| Well #5 RiggsRanch | Colusa | Electric | unknown | 150 | n/a | 1,700 | 9% | 223 | 1,335 | 23 | 4,265 | n/a |
| Well #6 CountyLine | Yolo | Electric | unknown | 250 | n/a | 5,900 | 31% | 772 | 4,634 | 23 | 4,265 | n/a |
| Well#1 Heidrick | Colusa | Electric | unknown | 100 | n/a | 3,500 | 18% | 458 | 2,749 | 23 | 4,265 | n/a |
| Well#7 Tract 6 | Yolo | Electric | unknown | 250 | n/a | 4,000 | 21% | 524 | 3,141 | 23 | 4,265 | n/a |
| | | | | | **Total** | **19,100** | **100%** | **2,500** | **15,000** | **115** | **21,325** | **0** |
| | | | | | **Total (Colusa County)** | **9,200** | **48%** | **1,204** | **7,225** | **69** | **12,795** | **0** |
| | | | | | **Total (Yolo County)** | **9,900** | **52%** | **1,296** | **7,775** | **46** | **8,530** | **0** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Colusa | Yolo |
|---|---|---|
| PM10 | A | A |
| PM2.5 | A | N |
| O3 | A | N |

*Engines subject to ATCM.*

Peak Month
2,500 AF/month
18,249 gallons/minute
96% peak pump rate

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

### Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Reclamation District 1004 | Peak Pumping by Transfer Period | |
| Transfer Volume | 0 acre-feet (Apr-Jun) | 0 | AF/month |
| | 7,175 acre-feet (Jul-Sep) | 2,733 | AF/month |
| | 7,175 acre-feet/year | | |

**Table E-41. Reclamation District 1004 Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 1 | 5 | 0 | 0 | 6 |
| Colusa | 17 | 5 | 0 | 0 | 22 |
| Sutter | 0 | 0 | 0 | 0 | 0 |
| Total | 18 | 10 | 0 | 0 | 28 |

**Table E-42. Reclamation District 1004 Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barale Well | Colusa | Diesel | TBD | 225 | T0 | 4,000 | 4% | 119 | 313 | 5 | 424 | 5,358 |
| Behring Ranch 10 Field Well No. 496441 | Colusa | Diesel | 2,008 | 225 | T3 | 5,800 | 6% | 173 | 453 | 5 | 424 | 5,358 |
| Behring Ranch Club House Well No.496461 | Colusa | Electric | unknown | 125 | n/a | 3,400 | 4% | 101 | 266 | 5 | 424 | n/a |
| Behring Ranch Nursery Well No. 17N1W10H1 | Colusa | Diesel | TBD | 225 | T0 | 1,000 | 1% | 30 | 78 | 5 | 424 | 5,358 |
| Behring Ranch Pearl Well No. 20094 | Colusa | Diesel | TBD | 225 | T0 | 2,500 | 3% | 74 | 195 | 5 | 424 | 5,358 |
| Behring Ranch West Well No.97863 | Colusa | Electric | unknown | unknown | n/a | 2,300 | 3% | 68 | 180 | 5 | 424 | n/a |
| Drumheller Well No.7 | Colusa | Diesel | TBD | 225 | T0 | 4,000 | 4% | 119 | 313 | 5 | 424 | 5,358 |
| 17N01W14N001M | Colusa | Diesel | TBD | 225 | T0 | 2,600 | 3% | 77 | 203 | 5 | 424 | 5,358 |
| 17N01W15Q001M | Colusa | Diesel | TBD | 225 | T0 | 1,300 | 1% | 39 | 102 | 5 | 424 | 5,358 |
| Gardener No. 374672 | Colusa | Diesel | 2,008 | 215 | T3 | 3,500 | 4% | 104 | 274 | 5 | 424 | 5,120 |
| Gardener No. 498178 | Colusa | Diesel | 2,009 | 215 | T3 | 3,500 | 4% | 104 | 274 | 5 | 424 | 5,120 |
| Hall Well No. X | Glenn | Electric | TBD | 125 | n/a | 4,500 | 5% | 134 | 352 | 5 | 424 | n/a |
| Hall Well No.369428 | Glenn | Electric | 2,011 | 125 | n/a | 4,500 | 5% | 134 | 352 | 5 | 424 | n/a |
| Mohammad No.e0084085 17N01W02D001M | Colusa | Electric | TBD | 125 | n/a | 4,500 | 5% | 134 | 352 | 5 | 424 | n/a |
| Myers Well #1 No.3457 | Glenn | Electric | 2,006 | 40 | n/a | 2,200 | 2% | 66 | 172 | 5 | 424 | n/a |
| Myers Well #2 No. 340884 | Glenn | Electric | 1,982 | 100 | n/a | 4,100 | 4% | 122 | 320 | 5 | 424 | n/a |
| Rancho Caleta No. 726883 | Colusa | Diesel | 2,004 | 170 | T2 | 4,500 | 5% | 134 | 352 | 5 | 424 | 4,048 |
| Sikes & Parachini Well #1 WS No.93124 | Colusa | Diesel | 2,006 | 173 | T2 | 4,000 | 4% | 119 | 313 | 5 | 424 | 4,120 |
| Sikes & Parachini Well #2 WS No. 374682 | Colusa | Diesel | 2,008 | 150 | T3 | 4,000 | 4% | 119 | 313 | 5 | 424 | 3,572 |
| Southam Sartain Well 18N01W26D001M | Glenn | Diesel | TBD | 225 | T0 | 4,800 | 5% | 143 | 375 | 5 | 424 | 5,358 |
| Stone Well #6 No.11334 | Colusa | Electric | 2,006 | 40 | n/a | 1,800 | 2% | 54 | 141 | 5 | 424 | n/a |
| Wilder Farms Well | Glenn | Electric | unknown | 125 | n/a | 2,500 | 3% | 74 | 195 | 5 | 424 | n/a |
| Dan Charter Well#1 | Colusa | Diesel | unknown | 225 | T0 | 2,500 | 3% | 74 | 195 | 5 | 424 | 5,358 |
| Dan Charter Well#2 | Colusa | Diesel | unknown | 225 | T0 | 2,500 | 3% | 74 | 195 | 5 | 424 | 5,358 |
| GVL Well#1 | Colusa | Diesel | unknown | 225 | T0 | 2,500 | 3% | 74 | 195 | 5 | 424 | 5,358 |
| Behring Ranch Well | Colusa | Electric | unknown | 125 | n/a | 4,000 | 4% | 119 | 313 | 5 | 424 | n/a |
| Claudia Charter | Colusa | Diesel | unknown | 225 | T0 | 2,500 | 3% | 74 | 195 | 5 | 424 | 5,358 |
| GVL Well#2 | Colusa | Diesel | unknown | 225 | T0 | 2,500 | 3% | 74 | 195 | 5 | 424 | 5,358 |
| **Total** | | | | | | **91,800** | **100%** | **2,733** | **7,175** | **146** | **11,885** | **91,633** |
| **Total (Glenn County)** | | | | | | **22,600** | **25%** | **673** | **1,766** | **31** | **2,547** | **5,358** |
| **Total (Colusa County)** | | | | | | **69,200** | **75%** | **2,060** | **5,409** | **115** | **9,338** | **86,275** |
| **Total (Sutter County)** | | | | | | **0** | **0%** | **0** | **0** | **0** | **0** | **0** |

| Well | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barale Well | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| Behring Ranch 10 Field Well No. 496441 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 0.39 | 7.34 | 6.76 | 2.41 | 0.39 | 0.39 | 0.02 | 0.30 | 0.27 | 0.10 | 0.02 | 0.02 |
| Behring Ranch Club House Well No.496461 | | | | | | | | | | | | | | | | | | |
| Behring Ranch Nursery Well No. 17N1W10H1 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| Behring Ranch Pearl Well No. 20094 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| Behring Ranch West Well No.97863 | | | | | | | | | | | | | | | | | | |
| Drumheller Well No.7 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| 17N01W14N001M | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| 17N01W15Q001M | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| Gardener No. 374672 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 0.37 | 7.01 | 6.46 | 2.30 | 0.37 | 0.37 | 0.02 | 0.29 | 0.26 | 0.09 | 0.02 | 0.02 |
| Gardener No. 498178 | 0.1 | 2.8 | 2.6 | 0.93 | 0.15 | 0.15 | 0.37 | 7.01 | 6.46 | 2.30 | 0.37 | 0.37 | 0.02 | 0.29 | 0.26 | 0.09 | 0.02 | 0.02 |
| Hall Well No. X | | | | | | | | | | | | | | | | | | |
| Hall Well No.369428 | | | | | | | | | | | | | | | | | | |
| Mohammad No.e0084085 17N01W02D001M | | | | | | | | | | | | | | | | | | |
| Myers Well #1 No.3457 | | | | | | | | | | | | | | | | | | |
| Myers Well #2 No. 340884 | | | | | | | | | | | | | | | | | | |
| Rancho Caleta No. 726883 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.48 | 9.15 | 7.29 | 1.82 | 0.44 | 0.44 | 0.02 | 0.37 | 0.30 | 0.07 | 0.02 | 0.02 |
| Sikes & Parachini Well #1 WS No.93124 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.49 | 9.31 | 7.42 | 1.85 | 0.45 | 0.45 | 0.02 | 0.38 | 0.30 | 0.08 | 0.02 | 0.02 |
| Sikes & Parachini Well #2 WS No. 374682 | 0.1 | 2.8 | 3.7 | 0.93 | 0.22 | 0.22 | 0.26 | 4.89 | 6.44 | 1.60 | 0.39 | 0.39 | 0.01 | 0.20 | 0.26 | 0.07 | 0.02 | 0.02 |
| Southam Sartain Well 18N01W26D001M | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| Stone Well #6 No.11334 | | | | | | | | | | | | | | | | | | |
| Wilder Farms Well | | | | | | | | | | | | | | | | | | |
| Dan Charter Well#1 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| Dan Charter Well#2 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| GVL Well#1 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| Behring Ranch Well | | | | | | | | | | | | | | | | | | |
| Claudia Charter | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| GVL Well#2 | 1.1 | 14.1 | 3.0 | 0.93 | 0.15 | 0.15 | 2.95 | 36.38 | 7.84 | 2.41 | 0.39 | 0.38 | 0.12 | 1.48 | 0.32 | 0.10 | 0.02 | 0.02 |
| **Total** | | | | | | | **37.76** | **481.31** | **134.91** | **41.15** | **7.05** | **6.94** | **1.54** | **19.58** | **5.49** | **1.67** | **0.29** | **0.28** |
| **Total (Glenn County)** | | | | | | | **2.95** | **36.38** | **7.84** | **2.41** | **0.39** | **0.38** | **0.12** | **1.48** | **0.32** | **0.10** | **0.02** | **0.02** |
| **Total (Colusa County)** | | | | | | | **34.81** | **444.92** | **127.07** | **38.74** | **6.66** | **6.56** | **1.42** | **18.10** | **5.17** | **1.58** | **0.27** | **0.27** |
| **Total (Sutter County)** | | | | | | | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Glenn | Colusa | Sutter |
|---|---|---|---|
| PM10 | A | A | A |
| PM2.5 | A | A | M |
| O3 | A | A | N |

*Engines subject to ATCM.*

Peak Month
2,733 AF/month
19,952 gallons/minute
22% peak pump rate

Legend
[green] Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
[orange] Emission factors based on NMHC+NOx standard

Conversion Factors

| | |
|---|---|
| 1 lb = | 453.6 g |
| 1 ton = | 2,000 lbs |
| 1 kW = | 1.34 hp |
| 1 day = | 24 hours |
| 1 month = | 31 days |
| 1 hour = | 60 minutes |
| 1 acre-foot = | 325,851 gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | River Garden Farms | | |
| Transfer Volume | 5,000 acre-feet | (Apr-Jun) | |
| | 5,000 acre-feet | (Jul-Sep) | |
| | 10,000 acre-feet/year | | |

Peak Pumping by Transfer Period
1,667 AF/month
1,667 AF/month

**Table E-43. River Garden Farms Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Yolo | 0 | 7 | 0 | 0 | 7 |
| Total | 0 | 7 | 0 | 0 | 7 |

**Table E-44. River Garden Farms Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Field 65 PW | Yolo | Electric | 2,008 | unknown | n/a | 2,500 | 12% | 204 | 1,226 | 14 | 2,663 |
| Field 71 PW | Yolo | Electric | 2,001 | unknown | n/a | 1,700 | 8% | 139 | 834 | 14 | 2,663 |
| Field 98 PW | Yolo | Electric | 1,963 | unknown | n/a | 2,900 | 14% | 237 | 1,422 | 14 | 2,663 |
| Field 104 PW | Yolo | Electric | 2,008 | unknown | n/a | 2,500 | 12% | 204 | 1,226 | 14 | 2,663 |
| Field 104-09 PW | Yolo | Electric | 2,009 | unknown | n/a | 2,990 | 15% | 244 | 1,466 | 14 | 2,663 |
| Field 91-09 PW | Yolo | Electric | 2,009 | unknown | n/a | 2,840 | 14% | 232 | 1,392 | 14 | 2,663 |
| Field 117 PW | Yolo | Electric | 2,009 | unknown | n/a | 1,965 | 10% | 161 | 963 | 14 | 2,663 |
| Shop PW | Yolo | unknown | 2,009 | unknown | n/a | 3,000 | 15% | 245 | 1,471 | 14 | 2,663 |
| | | | | | **Total** | **20,395** | **100%** | **1,667** | **10,000** | **115** | **21,303** |
| | | | | | **Total (Yolo County)** | **20,395** | **100%** | **1,667** | **10,000** | **115** | **21,303** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Yolo |
|---|---|
| PM10 | A |
| PM2.5 | N |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
1,667 AF/month
12,166 gallons/minute
60% peak pump rate

Conversion Factors

| | |
|---|---|
| 1 lb = | 453.6 g |
| 1 ton = | 2,000 lbs |
| 1 kW = | 1.34 hp |
| 1 day = | 24 hours |
| 1 month = | 31 days |
| 1 hour = | 60 minutes |
| 1 acre-foot = | 325,851 gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

**Groundwater Substitution Air Quality Emissions (Unmitigated)**

| | | | | |
|---|---|---|---|---|
| Agency | Sutter Mutual Water Company | | Peak Pumping by Transfer Period | |
| Transfer Volume | 8,000 acre-feet | (Apr-Jun) | 3,200 | AF/month |
| | 10,000 acre-feet | (Jul-Sep) | 4,000 | AF/month |
| | 18,000 acre-feet/year | | | |

**Table E-29. Sutter Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 8 | 6 | 0 | 6 | 20 |
| Total | 8 | 6 | 0 | 6 | 20 |

**Table E-30. Sutter Mutual Water Company Criteria Pollutant Emissions**

| Well<br>Van Ruiten Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frank Giusti | Sutter | Electric | unknown | 75 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | n/a |
| Matteoli | Sutter | Propane | 2015 | 150 | n/a | 2,700 | 5% | 205 | 922 | 13 | 1,855 | 15,610 |
| L&N Farms | Sutter | Diesel | 2014 | 150 | T4I | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #1 | Sutter | Electric | unknown | 250 | n/a | 5,000 | 9% | 380 | 1,708 | 13 | 1,855 | n/a |
| Well #2 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | n/a |
| Well #3 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | n/a |
| Well #4 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #5 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #6 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #7 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #8 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #9 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #10 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | n/a |
| Well #11 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | n/a |
| Well #12 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #13 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #14 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #15 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| Well #16 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 190 | 854 | 13 | 1,855 | 15,610 |
| | | | | | **Total** | **52,700** | **100%** | **4,000** | **18,000** | **266** | **37,099** | **218,534** |
| | | | | | **Total (Sutter County)** | **52,700** | **100%** | **4,000** | **18,000** | **266** | **37,099** | **218,534** |

| Well<br>Van Ruiten Well | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frank Giusti | | | | | | | | | | | | | | | | | | |
| Matteoli | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 4.40 | 8.79 | 17.59 | 4.09 | 0.04 | 0.04 | 0.31 | 0.61 | 1.23 | 0.29 | 0.00 | 0.00 |
| L&N Farms | 0.14 | 0.3 | 3.7 | 0.93 | 0.01 | 0.01 | 0.62 | 1.31 | 16.41 | 4.09 | 0.07 | 0.06 | 0.04 | 0.09 | 1.14 | 0.29 | 0.00 | 0.00 |
| Well #1 | | | | | | | | | | | | | | | | | | |
| Well #2 | | | | | | | | | | | | | | | | | | |
| Well #3 | | | | | | | | | | | | | | | | | | |
| Well #4 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 4.40 | 8.79 | 17.59 | 4.09 | 0.04 | 0.04 | 0.31 | 0.61 | 1.23 | 0.29 | 0.00 | 0.00 |
| Well #5 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 4.40 | 8.79 | 17.59 | 4.09 | 0.04 | 0.04 | 0.31 | 0.61 | 1.23 | 0.29 | 0.00 | 0.00 |
| Well #6 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.08 | 20.57 | 16.41 | 4.09 | 0.98 | 0.98 | 0.08 | 1.44 | 1.14 | 0.29 | 0.07 | 0.07 |
| Well #7 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.08 | 20.57 | 16.41 | 4.09 | 0.98 | 0.98 | 0.08 | 1.44 | 1.14 | 0.29 | 0.07 | 0.07 |
| Well #8 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.08 | 20.57 | 16.41 | 4.09 | 0.98 | 0.98 | 0.08 | 1.44 | 1.14 | 0.29 | 0.07 | 0.07 |
| Well #9 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.08 | 20.57 | 16.41 | 4.09 | 0.98 | 0.98 | 0.08 | 1.44 | 1.14 | 0.29 | 0.07 | 0.07 |
| Well #10 | | | | | | | | | | | | | | | | | | |
| Well #11 | | | | | | | | | | | | | | | | | | |
| Well #12 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 4.40 | 8.79 | 17.59 | 4.09 | 0.04 | 0.04 | 0.31 | 0.61 | 1.23 | 0.29 | 0.00 | 0.00 |
| Well #13 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 4.40 | 8.79 | 17.59 | 4.09 | 0.04 | 0.04 | 0.31 | 0.61 | 1.23 | 0.29 | 0.00 | 0.00 |
| Well #14 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 4.40 | 8.79 | 17.59 | 4.09 | 0.04 | 0.04 | 0.31 | 0.61 | 1.23 | 0.29 | 0.00 | 0.00 |
| Well #15 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.08 | 20.57 | 16.41 | 4.09 | 0.98 | 0.98 | 0.08 | 1.44 | 1.14 | 0.29 | 0.07 | 0.07 |
| Well #16 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.08 | 20.57 | 16.41 | 4.09 | 0.98 | 0.98 | 0.08 | 1.44 | 1.14 | 0.29 | 0.07 | 0.07 |
| | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 1.08 | 20.57 | 16.41 | 4.09 | 0.98 | 0.98 | 0.08 | 1.44 | 1.14 | 0.29 | 0.07 | 0.07 |
| **Total** | | | | | | | **34.59** | **198.10** | **236.79** | **57.24** | **7.22** | **7.22** | **2.41** | **13.82** | **16.52** | **3.99** | **0.50** | **0.50** |
| **Total (Sutter County)** | | | | | | | **34.59** | **198.10** | **236.79** | **57.24** | **7.22** | **7.22** | **2.41** | **13.82** | **16.52** | **3.99** | **0.50** | **0.50** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
4,000 AF/month
29,198 gallons/minute
55% peak pump rate

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type
Tier 4 Exhaust Emission Standards, Phase-In (100<=hp<=175, 2012-2014 model year)
Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
Engine tier adjusted to be consistent with minimum emission standard required to meet requirements of 17 CCR 93115.
Emission factors based on NMHC+NOx standard

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | | |
| 1 ton = | 453.6 | g |
| 1 kW = | 2,000 | lbs |
| 1 day = | 1.34 | hp |
| 1 month = | 24 | hours |
| 1 hour = | 31 | days |
| 1 acre-foot = | 60 | minutes |
| http://www.water.ca.g | 325,851 | gallons |

Diesel Engine Fuel Consumption
0.4
0.855 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
7.13 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
lb/gal

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Sycamore Mutual Water Company | | |
| Transfer Volume | 4,000 acre-feet | (Apr-Jun) | |
| | 4,000 acre-feet | (Jul-Sep) | |
| | 8,000 acre-feet/year | | |

Peak Pumping by Transfer Period
1,333 AF/month
1,333 AF/month

### Table E-45. Sycamore Mutual Water Company Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 5 | 0 | 0 | 5 |
| Total | 0 | 5 | 0 | 0 | 5 |

### Table E-46. Sycamore Mutual Water Company Criteria Pollutant Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Well #15 | Colusa | Electric | unknown | unknown | n/a | 3,270 | 15% | 197 | 1,183 | 11 | 1,966 |
| Well #14 | Colusa | Electric | unknown | unknown | n/a | 3,270 | 15% | 197 | 1,183 | 11 | 1,966 |
| Well #11 | Colusa | Electric | unknown | unknown | n/a | 6,409 | 29% | 387 | 2,320 | 11 | 1,966 |
| Well #2b | Colusa | Electric | unknown | unknown | n/a | 4,578 | 21% | 276 | 1,657 | 11 | 1,966 |
| Well #2a | Colusa | Electric | unknown | unknown | n/a | 4,578 | 21% | 276 | 1,657 | 11 | 1,966 |
| | | | | | **Total** | **22,104** | **100%** | **1,333** | **8,000** | **53** | **9,828** |
| | | | | | **Total (Colusa County)** | **22,104** | **100%** | **1,333** | **8,000** | **53** | **9,828** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Colusa |
|---|---|
| PM10 | A |
| PM2.5 | A |
| O3 | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
1,333 AF/month
9,733 gallons/minute
44% peak pump rate

Legend
(shaded box) Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | T&P Farms | | |
| Transfer Volume | 650 acre-feet | (Apr-Jun) | |
| | 550 acre-feet | (Jul-Sep) | |
| | 1,200 acre-feet/year | | |

Peak Pumping by Transfer Period
386 AF/month
210 AF/month

### Table E-47. T&P Farms Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 2 | 0 | 0 | 2 |
| Total | 0 | 2 | 0 | 0 | 2 |

### Table E-48. T&P Farms Criteria Pollutant Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NW-3 | Colusa | Electric | unknown | unknown | n/a | 3,500 | 47% | 180 | 560 | 9 | 869 |
| NW-4 | Colusa | Electric | unknown | unknown | n/a | 4,000 | 53% | 206 | 640 | 9 | 869 |
| | | | | | **Total** | **7,500** | **100%** | **386** | **1,200** | **18** | **1,738** |
| | | | | | **Total (Colusa County)** | **7,500** | **100%** | **386** | **1,200** | **18** | **1,738** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Colusa |
|---|---|
| PM10 | A |
| PM2.5 | A |
| O3 | A |

*Engines not subject to ATCM if remotely-located.*

Peak Month
386 AF/month
2,821 gallons/minute
38% peak pump rate

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency: Te Velde Revocable Family Trust

Transfer Volume:
2,700 acre-feet (Apr-Jun)
4,394 acre-feet (Jul-Sep)
7,094 acre-feet/year

Peak Pumping by Transfer Period
1,605 AF/month
1,674 AF/month

**Table E-49. Te Velde Revocable Family Trust Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Yolo | 0 | 5 | 0 | 0 | 5 |
| Total | 0 | 5 | 0 | 0 | 5 |

**Table E-50. Te Velde Revocable Family Trust Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GW1 | Yolo | Electric | unknown | unknown | n/a | 4,656 | 29% | 493 | 2,090 | 19 | 2,438 |
| GW10 | Yolo | Electric | unknown | unknown | n/a | 2,833 | 18% | 300 | 1,272 | 19 | 2,438 |
| GW9 | Yolo | Electric | unknown | unknown | n/a | 2,400 | 15% | 254 | 1,077 | 19 | 2,438 |
| GW3 | Yolo | Electric | unknown | unknown | n/a | 3,715 | 24% | 393 | 1,668 | 19 | 2,438 |
| GW4 | Yolo | Electric | unknown | unknown | n/a | 2,200 | 14% | 233 | 988 | 19 | 2,438 |
| | | | | | **Total** | **15,804** | **100%** | **1,674** | **7,094** | **93** | **12,189** |
| | | | | | **Total (Yolo County)** | **15,804** | **100%** | **1,674** | **7,094** | **93** | **12,189** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Yolo |
|---|---|
| PM10 | A |
| PM2.5 | N |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
1,674 AF/month
12,219 gallons/minute
77% peak pump rate

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

## Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency: Windswept Land & Livestock
Transfer Volume: 1,000 acre-feet (Apr-Jun)
1,000 acre-feet (Jul-Sep)
2,000 acre-feet/year

Peak Pumping by Transfer Period
333 AF/month
333 AF/month

### Table E-51. Windswept Land & Livestock Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 0 | 3 | 0 | 0 | 3 |
| Total | 0 | 3 | 0 | 0 | 3 |

### Table E-52. Windswept Land & Livestock Criteria Pollutant Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag Well #1 | Sutter | Electric | 2013 | 200 | n/a | 3,200 | 42% | 139 | 831 | 8 | 1,411 |
| Ag Well #3 | Sutter | Electric | unknown | unknown | n/a | 2,500 | 32% | 108 | 649 | 8 | 1,411 |
| Ag Well #4 | Sutter | Electric | unknown | unknown | n/a | 2,000 | 26% | 87 | 519 | 8 | 1,411 |
| **Total** | | | | | | **7,700** | **100%** | **333** | **2,000** | **23** | **4,232** |
| **Total (Sutter County)** | | | | | | **7,700** | **100%** | **333** | **2,000** | **23** | **4,232** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
333 AF/month
2,433 gallons/minute
32% peak pump rate

Conversion Factors

| | |
|---|---|
| 1 lb = | 453.6 g |
| 1 ton = | 2,000 lbs |
| 1 kW = | 1.34 hp |
| 1 day = | 24 hours |
| 1 month = | 31 days |
| 1 hour = | 60 minutes |
| 1 acre-foot = | 325,851 gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

**Table E-53. General Conformity Applicability Evaluation (Mitigated Emissions)**

| County/ Nonattainment Area | Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| | Sacramento Metro[1] | Sacramento Metro[1] | Sacramento Area[2] | Sacramento[3,4] | Sacramento Co. | Sacramento[4] |
| Colusa | n/a | n/a | n/a | n/a | n/a | n/a |
| Glenn | n/a | n/a | n/a | n/a | n/a | n/a |
| Sacramento | 0.0 | 2.9 | 0.1 | 1.4 | 0.0 | 0.0 |
| Shasta | n/a | n/a | n/a | n/a | n/a | n/a |
| Sutter[5] | 1.3 | 5.7 | n/a | 3.0 | n/a | 0.2 |
| Tehama | n/a | n/a | n/a | n/a | n/a | n/a |
| Yolo | 0.0 | 0.0 | 0.0 | 0.0 | n/a | 0.0 |
| Total | 1.3 | 8.6 | 0.1 | 4.3 | 0.0 | 0.2 |
| Classification | Severe-15 | Severe-15 | Maintenance | PM2.5 Precursor | Maintenance | Nonattainment |
| De Minimis Threshold (tpy) | 25 | 25 | 100 | 100 | 100 | 100 |
| Exceed? | No | No | No | No | No | No |

Note:

[1]The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

[2]The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

[3]All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

[4]The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

[5]VOC and NOx emissions are excluded from Cranmore Farms, Pelger Mutual Water Company, and Reclamation District 1004 because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

**Table E-54. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)**

| Water Agency | County | VOC | NOx |
|---|---|---|---|
| Pelger Road 1700 LLC | Sutter | All Electric | All Electric |
| Pelger Mutual Water Company | Sutter | 0.0 | 0.8 |
| Reclamation District 1004 | Sutter | No Engines | No Engines |
| **Total** | | **0.0** | **0.8** |

## Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

### Table E-55. Daily VOC Emissions (Mitigated)

| Water Agency | Daily VOC Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 1.54 | | | | | | | 1.54 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 58.76 | | | | | | | 58.76 |
| Glenn-Colusa Irrigation District | 11.95 | 2.99 | | | | | | 14.94 |
| Guisti Farms | | | | | 3.02 | | | 3.02 |
| Maxwell Irrigation District | 2.48 | | | | | | | 2.48 |
| Natomas Central Mutual Water Company | | | 0.08 | | 0.32 | | | 0.40 |
| Pelger Mutual Water Company | | | | | 0.99 | | | 0.99 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 8.71 | | | 8.71 |
| Princeton-Codora-Glenn Irrigation District | 6.58 | 20.89 | | | | | | 27.47 |
| Provident Irrigation District | No Engines | 54.54 | | | | | | 54.54 |
| Reclamation District 1004 | 34.81 | 2.95 | | | No Engines | | | 37.76 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 4.32 | | | 4.32 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **116.13** | **81.37** | **0.08** | **0.00** | **17.36** | **0.00** | **0.00** | **214.94** |

Key:
VOC = volatile organic compounds

### Table E-56. Daily NOx Emissions (Mitigated)

| Water Agency | Daily NOx Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 3.08 | | | | | | | 3.08 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 30.18 | | | | | | | 30.18 |
| Glenn-Colusa Irrigation District | 147.33 | 36.83 | | | | | | 184.17 |
| Guisti Farms | | | | | 6.03 | | | 6.03 |
| Maxwell Irrigation District | 47.21 | | | | | | | 47.21 |
| Natomas Central Mutual Water Company | | | 31.01 | | 11.55 | | | 42.56 |
| Pelger Mutual Water Company | | | | | 18.76 | | | 18.76 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 25.00 | | | 25.00 |
| Princeton-Codora-Glenn Irrigation District | 81.17 | 253.40 | | | | | | 334.58 |
| Provident Irrigation District | No Engines | 672.56 | | | | | | 672.56 |
| Reclamation District 1004 | 444.92 | 36.38 | | | No Engines | | | 481.31 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 24.76 | | | 24.76 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **753.91** | **999.18** | **31.01** | **0.00** | **86.10** | **0.00** | **0.00** | **1,870.19** |

Key:
NOx = nitrogen oxides

## Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

### Table E-57. Daily CO Emissions (Mitigated)

| Water Agency | Daily CO Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 6.17 | | | | | | | 6.17 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 57.02 | | | | | | | 57.02 |
| Glenn-Colusa Irrigation District | 31.75 | 7.94 | | | | | | 39.68 |
| Guisti Farms | | | | | 12.07 | | | 12.07 |
| Maxwell Irrigation District | 43.49 | | | | | | | 43.49 |
| Natomas Central Mutual Water Company | | | 0.79 | | 2.53 | | | 3.31 |
| Pelger Mutual Water Company | | | | | 24.68 | | | 24.68 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 191.15 | | | 191.15 |
| Princeton-Codora-Glenn Irrigation District | 17.49 | 61.96 | | | | | | 79.45 |
| Provident Irrigation District | No Engines | 144.93 | | | | | | 144.93 |
| Reclamation District 1004 | 127.07 | 7.84 | | | No Engines | | | 134.91 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 29.60 | | | 29.60 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **282.98** | **222.66** | **0.79** | **0.00** | **260.02** | **0.00** | **0.00** | **766.45** |

Key:
CO = carbon monoxide

### Table E-58. Daily SOx Emissions (Mitigated)

| Water Agency | Daily SOx Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 20.30 | | | | | | | 20.30 |
| Glenn-Colusa Irrigation District | 9.74 | 2.44 | | | | | | 12.18 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 15.48 | | | | | | | 15.48 |
| Natomas Central Mutual Water Company | | | 14.77 | | 3.36 | | | 18.12 |
| Pelger Mutual Water Company | | | | | 6.15 | | | 6.15 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 53.59 | | | 53.59 |
| Princeton-Codora-Glenn Irrigation District | 5.37 | 19.38 | | | | | | 24.75 |
| Provident Irrigation District | No Engines | 44.48 | | | | | | 44.48 |
| Reclamation District 1004 | 38.74 | 2.41 | | | No Engines | | | 41.15 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 7.16 | | | 7.16 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **89.63** | **68.70** | **14.77** | **0.00** | **70.25** | **0.00** | **0.00** | **243.36** |

Key:
SOx = sulfur oxides

## Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

### Table E-59. Daily PM10 Emissions (Mitigated)

| | Daily PM10 Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Water Agency | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.02 | | | | | | | 0.02 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.26 | | | | | | | 3.26 |
| Glenn-Colusa Irrigation District | 2.31 | 0.58 | | | | | | 2.88 |
| Guisti Farms | | | | | 0.03 | | | 0.03 |
| Maxwell Irrigation District | 2.48 | | | | | | | 2.48 |
| Natomas Central Mutual Water Company | | | 0.13 | | 0.07 | | | 0.20 |
| Pelger Mutual Water Company | | | | | 1.48 | | | 1.48 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.34 | | | 1.34 |
| Princeton-Codora-Glenn Irrigation District | 0.87 | 2.74 | | | | | | 3.60 |
| Provident Irrigation District | No Engines | 8.02 | | | | | | 8.02 |
| Reclamation District 1004 | 6.66 | 0.39 | | | No Engines | | | 7.05 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.90 | | | 0.90 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **15.59** | **11.73** | **0.13** | **0.00** | **3.83** | **0.00** | **0.00** | **31.28** |

Key:
PM10 = inhalable particulate matter

### Table E-60. Daily PM2.5 Emissions (Mitigated)

| | Daily PM2.5 Emissions (pounds per day) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Water Agency | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.02 | | | | | | | 0.02 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.21 | | | | | | | 3.21 |
| Glenn-Colusa Irrigation District | 2.25 | 0.56 | | | | | | 2.81 |
| Guisti Farms | | | | | 0.03 | | | 0.03 |
| Maxwell Irrigation District | 2.48 | | | | | | | 2.48 |
| Natomas Central Mutual Water Company | | | 0.13 | | 0.07 | | | 0.20 |
| Pelger Mutual Water Company | | | | | 1.48 | | | 1.48 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.34 | | | 1.34 |
| Princeton-Codora-Glenn Irrigation District | 0.85 | 2.67 | | | | | | 3.52 |
| Provident Irrigation District | No Engines | 7.83 | | | | | | 7.83 |
| Reclamation District 1004 | 6.56 | 0.38 | | | No Engines | | | 6.94 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.90 | | | 0.90 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **15.37** | **11.44** | **0.13** | **0.00** | **3.83** | **0.00** | **0.00** | **30.77** |

Key:
PM2.5 = fine particulate matter

## Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

**Table E-61. Annual VOC Emissions (Mitigated)**

| Water Agency | Annual VOC Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Colusa** | **Glenn** | **Sacramento** | **Shasta** | **Sutter** | **Tehama** | **Yolo** | **Total** |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.12 | | | | | | | 0.12 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.20 | | | | | | | 3.20 |
| Glenn-Colusa Irrigation District | 1.11 | 0.28 | | | | | | 1.39 |
| Guisti Farms | | | | | 0.28 | | | 0.28 |
| Maxwell Irrigation District | 0.15 | | | | | | | 0.15 |
| Natomas Central Mutual Water Company | | | 0.01 | | 0.03 | | | 0.04 |
| Pelger Mutual Water Company | | | | | 0.04 | | | 0.04 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.57 | | | 0.57 |
| Princeton-Codora-Glenn Irrigation District | 0.41 | 1.30 | | | | | | 1.71 |
| Provident Irrigation District | No Engines | 3.52 | | | | | | 3.52 |
| Reclamation District 1004 | 1.42 | 0.12 | | | No Engines | | | 1.54 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.40 | | | 0.40 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **6.42** | **5.22** | **0.01** | **0.00** | **1.33** | **0.00** | **0.00** | **12.97** |

Key:
VOC = volatile organic compounds

**Table E-62. Annual NOx Emissions (Mitigated)**

| Water Agency | Annual NOx Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Colusa** | **Glenn** | **Sacramento** | **Shasta** | **Sutter** | **Tehama** | **Yolo** | **Total** |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.25 | | | | | | | 0.25 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 1.64 | | | | | | | 1.64 |
| Glenn-Colusa Irrigation District | 13.70 | 3.43 | | | | | | 17.13 |
| Guisti Farms | | | | | 0.56 | | | 0.56 |
| Maxwell Irrigation District | 2.88 | | | | | | | 2.88 |
| Natomas Central Mutual Water Company | | | 2.88 | | 1.07 | | | 3.96 |
| Pelger Mutual Water Company | | | | | 0.79 | | | 0.79 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.75 | | | 1.75 |
| Princeton-Codora-Glenn Irrigation District | 5.06 | 15.81 | | | | | | 20.87 |
| Provident Irrigation District | No Engines | 43.44 | | | | | | 43.44 |
| Reclamation District 1004 | 18.10 | 1.48 | | | No Engines | | | 19.58 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 2.30 | | | 2.30 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **41.64** | **64.15** | **2.88** | **0.00** | **6.47** | **0.00** | **0.00** | **115.15** |

Key:
NOx = nitrogen oxides

## Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

### Table E-63. Annual CO Emissions (Mitigated)

| Water Agency | Annual CO Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.50 | | | | | | | 0.50 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 3.11 | | | | | | | 3.11 |
| Glenn-Colusa Irrigation District | 2.95 | 0.74 | | | | | | 3.69 |
| Guisti Farms | | | | | 1.12 | | | 1.12 |
| Maxwell Irrigation District | 2.65 | | | | | | | 2.65 |
| Natomas Central Mutual Water Company | | | 0.07 | | 0.23 | | | 0.31 |
| Pelger Mutual Water Company | | | | | 1.03 | | | 1.03 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 7.32 | | | 7.32 |
| Princeton-Codora-Glenn Irrigation District | 1.09 | 3.86 | | | | | | 4.96 |
| Provident Irrigation District | No Engines | 9.36 | | | | | | 9.36 |
| Reclamation District 1004 | 5.17 | 0.32 | | | No Engines | | | 5.49 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 2.75 | | | 2.75 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **15.47** | **14.28** | **0.07** | **0.00** | **12.47** | **0.00** | **0.00** | **42.30** |

Key:
CO = carbon monoxide

### Table E-64. Annual SOx Emissions (Mitigated)

| Water Agency | Annual SOx Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 1.11 | | | | | | | 1.11 |
| Glenn-Colusa Irrigation District | 0.91 | 0.23 | | | | | | 1.13 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 0.94 | | | | | | | 0.94 |
| Natomas Central Mutual Water Company | | | 1.37 | | 0.31 | | | 1.69 |
| Pelger Mutual Water Company | | | | | 0.26 | | | 0.26 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 1.73 | | | 1.73 |
| Princeton-Codora-Glenn Irrigation District | 0.33 | 1.21 | | | | | | 1.54 |
| Provident Irrigation District | No Engines | 2.87 | | | | | | 2.87 |
| Reclamation District 1004 | 1.58 | 0.10 | | | No Engines | | | 1.67 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.67 | | | 0.67 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **4.87** | **4.41** | **1.37** | **0.00** | **2.97** | **0.00** | **0.00** | **13.62** |

Key:
SOx = sulfur oxides

## Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

### Table E-65. Annual PM10 Emissions (Mitigated)

| Water Agency | Annual PM10 Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 0.18 | | | | | | | 0.18 |
| Glenn-Colusa Irrigation District | 0.21 | 0.05 | | | | | | 0.27 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 0.15 | | | | | | | 0.15 |
| Natomas Central Mutual Water Company | | | 0.01 | | 0.01 | | | 0.02 |
| Pelger Mutual Water Company | | | | | 0.06 | | | 0.06 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.07 | | | 0.07 |
| Princeton-Codora-Glenn Irrigation District | 0.05 | 0.17 | | | | | | 0.22 |
| Provident Irrigation District | No Engines | 0.52 | | | | | | 0.52 |
| Reclamation District 1004 | 0.27 | 0.02 | | | No Engines | | | 0.29 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.08 | | | 0.08 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **0.87** | **0.76** | **0.01** | **0.00** | **0.23** | **0.00** | **0.00** | **1.87** |

Key:
PM10 = inhalable particulate matter

### Table E-66. Annual PM2.5 Emissions (Mitigated)

| Water Agency | Annual PM2.5 Emissions (tons per year) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colusa | Glenn | Sacramento | Shasta | Sutter | Tehama | Yolo | Total |
| Anderson-Cottonwood Irrigation District | | | | All Electric | | No Engines | | 0.00 |
| Baber, Jack et al. | No Groundwater Substitution | | | | | | | 0.00 |
| Canal Farms | 0.00 | | | | | | | 0.00 |
| Conaway Preservation Group | No Groundwater Substitution | | | | | | | 0.00 |
| Eastside Mutual Water Company | 0.18 | | | | | | | 0.18 |
| Glenn-Colusa Irrigation District | 0.21 | 0.05 | | | | | | 0.26 |
| Guisti Farms | | | | | 0.00 | | | 0.00 |
| Maxwell Irrigation District | 0.15 | | | | | | | 0.15 |
| Natomas Central Mutual Water Company | | | 0.01 | | 0.01 | | | 0.02 |
| Pelger Mutual Water Company | | | | | 0.06 | | | 0.06 |
| Pelger Road 1700 LLC | | | | | All Electric | | | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | | | | | 0.07 | | | 0.07 |
| Princeton-Codora-Glenn Irrigation District | 0.05 | 0.17 | | | | | | 0.22 |
| Provident Irrigation District | No Engines | 0.51 | | | | | | 0.51 |
| Reclamation District 1004 | 0.27 | 0.02 | | | No Engines | | | 0.28 |
| Reclamation District 108 | All Electric | | | | | | All Electric | 0.00 |
| River Garden Farms | | | | | | | All Electric | 0.00 |
| Sutter Mutual Water Company | | | | | 0.08 | | | 0.08 |
| Sycamore Mutual Water Company | All Electric | | | | | | | 0.00 |
| T&P Farms | All Electric | | | | | | | 0.00 |
| Te Velde Revocable Family Trust | | | | | | | All Electric | 0.00 |
| Windswept Land & Livestock | | | | | All Electric | | | 0.00 |
| **Total** | **0.86** | **0.74** | **0.01** | **0.00** | **0.23** | **0.00** | **0.00** | **1.84** |

Key:
PM2.5 = fine particulate matter

## Groundwater Substitution Air Quality Emissions (Unmitigated)

| | | | |
|---|---|---|---|
| Agency | Pleasant Grove-Verona Mutual Water Company | | Peak Pumping by Transfer Period |
| Transfer Volume | 8,000 acre-feet | (Apr-Jun) | 4,757 AF/month |
| | 7,000 acre-feet | (Jul-Sep) | 2,667 AF/month |
| | 15,000 acre-feet/year | | |

### Table E-67. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 13 | 20 | 0 | 2 | 35 |
| Total | 13 | 20 | 0 | 2 | 35 |

### Table E-68. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) - diesel (MMBtu/yr) - propane |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kelly 190 Field Well #2 | Sutter | Electric | unknown | 30 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| Kelly Windmill Field Well #2 | Sutter | Electric | 2002 | 62.1 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| Kelly Windmill North Field Well | Sutter | Propane | 2014 | 133 | n/a | 1,750 | 2% | 97 | 306 | 2 | 951 | 321 |
| Kelly306 | Sutter | Electric | unknown | 60 | n/a | 2,600 | 3% | 144 | 455 | 19 | 951 | n/a |
| MLF Clubhouse B Well | Sutter | Electric | unknown | 300 | n/a | 3,700 | 4% | 205 | 648 | 19 | 951 | n/a |
| MLF Marsh Well | Sutter | Electric | unknown | 300 | n/a | 3,700 | 4% | 205 | 648 | 19 | 951 | n/a |
| MLF Monster Well | Sutter | Electric | unknown | 60 | n/a | 3,100 | 4% | 172 | 543 | 19 | 951 | n/a |
| MLF Well #1 | Sutter | Electric | unknown | 30 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| MLF Well #16 | Sutter | Electric | unknown | 50 | n/a | 1,700 | 2% | 94 | 298 | 19 | 951 | n/a |
| MLF Well#11 | Sutter | Diesel | 2011 | 250 | T4I | 4,200 | 5% | 233 | 735 | 14 | 951 | 13,332 |
| MLF Well#12/17 | Sutter | Electric | unknown | 50 | n/a | 1,500 | 2% | 83 | 263 | 19 | 951 | n/a |
| MLF Well#13&#15 | Sutter | Electric | 2000 | 215 | n/a | 4,800 | 6% | 266 | 840 | 19 | 951 | n/a |
| MLF Well#2B | Sutter | Electric | 2000 | 300 | n/a | 3,700 | 4% | 205 | 648 | 19 | 951 | n/a |
| Nicholas 72-Acre Field North | Sutter | Electric | unknown | 40 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| Nicholas 72-Acree Field South | Sutter | Diesel | 2008 | 62.1 | T4I | 2,000 | 2% | 111 | 350 | 6 | 951 | 3,312 |
| Nicholas BBC Well | Sutter | Electric | unknown | 30 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| Nicholas Filipino Camp South | Sutter | Diesel | 2008 | 62.1 | T4I | 2,000 | 2% | 111 | 350 | 6 | 951 | 3,312 |
| Nicholas Filipino Camp#2 | Sutter | Electric | unknown | 40 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| Nicholas Johnston Field Well #2 | Sutter | Electric | unknown | 40 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| Nicholas Sand Field Well | Sutter | Diesel | 2008 | 62.1 | T4I | 2,000 | 2% | 111 | 350 | 6 | 951 | 3,312 |
| RiverRanch#19 | Sutter | Diesel | 2012 | 99 | T4I | 2,000 | 2% | 111 | 350 | 17 | 951 | 5,279 |
| S&O#16 | Sutter | Electric | 2014 | 159 | n/a | 3,000 | 4% | 167 | 525 | 19 | 951 | n/a |
| S&O#17 | Sutter | Diesel | 2012 | 101 | T4I | 2,250 | 3% | 125 | 394 | 17 | 951 | 5,386 |
| S&O#18A | Sutter | Diesel | 2012 | 101 | T4I | 1,800 | 2% | 100 | 315 | 17 | 951 | 5,386 |
| S&O#19 | Sutter | Diesel | 2011 | 215 | T4I | 2,150 | 3% | 119 | 376 | 15 | 951 | 11,465 |
| S&O#20 | Sutter | Propane | 2014 | 154 | n/a | 2,250 | 3% | 125 | 394 | 0 | 951 | 372 |
| Willey#1 | Sutter | Diesel | 2012 | 168 | T4I | 3,000 | 4% | 167 | 525 | 16 | 951 | 8,959 |
| Willey#2 | Sutter | Diesel | 2011 | 250 | T4I | 3,000 | 4% | 167 | 525 | 14 | 951 | 13,332 |
| Willey#3 | Sutter | Electric | unknown | 75 | n/a | 2,000 | 2% | 111 | 350 | 19 | 951 | n/a |
| Willey#4 | Sutter | Diesel | 2012 | 150 | T4I | 2,000 | 2% | 111 | 350 | 16 | 951 | 7,999 |
| Will-Lee Well#30 | Sutter | Diesel | 2012 | 100 | T4I | 2,500 | 3% | 139 | 438 | 17 | 951 | 5,333 |
| Will-Lee Well#31 | Sutter | Electric | unknown | 50 | n/a | 2,500 | 3% | 139 | 438 | 19 | 951 | n/a |
| Will-Lee Well#32 | Sutter | Electric | unknown | 300 | n/a | 2,500 | 3% | 139 | 438 | 19 | 951 | n/a |
| Will-Lee Well#33 | Sutter | Electric | unknown | 75 | n/a | 2,500 | 3% | 139 | 438 | 19 | 951 | n/a |
| Will-Lee Well#4A | Sutter | Diesel | 2012 | 160 | T4I | 1,500 | 2% | 83 | 263 | 16 | 951 | 8,532 |
| | | | | | **Total** | **85,700** | **100%** | **4,757** | **15,000** | **567** | **33,270** | **95,632** |
| | | | | | **Total (Sutter County)** | **85,700** | **100%** | **4,757** | **15,000** | **567** | **33,270** | **95,632** |

| Well | Emission Factors (g/bhp-hr) - diesel and VOC, NOx, and CO for propane (lb/MMBtu) - SOx, PM10, and PM2.5 for propane: VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day): VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year): VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kelly 190 Field Well #2 | | | | | | | | | | | | | | | | | | |
| Kelly Windmill Field Well #2 | | | | | | | | | | | | | | | | | | |
| Kelly Windmill North Field Well | 1.0 | 2.0 | 4.0 | 5.88E-04 | 9.99E-03 | 9.99E-03 | 0.46 | 0.92 | 1.84 | 0.00 | 0.01 | 0.01 | 0.14 | 0.28 | 0.56 | 0.00 | 0.00 | 0.00 |
| Kelly306 | | | | | | | | | | | | | | | | | | |
| MLF Clubhouse B Well | | | | | | | | | | | | | | | | | | |
| MLF Marsh Well | | | | | | | | | | | | | | | | | | |
| MLF Monster Well | | | | | | | | | | | | | | | | | | |
| MLF Well #1 | | | | | | | | | | | | | | | | | | |
| MLF Well #16 | | | | | | | | | | | | | | | | | | |
| MLF Well#11 | 0.14 | 0.30 | 2.61 | 0.93 | 0.01 | 0.01 | 1.12 | 2.36 | 20.68 | 7.36 | 0.12 | 0.12 | 0.04 | 0.08 | 0.68 | 0.24 | 0.00 | 0.00 |
| MLF Well#12/17 | | | | | | | | | | | | | | | | | | |
| MLF Well#13&#15 | | | | | | | | | | | | | | | | | | |
| MLF Well#2B | | | | | | | | | | | | | | | | | | |
| Nicholas 72-Acre Field North | | | | | | | | | | | | | | | | | | |
| Nicholas 72-Acree Field South | 0.18 | 3.33 | 3.73 | 0.93 | 0.22 | 0.22 | 0.13 | 2.52 | 2.82 | 0.70 | 0.17 | 0.17 | 0.01 | 0.22 | 0.24 | 0.06 | 0.01 | 0.01 |
| Nicholas BBC Well | | | | | | | | | | | | | | | | | | |
| Nicholas Filipino Camp South | 0.18 | 3.33 | 3.73 | 0.93 | 0.22 | 0.22 | 0.13 | 2.52 | 2.82 | 0.70 | 0.17 | 0.17 | 0.01 | 0.22 | 0.24 | 0.06 | 0.01 | 0.01 |
| Nicholas Filipino Camp#2 | | | | | | | | | | | | | | | | | | |
| Nicholas Johnston Field Well #2 | | | | | | | | | | | | | | | | | | |
| Nicholas Sand Field Well | 0.18 | 3.33 | 3.73 | 0.93 | 0.22 | 0.22 | 0.13 | 2.52 | 2.82 | 0.70 | 0.17 | 0.17 | 0.01 | 0.22 | 0.24 | 0.06 | 0.01 | 0.01 |
| RiverRanch#19 | 0.14 | 0.30 | 3.73 | 0.93 | 0.01 | 0.01 | 0.54 | 1.13 | 14.15 | 3.53 | 0.06 | 0.06 | 0.01 | 0.03 | 0.39 | 0.10 | 0.00 | 0.00 |
| S&O#16 | | | | | | | | | | | | | | | | | | |
| S&O#17 | 0.14 | 0.30 | 3.73 | 0.93 | 0.01 | 0.01 | 0.55 | 1.15 | 14.41 | 3.59 | 0.06 | 0.06 | 0.02 | 0.03 | 0.39 | 0.10 | 0.00 | 0.00 |
| S&O#18A | 0.14 | 0.30 | 3.73 | 0.93 | 0.01 | 0.01 | 0.55 | 1.15 | 14.41 | 3.59 | 0.06 | 0.06 | 0.02 | 0.03 | 0.39 | 0.10 | 0.00 | 0.00 |
| S&O#19 | 0.14 | 0.30 | 2.61 | 0.93 | 0.01 | 0.01 | 1.01 | 2.13 | 18.65 | 6.64 | 0.11 | 0.11 | 0.03 | 0.07 | 0.59 | 0.21 | 0.00 | 0.00 |
| S&O#20 | 1.0 | 2.0 | 4.0 | 5.88E-04 | 9.99E-03 | 9.99E-03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.32 | 0.65 | 0.00 | 0.00 | 0.00 |
| Willey#1 | 0.14 | 0.30 | 3.73 | 0.93 | 0.01 | 0.01 | 0.84 | 1.77 | 22.12 | 5.51 | 0.09 | 0.09 | 0.02 | 0.05 | 0.66 | 0.16 | 0.00 | 0.00 |
| Willey#2 | 0.14 | 0.30 | 2.61 | 0.93 | 0.01 | 0.01 | 1.12 | 2.36 | 20.68 | 7.36 | 0.12 | 0.12 | 0.04 | 0.08 | 0.68 | 0.24 | 0.00 | 0.00 |
| Willey#3 | | | | | | | | | | | | | | | | | | |
| Willey#4 | 0.14 | 0.30 | 3.73 | 0.93 | 0.01 | 0.01 | 0.77 | 1.62 | 20.19 | 5.03 | 0.08 | 0.08 | 0.02 | 0.05 | 0.59 | 0.15 | 0.00 | 0.00 |
| Will-Lee Well#30 | 0.14 | 0.30 | 3.73 | 0.93 | 0.01 | 0.01 | 0.54 | 1.14 | 14.28 | 3.56 | 0.06 | 0.06 | 0.01 | 0.03 | 0.39 | 0.10 | 0.00 | 0.00 |
| Will-Lee Well#31 | | | | | | | | | | | | | | | | | | |
| Will-Lee Well#32 | | | | | | | | | | | | | | | | | | |
| Will-Lee Well#33 | | | | | | | | | | | | | | | | | | |
| Will-Lee Well#4A | 0.14 | 0.30 | 3.73 | 0.93 | 0.01 | 0.01 | 0.81 | 1.70 | 21.27 | 5.30 | 0.09 | 0.09 | 0.02 | 0.05 | 0.63 | 0.16 | 0.00 | 0.00 |
| **Total** | | | | | | | **8.71** | **25.00** | **191.15** | **53.59** | **1.34** | **1.34** | **0.57** | **1.75** | **7.32** | **1.73** | **0.07** | **0.07** |
| **Total (Sutter County)** | | | | | | | **8.71** | **25.00** | **191.15** | **53.59** | **1.34** | **1.34** | **0.57** | **1.75** | **7.32** | **1.73** | **0.07** | **0.07** |

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
4,757 AF/month
34,722 gallons/minute
41% peak pump rate

Legend
[blue] Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
[yellow] Mitigation requirement

Conversion Factors

| | | |
|---|---|---|
| 1 bhp-hr = | 2,542.5 | Btu |
| 1 lb = | 453.6 | g |
| 1 ton = | 2,000 | lbs |
| 1 kW = | 1.34 | hp |
| 1 day = | 24 | hours |
| 1 month = | 31 | days |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

**Groundwater Substitution Air Quality Emissions (Mitigated)**

Agency Sutter Mutual Water Company

**Table E-69. Sutter Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 8 | 6 | 0 | 6 | 20 |
| Total | 8 | 6 | 0 | 6 | 20 |

**Table E-70. Sutter Mutual Water Company Criteria Pollutant Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Emission Tier | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/month) | Transfer Volume (AF/year) | Operations (hours/day) | Operations (hours/year) | Fuel Consumption (gal/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Van Ruiten Well | Sutter | Electric | unknown | 75 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | n/a |
| Frank Giusti | Sutter | Propane | 2015 | 150 | n/a | 2,700 | 5% | 26 | 154 | 2 | 309 | 2,602 |
| Matteoli | Sutter | Diesel | 2014 | 150 | T4I | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| L&N Farms | Sutter | Electric | unknown | 250 | n/a | 5,000 | 9% | 47 | 285 | 2 | 309 | n/a |
| Well #1 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | n/a |
| Well #2 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | n/a |
| Well #3 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #4 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #5 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #6 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #7 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #8 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #9 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | n/a |
| Well #10 | Sutter | Electric | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | n/a |
| Well #11 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #12 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #13 | Sutter | Propane | unknown | 150 | n/a | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #14 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #15 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| Well #16 | Sutter | Diesel | unknown | 150 | T2 | 2,500 | 5% | 24 | 142 | 2 | 309 | 2,602 |
| **Total** | | | | | | **52,700** | **100%** | **500** | **3,000** | **33** | **6,183** | **36,422** |
| **Total (Sutter County)** | | | | | | **52,700** | **100%** | **500** | **3,000** | **33** | **6,183** | **36,422** |

| Well | Emission Factors (g/bhp-hr) VOC | NOx | CO | SOx | PM10 | PM2.5 | Daily Emissions (pounds per day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Emissions (tons per year) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Van Ruiten Well | | | | | | | | | | | | | | | | | | |
| Frank Giusti | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 0.55 | 1.10 | 2.20 | 0.51 | 0.01 | 0.01 | 0.05 | 0.10 | 0.20 | 0.05 | 0.00 | 0.00 |
| Matteoli | 0.14 | 0.3 | 3.7 | 0.93 | 0.01 | 0.01 | 0.08 | 0.16 | 2.05 | 0.51 | 0.01 | 0.01 | 0.01 | 0.02 | 0.19 | 0.05 | 0.00 | 0.00 |
| L&N Farms | | | | | | | | | | | | | | | | | | |
| Well #1 | | | | | | | | | | | | | | | | | | |
| Well #2 | | | | | | | | | | | | | | | | | | |
| Well #3 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 0.55 | 1.10 | 2.20 | 0.51 | 0.01 | 0.01 | 0.05 | 0.10 | 0.20 | 0.05 | 0.00 | 0.00 |
| Well #4 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 0.55 | 1.10 | 2.20 | 0.51 | 0.01 | 0.01 | 0.05 | 0.10 | 0.20 | 0.05 | 0.00 | 0.00 |
| Well #5 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.14 | 2.57 | 2.05 | 0.51 | 0.12 | 0.12 | 0.01 | 0.24 | 0.19 | 0.05 | 0.01 | 0.01 |
| Well #6 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.14 | 2.57 | 2.05 | 0.51 | 0.12 | 0.12 | 0.01 | 0.24 | 0.19 | 0.05 | 0.01 | 0.01 |
| Well #7 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.14 | 2.57 | 2.05 | 0.51 | 0.12 | 0.12 | 0.01 | 0.24 | 0.19 | 0.05 | 0.01 | 0.01 |
| Well #8 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.14 | 2.57 | 2.05 | 0.51 | 0.12 | 0.12 | 0.01 | 0.24 | 0.19 | 0.05 | 0.01 | 0.01 |
| Well #9 | | | | | | | | | | | | | | | | | | |
| Well #10 | | | | | | | | | | | | | | | | | | |
| Well #11 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 0.55 | 1.10 | 2.20 | 0.51 | 0.01 | 0.01 | 0.05 | 0.10 | 0.20 | 0.05 | 0.00 | 0.00 |
| Well #12 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 0.55 | 1.10 | 2.20 | 0.51 | 0.01 | 0.01 | 0.05 | 0.10 | 0.20 | 0.05 | 0.00 | 0.00 |
| Well #13 | 1.0 | 2.0 | 4.0 | 0.93 | 0.01 | 0.01 | 0.55 | 1.10 | 2.20 | 0.51 | 0.01 | 0.01 | 0.05 | 0.10 | 0.20 | 0.05 | 0.00 | 0.00 |
| Well #14 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.14 | 2.57 | 2.05 | 0.51 | 0.12 | 0.12 | 0.01 | 0.24 | 0.19 | 0.05 | 0.01 | 0.01 |
| Well #15 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.14 | 2.57 | 2.05 | 0.51 | 0.12 | 0.12 | 0.01 | 0.24 | 0.19 | 0.05 | 0.01 | 0.01 |
| Well #16 | 0.2 | 4.7 | 3.7 | 0.93 | 0.22 | 0.22 | 0.14 | 2.57 | 2.05 | 0.51 | 0.12 | 0.12 | 0.01 | 0.24 | 0.19 | 0.05 | 0.01 | 0.01 |
| **Total** | | | | | | | **4.32** | **24.76** | **29.60** | **7.16** | **0.90** | **0.90** | **0.40** | **2.30** | **2.75** | **0.67** | **0.08** | **0.08** |
| **Total (Sutter County)** | | | | | | | **4.32** | **24.76** | **29.60** | **7.16** | **0.90** | **0.90** | **0.40** | **2.30** | **2.75** | **0.67** | **0.08** | **0.08** |

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

| | Sutter |
|---|---|
| PM10 | A |
| PM2.5 | M |
| O3 | N |

*Engines subject to ATCM.*

Peak Month
500 AF/month
3,650 gallons/minute
7% peak pump rate

Legend
- Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type
- Tier 4 Exhaust Emission Standards, Phase-In (100<=hp<=175, 2012-2014 model year)
- Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
- Engine tier adjusted to be consistent with minimum emission standard required to meet requirements of 17 CCR 93115.
- Emission factors based on NMHC+NOx standard

Conversion Factors
1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## CARB Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines

### Table E-71. Summary of the Emission Standards for New Stationary Diesel-Fueled CI Engines > 50 BHP used in Agricultural Operations

| Horsepower Range | Diesel PM [1] (g/bhp-hr) | HC (g/bhp-hr) | NOx (g/bhp-hr) | NMHC+NOx (g/bhp-hr) | CO (g/bhp-hr) |
|---|---|---|---|---|---|
| 50<HP<100 | 0.3 | | | | |
| 100<=HP<175 | 0.22 | | | | |
| 175<=HP | 0.15 | | | | |

*Source: See Section 93115.8(a)*

Notes:

[1] Less than or equal to the emission standard OR Off-Road CI Engine Certification Standard for an off-road engine of the maximum rated power, whichever is more stringent.

[2] Off-Road CI Engine Certification Standard for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard, or Tier 1 standards.

[3] Prior to January 1, 2008, these limits shall not apply to engines sold from one agricultural operation to another and funded under State or federal incentive.

### Table E-72. Emission Standards for Noncertified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

| Horsepower (HP) Range | Compliance Date [1] | PM (g/bhp-hr) | HC [2,3] (g/bhp-hr) | NOx [2,3] (g/bhp-hr) | NMHC+NOx [2,3] (g/bhp-hr) | CO [2,3] (g/bhp-hr) |
|---|---|---|---|---|---|---|
| 50<HP<75 | 2011 | 0.3 | | | | |
| 75<=HP<100 | 2011 | 0.3 | | | | |
| 100<=HP<175 | 2010 | 0.22 | | | | |
| 175<=HP<=750 | 2010 | 0.15 | | | | |
| 750<HP | 2014 | 0.075 | | | | |

*Source: See Sections 93115.8(b) (2) and (4)*

Note:

[1] Compliance date on or after December 31

[2] Engine Certification Standards for off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in Title 13.

### Table E-73. Emission Standards Tier 1- and Tier 2-Certified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

| Horsepower Range (hp) | Compliance Date | PM (g/bhp-hr) | HC [2,3] (g/bhp-hr) | NOx [2,3] (g/bhp-hr) | NMHC+NOx [2,3] (g/bhp-hr) | CO [2,3] (g/bhp-hr) |
|---|---|---|---|---|---|---|
| 50<HP<75 | 2015 | 0.02 | | | | |
| 75<=HP<175 | 2015 | 0.01 | | | | |
| 175<=hp<=750 | 2014 | 0.01 | | | | |
| 750<HP | 2014 | 0.075 | | | | |

*Source: See Sections 93115.8(b)(3) and (4)*

Notes:

[1] Compliance date on or after December 31 or 12 years after the date of initial installation, whichever is later.

[2] Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in agricultural operation shall not exceed Tier 1 standards in Tier 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

**Table E-74. Tier 1, Tier 2, and Tier 3 Exhaust Emission Standards**

| | | | (g/kW-hr) | | | | | (g/hp-hr) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Maximum Rated Power** | **Tier** | **Model Year** | **NOx** | **HC** | **NMHC+NOx** | **CO** | **PM** | **NOx** | **HC** | **NMHC+NOx** | **CO** | **PM** |
| kW<8 | T1 | 2000-2004 | - | - | 10.5 | 8.0 | 1 | - | - | 7.8 | 6.0 | 0.7 |
| *hp <11* | T2 | 2005 -2007 | - | - | 7.5 | 8.0 | 0.8 | - | - | 5.6 | 6.0 | 0.6 |
| 8≤kW<19 | T1 | 2000-2004 | - | - | 9.5 | 6.6 | 0.8 | - | - | 7.1 | 4.9 | 0.6 |
| *11<=hp<25* | T2 | 2005 -2007 | - | - | 7.5 | 6.6 | 0.8 | - | - | 5.6 | 4.9 | 0.6 |
| 19≤kW<37 | T1 | 2000-2003 | - | - | 9.5 | 5.5 | 0.8 | - | - | 7.1 | 4.1 | 0.6 |
| *25<=hp<50* | T2 | 2004 -2007 | - | - | 7.5 | 5.5 | 0.6 | - | - | 5.6 | 4.1 | 0.4 |
| 37≤kW<56 | T1 | 2000-2003 | 9.2 | - | - | - | - | 6.9 | - | - | - | - |
| *50<=hp<75* | T2 | 2004-2007 | - | - | 7.5 | 5.0 | 0.4 | - | - | 5.6 | 3.7 | 0.3 |
| | T3 | 2008 -2011 | - | - | 4.7 | 5.0 | 0.4 | - | - | 3.5 | 3.7 | 0.3 |
| 56≤kW<75 | T1 | 2000-2003 | 9.2 | - | - | - | - | 6.9 | - | - | - | - |
| *75<=hp<100* | T2 | 2004-2007 | - | - | 7.5 | 5.0 | 0.4 | - | - | 5.6 | 3.7 | 0.3 |
| | T3 | 2008-2011 | - | - | 4.7 | 5.0 | 0.4 | - | - | 3.5 | 3.7 | 0.3 |
| 75≤kW<130 | T1 | 2000-2002 | 9.2 | - | - | - | - | 6.9 | - | - | - | - |
| *100<=hp<175* | T2 | 2003-2006 | - | - | 6.6 | 5.0 | 0.3 | - | - | 4.9 | 3.7 | 0.2 |
| | T3 | 2007 -2011 | - | - | 4.0 | 5.0 | 0.3 | - | - | 3.0 | 3.7 | 0.2 |
| 130≤kW<225 | T1 | 1996-2002 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *175<=hp<300* | T2 | 2003-2005 | - | - | 6.6 | 3.5 | 0.2 | - | - | 4.9 | 2.6 | 0.1 |
| | T3 | 2006 -2010 | - | - | 4.0 | 3.5 | 0.2 | - | - | 3.0 | 2.6 | 0.1 |
| 225≤kW<450 | T1 | 1996-2000 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *300<=hp<600* | T2 | 2001-2005 | - | - | 6.4 | 3.5 | 0.2 | - | - | 4.8 | 2.6 | 0.1 |
| | T3 | 2006 -2010 | - | - | 4.0 | 3.5 | 0.2 | - | - | 3.0 | 2.6 | 0.1 |
| 450≤kW≤560 | T1 | 1996-2001 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *600<=hp<750* | T2 | 2002-2005 | - | - | 6.4 | 3.5 | 0.2 | - | - | 4.8 | 2.6 | 0.1 |
| | T3 | 2006 -2010 | - | - | 4.0 | 3.5 | 0.2 | - | - | 3.0 | 2.6 | 0.1 |
| kW>560 | T1 | 2000-2005 | 9.2 | 1.3 | - | 11.4 | 0.54 | 6.9 | 1.0 | - | 8.5 | 0.4 |
| *hp>750* | T2 | 2006 -2010 | - | - | 6.4 | 3.5 | 0.2 | - | - | 4.8 | 2.6 | 0.1 |

*Source: Title 13, California Code of Regulations, Division 3, Chapter 9, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."*

<u>NOx and NMHC fraction - Table B-26</u>

| | |
|---|---|
| NOx | 95% |
| NMHC | 5% |

http://www.arb.ca.gov/msprog/moyer/guidelines/cmp_guidelines_part4.pdf

<u>PM Size Fractions</u>

| | |
|---|---|
| PM10 | 0.96 |
| PM2.5 | 0.937 |
| Ratio | 0.98 |

CARB PMSIZE Profile No. 116 (STAT. I.C. ENGINE-DIESEL)

**Table E-75. Tier 4 Exhaust Emission Standards**

| MAXIMUM ENGINE POWER | MODEL YEAR | TYPE | PM | NMHC+NOx | NMHC | NOx | CO |
|---|---|---|---|---|---|---|---|
| | | | grams per horsepower-hour | | | | |
| hp<11 | 2008 and later | FINAL | 0.30 | 5.6 | - | - | 6.0 |
| 11<=hp<25 | | | | | | | 4.9 |
| 25<=hp<50 | 2008-2012 | INTERIM | 0.22 | 5.6 | - | - | 4.1 |
| | 2013 and later | FINAL | 0.02 | 3.5 | | | |
| 50<=hp<75 | 2008-2012 | INTERIM | 0.22 | 3.5 | - | - | 3.7 |
| | 2013 and later | FINAL | 0.02 | | | | |
| 75<=hp<100 | 2012-2014 | PHASE-IN | 0.01 | - | 0.14 | 0.3 | 3.7 |
| | | PHASE-OUT | | 3.5 | - | - | |
| | | or/ ALT NOx | | | 0.14 | 2.5 | |
| | 2015 and later | FINAL | | - | | 0.3 | |
| 100<=hp<175 | 2012-2014 | PHASE-IN | 0.01 | - | 0.14 | 0.3 | 3.7 |
| | | PHASE-OUT | | 3.0 | - | - | |
| | | or/ ALT NOx | | - | 0.14 | 2.5 | |
| | 2015 and later | FINAL | | | 0.14 | 0.3 | |
| 175<=hp<=750 | 2011-2013 | PHASE-IN | 0.01 | - | 0.14 | 0.3 | 2.6 |
| | 2014 and later | PHASE-OUT | | 3.0 | - | - | |
| | | or/ ALT NOx | | - | 0.14 | 1.5 | |
| | | FINAL | | | | 0.3 | |
| 750 hp<GEN<=1205 hp | 2011-2014 | INTERIM | 0.07 | - | 0.30 | 2.6 | 2.6 |
| | 2015 and later | FINAL | 0.02 | | 0.14 | 0.5 | |
| GEN>1205 hp | 2011-2014 | INTERIM | 0.07 | - | 0.30 | | 2.6 |
| | 2015 and later | FINAL | 0.02 | | 0.14 | 0.5 | |
| ELSE>750 hp | 2011-2014 | INTERIM | 0.07 | - | 0.30 | 2.6 | 2.6 |
| | 2015 and later | FINAL | 0.03 | - | 0.14 | | |

*Source: Title 13, California Code of Regulations, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."*

**Table E-76. Engine Tier Matrix**

| HP Range | Year | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| hp <11 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T4 | T4 | T4 | T4 | T4 | T4 | T4 | T4 |
| 11<=hp<25 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T4 | T4 | T4 | T4 | T4 | T4 | T4 | T4 |
| 25<=hp<50 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T4I | T4I | T4I | T4I | T4I | T4 | T4 | T4 |
| 50<=hp<75 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T4I | T4I | T4I | T4I | T4I | T4 | T4 | T4 |
| 75<=hp<100 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 |
| 100<=hp<175 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 |
| 175<=hp<300 | T1 | T1 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 | T4 |
| 300<=hp<600 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 | T4 |
| 600<=hp<750 | T1 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T3 | T3 | T3 | T3 | T3 | T4I | T4I | T4I | T4 | T4 |
| hp>750 | T0 | T0 | T0 | T0 | T1 | T1 | T1 | T1 | T1 | T1 | T2 | T2 | T2 | T2 | T2 | T4I | T4I | T4I | T4I | T4 |

Key:

T0 = Tier 0 (Noncertified)
T1 = Tier 1
T2 = Tier 2
T3 = Tier 3
T4 = Tier 4
T4I = Tier 4 Interim

## AP-42 Emission Factors

### Table E-77. Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines [a]

| Pollutant | Gasoline Fuel Emission Factor (lb/hp-hr) (power output) | Gasoline Fuel Emission Factor (lb/MMBtu) (fuel input) | Diesel Fuel Emission Factor (lb/hp-hr) (power output) | Diesel Fuel Emission Factor (lb/MMBtu) (fuel input) | Emission Factor Rating |
|---|---|---|---|---|---|
| NOx | 0.011 | 1.63 | 0.031 | 4.41 | D |
| CO | 6.96E-03 [d] | 0.99 [d] | 6.68E-03 | 0.95 | D |
| SOx | 5.91E-04 | 0.084 | 2.05E-03 | 0.29 | D |
| PM-10 [b] | 7.21E-04 | 0.1 | 2.20E-03 | 0.31 | D |
| CO2 [c] | 1.08 | 154 | 1.15 | 164 | B |
| Aldehydes | 4.85E-04 | 0.07 | 4.63E-04 | 0.07 | D |
| TOC | | | | | |
| Exhaust | 0.015 | 2.1 | 2.47E-03 | 0.35 | D |
| Evaporative | 6.61E-04 | 0.09 | 0.00 | 0.00 | E |
| Crankcase | 4.85E-03 | 0.69 | 4.41E-05 | 0.01 | E |
| Refueling | 1.08E-03 | 0.15 | 0.00 | 0.00 | E |

*Source: U.S. Environmental Protection Agency. 1996. Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.3: Gasoline and Diesel Industrial Engines.*

Notes:

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kwhr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 :m aerodynamic diameter. All particulate is assumed to be 10 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

[d] Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009

For large stationary diesel engines (greater than 600 horsepower [hp]) see Chapter 3.4: Large Stationary Diesel and All Stationary Dual-Fuel Engines.

**Table E-78. Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines [a]**

| Pollutant | Emission Factor (lb/MMBtu) [b] (fuel input) | Emission Factor Rating |
|---|---|---|
| NOx [c] 90 - 105% Load | 4.08E+00 | B |
| NOx [c] <90% Load | 8.47E-01 | B |
| CO [c] 90 - 105% Load | 3.17E-01 | C |
| CO [c] <90% Load | 5.57E-01 | B |
| CO2 [d] | 1.10E+02 | A |
| SO2 [e] | 5.88E-04 | A |
| TOC [f] | 1.47E+00 | A |
| Methane[g] | 1.25E+00 | C |
| VOC [h] | 1.18E-01 | C |
| PM10 (filterable) [i] | 7.71E-05 | D |
| PM2.5 (filterable) [i] | 7.71E-05 | D |
| PM Condensable [j] | 9.91E-03 | D |

*Source: U.S. Environmental Protection Agency. 2000. Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.2: Natural Gas-Fired Reciprocating Engines. July.*
Notes:

[a] Reference 7. Factors represent uncontrolled levels. For NOx, CO, and PM10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, the data set may include units with control techniques used for NOx control, such as PCC"uncontrolled" means no oxidation control; and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter ≤ 10 microns (µ) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/$10^6$ scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

lb/hp-hr = (lb/MMBtu) (heat input, MMBtu/hr) (1/operating HP, 1/hp)

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO2. CO2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/$10^6$ scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60EF).

[e] Based on 100% conversion of fuel sulfur to SO2. Assumes sulfur content in natural gas of 2,000 gr/$10^6$scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered ≤ 1 µ in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

## Engine Size Summary

**Table E-79. Engine Power Rating Summary by Fuel Type**

| Fuel Type | No. Engines | Avg. HP | Max HP | Min HP |
|---|---|---|---|---|
| Diesel | 23 | 170 | 250 | 60 |
| Electric | 47 | 125 | 300 | 30 |
| Natural Gas | 0 | n/a | 0 | 0 |
| Propane | 3 | 180 | 250 | 135 |

## Summary of Crop Idling Emissions by Air District

### Table E-80. Reduced Exhaust Emissions from Cropland Idling

| | Peak Daily Emissions (lbs/day) | | | | | | Annual Project Emissions (tpy) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air District | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Colusa County APCD | | | | | | | | | | | | |
| Baber, Jack et al. | (1) | (17) | (22) | (6) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Canal Farms | (0) | (5) | (6) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Eastside Mutual Water Company | (1) | (14) | (18) | (4) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Glenn-Colusa Irrigation District | (6) | (122) | (160) | (40) | (10) | (10) | (0) | (5) | (7) | (2) | (0) | (0) |
| Maxwell Irrigation District | (1) | (15) | (19) | (5) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Princeton-Codora-Glenn Irrigation District | (1) | (24) | (32) | (8) | (2) | (2) | (0) | (1) | (1) | (0) | (0) | (0) |
| Provident Irrigation District | (2) | (37) | (48) | (12) | (3) | (3) | (0) | (2) | (2) | (1) | (0) | (0) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| Reclamation District 108 | (4) | (74) | (97) | (24) | (6) | (6) | (0) | (3) | (4) | (1) | (0) | (0) |
| Sycamore Mutual Water Company | (3) | (52) | (68) | (17) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| T&P Farms | (0) | (7) | (9) | (2) | (1) | (1) | (0) | (0) | (0) | (0) | (0) | (0) |
| Colusa County APCD Subtotal | (22) | (415) | (546) | (136) | (33) | (33) | (1) | (17) | (23) | (6) | (1) | (1) |
| Glenn County APCD | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (6) | (122) | (160) | (40) | (10) | (10) | (0) | (5) | (7) | (2) | (0) | (0) |
| Princeton-Codora-Glenn Irrigation District | (1) | (24) | (32) | (8) | (2) | (2) | (0) | (1) | (1) | (0) | (0) | (0) |
| Provident Irrigation District | (2) | (37) | (48) | (12) | (3) | (3) | (0) | (2) | (2) | (1) | (0) | (0) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| Glenn County APCD Subtotal | (12) | (232) | (306) | (76) | (18) | (18) | (1) | (10) | (13) | (3) | (1) | (1) |
| Feather River AQMD | | | | | | | | | | | | |
| Guisti Farms | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natomas Central Mutual Water Company | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pelger Mutual Water Company | (1) | (19) | (25) | (6) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Pelger Road 1700 LLC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | (4) | (67) | (88) | (22) | (5) | (5) | (0) | (3) | (4) | (1) | (0) | (0) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| Sutter Mutual Water Company | (7) | (133) | (175) | (44) | (11) | (11) | (0) | (6) | (7) | (2) | (0) | (0) |
| Windswept Land & Livestock | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feather River AQMD Subtotal | (14) | (268) | (352) | (88) | (21) | (21) | (1) | (11) | (15) | (4) | (1) | (1) |
| Yolo-Solano AQMD | | | | | | | | | | | | |
| Conaway Preservation Group | (8) | (158) | (208) | (52) | (12) | (12) | (0) | (7) | (9) | (2) | (1) | (1) |
| Reclamation District 108 | (4) | (74) | (97) | (24) | (6) | (6) | (0) | (3) | (4) | (1) | (0) | (0) |
| River Garden Farms | (4) | (74) | (97) | (24) | (6) | (6) | (0) | (3) | (4) | (1) | (0) | (0) |
| Te Velde Revocable Family Trust | (3) | (52) | (68) | (17) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| Yolo-Solano AQMD Subtotal | (19) | (357) | (470) | (117) | (28) | (28) | (1) | (15) | (20) | (5) | (1) | (1) |
| GRAND TOTAL | (67) | (1,272) | (1,673) | (417) | (100) | (100) | (3) | (53) | (70) | (17) | (4) | (4) |

## Table E-81. Reduced Peak Daily Fugitive Dust Emissions from Cropland Idling

| | Peak Daily PM10 Emissions (lbs/day) | | | | Peak Daily PM2.5 Emissions (lbs/day) | | | |
|---|---|---|---|---|---|---|---|---|
| **Air District** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** |
| Colusa County APCD | | | | | | | | |
| Baber, Jack et al. | (38) | (3) | 9 | (33) | (6) | (0) | 2 | (4) |
| Canal Farms | (11) | (1) | 2 | (9) | (2) | (0) | 0 | (1) |
| Eastside Mutual Water Company | (31) | (3) | 7 | (26) | (5) | (0) | 1 | (4) |
| Glenn-Colusa Irrigation District | (274) | (23) | 66 | (231) | (41) | (3) | 13 | (31) |
| Maxwell Irrigation District | (33) | (3) | 8 | (28) | (5) | (0) | 2 | (4) |
| Princeton-Codora-Glenn Irrigation District | (55) | (5) | 13 | (46) | (8) | (1) | 3 | (6) |
| Provident Irrigation District | (82) | (7) | 20 | (69) | (12) | (1) | 4 | (9) |
| Reclamation District 1004 | (111) | (9) | 19 | (101) | (17) | (1) | 4 | (14) |
| Reclamation District 108 | (166) | (14) | 22 | (158) | (25) | (2) | 4 | (23) |
| Sycamore Mutual Water Company | (116) | (10) | 27 | (99) | (17) | (1) | 5 | (13) |
| T&P Farms | (15) | (1) | 3 | (13) | (2) | (0) | 1 | (2) |
| Colusa County APCD Subtotal | (932) | (78) | 197 | (813) | (140) | (12) | 39 | (112) |
| | | | | | | | | |
| Glenn County APCD | | | | | | | | |
| Glenn-Colusa Irrigation District | (274) | (23) | 66 | (231) | (41) | (3) | 13 | (31) |
| Princeton-Codora-Glenn Irrigation District | (55) | (5) | 13 | (46) | (8) | (1) | 3 | (6) |
| Provident Irrigation District | (82) | (7) | 20 | (69) | (12) | (1) | 4 | (9) |
| Reclamation District 1004 | (111) | (9) | 19 | (101) | (17) | (1) | 4 | (14) |
| Glenn County APCD Subtotal | (522) | (44) | 118 | (448) | (78) | (7) | 24 | (61) |
| | | | | | | | | |
| Feather River AQMD | | | | | | | | |
| Guisti Farms | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natomas Central Mutual Water Company | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pelger Mutual Water Company | (42) | (4) | 1 | (45) | (6) | (1) | 0 | (7) |
| Pelger Road 1700 LLC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | (149) | (13) | 3 | (159) | (22) | (2) | 1 | (24) |
| Reclamation District 1004 | (111) | (9) | 19 | (101) | (17) | (1) | 4 | (14) |
| Sutter Mutual Water Company | (299) | (25) | 6 | (318) | (45) | (4) | 1 | (47) |
| Windswept Land & Livestock | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feather River AQMD Subtotal | (601) | (50) | 28 | (624) | (90) | (8) | 6 | (92) |
| | | | | | | | | |
| Yolo-Solano AQMD | | | | | | | | |
| Conaway Preservation Group | (355) | (30) | 11 | (373) | (53) | (4) | 2 | (55) |
| Reclamation District 108 | (166) | (14) | 22 | (158) | (25) | (2) | 4 | (23) |
| River Garden Farms | (166) | (14) | 5 | (175) | (25) | (2) | 1 | (26) |
| Te Velde Revocable Family Trust | (116) | (10) | 4 | (122) | (17) | (1) | 1 | (18) |
| Yolo-Solano AQMD Subtotal | (802) | (67) | 42 | (828) | (120) | (10) | 8 | (122) |
| | | | | | | | | |
| GRAND TOTAL | (2,857) | (240) | 384 | (2,712) | (428) | (36) | 77 | (387) |

### Table E-82. Reduced Annual Fugitive Dust Emissions from Cropland Idling

| | Annual PM10 Emissions (tpy) | | | | Annual PM2.5 Emissions (tpy) | | | |
|---|---|---|---|---|---|---|---|---|
| **Air District** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** | **Land Prep** | **Harvest** | **Wind Erosion** | **Total** |
| Colusa County APCD | | | | | | | | |
| Baber, Jack et al. | (3) | (0) | 1 | (3) | (1) | (0) | 0 | (0) |
| Canal Farms | (1) | (0) | 0 | (1) | (0) | (0) | 0 | (0) |
| Eastside Mutual Water Company | (3) | (0) | 1 | (2) | (0) | (0) | 0 | (0) |
| Glenn-Colusa Irrigation District | (25) | (2) | 6 | (21) | (4) | (0) | 1 | (3) |
| Maxwell Irrigation District | (3) | (0) | 1 | (3) | (0) | (0) | 0 | (0) |
| Princeton-Codora-Glenn Irrigation District | (5) | (0) | 1 | (4) | (1) | (0) | 0 | (1) |
| Provident Irrigation District | (7) | (1) | 2 | (6) | (1) | (0) | 0 | (1) |
| Reclamation District 1004 | (10) | (1) | 2 | (9) | (1) | (0) | 0 | (1) |
| Reclamation District 108 | (15) | (1) | 2 | (14) | (2) | (0) | 0 | (2) |
| Sycamore Mutual Water Company | (10) | (1) | 2 | (9) | (2) | (0) | 0 | (1) |
| T&P Farms | (1) | (0) | 0 | (1) | (0) | (0) | 0 | (0) |
| Colusa County APCD Subtotal | (84) | (7) | 18 | (73) | (13) | (1) | 4 | (10) |
| Glenn County APCD | | | | | | | | |
| Glenn-Colusa Irrigation District | (25) | (2) | 6 | (21) | (4) | (0) | 1 | (3) |
| Princeton-Codora-Glenn Irrigation District | (5) | (0) | 1 | (4) | (1) | (0) | 0 | (1) |
| Provident Irrigation District | (7) | (1) | 2 | (6) | (1) | (0) | 0 | (1) |
| Reclamation District 1004 | (10) | (1) | 2 | (9) | (1) | (0) | 0 | (1) |
| Glenn County APCD Subtotal | (47) | (4) | 11 | (40) | (7) | (1) | 2 | (6) |
| Feather River AQMD | | | | | | | | |
| Guisti Farms | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natomas Central Mutual Water Company | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pelger Mutual Water Company | (4) | (0) | 0 | (4) | (1) | (0) | 0 | (1) |
| Pelger Road 1700 LLC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | (13) | (1) | 0 | (14) | (2) | (0) | 0 | (2) |
| Reclamation District 1004 | (10) | (1) | 2 | (9) | (1) | (0) | 0 | (1) |
| Sutter Mutual Water Company | (27) | (2) | 0 | (29) | (4) | (0) | 0 | (4) |
| Windswept Land & Livestock | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feather River AQMD Subtotal | (54) | (5) | 2 | (56) | (8) | (1) | 0 | (8) |
| Yolo-Solano AQMD | | | | | | | | |
| Conaway Preservation Group | (32) | (3) | 1 | (34) | (5) | (0) | 0 | (5) |
| Reclamation District 108 | (15) | (1) | 2 | (14) | (2) | (0) | 0 | (2) |
| River Garden Farms | (15) | (1) | 0 | (16) | (2) | (0) | 0 | (2) |
| Te Velde Revocable Family Trust | (10) | (1) | 0 | (11) | (2) | (0) | 0 | (2) |
| Yolo-Solano AQMD Subtotal | (72) | (6) | 4 | (75) | (11) | (1) | 1 | (11) |
| GRAND TOTAL | (257) | (22) | 35 | (244) | (39) | (3) | 7 | (35) |

## Table E-83. Combined Emissions by Air District

| Air District | Peak Daily Emissions (lbs/day) VOC | NOx | CO | SOx | PM10 | PM2.5 | Annual Project Emissions (tpy) VOC | NOx | CO | SOx | PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Colusa County APCD | | | | | | | | | | | | |
| Baber, Jack et al. | (1) | (17) | (22) | (6) | (34) | (6) | (0) | (1) | (1) | (0) | (3) | (0) |
| Canal Farms | (0) | (5) | (6) | (2) | (9) | (2) | (0) | (0) | (0) | (0) | (1) | (0) |
| Eastside Mutual Water Company | (1) | (14) | (18) | (4) | (27) | (5) | (0) | (1) | (1) | (0) | (2) | (0) |
| Glenn-Colusa Irrigation District | (6) | (122) | (160) | (40) | (240) | (41) | (0) | (5) | (7) | (2) | (21) | (3) |
| Maxwell Irrigation District | (1) | (15) | (19) | (5) | (29) | (5) | (0) | (1) | (1) | (0) | (3) | (0) |
| Princeton-Codora-Glenn Irrigation District | (1) | (24) | (32) | (8) | (48) | (8) | (0) | (1) | (1) | (0) | (4) | (1) |
| Provident Irrigation District | (2) | (37) | (48) | (12) | (72) | (12) | (0) | (2) | (2) | (1) | (6) | (1) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (105) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| Reclamation District 108 | (4) | (74) | (97) | (24) | (164) | (28) | (0) | (3) | (4) | (1) | (14) | (2) |
| Sycamore Mutual Water Company | (3) | (52) | (68) | (17) | (103) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| T&P Farms | (0) | (7) | (9) | (2) | (13) | (2) | (0) | (0) | (0) | (0) | (1) | (0) |
| Colusa County APCD Subtotal | (22) | (415) | (546) | (136) | (845) | (145) | (1) | (17) | (23) | (6) | (75) | (11) |
| | | | | | | | | | | | | |
| Glenn County APCD | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (6) | (122) | (160) | (40) | (240) | (41) | (0) | (5) | (7) | (2) | (21) | (3) |
| Princeton-Codora-Glenn Irrigation District | (1) | (24) | (32) | (8) | (48) | (8) | (0) | (1) | (1) | (0) | (4) | (1) |
| Provident Irrigation District | (2) | (37) | (48) | (12) | (72) | (12) | (0) | (2) | (2) | (1) | (6) | (1) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (105) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| Glenn County APCD Subtotal | (12) | (232) | (306) | (76) | (466) | (80) | (1) | (10) | (13) | (3) | (41) | (6) |
| | | | | | | | | | | | | |
| Feather River AQMD | | | | | | | | | | | | |
| Guisti Farms | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natomas Central Mutual Water Company | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pelger Mutual Water Company | (1) | (19) | (25) | (6) | (46) | (8) | (0) | (1) | (1) | (0) | (4) | (1) |
| Pelger Road 1700 LLC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | (4) | (67) | (88) | (22) | (164) | (29) | (0) | (3) | (4) | (1) | (15) | (2) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (105) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| Sutter Mutual Water Company | (7) | (133) | (175) | (44) | (329) | (58) | (0) | (6) | (7) | (2) | (29) | (5) |
| Windswept Land & Livestock | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feather River AQMD Subtotal | (14) | (268) | (352) | (88) | (645) | (113) | (1) | (11) | (15) | (4) | (57) | (9) |
| | | | | | | | | | | | | |
| Yolo-Solano AQMD | | | | | | | | | | | | |
| Conaway Preservation Group | (8) | (158) | (208) | (52) | (386) | (68) | (0) | (7) | (9) | (2) | (34) | (6) |
| Reclamation District 108 | (4) | (74) | (97) | (24) | (164) | (28) | (0) | (3) | (4) | (1) | (14) | (2) |
| River Garden Farms | (4) | (74) | (97) | (24) | (181) | (32) | (0) | (3) | (4) | (1) | (16) | (3) |
| Te Velde Revocable Family Trust | (3) | (52) | (68) | (17) | (126) | (22) | (0) | (2) | (3) | (1) | (11) | (2) |
| Yolo-Solano AQMD Subtotal | (19) | (357) | (470) | (117) | (856) | (150) | (1) | (15) | (20) | (5) | (76) | (12) |
| | | | | | | | | | | | | |
| GRAND TOTAL | (67) | (1,272) | (1,673) | (417) | (2,813) | (488) | (3) | (53) | (70) | (17) | (248) | (39) |

**Table E-84. Summary of Cropland Idling Emissions by Water Agency**

| | Daily Emissions (lbs per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Agency** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Anderson-Cottonwood Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Land Preparation | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Harvesting | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Wind Erosion | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | - |
| Anderson-Cottonwood Irrigation District Subtotal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Baber, Jack et al. | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (17) | (22) | (6) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (38) | (6) | -- | -- | -- | -- | (3) | (1) |
| Harvesting | -- | -- | -- | -- | (3) | (0) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 9 | 2 | -- | -- | -- | -- | 1 | 0 |
| Baber, Jack et al. Subtotal | (1) | (17) | (22) | (6) | (34) | (6) | (0) | (1) | (1) | (0) | (3) | (0) |
| Canal Farms | | | | | | | | | | | | |
| Exhaust Emissions | (0) | (5) | (6) | (2) | (0) | (0) | (0) | (0) | (0) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (11) | (2) | -- | -- | -- | -- | (1) | (0) |
| Harvesting | -- | -- | -- | -- | (1) | (0) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 2 | 0 | -- | -- | -- | -- | 0 | 0 |
| Canal Farms Subtotal | (0) | (5) | (6) | (2) | (9) | (2) | (0) | (0) | (0) | (0) | (1) | (0) |
| Conaway Preservation Group | | | | | | | | | | | | |
| Exhaust Emissions | (8) | (158) | (208) | (52) | (12) | (12) | (0) | (7) | (9) | (2) | (1) | (1) |
| Land Preparation | -- | -- | -- | -- | (355) | (53) | -- | -- | -- | -- | (32) | (5) |
| Harvesting | -- | -- | -- | -- | (30) | (4) | -- | -- | -- | -- | (3) | (0) |
| Wind Erosion | -- | -- | -- | -- | 11 | 2 | -- | -- | -- | -- | 1 | 0 |
| Conaway Preservation Group Subtotal | (8) | (158) | (208) | (52) | (386) | (68) | (0) | (7) | (9) | (2) | (34) | (6) |
| Eastside Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (14) | (18) | (4) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (31) | (5) | -- | -- | -- | -- | (3) | (0) |
| Harvesting | -- | -- | -- | -- | (3) | (0) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 7 | 1 | -- | -- | -- | -- | 1 | 0 |
| Eastside Mutual Water Company Subtotal | (1) | (14) | (18) | (4) | (27) | (5) | (0) | (1) | (1) | (0) | (2) | (0) |
| Guisti Farms | | | | | | | | | | | | |
| Exhaust Emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Land Preparation | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Harvesting | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Wind Erosion | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | - |
| Guisti Farms Subtotal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Glenn-Colusa Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (13) | (244) | (321) | (80) | (19) | (19) | (1) | (10) | (13) | (3) | (1) | (1) |
| Land Preparation | -- | -- | -- | -- | (548) | (82) | -- | -- | -- | -- | (49) | (7) |
| Harvesting | -- | -- | -- | -- | (46) | (7) | -- | -- | -- | -- | (4) | (1) |
| Wind Erosion | -- | -- | -- | -- | 132 | 26 | -- | -- | -- | -- | 12 | 2 |
| Glenn-Colusa Irrigation District Subtotal | (13) | (244) | (321) | (80) | (481) | (82) | (1) | (10) | (13) | (3) | (42) | (6) |

**Table E-84. Summary of Cropland Idling Emissions by Water Agency**

| | Daily Emissions (lbs per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Agency** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Maxwell Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (15) | (19) | (5) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (33) | (5) | -- | -- | -- | -- | (3) | (0) |
| Harvesting | -- | -- | -- | -- | (3) | (0) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 8 | 2 | -- | -- | -- | -- | 1 | 0 |
| Maxwell Irrigation District Subtotal | (1) | (15) | (19) | (5) | (29) | (5) | (0) | (1) | (1) | (0) | (3) | (0) |
| Natomas Central Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Land Preparation | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Harvesting | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Wind Erosion | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | - |
| Natomas Central Mutual Water Company Subtotal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pelger Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (1) | (19) | (25) | (6) | (1) | (1) | (0) | (1) | (1) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (42) | (6) | -- | -- | -- | -- | (4) | (1) |
| Harvesting | -- | -- | -- | -- | (4) | (1) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 1 | 0 | -- | -- | -- | -- | 0 | 0 |
| Pelger Mutual Water Company Subtotal | (1) | (19) | (25) | (6) | (46) | (8) | (0) | (1) | (1) | (0) | (4) | (1) |
| Pelger Road 1700 LLC | | | | | | | | | | | | |
| Exhaust Emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Land Preparation | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Harvesting | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Wind Erosion | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | - |
| Pelger Road 1700 LLC Subtotal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (4) | (67) | (88) | (22) | (5) | (5) | (0) | (3) | (4) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (149) | (22) | -- | -- | -- | -- | (13) | (2) |
| Harvesting | -- | -- | -- | -- | (13) | (2) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 3 | 1 | -- | -- | -- | -- | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company Subtotal | (4) | (67) | (88) | (22) | (164) | (29) | (0) | (3) | (4) | (1) | (15) | (2) |
| Princeton-Codora-Glenn Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (3) | (49) | (64) | (16) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (110) | (16) | -- | -- | -- | -- | (10) | (1) |
| Harvesting | -- | -- | -- | -- | (9) | (1) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 26 | 5 | -- | -- | -- | -- | 2 | 0 |
| Princeton-Codora-Glenn Irrigation District Subtotal | (3) | (49) | (64) | (16) | (96) | (16) | (0) | (2) | (3) | (1) | (8) | (1) |
| Provident Irrigation District | | | | | | | | | | | | |
| Exhaust Emissions | (4) | (73) | (96) | (24) | (6) | (6) | (0) | (3) | (4) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (164) | (25) | -- | -- | -- | -- | (15) | (2) |
| Harvesting | -- | -- | -- | -- | (14) | (2) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 40 | 8 | -- | -- | -- | -- | 4 | 1 |
| Provident Irrigation District Subtotal | (4) | (73) | (96) | (24) | (144) | (25) | (0) | (3) | (4) | (1) | (13) | (2) |

**Table E-84. Summary of Cropland Idling Emissions by Water Agency**

| Water Agency | Daily Emissions (lbs per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Reclamation District 108 | | | | | | | | | | | | |
| Exhaust Emissions | (8) | (148) | (195) | (48) | (12) | (12) | (0) | (6) | (8) | (2) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (332) | (50) | -- | -- | -- | -- | (30) | (4) |
| Harvesting | -- | -- | -- | -- | (28) | (4) | -- | -- | -- | -- | (3) | (0) |
| Wind Erosion | -- | -- | -- | -- | 44 | 9 | -- | -- | -- | -- | 4 | 1 |
| Reclamation District 108 Subtotal | (8) | (148) | (195) | (48) | (327) | (57) | (0) | (6) | (8) | (2) | (29) | (5) |
| Reclamation District 1004 | | | | | | | | | | | | |
| Exhaust Emissions | (8) | (148) | (195) | (48) | (12) | (12) | (0) | (6) | (8) | (2) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (332) | (50) | -- | -- | -- | -- | (30) | (4) |
| Harvesting | -- | -- | -- | -- | (28) | (4) | -- | -- | -- | -- | (3) | (0) |
| Wind Erosion | -- | -- | -- | -- | 56 | 11 | -- | -- | -- | -- | 5 | 1 |
| Reclamation District 1004 Subtotal | (8) | (148) | (195) | (48) | (316) | (55) | (0) | (6) | (8) | (2) | (28) | (4) |
| River Garden Farms | | | | | | | | | | | | |
| Exhaust Emissions | (4) | (74) | (97) | (24) | (6) | (6) | (0) | (3) | (4) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (166) | (25) | -- | -- | -- | -- | (15) | (2) |
| Harvesting | -- | -- | -- | -- | (14) | (2) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 5 | 1 | -- | -- | -- | -- | 0 | 0 |
| River Garden Farms Subtotal | (4) | (74) | (97) | (24) | (181) | (32) | (0) | (3) | (4) | (1) | (16) | (3) |
| Sutter Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (7) | (133) | (175) | (44) | (11) | (11) | (0) | (6) | (7) | (2) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (299) | (45) | -- | -- | -- | -- | (27) | (4) |
| Harvesting | -- | -- | -- | -- | (25) | (4) | -- | -- | -- | -- | (2) | (0) |
| Wind Erosion | -- | -- | -- | -- | 6 | 1 | -- | -- | -- | -- | 0 | 0 |
| Sutter Mutual Water Company Subtotal | (7) | (133) | (175) | (44) | (329) | (58) | (0) | (6) | (7) | (2) | (29) | (5) |
| Sycamore Mutual Water Company | | | | | | | | | | | | |
| Exhaust Emissions | (3) | (52) | (68) | (17) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (116) | (17) | -- | -- | -- | -- | (10) | (2) |
| Harvesting | -- | -- | -- | -- | (10) | (1) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 27 | 5 | -- | -- | -- | -- | 2 | 0 |
| Sycamore Mutual Water Company Subtotal | (3) | (52) | (68) | (17) | (103) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| T&P Farms | | | | | | | | | | | | |
| Exhaust Emissions | (0) | (7) | (9) | (2) | (1) | (1) | (0) | (0) | (0) | (0) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (15) | (2) | -- | -- | -- | -- | (1) | (0) |
| Harvesting | -- | -- | -- | -- | (1) | (0) | -- | -- | -- | -- | (0) | (0) |
| Wind Erosion | -- | -- | -- | -- | 3 | 1 | -- | -- | -- | -- | 0 | 0 |
| T&P Farms Subtotal | (0) | (7) | (9) | (2) | (13) | (2) | (0) | (0) | (0) | (0) | (1) | (0) |
| Te Velde Revocable Family Trust | | | | | | | | | | | | |
| Exhaust Emissions | (3) | (52) | (68) | (17) | (4) | (4) | (0) | (2) | (3) | (1) | (0) | (0) |
| Land Preparation | -- | -- | -- | -- | (116) | (17) | -- | -- | -- | -- | (10) | (2) |
| Harvesting | -- | -- | -- | -- | (10) | (1) | -- | -- | -- | -- | (1) | (0) |
| Wind Erosion | -- | -- | -- | -- | 4 | 1 | -- | -- | -- | -- | 0 | 0 |
| Te Velde Revocable Family Trust Subtotal | (3) | (52) | (68) | (17) | (126) | (22) | (0) | (2) | (3) | (1) | (11) | (2) |

**Table E-84. Summary of Cropland Idling Emissions by Water Agency**

| | Daily Emissions (lbs per day) | | | | | | Annual Emissions (tons per year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Agency** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** | **VOC** | **NOx** | **CO** | **SOx** | **PM10** | **PM2.5** |
| Windswept Land & Livestock | | | | | | | | | | | | |
| Exhaust Emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Land Preparation | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Harvesting | -- | -- | -- | -- | 0 | 0 | -- | -- | -- | -- | 0 | 0 |
| Wind Erosion | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | - |
| Windswept Land & Livestock Subtotal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| Exhaust Emissions Total | (67) | (1,272) | (1,673) | (417) | (100) | (100) | (3) | (53) | (70) | (17) | (4) | (4) |
| Land Preparation Total | 0 | 0 | 0 | 0 | (2,857) | (428) | 0 | 0 | 0 | 0 | (257) | (39) |
| Harvesting Total | 0 | 0 | 0 | 0 | (240) | (36) | 0 | 0 | 0 | 0 | (22) | (3) |
| Wind Erosion Total | 0 | 0 | 0 | 0 | 384 | 77 | 0 | 0 | 0 | 0 | 35 | 7 |
| **GRAND TOTAL** | **(67)** | **(1,272)** | **(1,673)** | **(417)** | **(2,813)** | **(488)** | **(3)** | **(53)** | **(70)** | **(17)** | **(248)** | **(39)** |

## Table E-85. Summary of Cropland Idling Emissions by County

| County | Daily Emissions (lbs/day) | | | | | | Annual Emissions (tons/yr) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Colusa | | | | | | | | | | | | |
| Baber, Jack et al. | (1) | (17) | (22) | (6) | (34) | (6) | (0) | (1) | (1) | (0) | (3) | (0) |
| Canal Farms | (0) | (5) | (6) | (2) | (9) | (2) | (0) | (0) | (0) | (0) | (1) | (0) |
| Eastside Mutual Water Company | (1) | (14) | (18) | (4) | (27) | (5) | (0) | (1) | (1) | (0) | (2) | (0) |
| Glenn-Colusa Irrigation District | (6) | (122) | (160) | (40) | (240) | (41) | (0) | (5) | (7) | (2) | (21) | (3) |
| Maxwell Irrigation District | (1) | (15) | (19) | (5) | (29) | (5) | (0) | (1) | (1) | (0) | (3) | (0) |
| Princeton-Codora-Glenn Irrigation District | (1) | (24) | (32) | (8) | (48) | (8) | (0) | (1) | (1) | (0) | (4) | (1) |
| Provident Irrigation District | (2) | (37) | (48) | (12) | (72) | (12) | (0) | (2) | (2) | (1) | (6) | (1) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (105) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| Reclamation District 108 | (4) | (74) | (97) | (24) | (164) | (28) | (0) | (3) | (4) | (1) | (14) | (2) |
| Sycamore Mutual Water Company | (3) | (52) | (68) | (17) | (103) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| T&P Farms | (0) | (7) | (9) | (2) | (13) | (2) | (0) | (0) | (0) | (0) | (1) | (0) |
| Colusa Subtotal | (22) | (415) | (546) | (136) | (845) | (145) | (1) | (17) | (23) | (6) | (75) | (11) |
| Glenn | | | | | | | | | | | | |
| Glenn-Colusa Irrigation District | (6) | (122) | (160) | (40) | (240) | (41) | (0) | (5) | (7) | (2) | (21) | (3) |
| Princeton-Codora-Glenn Irrigation District | (1) | (24) | (32) | (8) | (48) | (8) | (0) | (1) | (1) | (0) | (4) | (1) |
| Provident Irrigation District | (2) | (37) | (48) | (12) | (72) | (12) | (0) | (2) | (2) | (1) | (6) | (1) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (105) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| Glenn Subtotal | (12) | (232) | (306) | (76) | (466) | (80) | (1) | (10) | (13) | (3) | (41) | (6) |
| Sutter | | | | | | | | | | | | |
| Guisti Farms | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natomas Central Mutual Water Company | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pelger Mutual Water Company | (1) | (19) | (25) | (6) | (46) | (8) | (0) | (1) | (1) | (0) | (4) | (1) |
| Pelger Road 1700 LLC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | (4) | (67) | (88) | (22) | (164) | (29) | (0) | (3) | (4) | (1) | (15) | (2) |
| Reclamation District 1004 | (3) | (49) | (65) | (16) | (105) | (18) | (0) | (2) | (3) | (1) | (9) | (1) |
| Sutter Mutual Water Company | (7) | (133) | (175) | (44) | (329) | (58) | (0) | (6) | (7) | (2) | (29) | (5) |
| Windswept Land & Livestock | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sutter Subtotal | (11) | (201) | (265) | (66) | (481) | (84) | (0) | (8) | (11) | (3) | (43) | (7) |
| Yolo | | | | | | | | | | | | |
| Conaway Preservation Group | (8) | (158) | (208) | (52) | (386) | (68) | (0) | (7) | (9) | (2) | (34) | (6) |
| Reclamation District 108 | (4) | (74) | (97) | (24) | (164) | (28) | (0) | (3) | (4) | (1) | (14) | (2) |
| River Garden Farms | (4) | (74) | (97) | (24) | (181) | (32) | (0) | (3) | (4) | (1) | (16) | (3) |
| Te Velde Revocable Family Trust | (3) | (52) | (68) | (17) | (126) | (22) | (0) | (2) | (3) | (1) | (11) | (2) |
| Yolo Subtotal | (19) | (357) | (470) | (117) | (856) | (150) | (1) | (15) | (20) | (5) | (76) | (12) |
| **GRAND TOTAL** | (63) | (1,205) | (1,586) | (395) | (2,648) | (459) | (3) | (51) | (66) | (17) | (234) | (37) |

**Table E-86. Reduced Exhaust Emissions from Cropland Idling**

| Water Agency | Groundwater Substitution (acre-feet/year) | Cropland Idling/ Crop Shifting (acre-feet/year) | GW Pumping Equivalent (acre-feet/year) | Reduced Daily Emissions (lbs/day) | | | | | | Reduced Annual Emissions (tons/year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | VOC | NOx | CO | SOx | PM10 | PM2.5 | VOC | NOx | CO | SOx | PM10 | PM2.5 |
| Anderson-Cottonwood Irrigation District | 4,800 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Baber, Jack et al. | 0 | 2,310 | 544 | 0.90 | 17.09 | 22.49 | 5.60 | 1.35 | 1.35 | 0.04 | 0.72 | 0.94 | 0.23 | 0.06 | 0.06 |
| Canal Farms | 1,000 | 635 | 149 | 0.25 | 4.68 | 6.16 | 1.53 | 0.37 | 0.37 | 0.01 | 0.20 | 0.26 | 0.06 | 0.02 | 0.02 |
| Conaway Preservation Group | 0 | 21,350 | 5,024 | 8.31 | 157.83 | 207.68 | 51.75 | 12.46 | 12.46 | 0.35 | 6.62 | 8.71 | 2.17 | 0.52 | 0.52 |
| Eastside Mutual Water Company | 2,230 | 1,846 | 434 | 0.72 | 13.63 | 17.94 | 4.47 | 1.08 | 1.08 | 0.03 | 0.57 | 0.75 | 0.19 | 0.05 | 0.05 |
| Glenn-Colusa Irrigation District | 11,300 | 33,000 | 7,765 | 12.84 | 243.95 | 320.98 | 79.99 | 19.26 | 19.26 | 0.54 | 10.23 | 13.45 | 3.35 | 0.81 | 0.81 |
| Guisti Farms | 1,000 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Maxwell Irrigation District | 3,000 | 2,003 | 471 | 0.78 | 14.80 | 19.47 | 4.85 | 1.17 | 1.17 | 0.03 | 0.62 | 0.82 | 0.20 | 0.05 | 0.05 |
| Natomas Central Mutual Water Company | 20,000 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pelger Mutual Water Company | 4,670 | 2,538 | 597 | 0.99 | 18.76 | 24.68 | 6.15 | 1.48 | 1.48 | 0.04 | 0.79 | 1.03 | 0.26 | 0.06 | 0.06 |
| Pelger Road 1700 LLC | 5,200 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pleasant Grove-Verona Mutual Water Company | 15,000 | 9,000 | 2,118 | 3.50 | 66.54 | 87.55 | 21.82 | 5.25 | 5.25 | 0.15 | 2.79 | 3.67 | 0.91 | 0.22 | 0.22 |
| Princeton-Codora-Glenn Irrigation District | 6,600 | 6,600 | 1,553 | 2.57 | 48.79 | 64.20 | 16.00 | 3.85 | 3.85 | 0.11 | 2.05 | 2.69 | 0.67 | 0.16 | 0.16 |
| Provident Irrigation District | 10,000 | 9,900 | 2,329 | 3.85 | 73.17 | 96.27 | 23.99 | 5.78 | 5.78 | 0.16 | 3.07 | 4.04 | 1.01 | 0.24 | 0.24 |
| Reclamation District 1004 | 7,175 | 20,000 | 4,706 | 7.78 | 147.84 | 194.53 | 48.48 | 11.67 | 11.67 | 0.33 | 6.20 | 8.15 | 2.03 | 0.49 | 0.49 |
| Reclamation District 108 | 15,000 | 20,000 | 4,706 | 7.78 | 147.84 | 194.53 | 48.48 | 11.67 | 11.67 | 0.33 | 6.20 | 8.15 | 2.03 | 0.49 | 0.49 |
| River Garden Farms | 10,000 | 10,000 | 2,353 | 3.89 | 73.92 | 97.27 | 24.24 | 5.84 | 5.84 | 0.16 | 3.10 | 4.08 | 1.02 | 0.24 | 0.24 |
| Sutter Mutual Water Company | 18,000 | 18,000 | 4,235 | 7.00 | 133.05 | 175.06 | 43.63 | 10.50 | 10.50 | 0.29 | 5.58 | 7.34 | 1.83 | 0.44 | 0.44 |
| Sycamore Mutual Water Company | 8,000 | 7,000 | 1,647 | 2.72 | 51.74 | 68.08 | 16.97 | 4.08 | 4.08 | 0.11 | 2.17 | 2.85 | 0.71 | 0.17 | 0.17 |
| T&P Farms | 1,200 | 890 | 209 | 0.35 | 6.57 | 8.64 | 2.15 | 0.52 | 0.52 | 0.01 | 0.28 | 0.36 | 0.09 | 0.02 | 0.02 |
| Te Velde Revocable Family Trust | 7,094 | 6,975 | 1,641 | 2.71 | 51.55 | 67.83 | 16.90 | 4.07 | 4.07 | 0.11 | 2.16 | 2.84 | 0.71 | 0.17 | 0.17 |
| Windswept Land & Livestock | 2,000 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total** | **153,269** | **172,047** | **40,481** | **66.93** | **1,271.76** | **1,673.36** | **417.02** | **100.40** | **100.40** | **2.81** | **53.31** | **70.14** | **17.48** | **4.21** | **4.21** |

Notes:
Pelger Mutual Water District used to estimate emissions for other water agencies.
Engine power rating equal to 250 hp for Pelger Mutual Water District engines.
The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).
Pelger Mutual Water District engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing

*Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."*

## Fugitive Dust Emissions from Cropland Idling

**Table E-87. Land Preparation (Reduced Emissions)**

| District | County | Acres | Daily PM10 Emissions (lbs/day) | Annual PM10 Emissions (tons per year) |
|---|---|---|---|---|
| | | Rice | Rice | Rice |
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | Shasta/Tehama | 0 | 0 | 0 |
| Baber, Jack et al. | Colusa | 700 | 38 | 3 |
| Canal Farms | Colusa | 192 | 11 | 1 |
| Conaway Preservation Group | Yolo | 6,470 | 355 | 32 |
| Eastside Mutual Water Company | Colusa | 559 | 31 | 3 |
| Glenn-Colusa Irrigation District | Glenn/Colusa | 10,000 | 548 | 49 |
| Guisti Farms | Sutter | 0 | 0 | 0 |
| Maxwell Irrigation District | Colusa | 607 | 33 | 3 |
| Natomas Central Mutual Water Company | Sacramento/Sutter | 0 | 0 | 0 |
| Pelger Mutual Water Company | Sutter | 769 | 42 | 4 |
| Pelger Road 1700 LLC | Sutter | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | Sutter | 2,727 | 149 | 13 |
| Princeton-Codora-Glenn Irrigation District | Glenn/Colusa | 2,000 | 110 | 10 |
| Provident Irrigation District | Glenn/Colusa | 3,000 | 164 | 15 |
| Reclamation District 1004 | Glenn/Colusa/Sutter | 6,061 | 332 | 30 |
| Reclamation District 108 | Colusa/Yolo | 6,061 | 332 | 30 |
| River Garden Farms | Yolo | 3,030 | 166 | 15 |
| Sutter Mutual Water Company | Sutter | 5,455 | 299 | 27 |
| Sycamore Mutual Water Company | Colusa | 2,121 | 116 | 10 |
| T&P Farms | Colusa | 270 | 15 | 1 |
| Te Velde Revocable Family Trust | Yolo | 2,114 | 116 | 10 |
| Windswept Land & Livestock | Sutter | 0 | 0 | 0 |
| **Total** | | **52,135** | **2,857** | **257** |

**Table E-88. Harvesting (Reduced Emissions)**

| District | County | Acres | Daily PM10 Emissions (lbs/day) | Annual PM10 Emissions (tons per year) |
|---|---|---|---|---|
| | | Rice | Rice | Rice |
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | Shasta/Tehama | 0 | 0 | 0 |
| Baber, Jack et al. | Colusa | 700 | 3 | 0 |
| Canal Farms | Colusa | 192 | 1 | 0 |
| Conaway Preservation Group | Yolo | 6,470 | 30 | 3 |
| Eastside Mutual Water Company | Colusa | 559 | 3 | 0 |
| Glenn-Colusa Irrigation District | Glenn/Colusa | 10,000 | 46 | 4 |
| Guisti Farms | Sutter | 0 | 0 | 0 |
| Maxwell Irrigation District | Colusa | 607 | 3 | 0 |
| Natomas Central Mutual Water Company | Sacramento/Sutter | 0 | 0 | 0 |
| Pelger Mutual Water Company | Sutter | 769 | 4 | 0 |
| Pelger Road 1700 LLC | Sutter | 0 | 0 | 0 |
| Pleasant Grove-Verona Mutual Water Company | Sutter | 2,727 | 13 | 1 |
| Princeton-Codora-Glenn Irrigation District | Glenn/Colusa | 2,000 | 9 | 1 |
| Provident Irrigation District | Glenn/Colusa | 3,000 | 14 | 1 |
| Reclamation District 1004 | Glenn/Colusa/Sutter | 6,061 | 28 | 3 |
| Reclamation District 108 | Colusa/Yolo | 6,061 | 28 | 3 |
| River Garden Farms | Yolo | 3,030 | 14 | 1 |
| Sutter Mutual Water Company | Sutter | 5,455 | 25 | 2 |
| Sycamore Mutual Water Company | Colusa | 2,121 | 10 | 1 |
| T&P Farms | Colusa | 270 | 1 | 0 |
| Te Velde Revocable Family Trust | Yolo | 2,114 | 10 | 1 |
| Windswept Land & Livestock | Sutter | 0 | 0 | 0 |
| **Total** | | **52,135** | **240** | **22** |

**Table E-89. Windblown Dust (Increased Emissions)**

| District | County | Acres | Daily PM10 Emissions (lbs/day) | Annual PM10 Emissions (tons per year) |
|---|---|---|---|---|
| | | Rice | Rice | Rice |
| **Sacramento River Area of Analysis** | | | | |
| Anderson-Cottonwood Irrigation District | Shasta/Tehama | 0 | -- | -- |
| Baber, Jack et al. | Colusa | 700 | 9 | 1 |
| Canal Farms | Colusa | 192 | 2 | 0 |
| Conaway Preservation Group | Yolo | 6,470 | 11 | 1 |
| Eastside Mutual Water Company | Colusa | 559 | 7 | 1 |
| Glenn-Colusa Irrigation District | Glenn/Colusa | 10,000 | 132 | 12 |
| Guisti Farms | Sutter | 0 | -- | -- |
| Maxwell Irrigation District | Colusa | 607 | 8 | 1 |
| Natomas Central Mutual Water Company | Sacramento/Sutter | 0 | -- | -- |
| Pelger Mutual Water Company | Sutter | 769 | 1 | 0 |
| Pelger Road 1700 LLC | Sutter | 0 | -- | -- |
| Pleasant Grove-Verona Mutual Water Company | Sutter | 2,727 | 3 | 0 |
| Princeton-Codora-Glenn Irrigation District | Glenn/Colusa | 2,000 | 26 | 2 |
| Provident Irrigation District | Glenn/Colusa | 3,000 | 40 | 4 |
| Reclamation District 1004 | Glenn/Colusa/Sutter | 6,061 | 56 | 5 |
| Reclamation District 108 | Colusa/Yolo | 6,061 | 44 | 4 |
| River Garden Farms | Yolo | 3,030 | 5 | 0 |
| Sutter Mutual Water Company | Sutter | 5,455 | 6 | 0 |
| Sycamore Mutual Water Company | Colusa | 2,121 | 27 | 2 |
| T&P Farms | Colusa | 270 | 3 | 0 |
| Te Velde Revocable Family Trust | Yolo | 2,114 | 4 | 0 |
| Windswept Land & Livestock | Sutter | 0 | -- | -- |
| **Total** | | **52,135** | **384** | **35** |

Note:
Fraction of PM10 (FRPM10) from wind erosion: 0.50
(PM10 Emissions = PM x FRPM10)

Conversions

| | | | |
|---|---|---|---|
| 1 ton = | 2,000 | pounds | |
| 1 year = | 365 | days | |
| Project duration = | 180 | days | (assumes 6-month crop idling season) |

Legend

| | |
|---|---|
| Yellow | Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available. |
| Blue | Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Yolo County only). |
| Purple | Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Sutter County only). |

## Agricultural Land Preparation

**Table E-90. Summary of Crop Profile, Acre-Pass, and Emission Factor**

| Crop profile | Land Preparation Operations | Category | Acre-Pass | Emission Factor Operation (lbs/Acre-pass) | Emission Factor Crop (lbs/Acre/year) |
|---|---|---|---|---|---|
| Alfalfa | Unspecified | Discing | 1.25 | 1.2 | 4 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Almonds | Float | Land Planing | 0.25 | 12.5 | 3.13 |
| Citrus | Unspecified | Discing | 0.06 | 1.2 | 0.07 |
| Corn | List & Fertilize | Weeding | 1 | 0.8 | 6.9 |
| | Mulch Beds | Discing | 1 | 1.2 | |
| | Finish Disc | Discing | 1 | 1.2 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| Cotton | Land Preparation | Discing | 4 | 1.2 | 8.9 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Seed Bed Preparation | Weeding | 2 | 0.8 | |
| DryBeans | Land Maintenance | Land Planing | 0.2 | 12.5 | 7.7 |
| | Chisel | Discing | 1 | 1.2 | |
| | Shaping | Weeding | 1 | 0.8 | |
| | Disc | Discing | 2 | 1.2 | |
| | Listing | Weeding | 1 | 0.8 | |
| Garbanzo | Chisel | Discing | 1 | 1.2 | 7.7 |
| | Listing | Weeding | 1 | 0.8 | |
| | Shaping | Weeding | 1 | 0.8 | |
| | Disc | Discing | 2 | 1.2 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Garlic | Land Maintenance | Land Planing | 0.2 | 12.5 | 6.5 |
| | Disc & Roll | Discing | 1 | 1.2 | |
| | Chisel | Discing | 1 | 1.2 | |
| | List | Weeding | 1 | 0.8 | |
| | Shape Beds | Weeding | 1 | 0.8 | |
| Grapes-Raisin | Terrace | Weeding | 1 | 0.8 | 2.6 |
| | Spring Tooth | Weeding | 0.2 | 0.8 | |
| | Subsoil | Ripping | 0.05 | 4.6 | |
| | Disc & Furrow-out | Discing | 1 | 1.2 | |
| | Level (new vineyard) | Land Planing | 0.02 | 12.5 | |
| Grapes-Table | Subsoil | Ripping | 0.05 | 4.6 | 0.83 |
| | Disc & Furrow-out | Discing | 0.5 | 1.2 | |
| Grapes-Wine | Level (new vineyard) | Land Planing | 0.02 | 12.5 | 1.5 |
| | Spring Tooth | Weeding | 0.2 | 0.8 | |
| | Subsoil | Ripping | 0.05 | 4.6 | |
| | Disc & Furrow-out | Discing | 0.75 | 1.2 | |
| Lettuce* | Land Maintenance | Land Planing | 0.2 | 12.5 | 12.75 |
| | Disc & Roll | Discing | 2/2 | 1.2 | |
| | Chisel | Discing | 2/2 | 1.2 | |
| | List | Weeding | 2/2 | 0.8 | |
| | Plane | Land Planing | ½ | 12.5 | |
| | Shape Beds & Roll | Weeding | 2/2 | 0.8 | |
| Melon | Plow | Discing | 1 | 1.2 | 5.7 |
| | Shape Beds | Weeding | 1 | 0.8 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Disc | Discing | 1 | 1.2 | |
| No Land Prep. | Unspecified | Discing | 0 | 1.2 | 0 |
| Onions | List | Weeding | 1 | 0.8 | 6.5 |
| | Shape Beds | Weeding | 1 | 0.8 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Chisel | Discing | 1 | 1.2 | |
| | Disc & Roll | Discing | 1 | 1.2 | |

## Agricultural Land Preparation

**Table E-90. Summary of Crop Profile, Acre-Pass, and Emission Factor**

| Crop profile | Land Preparation Operations | Category | Acre-Pass | Emission Factor | |
|---|---|---|---|---|---|
| | | | | Operation (lbs/Acre-pass) | Crop (lbs/Acre/year) |
| Rice | Chisel | Discing | 1 | 1.2 | 20 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Post Burn/Harvest Disc | Discing | 0.5 | 1.2 | |
| | Roll | Weeding | 1 | 0.8 | |
| | 3 Wheel Plane | Land Planing | 1 | 12.5 | |
| | Harrow Disc | Discing | 1 | 1.2 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| Safflower | List | Weeding | 1 | 0.8 | 4.5 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| Sugar Beets | Disc | Discing | 1 | 1.2 | 22.8 |
| | Land Plane | Land Planing | 1 | 12.5 | |
| | Subsoil-deep chisel | Ripping | 1 | 4.6 | |
| | Stubble Disc | Discing | 1 | 1.2 | |
| | List | Weeding | 1 | 0.8 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Tomatoes | Bed Preparation | Weeding | 2 | 0.8 | 10.1 |
| | Land Preparation | Discing | 5 | 1.2 | |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |
| Vegetables | Land Maintenance | Land Planing | 0.2 | 12.5 | 8.5 |
| | Unspecified | Discing | 5 | 1.2 | |
| Wheat | Stubble Disc | Discing | 1 | 1.2 | 3.7 |
| | Land Maintenance | Land Planing | 0.2 | 12.5 | |

Source:
CARB. 2003. Emission Inventory Documentation, Section 7.4: Agricultural Land Preparation. January.
Accessed on: January 21, 2015. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm.

## Agricultural Harvest Operations

### Table E-91. Summary of Crop Emission Factor Assumptions

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 101999 | WHEAT ALL | Wheat | Wheat/1 | 5.8 |
| 104999 | RYE FOR GRAIN | Wheat | Wheat/1 | 5.8 |
| 106199 | RICE, FOR MILLING | Rice | Cotton/2 | 1.68 |
| 106269 | FIELD CROP BY PRODUCTS | Cotton | Cotton/20 | 0.17 |
| 108999 | FOOD GRAINS, MISC | Corn | Cotton/2 | 1.68 |
| 111559 | CORN, WHITE | Corn | Cotton/40 | 0.08 |
| 111991 | CORN FOR GRAIN | Corn | Cotton/2 | 1.68 |
| 111992 | CORN FOR SILAGE | Corn | Cotton/20 | 0.17 |
| 112999 | OATS FOR GRAIN | Wheat | Wheat/1 | 5.8 |
| 113994 | BARLEY, MALTING | Wheat | Wheat/1 | 5.8 |
| 113995 | BARLEY, FEED | Wheat | Wheat/1 | 5.8 |
| 113999 | BARLEY, UNSPECIFIED | Wheat | Wheat/1 | 5.8 |
| 114991 | SORGHUM, GRAIN | Wheat | Wheat/1 | 5.8 |
| 121219 | COTTON LINT, UPLAND | Cotton | Cotton/1 | 3.37 |
| 121229 | COTTON LINT, PIMA | Cotton | Cotton/1 | 3.37 |
| 121299 | COTTON LINT, UNSPEC | Cotton | Cotton/1 | 3.37 |
| 132999 | SUGAR BEETS | Sugar Beets | Cotton/2 | 1.68 |
| 151999 | COTTONSEED | Cotton | Cotton/1 | 3.37 |
| 153999 | PEANUTS, ALL | Safflower | Cotton/2 | 1.68 |
| 158269 | SAFFLOWER | Safflower | Wheat/1 | 5.8 |
| 158316 | SUNFLOWER SEED, PLANTING | Corn | Wheat/1 | 5.8 |
| 158319 | SUNFLOWER SEED | Corn | Wheat/1 | 5.8 |
| 158499 | JOJOBA | Melon | Cotton/40 | 0.08 |
| 161131 | BEANS, LIMAS, LG. DRY | DryBeans | Cotton/2 | 1.68 |
| 161132 | BEANS, LIMAS, BABY DRY | DryBeans | Cotton/2 | 1.68 |
| 161199 | LIMA BEANS, UNSPECIFIED | DryBeans | Cotton/2 | 1.68 |
| 161717 | BEANS, RED KIDNEY | DryBeans | Cotton/2 | 1.68 |
| 161721 | BEANS, PINK | DryBeans | Cotton/2 | 1.68 |
| 161741 | BEANS, BLACKEYE (PEAS) | DryBeans | Cotton/2 | 1.68 |
| 161742 | BEANS, GARBANZO | Garbanzo | Cotton/2 | 1.68 |
| 162399 | BEANS, FAVA | DryBeans | Cotton/2 | 1.68 |
| 163999 | PEAS, DRY EDIBLE | DryBeans | Cotton/20 | 0.17 |
| 169999 | BEANS,UNSPEC. DRY EDIBLE | DryBeans | Cotton/2 | 1.68 |
| 171019 | SEED WHEAT | Wheat | Wheat/1 | 5.8 |
| 171049 | SEED RYE | Wheat | Wheat/1 | 5.8 |
| 171069 | SEED RICE | Rice | Cotton/2 | 1.68 |
| 171129 | SEED OATS | Wheat | Wheat/1 | 5.8 |
| 171139 | SEED BARLEY | Wheat | Wheat/1 | 5.8 |
| 171519 | SEED, COTTON FOR PLANTING | Cotton | Cotton/1 | 3.37 |
| 171582 | SEED, SAFFLOWER, PLANTING | Safflower | Wheat/1 | 5.8 |
| 171619 | SEED BEANS | DryBeans | Cotton/2 | 1.68 |
| 171639 | SEED PEAS | DryBeans | Cotton/20 | 0.17 |
| 171949 | SEED, MISC FIELD CROP | Corn | Cotton/20 | 0.17 |
| 171959 | SEED, VEG & VINECROP | Vegetables | Cotton/20 | 0.17 |
| 172119 | SEED, ALFALFA | Alfalfa | Zero/1 | 0 |
| 172289 | CLOVER, UNSPECIFIED SEED | Alfalfa | Zero/1 | 0 |
| 173079 | SEED, BERMUDA GRASS | Alfalfa | Zero/1 | 0 |
| 173669 | SEED, SUDAN GRASS | Alfalfa | Zero/1 | 0 |
| 173999 | SEED, GRASS, UNSPECIFIED | Alfalfa | Zero/1 | 0 |
| 178999 | SEED, OTHER (NO FLOWERS) | Alfalfa | Cotton/20 | 0.17 |
| 181999 | HAY, ALFALFA | Alfalfa | Zero/1 | 0 |
| 188499 | HAY, GRAIN | Alfalfa | Cotton/2 | 1.68 |
| 188799 | HAY, WILD | Alfalfa | Cotton/2 | 1.68 |
| 188899 | HAY, SUDAN | Alfalfa | Zero/1 | 0 |

## Agricultural Harvest Operations

**Table E-91. Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 188999 | HAY, OTHER UNSPECIFIED | Alfalfa | Cotton/2 | 1.68 |
| 194599 | PASTURE, IRRIGATED | No Land | Zero/1 | 0 |
| 194699 | PASTURE, RANGE | No Land | Zero/1 | 0 |
| 194799 | PASTURE, MISC. FORAGE | No Land | Zero/1 | 0 |
| 195199 | SILAGE | Wheat | Cotton/20 | 0.17 |
| 195299 | HAY, GREEN CHOP | Alfalfa | Zero/1 | 0 |
| 195399 | STRAW | Alfalfa | Wheat/1 | 5.8 |
| 198199 | RICE, WILD | Rice | Cotton/2 | 1.68 |
| 198999 | FIELD CROPS, UNSPEC. | Corn | Cotton/20 | 0.17 |
| 201119 | ORANGES, NAVEL | Citrus | Cotton/40 | 0.08 |
| 201519 | ORANGES, VALENCIAS | Citrus | Cotton/40 | 0.08 |
| 201999 | ORANGES, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 202999 | GRAPEFRUIT, ALL | Citrus | Cotton/40 | 0.08 |
| 203999 | TANGERINES & MANDARINS | Citrus | Cotton/40 | 0.08 |
| 204999 | LEMONS, ALL | Citrus | Cotton/40 | 0.08 |
| 205999 | LIMES, ALL | Citrus | Cotton/40 | 0.08 |
| 206999 | TANGELOS | Citrus | Cotton/40 | 0.08 |
| 207999 | KUMQUATS | Citrus | Cotton/40 | 0.08 |
| 208059 | CITRUS, MISC BY-PROD | Citrus | Cotton/40 | 0.08 |
| 209999 | CITRUS, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 211999 | APPLES, ALL | Citrus | Cotton/40 | 0.08 |
| 212199 | PEACHES, FREESTONE | Citrus | Cotton/40 | 0.08 |
| 212399 | PEACHES, CLINGSTONE | Citrus | Cotton/40 | 0.08 |
| 212999 | PEACHES, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 213199 | CHERRIES, SWEET | Citrus | Cotton/40 | 0.08 |
| 214199 | PEARS, BARLETT | Citrus | Cotton/40 | 0.08 |
| 214899 | PEARS, ASIAN | Citrus | Cotton/40 | 0.08 |
| 214999 | PEARS, UNSPECIFIED | Citrus | Cotton/40 | 0.08 |
| 215199 | PLUMS | Citrus | Cotton/40 | 0.08 |
| 215399 | PLUMCOTS | Citrus | Cotton/40 | 0.08 |
| 215999 | PRUNES, DRIED | Citrus | Cotton/40 | 0.08 |
| 216199 | GRAPES, TABLE | Grapes-Table | Cotton/20 | 0.17 |
| 216299 | GRAPES, WINE | Grapes-Wine | Cotton/20 | 0.17 |
| 216399 | GRAPES, RAISIN | Grapes-Raisin | Cotton/20 | 0.17 |
| 216999 | GRAPES, UNSPECIFIED | Grapes-Wine | Cotton/20 | 0.17 |
| 217999 | APRICOTS, ALL | Citrus | Cotton/40 | 0.08 |
| 218199 | NECTARINES | Citrus | Cotton/40 | 0.08 |
| 218299 | PERSIMMONS | Citrus | Cotton/40 | 0.08 |
| 218399 | POMEGRANATES | Citrus | Cotton/40 | 0.08 |
| 218499 | QUINCE | Citrus | Cotton/40 | 0.08 |
| 218839 | CHERIMOYAS | Citrus | Cotton/40 | 0.08 |
| 218889 | ORCHARD BIOMASS | Almonds | Cotton/40 | 0.08 |
| 218899 | FRUITS & NUTS, UNSPEC. | Citrus | Cotton/40 | 0.08 |
| 221999 | AVOCADOS, ALL | Citrus | Cotton/40 | 0.08 |
| 224999 | DATES | Citrus | Almonds/20 | 2.04 |
| 225999 | FIGS, DRIED | Citrus | Almonds/20 | 2.04 |
| 226999 | OLIVES | Citrus | Cotton/40 | 0.08 |
| 228019 | GUAVAS | Citrus | Cotton/40 | 0.08 |
| 229999 | KIWIFRUIT | Citrus | Cotton/40 | 0.08 |
| 230639 | BERRIES, BLACKBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 230869 | BERRIES, BOYSENBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 234799 | BERRIES, LOGANBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 236199 | BERRIES, RASPBERRIES | Grapes-Table | Cotton/40 | 0.08 |
| 237199 | STRAWBERRIES, FRESH MKT | Melon | Cotton/40 | 0.08 |

## Agricultural Harvest Operations

**Table E-91. Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 237299 | STRAWBERRIES, PROC | Melon | Cotton/40 | 0.08 |
| 237999 | STRAWBERRIES, UNSPECIFIED | Melon | Cotton/40 | 0.08 |
| 239999 | BERRIES, BUSH, UNSPECIFIED | Grapes-Table | Cotton/40 | 0.08 |
| 261999 | ALMONDS, ALL | Almonds | Almonds/1 | 40.77 |
| 263999 | WALNUTS, ENGLISH | Almonds | Almonds/1 | 40.77 |
| 264999 | PECANS | Almonds | Almonds/10 | 4.08 |
| 265999 | WALNUTS, BLACK | Almonds | Almonds/1 | 40.77 |
| 266999 | CHESTNUTS | Almonds | Almonds/10 | 4.08 |
| 267999 | MACADAMIA NUT | Almonds | Almonds/10 | 4.08 |
| 268079 | PISTACHIOS | Almonds | Almonds/10 | 4.08 |
| 268099 | ALMOND HULLS | Almonds | Almonds/1 | 40.77 |
| 301999 | ARTICHOKES | Melon | Cotton/40 | 0.08 |
| 302199 | ASPARAGUS, FRESH MKT | Melon | Cotton/2 | 1.68 |
| 302299 | ASPARAGUS, PROC | Melon | Cotton/2 | 1.68 |
| 302999 | ASPARAGUS, UNSPECIFIED | Melon | Cotton/2 | 1.68 |
| 303999 | BEANS, GREEN LIMAS | DryBeans | Cotton/2 | 1.68 |
| 304199 | BEANS, SNAP FR MKT | DryBeans | Cotton/20 | 0.17 |
| 304299 | BEANS, SNAP PROC | DryBeans | Cotton/20 | 0.17 |
| 304399 | BEANS FRESH UNSPECIFIED | DryBeans | Cotton/20 | 0.17 |
| 304999 | BEANS, UNSPECIFIED SNAP | DryBeans | Cotton/20 | 0.17 |
| 305999 | BEETS, GARDEN | Sugar Beets | Cotton/2 | 1.68 |
| 306999 | RAPINI | Sugar Beets | Cotton/40 | 0.08 |
| 307189 | BROCCOLI,FOOD SERV | Vegetables | Cotton/40 | 0.08 |
| 307199 | BROCCOLI, FR MKT | Vegetables | Cotton/40 | 0.08 |
| 307299 | BROCCOLI, PROC | Vegetables | Cotton/40 | 0.08 |
| 307919 | BROCCOLI, UNSPECIFIED | Vegetables | Cotton/40 | 0.08 |
| 308999 | BRUSSELS SPROUTS | Melon | Cotton/40 | 0.08 |
| 309999 | CABBAGE, CH. & SPECIALTY | Lettuce | Cotton/40 | 0.08 |
| 310999 | CABBAGE, HEAD | Lettuce | Cotton/40 | 0.08 |
| 313189 | CARROTS, FOOD SERV | Sugar Beets | Cotton/20 | 0.17 |
| 313199 | CARROTS, FR MKT | Sugar Beets | Cotton/20 | 0.17 |
| 313299 | CARROTS, PROC | Sugar Beets | Cotton/20 | 0.17 |
| 313999 | CARROTS, UNSPECIFIED | Sugar Beets | Cotton/20 | 0.17 |
| 314189 | CAULIFLOWER, FOOD SERV | Vegetables | Cotton/40 | 0.08 |
| 314199 | CAULIFLOWER, FR MKT | Vegetables | Cotton/40 | 0.08 |
| 314299 | CAULIFLOWER, PROC | Vegetables | Cotton/40 | 0.08 |
| 314999 | CAULIFLOWER, UNSPECIFIED | Vegetables | Cotton/40 | 0.08 |
| 316189 | CELERY, FOOD SERV | Lettuce | Cotton/40 | 0.08 |
| 316199 | CELERY, FR MKT | Lettuce | Cotton/40 | 0.08 |
| 316299 | CELERY, PROC | Lettuce | Cotton/40 | 0.08 |
| 316999 | CELERY, UNSPECIFIED | Lettuce | Cotton/40 | 0.08 |
| 318999 | RADICCHIO | Lettuce | Cotton/40 | 0.08 |
| 320999 | CHIVES | Lettuce | Cotton/40 | 0.08 |
| 322999 | COLLARD GREENS | Lettuce | Cotton/40 | 0.08 |
| 323999 | CORN, SWEET ALL | Corn | Cotton/40 | 0.08 |
| 325999 | CUCUMBERS | Vegetables | Cotton/40 | 0.08 |
| 330999 | EGGPLANT, ALL | Vegetables | Cotton/40 | 0.08 |
| 331999 | ENDIVE, ALL | Lettuce | Cotton/40 | 0.08 |
| 332999 | ESCAROLE, ALL | Lettuce | Cotton/40 | 0.08 |
| 333999 | ANISE (FENNEL) | Lettuce | Cotton/2 | 1.68 |
| 335999 | GARLIC, ALL | Garlic | Cotton/2 | 1.68 |
| 337999 | KALE | Lettuce | Cotton/40 | 0.08 |
| 338999 | KOHLRABI | Lettuce | Cotton/40 | 0.08 |
| 339196 | LETTUCE, BULK SALAD PRODS. | Lettuce | Cotton/40 | 0.08 |

## Agricultural Harvest Operations

**Table E-91. Summary of Crop Emission Factor Assumptions**

| CDFA Crop Code | CDFA Crop Description | Crop Profile | Assumption | Emission Factor (lbs PM10/acre/yr) |
|---|---|---|---|---|
| 339999 | LETTUCE, UNSPECIFIED | Lettuce | Cotton/40 | 0.08 |
| 340999 | LETTUCE, HEAD | Lettuce | Cotton/40 | 0.08 |
| 341999 | LETTUCE, ROMAINE | Lettuce | Cotton/40 | 0.08 |
| 342999 | LETTUCE, LEAF | Lettuce | Cotton/40 | 0.08 |
| 343999 | MELON, CANTALOUPE | Melon | Cotton/40 | 0.08 |
| 348999 | MELON, HONEYDEW | Melon | Cotton/40 | 0.08 |
| 354299 | MELON, UNSPECIFIED | Melon | Cotton/40 | 0.08 |
| 354999 | MELON, WATER MELONS | Melon | Cotton/40 | 0.08 |
| 355999 | MUSHROOMS | No Land Prep. | Zero/1 | 0 |
| 356999 | MUSTARD | Lettuce | Cotton/40 | 0.08 |
| 357999 | OKRA | Lettuce | Cotton/40 | 0.08 |
| 358999 | ONIONS | Onions | Cotton/2 | 1.68 |
| 359999 | PARSLEY | Lettuce | Cotton/40 | 0.08 |
| 361299 | PEAS, GREEN, PROCESSING | DryBeans | Cotton/20 | 0.17 |
| 361999 | PEAS, GREEN, UNSPECIFIED | DryBeans | Cotton/20 | 0.17 |
| 363999 | PEPPERS, BELL | Tomatoes | Cotton/40 | 0.08 |
| 364999 | PEPPERS, CHILI, HOT | Tomatoes | Cotton/40 | 0.08 |
| 366999 | PUMPKINS | Melon | Cotton/20 | 0.17 |
| 367999 | RADISHES | Sugar Beets | Cotton/40 | 0.08 |
| 368999 | RHUBARB | Lettuce | Cotton/40 | 0.08 |
| 370999 | RUTABAGAS | Sugar Beets | Cotton/2 | 1.68 |
| 372999 | ONIONS, GREEN & SHALLOTS | Onions | Cotton/40 | 0.08 |
| 374189 | SPINACH, FOOD SERV | Lettuce | Cotton/40 | 0.08 |
| 374199 | SPINACH, FR MKT | Lettuce | Cotton/40 | 0.08 |
| 374299 | SPINACH, PROC | Lettuce | Cotton/40 | 0.08 |
| 374999 | SPINACH UNSPECIFIED | Lettuce | Cotton/40 | 0.08 |
| 375999 | SQUASH | Melon | Cotton/20 | 0.17 |
| 376999 | SWISSCHARD | Lettuce | Cotton/40 | 0.08 |
| 378199 | TOMATOES, FRESH MARKET | Tomatoes | Cotton/40 | 0.08 |
| 378299 | TOMATOES, PROCESSING | Tomatoes | Cotton/20 | 0.17 |
| 378999 | TOMATOES, UNSPECIFIED | Tomatoes | Cotton/20 | 0.17 |
| 380999 | TURNIPS, ALL | Sugar Beets | Cotton/2 | 1.68 |
| 381999 | GREENS, TURNIP & MUSTARD | Lettuce | Cotton/40 | 0.08 |
| 387999 | LEEKS | Onions | Cotton/40 | 0.08 |
| 391999 | POTATOES, IRISH ALL | Sugar Beets | Cotton/2 | 1.68 |
| 392999 | SWEET POTATOES | Sugar Beets | Cotton/2 | 1.68 |
| 393999 | HORSERADISH | Onions | Cotton/40 | 0.08 |
| 394199 | SALAD GREENS NEC | Lettuce | Cotton/40 | 0.08 |
| 394999 | PEAS, EDIBLE POD (SNOW) | DryBeans | Cotton/20 | 0.17 |
| 395999 | VEGETABLES, ORIENTAL, ALL | Vegetables | Cotton/40 | 0.08 |
| 396999 | SPROUTS, ALFALFA & BEAN | Lettuce | Cotton/40 | 0.08 |
| 398199 | CUCUMBERS, GREENHOUSE | No Land Prep. | Zero/1 | 0 |
| 398299 | TOMATOES, GREENHOUSE | No Land Prep. | Zero/1 | 0 |
| 398399 | TOMATOES, CHERRY | Tomatoes | Cotton/40 | 0.08 |
| 398499 | TOMATILLO | Tomatoes | Cotton/40 | 0.08 |
| 398559 | CILANTRO | Lettuce | Cotton/40 | 0.08 |
| 398599 | SPICES AND HERBS | Lettuce | Cotton/40 | 0.08 |
| 398899 | VEGETABLES, BABY | Vegetables | Cotton/40 | 0.08 |
| 398999 | VEGETABLES, UNSPECIFIED | Vegetables | Cotton/20 | 0.17 |
| 832919 | POTATOES SEED | Sugar Beets | Cotton/2 | 1.68 |
| 892999 | NURSERY TURF | No Land Prep. | Zero 1 | 0 |

Source:
CARB. 2003. Emission Inventory Documentation, Section 7.5: Agricultural Harvest Operations. January.
Accessed on: January 21, 2015. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm.

## Windblown Dust - Agricultural Lands

**Table E-92. Windblown Dust - Agricultural Lands**

| Air Basin Code | County Name | Emission Factor (tons/acre/yr) | Process Rate (acres) | PM Emissions (tons/year) |
|---|---|---|---|---|
| NCC | Monterey | 0.020478 | 279,178.00 | 5,717.07 |
| | San Benito | 0.015936 | 50,009.00 | 796.96 |
| | Santa Cruz | 0.002485 | 14,873.00 | 36.97 |
| SCC | San Luis Obispo | 0.006876 | 109,694.00 | 754.2 |
| | Santa Barbara | 0.00319 | 80,732.00 | 257.56 |
| | Ventura | 0.018418 | 54,568.00 | 1,005.02 |
| SED | Imperial | 0.141666 | 490,409.00 | 69,474.43 |
| SJV | Fresno | 0.013761 | 864,164.00 | 11,891.35 |
| | Kern | 0.008662 | 408,313.48 | 3,536.73 |
| | Kings | 0.012856 | 473,817.00 | 6,091.62 |
| | Madera | 0.008032 | 141,617.00 | 1,137.47 |
| | Merced | 0.013659 | 364,804.00 | 4,982.86 |
| | San Joaquin | 0.003527 | 387,278.00 | 1,365.96 |
| | Stanislaus | 0.009052 | 229,805.00 | 2,080.26 |
| | Tulare | 0.004693 | 471,664.00 | 2,213.29 |
| SV | Butte | 0.001154 | 116,869.00 | 134.87 |
| | Colusa | 0.004702 | 229,747.00 | 1,080.31 |
| | Glenn | 0.004957 | 186,067.00 | 922.39 |
| | Placer | 0.002172 | 6,962.90 | 15.12 |
| | Sacramento | 0.002479 | 117,770.00 | 291.92 |

Note:
Fraction of PM10 (FRPM10): 0.50
(PM10 Emissions = PM x FRPM10)

**Table E-93. Windblown Dust - Pasture Lands**

| Air Basin Code | County Name | Emission Factor (tons/acre/yr) | Process Rate (acres) | PM Emissions (tons/year) |
|---|---|---|---|---|
| NCC | Monterey | 0.00110562 | 1,108,000 | 1,225.03 |
| | San Benito | 0.00109336 | 512,000 | 559.8 |
| | Santa Cruz | 0.0001605 | 8,000 | 1.28 |
| SCC | Santa Barbara | 0.00021801 | 602,913 | 131.44 |
| | San Luis Obispo | 0.00046964 | 1,102,500 | 517.78 |
| | Ventura | 0.00050356 | 210,918 | 106.21 |
| SED | Imperial | 0.00867346 | 158,449 | 1,374.30 |
| SJV | Fresno | 0.00149089 | 907,300 | 1,352.69 |
| | Kern | 0.00082834 | 1,527,603 | 1,265.37 |
| | Kings | 0.00146875 | 142,777 | 209.7 |
| | Madera | 0.00116178 | 421,000 | 489.11 |
| | Merced | 0.00155578 | 642,700 | 999.9 |
| | San Joaquin | 0.0005228 | 167,700 | 87.67 |
| | Stanislaus | 0.00107875 | 434,300 | 468.5 |
| | Tulare | 0.00063424 | 713,400 | 452.47 |
| SV | Butte | 0.00014292 | 288,500 | 41.23 |
| | Colusa | 0.00046444 | 181,900 | 84.48 |
| | Glenn | 0.00048846 | 256,575 | 125.33 |
| | Placer | 0.00026499 | 65,656 | 17.4 |
| | Sacramento | 0.00019538 | 118,000 | 23.05 |
| | Shasta | 0.00034146 | 459,000 | 156.73 |
| | Solano | 0.00039453 | 131,360 | 51.83 |
| | Sutter | 0.00037084 | 71,500 | 26.51 |
| | Tehama | 0.00035146 | 955,350 | 335.76 |
| | Yolo | 0.00061919 | 136,870 | 84.75 |
| | Yuba | 0.00023892 | 207,600 | 49.6 |

Note:
Fraction of PM10 (FRPM10): 0.50
(PM10 Emissions = PM x FRPM10)

**Table E-94. County Size**

| County | Area (acres) | |
|---|---|---|
| | Non-Pasture | Pasture |
| Butte | n/a | n/a |
| Colusa | n/a | n/a |
| Fresno | n/a | n/a |
| Glenn | n/a | n/a |
| Imperial | n/a | n/a |
| Kern | n/a | n/a |
| Kings | n/a | n/a |
| Madera | n/a | n/a |
| Merced | n/a | n/a |
| Monterey | n/a | n/a |
| Placer | n/a | n/a |
| Sacramento | n/a | n/a |
| San Benito | n/a | n/a |
| San Joaquin | n/a | n/a |
| San Luis Obispo | n/a | n/a |
| Santa Barbara | n/a | n/a |
| Santa Cruz | n/a | n/a |
| Shasta | n/a | n/a |
| Solano | n/a | n/a |
| Stanislaus | n/a | n/a |
| Sutter | n/a | n/a |
| Tehama | n/a | n/a |
| Tulare | n/a | n/a |
| Ventura | n/a | n/a |
| Yolo | n/a | n/a |
| Yuba | n/a | n/a |
| **Total** | **0** | **0** |

*Source:*
*CARB. 1997. Emission Inventory Documentation, Section 7.12: Windblown Dust - Agricultural Lands. July.*
*Accessed on: January 21, 2015. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocfugwbdst.htm.*

As discussed in Chapter 3, Environmental Impacts, Figure 1 below shows the CO maintenance area; Figure 2 displays the O3 nonattainment area; Figure 3 shows the PM10 maintenance area; and Figure 4 displays the PM2.5 nonattainment area.

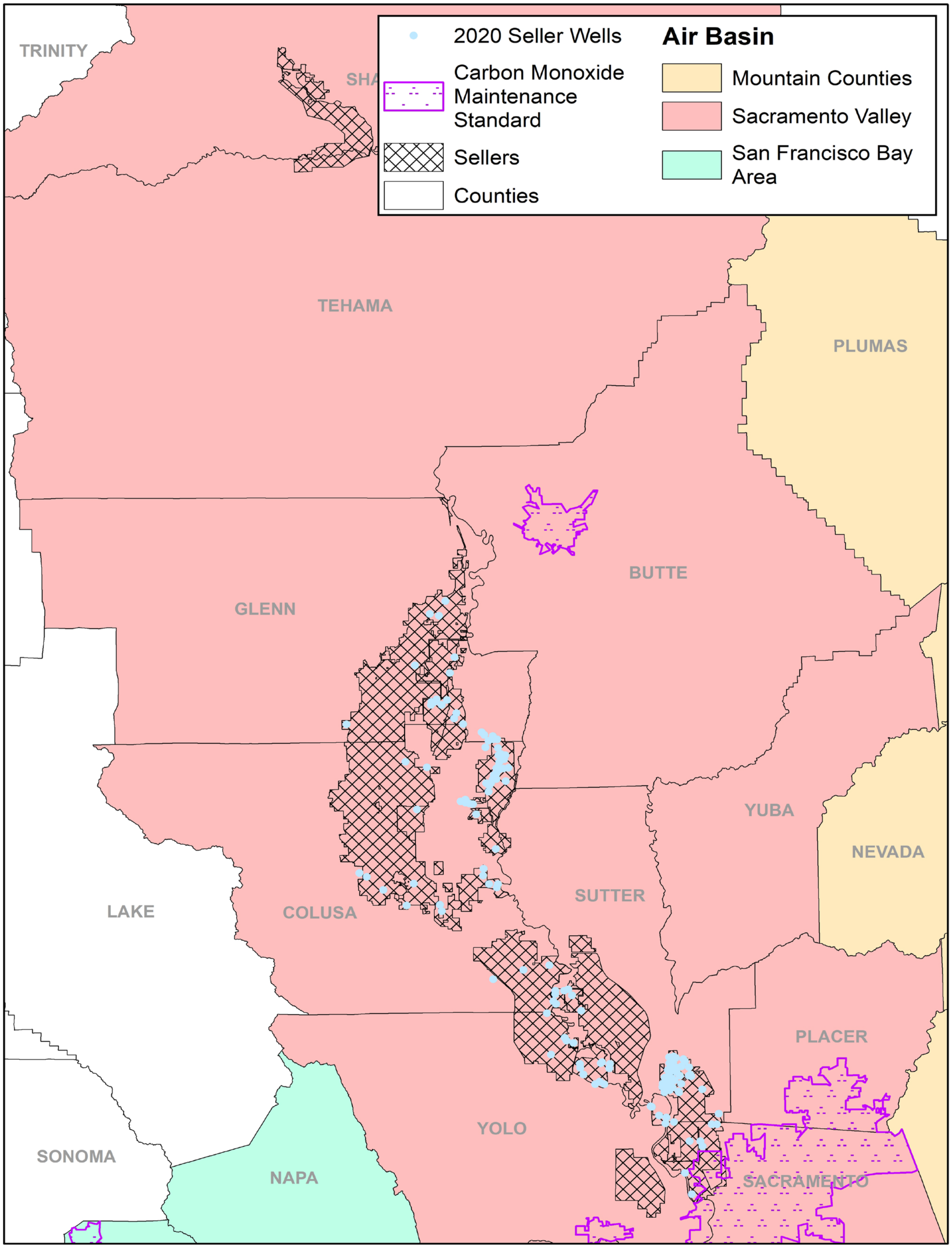


**Figure 1. Location of CO Maintenance Area in Seller Service Area**

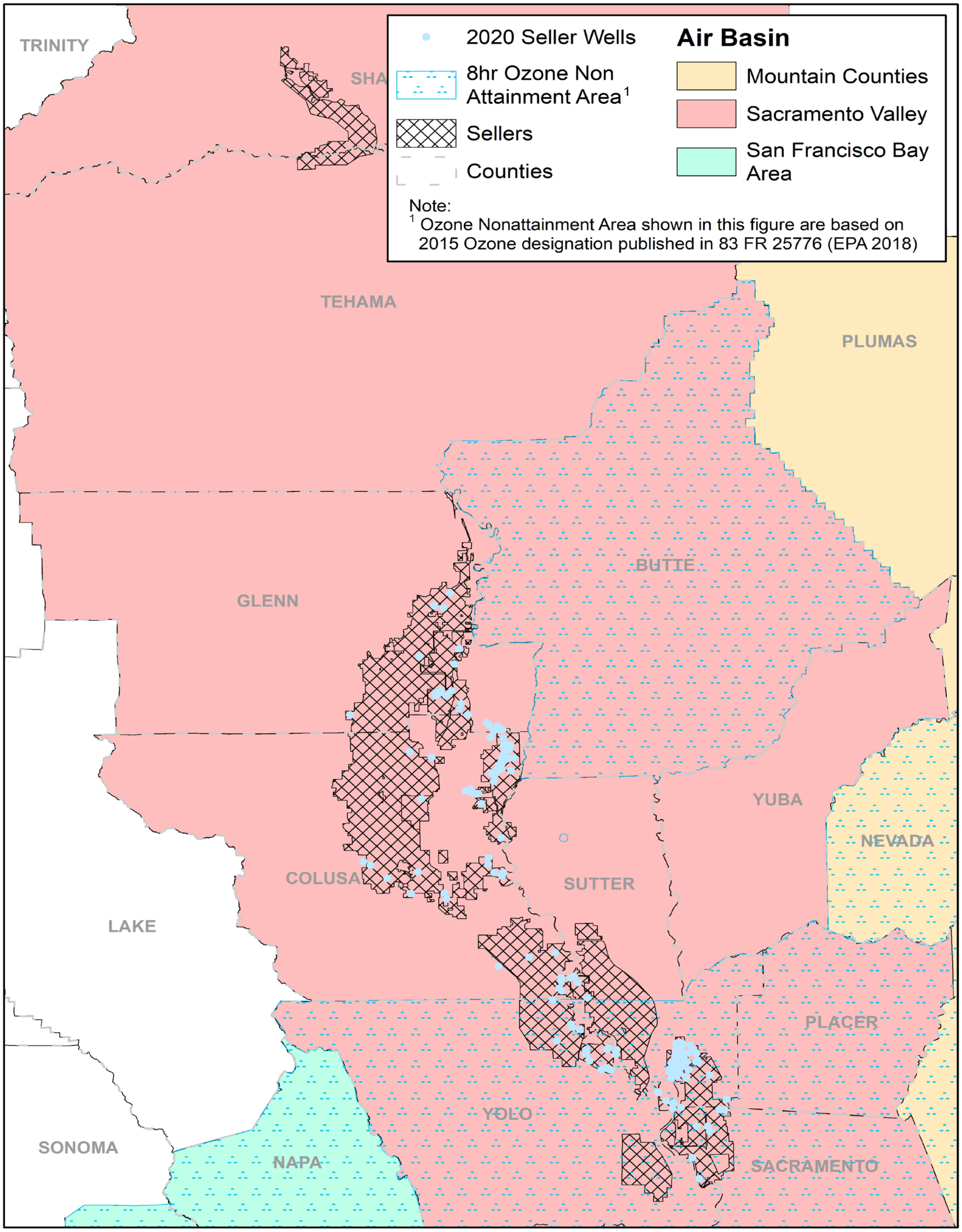


**Figure 2. Location of $O_3$ Nonattainment Area in Seller Service Area**

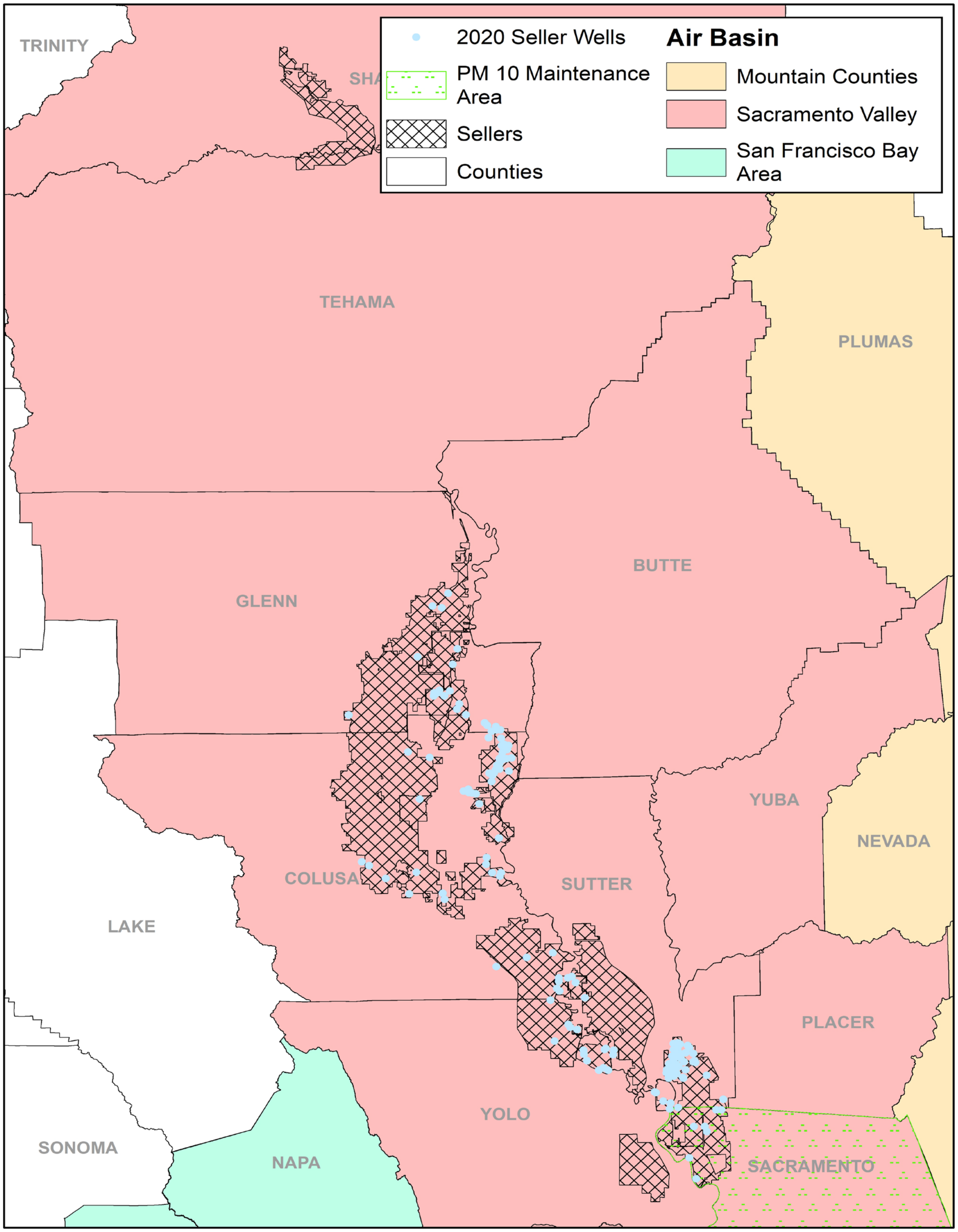


**Figure 3. Location of $PM_{10}$ Maintenance Area in Seller Service Area**

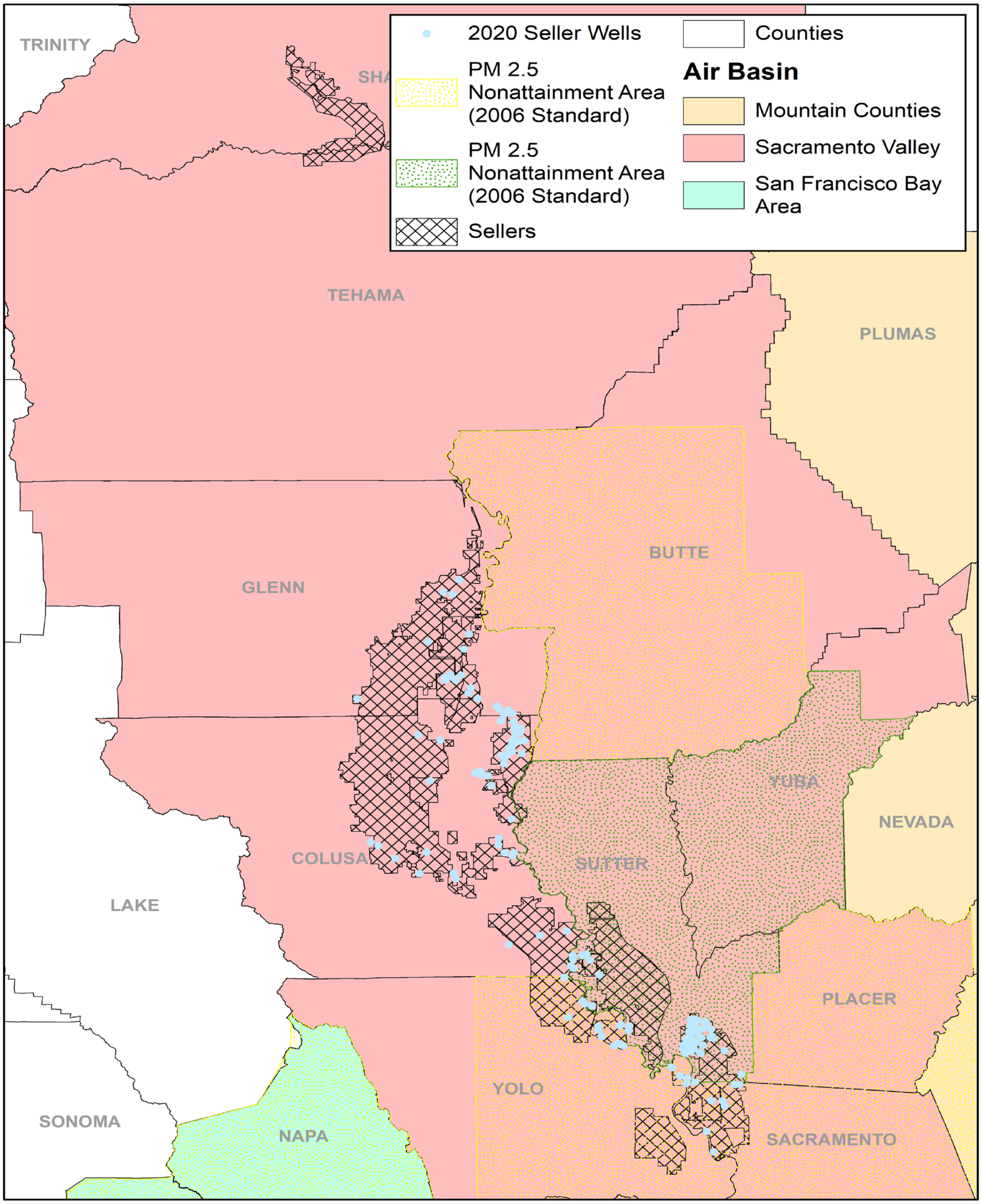


**Figure 4. Location of $PM_{2.5}$ Nonattainment and Maintenance Areas in Seller Service Area**

# Appendix F

# Climate Change Emission Calculations

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## Summary of Annual Greenhouse Gas Emissions

### Table F-1. GHG Emissions from Groundwater Substitution

| Water Agency | Emissions (MTCO2e/year) | | | |
|---|---|---|---|---|
| | CO2 | CH4 | N2O | Total |
| Anderson-Cottonwood Irrigation District | 71 | 0 | 0 | 72 |
| Baber, Jack et al. | No Groundwater Substitution | | | 0 |
| Canal Farms | 26 | 0 | 0 | 26 |
| Conaway Preservation Group | No Groundwater Substitution | | | 0 |
| Eastside Mutual Water Company | 618 | 1 | 1 | 620 |
| Glenn-Colusa Irrigation District | 822 | 1 | 3 | 826 |
| Guisti Farms | 898 | 1 | 3 | 902 |
| Maxwell Irrigation District | 528 | 1 | 1 | 530 |
| Natomas Central Mutual Water Company | 1,488 | 3 | 5 | 1,496 |
| Pelger Mutual Water Company | 198 | 0 | 1 | 199 |
| Pelger Road 1700 LLC | 79 | 0 | 0 | 80 |
| Pleasant Grove-Verona Mutual Water Company | 1,161 | 2 | 3 | 1,166 |
| Princeton-Cordora-Glenn Irrigation District | 915 | 1 | 2 | 918 |
| Provident Irrigation District | 1,633 | 2 | 4 | 1,639 |
| Reclamation District 1004 | 967 | 1 | 2 | 971 |
| Reclamation District 108 | 304 | 1 | 2 | 307 |
| River Garden Farms | 190 | 1 | 1 | 192 |
| Sutter Mutual Water Company | 129 | 1 | 1 | 130 |
| Sycamore Mutual Water Company | 88 | 0 | 0 | 88 |
| T&P Farms | 15 | 0 | 0 | 16 |
| Te Velde Revocable Family Trust | 96 | 0 | 1 | 97 |
| Windswept Land & Livestock | 60 | 0 | 0 | 61 |
| **Total** | **10,286** | **16** | **31** | **10,334** |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

| | | |
|---|---|---|
| Agency | Anderson-Cottonwood Irrigation District | |
| Transfer Volume | 4,800 | acre-feet/year |

**Table F-2. Anderson-Cottonwood Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Shasta | 0 | 2 | 0 | 0 | 2 |
| Tehama | 0 | 0 | 0 | 0 | 0 |
| Total | 0 | 2 | 0 | 0 | 2 |

**Table F-3. Anderson-Cottonwood Irrigation District GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | GHG Emissions (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barney Street | Shasta | Electric | 2012 | 200 | 5,500 | 85% | 4,062 | 4,010 | 598,578 | n/a | 57 | 0.0090 | 0.0011 | 57 | 0.22 | 0.32 | 58 |
| Crowley Gulch | Shasta | Electric | 2012 | 50 | 1,000 | 15% | 738 | 4,010 | 149,645 | n/a | 14 | 0.0022 | 0.0003 | 14 | 0.06 | 0.08 | 14 |
| | | | | **Total** | **6,500** | **100%** | **4,800** | **8,021** | **748,223** | **0** | **71** | **0.0112** | **0.0014** | **71** | **0.28** | **0.40** | **72** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Canal Farms
Transfer Volume 1,000 acre-feet/year

### Table F-4. Canal Farms Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 2 | 0 | 1 | 3 |
| Total | 0 | 2 | 0 | 1 | 3 |

### Table F-5. Canal Farms GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (MMBtu/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dennis Well North | Colusa | Electric | unknown | 125 | 3,500 | 29% | 292 | 453 | 42,217 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.02 | 0.02 | 4 |
| Dennis Well South | Colusa | Electric | unknown | 125 | 3,500 | 29% | 292 | 453 | 42,217 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.02 | 0.02 | 4 |
| East Well | Colusa | Propane | unknown | 250 | 5,000 | 42% | 417 | 453 | n/a | 288 | 18 | 0.0009 | 0.0002 | 18 | 0.02 | 0.05 | 18 |
| | | | | **Total** | **12,000** | **100%** | **1,000** | **1,358** | **84,435** | **288** | **26** | **0.0021** | **0.0003** | **26** | **0.05** | **0.10** | **26** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 bhp-hr = | 2,542.5 | Btu |
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Eastside Mutual Water Company
Transfer Volume 2,230 acre-feet/year

### Table F-6. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 2 | 0 | 0 | 0 | 2 |
| Total | 2 | 0 | 0 | 0 | 2 |

### Table F-7. Eastside Mutual Water Company GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ATW-1 | Colusa | Diesel | 2006 | 215 | 2,500 | 45% | 1,014 | 2,202 | n/a | 26,559 | 271 | 0.011 | 0.0022 | 271 | 0.27 | 0.66 | 272 |
| ATW-2 | Colusa | Diesel | 2002 | 275 | 3,000 | 55% | 1,216 | 2,202 | n/a | 33,971 | 347 | 0.014 | 0.0028 | 347 | 0.35 | 0.84 | 348 |
| | | | | **Total** | **5,500** | **100%** | **2,230** | **4,404** | **0** | **60,531** | **618** | **0.025** | **0.0050** | **618** | **0.63** | **1.49** | **620** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Glenn-Colusa Irrigation District
Transfer Volume 11,300 acre-feet/year

**Table F-8. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 1 | 6 | 0 | 0 | 7 |
| Colusa | 4 | 6 | 0 | 0 | 10 |
| Total | 5 | 12 | 0 | 0 | 17 |

**Table F-9. Glenn-Colusa Irrigation District GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15-3-22H-3 | Colusa | Diesel | unknown | 121 | 800 | 2% | 269 | 1,826 | n/a | 12,398 | 127 | 0.0051 | 0.0010 | 127 | 0.13 | 0.31 | 127 |
| 17-2-6B-1 | Colusa | Electric | unknown | 121 | 3,000 | 9% | 1,009 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| GRS-22H-1 | Glenn | Electric | unknown | 121 | 2,300 | 7% | 774 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| GRS-34N-1 | Glenn | Diesel | unknown | 121 | 2,500 | 7% | 841 | 1,826 | n/a | 12,398 | 127 | 0.0051 | 0.0010 | 127 | 0.13 | 0.31 | 127 |
| GRS-35A-2 | Glenn | Electric | unknown | 121 | 4,300 | 13% | 1,446 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| GRS-84A-1 | Glenn | Electric | unknown | 121 | 2,500 | 7% | 841 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| Haymen | Colusa | Diesel | unknown | 121 | 2,250 | 7% | 757 | 1,826 | n/a | 12,398 | 127 | 0.0051 | 0.0010 | 127 | 0.13 | 0.31 | 127 |
| LaCroix 1 | Glenn | Electric | unknown | 121 | 850 | 3% | 286 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| LaCroix 2 | Glenn | Electric | unknown | 121 | 850 | 3% | 286 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| LaCroix 3 | Glenn | Electric | unknown | 121 | 850 | 3% | 286 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| Lagrande | Colusa | Diesel | unknown | 121 | 3,000 | 9% | 1,009 | 1,826 | n/a | 12,398 | 127 | 0.0051 | 0.0010 | 127 | 0.13 | 0.31 | 127 |
| Reister 1 | Colusa | Electric | unknown | 121 | 850 | 3% | 286 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| Reister 2 | Colusa | Electric | unknown | 121 | 850 | 3% | 286 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| Reister 3 | Colusa | Electric | unknown | 121 | 850 | 3% | 286 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| Reister 4 | Colusa | Electric | unknown | 121 | 850 | 3% | 286 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| Vann 1 | Colusa | Diesel | unknown | 121 | 3,000 | 9% | 1,009 | 1,826 | n/a | 12,398 | 127 | 0.0051 | 0.0010 | 127 | 0.13 | 0.31 | 127 |
| Vann 2 | Colusa | Electric | unknown | 121 | 4,000 | 12% | 1,345 | 1,826 | 164,925 | n/a | 16 | 0.0025 | 0.0003 | 16 | 0.06 | 0.09 | 16 |
| | | | | **Total** | **33,600** | **100%** | **11,300** | **31,050** | **1,979,105** | **61,992** | **822** | **0.0553** | **0.0087** | **822** | **1.38** | **2.60** | **826** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Guisti Farms
Transfer Volume 1,000 acre-feet/year

### Table F-10. Guisti Farms Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 0 | 0 | 0 | 2 | 2 |
| Total | 0 | 0 | 0 | 2 | 2 |

### Table F-11. Guisti Farms GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Guisti Well 1 | Sutter | Propane | 2015 | 150 | 3,200 | 50% | 500 | 849 | n/a | 7,141 | 449 | 0.0214 | 0.0043 | 449 | 0.54 | 1.28 | 451 |
| Guisti Well 2 | Sutter | Propane | 2015 | 150 | 3,200 | 50% | 500 | 849 | n/a | 7,141 | 449 | 0.0214 | 0.0043 | 449 | 0.54 | 1.28 | 451 |
| | | | | **Total** | **6,400** | **100%** | **1,000** | **1,697** | **0** | **14,282** | **898** | **0.0428** | **0.0086** | **898** | **1.07** | **2.55** | **902** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Maxwell Irrigation District
Transfer Volume 3,000 acre-feet/year

### Table F-12. Maxwell Irrigation District Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 2 | 0 | 0 | 0 | 2 |
| Total | 2 | 0 | 0 | 0 | 2 |

### Table F-13. Maxwell Irrigation District GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | GHG Emissions (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MainWell | Colusa | Diesel | 2006 | 215 | 3,800 | 50% | 1,500 | 2,144 | n/a | 25,857 | 264 | 0.0107 | 0.0021 | 264 | 0.27 | 0.64 | 265 |
| TuttleWell | Colusa | Diesel | 2006 | 215 | 3,800 | 50% | 1,500 | 2,144 | n/a | 25,857 | 264 | 0.0107 | 0.0021 | 264 | 0.27 | 0.64 | 265 |
| | | | | **Total** | **7,600** | **100%** | **3,000** | **4,288** | **0** | **51,715** | **528** | **0.0214** | **0.0043** | **528** | **0.54** | **1.28** | **530** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Natomas Central Mutual Water Company
Transfer Volume 20,000 acre-feet/year

**Table F-14. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sacramento | 3 | 6 | 0 | 0 | 9 |
| Sutter | 1 | 14 | 0 | 0 | 15 |
| Total | 4 | 20 | 0 | 0 | 24 |

**Table F-15. Natomas Central Mutual Water Company GHG Emissions**

| | Well | | | | | | Transfer | | | Fuel | GHG Emissions | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Location | | | Power Rating | Pump Rate | | Volume | Operation | | Consumption | (tonnes per year) | | | (MTCO2e per year) | | | |
| **Well** | **(County)** | **Fuel Type** | **Model Year** | **(hp)** | **(gpm)** | **(% of Total)** | **(AF/year)** | **(hours/year)** | **(kWh/yr)** | **(gal/yr)** | **CO2** | **CH4** | **N2O** | **CO2** | **CH4** | **N2O** | **Total** |
| L-1 | Sutter | Diesel | 2013 | 120 | 1,600 | 4% | 748 | 2,538 | n/a | 17,085 | 174 | 0.0071 | 0.0014 | 174 | 0.18 | 0.42 | 175 |
| L-2 | Sutter | Electric | unknown | 30 | 1,900 | 4% | 888 | 2,538 | 56,816 | n/a | 5 | 0.0009 | 0.0001 | 5 | 0.02 | 0.03 | 5 |
| L-3 | Sutter | Electric | unknown | 125 | 1,300 | 3% | 607 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-4 | Sutter | Electric | unknown | 125 | 1,300 | 3% | 607 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-6 | Sutter | Electric | unknown | 125 | 2,000 | 5% | 935 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-7 | Sutter | Electric | unknown | 125 | 1,200 | 3% | 561 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-8 | Sutter | Electric | unknown | 125 | 2,800 | 7% | 1,308 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-9 | Sutter | Electric | unknown | 125 | 1,500 | 4% | 701 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-10 | Sutter | Electric | unknown | 125 | 1,000 | 2% | 467 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-11 | Sutter | Electric | unknown | 125 | 1,500 | 4% | 701 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| L-12 | Sutter | Electric | unknown | 125 | 1,500 | 4% | 701 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| MAP | Sacramento | Electric | unknown | 125 | 2,000 | 5% | 935 | 2,538 | 236,733 | n/a | 41 | 0.0035 | 0.0004 | 41 | 0.09 | 0.13 | 41 |
| Ose-1 | Sacramento | Diesel | 2013 | 200 | 1,800 | 4% | 841 | 2,538 | n/a | 28,474 | 291 | 0.0118 | 0.0024 | 291 | 0.29 | 0.70 | 292 |
| Ose-2 | Sacramento | Electric | unknown | 150 | 1,600 | 4% | 748 | 2,538 | 284,080 | n/a | 49 | 0.0043 | 0.0005 | 49 | 0.11 | 0.15 | 50 |
| Perry | Sacramento | Electric | unknown | 125 | 2,000 | 5% | 935 | 2,538 | 236,733 | n/a | 41 | 0.0035 | 0.0004 | 41 | 0.09 | 0.13 | 41 |
| Spangler | Sutter | Electric | unknown | 80 | 2,400 | 6% | 1,121 | 2,538 | 151,509 | n/a | 14 | 0.0023 | 0.0003 | 14 | 0.06 | 0.08 | 15 |
| TNBC Frazer | Sutter | Electric | unknown | 125 | 2,000 | 5% | 935 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| TNBC Bennett North | Sutter | Electric | unknown | 125 | 2,000 | 5% | 935 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| TNBC Atkinson | Sutter | Electric | unknown | 125 | 1,800 | 4% | 841 | 2,538 | 236,733 | n/a | 23 | 0.0035 | 0.0004 | 23 | 0.09 | 0.13 | 23 |
| TNBC Fisherman's Lake | Sacramento | Electric | unknown | 125 | 1,500 | 4% | 701 | 2,538 | 236,733 | n/a | 41 | 0.0035 | 0.0004 | 41 | 0.09 | 0.13 | 41 |
| TNBC Silva Dairy | Sacramento | Electric | unknown | 125 | 1,100 | 3% | 514 | 2,538 | 236,733 | n/a | 41 | 0.0035 | 0.0004 | 41 | 0.09 | 0.13 | 41 |
| TNBC Betts | Sacramento | Electric | unknown | 125 | 1,500 | 4% | 701 | 2,538 | 236,733 | n/a | 41 | 0.0035 | 0.0004 | 41 | 0.09 | 0.13 | 41 |
| Dhaliwal | Sacramento | Diesel | 2013 | 180 | 2,500 | 6% | 1,168 | 2,538 | n/a | 25,627 | 262 | 0.0106 | 0.0021 | 262 | 0.27 | 0.63 | 263 |
| Willey | Sacramento | Diesel | 2012 | 148 | 3,000 | 7% | 1,402 | 2,538 | n/a | 21,071 | 215 | 0.0087 | 0.0017 | 215 | 0.22 | 0.52 | 216 |
| | | | | **Total** | **42,800** | **100%** | **20,000** | **60,907** | **4,516,870** | **92,257** | **1,488** | **0.1058** | **0.0158** | **1,488** | **2.65** | **4.72** | **1,496** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
(shaded cell) Engine power rating not provided; assumed to be equal to max horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Pelger Mutual Water Company
Transfer Volume 4,670 acre-feet/year

**Table F-16. Pelger Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 1 | 3 | 0 | 0 | 4 |
| Total | 1 | 3 | 0 | 0 | 4 |

**Table F-17. Pelger Mutual Water Company GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | GHG Emissions (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PMWC#1 | Sutter | Electric | unknown | 150 | 3,100 | 25% | 1,149 | 2,013 | 225,320 | n/a | 22 | 0.0034 | 0.0004 | 22 | 0.08 | 0.12 | 22 |
| Well 1 Tucker | Sutter | Electric | unknown | 75 | 3,100 | 25% | 1,149 | 2,013 | 112,660 | n/a | 11 | 0.0017 | 0.0002 | 11 | 0.04 | 0.06 | 11 |
| Well 2 Flopet | Sutter | Diesel | 2008 | 125 | 2,100 | 17% | 778 | 2,013 | n/a | 14,115 | 144 | 0.0058 | 0.0012 | 144 | 0.15 | 0.35 | 145 |
| Well 3 Klein | Sutter | Electric | unknown | 150 | 4,300 | 34% | 1,594 | 2,013 | 225,320 | n/a | 22 | 0.0034 | 0.0004 | 22 | 0.08 | 0.12 | 22 |
| | | | | **Total** | **12,600** | **100%** | **4,670** | **8,051** | **563,301** | **14,115** | **198** | **0.0143** | **0.0022** | **198** | **0.36** | **0.65** | **199** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Pelger Road 1700 LLC
Transfer Volume 5,200 acre-feet/year

### Table F-18. Pelger Road 1700 LLC Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 0 | 4 | 0 | 0 | 4 |
| Total | 0 | 4 | 0 | 0 | 4 |

### Table F-19. Pelger Road 1700 LLC GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | GHG Emissions (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North Well | Sutter | Electric | unknown | 125 | 3,500 | 28% | 1,433 | 2,224 | 207,431 | n/a | 20 | 0.0031 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| South Well | Sutter | Electric | unknown | 125 | 3,000 | 24% | 1,228 | 2,224 | 207,431 | n/a | 20 | 0.0031 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| Well #3 | Sutter | Electric | unknown | 125 | 3,100 | 24% | 1,269 | 2,224 | 207,431 | n/a | 20 | 0.0031 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| Well #4 | Sutter | Electric | unknown | 125 | 3,100 | 24% | 1,269 | 2,224 | 207,431 | n/a | 20 | 0.0031 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| | | | | **Total** | **12,700** | **100%** | **5,200** | **8,895** | **829,722** | **0** | **79** | **0.0124** | **0.0015** | **79** | **0.31** | **0.45** | **80** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

### Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency: Pleasant Grove-Verona Mutual Water Company
Transfer Volume: 15,000 acre-feet/year

**Table F-20. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 13 | 20 | 0 | 2 | 35 |
| Total | 13 | 20 | 0 | 2 | 35 |

**Table F-21. Pleasant Grove-Verona Mutual Water Company GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) - diesel (MMBtu/yr) - propane | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kelly 190 Field Well #2 | Sutter | Electric | unknown | 30 | 2,000 | 2% | 348 | 946 | 21,182 | n/a | 2 | 0.0003 | 0.0000 | 2 | 0.01 | 0.01 | 2 |
| Kelly Windmill Field Well #2 | Sutter | Electric | 2002 | 62.1 | 2,000 | 2% | 348 | 946 | 43,847 | n/a | 4 | 0.0007 | 0.0001 | 4 | 0.02 | 0.02 | 4 |
| Kelly Windmill North Field Well | Sutter | Propane | 2014 | 133 | 1,750 | 2% | 305 | 946 | n/a | 320 | 20 | 0.0010 | 0.0002 | 20 | 0.02 | 0.06 | 20 |
| Kelly306 | Sutter | Electric | unknown | 60 | 2,600 | 3% | 453 | 946 | 42,365 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.02 | 0.02 | 4 |
| MLF Clubhouse B Well | Sutter | Electric | unknown | 300 | 2,500 | 3% | 436 | 946 | 211,823 | n/a | 20 | 0.0032 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| MLF Marsh Well | Sutter | Electric | unknown | 300 | 2,500 | 3% | 436 | 946 | 211,823 | n/a | 20 | 0.0032 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| MLF Monster Well | Sutter | Electric | unknown | 60 | 3,100 | 4% | 540 | 946 | 42,365 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.02 | 0.02 | 4 |
| MLF Well #1 | Sutter | Electric | unknown | 30 | 2,000 | 2% | 348 | 946 | 21,182 | n/a | 2 | 0.0003 | 0.0000 | 2 | 0.01 | 0.01 | 2 |
| MLF Well #16 | Sutter | Electric | unknown | 50 | 1,700 | 2% | 296 | 946 | 35,304 | n/a | 3 | 0.0005 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| MLF Well#11 | Sutter | Diesel | 2004 | 250 | 4,200 | 5% | 732 | 946 | n/a | 13,270 | 135 | 0.0055 | 0.0011 | 135 | 0.14 | 0.33 | 136 |
| MLF Well#12/17 | Sutter | Electric | unknown | 50 | 1,500 | 2% | 261 | 946 | 35,304 | n/a | 3 | 0.0005 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| MLF Well#13&#15 | Sutter | Electric | 2000 | 215 | 4,800 | 6% | 836 | 946 | 151,806 | n/a | 14 | 0.0023 | 0.0003 | 14 | 0.06 | 0.08 | 15 |
| MLF Well#2B | Sutter | Electric | 2000 | 300 | 2,500 | 3% | 436 | 946 | 211,823 | n/a | 20 | 0.0032 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| Nicholas 72-Acre Field North | Sutter | Electric | unknown | 40 | 5,000 | 6% | 871 | 946 | 28,243 | n/a | 3 | 0.0004 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| Nicholas 72-Acree Field South | Sutter | Diesel | 2002 | 62.1 | 2,000 | 2% | 348 | 946 | n/a | 3,296 | 34 | 0.0014 | 0.0003 | 34 | 0.03 | 0.08 | 34 |
| Nicholas BBC Well | Sutter | Electric | unknown | 30 | 2,500 | 3% | 436 | 946 | 21,182 | n/a | 2 | 0.0003 | 0.0000 | 2 | 0.01 | 0.01 | 2 |
| Nicholas Filipino Camp South | Sutter | Diesel | 2002 | 62.1 | 2,000 | 2% | 348 | 946 | n/a | 3,296 | 34 | 0.0014 | 0.0003 | 34 | 0.03 | 0.08 | 34 |
| Nicholas Filipino Camp#2 | Sutter | Electric | unknown | 40 | 2,000 | 2% | 348 | 946 | 28,243 | n/a | 3 | 0.0004 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| Nicholas Johnston Field Well #2 | Sutter | Electric | unknown | 40 | 2,000 | 2% | 348 | 946 | 28,243 | n/a | 3 | 0.0004 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| Nicholas Sand Field Well | Sutter | Diesel | 2002 | 62.1 | 2,000 | 2% | 348 | 946 | n/a | 3,296 | 34 | 0.0014 | 0.0003 | 34 | 0.03 | 0.08 | 34 |
| RiverRanch#19 | Sutter | Diesel | 2008 | 99 | 2,500 | 3% | 436 | 946 | n/a | 5,255 | 54 | 0.0022 | 0.0004 | 54 | 0.05 | 0.13 | 54 |
| S&O#16 | Sutter | Electric | 2014 | 159 | 2,000 | 2% | 348 | 946 | 112,266 | n/a | 11 | 0.0017 | 0.0002 | 11 | 0.04 | 0.06 | 11 |
| S&O#17 | Sutter | Diesel | 1999 | 101 | 3,000 | 3% | 523 | 946 | n/a | 5,361 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| S&O#18A | Sutter | Diesel | 1999 | 101 | 2,250 | 3% | 392 | 946 | n/a | 5,361 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| S&O#19 | Sutter | Diesel | 2007 | 215 | 1,800 | 2% | 314 | 946 | n/a | 11,412 | 117 | 0.0047 | 0.0009 | 117 | 0.12 | 0.28 | 117 |
| S&O#20 | Sutter | Propane | 2014 | 154 | 2,150 | 2% | 375 | 946 | n/a | 370 | 23 | 0.0011 | 0.0002 | 23 | 0.03 | 0.07 | 23 |
| Willey#1 | Sutter | Diesel | 2000 | 168 | 2,250 | 3% | 392 | 946 | n/a | 8,917 | 91 | 0.0037 | 0.0007 | 91 | 0.09 | 0.22 | 91 |
| Willey#2 | Sutter | Diesel | unknown | 250 | 3,000 | 3% | 523 | 946 | n/a | 13,270 | 135 | 0.0055 | 0.0011 | 135 | 0.14 | 0.33 | 136 |
| Willey#3 | Sutter | Electric | unknown | 75 | 3,000 | 3% | 523 | 946 | 52,956 | n/a | 5 | 0.0008 | 0.0001 | 5 | 0.02 | 0.03 | 5 |
| Willey#4 | Sutter | Diesel | 1974 | 150 | 2,000 | 2% | 348 | 946 | n/a | 7,962 | 81 | 0.0033 | 0.0007 | 81 | 0.08 | 0.20 | 82 |
| Will-Lee Well#30 | Sutter | Diesel | 2000 | 100 | 2,500 | 3% | 436 | 946 | n/a | 5,308 | 54 | 0.0022 | 0.0004 | 54 | 0.05 | 0.13 | 54 |
| Will-Lee Well#31 | Sutter | Electric | unknown | 50 | 2,500 | 3% | 436 | 946 | 35,304 | n/a | 3 | 0.0005 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| Will-Lee Well#32 | Sutter | Electric | unknown | 300 | 2,500 | 3% | 436 | 946 | 211,823 | n/a | 20 | 0.0032 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| Will-Lee Well#33 | Sutter | Electric | unknown | 75 | 2,500 | 3% | 436 | 946 | 52,956 | n/a | 5 | 0.0008 | 0.0001 | 5 | 0.02 | 0.03 | 5 |
| Will-Lee Well#4A | Sutter | Diesel | 2000 | 160 | 1,500 | 2% | 261 | 946 | n/a | 8,493 | 87 | 0.0035 | 0.0007 | 87 | 0.09 | 0.21 | 87 |
| | | | | **Total** | **86,100** | **100%** | **15,000** | **33,115** | **1,600,038** | **n/a** | **1,161** | **0.0651** | **0.0111** | **1,161** | **1.63** | **3.32** | **1,166** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 bhp-hr = | 2,542.5 | Btu |
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Princeton-Codora-Glenn Irrigation District
Transfer Volume 6,600 acre-feet/year

**Table F-22. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 7 | 3 | 0 | 0 | 10 |
| Colusa | 2 | 1 | 0 | 0 | 3 |
| Total | 9 | 4 | 0 | 0 | 13 |

**Table F-23. Princeton-Codora-Glenn Irrigation District GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | GHG Emissions (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Joel Mann | Glenn | Diesel | unknown | 180 | 3,500 | 9% | 585 | 907 | n/a | 9,163 | 94 | 0.0038 | 0.0008 | 94 | 0.09 | 0.23 | 94 |
| D.Withrow | Glenn | Diesel | unknown | 180 | 1,000 | 3% | 167 | 907 | n/a | 9,163 | 94 | 0.0038 | 0.0008 | 94 | 0.09 | 0.23 | 94 |
| Chrisman | Glenn | Diesel | unknown | 180 | 2,000 | 5% | 334 | 907 | n/a | 9,163 | 94 | 0.0038 | 0.0008 | 94 | 0.09 | 0.23 | 94 |
| D.Schmidt | Glenn | Diesel | 2013 | 180 | 3,000 | 8% | 501 | 907 | n/a | 9,163 | 94 | 0.0038 | 0.0008 | 94 | 0.09 | 0.23 | 94 |
| Argo B | Glenn | Diesel | unknown | 200 | 3,000 | 8% | 501 | 907 | n/a | 10,182 | 104 | 0.0042 | 0.0008 | 104 | 0.11 | 0.25 | 104 |
| Argo C | Glenn | Diesel | unknown | 200 | 3,000 | 8% | 501 | 907 | n/a | 10,182 | 104 | 0.0042 | 0.0008 | 104 | 0.11 | 0.25 | 104 |
| F. Gomes | Colusa | Diesel | unknown | 180 | 2,500 | 6% | 418 | 907 | n/a | 9,163 | 94 | 0.0038 | 0.0008 | 94 | 0.09 | 0.23 | 94 |
| Jones Well | Glenn | Electric | 2012 | 200 | 3,500 | 9% | 585 | 907 | 135,438 | n/a | 13 | 0.0020 | 0.0002 | 13 | 0.05 | 0.07 | 13 |
| M. Cota | Colusa | Diesel | unknown | 180 | 3,000 | 8% | 501 | 907 | n/a | 9,163 | 94 | 0.0038 | 0.0008 | 94 | 0.09 | 0.23 | 94 |
| Zoller A | Glenn | Diesel | unknown | 180 | 3,000 | 8% | 501 | 907 | n/a | 9,163 | 94 | 0.0038 | 0.0008 | 94 | 0.09 | 0.23 | 94 |
| Clark #1 | Glenn | Electric | unknown | 200 | 4,000 | 10% | 668 | 907 | 135,438 | n/a | 13 | 0.0020 | 0.0002 | 13 | 0.05 | 0.07 | 13 |
| Clark #2 | Glenn | Electric | unknown | 200 | 4,000 | 10% | 668 | 907 | 135,438 | n/a | 13 | 0.0020 | 0.0002 | 13 | 0.05 | 0.07 | 13 |
| J. Southam | Colusa | Electric | unknown | 200 | 4,000 | 10% | 668 | 907 | 135,438 | n/a | 13 | 0.0020 | 0.0002 | 13 | 0.05 | 0.07 | 13 |
| | | | | **Total** | **39,500** | **100%** | **6,600** | **11,797** | **541,751** | **84,507** | **915** | **0.0431** | **0.0080** | **915** | **1.08** | **2.38** | **918** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Provident Irrigation District
Transfer Volume 10,000 acre-feet/year

**Table F-24. Provident Irrigation District Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 13 | 3 | 0 | 0 | 16 |
| Colusa | 0 | 0 | 0 | 0 | 0 |
| Total | 13 | 3 | 0 | 0 | 16 |

**Table F-25. Provident Irrigation District GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weller62V | Glenn | Diesel | unknown | 200 | 2,000 | 4% | 400 | 1,086 | n/a | 12,187 | 124 | 0.0050 | 0.0010 | 124 | 0.13 | 0.30 | 125 |
| L Hansen#1 | Glenn | Diesel | unknown | 200 | 3,800 | 8% | 760 | 1,086 | n/a | 12,187 | 124 | 0.0050 | 0.0010 | 124 | 0.13 | 0.30 | 125 |
| L Hansen#2 | Glenn | Diesel | unknown | 200 | 4,500 | 9% | 900 | 1,086 | n/a | 12,187 | 124 | 0.0050 | 0.0010 | 124 | 0.13 | 0.30 | 125 |
| K Hansen#1 | Glenn | Diesel | unknown | 200 | 2,600 | 5% | 520 | 1,086 | n/a | 12,187 | 124 | 0.0050 | 0.0010 | 124 | 0.13 | 0.30 | 125 |
| K Hansen#2 | Glenn | Electric | unknown | 120 | 3,500 | 7% | 700 | 1,086 | 97,269 | n/a | 9 | 0.0015 | 0.0002 | 9 | 0.04 | 0.05 | 9 |
| E Weller | Glenn | Diesel | unknown | 200 | 2,500 | 5% | 500 | 1,086 | n/a | 12,187 | 124 | 0.0050 | 0.0010 | 124 | 0.13 | 0.30 | 125 |
| Weller#4 | Glenn | Electric | unknown | 120 | 3,500 | 7% | 700 | 1,086 | 97,269 | n/a | 9 | 0.0015 | 0.0002 | 9 | 0.04 | 0.05 | 9 |
| Calvert | Glenn | Diesel | unknown | 150 | 3,000 | 6% | 600 | 1,086 | n/a | 9,140 | 93 | 0.0038 | 0.0008 | 93 | 0.09 | 0.23 | 94 |
| D. Alves | Glenn | Diesel | unknown | 165 | 3,000 | 6% | 600 | 1,086 | n/a | 10,054 | 103 | 0.0042 | 0.0008 | 103 | 0.10 | 0.25 | 103 |
| D. Kennedy | Glenn | Electric | unknown | 120 | 3,000 | 6% | 600 | 1,086 | 97,269 | n/a | 9 | 0.0015 | 0.0002 | 9 | 0.04 | 0.05 | 9 |
| G. Clark #1 | Glenn | Diesel | unknown | 200 | 3,000 | 6% | 600 | 1,086 | n/a | 12,187 | 124 | 0.0050 | 0.0010 | 124 | 0.13 | 0.30 | 125 |
| M. Jones #1 | Glenn | Diesel | unknown | 275 | 3,000 | 6% | 600 | 1,086 | n/a | 16,757 | 171 | 0.0069 | 0.0014 | 171 | 0.17 | 0.41 | 172 |
| M. Jones #2 | Glenn | Diesel | unknown | 250 | 3,000 | 6% | 600 | 1,086 | n/a | 15,234 | 156 | 0.0063 | 0.0013 | 156 | 0.16 | 0.38 | 156 |
| Perez and Perez | Glenn | Diesel | unknown | 200 | 3,200 | 6% | 640 | 1,086 | n/a | 12,187 | 124 | 0.0050 | 0.0010 | 124 | 0.13 | 0.30 | 125 |
| S. Jones #1 | Glenn | Diesel | unknown | 170 | 3,200 | 6% | 640 | 1,086 | n/a | 10,359 | 106 | 0.0043 | 0.0009 | 106 | 0.11 | 0.26 | 106 |
| S. Jones #2 | Glenn | Diesel | unknown | 170 | 3,200 | 6% | 640 | 1,086 | n/a | 10,359 | 106 | 0.0043 | 0.0009 | 106 | 0.11 | 0.26 | 106 |
| | | | | **Total** | **50,000** | **100%** | **10,000** | **17,379** | **291,807** | **157,213** | **1,633** | **0.0695** | **0.0135** | **1,633** | **1.74** | **4.04** | **1,639** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Reclamation District 108
Transfer Volume 15,000 acre-feet/year

### Table F-26. Reclamation District 108 Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 3 | 0 | 0 | 3 |
| Yolo | 0 | 2 | 0 | 0 | 2 |
| Total | 0 | 5 | 0 | 0 | 5 |

### Table F-27. Reclamation District 108 GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well #4 Huff | Colusa | Electric | unknown | 250 | 4,000 | 21% | 3,141 | 4,265 | 795,721 | n/a | 76 | 0.0119 | 0.0014 | 76 | 0.30 | 0.43 | 77 |
| Well #5 RiggsRanch | Colusa | Electric | unknown | 150 | 1,700 | 9% | 1,335 | 4,265 | 477,433 | n/a | 46 | 0.0071 | 0.0009 | 46 | 0.18 | 0.26 | 46 |
| Well #6 CountyLine | Yolo | Electric | unknown | 250 | 5,900 | 31% | 4,634 | 4,265 | 795,721 | n/a | 76 | 0.0119 | 0.0014 | 76 | 0.30 | 0.43 | 77 |
| Well#1 Heidrick | Colusa | Electric | unknown | 100 | 3,500 | 18% | 2,749 | 4,265 | 318,288 | n/a | 30 | 0.0048 | 0.0006 | 30 | 0.12 | 0.17 | 31 |
| Well#7 Tract 6 | Yolo | Electric | unknown | 250 | 4,000 | 21% | 3,141 | 4,265 | 795,721 | n/a | 76 | 0.0119 | 0.0014 | 76 | 0.30 | 0.43 | 77 |
| | | | | **Total** | **19,100** | **100%** | **15,000** | **21,325** | **3,182,885** | **0** | **304** | **0.0476** | **0.0058** | **304** | **1.19** | **1.72** | **307** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

### Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

| | |
|---|---|
| Agency | Reclamation District 1004 |
| Transfer Volume | 7,175 acre-feet/year |

**Table F-28. Reclamation District 1004 Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Glenn | 1 | 5 | 0 | 0 | 6 |
| Colusa | 17 | 5 | 0 | 0 | 22 |
| Sutter | 0 | 0 | 0 | 0 | 0 |
| Total | 18 | 10 | 0 | 0 | 28 |

**Table F-29. Reclamation District 1004 GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barale Well | Colusa | Diesel | TBD | 225 | 4,000 | 4% | 313 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Behring Ranch 10 Field Well No. 496441 | Colusa | Diesel | 2008 | 225 | 5,800 | 6% | 453 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Behring Ranch Club House Well No.496461 | Colusa | Electric | unknown | 125 | 3,400 | 4% | 266 | 424 | 39,596 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| Behring Ranch Nursery Well No. 17N1W10H1 | Colusa | Diesel | TBD | 225 | 1,000 | 1% | 78 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Behring Ranch Pearl Well No. 20094 | Colusa | Diesel | TBD | 225 | 2,500 | 3% | 195 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Behring Ranch West Well No.97863 | Colusa | Electric | unknown | 125 | 2,300 | 3% | 180 | 424 | 39,596 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| Drumheller Well No.7 | Colusa | Diesel | TBD | 225 | 4,000 | 4% | 313 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| East Morgan Well #1 No. 374667 17N01W14N001M | Colusa | Diesel | TBD | 225 | 2,600 | 3% | 203 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| East Morgan Well#2 No. 498195 17N01W15Q001M | Colusa | Diesel | TBD | 225 | 1,300 | 1% | 102 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Gardener No. 374672 | Colusa | Diesel | 2008 | 215 | 3,500 | 4% | 274 | 424 | n/a | 5,120 | 52 | 0.0021 | 0.0004 | 52 | 0.05 | 0.13 | 52 |
| Gardener No. 498178 | Colusa | Diesel | 2009 | 215 | 3,500 | 4% | 274 | 424 | n/a | 5,120 | 52 | 0.0021 | 0.0004 | 52 | 0.05 | 0.13 | 52 |
| Hall Well No. X | Glenn | Electric | TBD | 125 | 4,500 | 5% | 352 | 424 | 39,596 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| Hall Well No.369428 | Glenn | Electric | 2011 | 125 | 4,500 | 5% | 352 | 424 | 39,596 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| Mohammad No.e0084085 17N01W02D001M | Colusa | Electric | TBD | 125 | 4,500 | 5% | 352 | 424 | 39,596 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| Myers Well #1 No.3457 | Glenn | Electric | 2006 | 40 | 2,200 | 2% | 172 | 424 | 12,671 | n/a | 1 | 0.0002 | 0.0000 | 1 | 0.00 | 0.01 | 1 |
| Myers Well #2 No. 340884 | Glenn | Electric | 1982 | 100 | 4,100 | 4% | 320 | 424 | 31,677 | n/a | 3 | 0.0005 | 0.0001 | 3 | 0.01 | 0.02 | 3 |
| Rancho Caleta No. 726883 | Colusa | Diesel | 2004 | 170 | 4,500 | 5% | 352 | 424 | n/a | 4,048 | 41 | 0.0017 | 0.0003 | 41 | 0.04 | 0.10 | 41 |
| Sikes & Parachini Well #1 WS No.93124 | Colusa | Diesel | 2006 | 173 | 4,000 | 4% | 313 | 424 | n/a | 4,120 | 42 | 0.0017 | 0.0003 | 42 | 0.04 | 0.10 | 42 |
| Sikes & Parachini Well #2 WS No. 374682 | Colusa | Diesel | 2008 | 150 | 4,000 | 4% | 313 | 424 | n/a | 3,572 | 36 | 0.0015 | 0.0003 | 36 | 0.04 | 0.09 | 37 |
| Southam Sartain Well 18N01W26D001M | Glenn | Diesel | TBD | 225 | 4,800 | 5% | 375 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Stone Well #6 No.11334 | Colusa | Electric | 2006 | 40 | 1,800 | 2% | 141 | 424 | 12,671 | n/a | 1 | 0.0002 | 0.0000 | 1 | 0.00 | 0.01 | 1 |
| Wilder Farms Well | Glenn | Electric | unknown | 125 | 2,500 | 3% | 195 | 424 | 39,596 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| Dan Charter Well#1 | Colusa | Diesel | unknown | 225 | 2,500 | 3% | 195 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Dan Charter Well#2 | Colusa | Diesel | unknown | 225 | 2,500 | 3% | 195 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| GVL Well#1 | Colusa | Diesel | unknown | 225 | 2,500 | 3% | 195 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| Behring Ranch Well | Colusa | Electric | unknown | 125 | 4,000 | 4% | 313 | 424 | 39,596 | n/a | 4 | 0.0006 | 0.0001 | 4 | 0.01 | 0.02 | 4 |
| Claudia Charter | Colusa | Diesel | unknown | 225 | 2,500 | 3% | 195 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| GVL Well#2 | Colusa | Diesel | unknown | 225 | 2,500 | 3% | 195 | 424 | n/a | 5,358 | 55 | 0.0022 | 0.0004 | 55 | 0.06 | 0.13 | 55 |
| | | | | **Total** | **91,800** | **100%** | **7,175** | **11,885** | **334,191** | **91,633** | **967** | **0.0429** | **0.0082** | **967** | **1.07** | **2.44** | **971** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | |
|---|---|
| 1 lb = | 453.6 g |
| 1 tonne = | 1,000 kg |
| 1 tonne = | 1,000,000 g |
| 1 MWh = | 1,000 kWh |
| 1 GWh = | 1,000,000 kWh |
| 1 kW = | 1.34 hp |
| 1 hour = | 60 minutes |
| 1 acre-foot = | 325,851 gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | |
|---|---|
| 0.4 lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 lb/gal | |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency River Garden Farms
Transfer Volume 10,000 acre-feet/year

**Table F-30. River Garden Farms Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Yolo | 0 | 8 | 0 | 0 | 8 |
| Total | 0 | 8 | 0 | 0 | 8 |

**Table F-31. River Garden Farms GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Field 65 PW | Yolo | Electric | 2008 | 125 | 2500 | 12% | 1,226 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| Field 71 PW | Yolo | Electric | 2001 | 125 | 1700 | 8% | 834 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| Field 98 PW | Yolo | Electric | 1963 | 125 | 2900 | 14% | 1,422 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| Field 104 PW | Yolo | Electric | 2008 | 125 | 2500 | 12% | 1,226 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| Field 104-09 PW | Yolo | Electric | 2009 | 125 | 2990 | 15% | 1,466 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| Field 91-09 PW | Yolo | Electric | 2009 | 125 | 2840 | 14% | 1,392 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| Field 117 PW | Yolo | Electric | 2009 | 125 | 1965 | 10% | 963 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| Shop PW | Yolo | Electric | 2009 | 125 | 3000 | 15% | 1,471 | 2,663 | 248,399 | n/a | 24 | 0.0037 | 0.0005 | 24 | 0.09 | 0.13 | 24 |
| | | | | **Total** | **20,395** | **100%** | **10,000** | **21,303** | **1,987,190** | **0** | **190** | **0.0297** | **0.0036** | **190** | **0.74** | **1.07** | **192** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
- (light blue) Information on engine not available; engine assumed to be electric based on other engines used by water agency.
- (light green) Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Sutter Mutual Water Company
Transfer Volume 18,000 acre-feet/year

**Table F-32. Sutter Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 8 | 6 | 0 | 6 | 20 |
| Total | 8 | 6 | 0 | 6 | 20 |

**Table F-33. Sutter Mutual Water Company GHG Emissions**

| | Well Location | | | Power Rating | Pump Rate | | Transfer Volume | Operation | | Fuel Consumption | GHG Emissions (tonnes per year) | | | GHG Emissions (MTCO2e per year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well | (County) | Fuel Type | Model Year | (hp) | (gpm) | (% of Total) | (AF/year) | (hours/year) | (kWh/yr) | (gal/yr) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Van Ruiten Well | Sutter | Electric | unknown | 75 | 2,500 | 5% | 897 | 1,948 | 109,013 | n/a | 10 | 0.0016 | 0.0002 | 10 | 0.04 | 0.06 | 11 |
| Frank Giusti | Sutter | Propane | 2015 | 150 | 2,501 | 5% | 897 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Matteoli | Sutter | Diesel | 2014 | 150 | 2,502 | 5% | 897 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| L&N Farms | Sutter | Electric | unknown | 250 | 2,503 | 5% | 898 | 1,948 | 363,378 | n/a | 35 | 0.0054 | 0.0007 | 35 | 0.14 | 0.20 | 35 |
| Well #1 | Sutter | Electric | unknown | 150 | 2,504 | 5% | 898 | 1,948 | 218,027 | n/a | 21 | 0.0033 | 0.0004 | 21 | 0.08 | 0.12 | 21 |
| Well #2 | Sutter | Electric | unknown | 150 | 2,505 | 5% | 898 | 1,948 | 218,027 | n/a | 21 | 0.0033 | 0.0004 | 21 | 0.08 | 0.12 | 21 |
| Well #3 | Sutter | Propane | unknown | 150 | 2,506 | 5% | 899 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #4 | Sutter | Propane | unknown | 150 | 2,507 | 5% | 899 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #5 | Sutter | Diesel | unknown | 150 | 2,508 | 5% | 899 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #6 | Sutter | Diesel | unknown | 150 | 2,509 | 5% | 900 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #7 | Sutter | Diesel | unknown | 150 | 2,510 | 5% | 900 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #8 | Sutter | Diesel | unknown | 150 | 2,511 | 5% | 901 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #9 | Sutter | Electric | unknown | 150 | 2,512 | 5% | 901 | 1,948 | 218,027 | n/a | 21 | 0.0033 | 0.0004 | 21 | 0.08 | 0.12 | 21 |
| Well #10 | Sutter | Electric | unknown | 150 | 2,513 | 5% | 901 | 1,948 | 218,027 | n/a | 21 | 0.0033 | 0.0004 | 21 | 0.08 | 0.12 | 21 |
| Well #11 | Sutter | Propane | unknown | 150 | 2,514 | 5% | 902 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #12 | Sutter | Propane | unknown | 150 | 2,515 | 5% | 902 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #13 | Sutter | Propane | unknown | 150 | 2,516 | 5% | 902 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #14 | Sutter | Diesel | unknown | 150 | 2,517 | 5% | 903 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #15 | Sutter | Diesel | unknown | 150 | 2,518 | 5% | 903 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| Well #16 | Sutter | Diesel | unknown | 150 | 2,519 | 5% | 903 | 1,948 | n/a | 16,390 | 0 | 0.0000 | 0.0000 | 0 | 0.00 | 0.00 | 0 |
| | | | | **Total** | **50,190** | **100%** | **18,000** | **38,954** | **1,344,498** | **229,463** | **129** | **0.0201** | **0.0024** | **129** | **0.50** | **0.73** | **130** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential
CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Sycamore Mutual Water Company
Transfer Volume 8,000 acre-feet/year

**Table F-34. Sycamore Mutual Water Company Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 5 | 0 | 0 | 5 |
| Total | 0 | 5 | 0 | 0 | 5 |

**Table F-35. Sycamore Mutual Water Company GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well #15 | Colusa | Electric | unknown | 125 | 3,270 | 15% | 1,183 | 1,966 | 183,356 | n/a | 18 | 0.0027 | 0.0003 | 18 | 0.07 | 0.10 | 18 |
| Well #14 | Colusa | Electric | unknown | 125 | 3,270 | 15% | 1,183 | 1,966 | 183,356 | n/a | 18 | 0.0027 | 0.0003 | 18 | 0.07 | 0.10 | 18 |
| Well #11 | Colusa | Electric | unknown | 125 | 6,409 | 29% | 2,320 | 1,966 | 183,356 | n/a | 18 | 0.0027 | 0.0003 | 18 | 0.07 | 0.10 | 18 |
| Well #2b | Colusa | Electric | unknown | 125 | 4,578 | 21% | 1,657 | 1,966 | 183,356 | n/a | 18 | 0.0027 | 0.0003 | 18 | 0.07 | 0.10 | 18 |
| Well #2a | Colusa | Electric | unknown | 125 | 4,578 | 21% | 1,657 | 1,966 | 183,356 | n/a | 18 | 0.0027 | 0.0003 | 18 | 0.07 | 0.10 | 18 |
| | | | | **Total** | **22,104** | **100%** | **8,000** | **9,828** | **916,778** | **0** | **88** | **0.0137** | **0.0017** | **88** | **0.34** | **0.50** | **88** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
(shaded) Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency T&P Farms
Transfer Volume 1,200 acre-feet/year

### Table F-36. T&P Farms Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Colusa | 0 | 2 | 0 | 0 | 2 |
| Total | 0 | 2 | 0 | 0 | 2 |

### Table F-37. T&P Farms GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | GHG Emissions (tonnes per year) CH4 | GHG Emissions (tonnes per year) N2O | GHG Emissions (MTCO2e per year) CO2 | GHG Emissions (MTCO2e per year) CH4 | GHG Emissions (MTCO2e per year) N2O | GHG Emissions (MTCO2e per year) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NW-3 | Colusa | Electric | unknown | 125 | 3,500 | 47% | 560 | 869 | 81,057 | n/a | 8 | 0.0012 | 0.0001 | 8 | 0.03 | 0.04 | 8 |
| NW-4 | Colusa | Electric | unknown | 125 | 4,000 | 53% | 640 | 869 | 81,057 | n/a | 8 | 0.0012 | 0.0001 | 8 | 0.03 | 0.04 | 8 |
| | | | | **Total** | **7,500** | **100%** | **1,200** | **1,738** | **162,115** | **0** | **15** | **0.0024** | **0.0003** | **15** | **0.06** | **0.09** | **16** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Te Velde Revocable Family Trust
Transfer Volume 7,094 acre-feet/year

**Table F-38. Te Velde Revocable Family Trust Summary of Engines by Fuel Type and Location**

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Yolo | 0 | 5 | 0 | 0 | 5 |
| Total | 0 | 5 | 0 | 0 | 5 |

**Table F-39. Te Velde Revocable Family Trust GHG Emissions**

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | GHG Emissions (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GW1 | Yolo | Electric | unknown | 127 | 4,656 | 29% | 2,090 | 2,438 | 231,042 | n/a | 22 | 0.0035 | 0.0004 | 22 | 0.09 | 0.12 | 22 |
| GW10 | Yolo | Electric | unknown | 143 | 2,833 | 18% | 1,272 | 2,438 | 260,150 | n/a | 25 | 0.0039 | 0.0005 | 25 | 0.10 | 0.14 | 25 |
| GW9 | Yolo | Electric | unknown | 104 | 2,400 | 15% | 1,077 | 2,438 | 189,200 | n/a | 18 | 0.0028 | 0.0003 | 18 | 0.07 | 0.10 | 18 |
| GW3 | Yolo | Electric | unknown | 52 | 3,715 | 24% | 1,668 | 2,438 | 94,600 | n/a | 9 | 0.0014 | 0.0002 | 9 | 0.04 | 0.05 | 9 |
| GW4 | Yolo | Electric | unknown | 125 | 2,200 | 14% | 988 | 2,438 | 227,404 | n/a | 22 | 0.0034 | 0.0004 | 22 | 0.09 | 0.12 | 22 |
| | | | | **Total** | **15,804** | **100%** | **7,094** | **12,189** | **1,002,395** | **0** | **96** | **0.0150** | **0.0018** | **96** | **0.38** | **0.54** | **97** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

## Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Windswept Land & Livestock
Transfer Volume 2,000 acre-feet/year

### Table F-40. Windswept Land & Livestock Summary of Engines by Fuel Type and Location

| County | Diesel | Electric | Natural Gas | Propane | Total |
|---|---|---|---|---|---|
| Sutter | 0 | 3 | 0 | 0 | 3 |
| Total | 0 | 3 | 0 | 0 | 3 |

### Table F-41. Windswept Land & Livestock GHG Emissions

| Well | Well Location (County) | Fuel Type | Model Year | Power Rating (hp) | Pump Rate (gpm) | Pump Rate (% of Total) | Transfer Volume (AF/year) | Operation (hours/year) | Operation (kWh/yr) | Fuel Consumption (gal/yr) | GHG Emissions (tonnes per year) CO2 | CH4 | N2O | GHG Emissions (MTCO2e per year) CO2 | CH4 | N2O | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag Well #1 | Sutter | Electric | 2013 | 200 | 3,200 | 42% | 831 | 1,411 | 210,539 | n/a | 20 | 0.0032 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| Ag Well #3 | Sutter | Electric | unknown | 200 | 2,500 | 32% | 649 | 1,411 | 210,539 | n/a | 20 | 0.0032 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| Ag Well #4 | Sutter | Electric | unknown | 200 | 2,000 | 26% | 519 | 1,411 | 210,539 | n/a | 20 | 0.0032 | 0.0004 | 20 | 0.08 | 0.11 | 20 |
| | | | | **Total** | **7,700** | **100%** | **2,000** | **4,232** | **631,617** | **0** | **60** | **0.0095** | **0.0011** | **60** | **0.24** | **0.34** | **61** |

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
[shaded cell] Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

| | | |
|---|---|---|
| 1 lb = | 453.6 | g |
| 1 tonne = | 1,000 | kg |
| 1 tonne = | 1,000,000 | g |
| 1 MWh = | 1,000 | kWh |
| 1 GWh = | 1,000,000 | kWh |
| 1 kW = | 1.34 | hp |
| 1 hour = | 60 | minutes |
| 1 acre-foot = | 325,851 | gallons |

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

| | |
|---|---|
| CO2 | 1 |
| CH4 | 25 |
| N2O | 298 |

Diesel Engine Fuel Consumption

| | | |
|---|---|---|
| 0.4 | lb/hp-hr | *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)* |
| 0.855 | g/mL | *(Based on MSDS for Hess Diesel Fuel All Types)* |
| 7.13 | lb/gal | |

## Engine Size Summary

**Table F-42. Engine Power Rating Summary by Fuel Type**

| Fuel Type | No. Engines | Avg. HP | Max HP | Min HP |
|---|---|---|---|---|
| Diesel | 23 | 170 | 250 | 60 |
| Electric | 47 | 125 | 300 | 30 |
| Natural Gas | 0 | n/a | 0 | 0 |
| Propane | 3 | 180 | 250 | 135 |

## GHG Emission Factors

### Table F-43. GHG Emission Factors for Electric Pumps

| County | Utility Company | Emission Factors | | |
|---|---|---|---|---|
| | | CO2 (lbs/MWh) | CH4 (lbs/GWh) | N2O (lbs/GWh) |
| Colusa | Pacific Gas & Electric | 210.44 | 33.0 | 4.0 |
| Glenn | Pacific Gas & Electric | 210.44 | 33.0 | 4.0 |
| Sacramento | Sacramento Municipal Utility District | 383.6 | 33.0 | 4.0 |
| Shasta | Pacific Gas & Electric | 210.44 | 33.0 | 4.0 |
| Sutter | Pacific Gas & Electric | 210.44 | 33.0 | 4.0 |
| Tehama | Pacific Gas & Electric | 210.44 | 33.0 | 4.0 |
| Yolo | Pacific Gas & Electric | 210.44 | 33.0 | 4.0 |

### Table F-44. Utility-Specific CO2 Emission Factors

| 2017 Emission Rates | | |
|---|---|---|
| Utility | Factor Type | Emission Factor (lbs $CO_2$/MWh) |
| Sacramento Municipal Utility District | Retail Power | 383.60 |
| | Special Power | 0.00 |
| | Wholesale Power | 645.95 |
| Pacific Gas & Electric | System average | 210.44 |

*Source:*

*The Climate Registry. 2019. Utility-Specific Emission Factors. Accessed on: December 12, 2019. Available at: https://www.theclimateregistry.org/our-members/cris-public-reports/*

### Table F-45. Diesel Emission Factors

| Pollutant | Emission Factor | Unit | Emission Factor Description |
|---|---|---|---|
| CO2 | 10.21 | kg/gallon | Table 1.1, Distillate Fuel Oil No. 2 |
| CH4 | 3.00E-03 | kg/MMBtu | Table 1.9, Petroleum Products, Industrial |
| N2O | 6.00E-04 | kg/MMBtu | Table 1.9, Petroleum Products, Industrial |
| Heat Content | 0.138 | MMBtu/gallon | Table 1.1, Distillate Fuel Oil No. 2 |

*Source: The Climate Registry. 2019. 2019 Climate Registry Default Emission Factors. Accessed on: December 12, 2019. Available at: https://www.theclimateregistry.org/wp-content/uploads/2019/05/The-Climate-Registry-2019-Default-Emission-Factor-Document.pdf*

### Table F-46. Natural Gas Emission Factors

| Pollutant | Emission Factor | Unit | Emission Factor Description |
|---|---|---|---|
| CO2 | 53.06 | kg/MMBtu | Table 12.1, US Weighted Average |
| CH4 | 1.00E-03 | kg/MMBtu | Table 1.9, Natural Gas, Industrial |
| N2O | 1.00E-04 | kg/MMBtu | Table 1.9, Natural Gas, Industrial |
| Heat Content | 1,026 | Btu/scf | Table 12.1, US Weighted Average |

*Source: The Climate Registry. 2019. 2019 Climate Registry Default Emission Factors. Accessed on: December 12, 2019. Available at: https://www.theclimateregistry.org/wp-content/uploads/2019/05/The-Climate-Registry-2019-Default-Emission-Factor-Document.pdf*

### Table F-47. Propane Emission Factors

| Pollutant | Emission Factor | Unit | Emission Factor Description |
|---|---|---|---|
| CO2 | 62.87 | kg/MMBtu | Table 12.1, Propane (liquid) |
| CH4 | 3.00E-03 | kg/MMBtu | Table 1.9, Petroleum Products, Industrial |
| N2O | 6.00E-04 | kg/MMBtu | Table 1.9, Petroleum Products, Industrial |
| Heat Content | 0.091 | MMBtu/gal | Table 12.1, Propane (liquid) |

*Source: The Climate Registry. 2019. 2019 Climate Registry Default Emission Factors. Accessed on: December 12, 2019. Available at: https://www.theclimateregistry.org/wp-content/uploads/2019/05/The-Climate-Registry-2019-Default-Emission-Factor-Document.pdf*

**Table F-48. Year 2012 eGRID Subregion Emissions - Greenhouse Gases**

| eGRID subregion acronym | eGRID subregion name | Carbon dioxide (CO2) | | Methane (CH4) | | Nitrous oxide (N2O) | | Carbon dioxide equivalent (CO2e) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Emissions (tons) | Total output emission rate (lb/MWh) | Emissions (tons) | Total output emission rate (lb/MWh) | Emissions (tons) | Total output emission rate (lb/MWh) | Emissions (tons) | Total output emission rate (lb/MWh) |
| AKGD | ASCC Alaska Grid | | | | | | | | |
| AKMS | ASCC Miscellaneous | | | | | | | | |
| AZNM | WECC Southwest | | | | | | | | |
| CAMX | WECC California | | 527.9 | | 0.033 | | 0.004 | | 529.9 |
| ERCT | ERCOT All | | | | | | | | |
| FRCC | FRCC All | | | | | | | | |
| HIMS | HICC Miscellaneous | | | | | | | | |
| HIOA | HICC Oahu | | | | | | | | |
| MROE | MRO East | | | | | | | | |
| MROW | MRO West | | | | | | | | |
| NEWE | NPCC New England | | | | | | | | |
| NWPP | WECC Northwest | | | | | | | | |
| NYCW | NPCC NYC/Westchester | | | | | | | | |
| NYLI | NPCC Long Island | | | | | | | | |
| NYUP | NPCC Upstate NY | | | | | | | | |
| RFCE | RFC East | | | | | | | | |
| RFCM | RFC Michigan | | | | | | | | |
| RFCW | RFC West | | | | | | | | |
| RMPA | WECC Rockies | | | | | | | | |
| SPNO | SPP North | | | | | | | | |
| SPSO | SPP South | | | | | | | | |
| SRMV | SERC Mississippi Valley | | | | | | | | |
| SRMW | SERC Midwest | | | | | | | | |
| SRSO | SERC South | | | | | | | | |
| SRTV | SERC Tennessee Valley | | | | | | | | |
| SRVC | SERC Virginia/Carolina | | | | | | | | |
| **U.S.** | | | | | | | | | |

*Source: U.S. Environmental Protection Agency. 2018. eGRID2016, Summary Tables. February 15. Available online at: https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf [Accessed on December 12, 2019].*

**Table F-49. Reduced Exhaust Emissions from Cropland Idling**

| Water Agency | Groundwater Substitution | Cropland Idling/ Crop Shifting | GW Pumping Equivalent | Annual Emission (MT/year) | | | Annual Emissions (MTCO2e/year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (acre-feet/year) | (acre-feet/year) | (acre-feet/year) | CO2 | CH4 | N2O | CO2 | CH4 | N2O | Total |
| Anderson-Cottonwood Irrigation District | 4,800 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Baber, Jack et al. | -- | 2,310 | 544 | 234 | 0.014 | 0.0021 | 234 | 0.3 | 0.6 | 235 |
| Canal Farms | 1,000 | 635 | 149 | 64 | 0.0038 | 0.00058 | 64 | 0.1 | 0.2 | 64 |
| Conaway Preservation Group | -- | 21,350 | 5,024 | 2,165 | 0.13 | 0.020 | 2,165 | 3.2 | 5.9 | 2,174 |
| Pelger Road 1700 LLC | 5,200 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Eastside Mutual Water Company | 2,230 | 1,846 | 434 | 187 | 0.011 | 0.0017 | 187 | 0.3 | 0.5 | 188 |
| Guisti Farms | 1,000 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Glenn-Colusa Irrigation District | 11,300 | 33,000 | 7,765 | 3,346 | 0.20 | 0.030 | 3,346 | 5.0 | 9.1 | 3,360 |
| Maxwell Irrigation District | 3,000 | 2,003 | 471 | 203 | 0.012 | 0.0018 | 203 | 0.3 | 0.5 | 204 |
| Natomas Central Mutual Water Company | 20,000 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pelger Mutual Water Company | 4,670 | 2,538 | 597 | 257 | 0.015 | 0.0023 | 257 | 0.4 | 0.7 | 258 |
| Pleasant Grove-Verona Mutual Water Company | 15,000 | 9,000 | 2,118 | 913 | 0.054 | 0.0083 | 913 | 1.4 | 2.5 | 916 |
| Princeton-Codora-Glenn Irrigation District | 6,600 | 6,600 | 1,553 | 669 | 0.040 | 0.0061 | 669 | 1.0 | 1.8 | 672 |
| Provident Irrigation District | 10,000 | 9,900 | 2,329 | 1,003 | 0.060 | 0.009 | 1,003 | 1.5 | 2.7 | 1,008 |
| Reclamation District 108 | 15,000 | 20,000 | 4,706 | 2,028 | 0.12 | 0.018 | 2,028 | 3.0 | 5.5 | 2,036 |
| Reclamation District 1004 | 7,175 | 20,000 | 4,706 | 2,028 | 0.121 | 0.018 | 2,028 | 3.0 | 5.5 | 2,036 |
| River Garden Farms | 10,000 | 10,000 | 2,353 | 1,014 | 0.060 | 0.009 | 1,014 | 1.5 | 2.7 | 1,018 |
| Sutter Mutual Water Company | 18,000 | 18,000 | 4,235 | 1,825 | 0.109 | 0.017 | 1,825 | 2.7 | 4.9 | 1,832 |
| Sycamore Mutual Water Company | 8,000 | 7,000 | 1,647 | 710 | 0.042 | 0.0064 | 710 | 1.1 | 1.9 | 713 |
| T&P Farms | 1,200 | 890 | 209 | 90 | 0.0054 | 0.00082 | 90 | 0.1 | 0.2 | 90 |
| Te Velde Revocable Family Trust | 7,094 | 6,975 | 1,641 | 707 | 0.042 | 0.0064 | 707 | 1.1 | 1.9 | 710 |
| Windswept Land & Livestock | 2,000 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total** | **151,269** | **172,047** | **40,481** | **17,442** | **1.04** | **0.16** | **17,442** | **25.9** | **47.2** | **17,515** |

Notes:
Reclamation District 108 used to estimate emissions for other water agencies.
Engine power rating equal to 140 hp for RD-108 engines.
The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).
RD-108 engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing

*Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."*

# Appendix G

# Giant Garter Snake Important Populations Maps

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# 2020 Tehama-Colusa Canal Authority Water Transfers Initial Study/ Environmental Assessment

## Appendix G: Giant Garter Snake Important Population Maps

# IMPORTANT GIANT GARTER SNAKE POPULATIONS

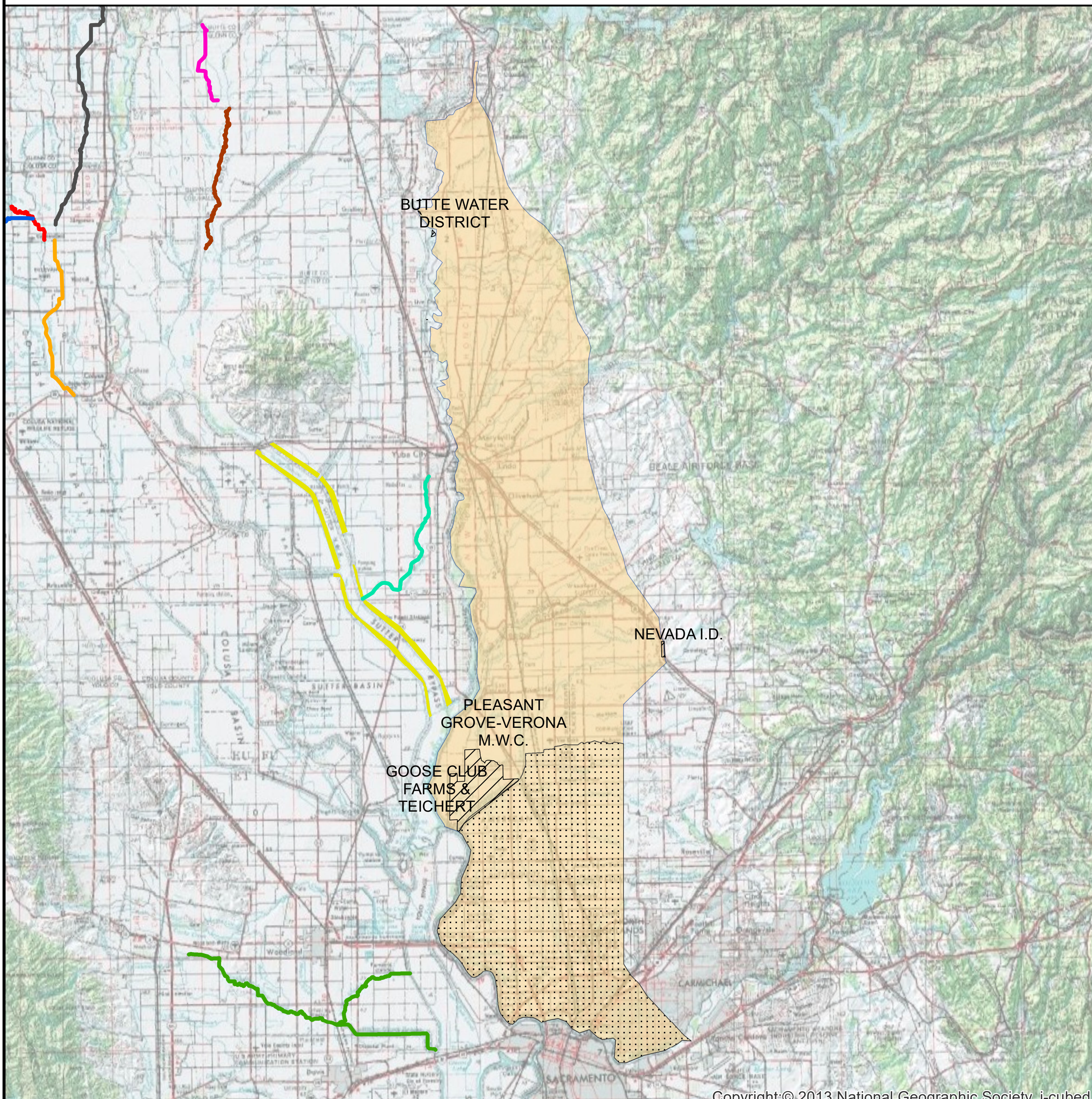
## American Basin Recovery Unit

- Seller Areas in American Basin
- American Basin (376,104 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Logan Creek Selection
- Little Butte Creek
- Natomas Basin
- Sutter Bypass Toe Drain
- Willow Slough & Bypass

| SELLER AREAS IN AMERICAN BASIN (acres) | |
|---|---|
| BUTTE WATER DISTRICT | 55 |
| GOOSE CLUB FARMS & TEICHERT | 4 |
| NEVADA IRRIGATION DISTRICT | 132 |
| PLEASANT-GROVE-VERONA MUTUAL WATER COMPANY | 7429 |

Datum: NAD 1983

0 2.75 5.5 11 Miles



# IMPORTANT GIANT GARTER SNAKE POPULATIONS

## Butte Basin Recovery Unit

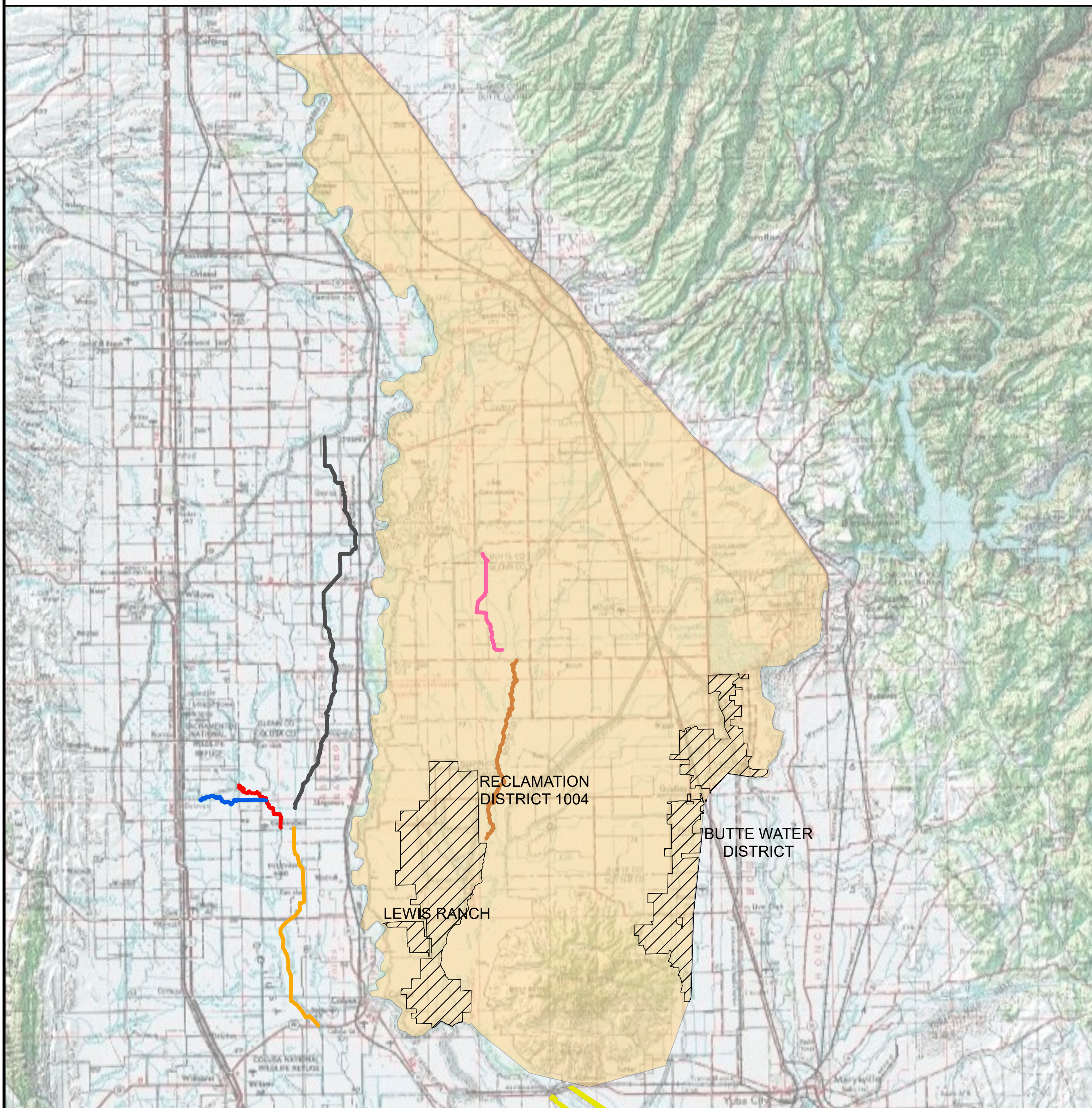
- Seller Areas in Butte Basin
- Butte Basin (479,117 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Willow Slough & Bypass
- Sutter Bypass Toe Drain

| SELLER AREAS IN BUTTE BASIN (acres) | |
|---|---|
| BUTTE WATER DISTRICT | 17656 |
| LEWIS RANCH | 1172 |
| RECLAMATION DISTRICT 1004 | 23159 |

Datum: NAD 1983

0 2.25 4.5 9 Miles

N



# IMPORTANT GIANT GARTER SNAKE POPULATIONS

## Colusa Basin Recovery Unit

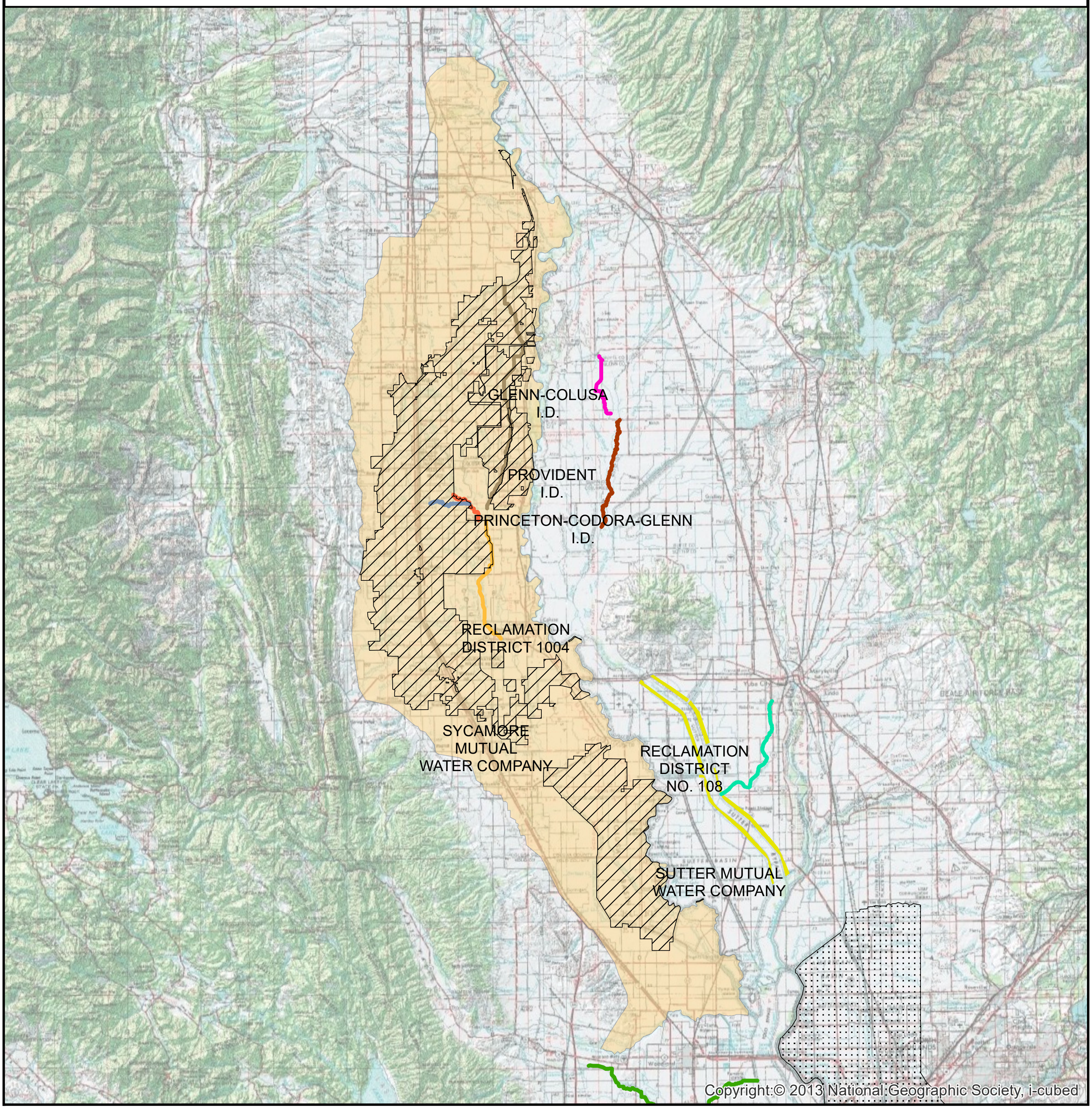
- Seller Areas in Colusa Basin
- Colusa Basin (686,096 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Sutter Bypass Toe Drain
- Willow Slough & Bypass

| SELLER AREAS IN COLUSA BASIN (acres) | |
|---|---|
| GLENN-COLUSA IRRIGATION DISTRICT | 174886 |
| PRINCETON-CORDORA-GLENN IRRIGATION DISTRCIT | 12112 |
| PROVIDENT IRRIGATION DISTRICT | 17019 |
| RECLAMATION DISTRICT 1004 | 54 |
| RECLAMATION DISTRICT 108 | 58821 |
| SUTTER MUTUAL WATER COMPANY | 33 |
| SYCAMORE MUTUAL WATER COMPANY | 8431 |

Datum: NAD 1983

N

0 3.75 7.5 15 Miles



# IMPORTANT GIANT GARTER SNAKE POPULATIONS

## Delta Basin Recovery Unit

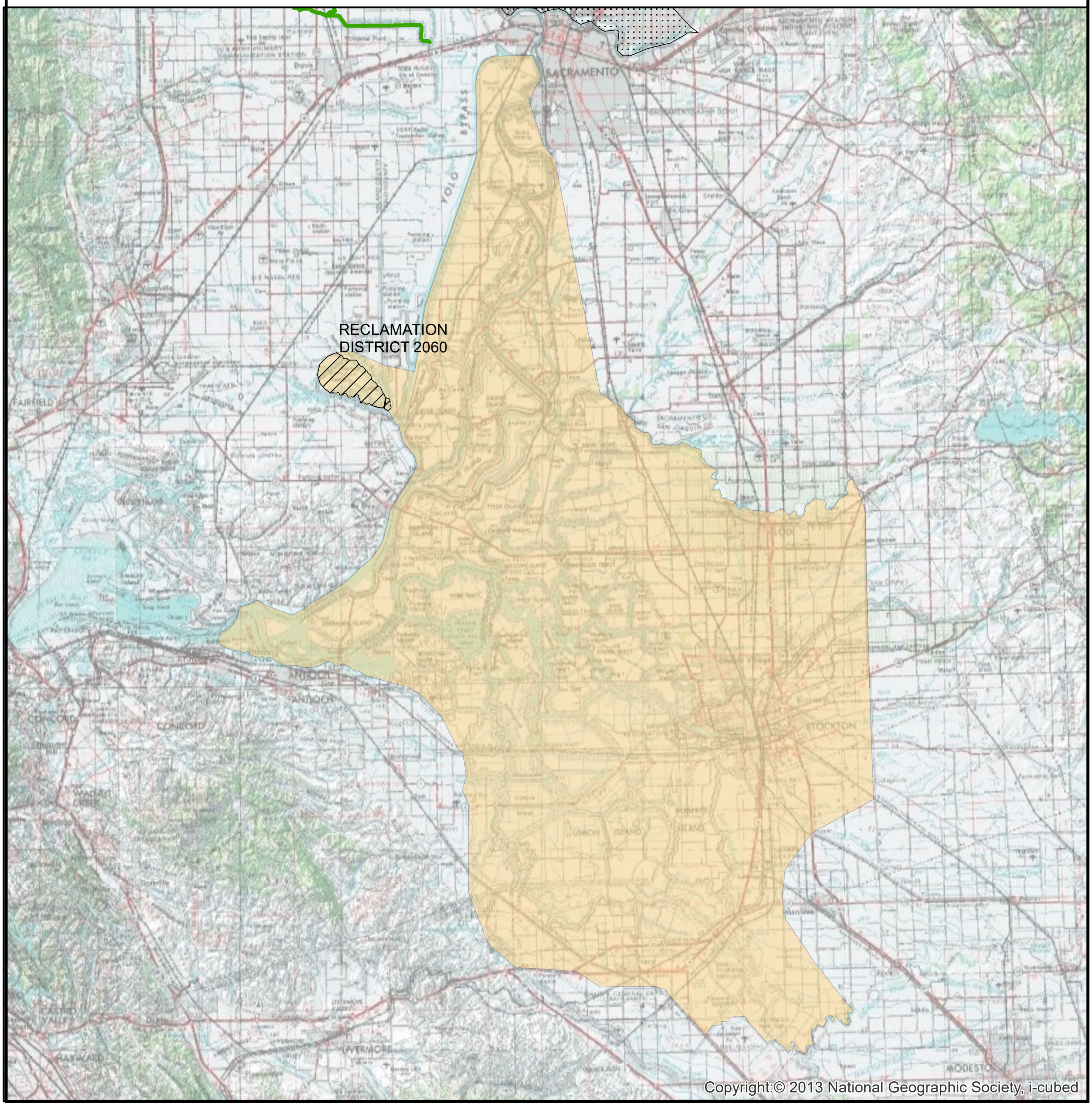
- Seller Areas in Delta Basin
- Delta Basin (786,268 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Willow Slough & Bypass
- Sutter Bypass Toe Drain

| SELLER AREAS IN DELTA BASIN (acres) | |
|---|---|
| RECLAMATION DISTRICT 2060 | 5232 |

N

Datum: NAD 1983

0 2.75 5.5 11 Miles



# IMPORTANT GIANT GARTER SNAKE POPULATIONS

## Sutter Basin Recovery Unit

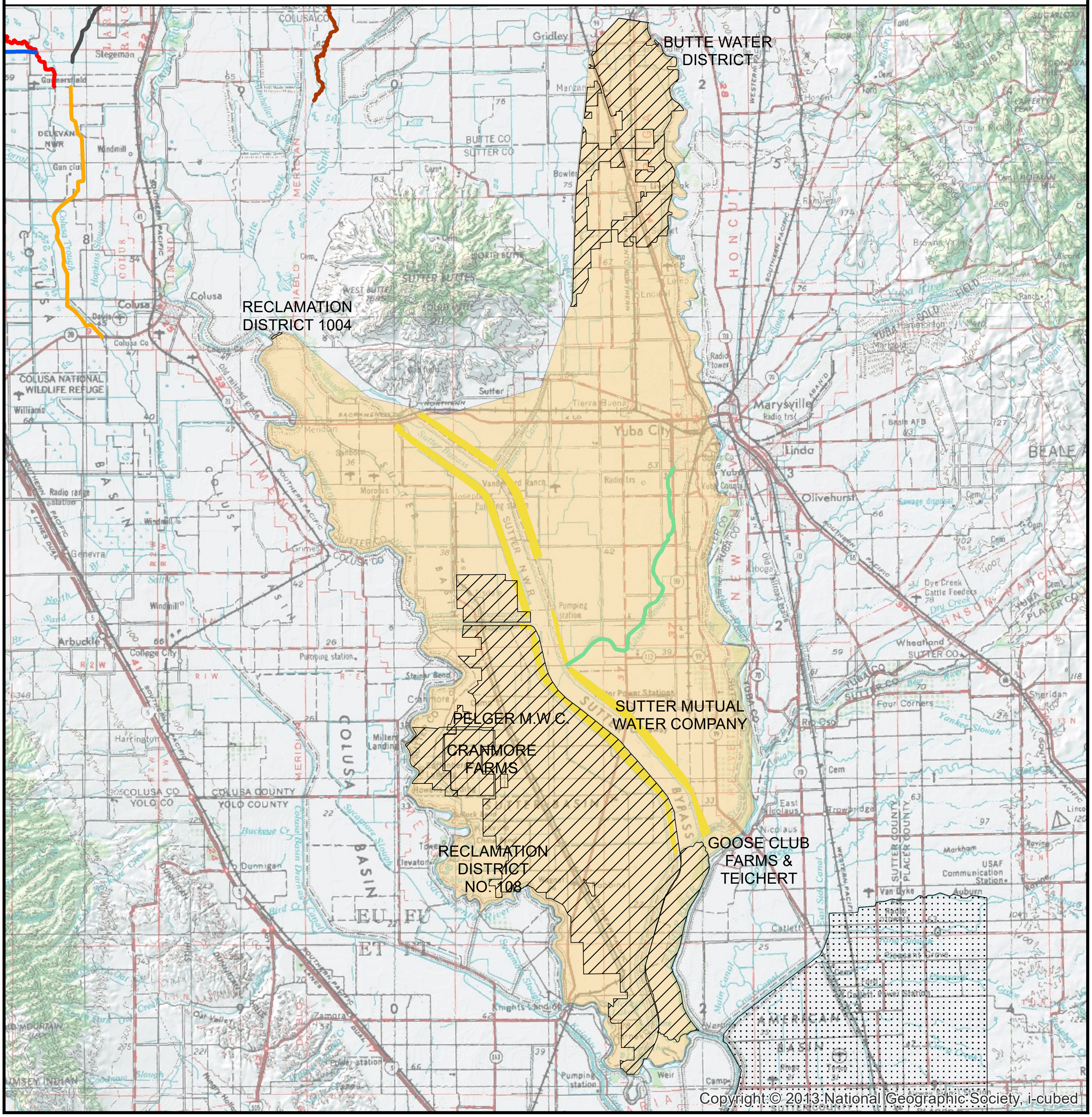
- Seller Areas in Sutter Basin
- Sutter Basin (239,927 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Willow Slough & Bypass
- Sutter Bypass Toe Drain

| SELLER AREAS IN SUTTER BASIN (acres) | |
|---|---|
| BUTTE WATER DISTRICT | 14508 |
| CRANMORE FARMS | 2219 |
| GOOSE CLUB FARMS & TEICHERT | 5724 |
| PELGER MUTUAL WATER COMPANY | 2970 |
| RECLAMATION DISTRICT 1004 | 23 |
| RECLAMATION DISTRICT 108 | 0.02 |
| SUTTER MUTUAL WATER COMPANY | 51085 |

N

Datum: NAD 1983

0 1.75 3.5 7 Miles



# IMPORTANT GIANT GARTER SNAKE POPULATIONS

## Yolo Basin Recovery Unit

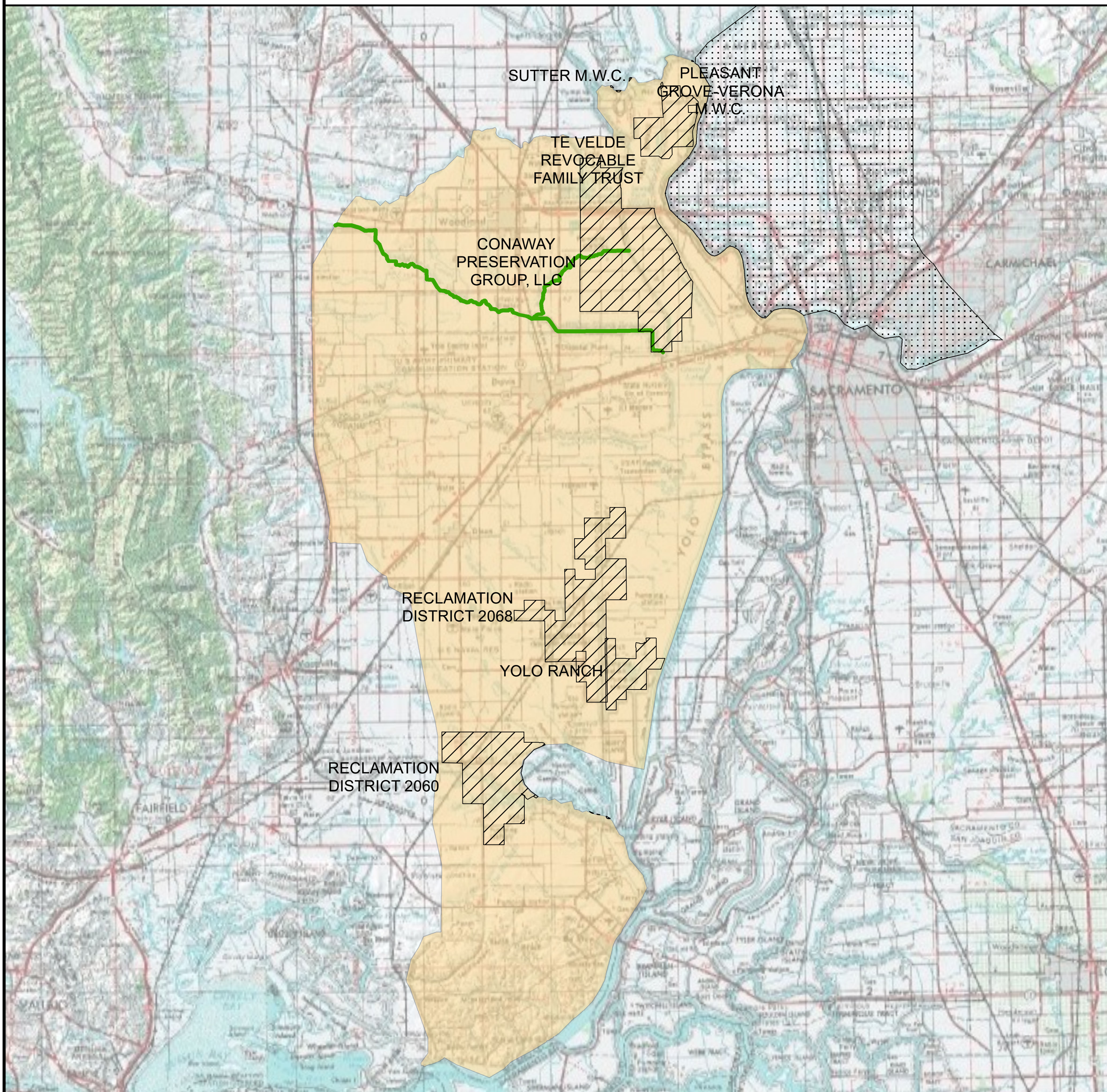
N

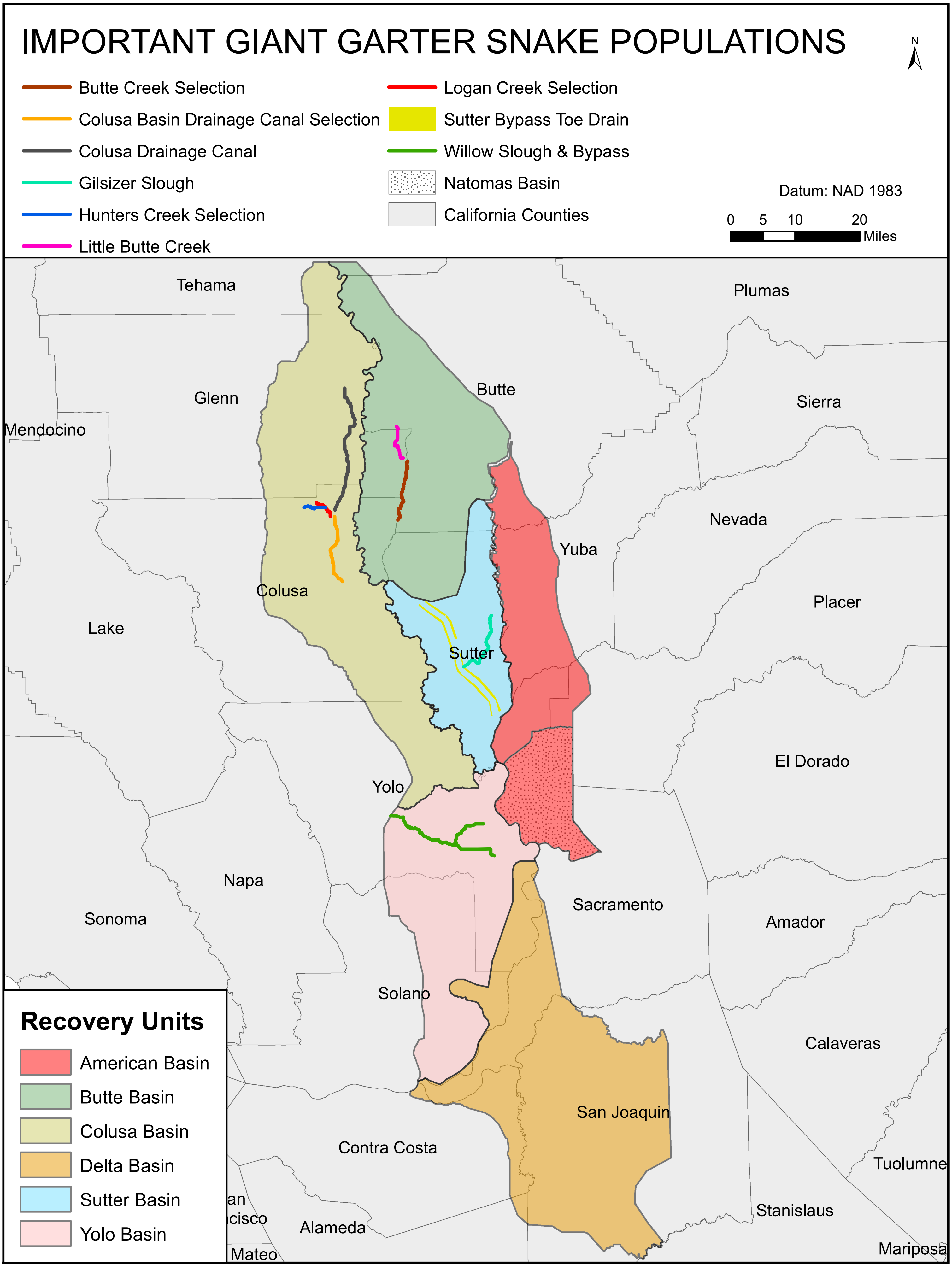
- Seller Areas in Yolo Basin
- Yolo Basin (410,915 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Sutter Bypass Toe Drain
- Willow Slough & Bypass

| SELLER AREAS IN YOLO BASIN (acres) | |
|---|---|
| CONAWAY PRESERVATION GROUP, LLC | 20463 |
| PLEASANT-GROVE-VERONA MUTUAL WATER COMPANY | 3 |
| RECLAMATION DISTRICT 2060 | 9982 |
| RECLAMATION DISTRICT 2068 | 13262 |
| TE VELDE REVOCABLE FAMILY TRUST | 4406 |
| SUTTER MUTUAL WATER COMPANY | 21 |
| YOLO RANCH | 3350 |

Datum: NAD 1983

0 2.25 4.5 9 Miles





IMPORTANT GIANT GARTER SNAKE POPULATIONS
N
Butte Creek Selection
Colusa Basin Drainage Canal Selection
Colusa Drainage Canal
Gilsizer Slough
Hunters Creek Selection
Little Butte Creek
Logan Creek Selection
Sutter Bypass Toe Drain
Willow Slough & Bypass
Natomas Basin
California Counties
Datum: NAD 1983
0 5 10 20
Miles
Tehama
Plumas
Glenn
Butte
Sierra
Mendocino
Nevada
Yuba
Colusa
Placer
Lake
Sutter
El Dorado
Yolo
Napa
Sacramento
Sonoma
Amador
Solano
Calaveras
San Joaquin
Contra Costa
Tuolumne
Stanislaus
Alameda
Mariposa
Mateo
Recovery Units
American Basin
Butte Basin
Colusa Basin
Delta Basin
Sutter Basin
Yolo Basin

# Appendix H
# Groundwater Modeling Results

## Numerical groundwater modeling analysis

Numerical groundwater modeling analysis was performed using the Sacramento Valley Finite Element Groundwater Model (SACFEM2013) developed to simulate groundwater conditions in the Sacramento Valley. SACFEM2013 was selected as the numerical modeling tool for this analysis based on the state of the model and its capabilities to simulate groundwater conditions at a greater level of detail than other potential modeling tools within the Seller Service Area. Reclamation commissioned a peer review of the SACFEM2013 model in 2010 (WRIME 2011). Revisions were made to the model and the revised model was used for the impacts analysis described here.

SACFEM2013 uses the MicroFEM finite-element numerical modeling code. MicroFEM is capable of simulating multiple aquifer systems in both steady state and transient conditions. The model is capable of simulating groundwater conditions and groundwater/surface water interactions in the valley. SACFEM2013 was also used to estimate how groundwater pumping and recharge affects surface water.

SACFEM2013 covers the entire Sacramento Valley Groundwater Basin from just north of Red Bluff to the Cosumnes River in the south (see Figure H-1). The model was calibrated to historic conditions from Water Years (WY) 1970 through WY 2009. This SACFEM2013 model simulation, which includes highly variable hydrology (from very wet periods to very dry periods), was used as a basis for simulating groundwater substitution pumping. Proposed water transfers for 2020 were simulated in SACFEM2013 using September 1977 hydrologic conditions because this year represents the driest condition available during the SACFEM2013 simulation period (WY 1970 to WY 2003).

Groundwater drawdown impacts associated with the groundwater substitution pumping from 187 wells that are part of the Proposed Action have been modeled to estimate effects to groundwater resources. Table H-1 summarizes the pumping details including pumping capacity and the range of screened intervals of the modeled groundwater substitution pumping wells. The locations and depths of these wells are specified in the model based on data collected from the potential groundwater substitution sellers.

Figures H-1, H-2, H-3, and H-4 show the simulated drawdown due to the Proposed Action under September 1977 hydrologic conditions. During dry years, surface water resources are limited and users have historically increased groundwater pumping to address shortages. Proposed water transfers for 2020 were simulated in SACFEM2013 using September 1977 hydrologic conditions because this year represents the driest condition available during the SACFEM2013 simulation period (WY 1970 to WY 2003). Simulating transfers during this period illustrates the potential to compound impacts from dry-year pumping as compared to the No Action Alternative.

- Figure H-1 shows the simulated drawdown at the water table based on results from the top layer of the SACFEM2013 model. This layer has a depth of up to 35 feet bgs.

- Figure H-2 shows simulated drawdown at approximately 200 to 300 feet bgs.
- Figure H-3 presents the simulated drawdown at approximately 300 to 400 feet bgs.
- Figure H-4 presents the simulated drawdown at approximately 700 to 900 feet bgs.
- Figure H-5 overlays the Indian Trust Assets (ITAs) within the Sacramento Valley Groundwater Basin over the simulated drawdown at the water table.

Drawdown at the water table (Figure H-5) represents the estimated decline in the groundwater surface within the shallow, unconfined portion of the aquifer (i.e., the height of water within a shallow groundwater well). The drawdown in the deeper portions of the aquifer (Figures H-2 through H-4) represents a change in hydraulic head (i.e., water pressure) in a well that is screened in this deeper portion of the aquifer.

**Table H-1. Water Transfers through Groundwater Substitution under the Proposed Action**

| Groundwater Basin | Potential Seller | Number of Wells | Pumping Rate (gpm) | Range of Screened Interval (feet) |
|---|---|---|---|---|
| Redding Area | Anderson-Cottonwood Irrigation District | 2 | 1,000 - 5,500 | 150 - 455 |
| Sacramento Valley | Canal Farms | 3 | 3,500 - 5,000 | 65 - 660 |
| | Eastside Mutual Water Company | 1 | 4,720 | 150 - 240 |
| | Giusti Farms | 2 | 3,200 | 150 - 400 |
| | Glenn-Colusa Irrigation District | 17 | 800 – 4,300 | 25 –945 |
| | Maxwell Irrigation District | 2 | 3,800 | 150 - 240 |
| | Natomas Central Mutual Water Company | 14 | 1,000 - 2,500 | 10 - 952 |
| | Pelger Mutual Water Company | 4 | 1,500 - 5,000 | 101 - 485 |
| | Pelger Road 1700 LLC | 4 | 3,000 - 3,500 | 200 - 820 |
| | Pleasant Grove-Verona Mutual Water Company | 35 | 1,500 - 5,000 | 99 - 260 |
| | Princeton-Codora-Glenn Irrigation District | 13 | 1,000 - 3,000 | 120 - 380 |
| | Provident Irrigation District | 16 | 2,000 – 4,500 | 100 - 420 |
| | Reclamation District 108 | 5 | 1,700 - 5,900 | 250 - 680 |
| | Reclamation District 1004 | 28 | 1,000 - 5,800 | 56 - 430 |
| | River Garden Farms | 8 | 1,700 - 3,000 | 170 - 686 |
| | Sutter Mutual Water Company | 20 | 2,500 – 5,000 | 160 - 400 |
| | Sycamore Mutual Water Company | 5 | 3,200 - 6,500 | 160 - 906 |
| | T&P Farms | 2 | 3,500 - 4,000 | 256 - 862 |
| | Te Velde Revocable Family Trust | 5 | 2,200 - 4,700 | 115 - 455 |
| | Windswept Land & Livestock | 3 | 2,000 – 3,200 | 120 - 580 |

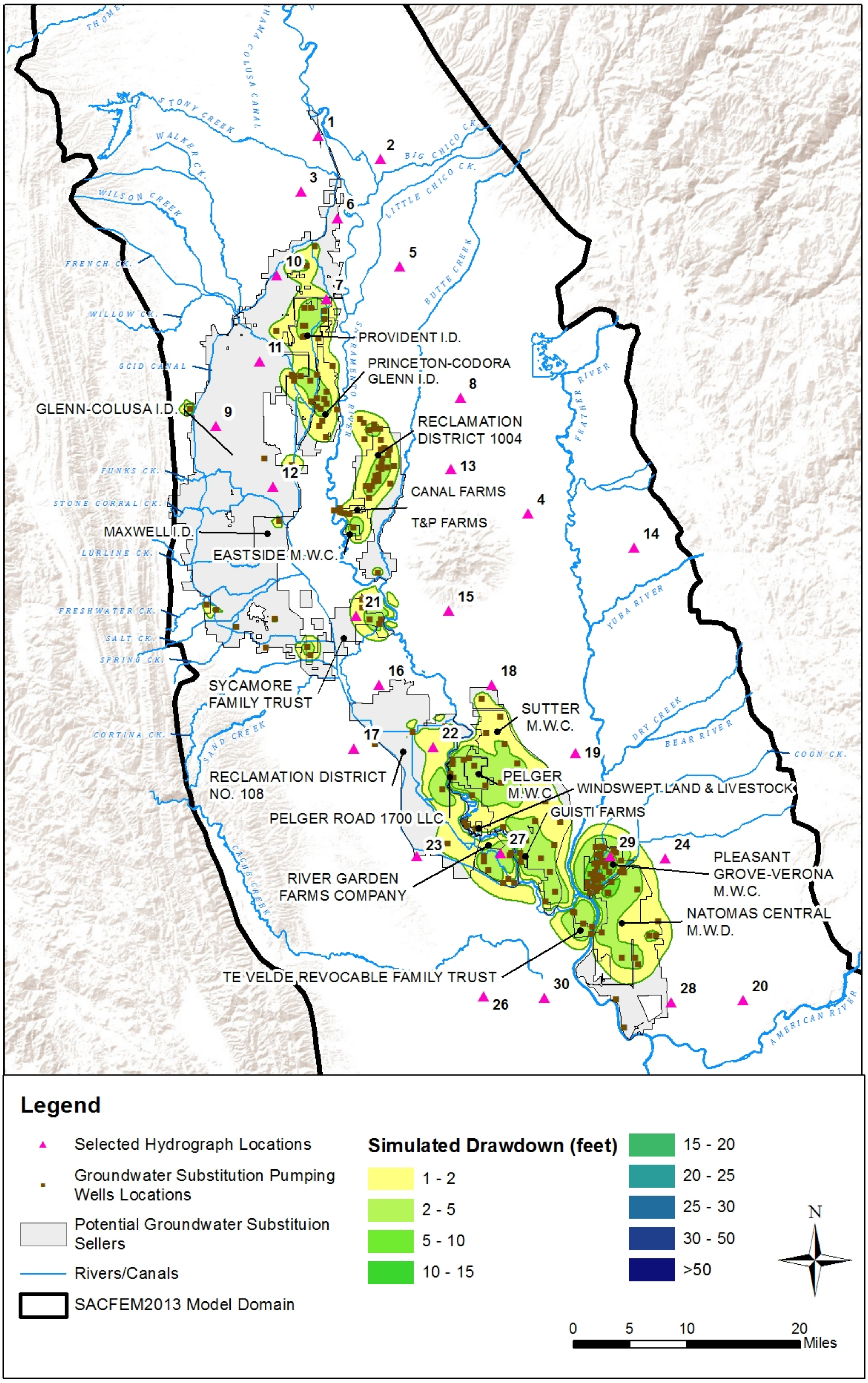



**Figure H-1. Simulated Change in Water Table Elevation (0 to approximately 35 feet bgs), Based on September 1977 Hydrologic Conditions**

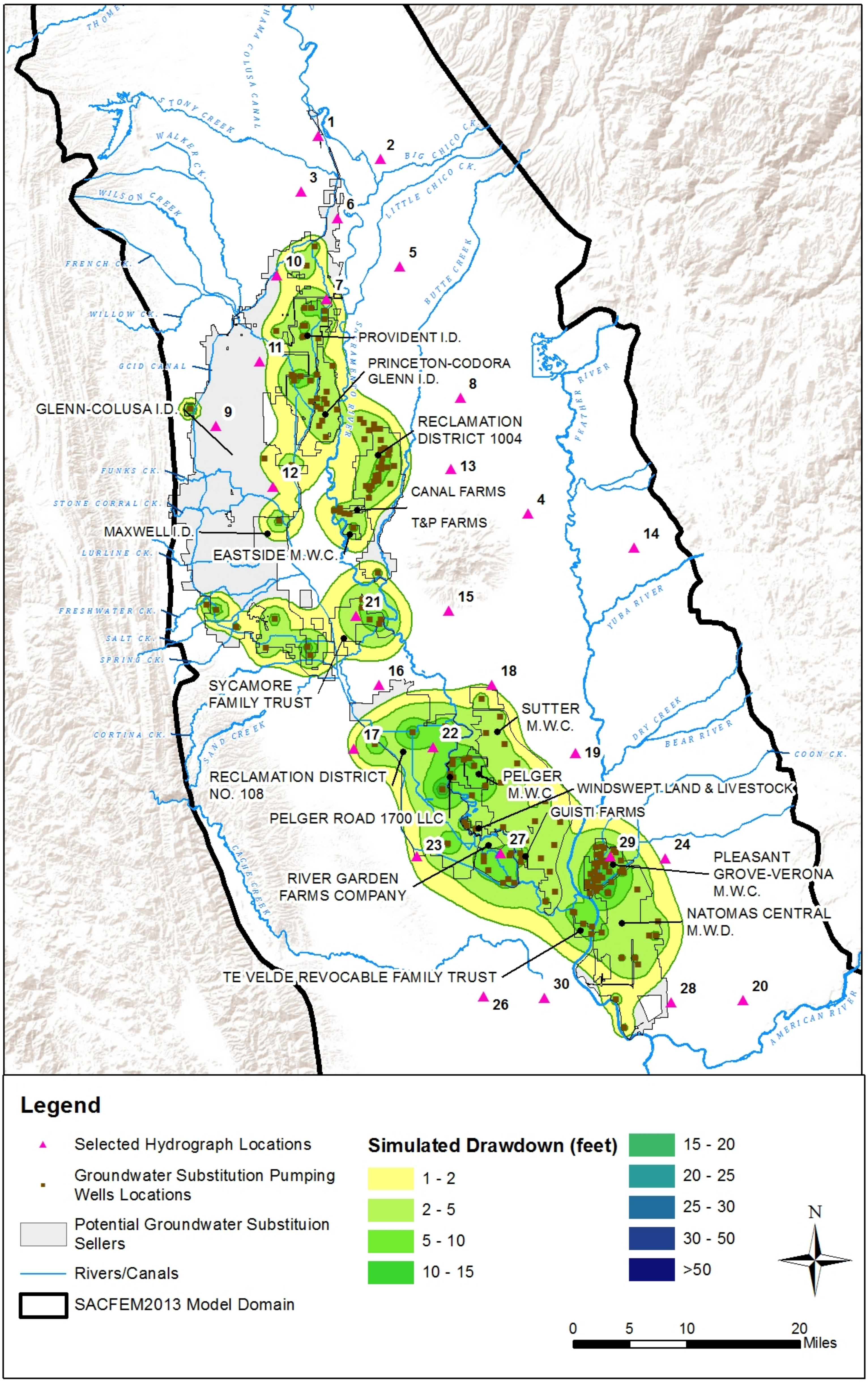



**Figure H-2. Simulated Change in Groundwater Head (approximately 200 to 300 feet bgs), Based on September 1977 Hydrologic Conditions**

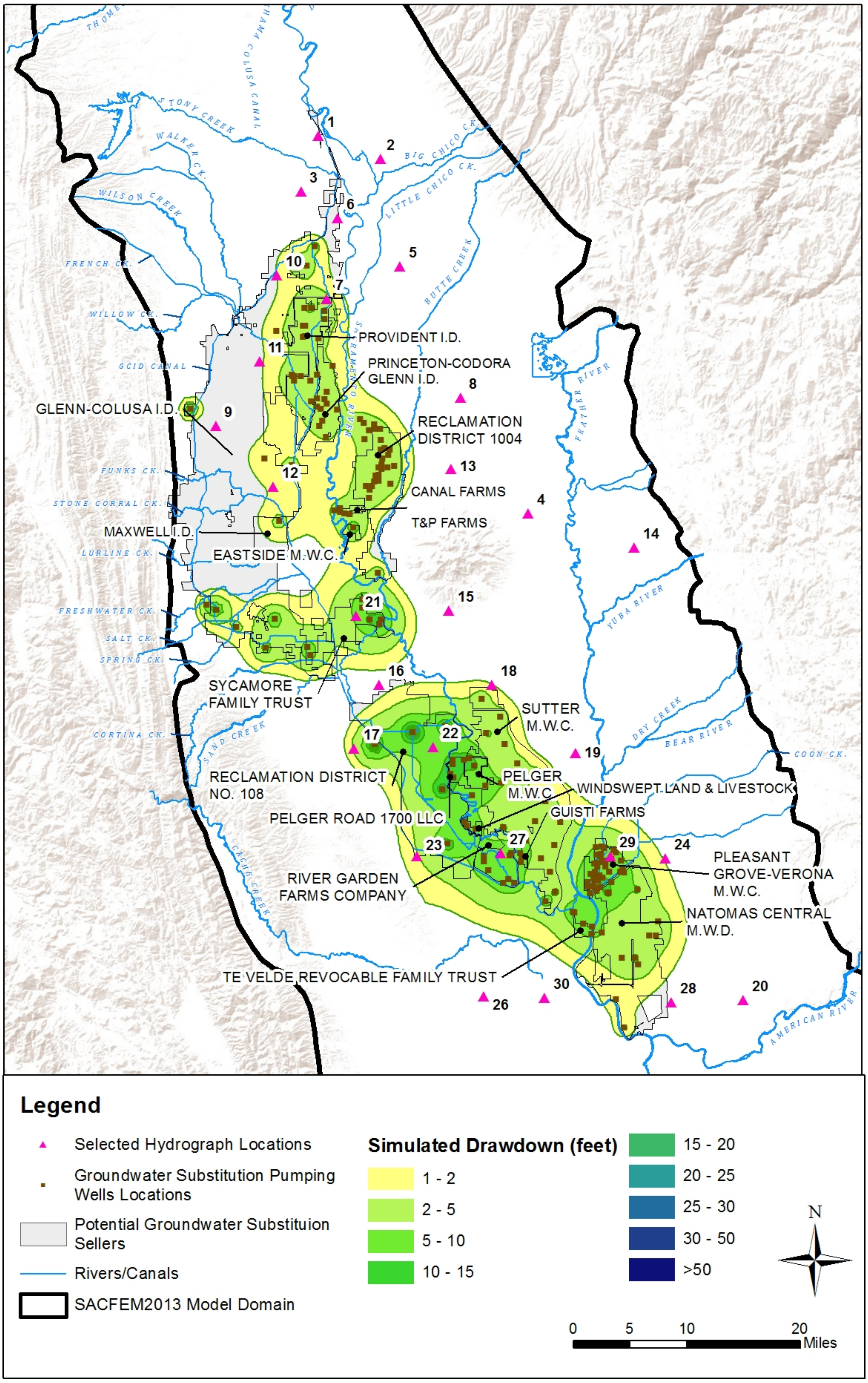



**Figure H-3. Simulated Change in Groundwater Head (approximately 300 to 400 feet bgs), Based on September 1977 Hydrologic Conditions**

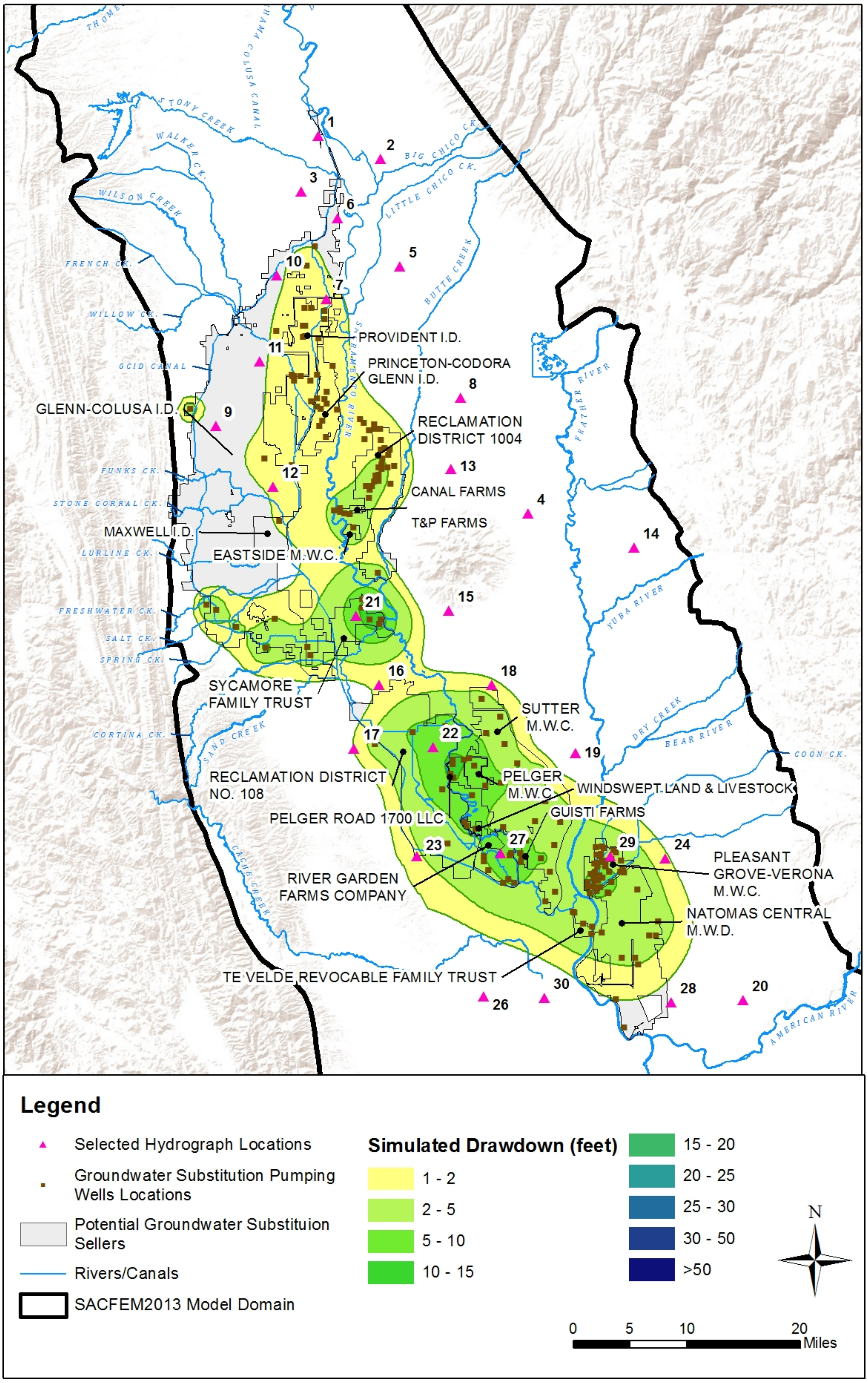



**Figure H-4. Simulated Change in Groundwater Head (approximately 700 to 900 feet bgs), Based on September 1977 Hydrologic Conditions**

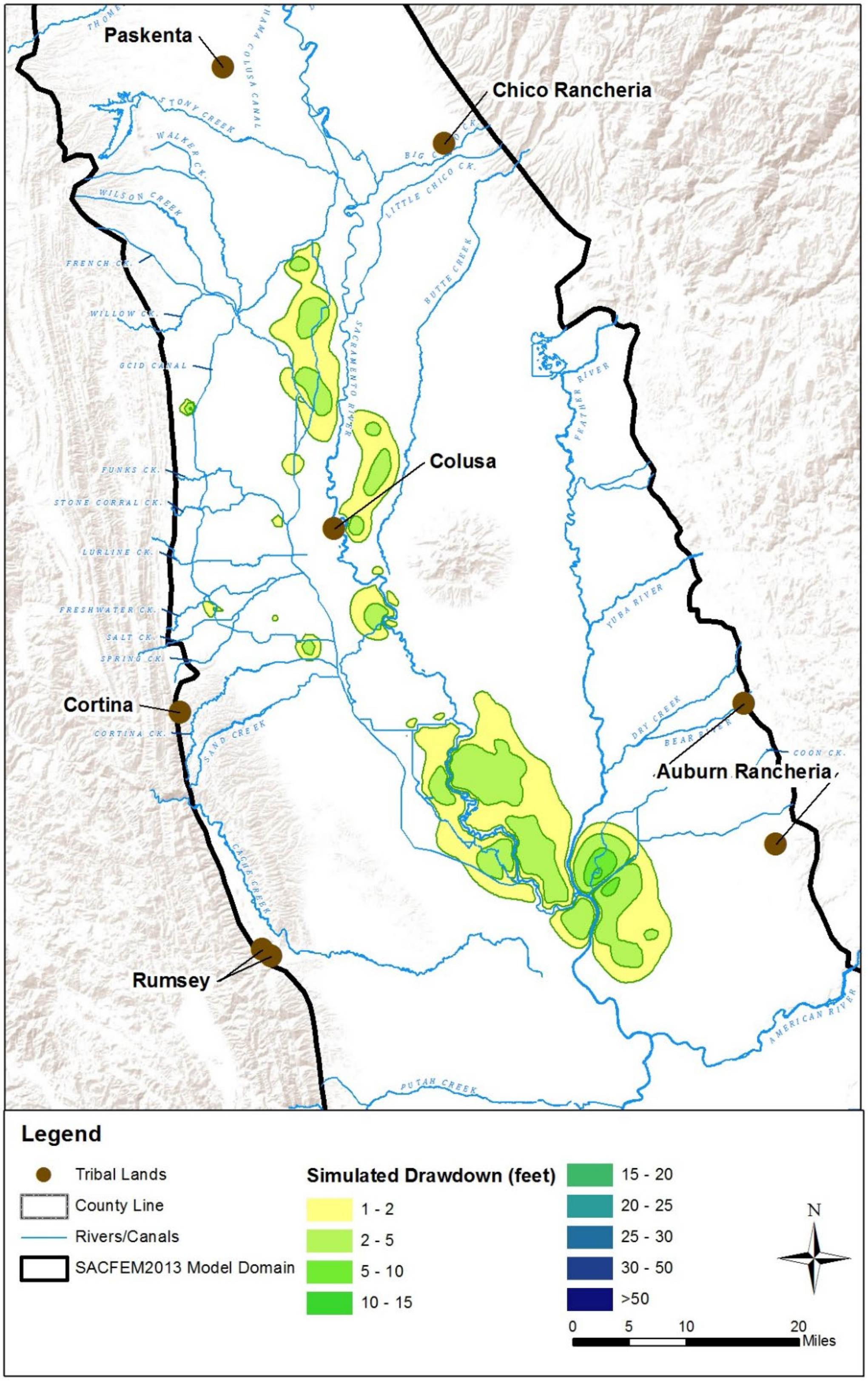
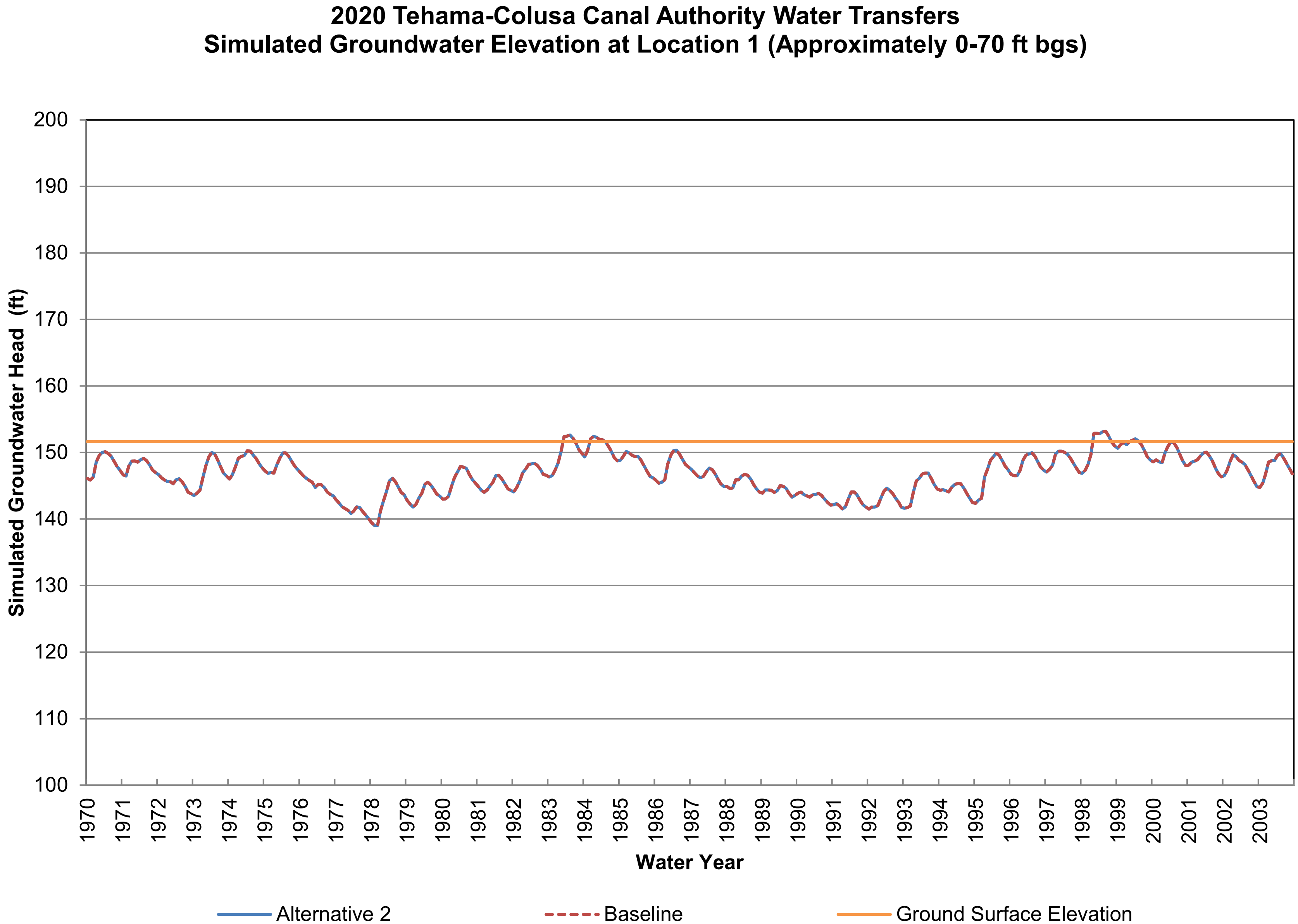
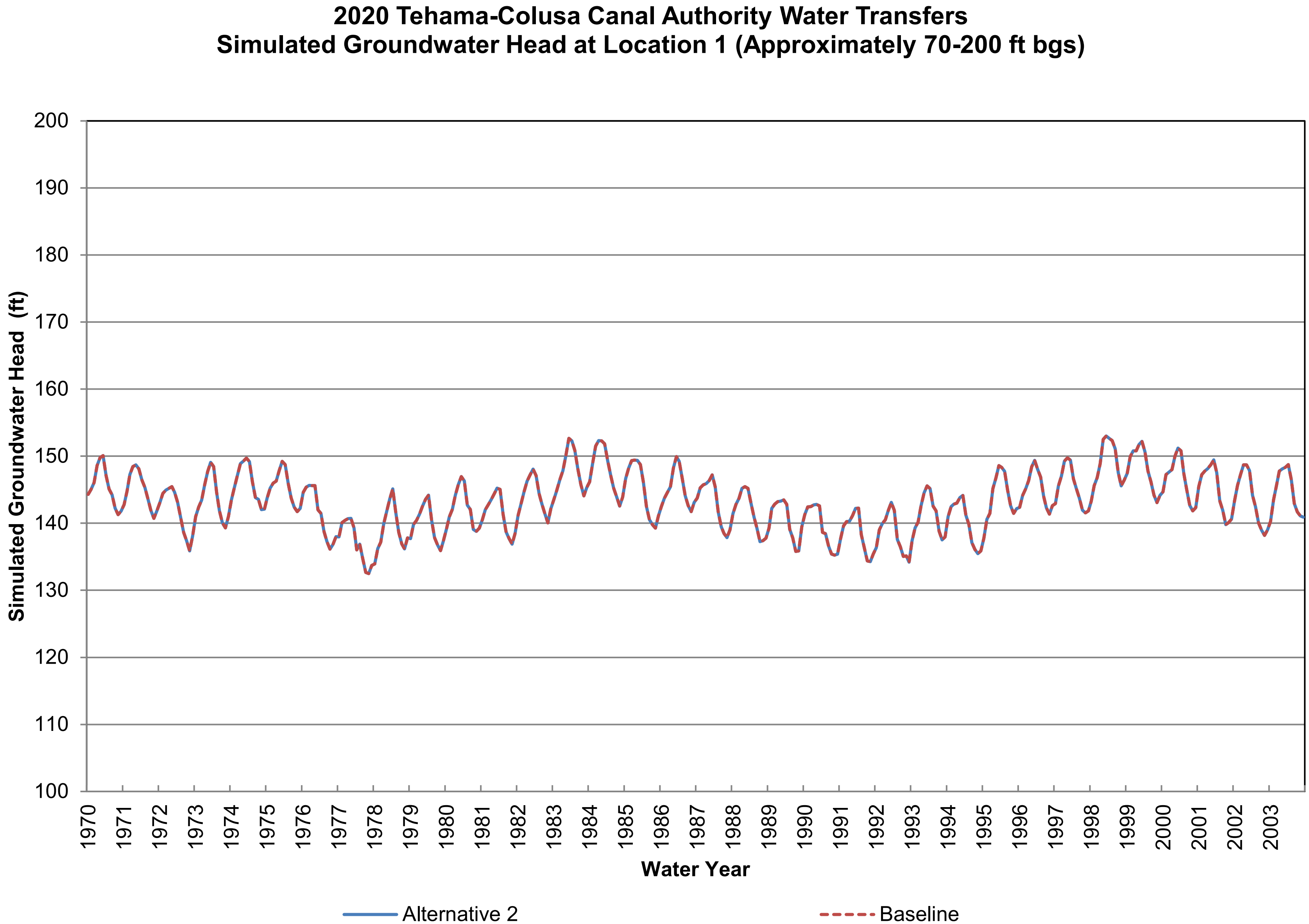



**Figure H-5. Groundwater Effects to ITAs in the Sacramento Valley Groundwater Basin**

# Groundwater head hydrographs for Locations 1 to 34


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 1 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 70-200 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
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1992
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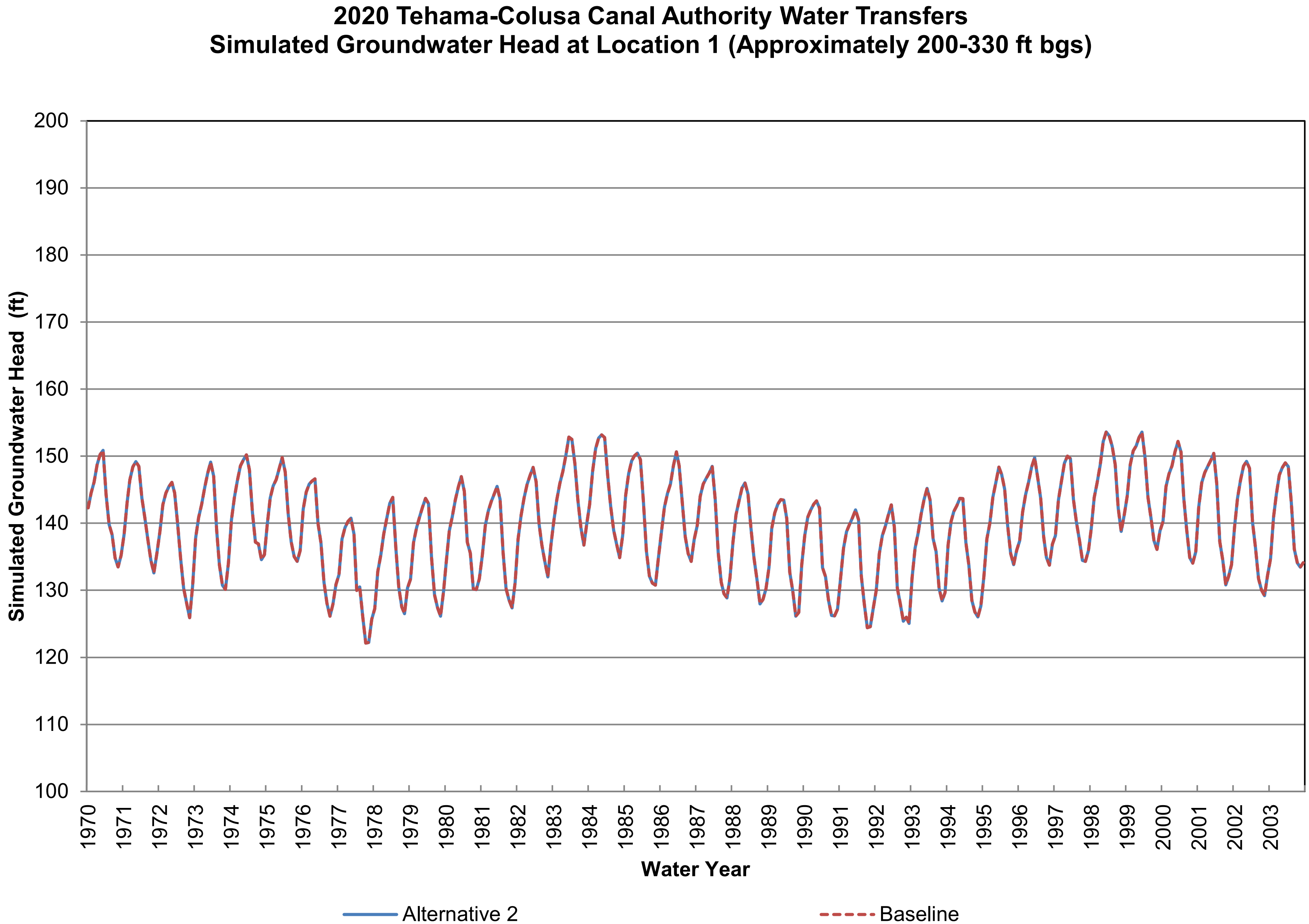
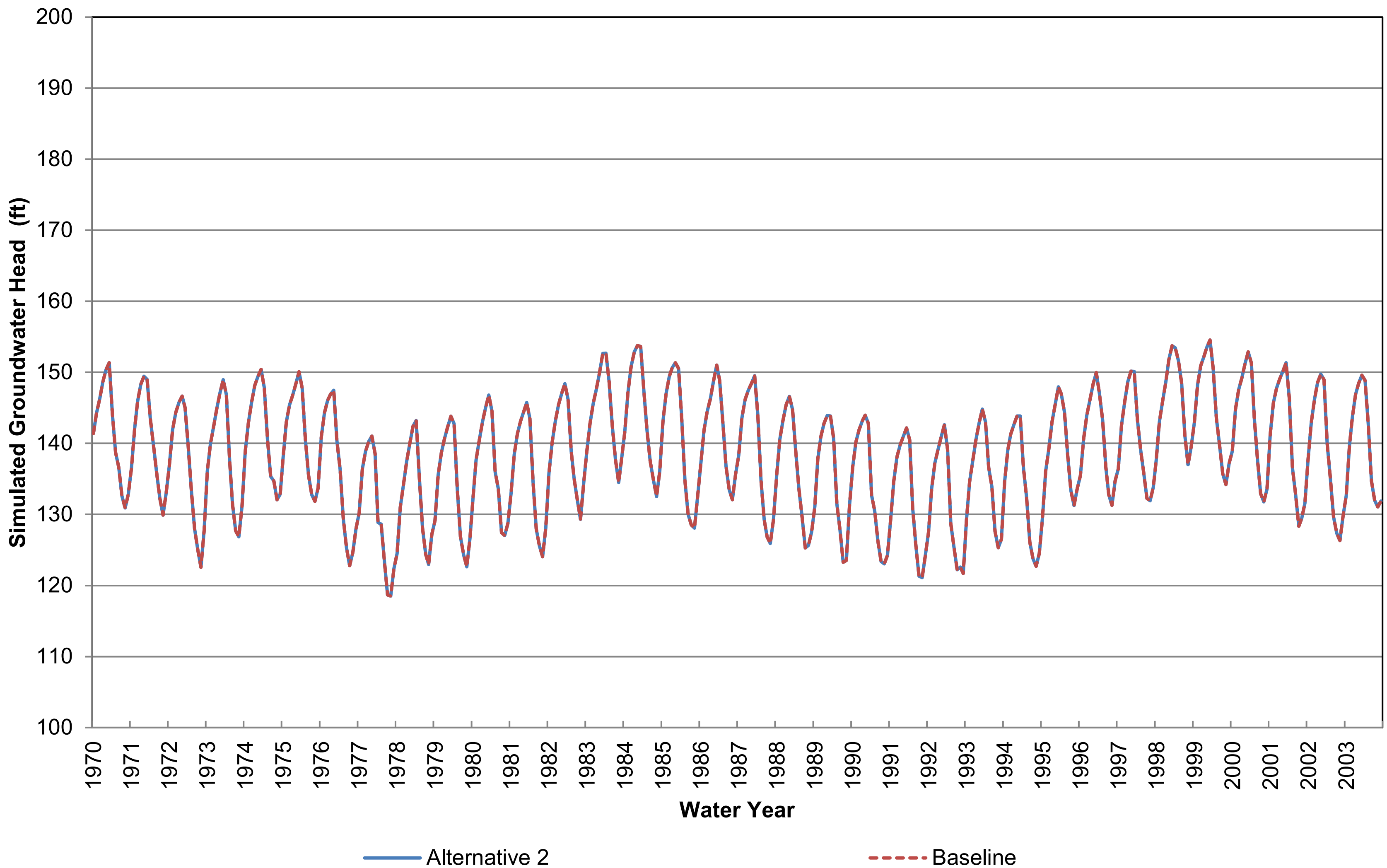
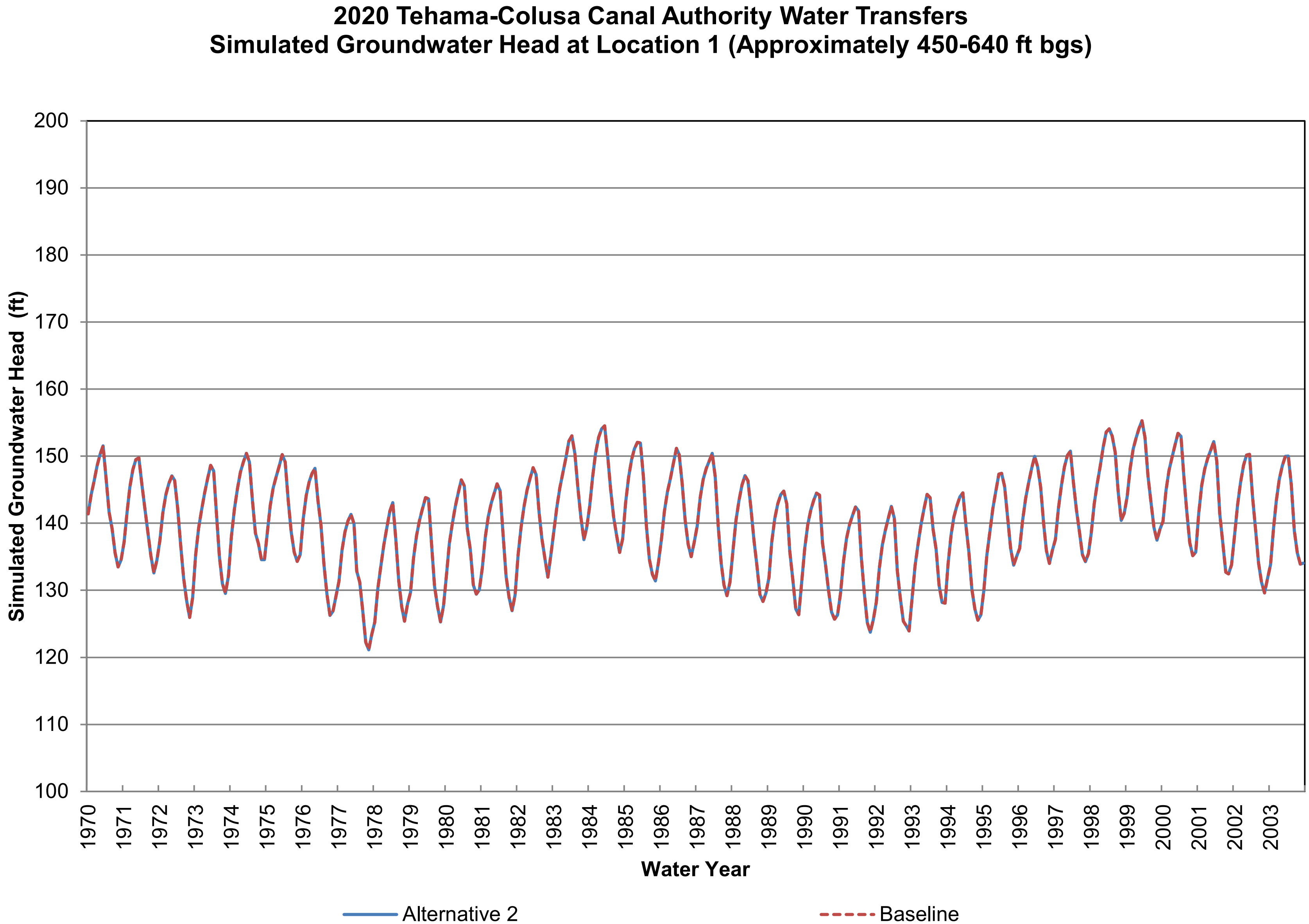
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 200-330 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

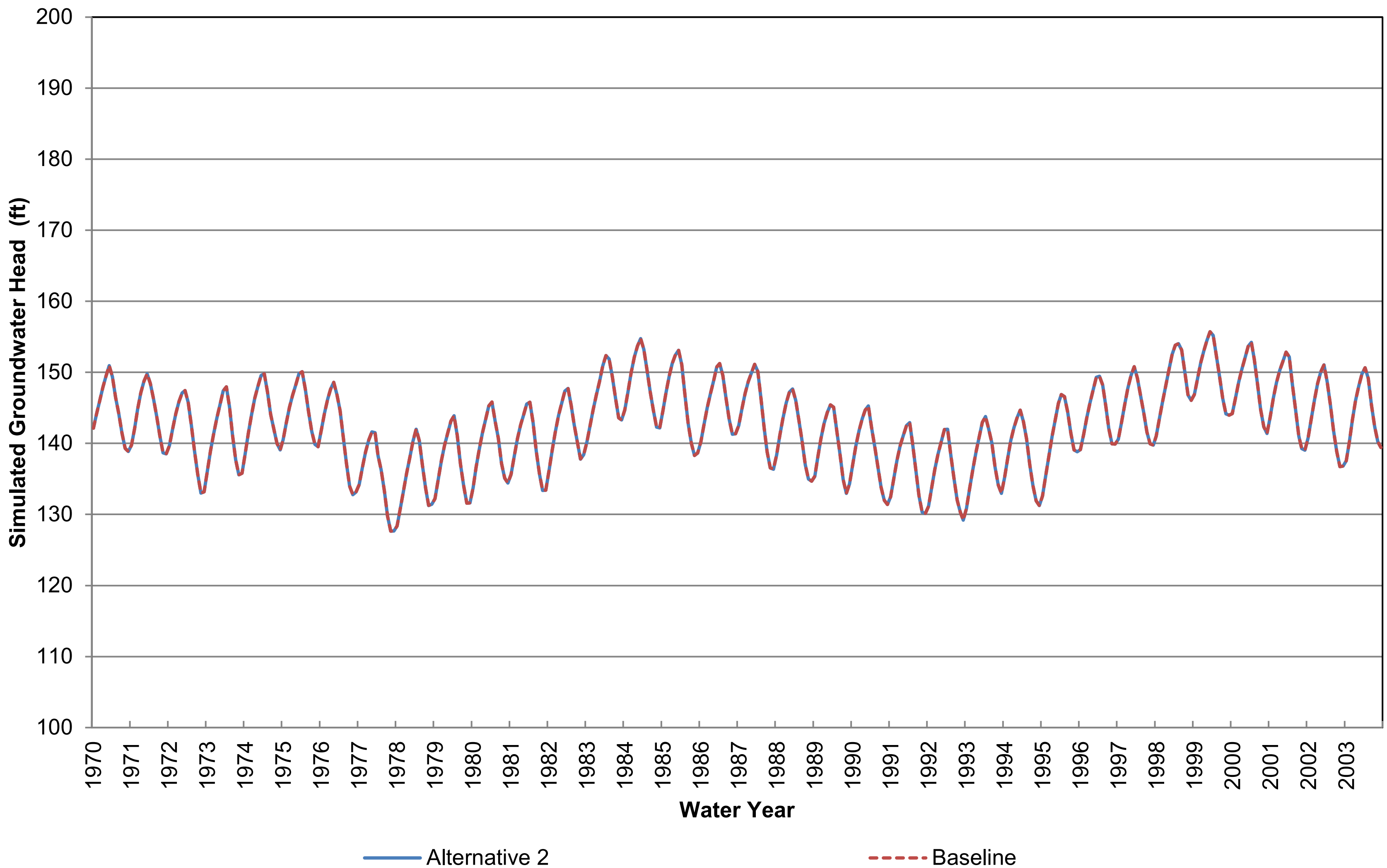
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 1 (Approximately 330-450 ft bgs)

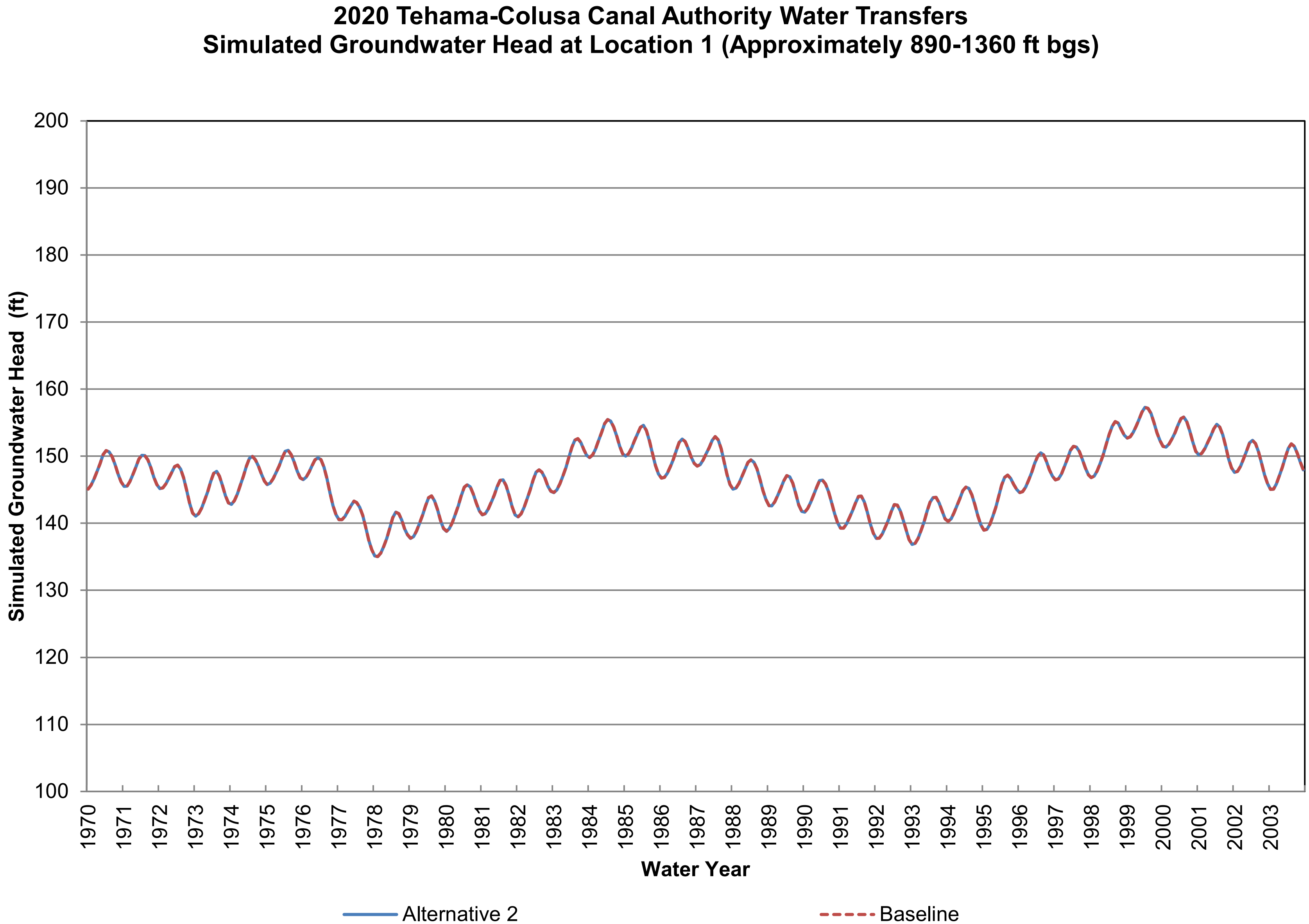




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 450-640 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 1 (Approximately 640-890 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 890-1360 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
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1997
1998
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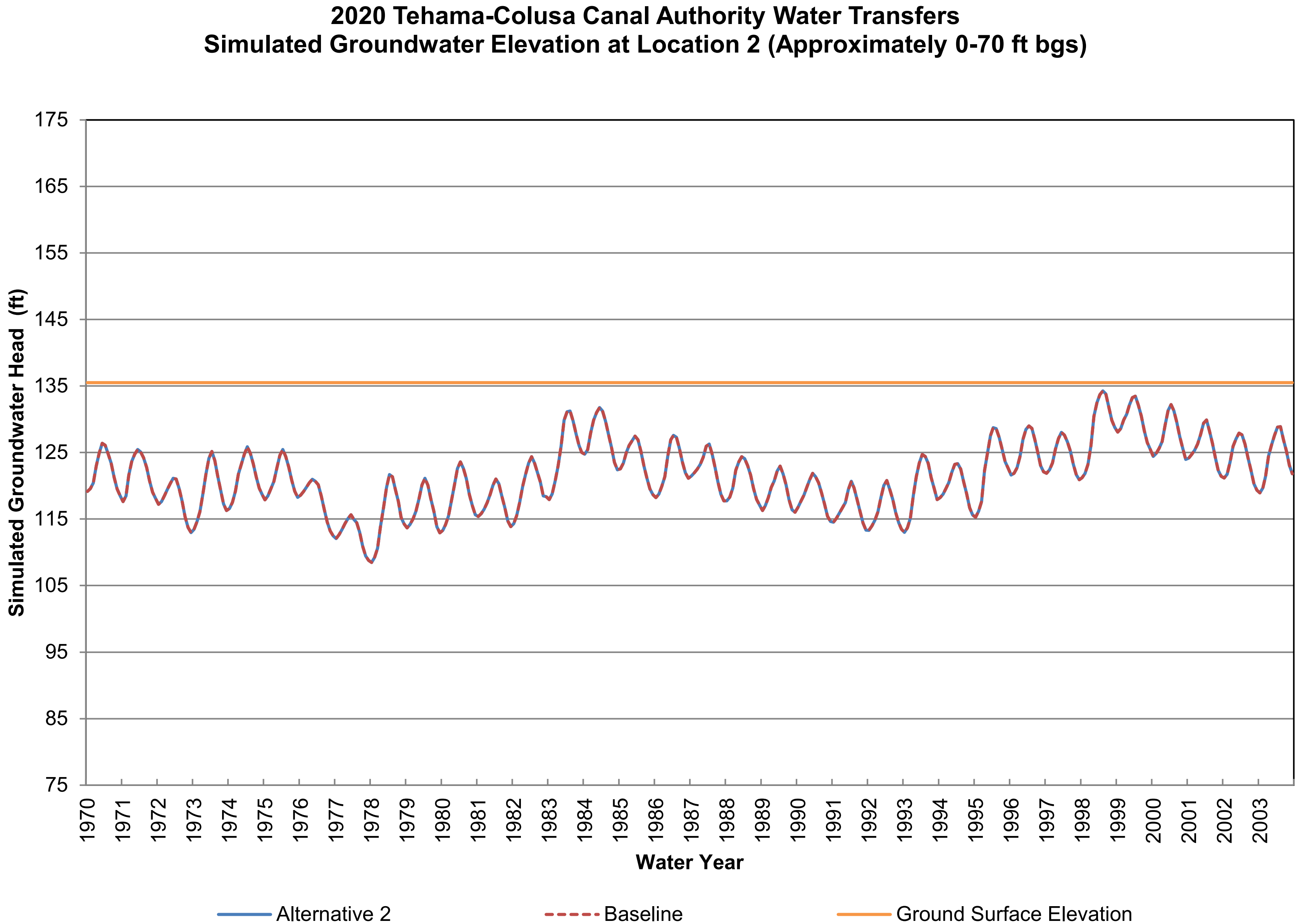
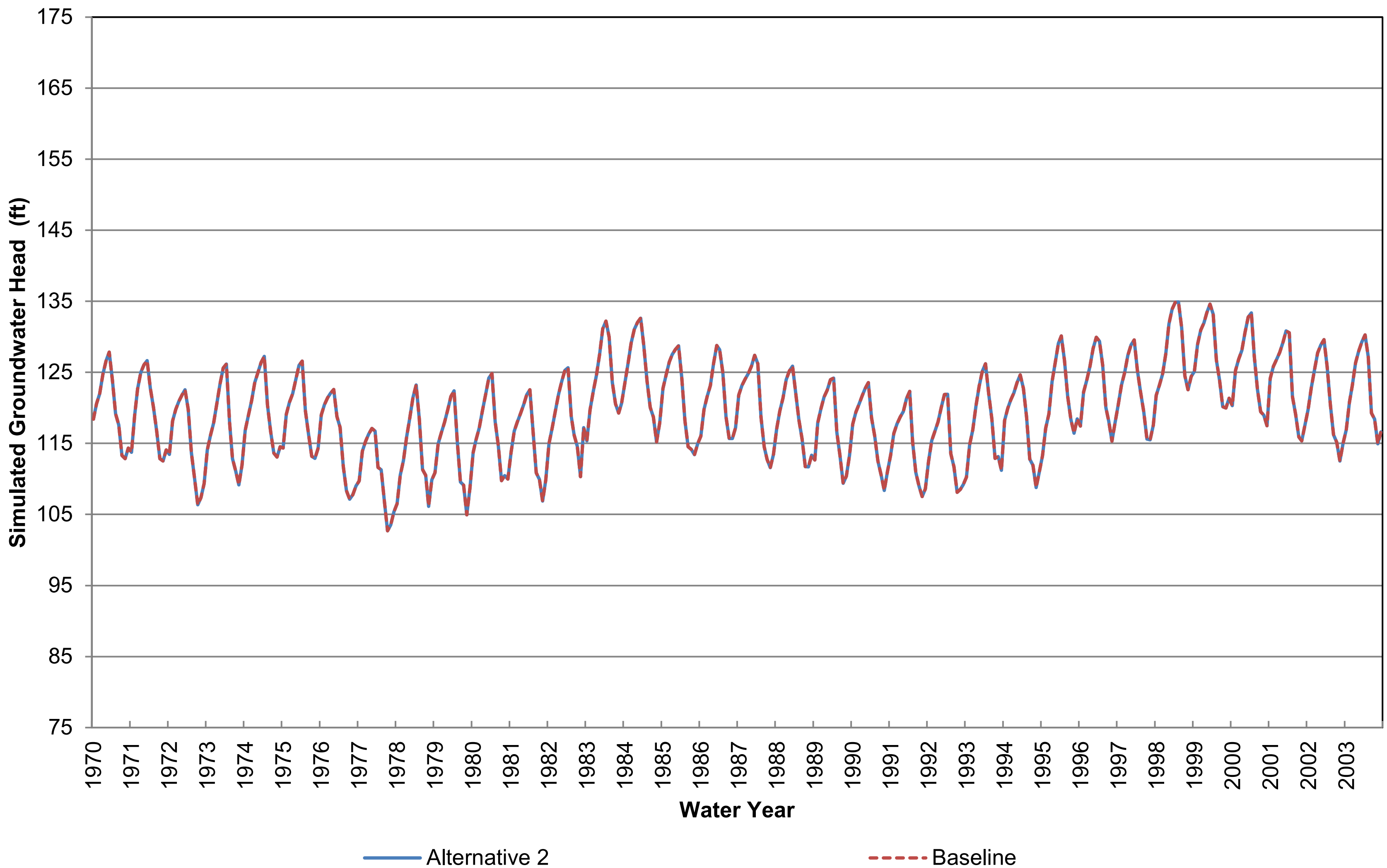
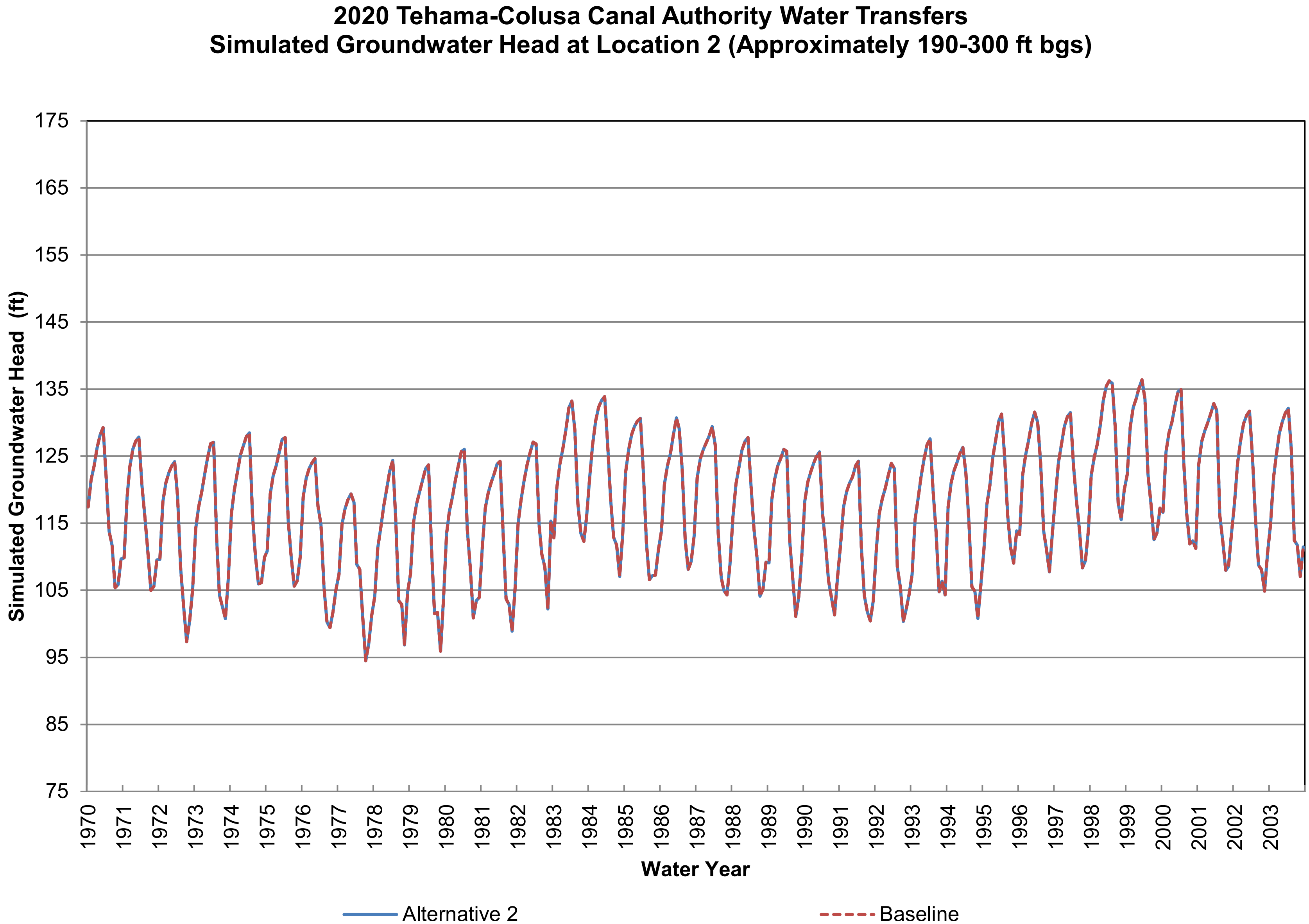
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 2 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 2 (Approximately 70-190 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 190-300 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
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1992
1993
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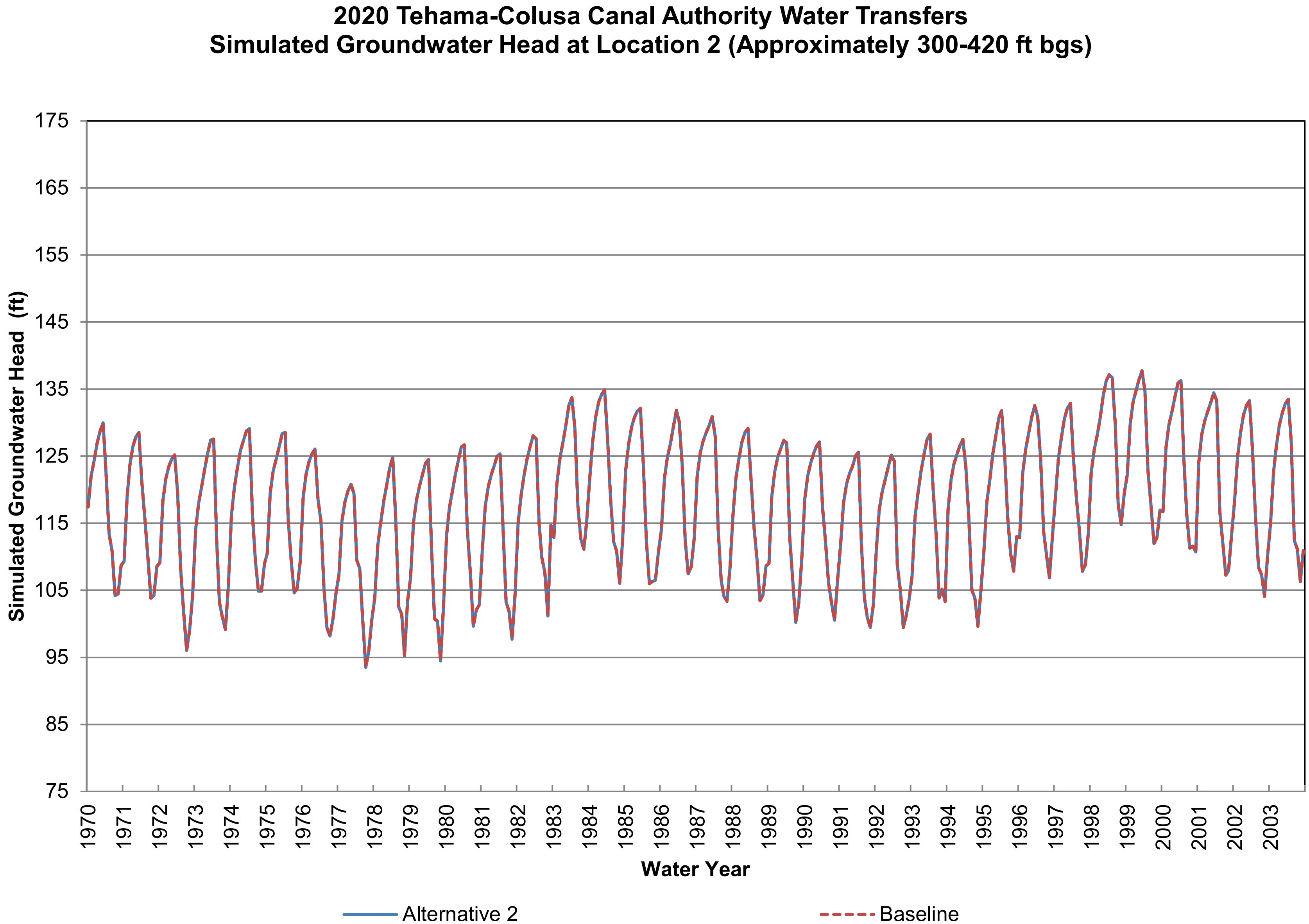
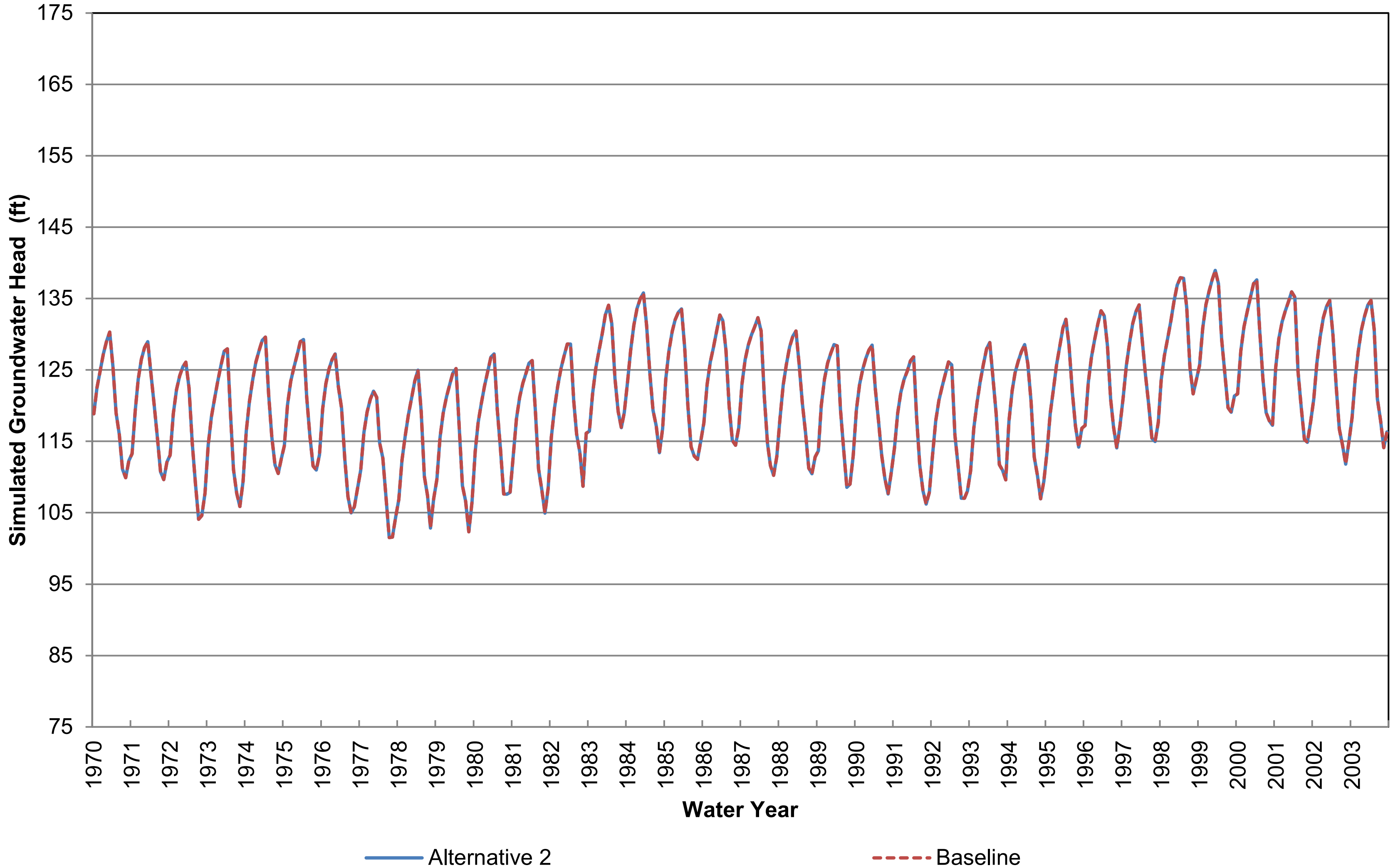
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

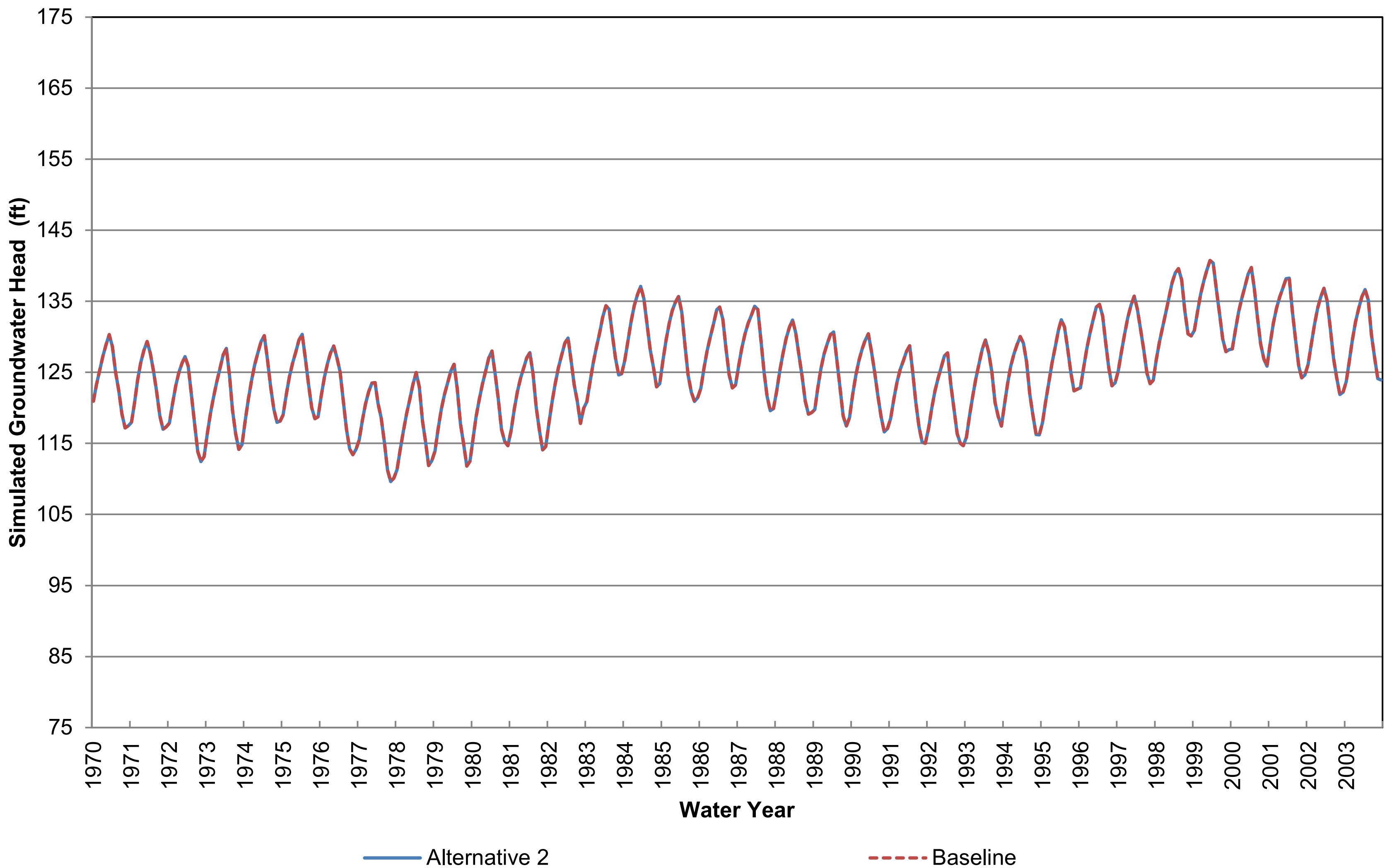


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 300-420 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

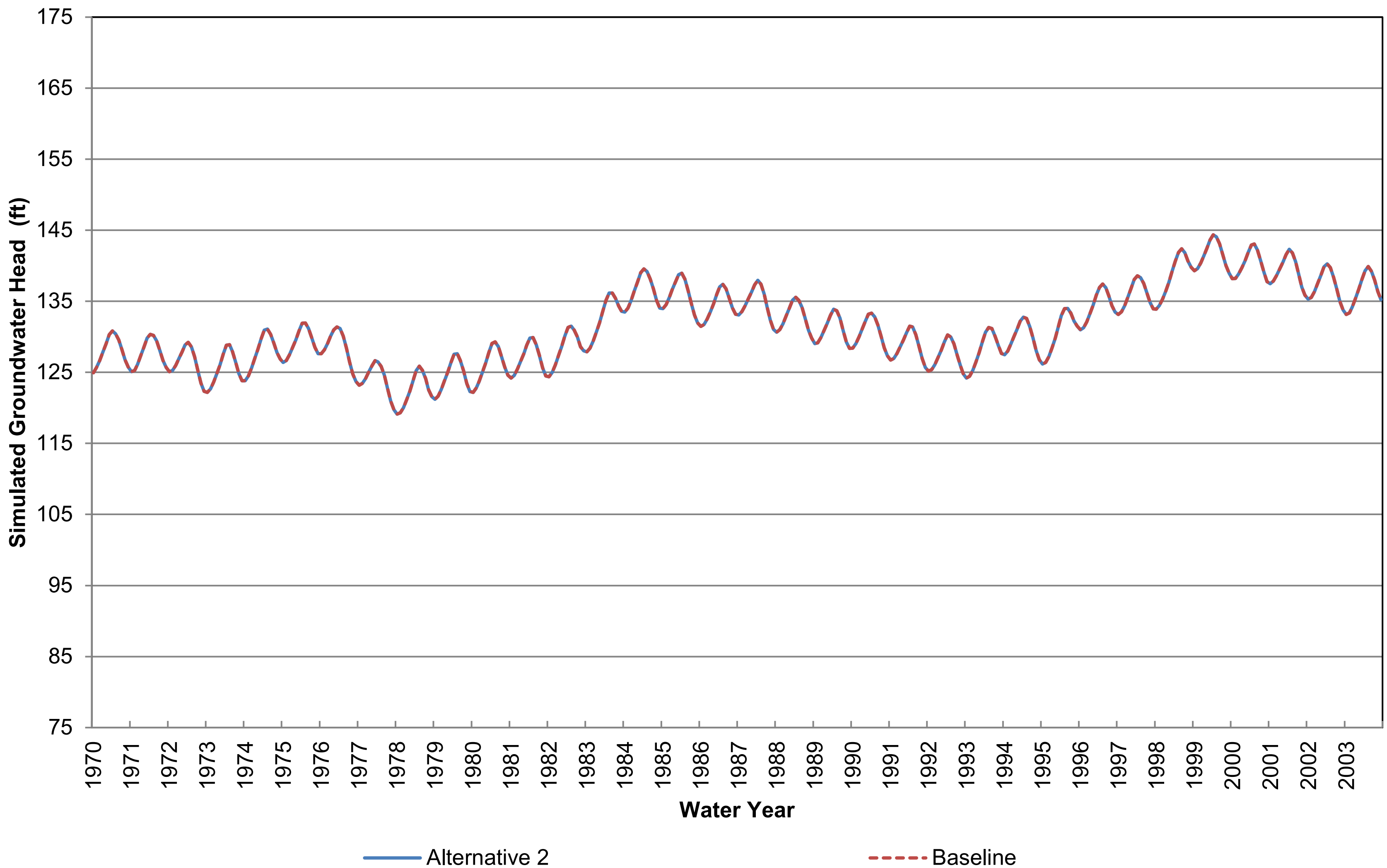
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 2 (Approximately 420-580 ft bgs)



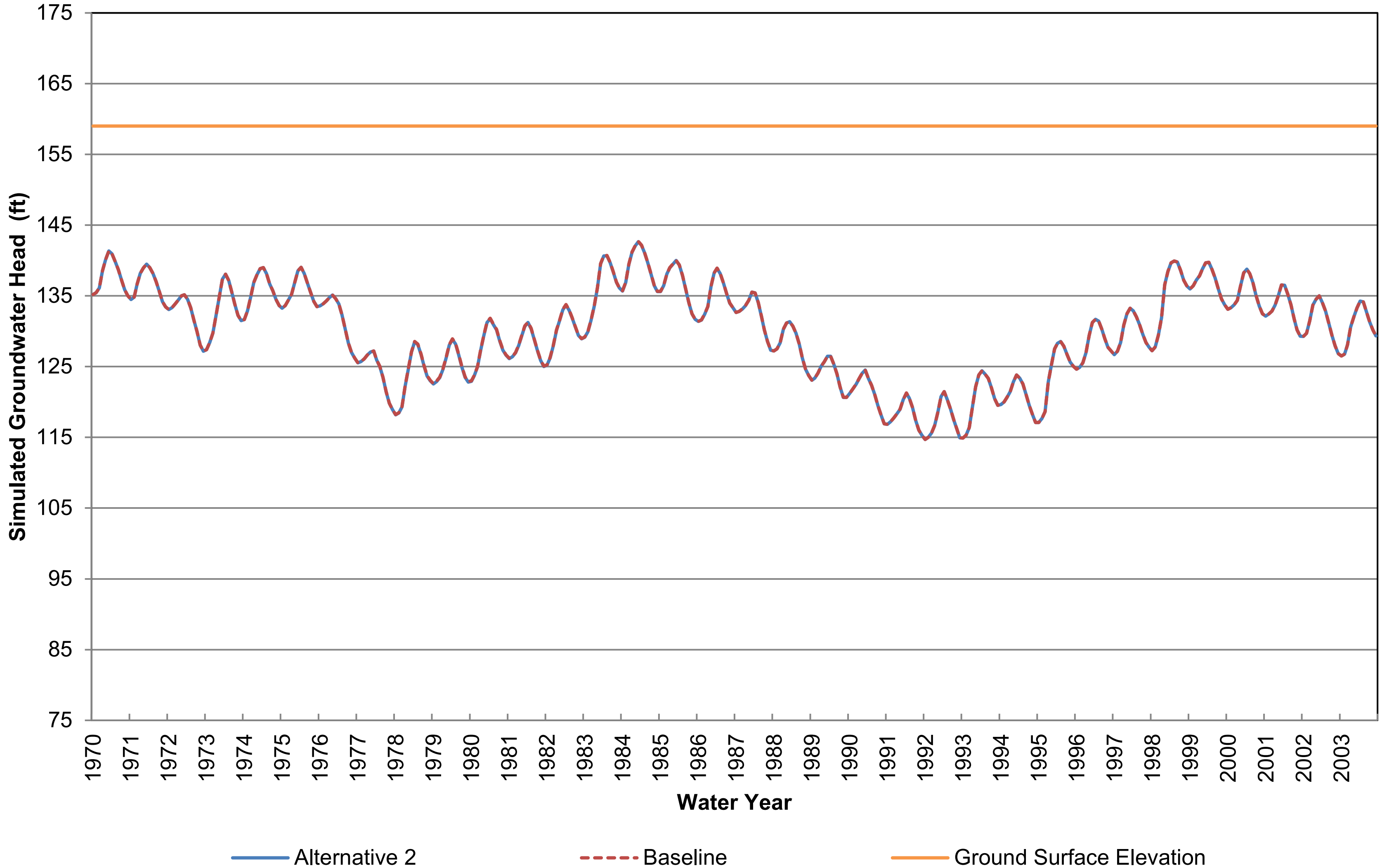
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 2 (Approximately 580-830 ft bgs)



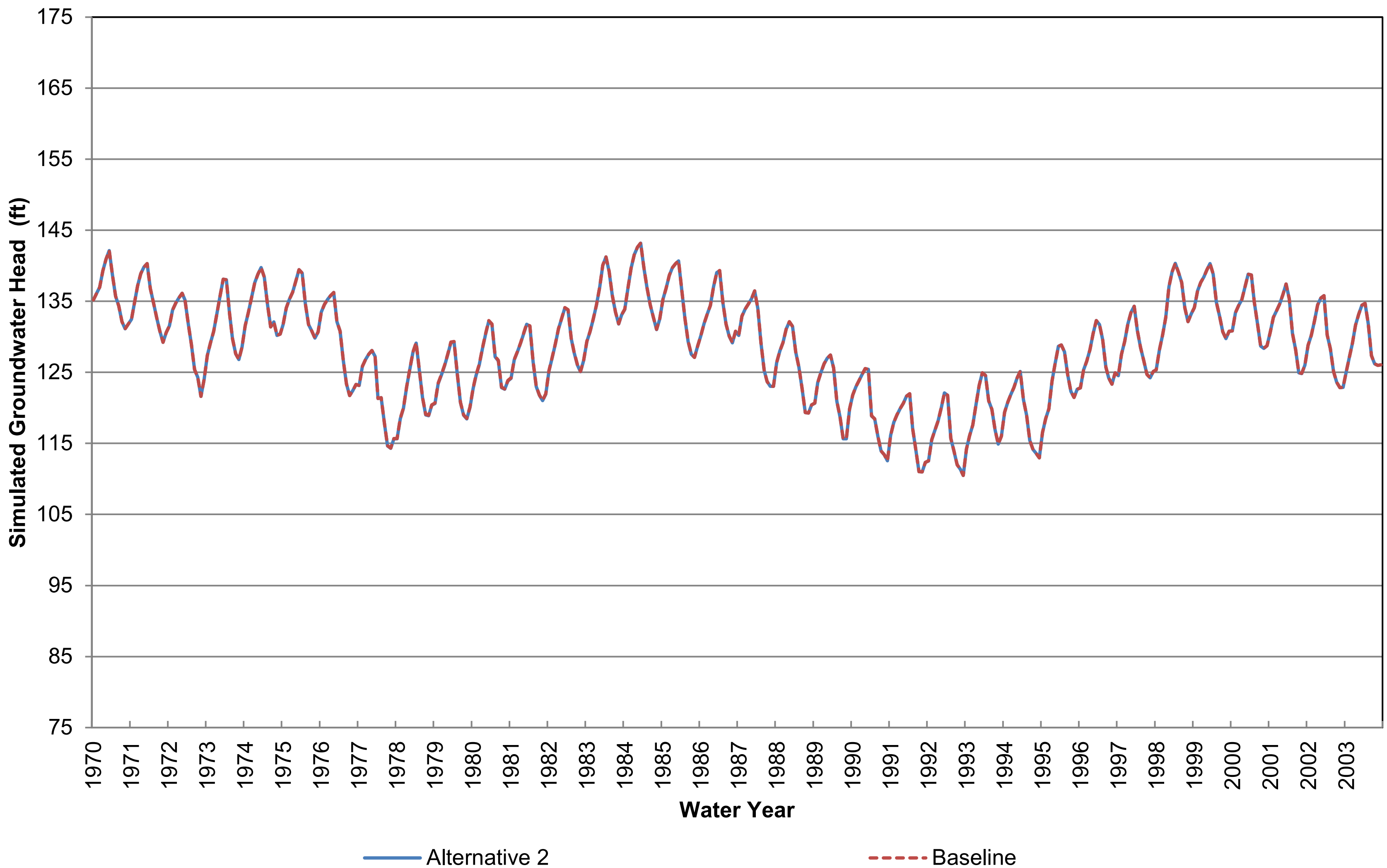
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 2 (Approximately 830-1330 ft bgs)

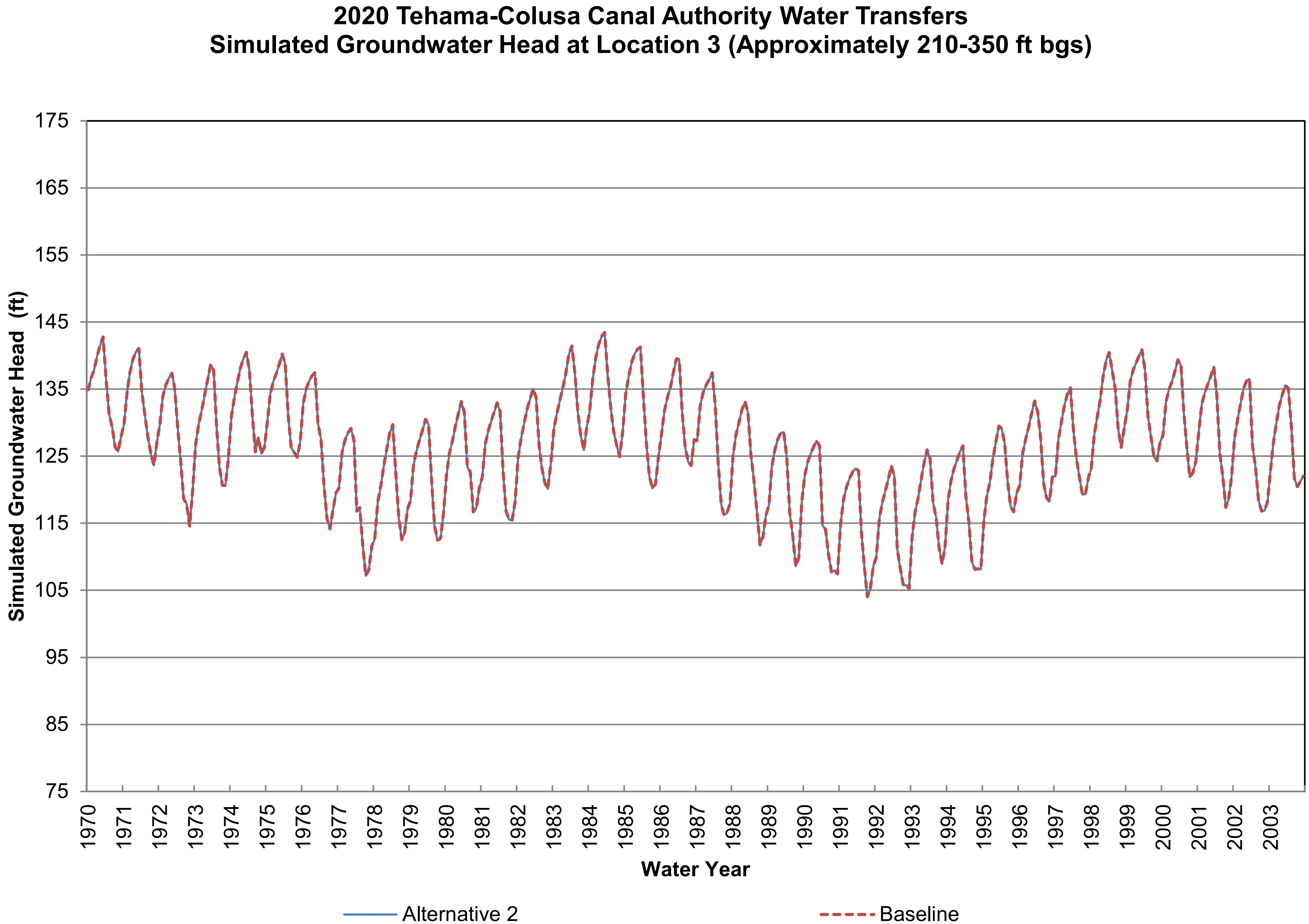


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 3 (Approximately 0-70 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 3 (Approximately 70-210 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 210-350 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
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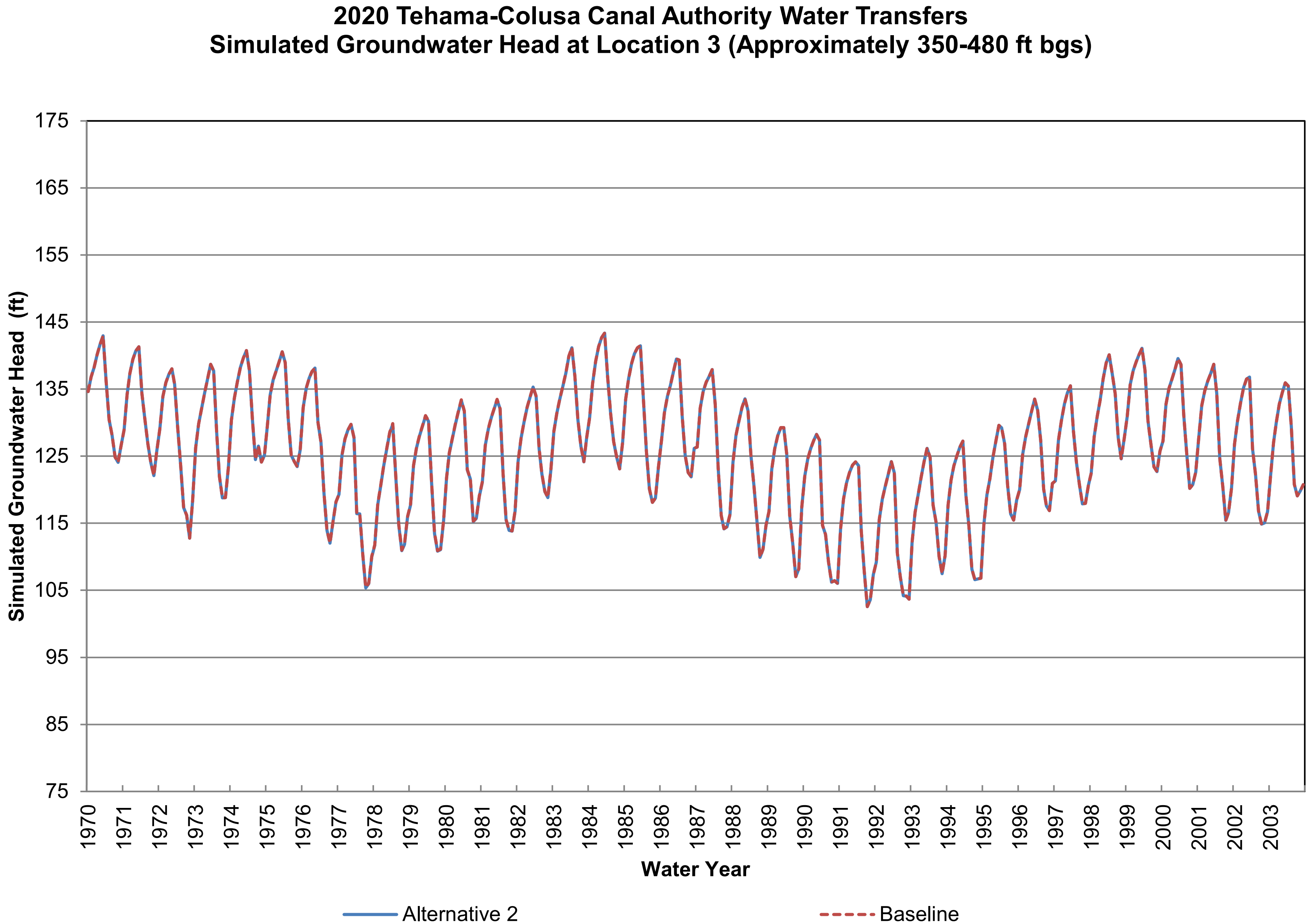
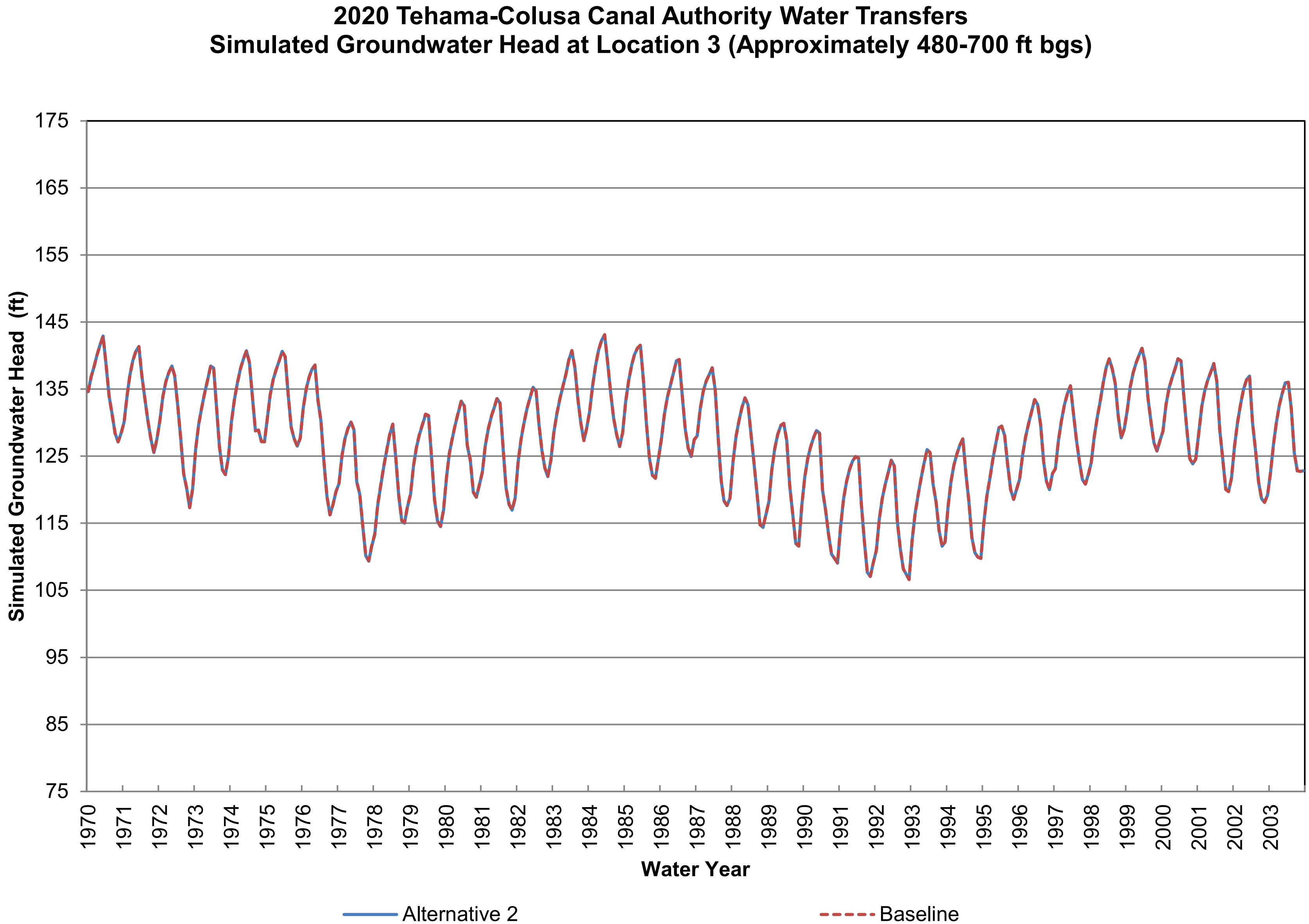
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

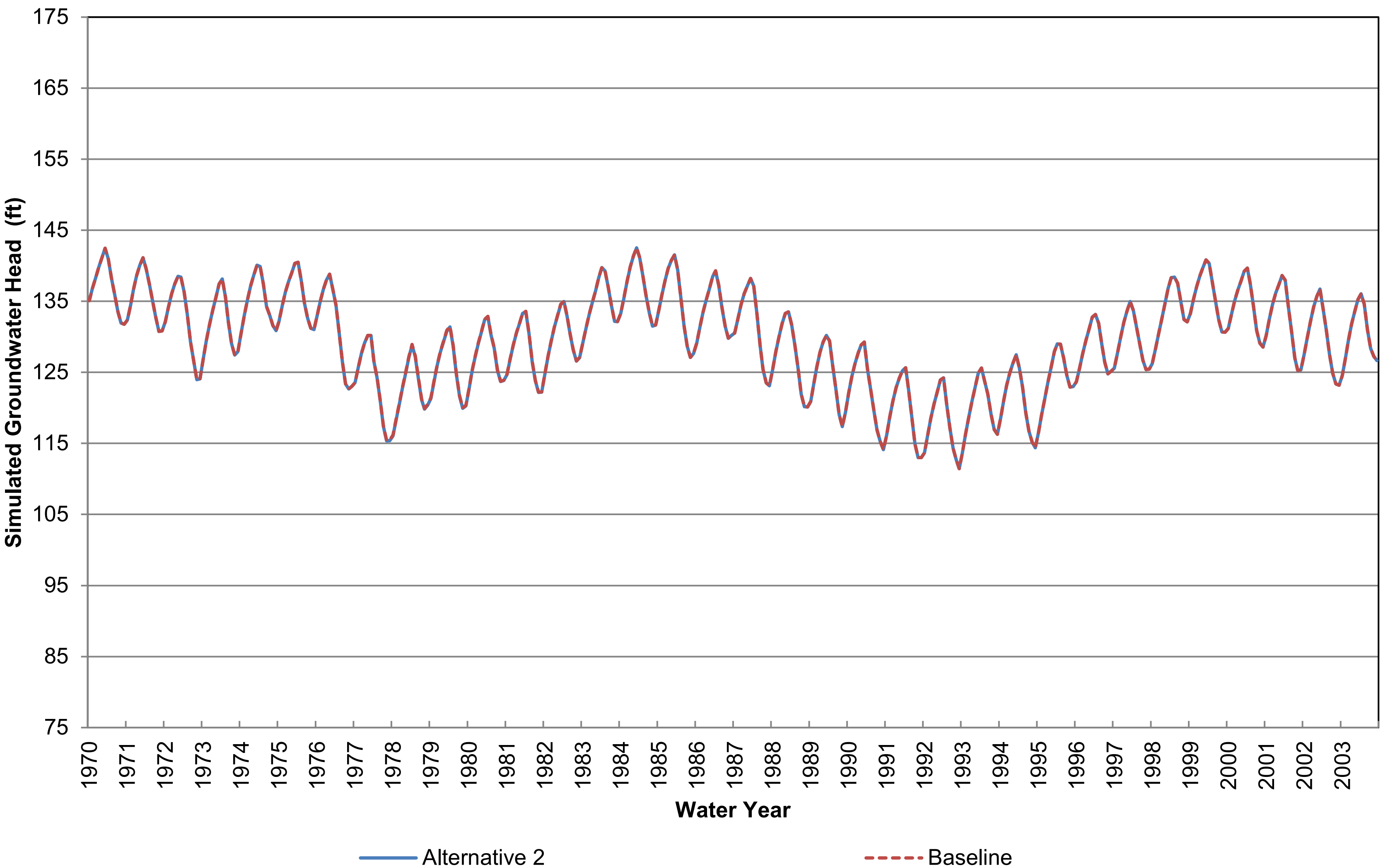


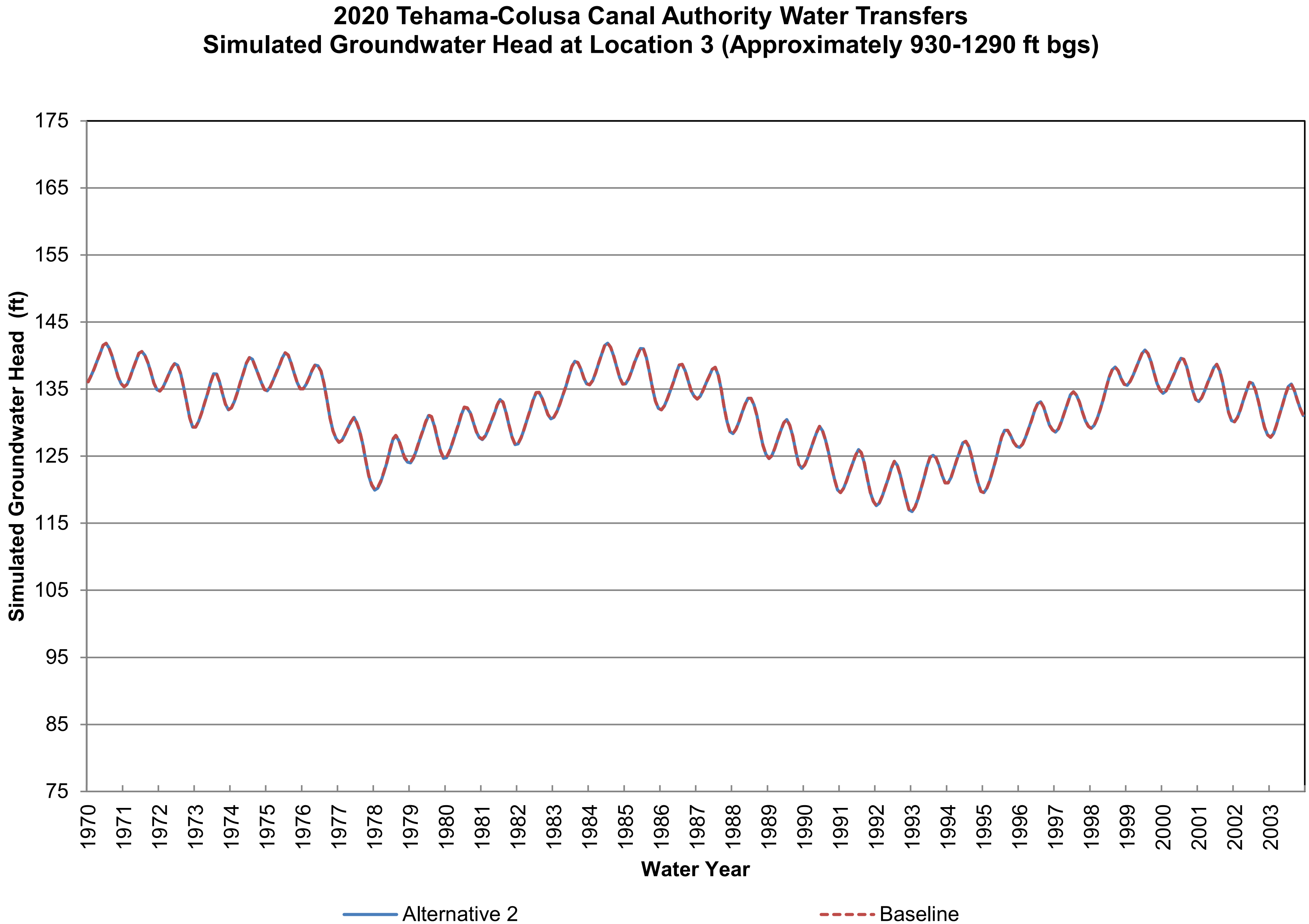
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 350-480 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 480-700 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

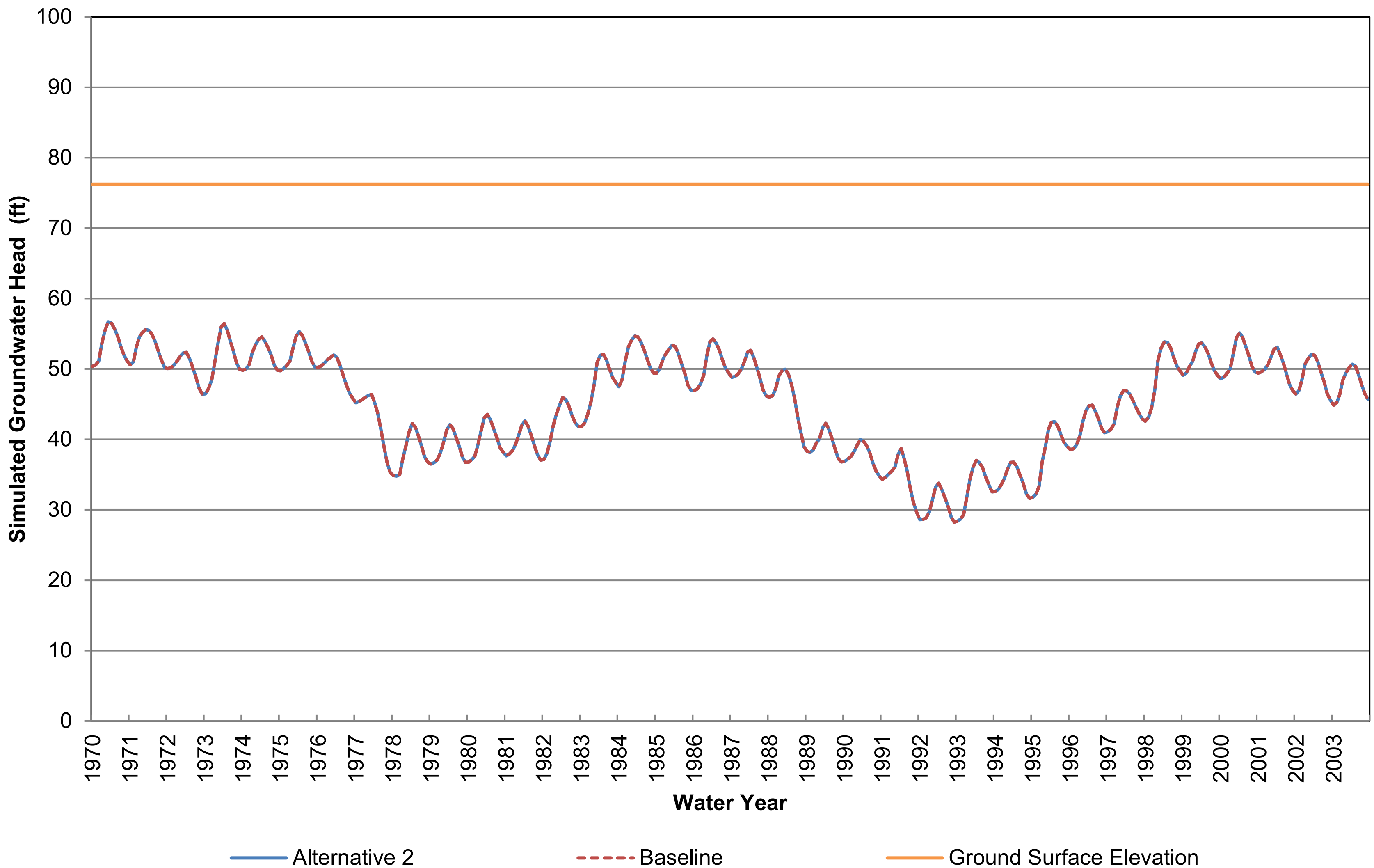
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 700-930 ft bgs)

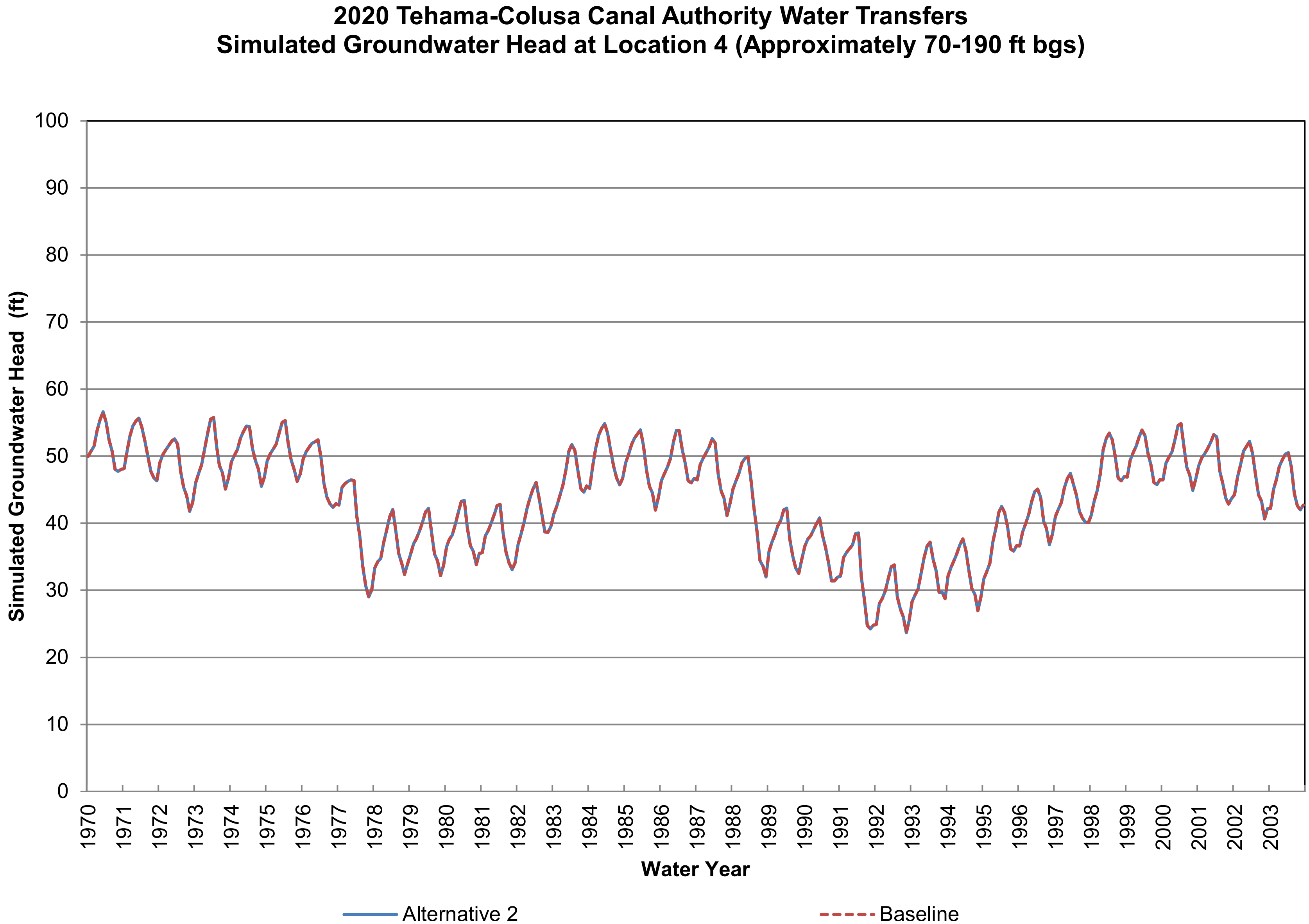




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 930-1290 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 4 (Approximately 0-70 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 70-190 ft bgs)
Simulated Groundwater Head (ft)
0
10
20
30
40
50
60
70
80
90
100
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
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1994
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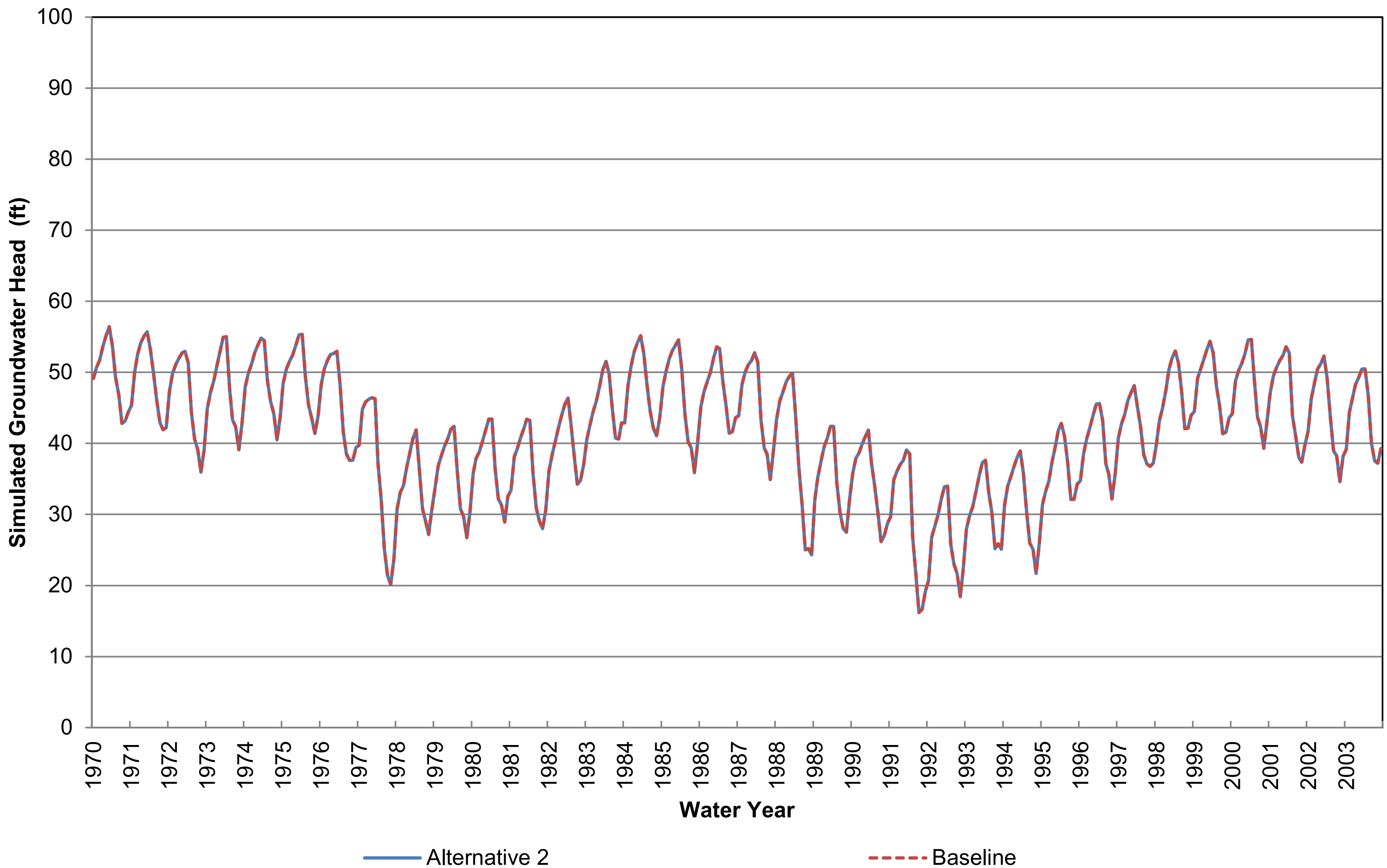
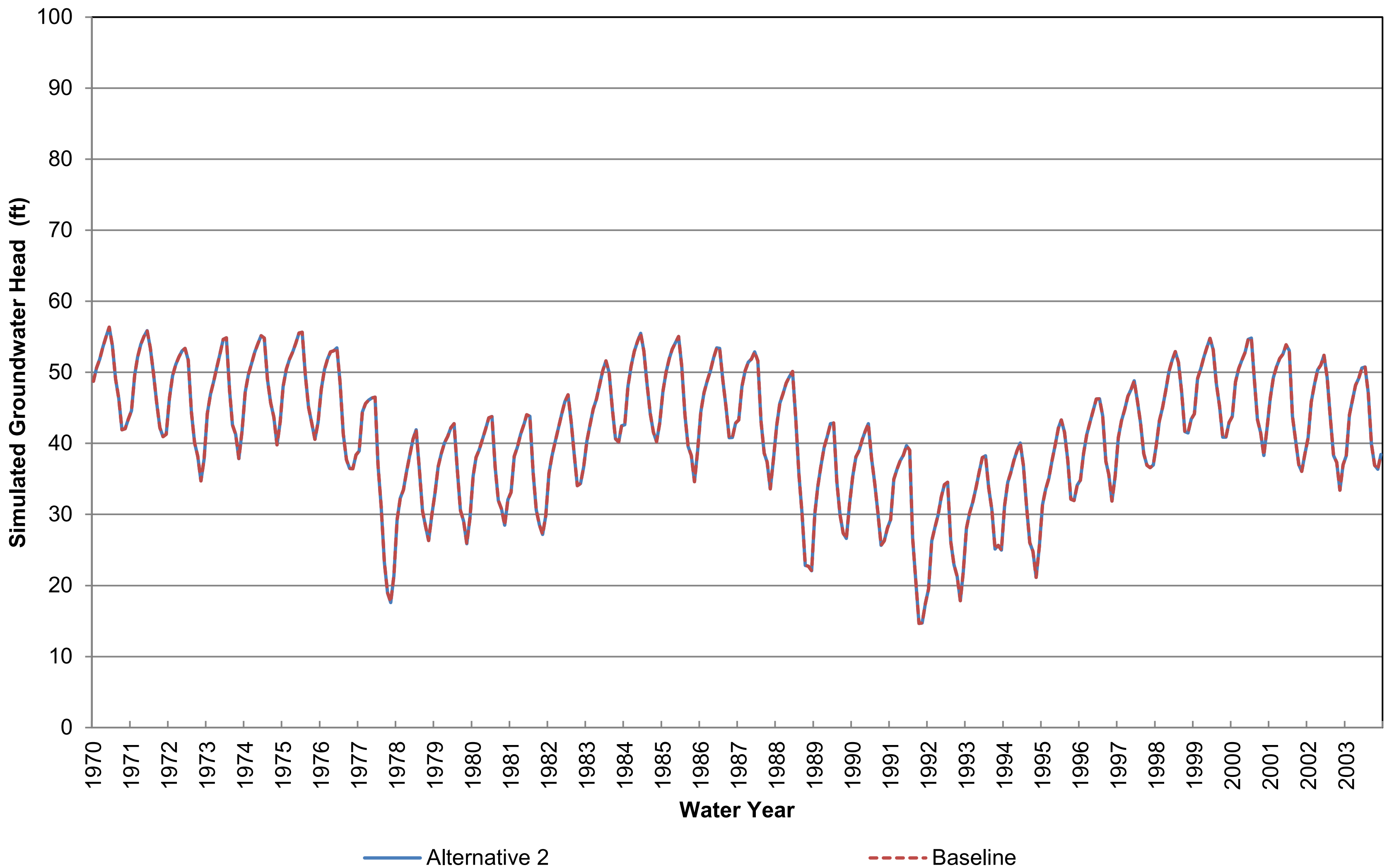
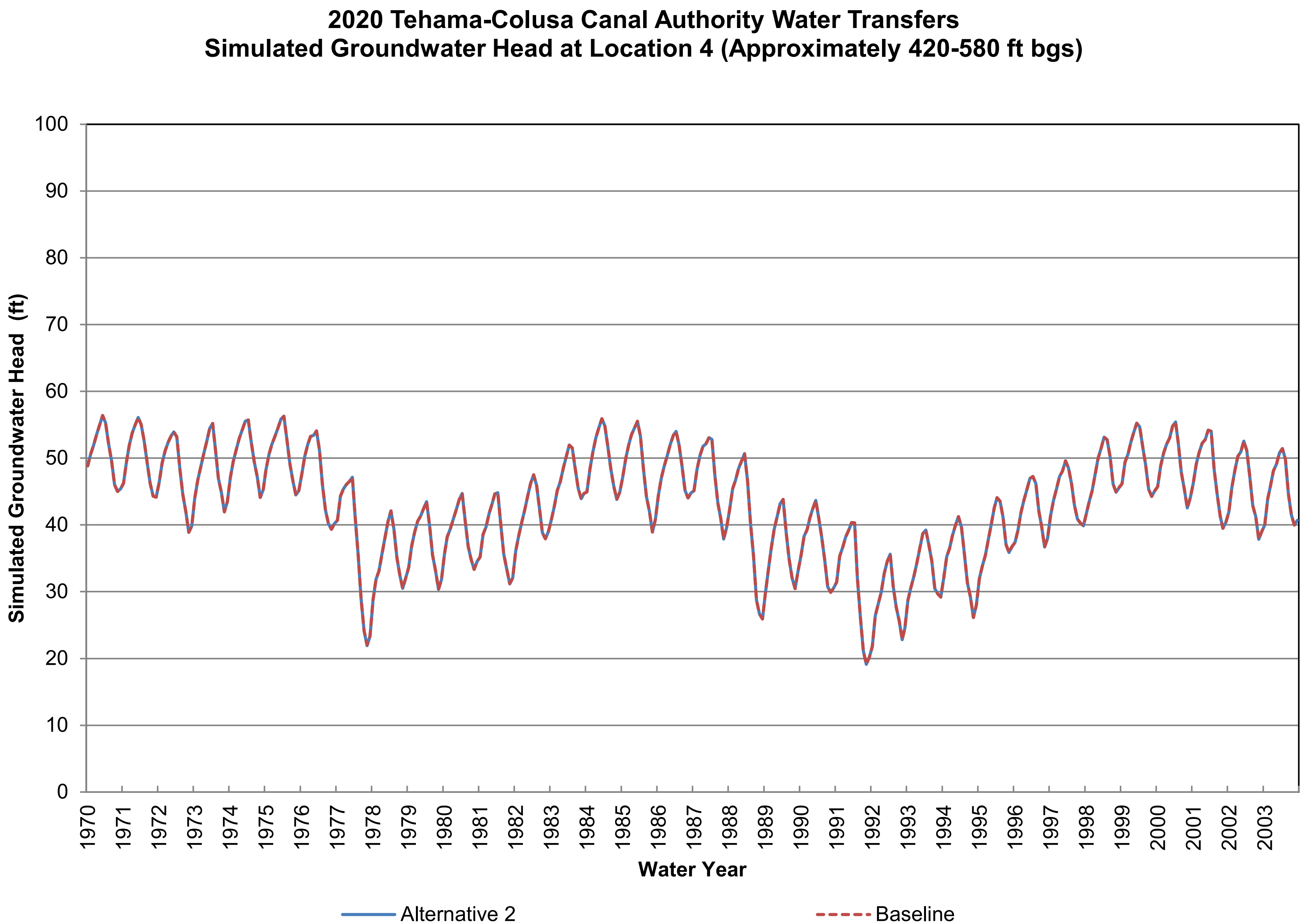
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 4 (Approximately 190-300 ft bgs)



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 300-420 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 420-580 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
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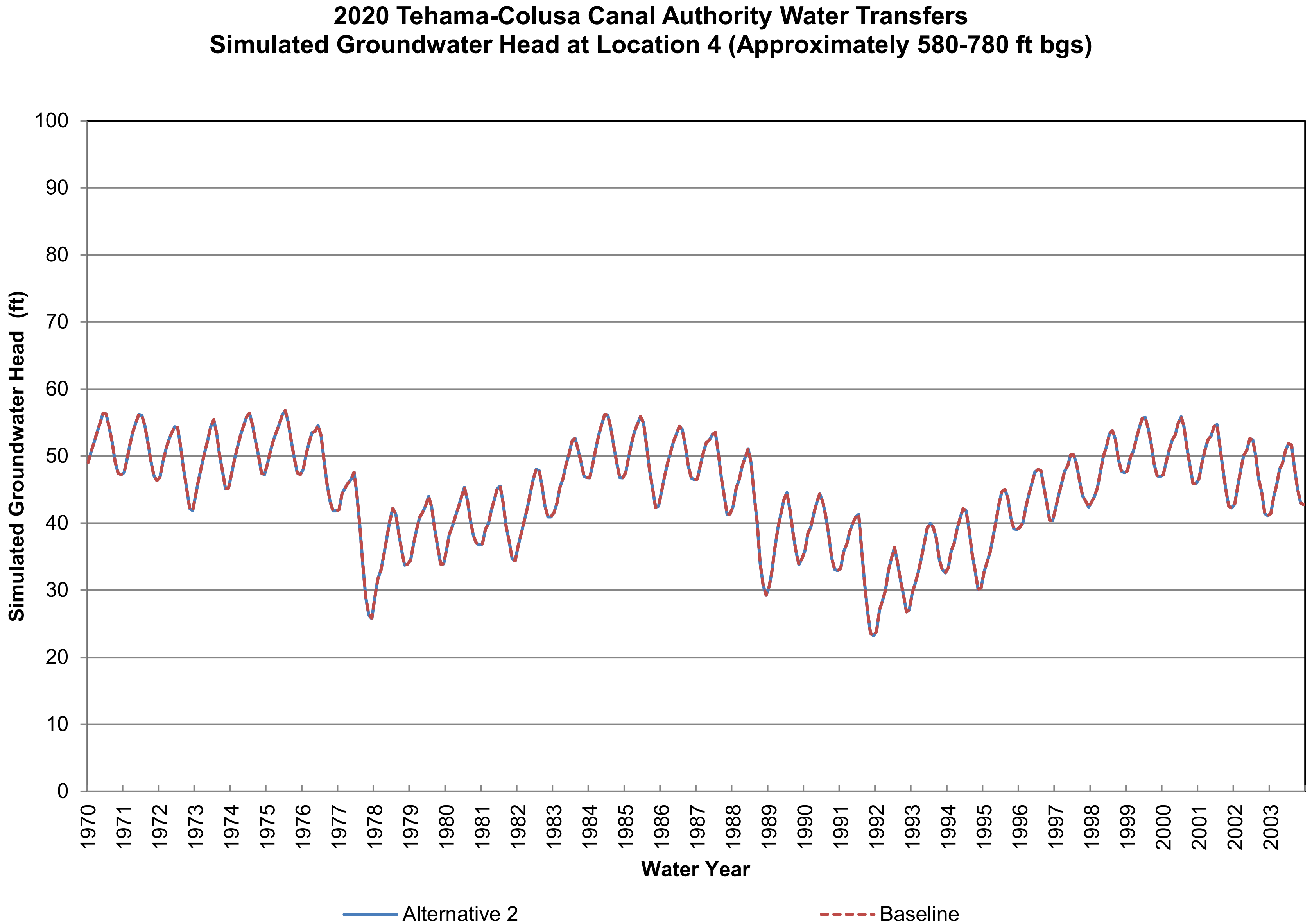
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 580-780 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1999
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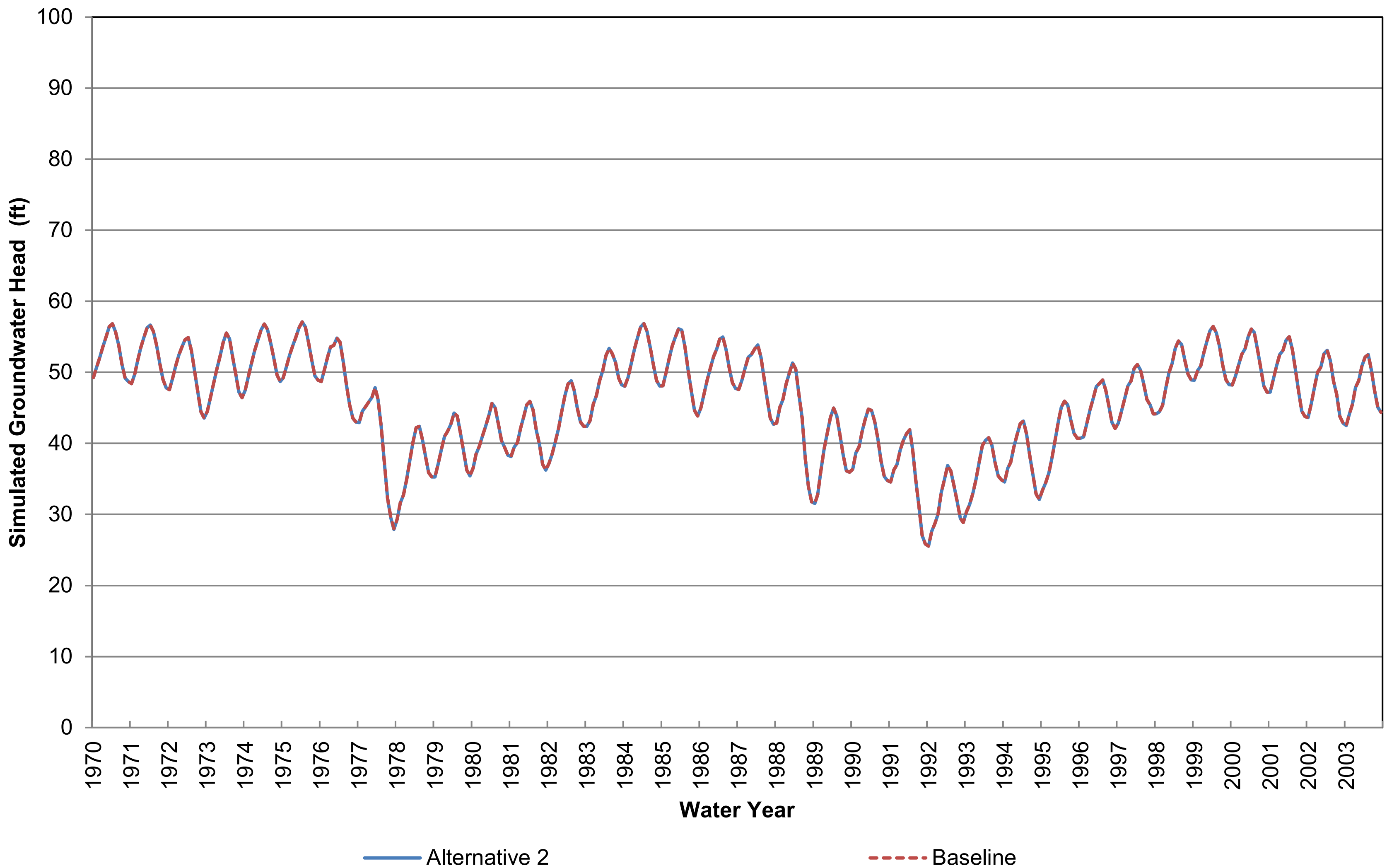
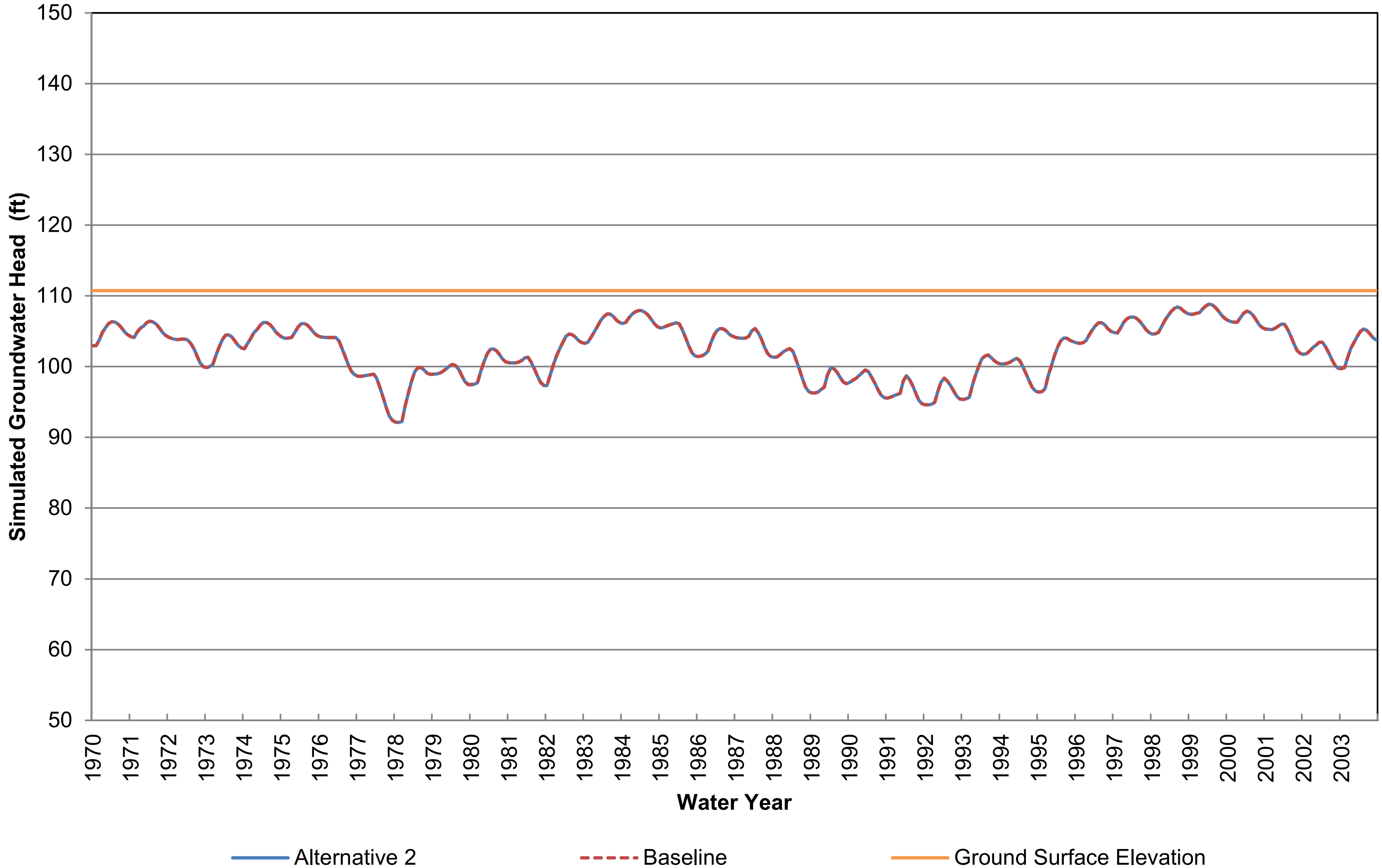
2001
2002
2003
Water Year
Alternative 2
Baseline

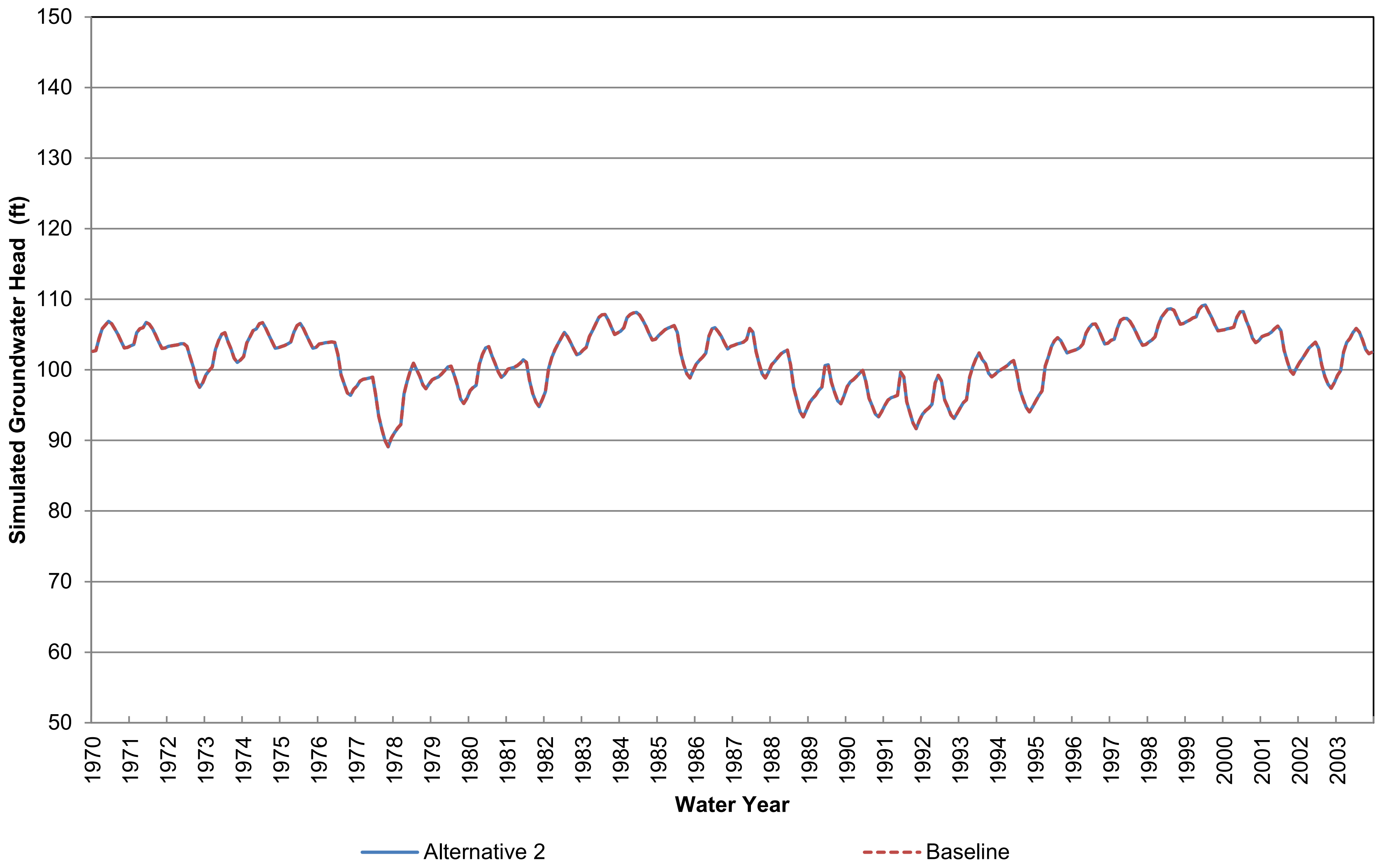
# 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 4 (Approximately 780-1060 ft bgs)

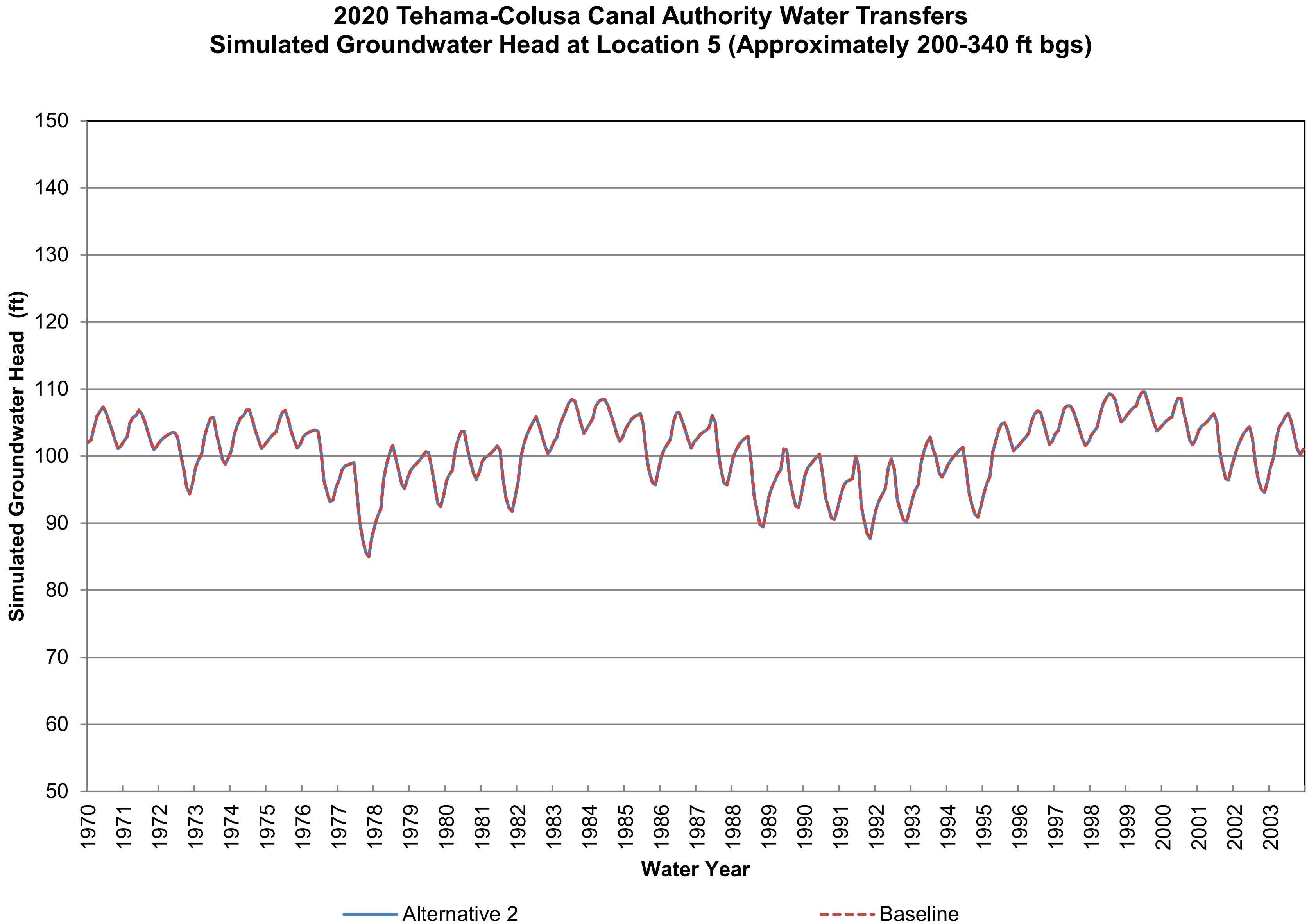


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 5 (Approximately 0-70 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 5 (Approximately 70-200 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 200-340 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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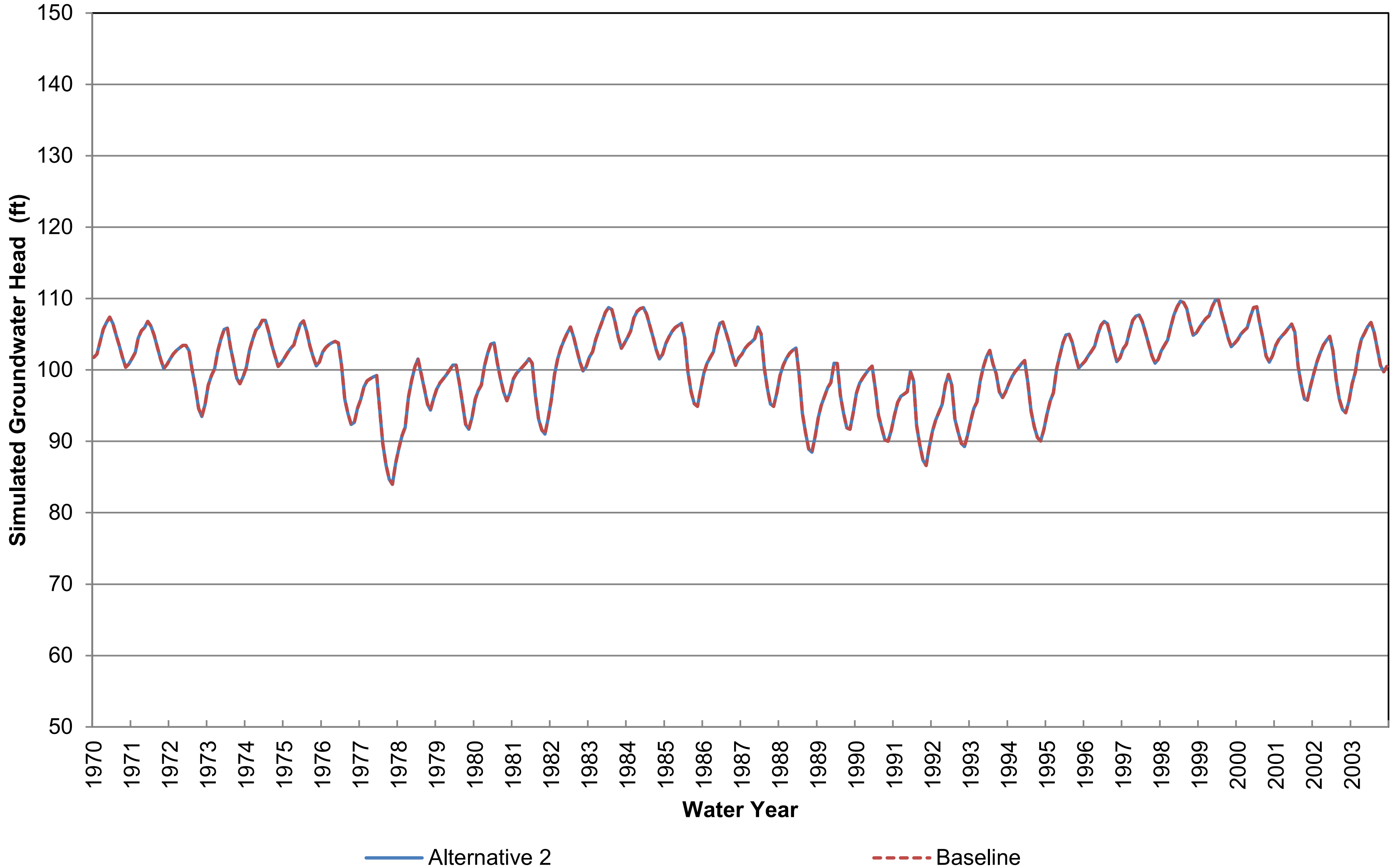
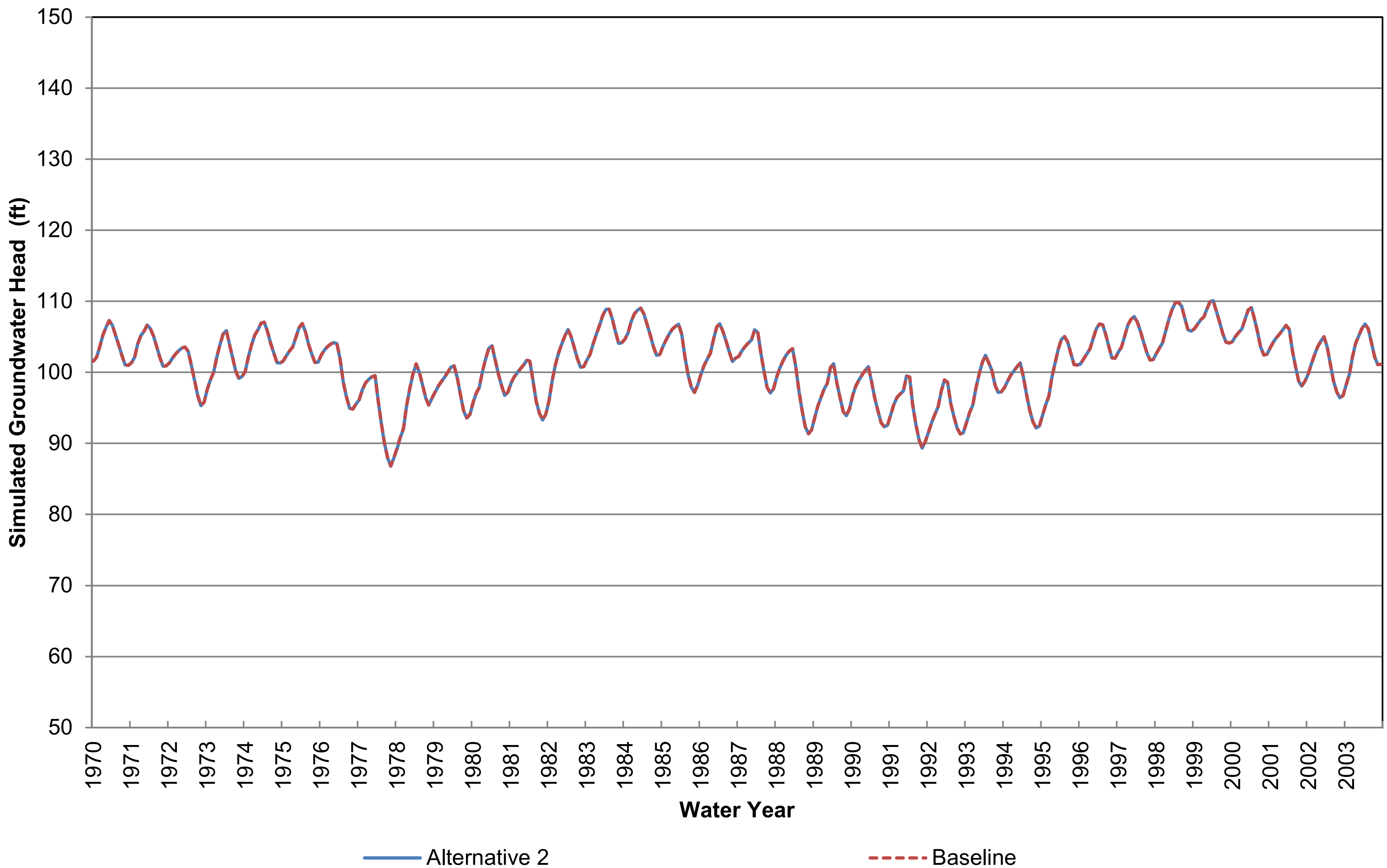
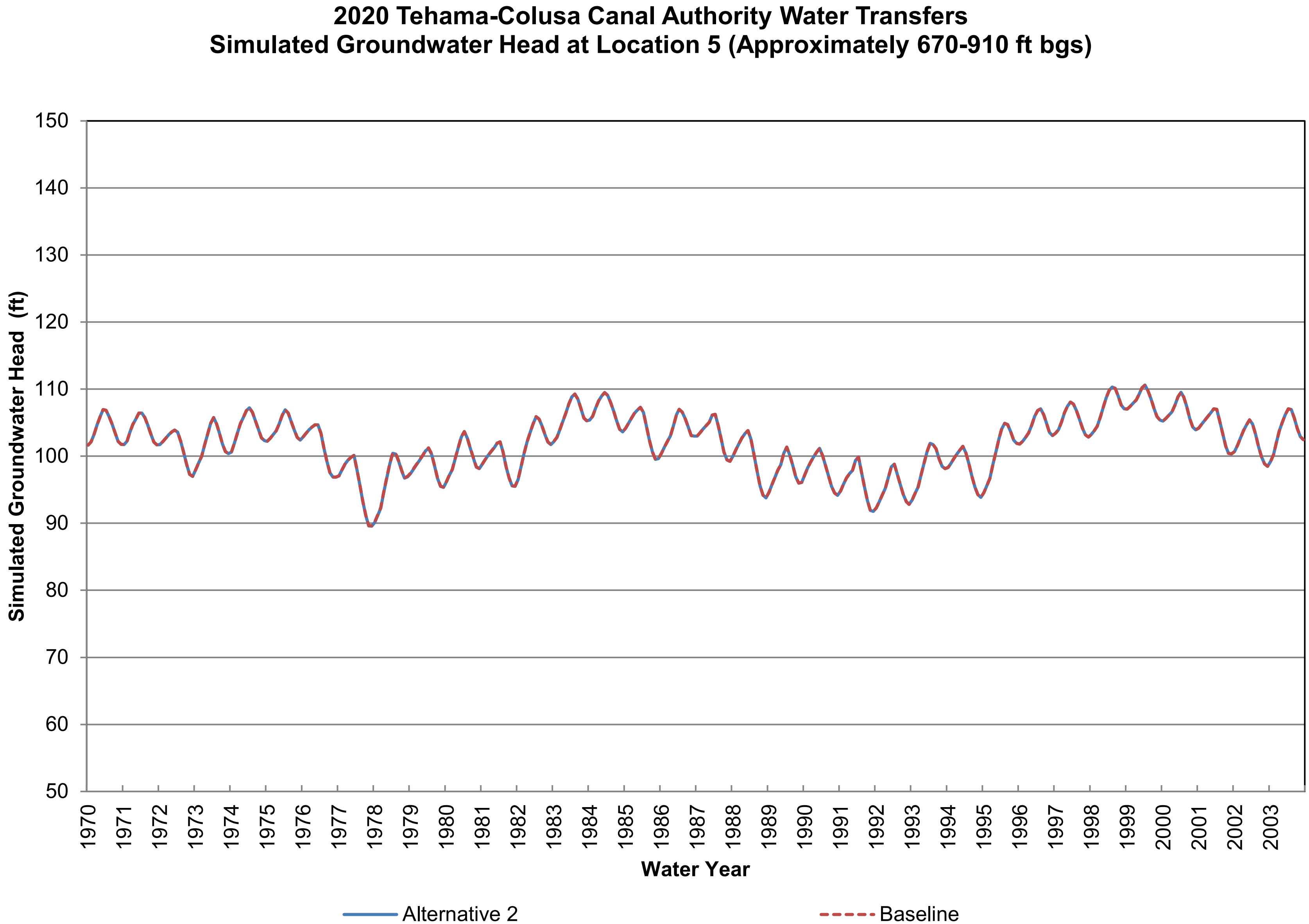
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 340-470 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 5 (Approximately 470-670 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 670-910 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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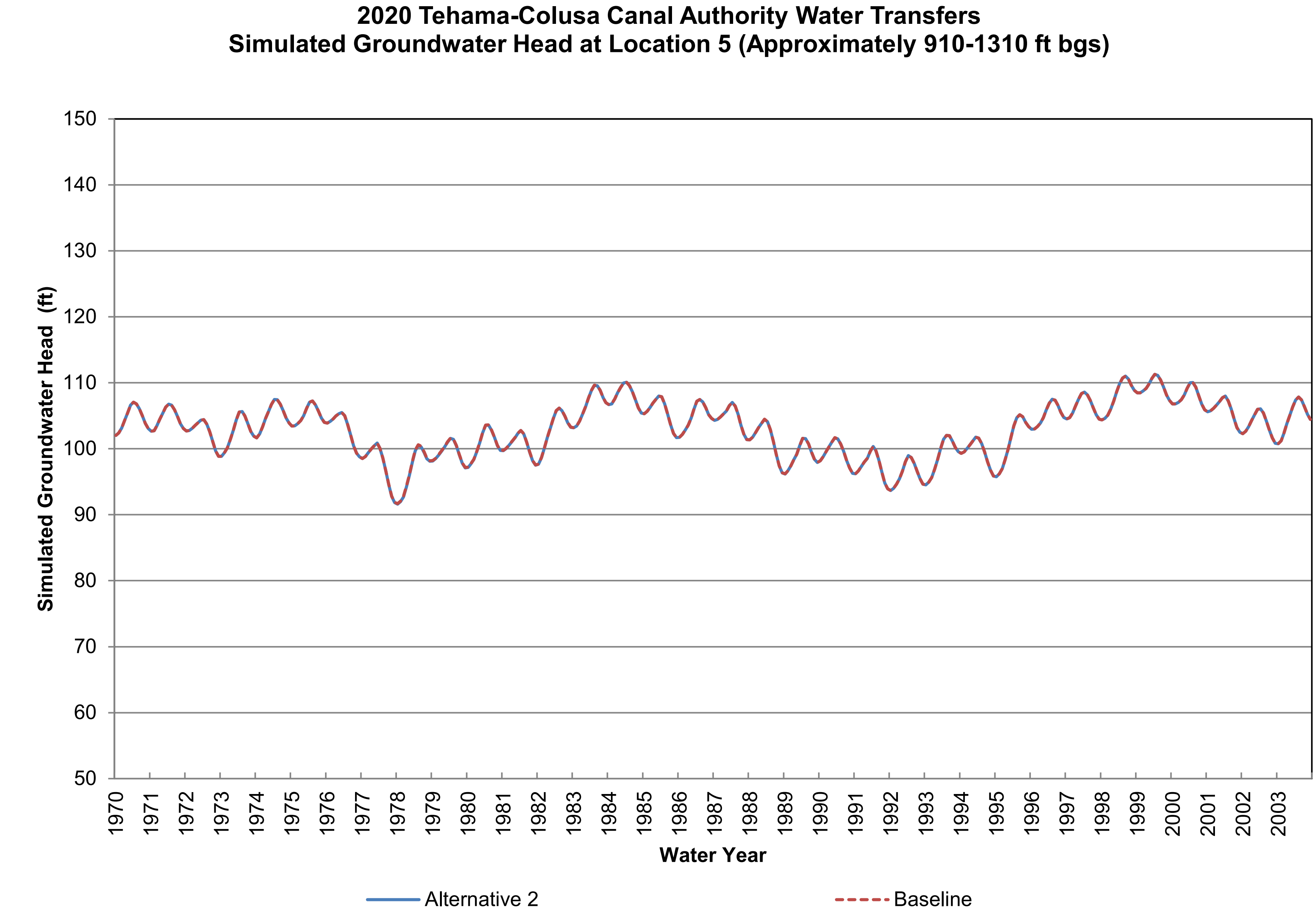
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 910-1310 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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1998
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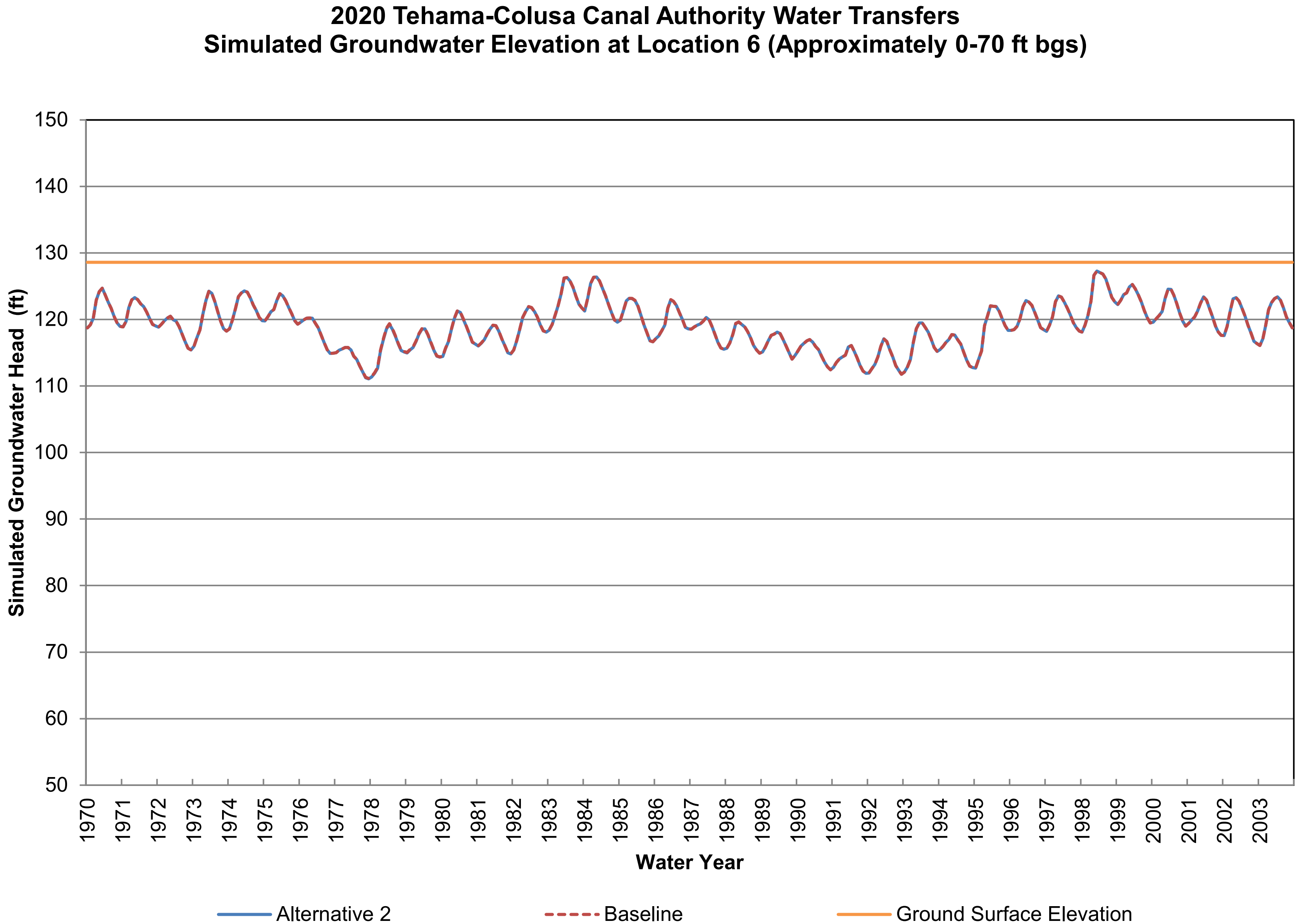
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 6 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
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1979
1980
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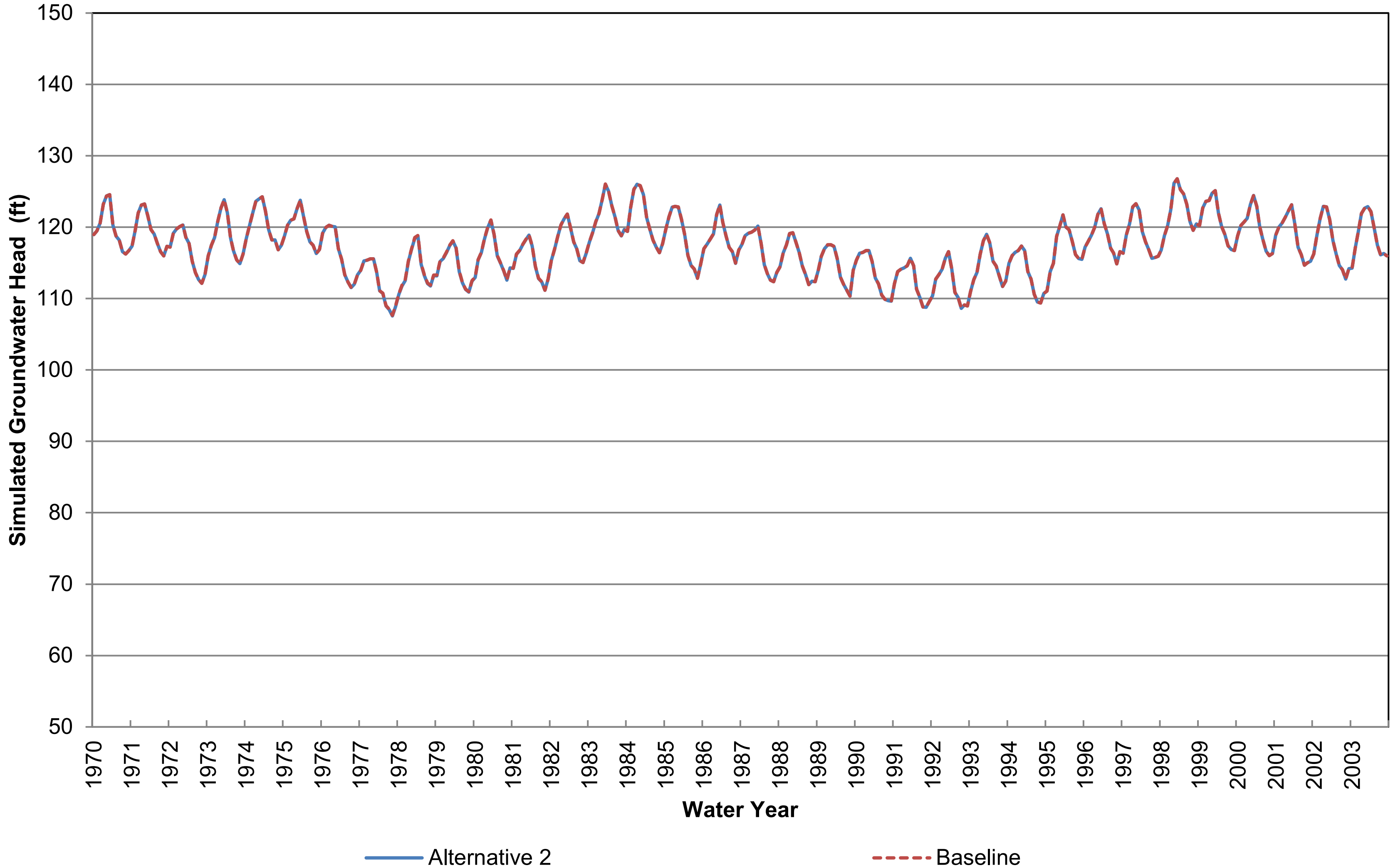
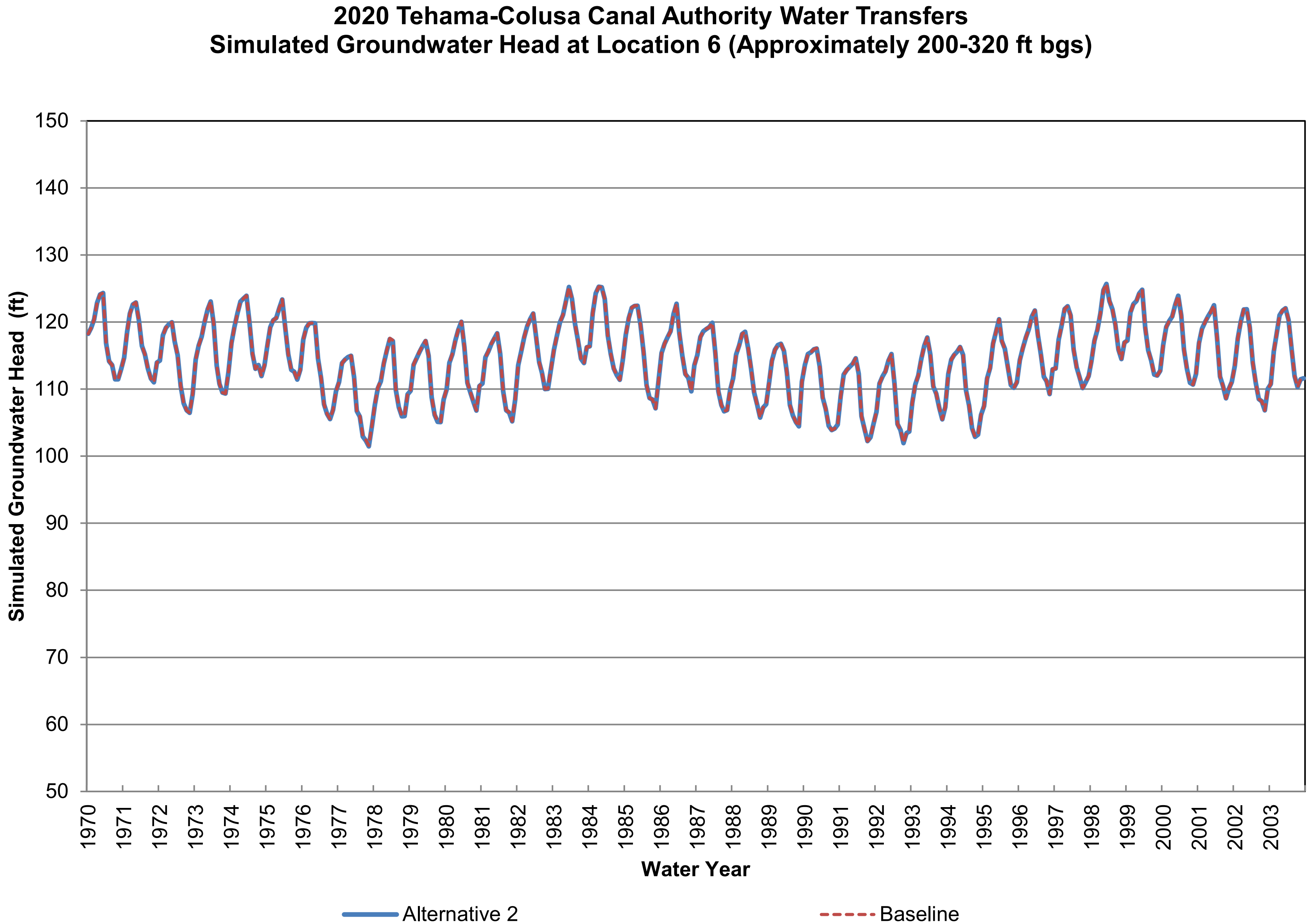
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 6 (Approximately 70-200 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 200-320 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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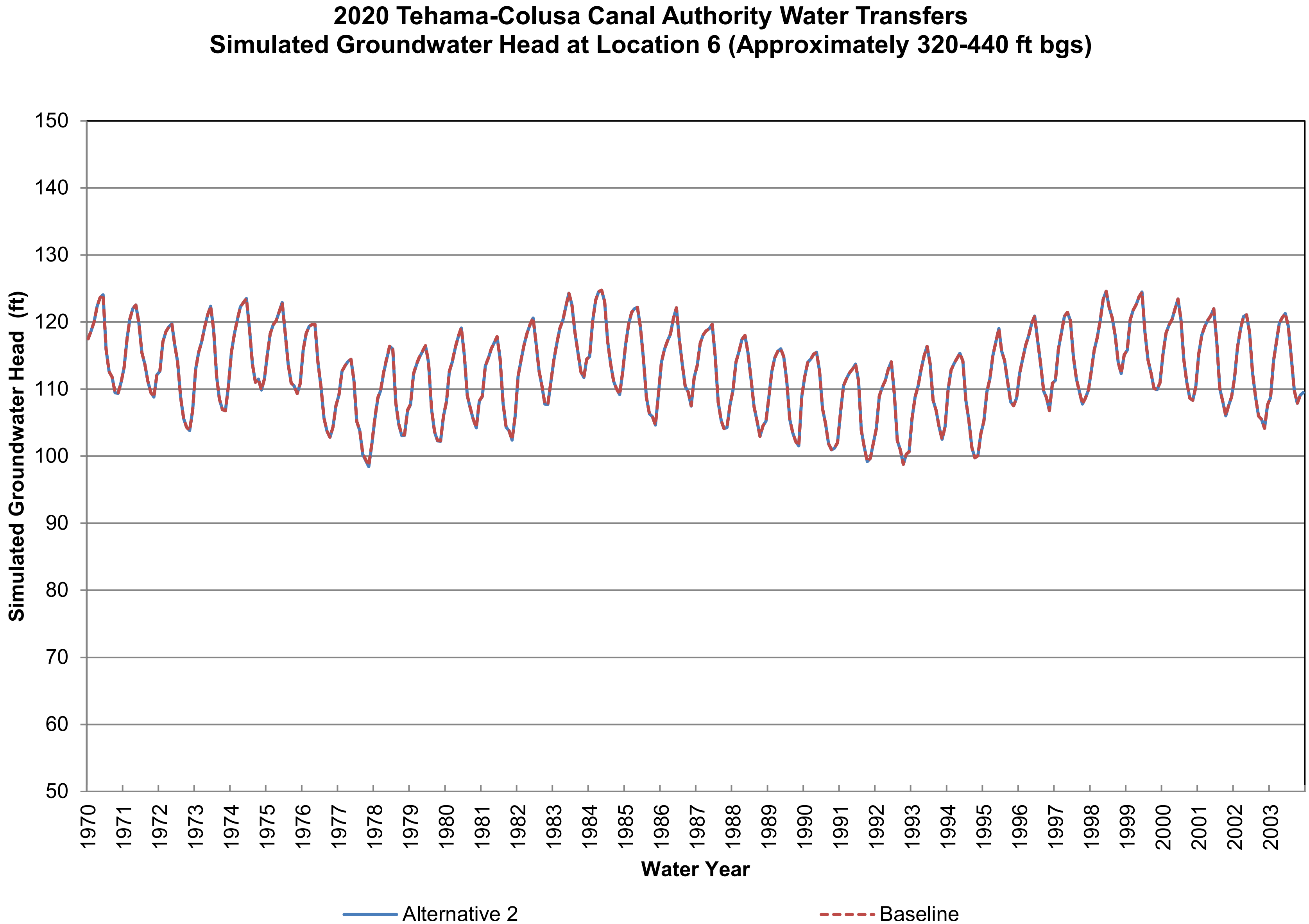
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 320-440 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
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1970
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1972
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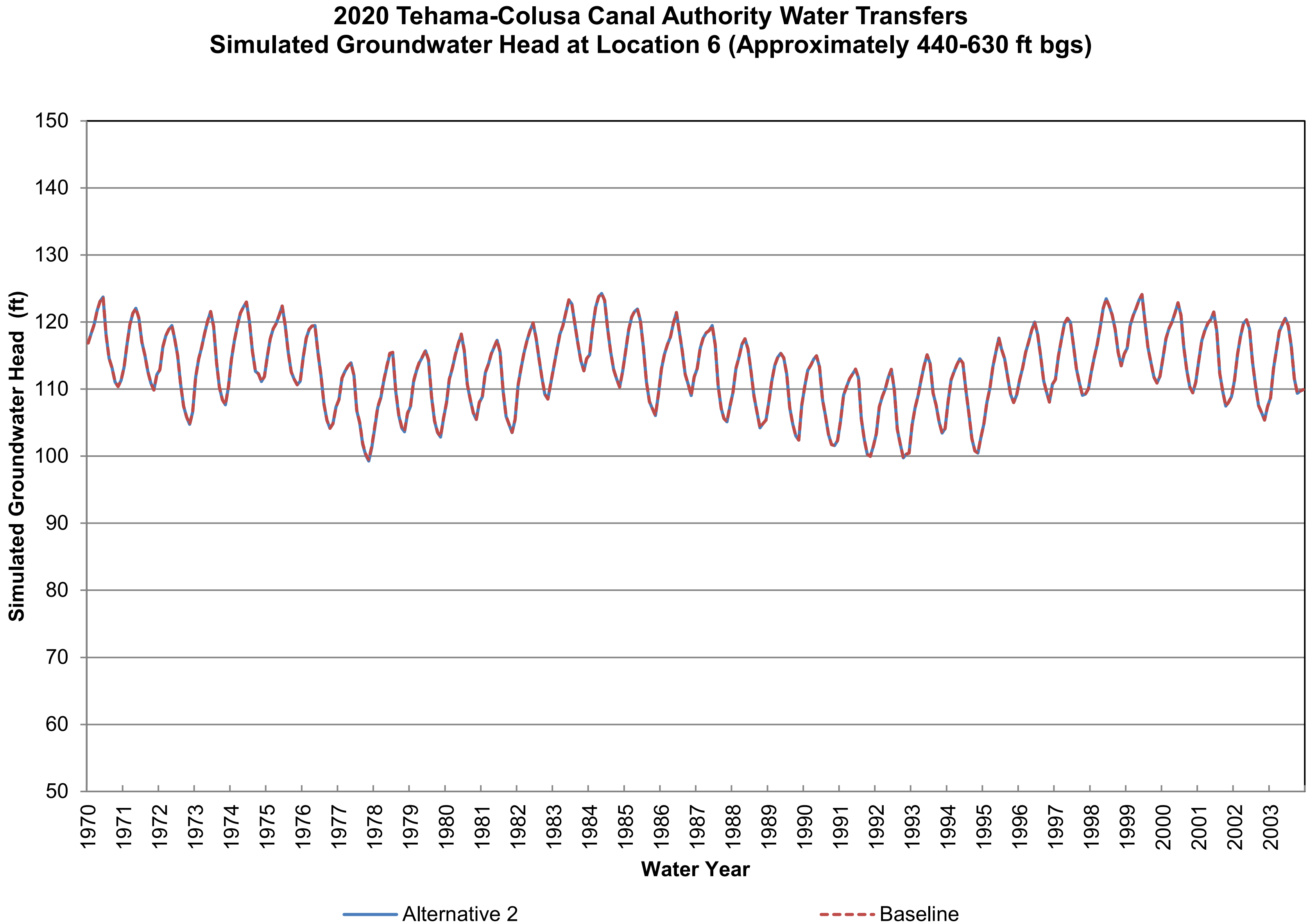
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 440-630 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
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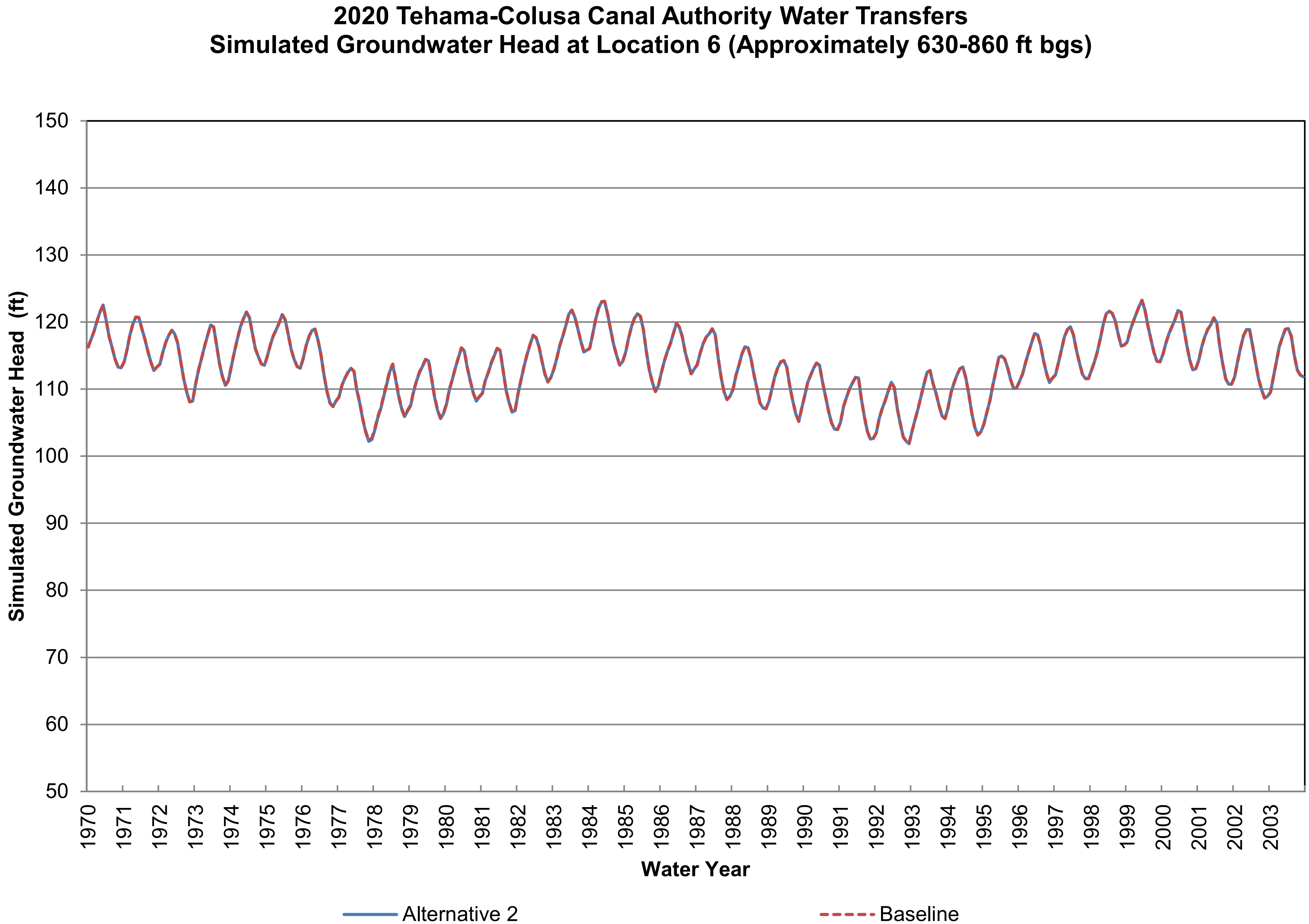
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 630-860 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
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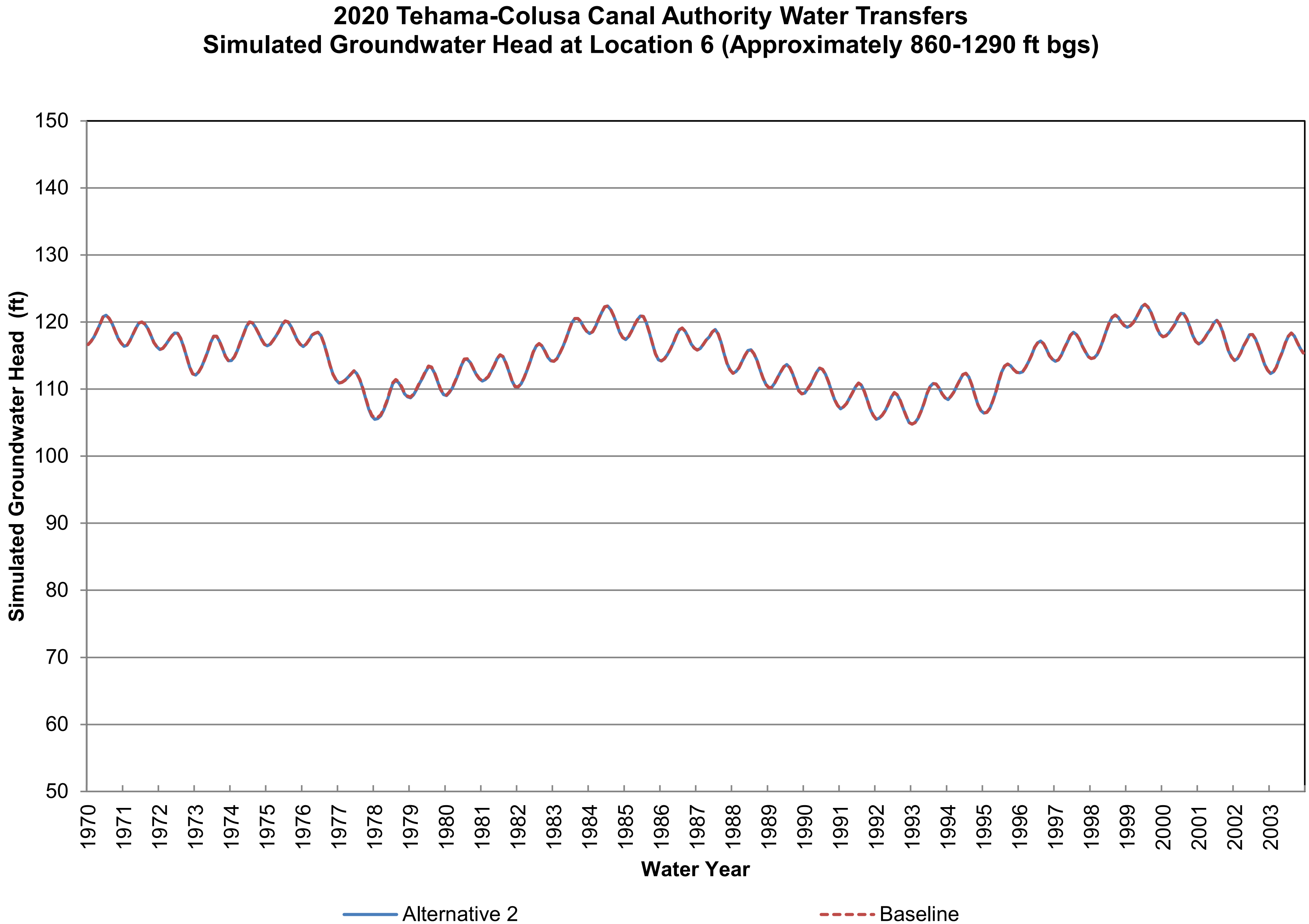
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 860-1290 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
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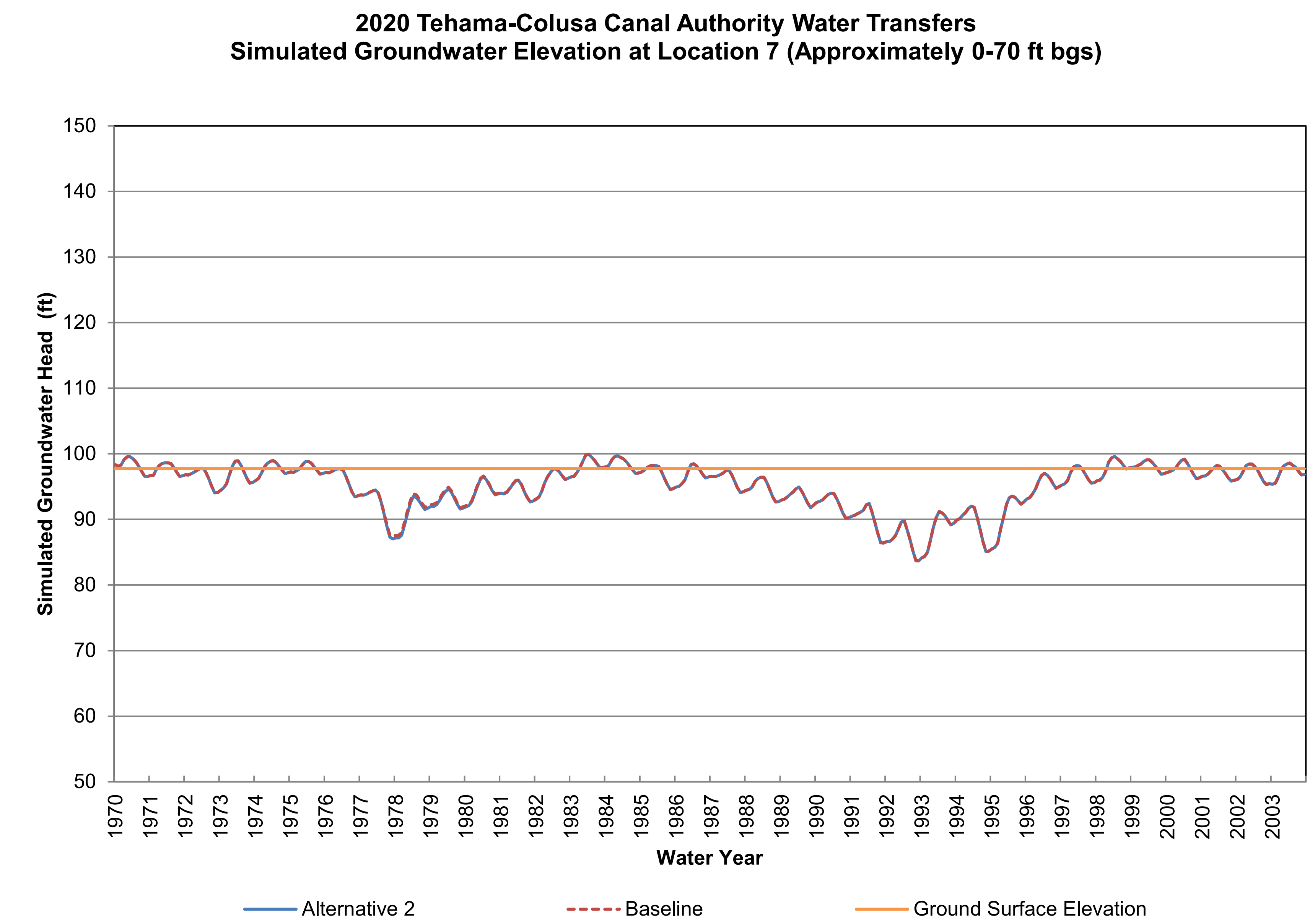
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 7 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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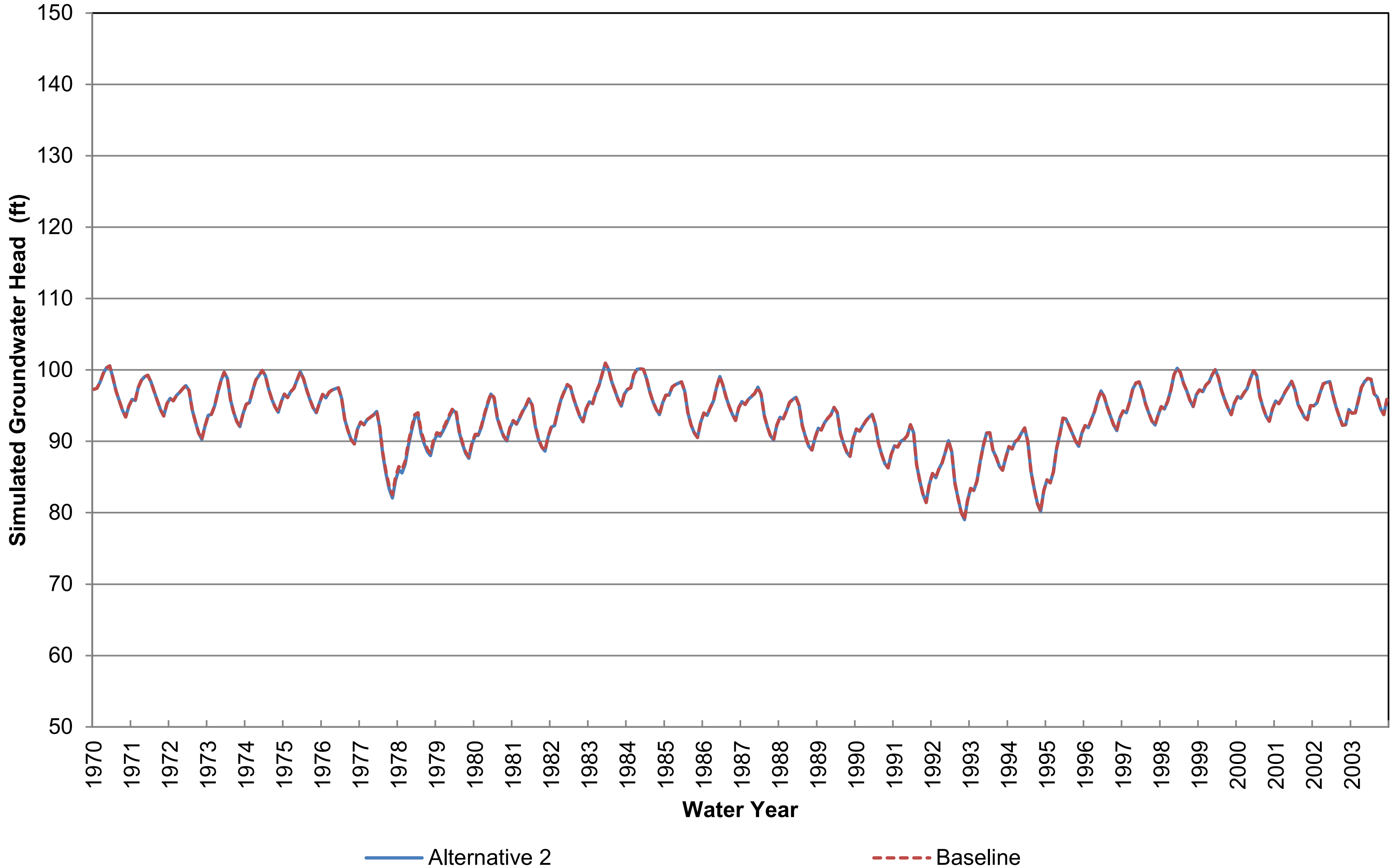
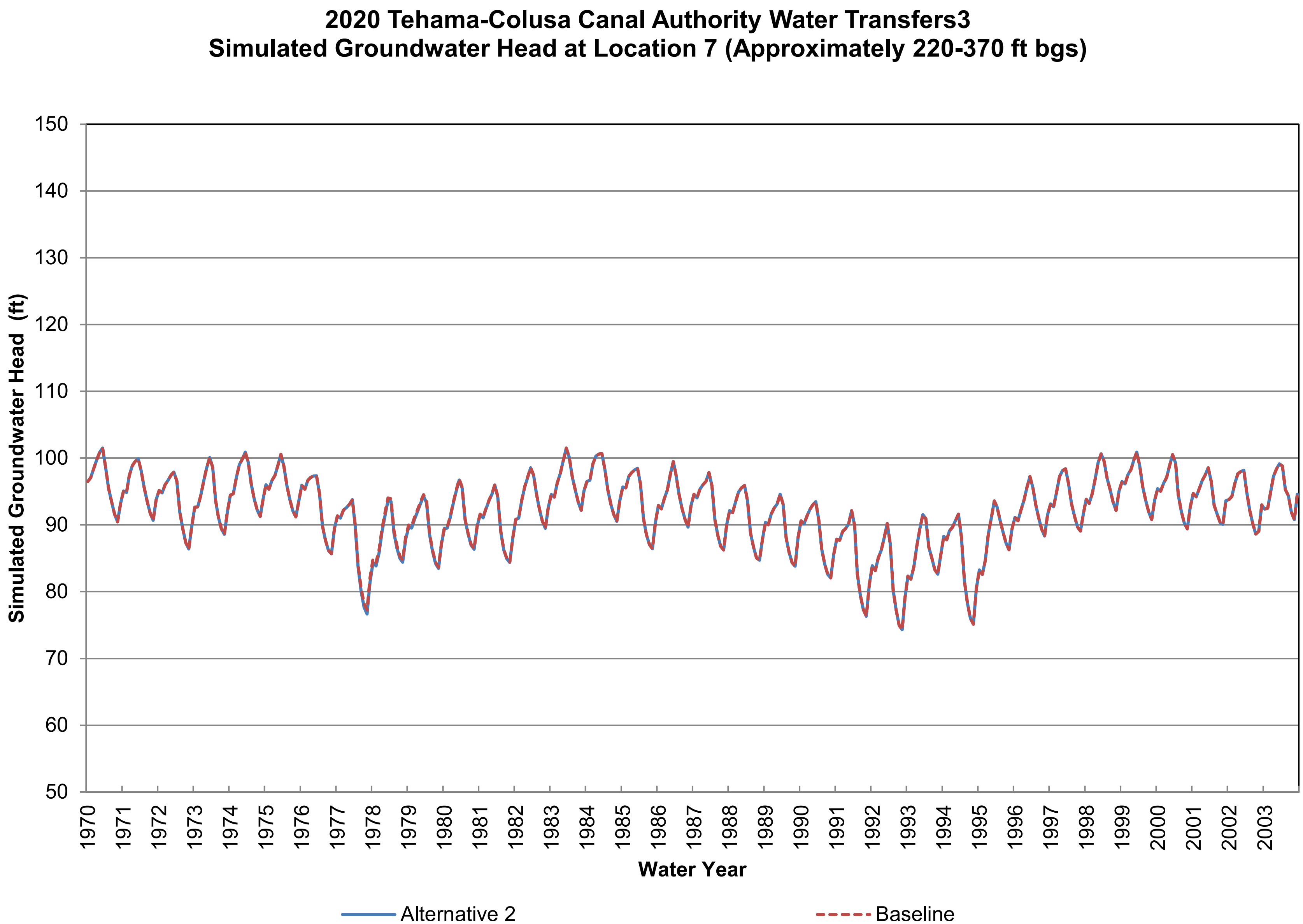
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 7 (Approximately 70-220 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers3
Simulated Groundwater Head at Location 7 (Approximately 220-370 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
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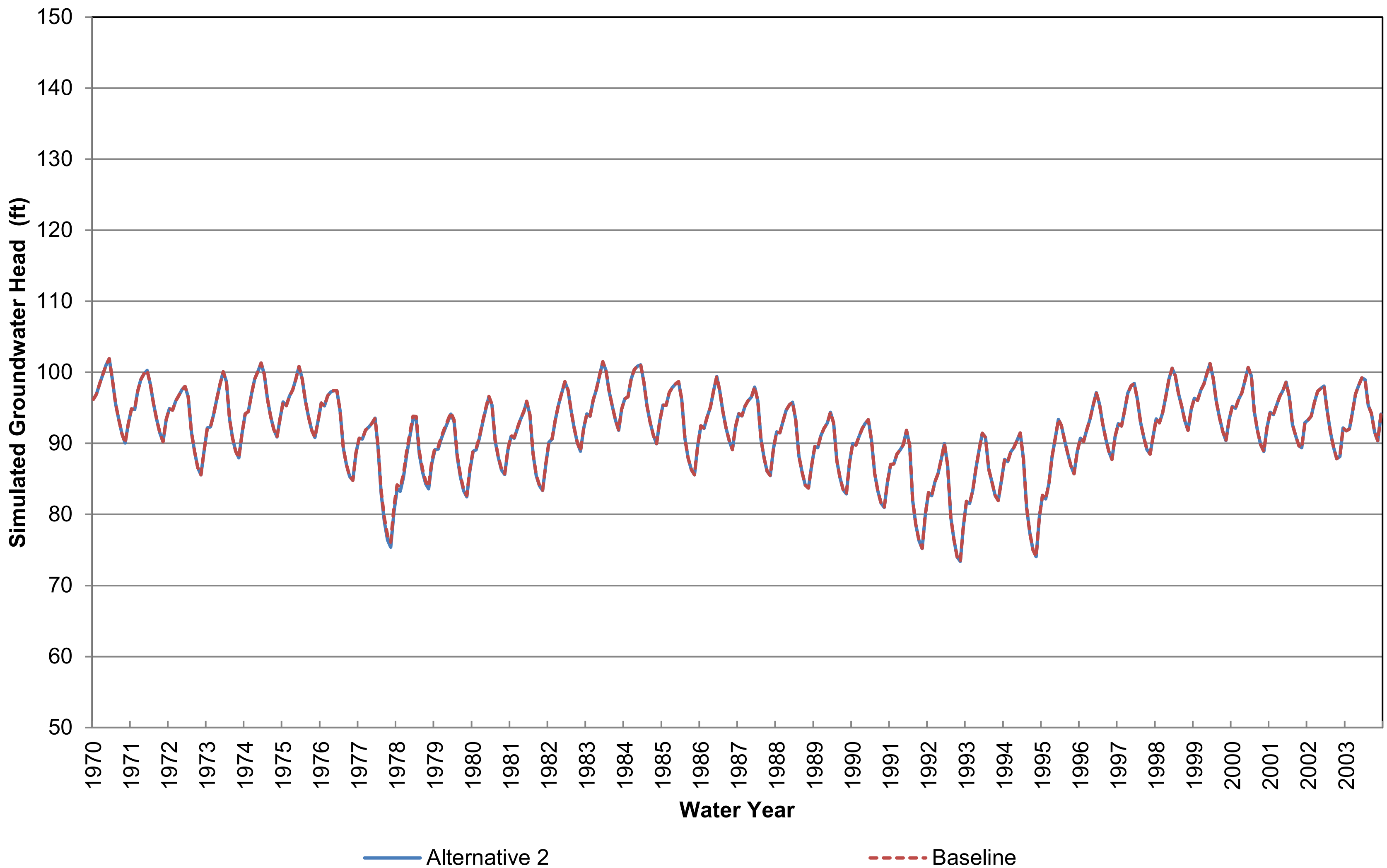
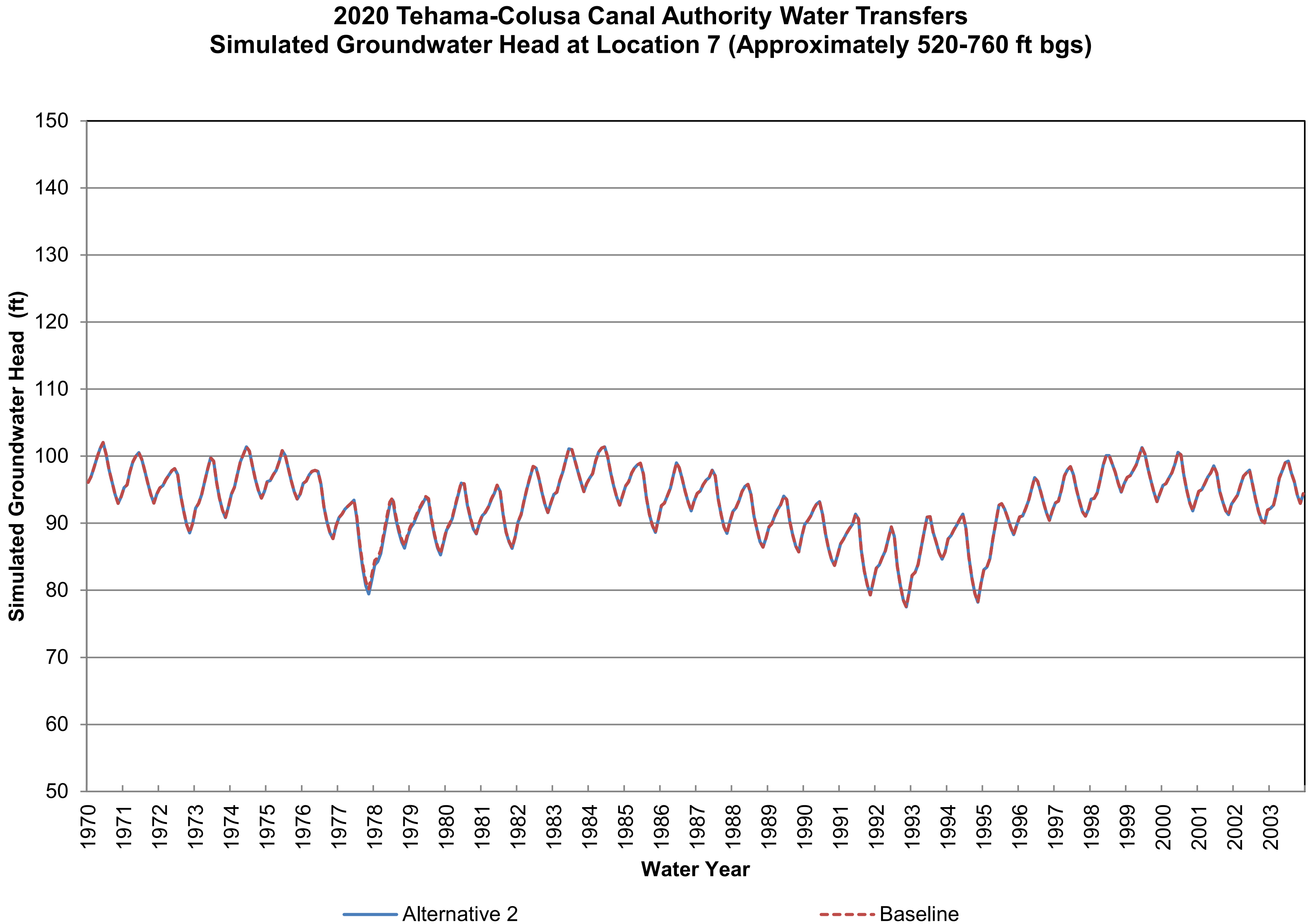
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 7 (Approximately 370-520 ft bgs)**





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 520-760 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
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1991
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1994
1995
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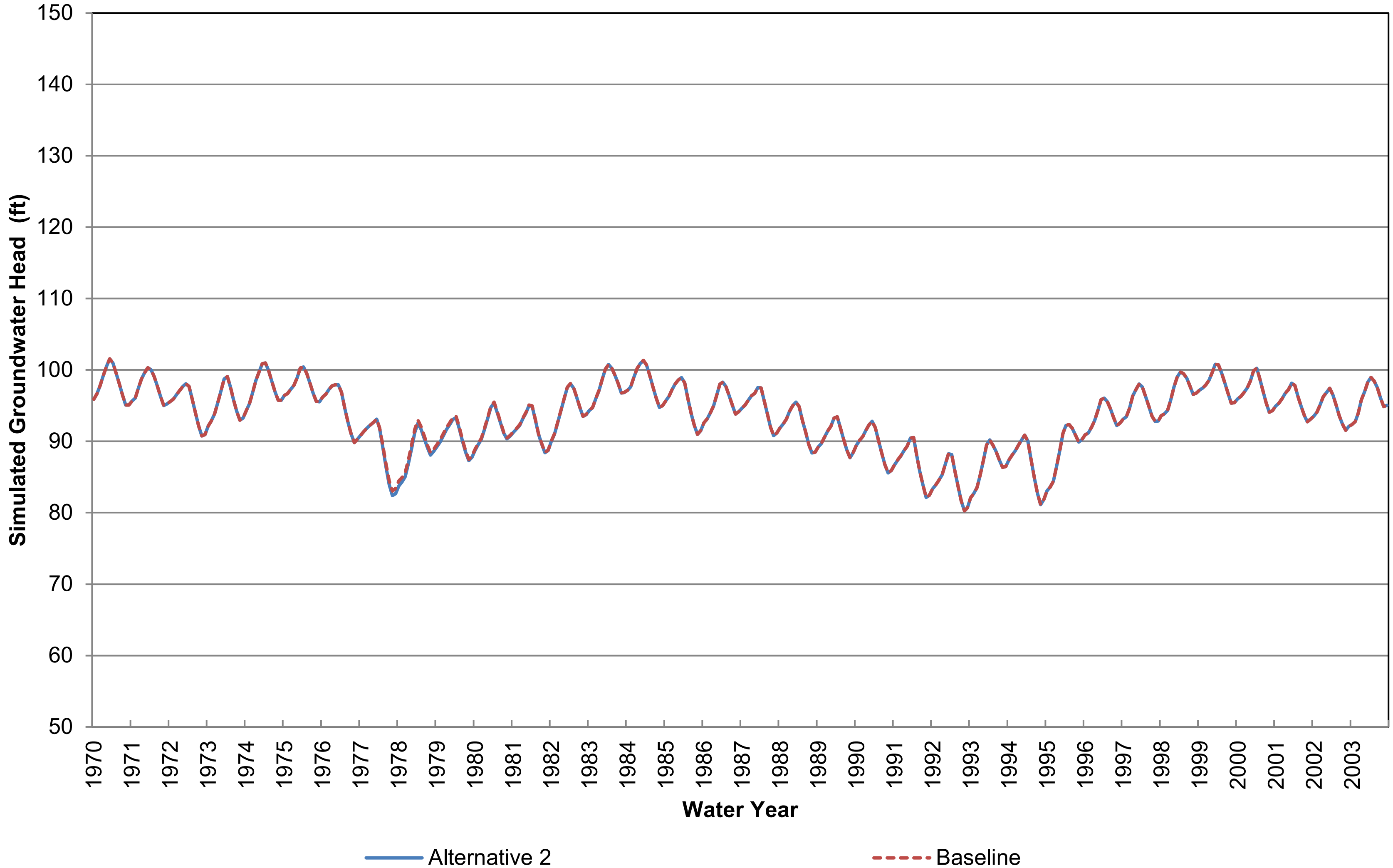
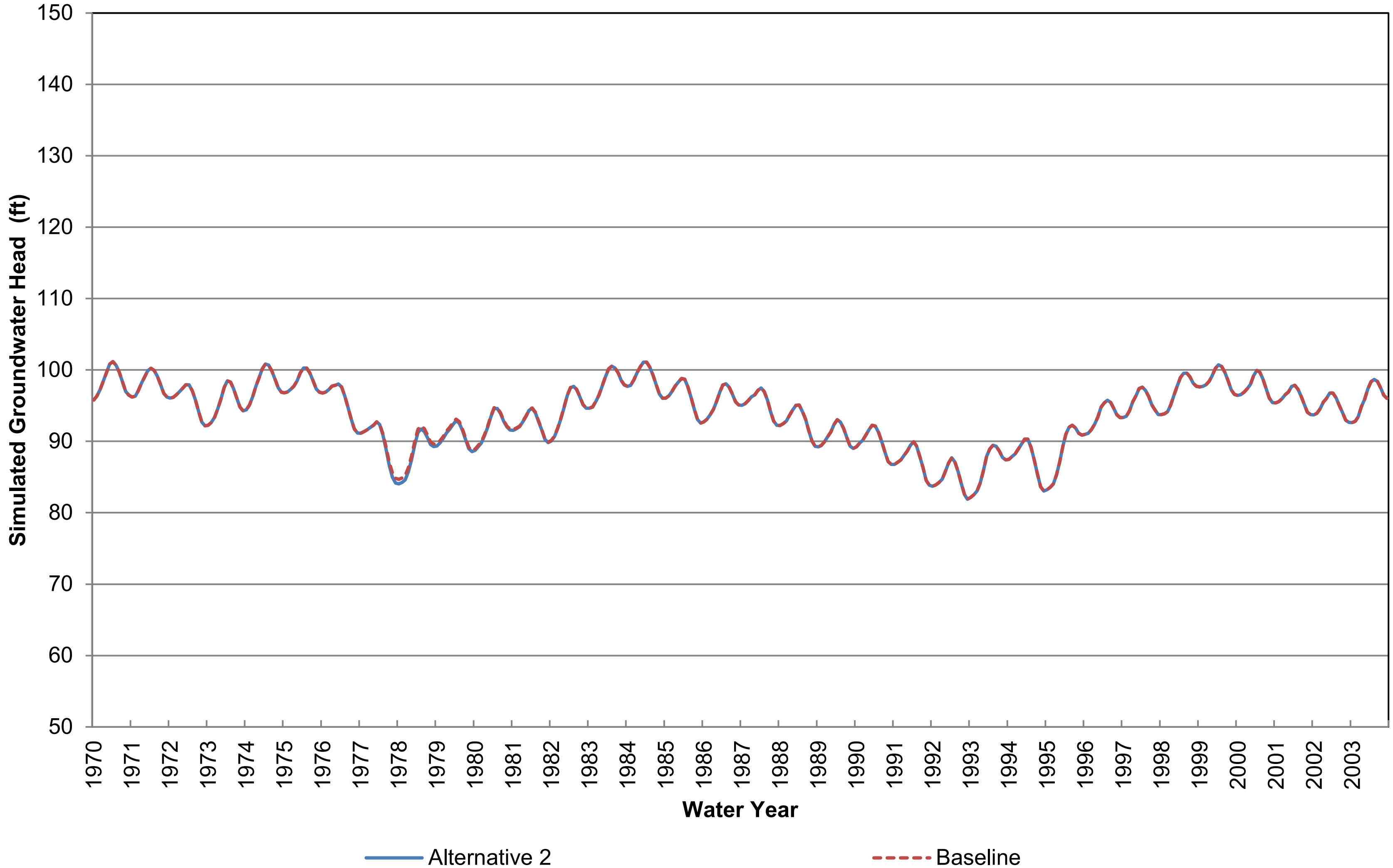
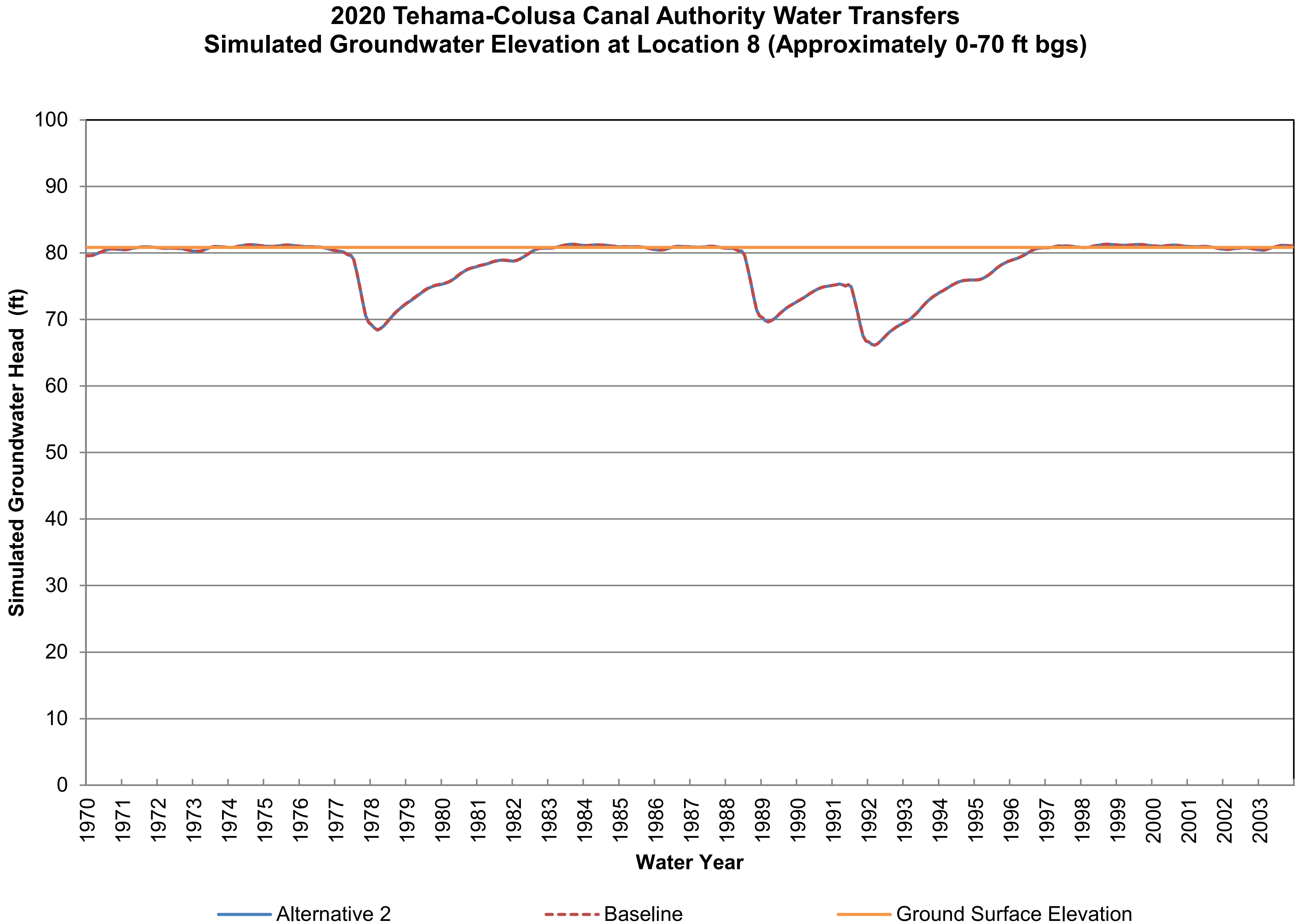
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 7 (Approximately 760-1030 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 7 (Approximately 1030-1520 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 8 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1983
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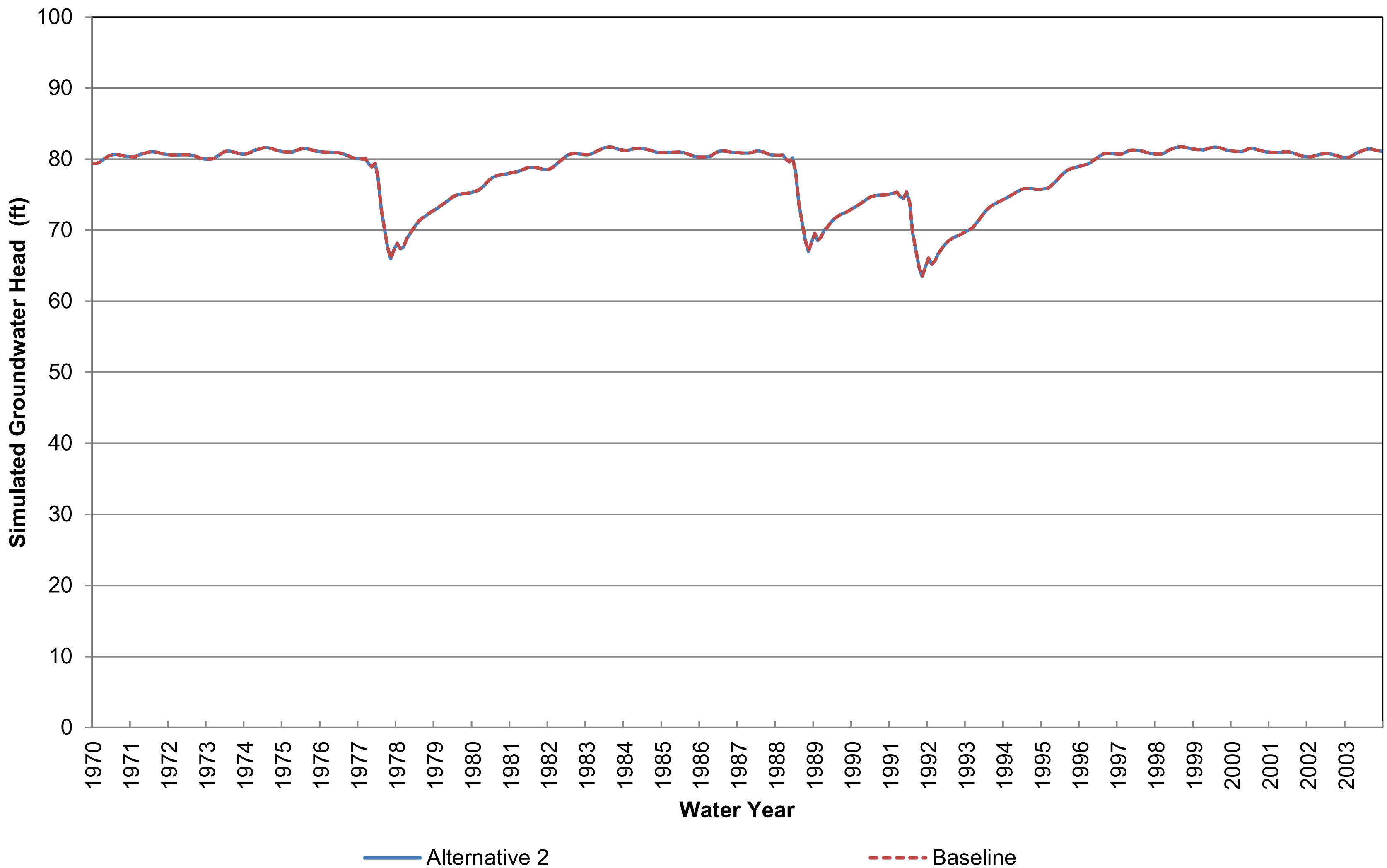
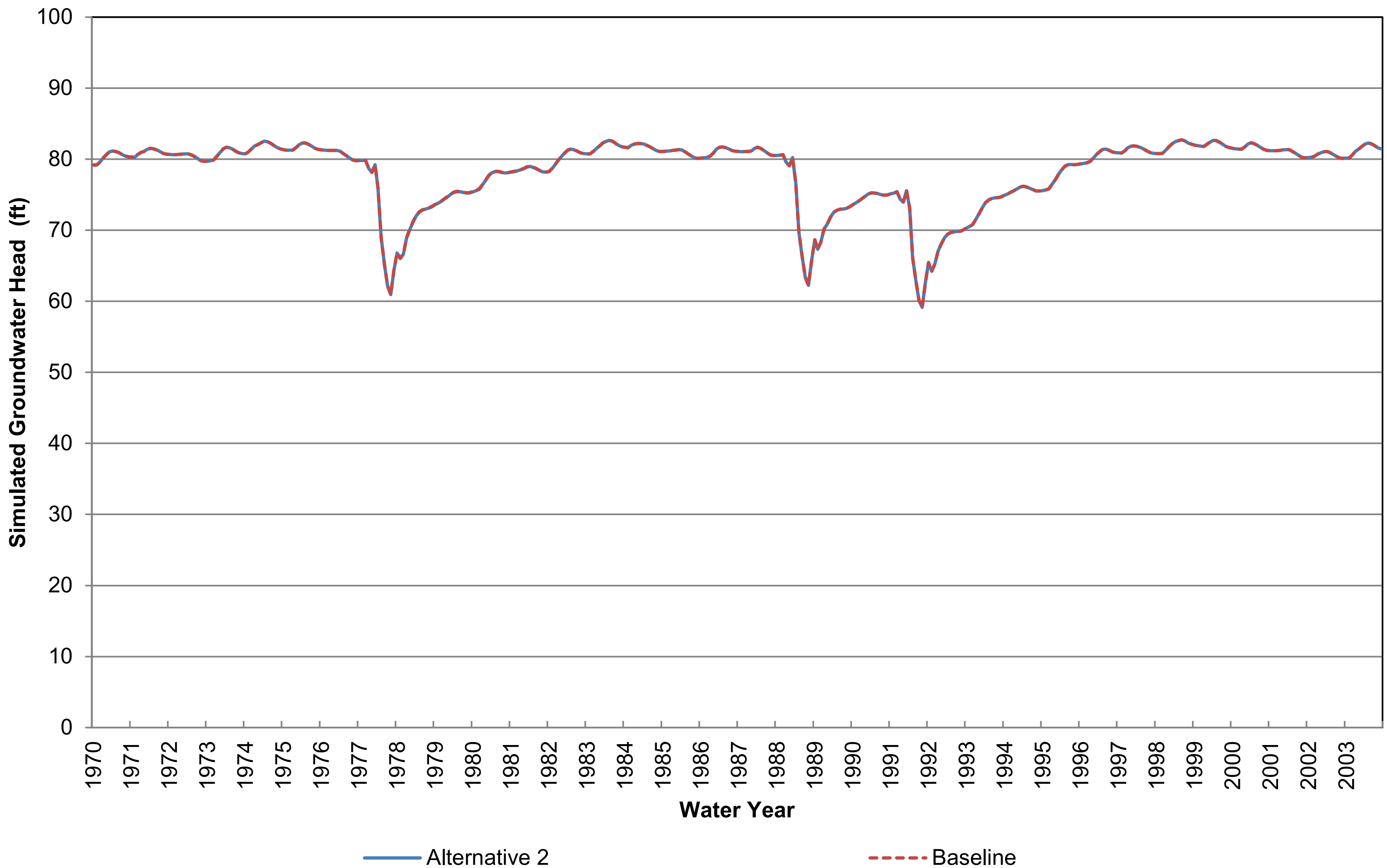
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

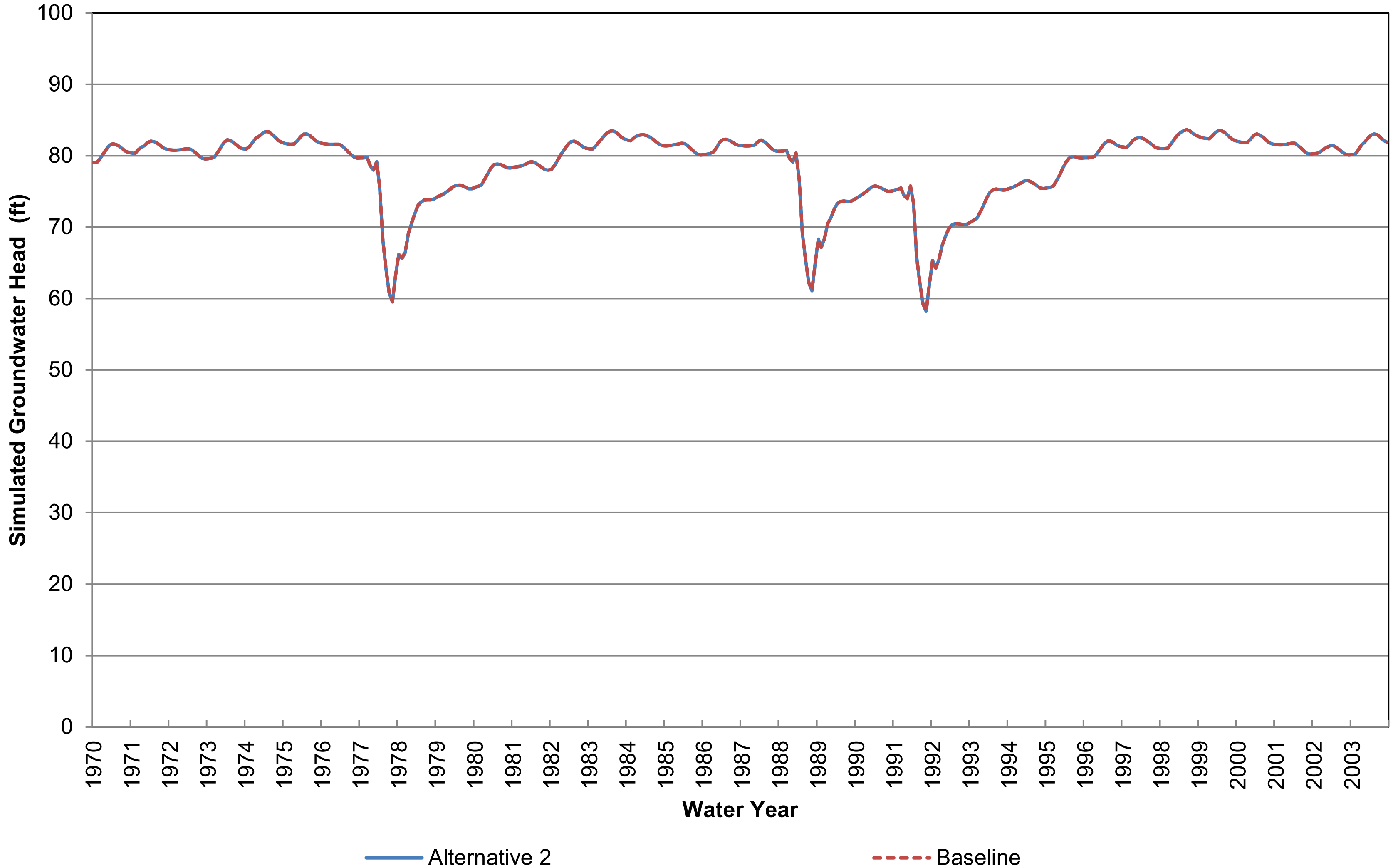
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 8 (Approximately 70-200 ft bgs)



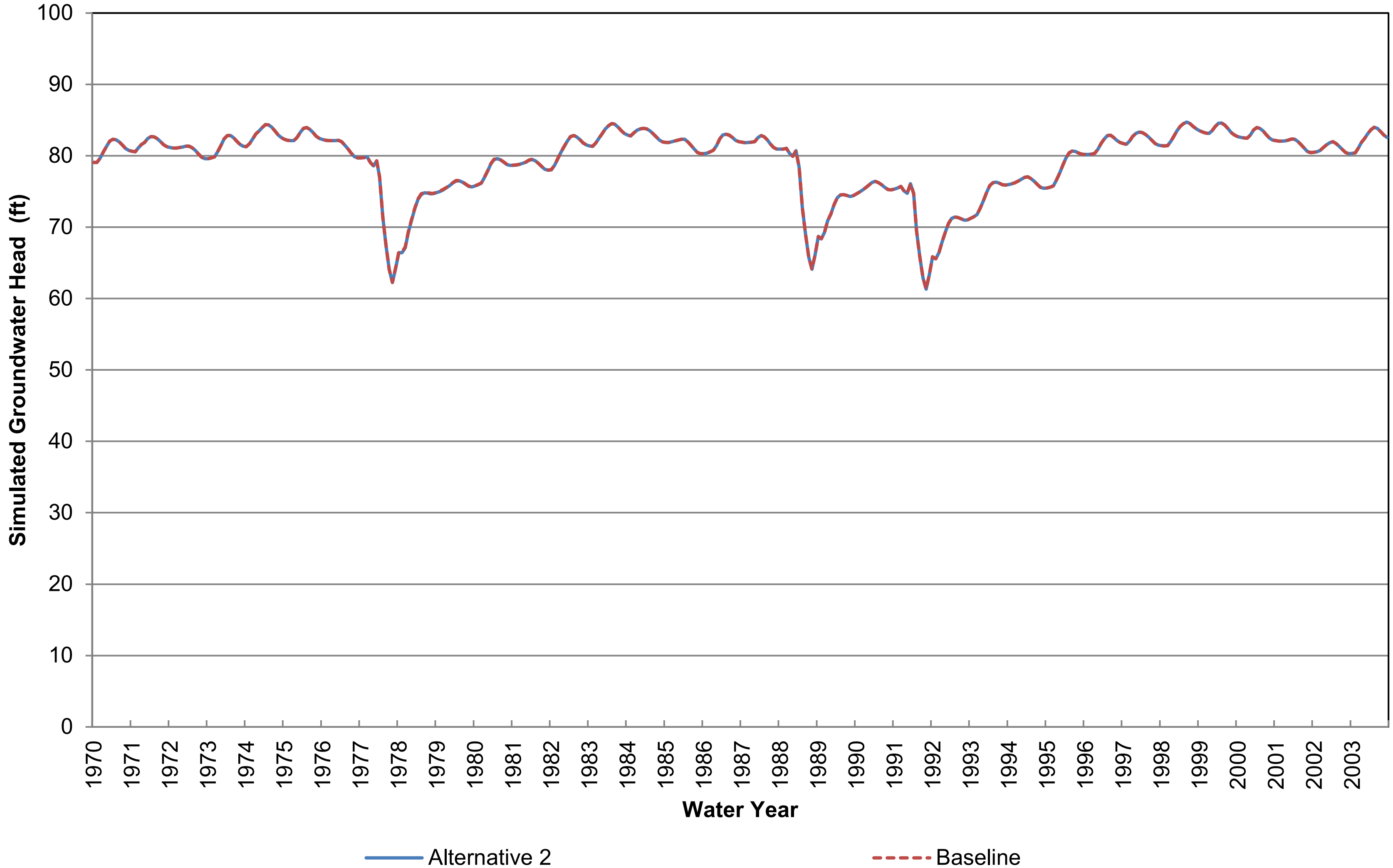
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 8 (Approximately 200-330 ft bgs)

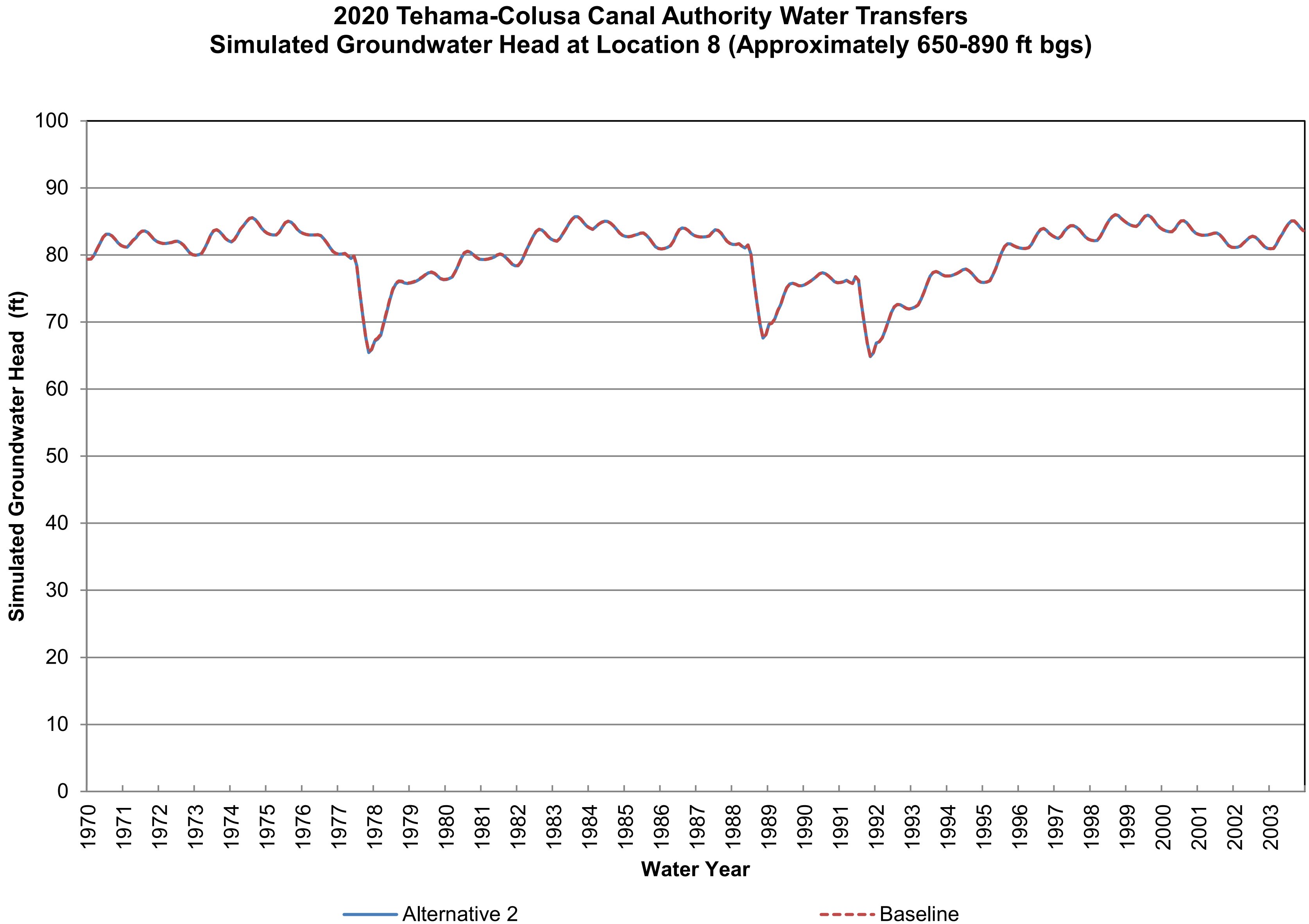


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 8 (Approximately 330-450 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 8 (Approximately 450-650 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 650-890 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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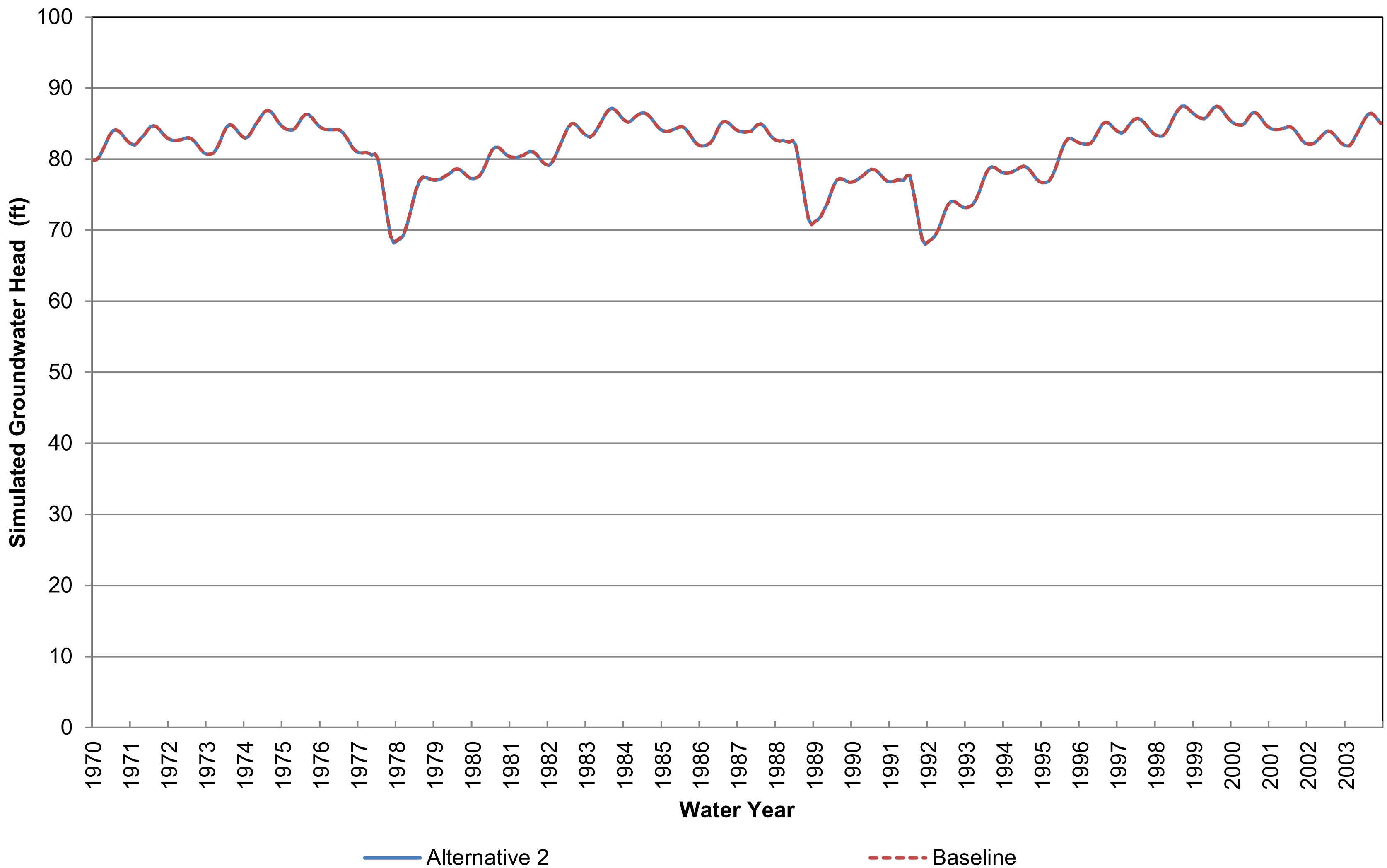
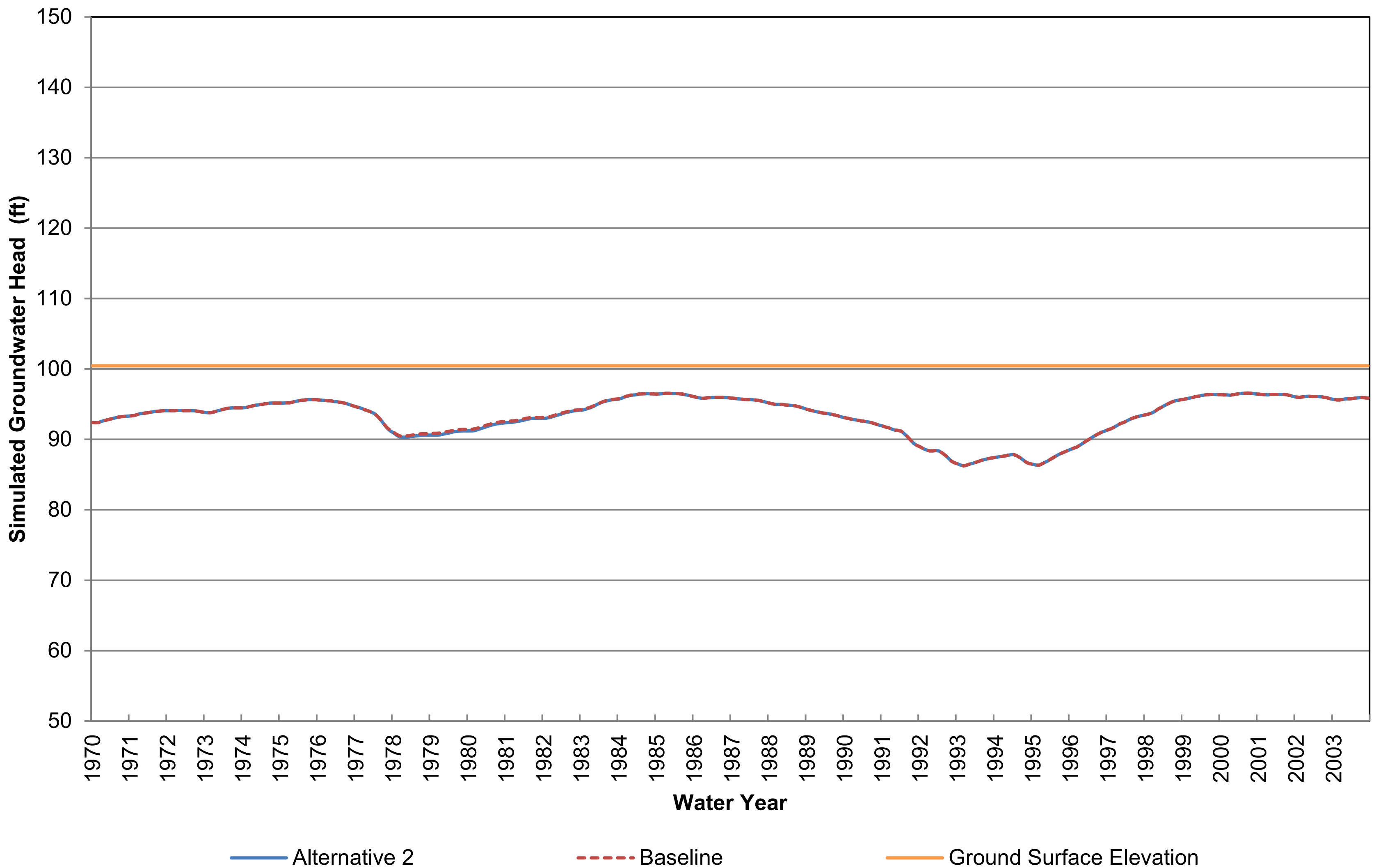
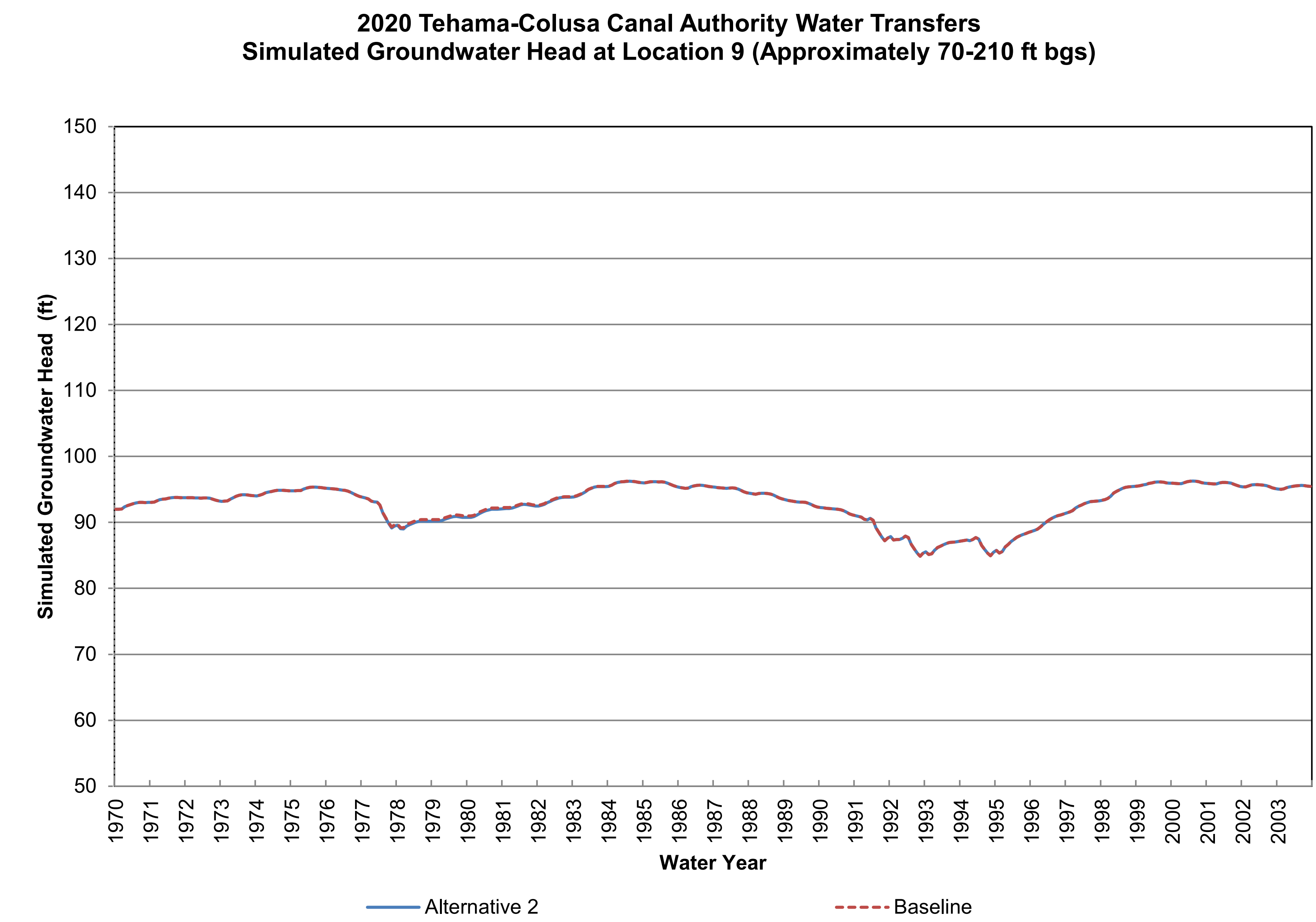
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 8 (Approximately 890-1330 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 9 (Approximately 0-70 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 70-210 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
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1970
1971
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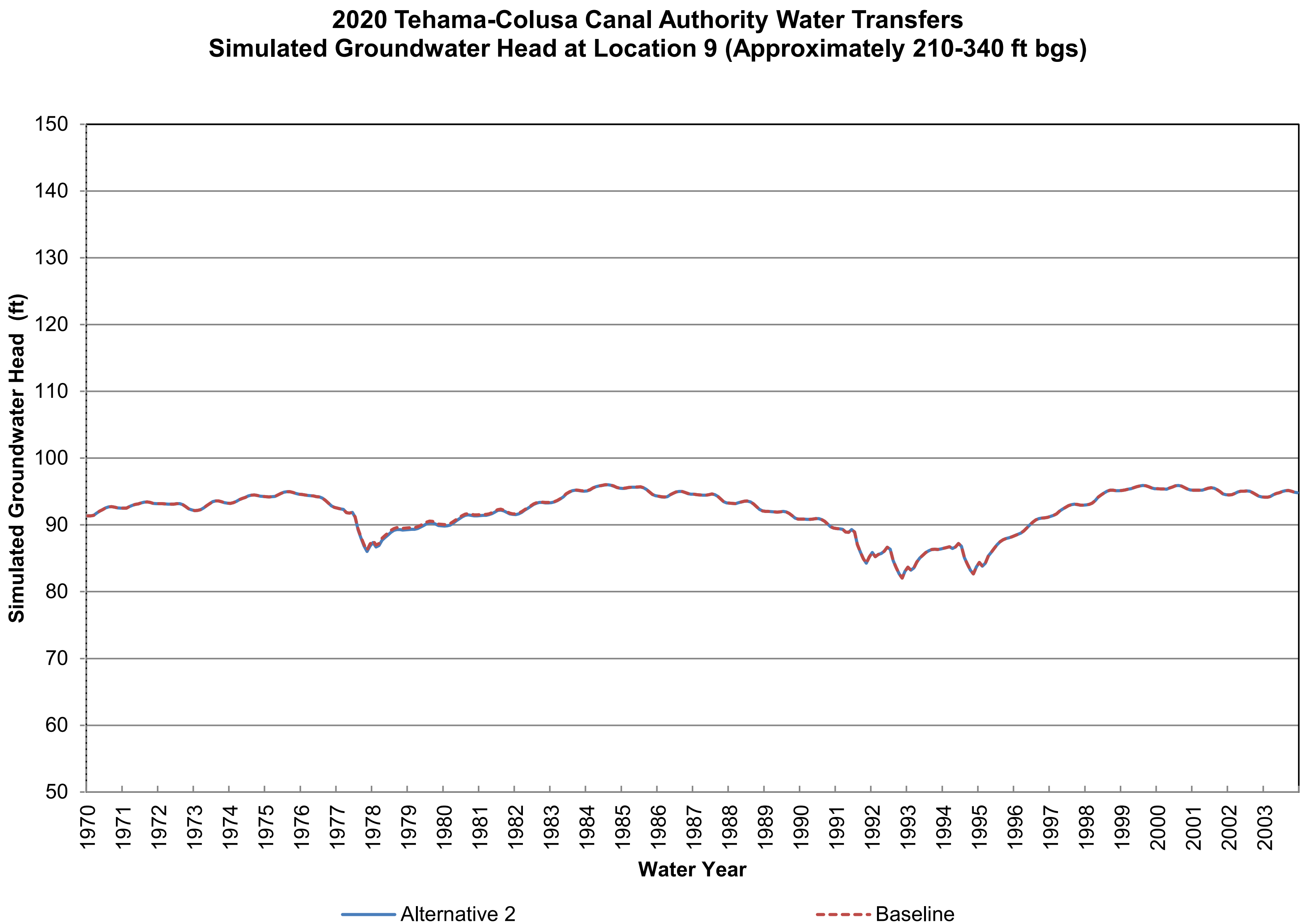
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 210-340 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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1989
1990
1991
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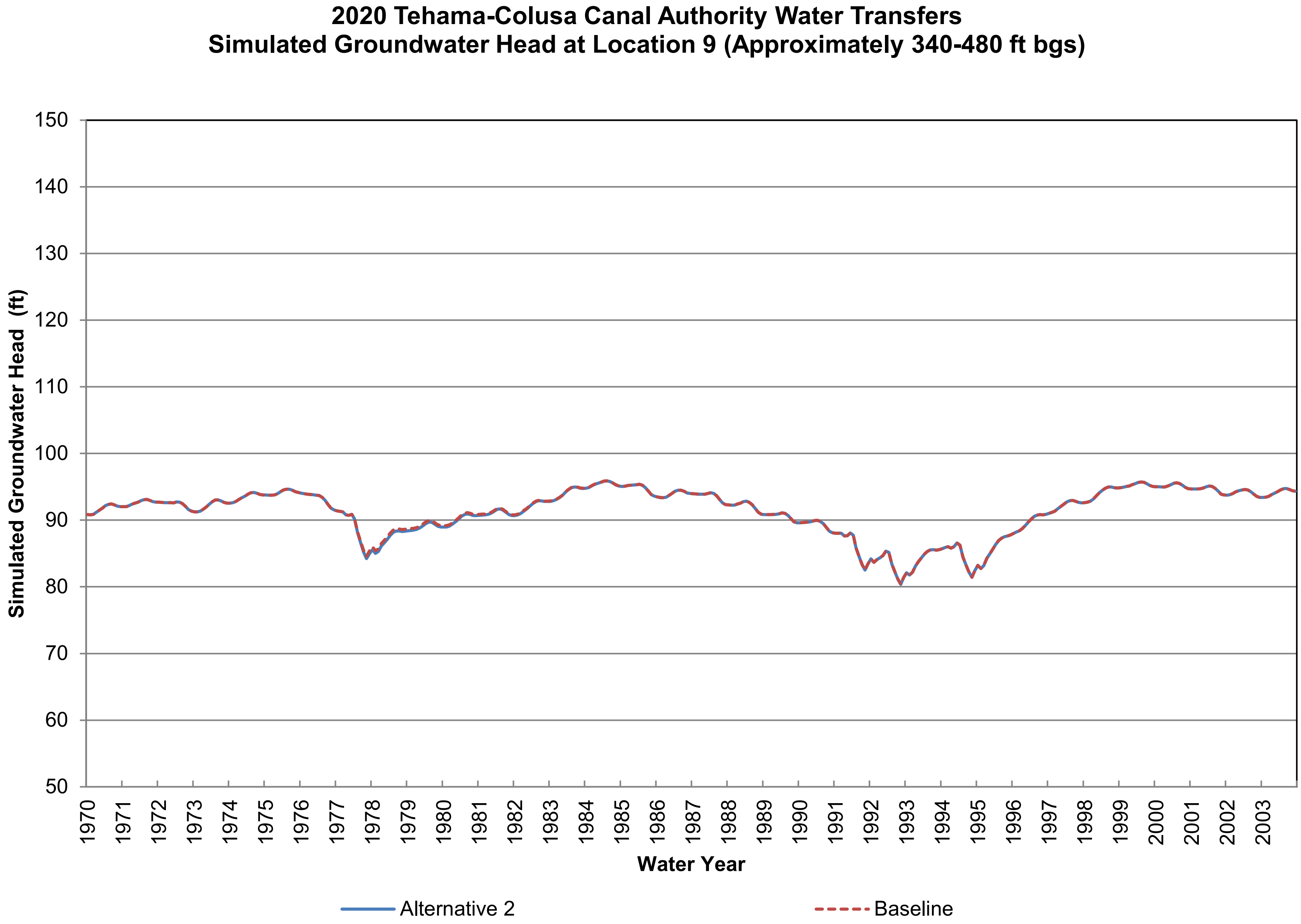
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 340-480 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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1983
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1987
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1989
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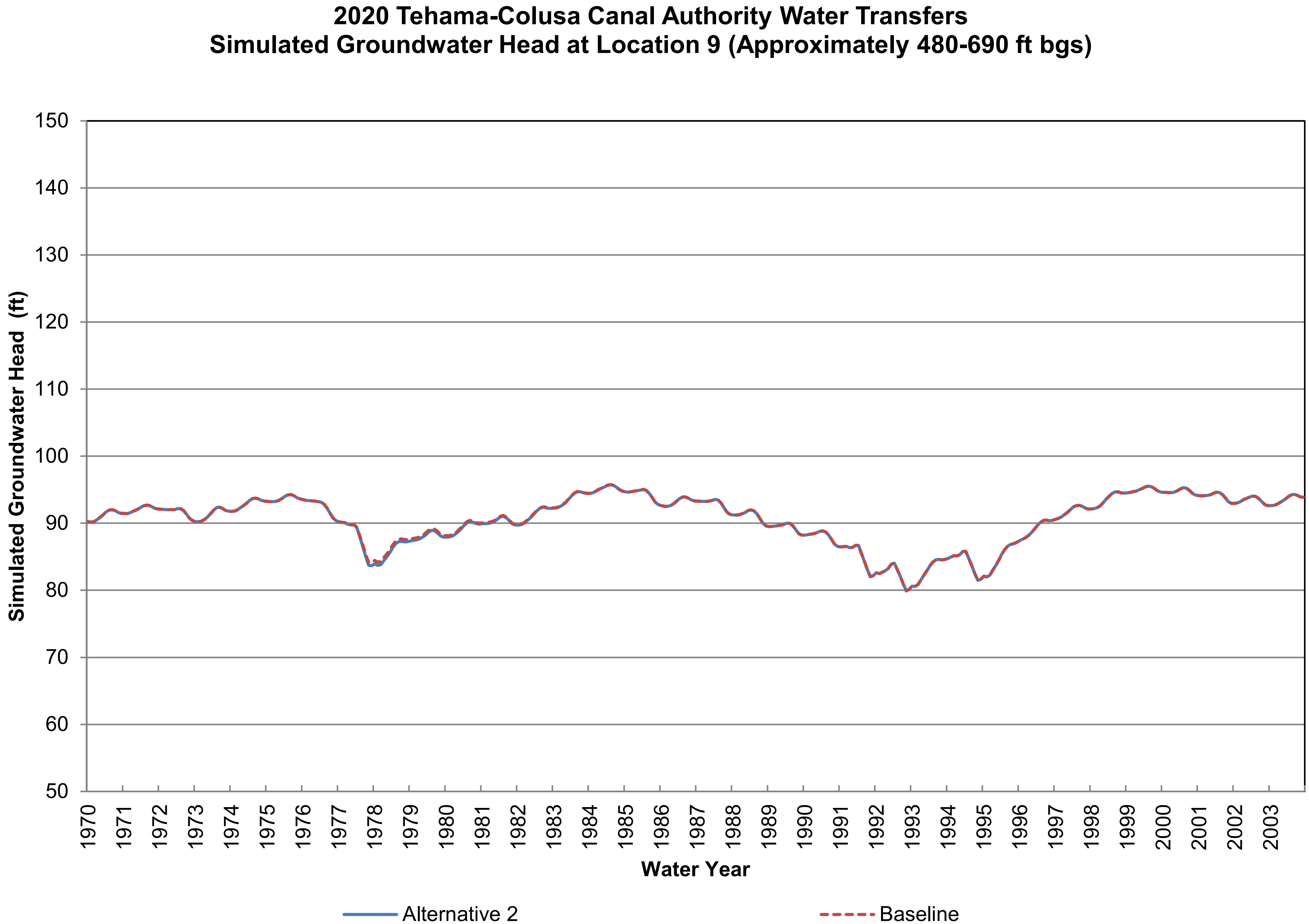
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 480-690 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
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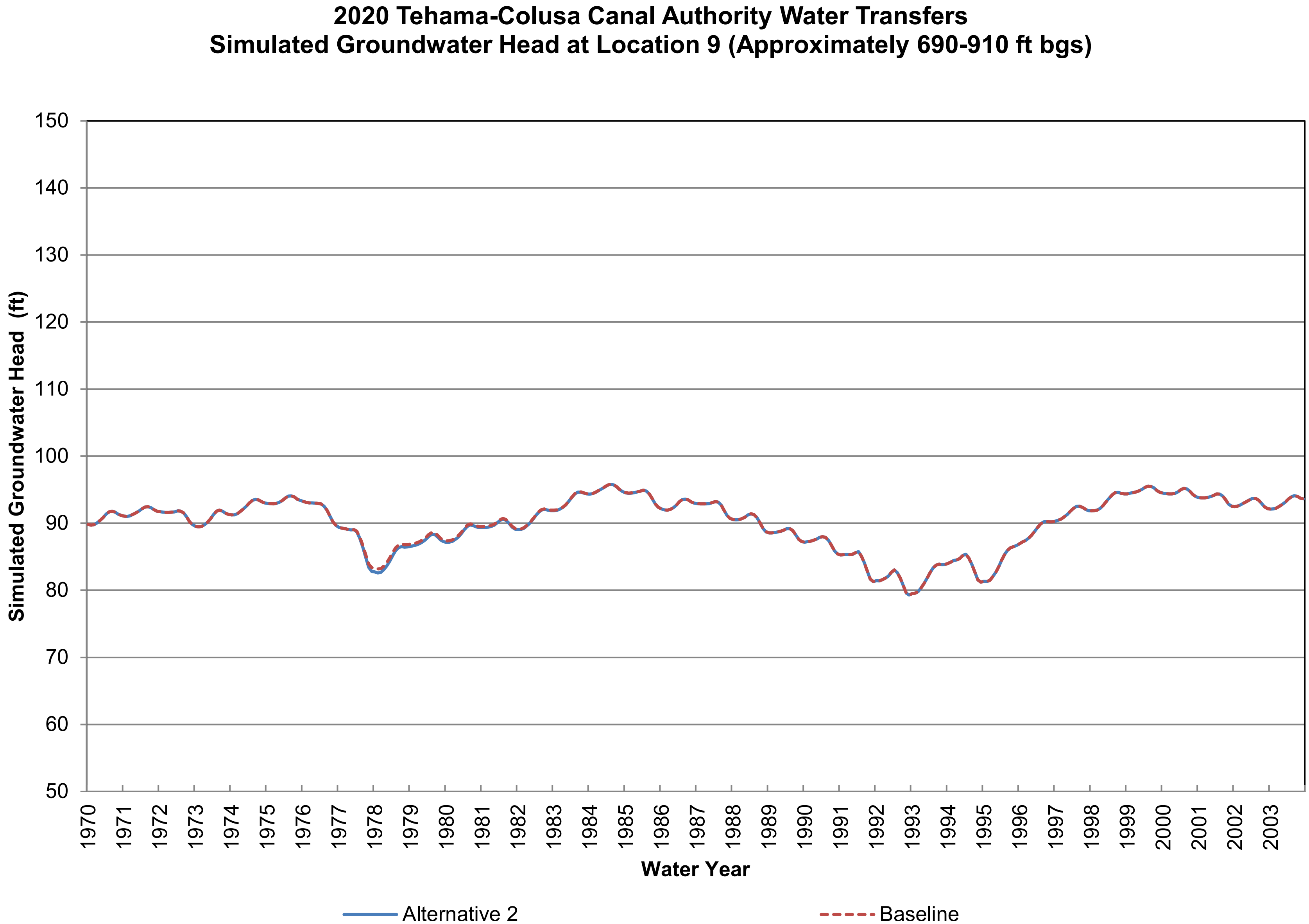
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 690-910 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
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1970
1971
1972
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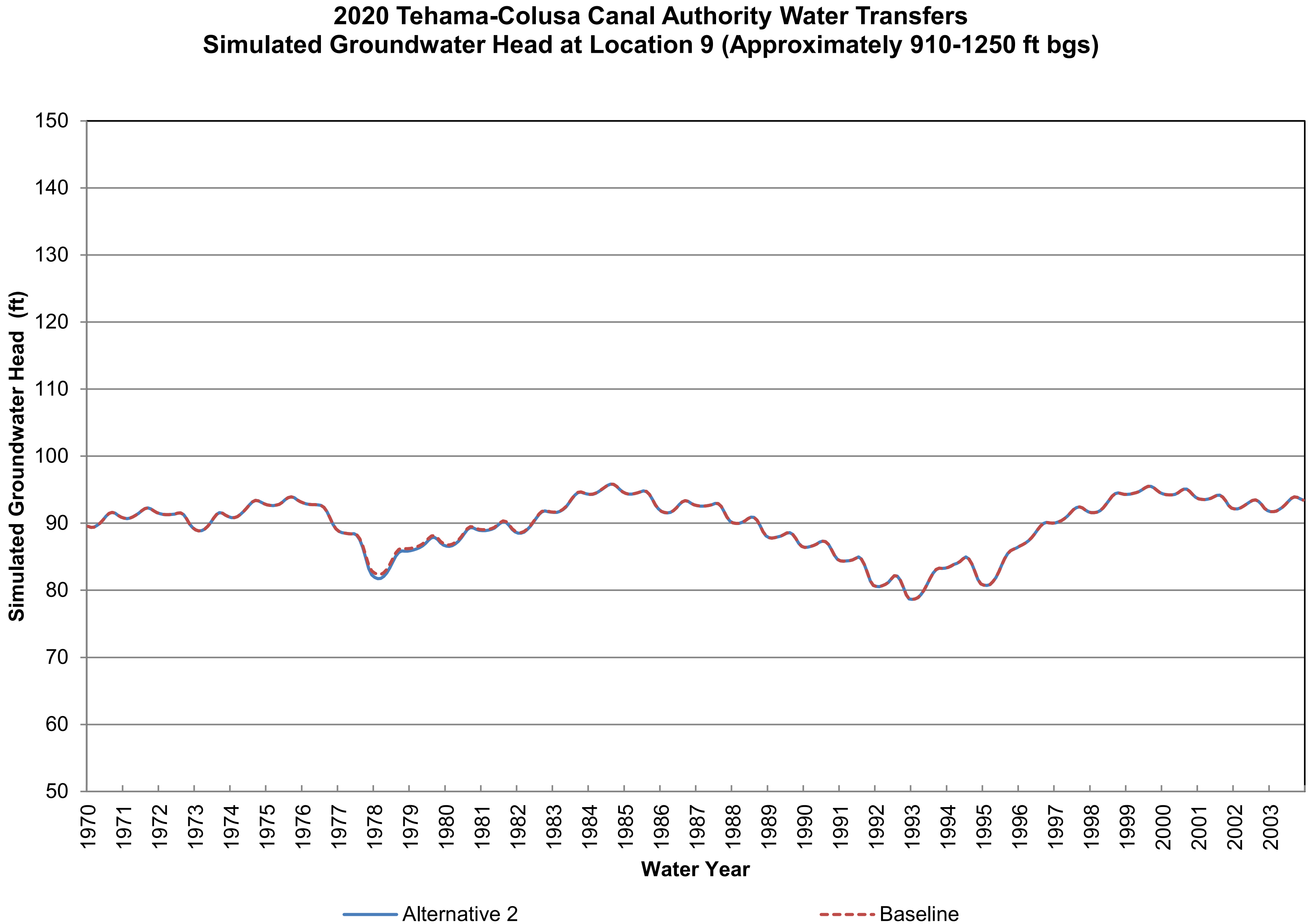
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 910-1250 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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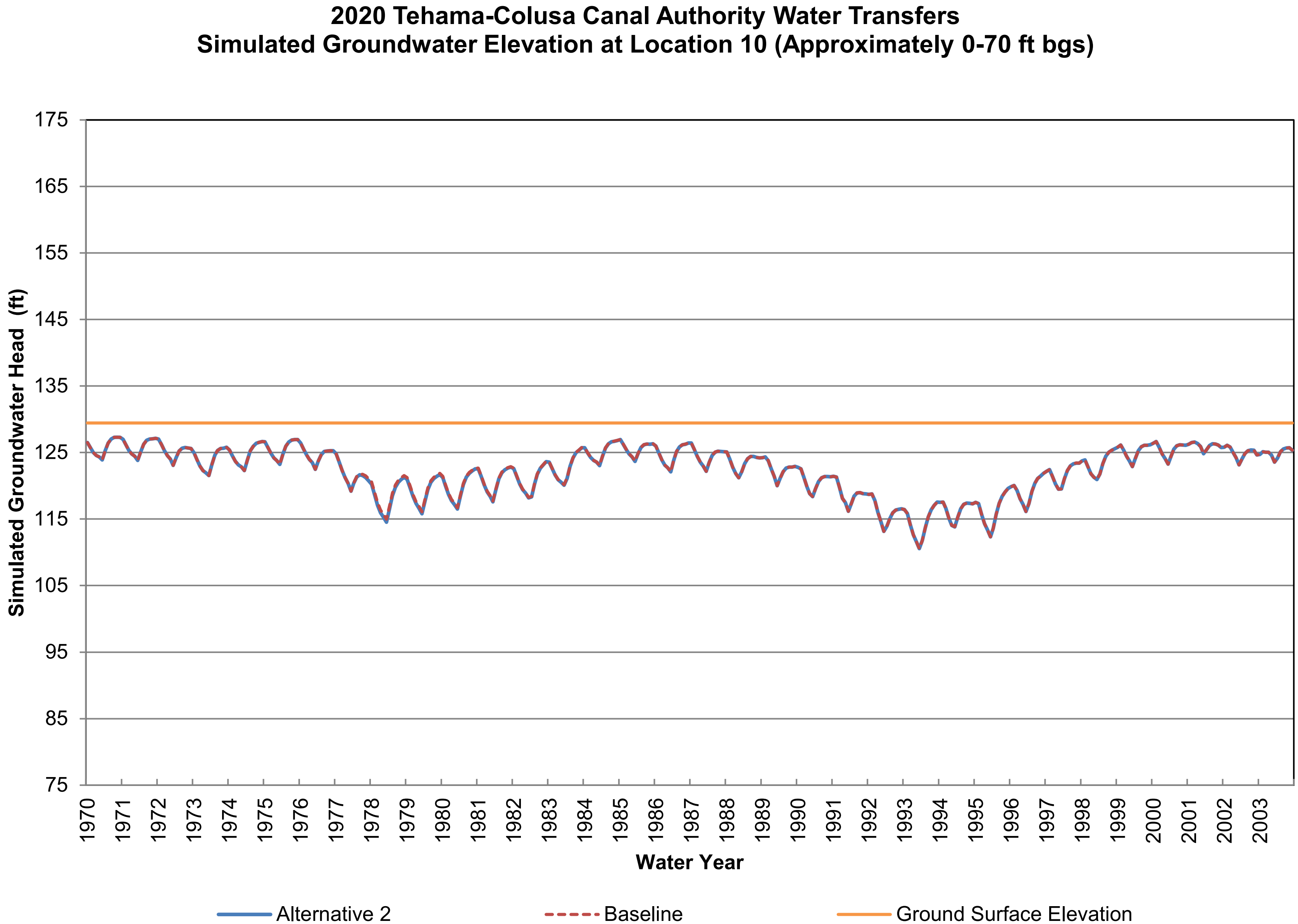
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 10 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
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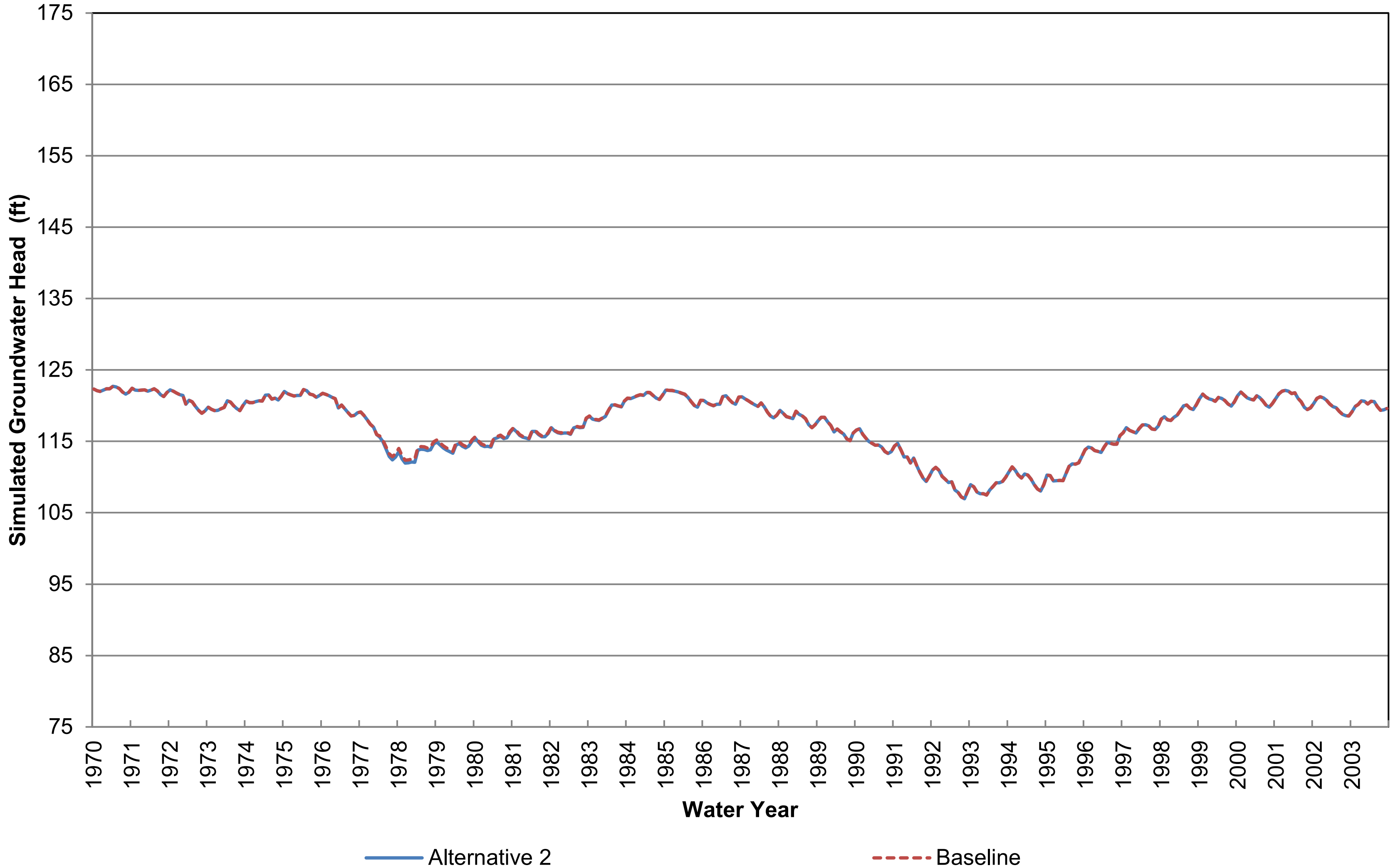
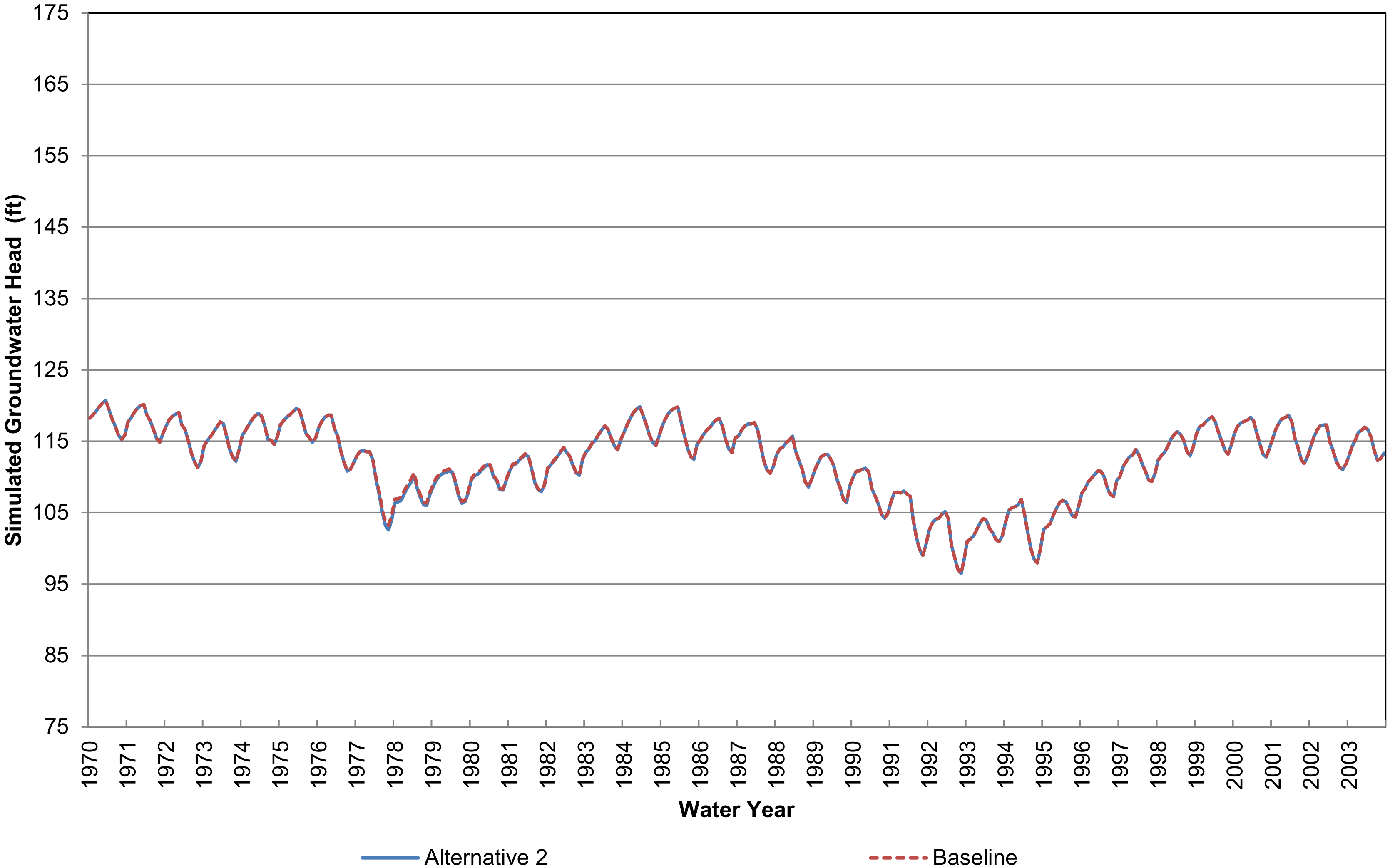
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

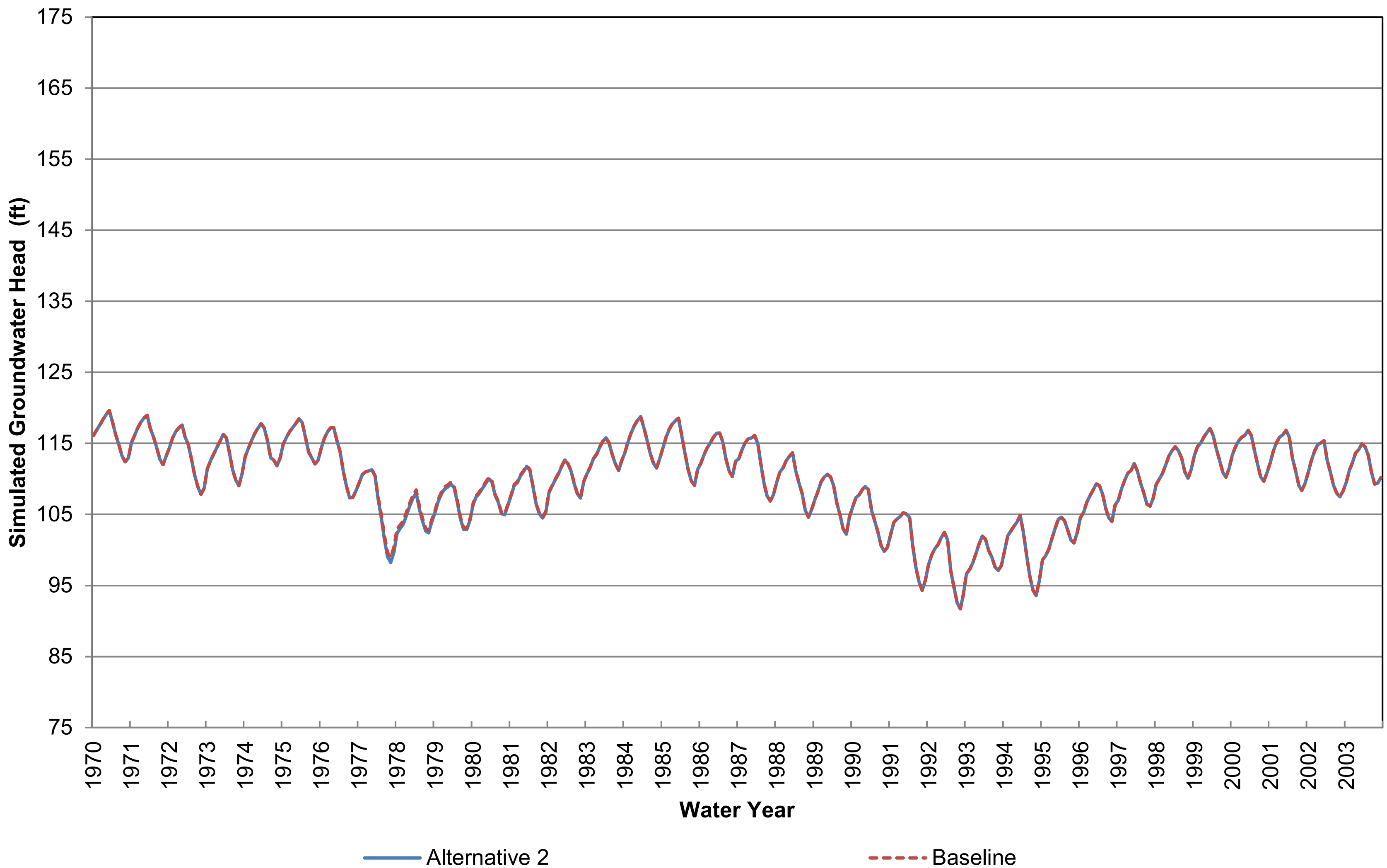
**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 10 (Approximately 70-240 ft bgs)**



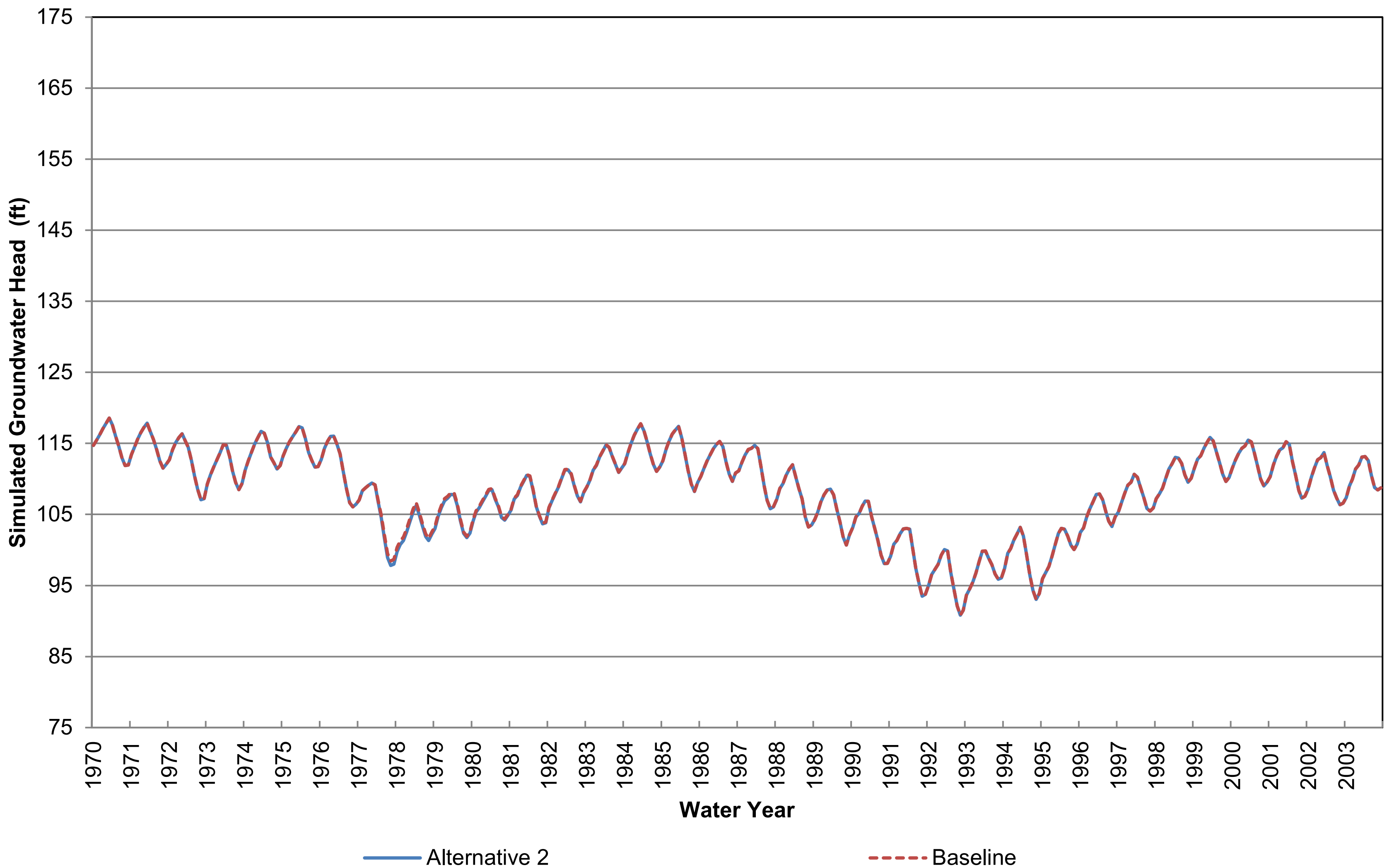
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 10 (Approximately 240-420 ft bgs)

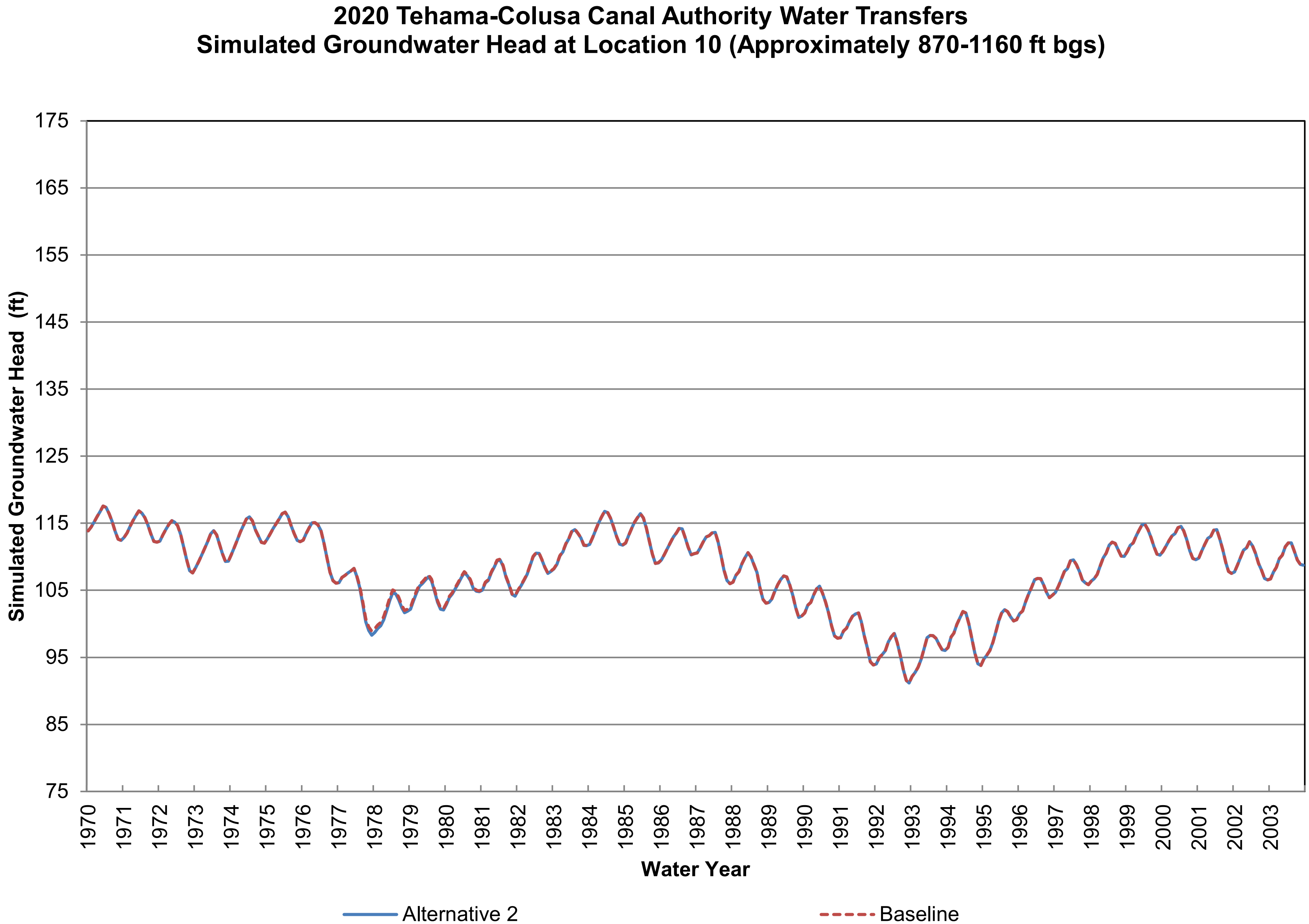


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 10 (Approximately 420-590 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 10 (Approximately 590-870 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 870-1160 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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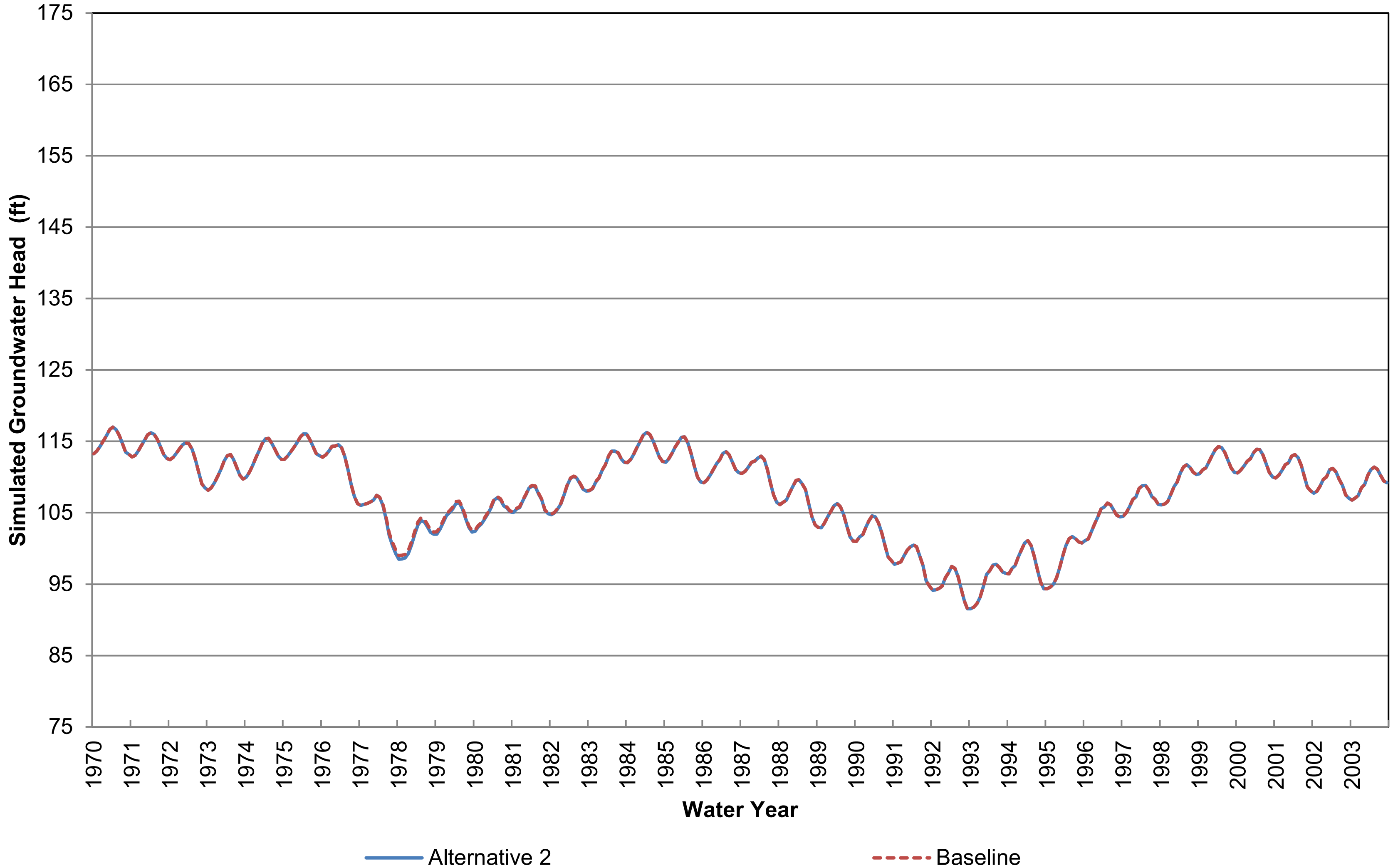
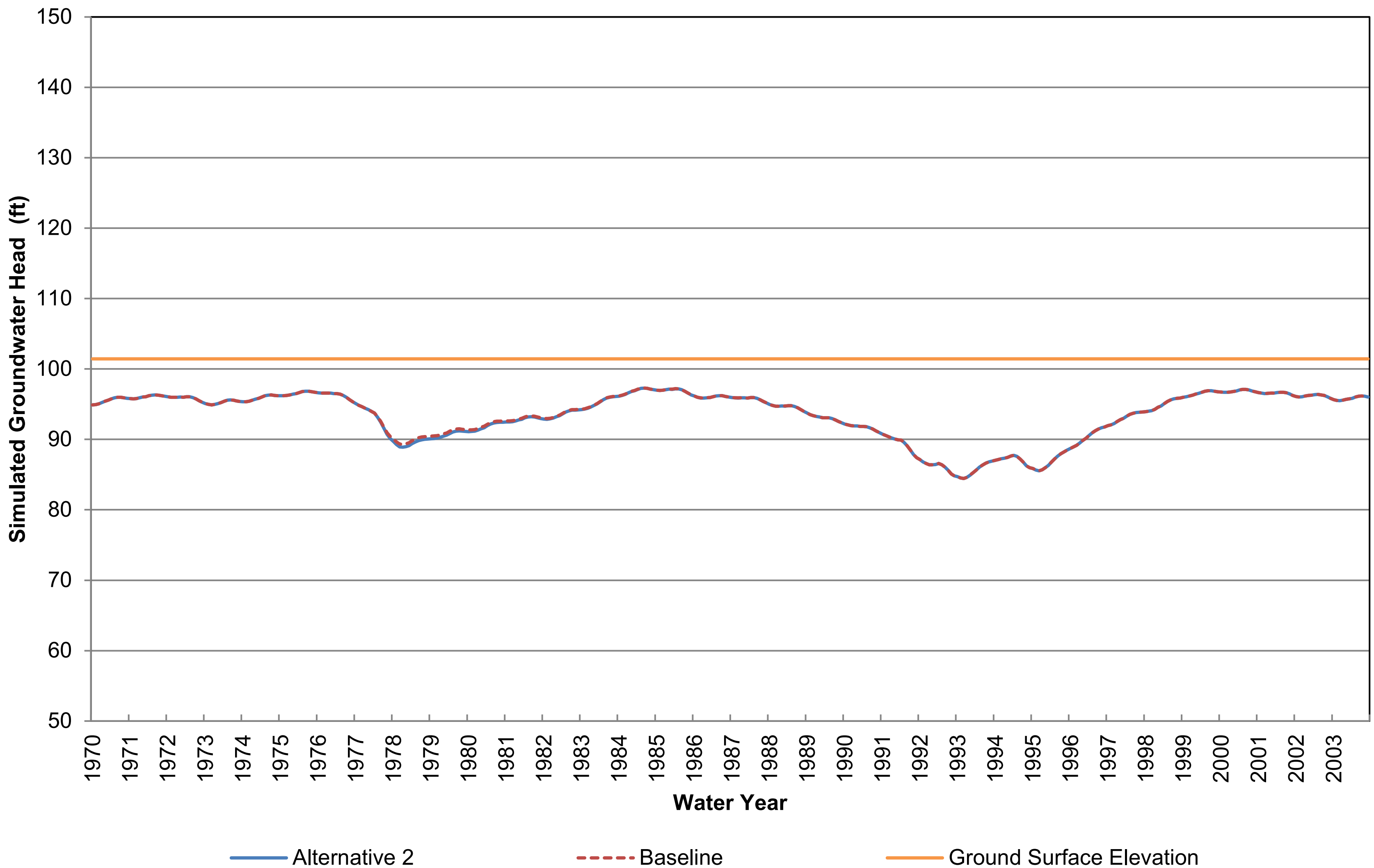
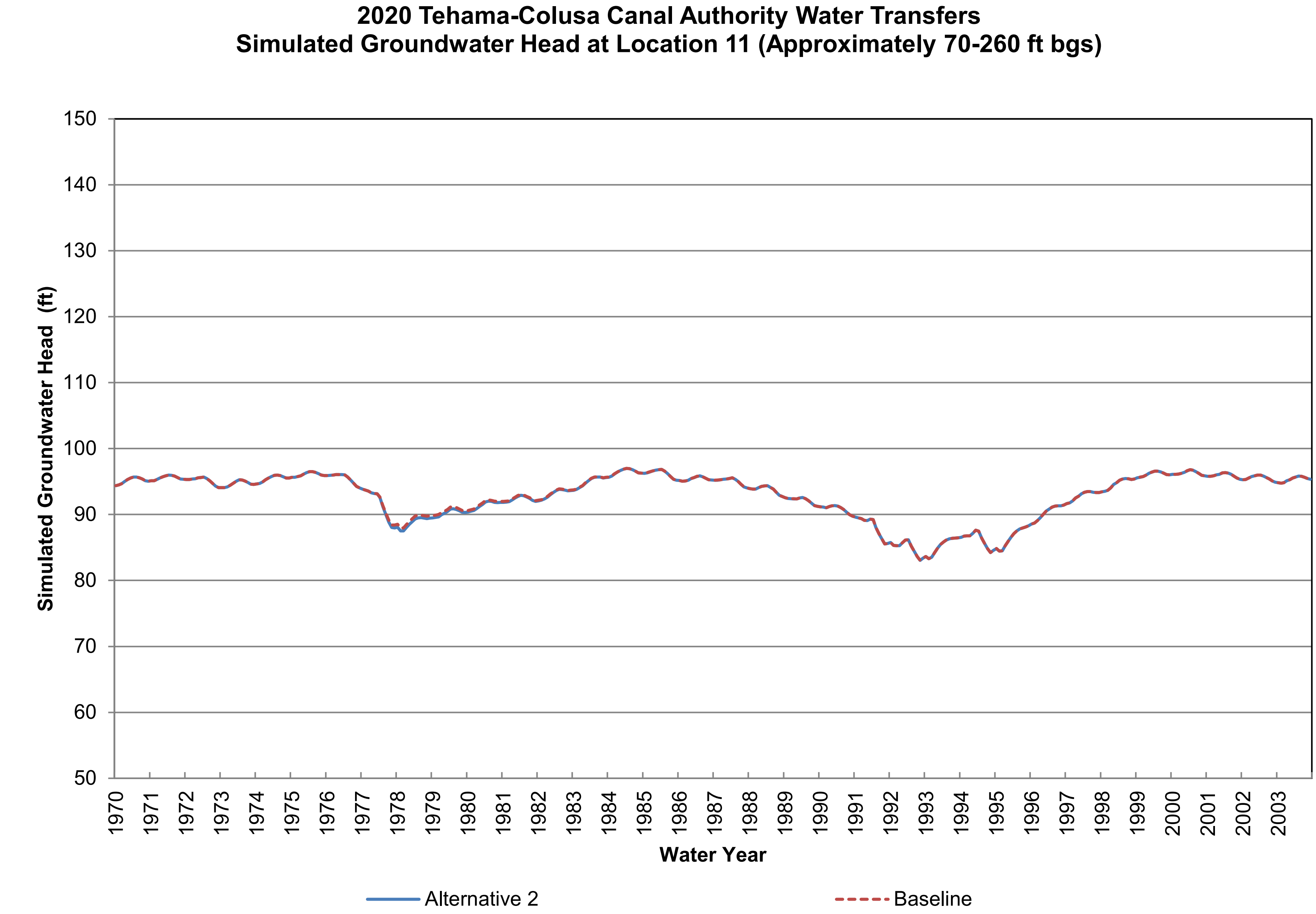
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 10 (Approximately 1160-1590 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 11 (Approximately 0-70 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 70-260 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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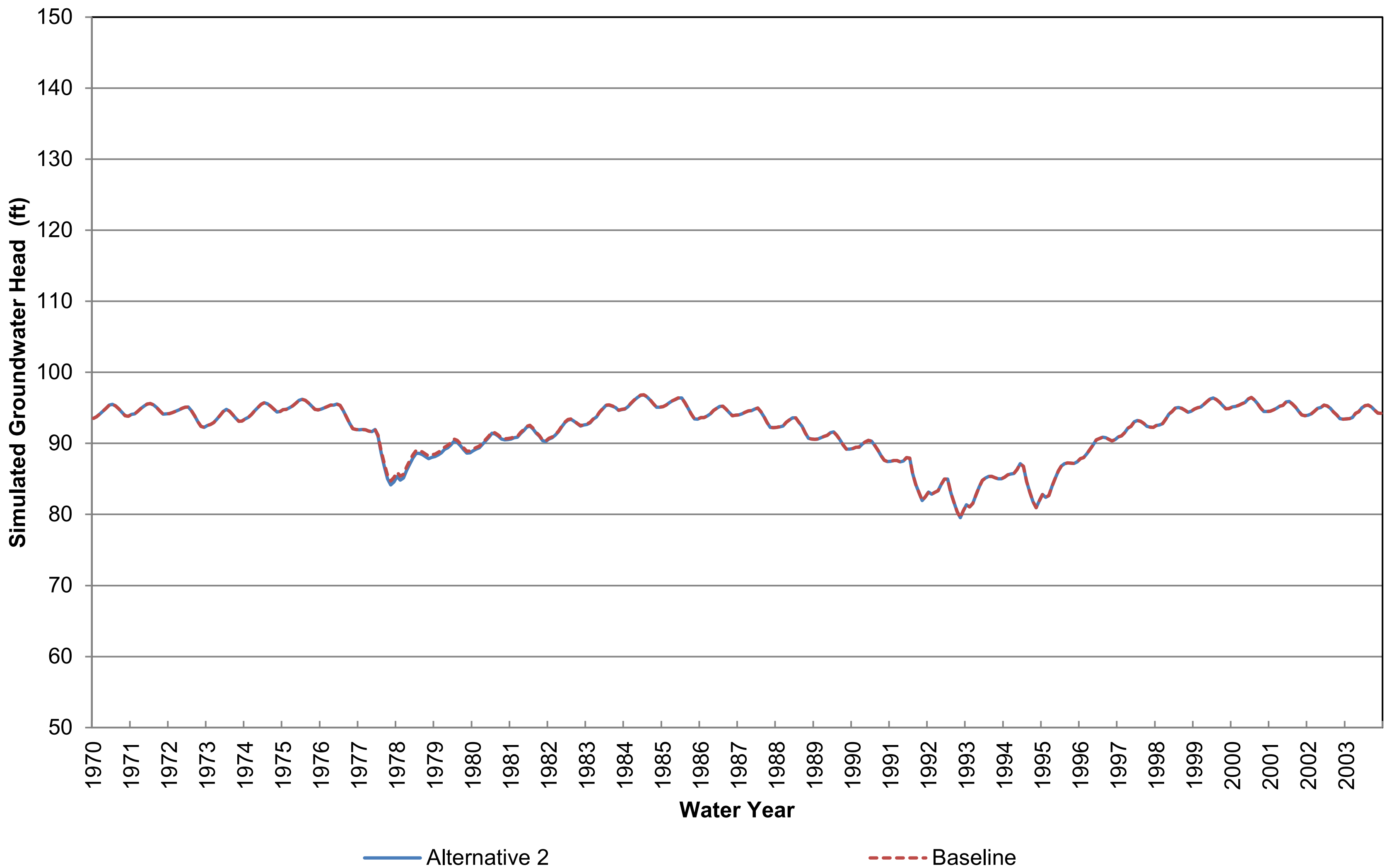
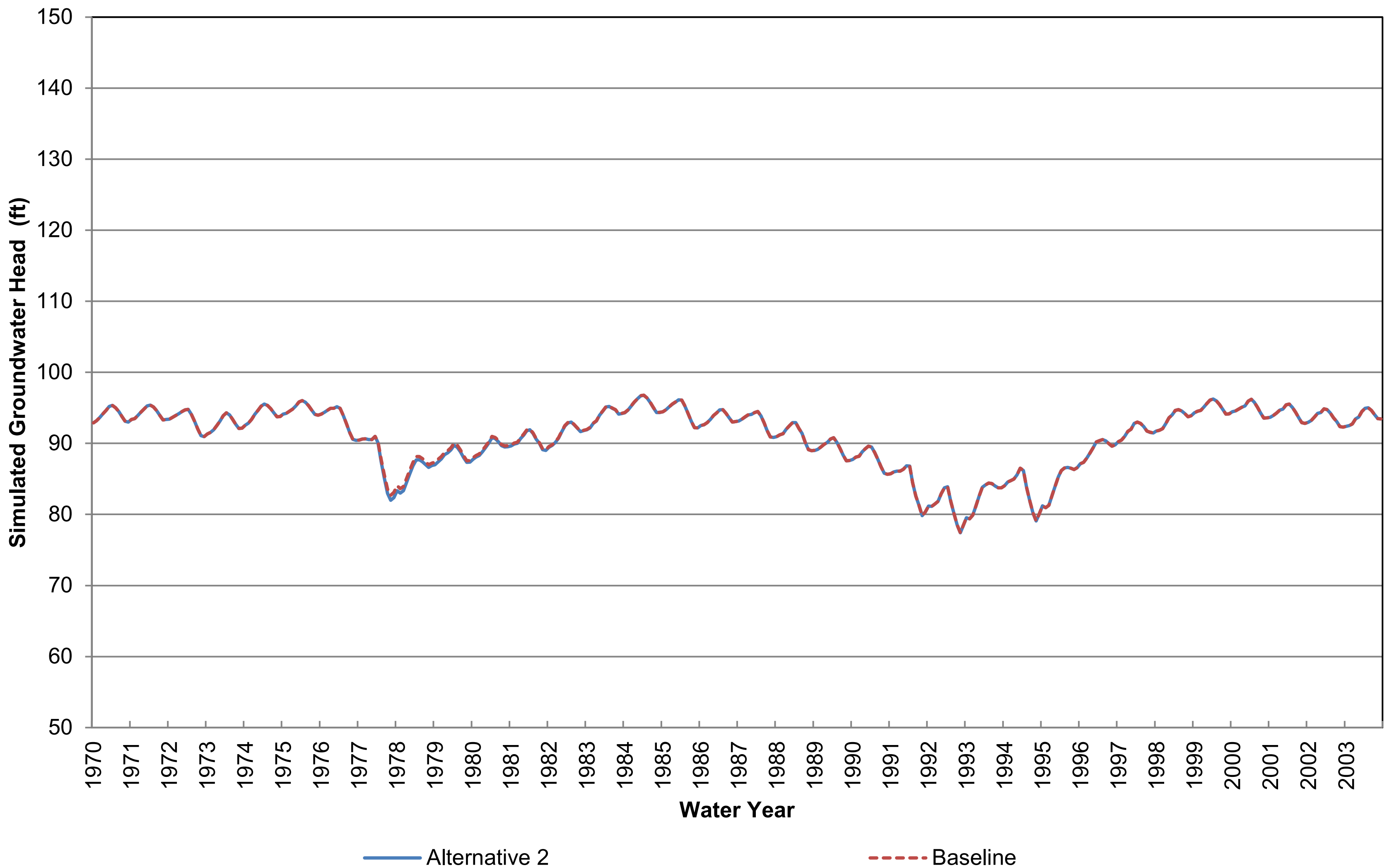
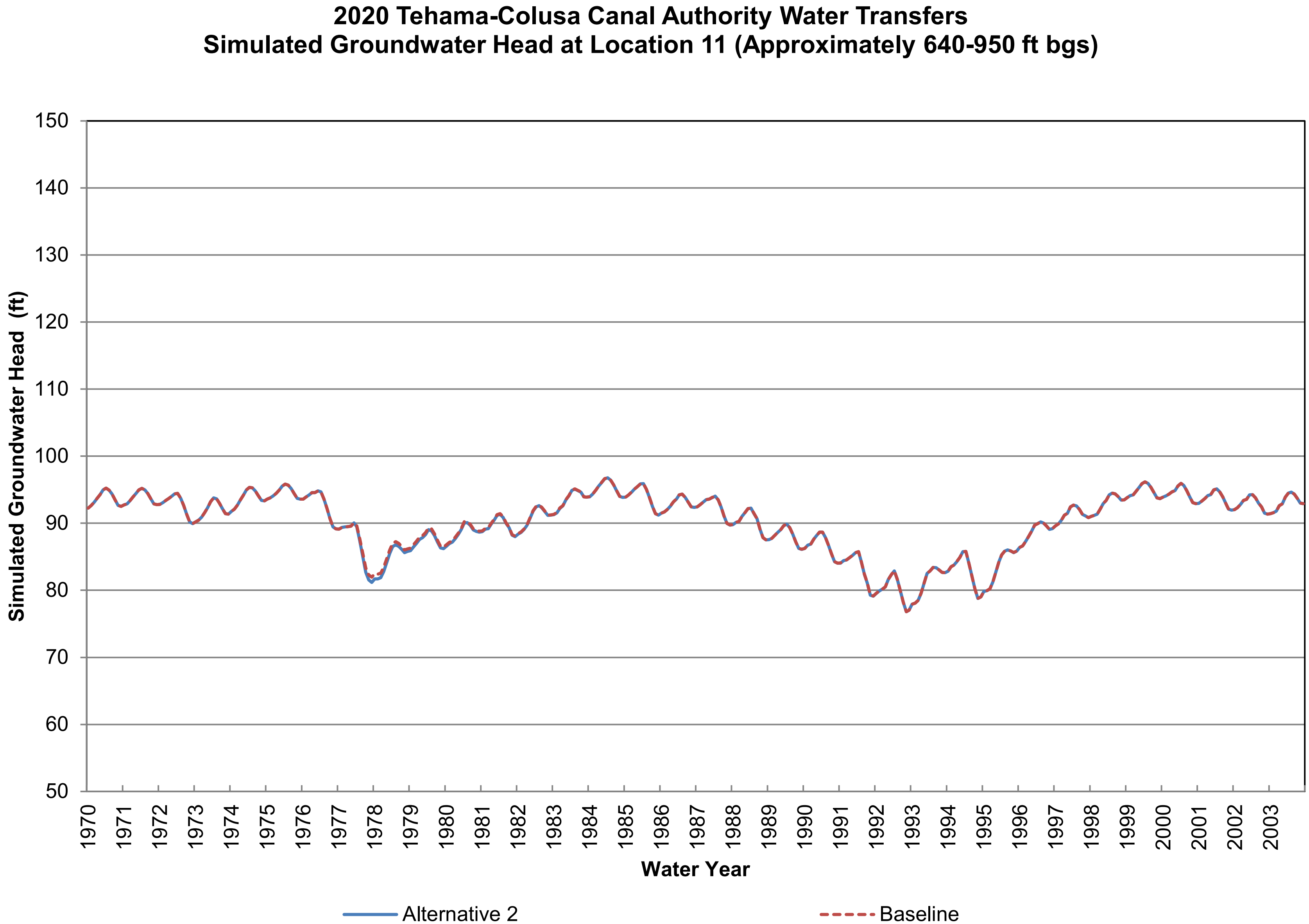
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 11 (Approximately 260-450 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 11 (Approximately 450-640 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 640-950 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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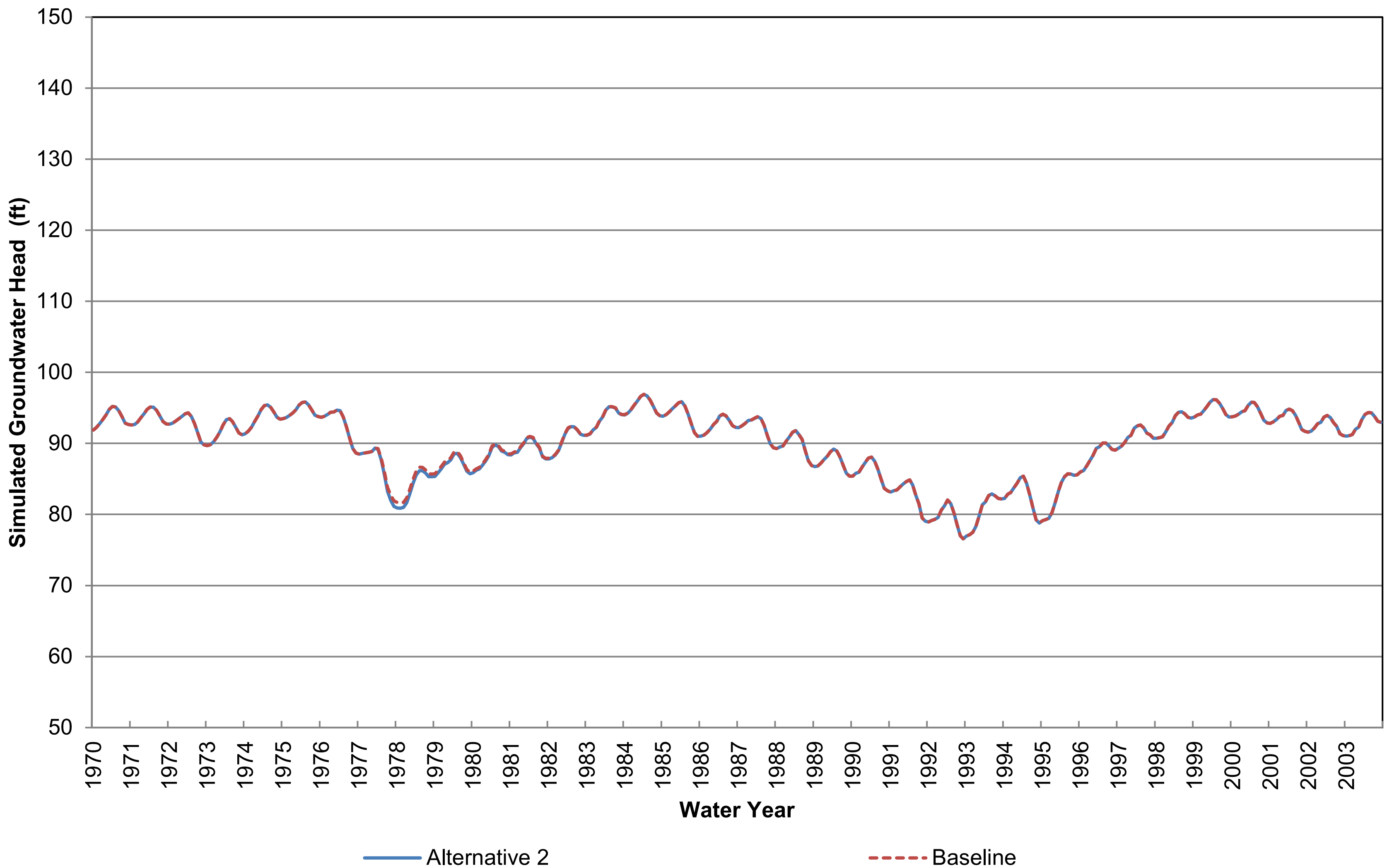
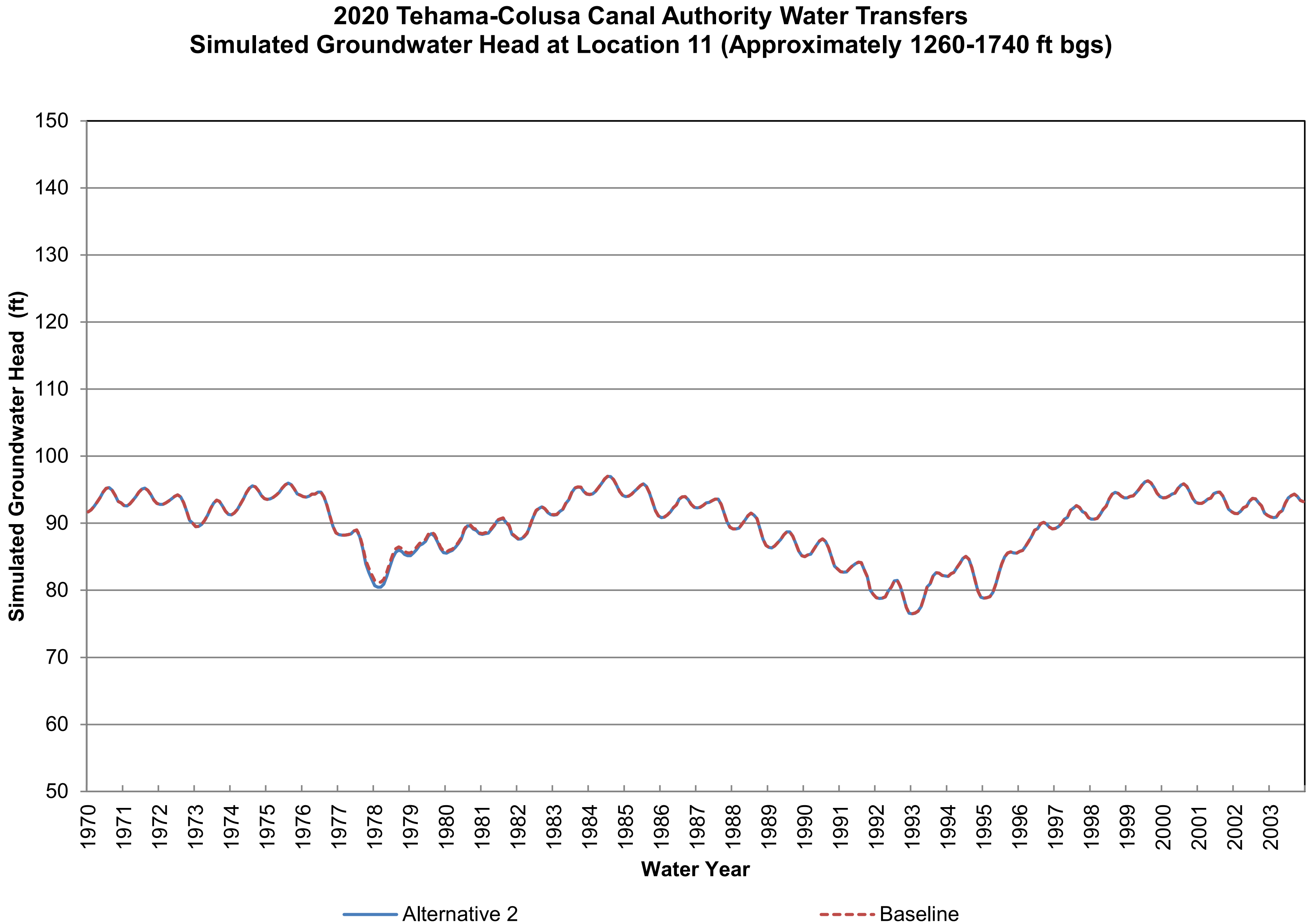
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 11 (Approximately 950-1260 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 1260-1740 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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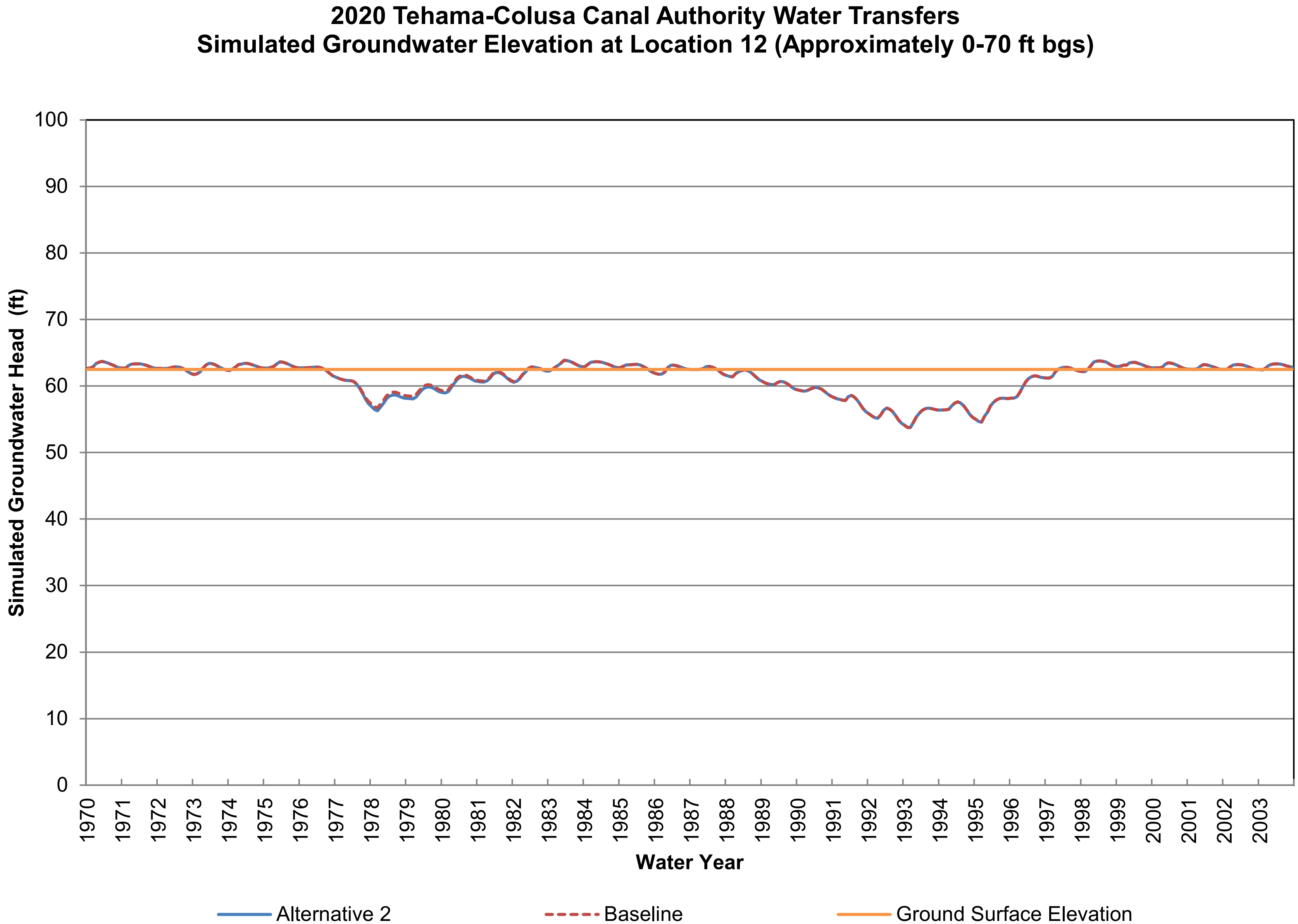
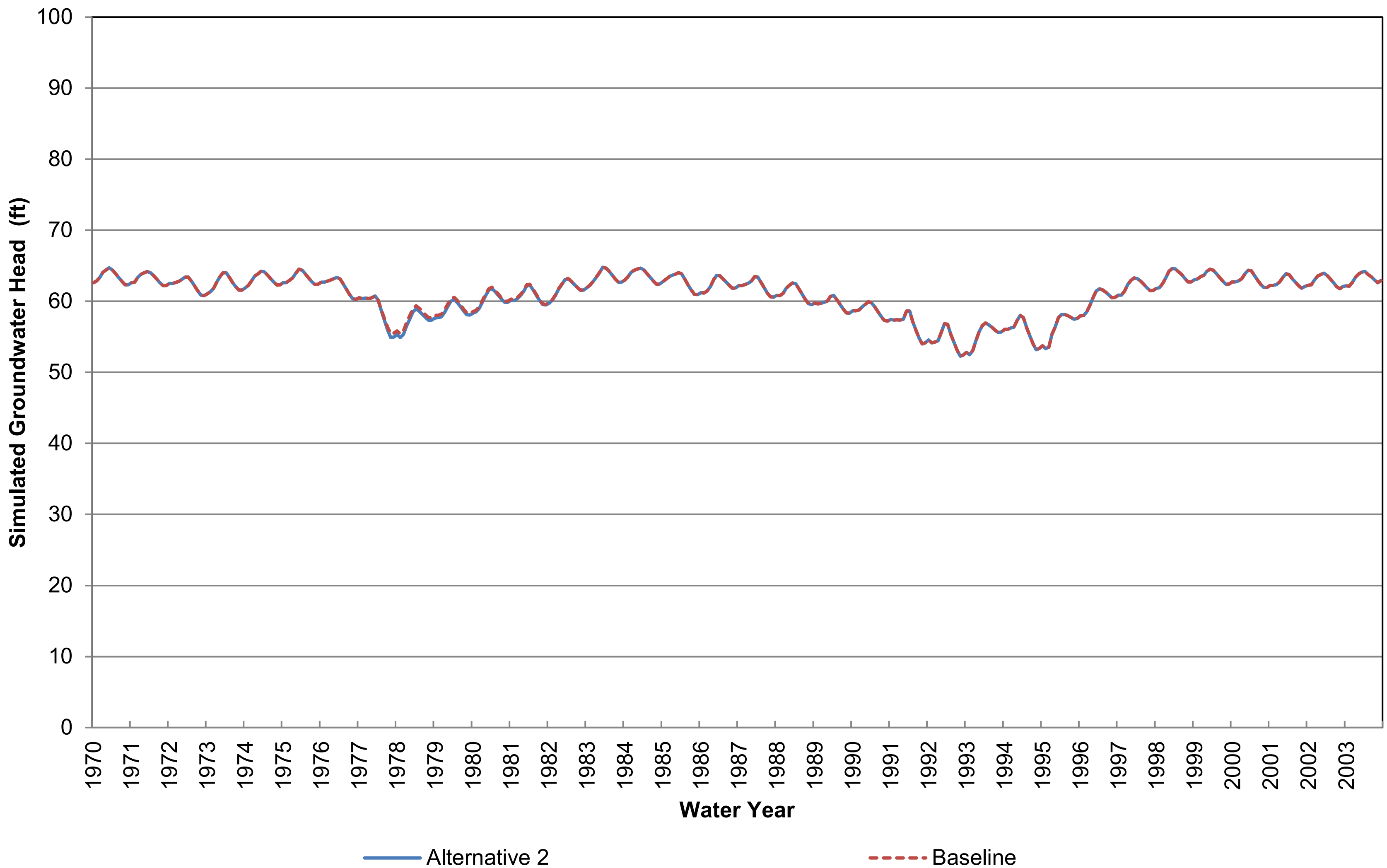
2001
2002
2003
Water Year
Alternative 2
Baseline

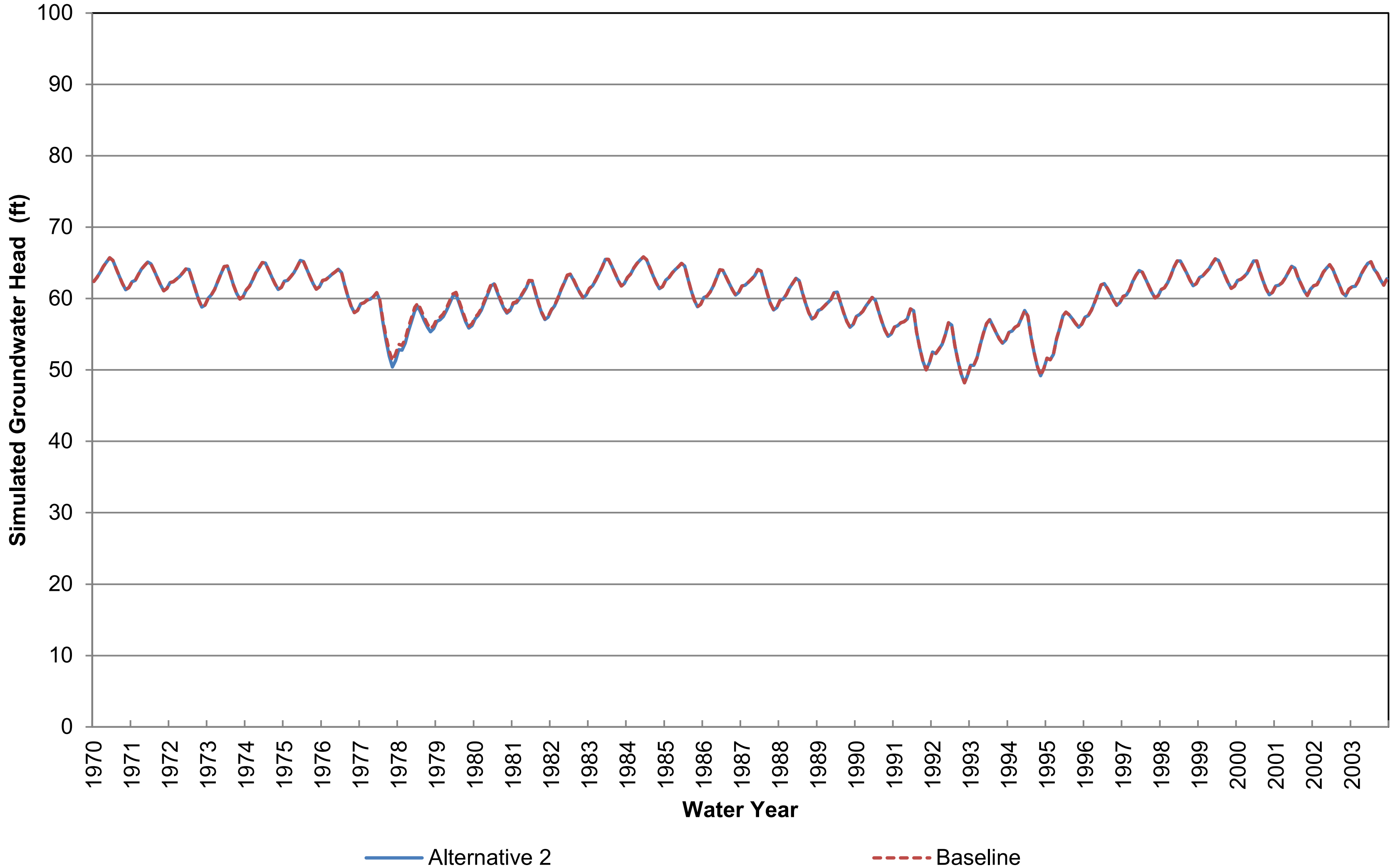


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 12 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

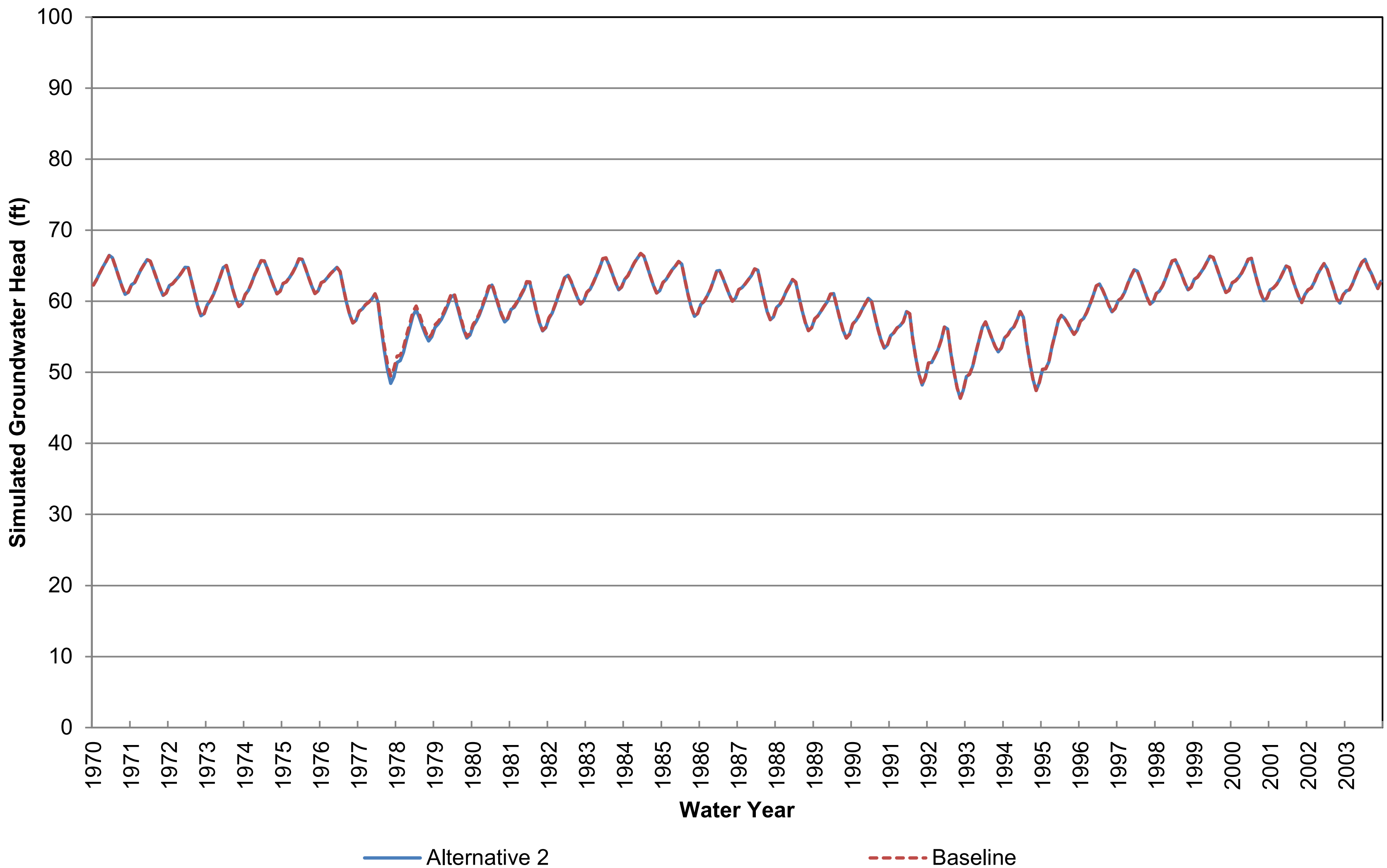
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 12 (Approximately 70-260 ft bgs)



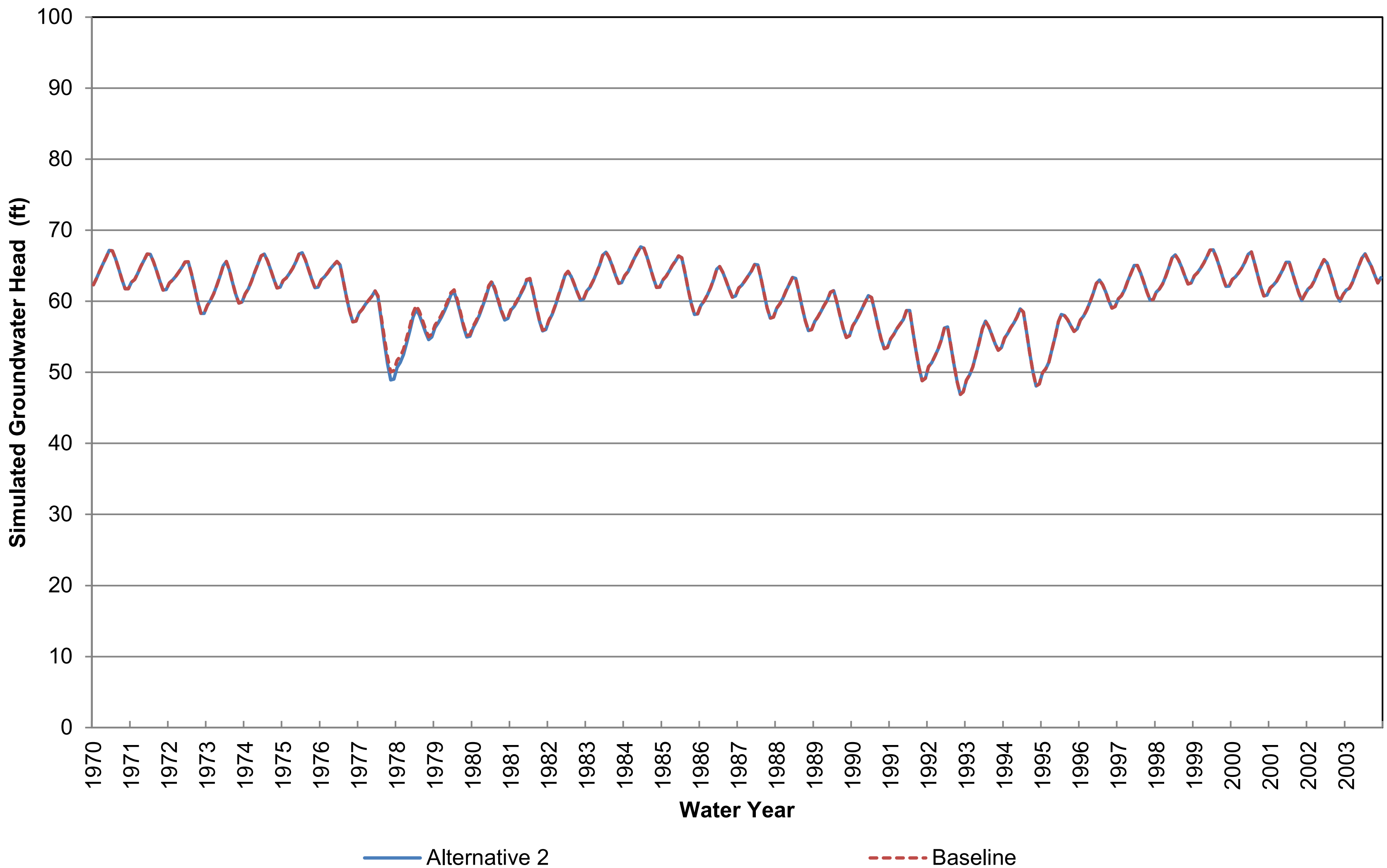
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 12 (Approximately 260-440 ft bgs)

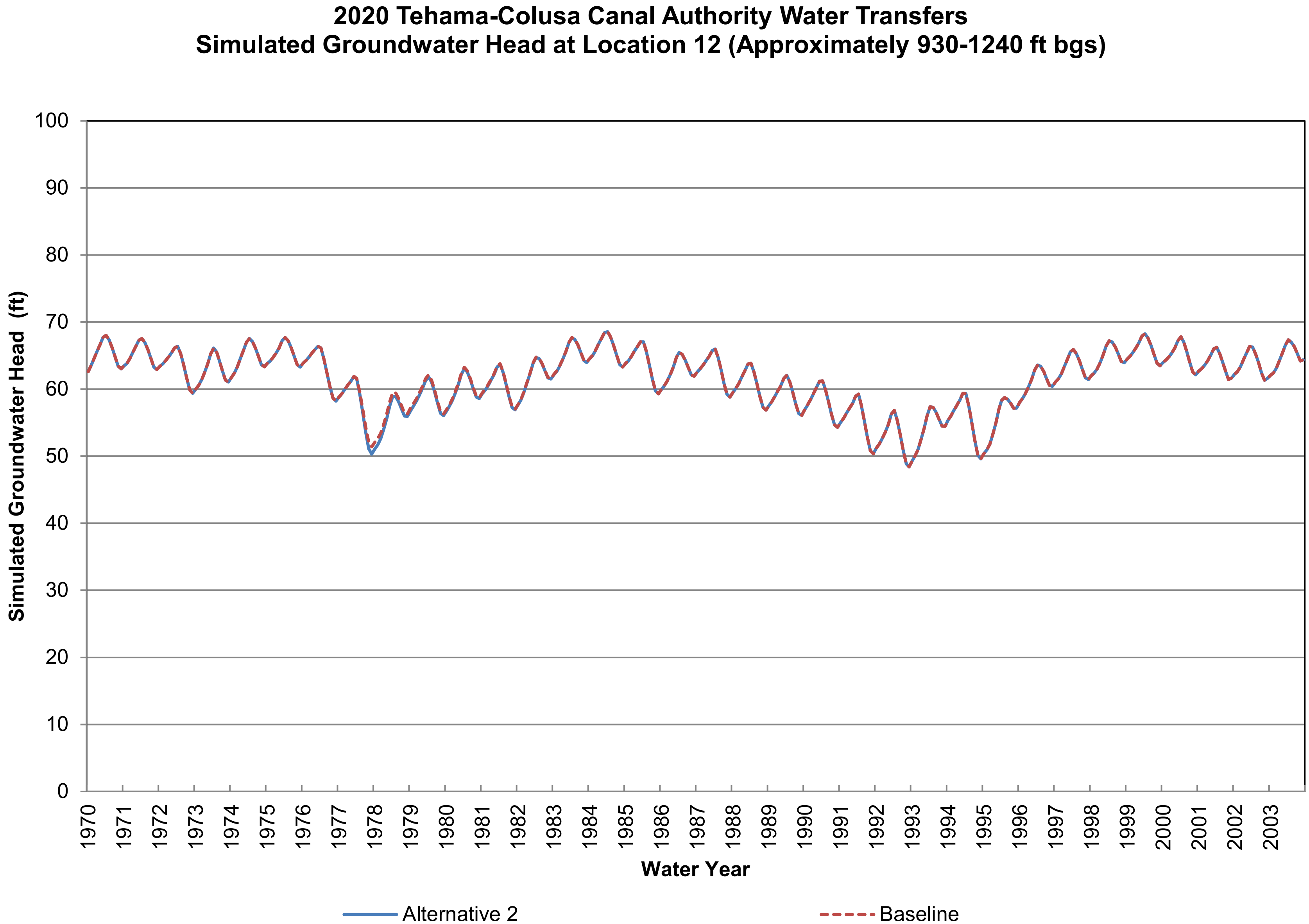


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 12 (Approximately 440-630 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 12 (Approximately 630-930 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 930-1240 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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1986
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1988
1989
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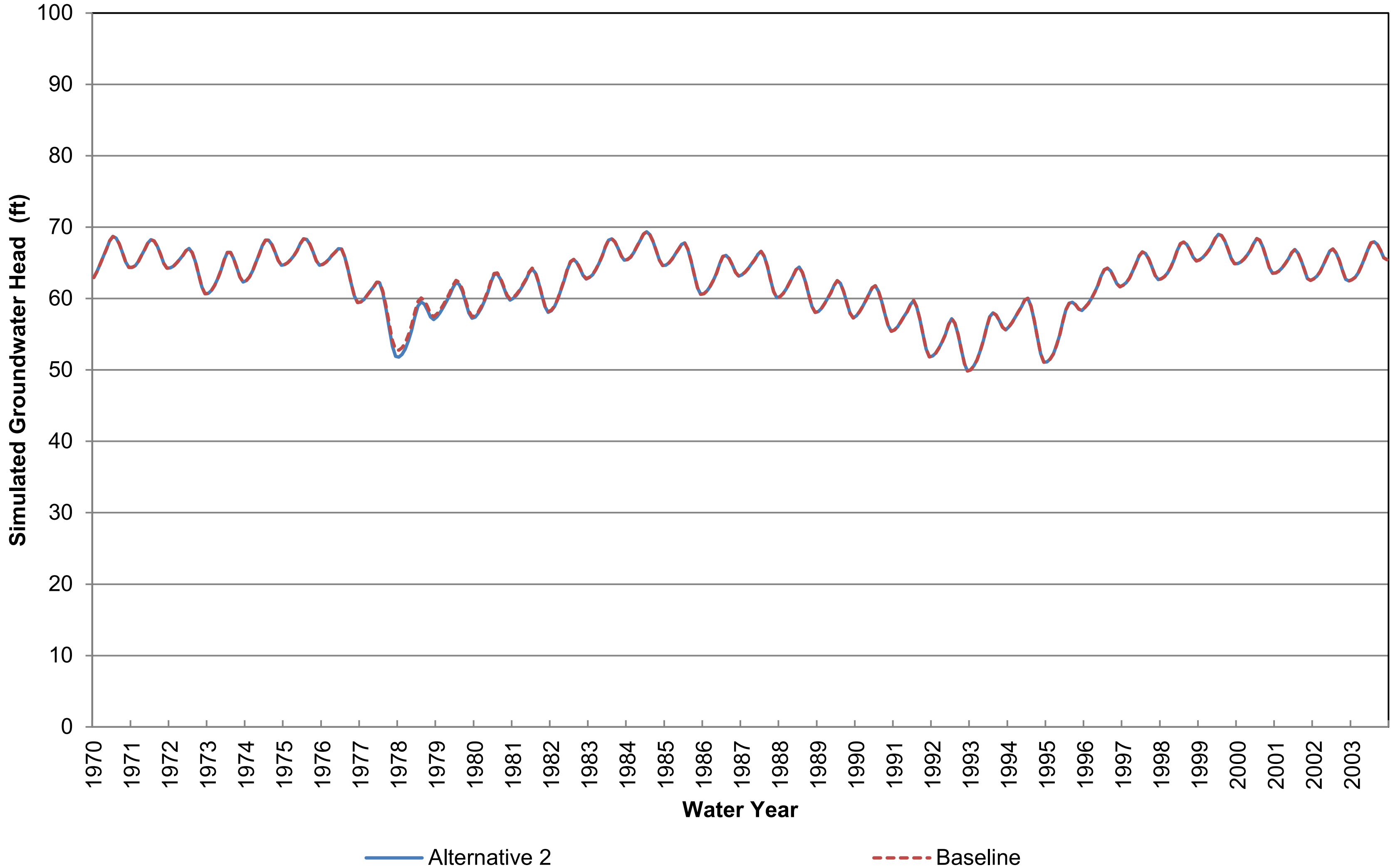
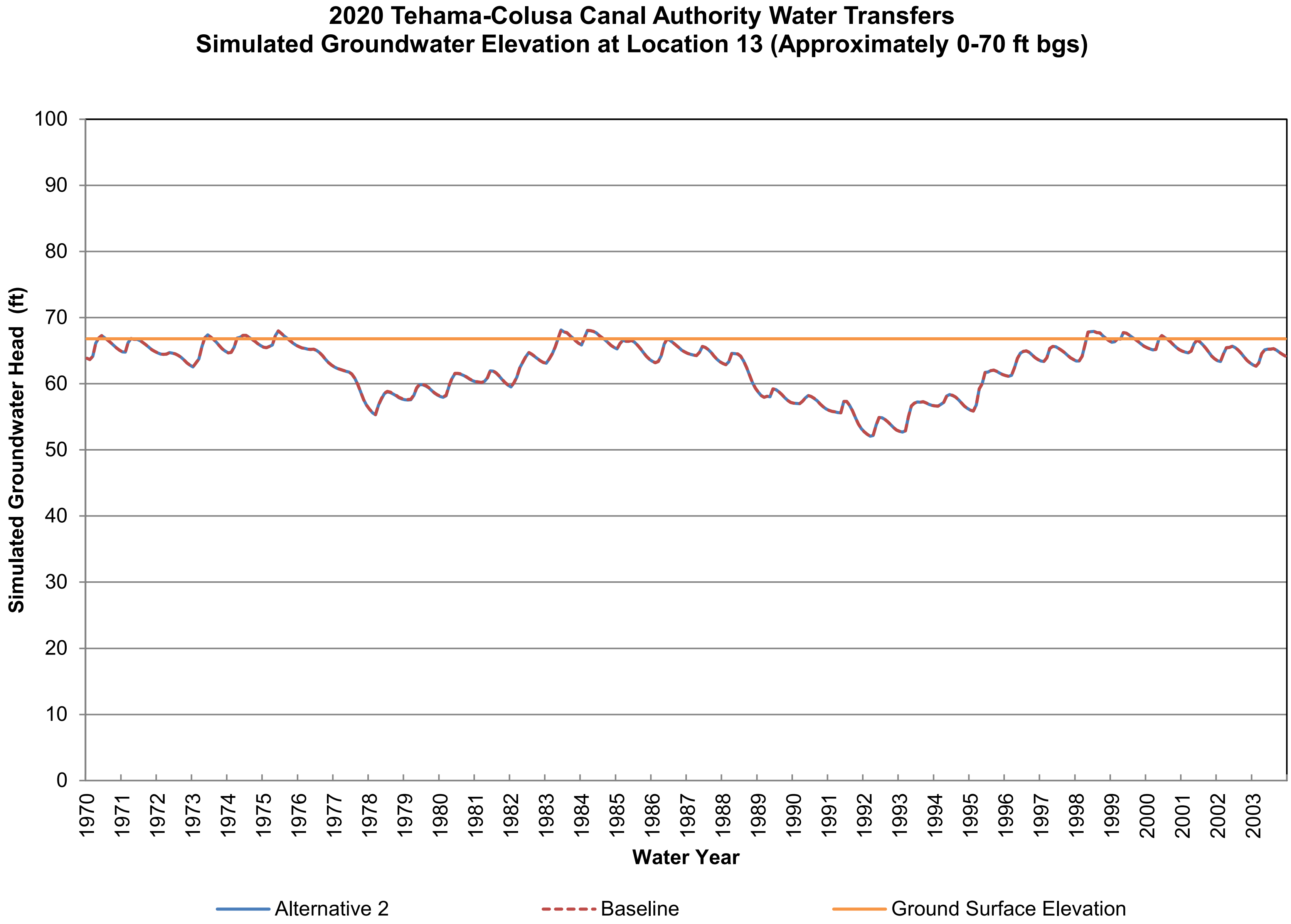
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 12 (Approximately 1240-1700 ft bgs)**




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 13 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
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1992
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1994
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1996
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1998
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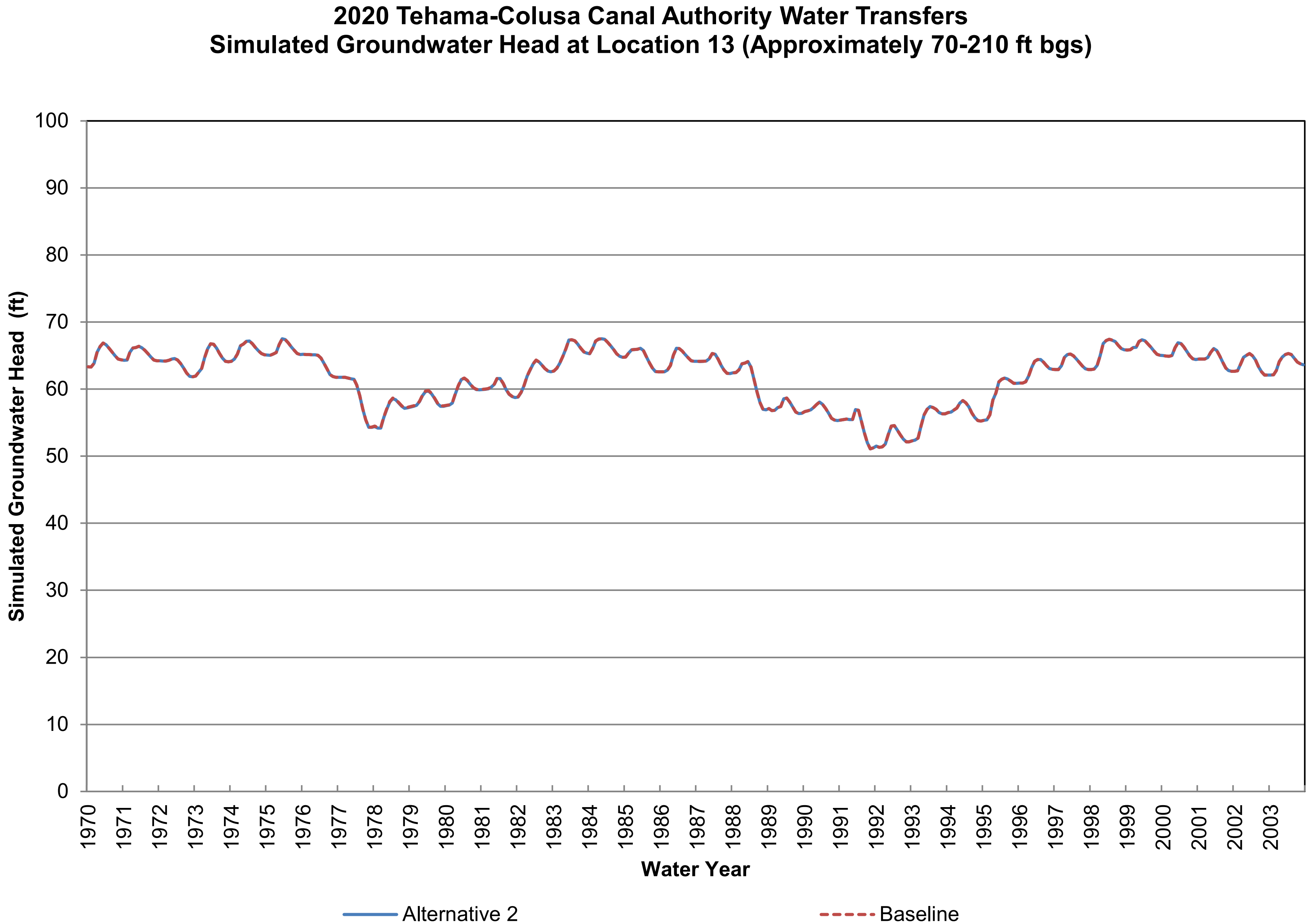
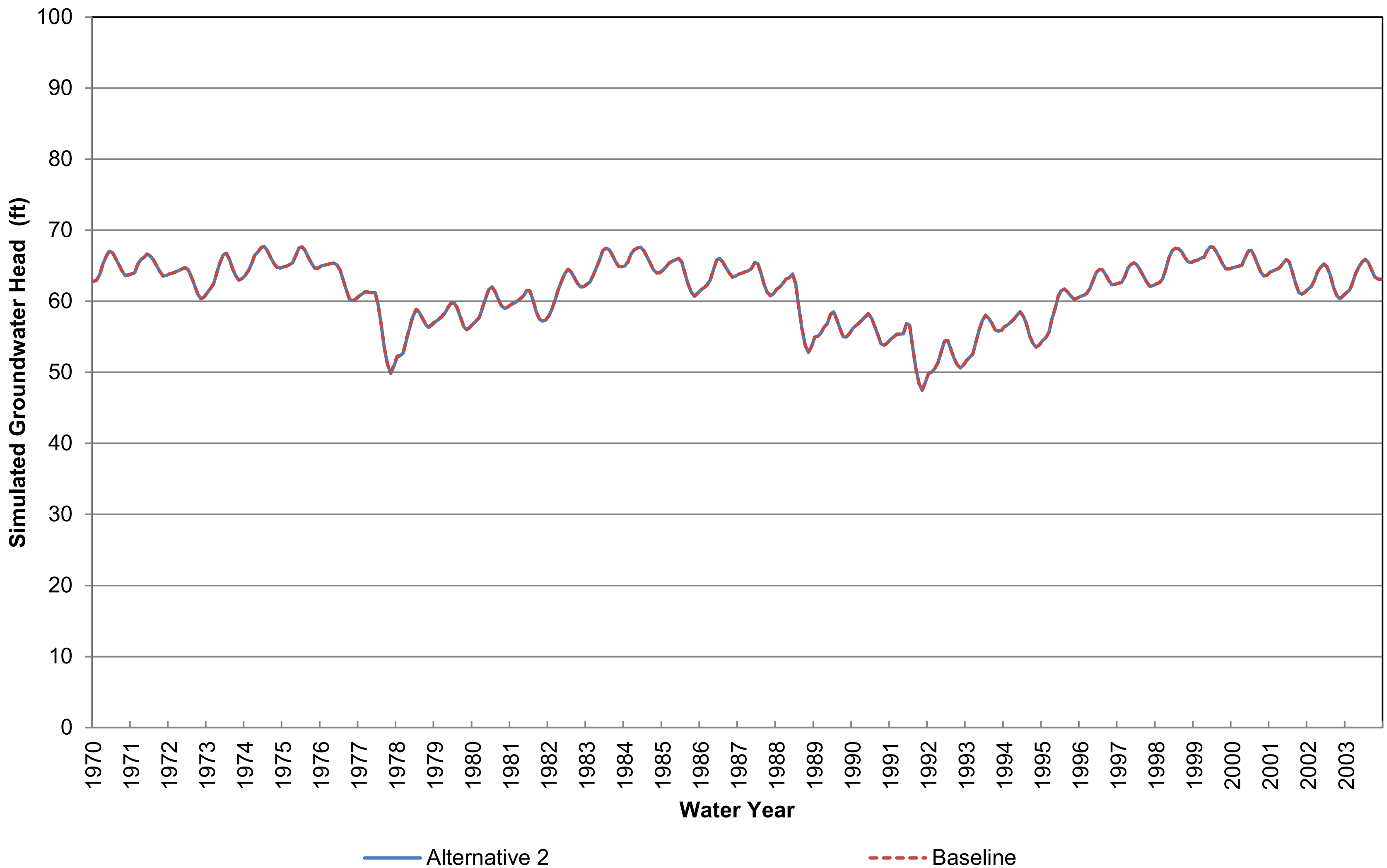
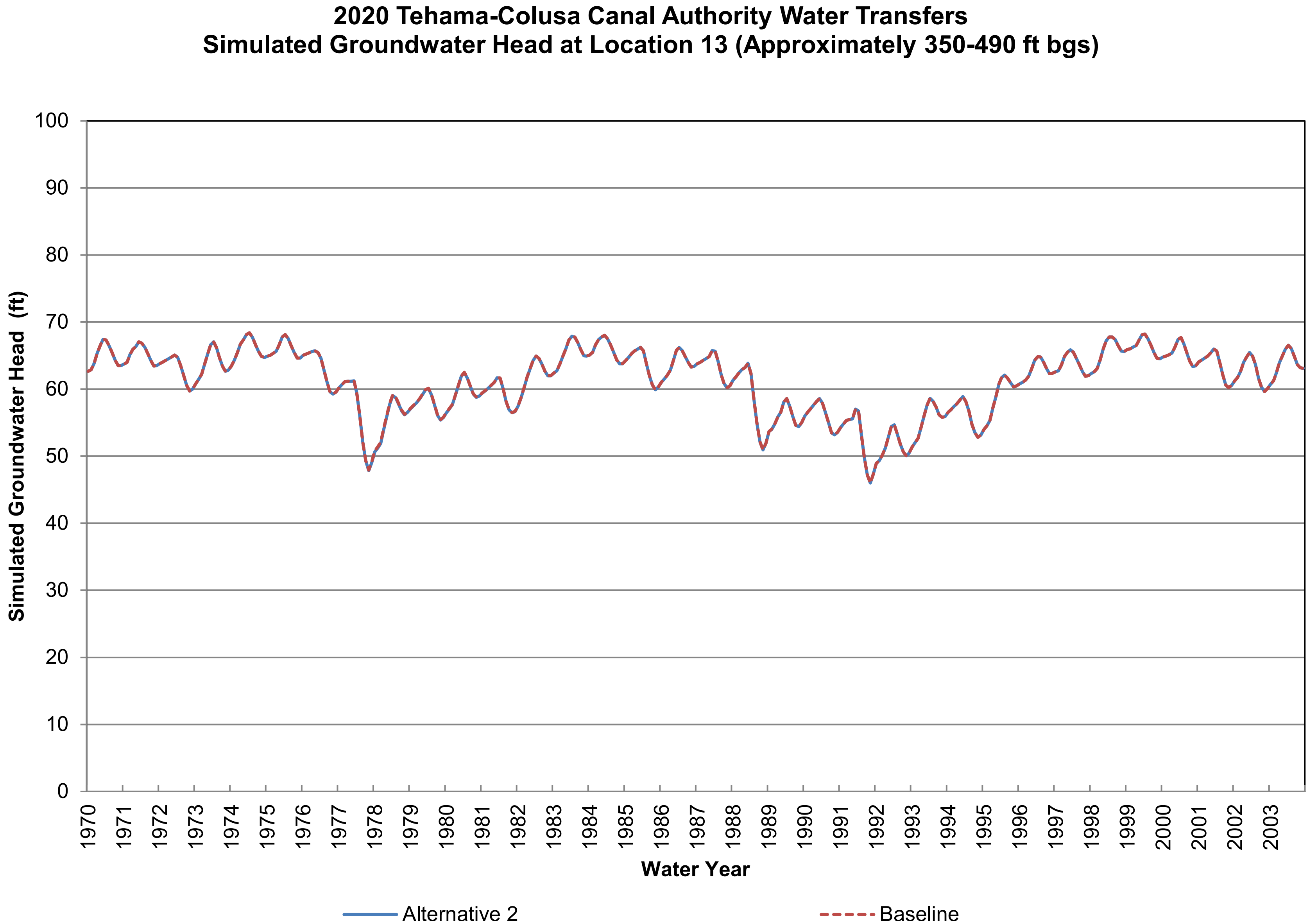
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation



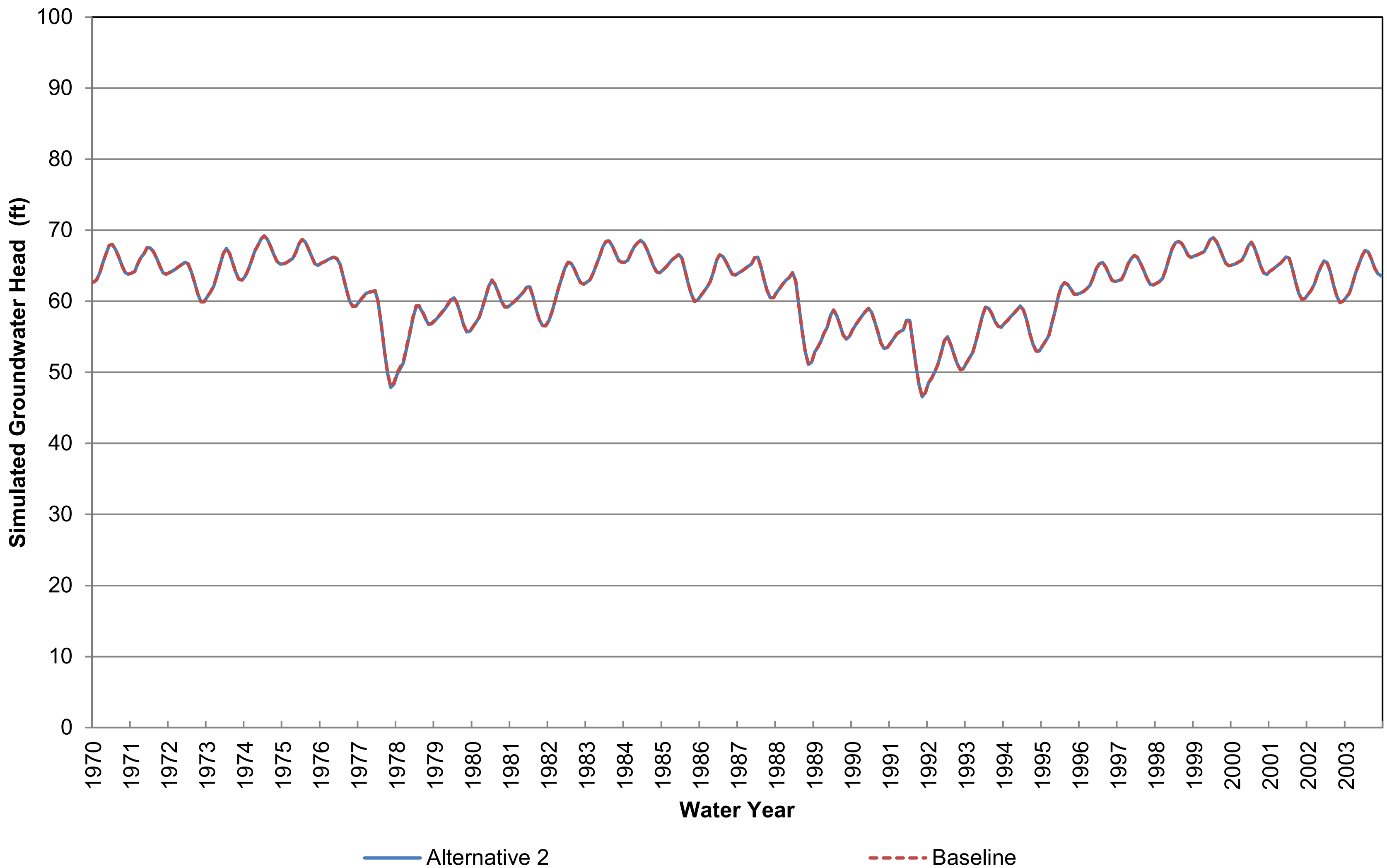
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 70-210 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

# 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 13 (Approximately 210-350 ft bgs)

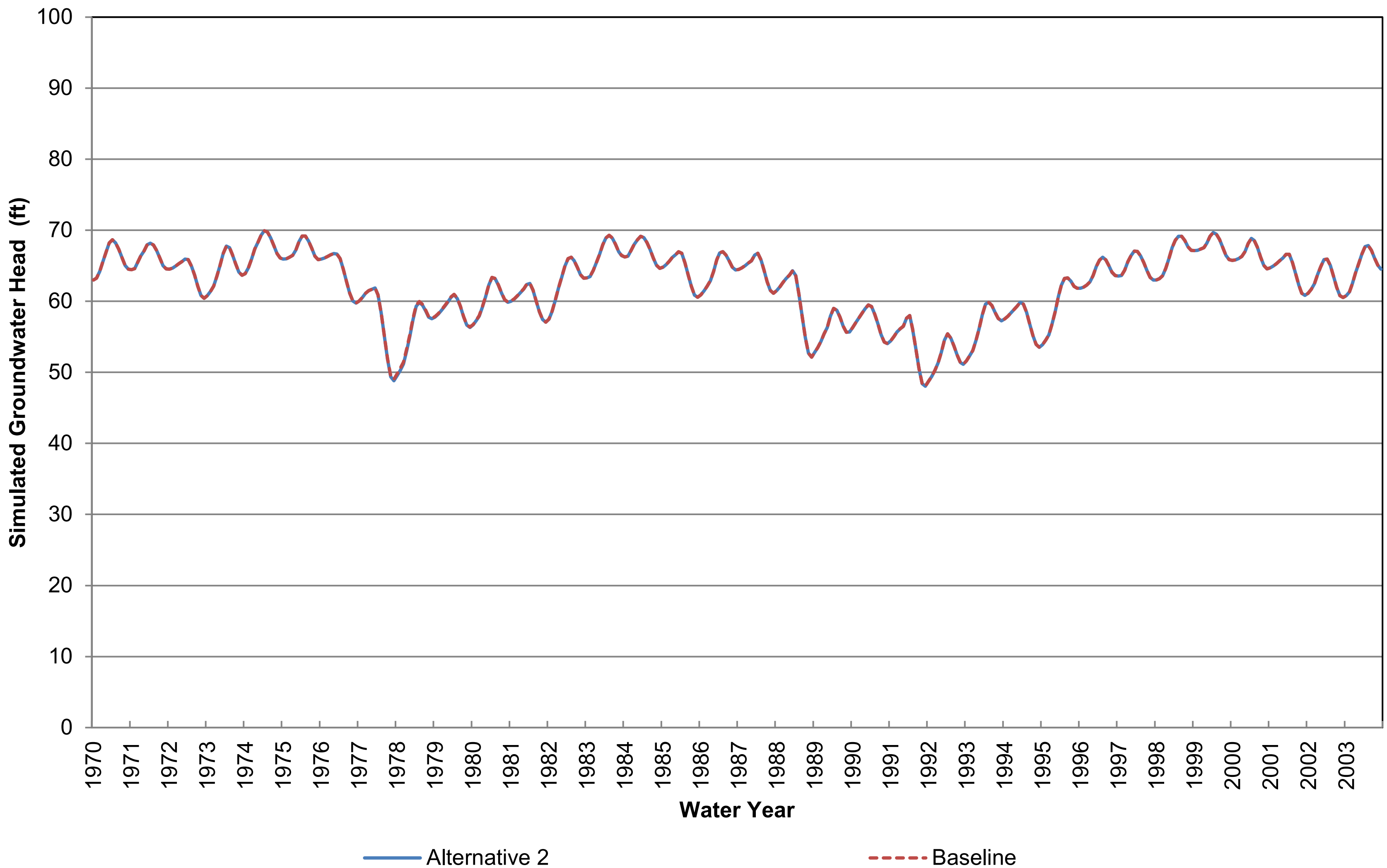


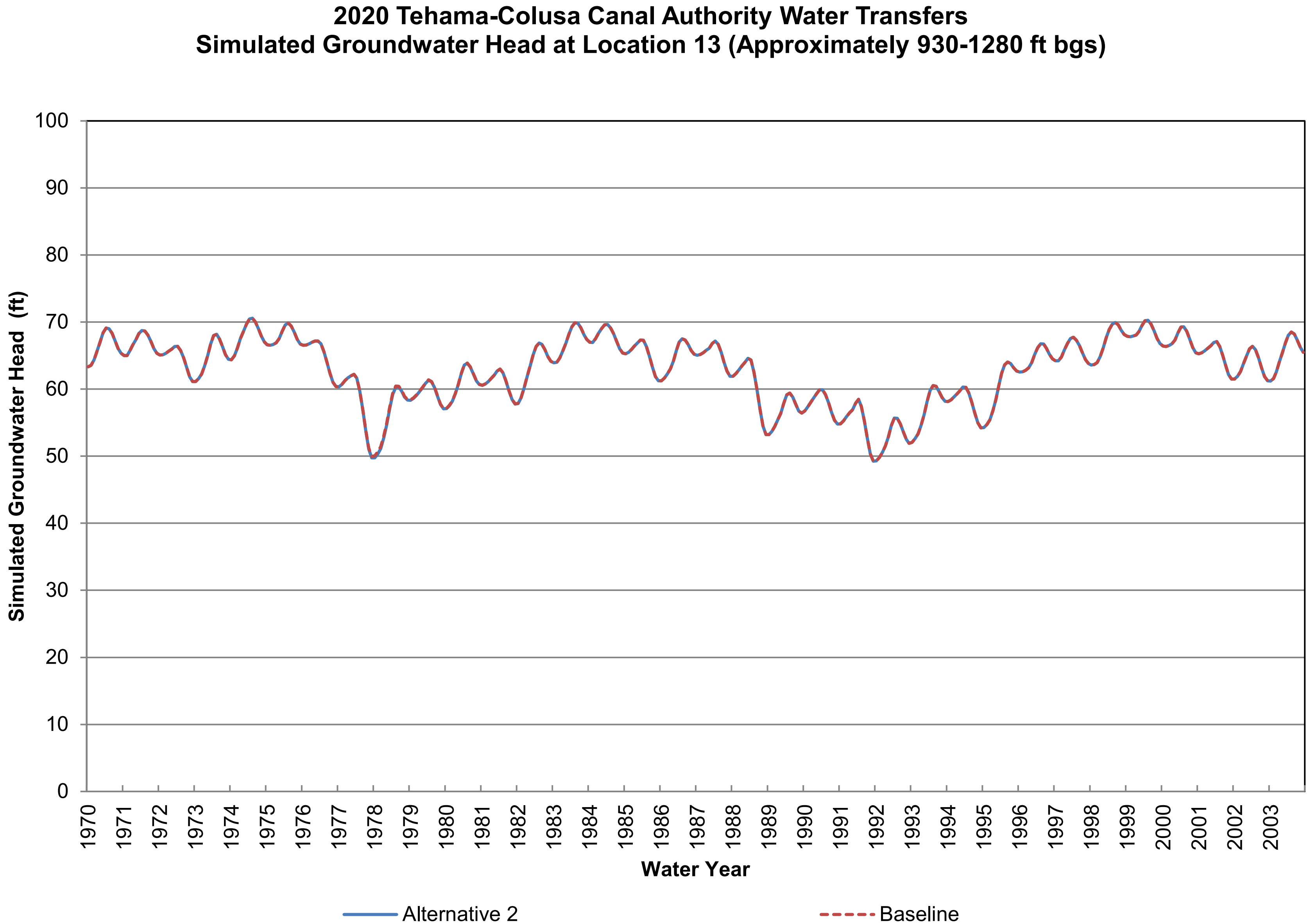

2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 350-490 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 13 (Approximately 490-700 ft bgs)



**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 13 (Approximately 700-930 ft bgs)**




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 930-1280 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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1995
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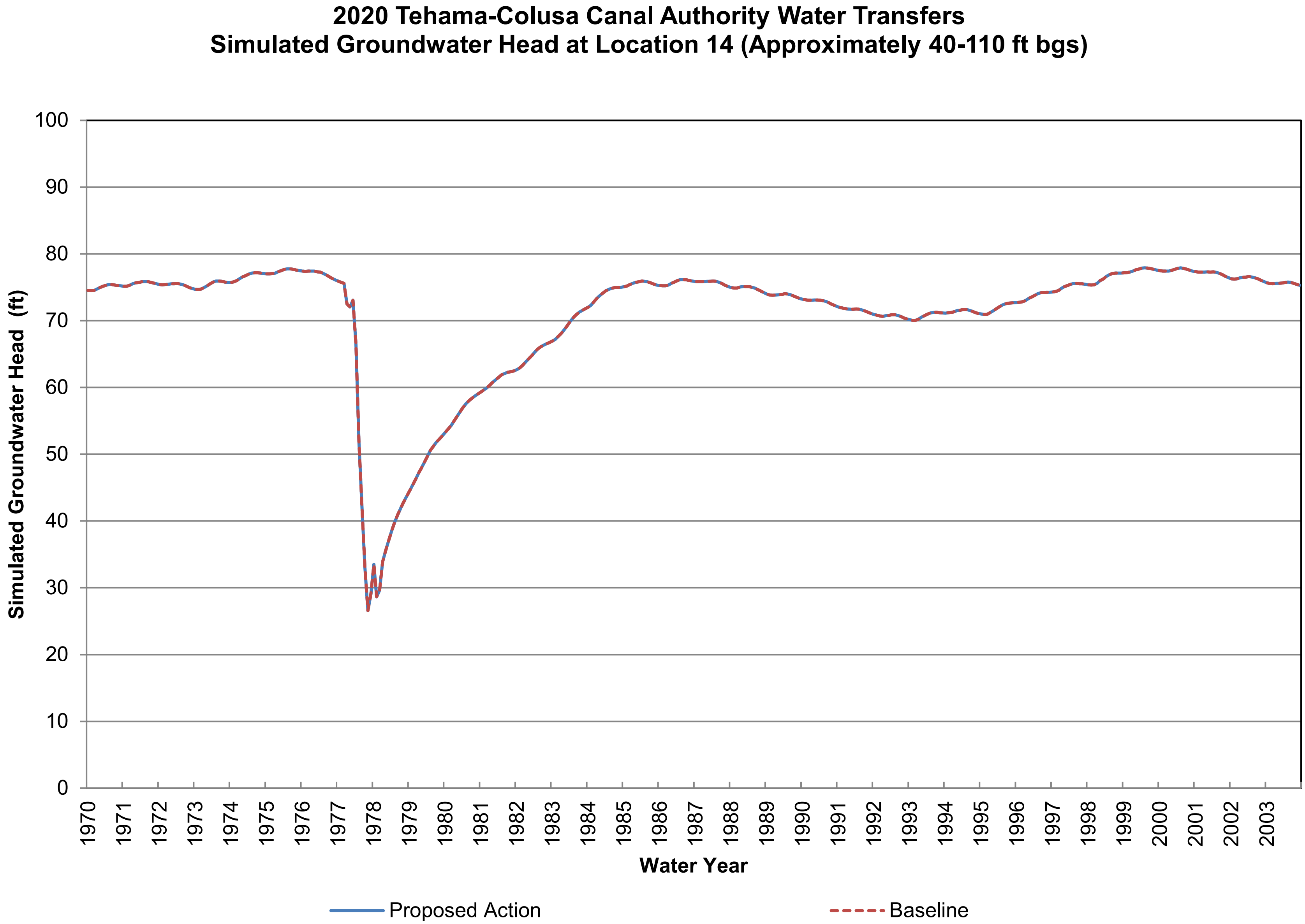
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 14 (Approximately 0-40 ft bgs)


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 40-110 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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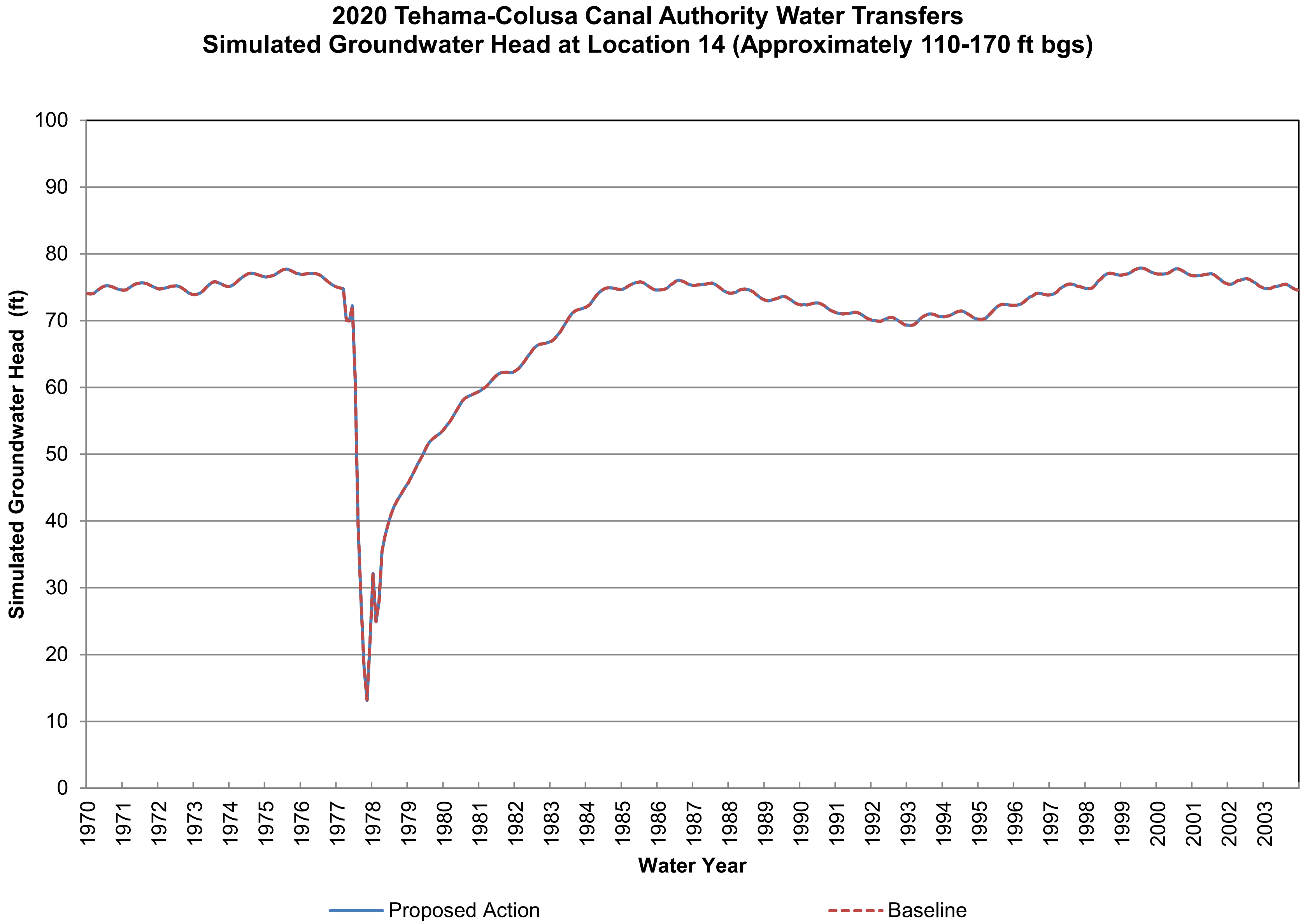
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 110-170 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1991
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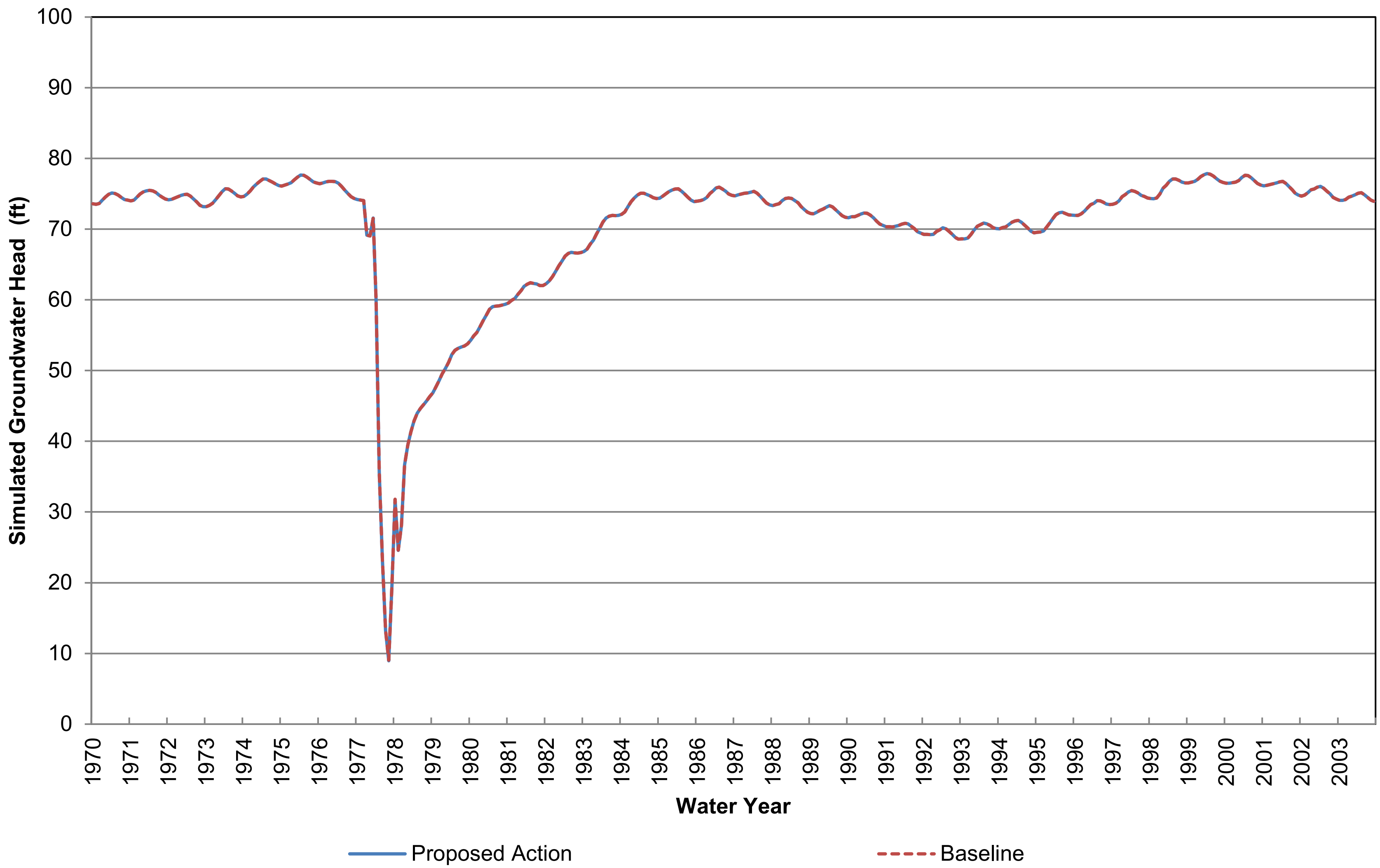
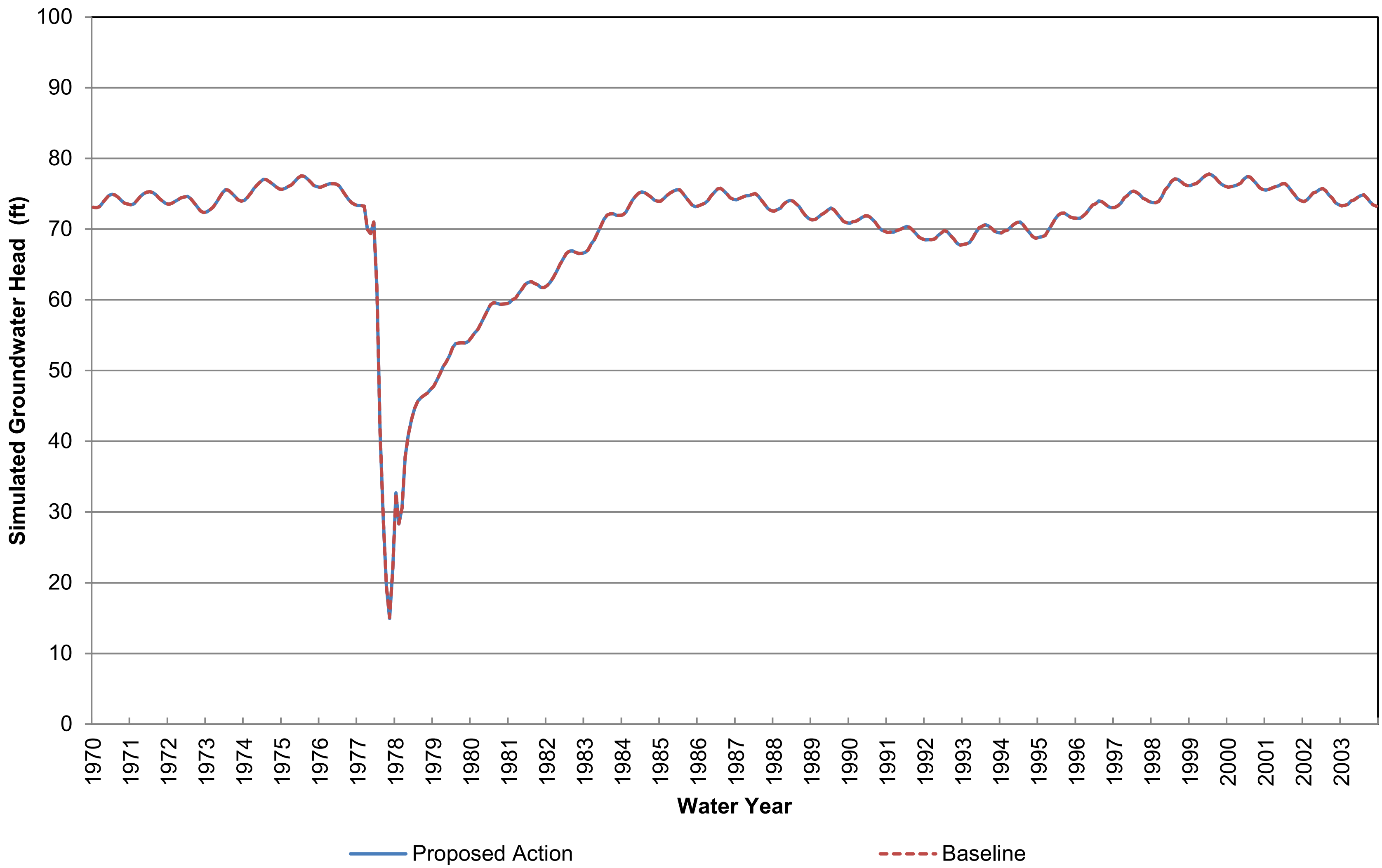
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline

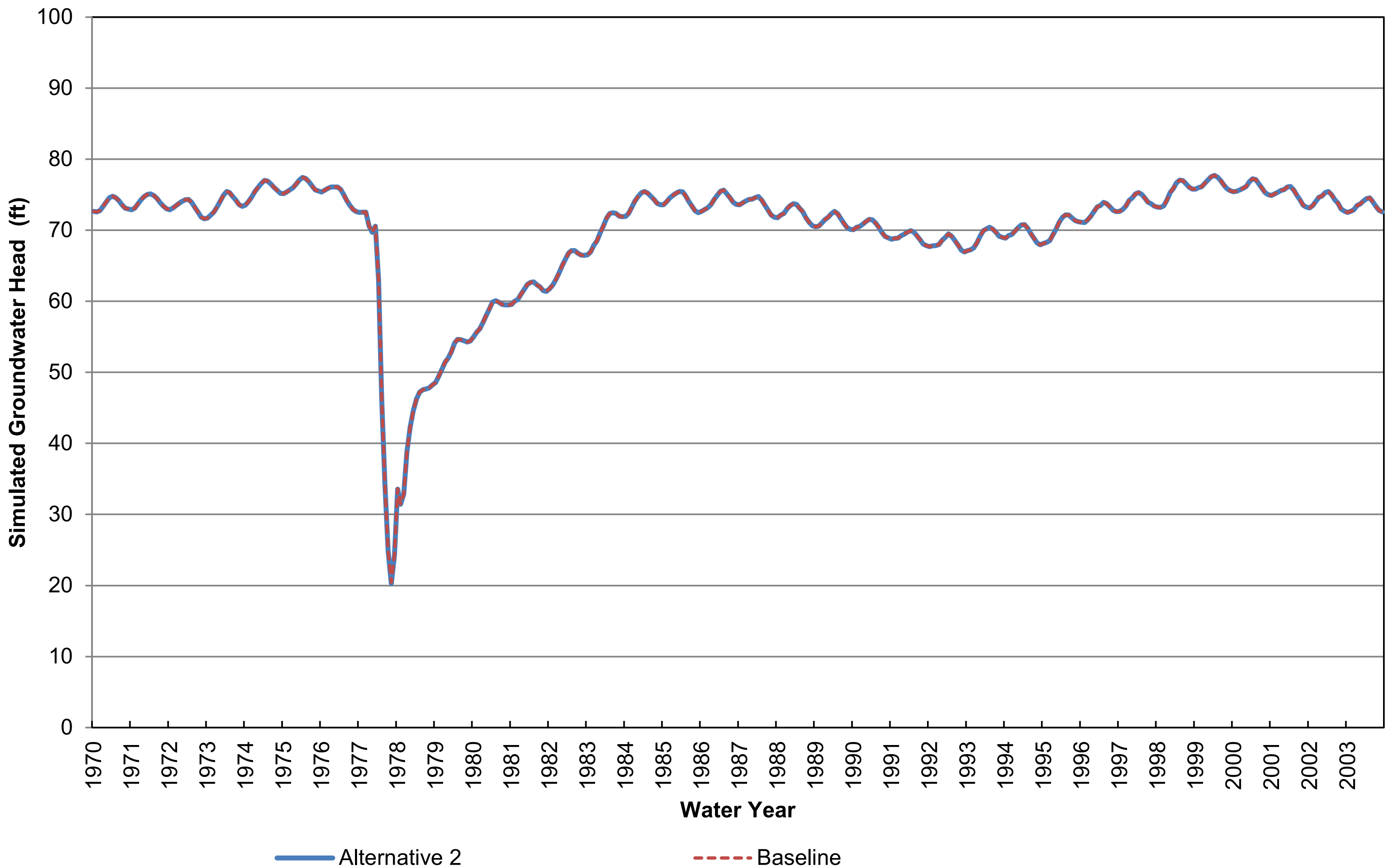
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 14 (Approximately 170-230 ft bgs)



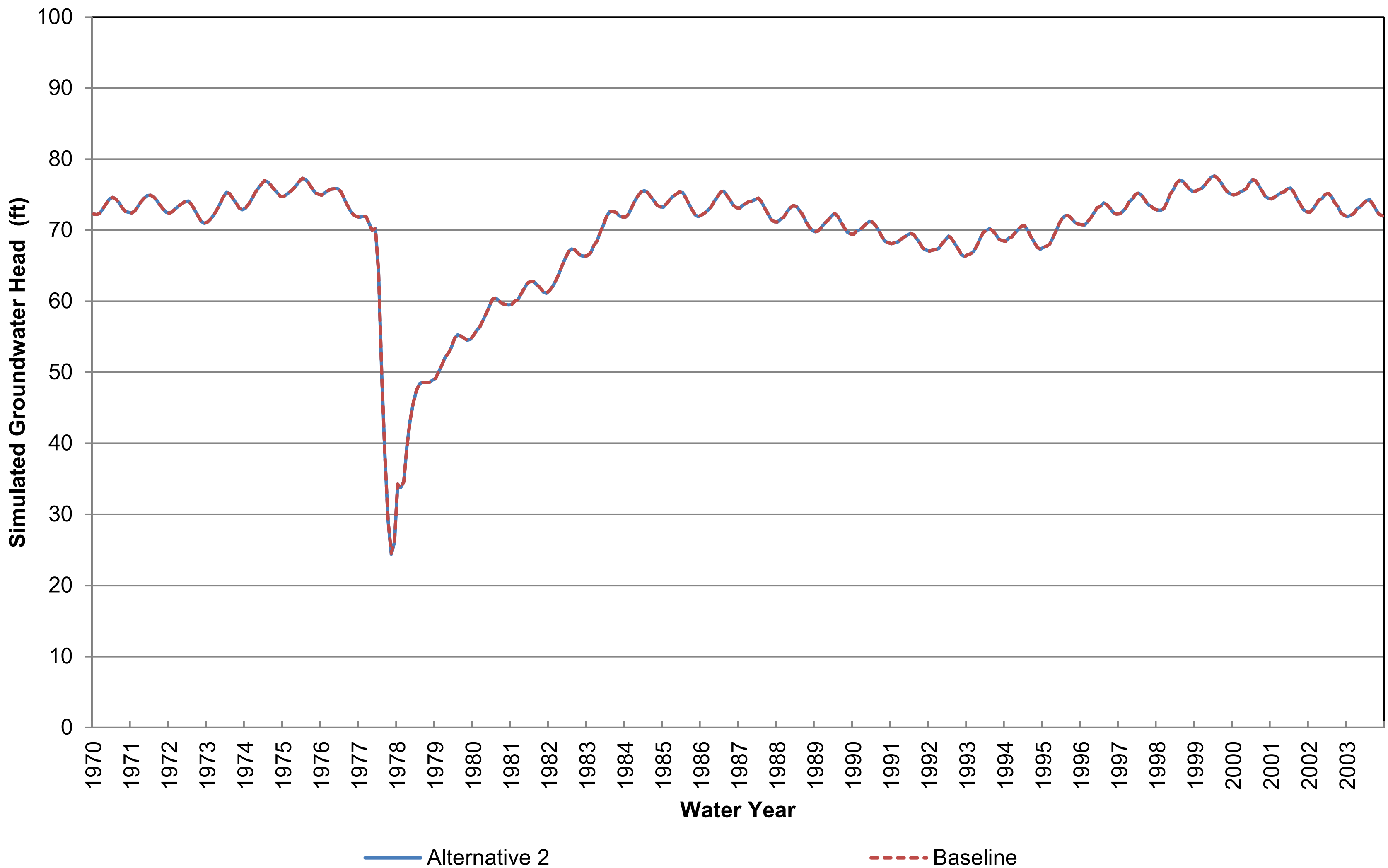
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 14 (Approximately 230-310 ft bgs)

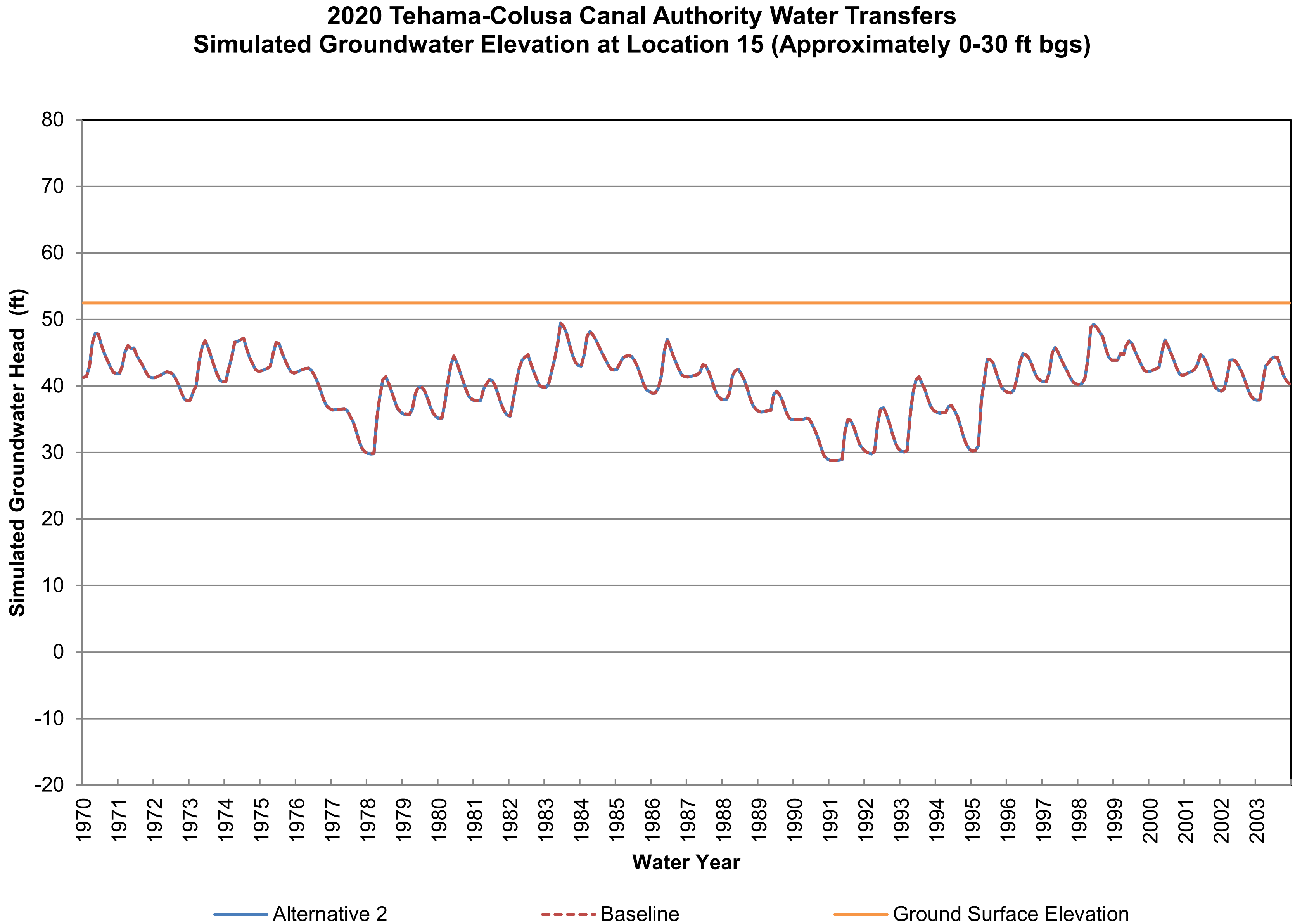


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 14 (Approximately 310-420 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 14 (Approximately 420-570 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 15 (Approximately 0-30 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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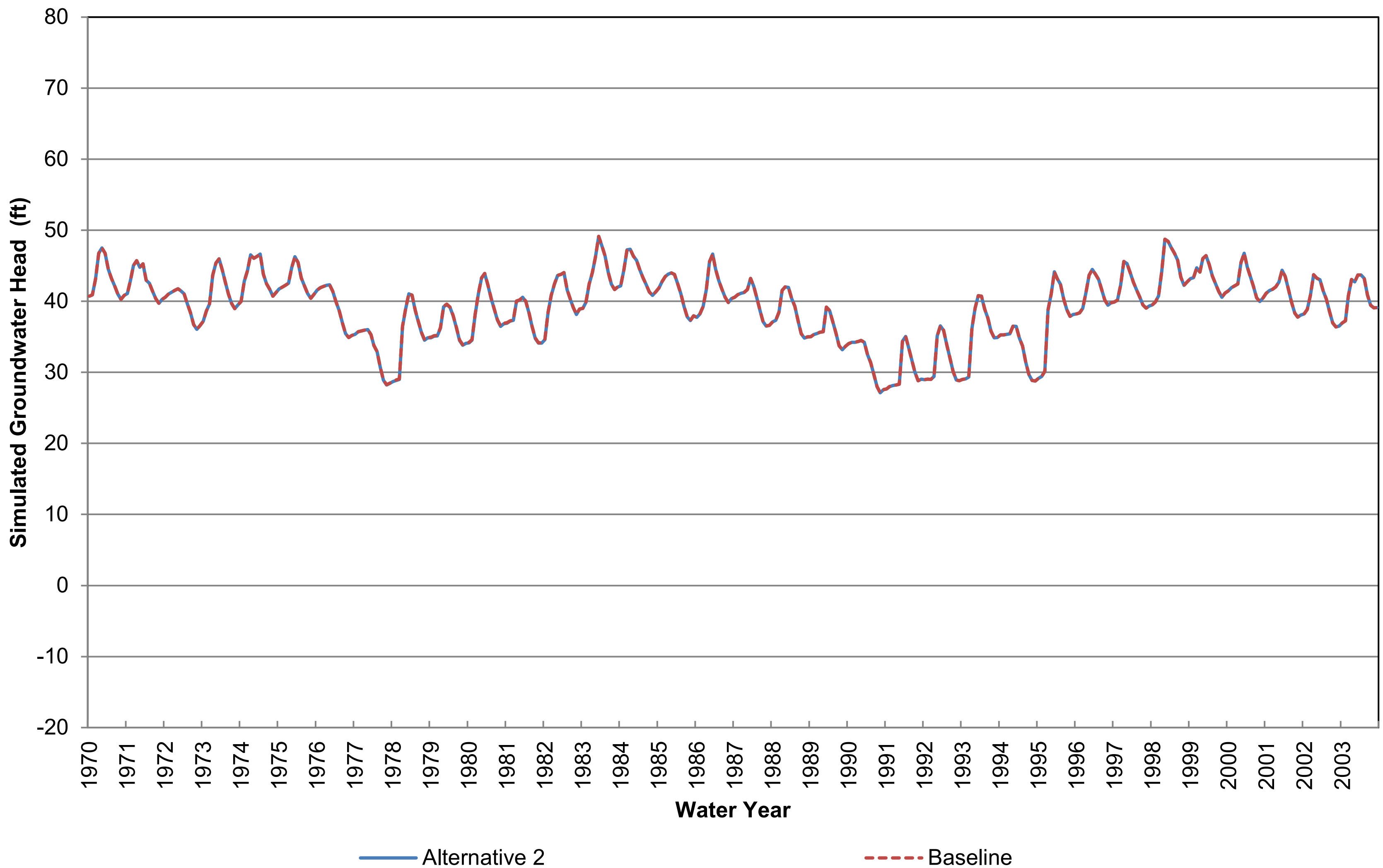
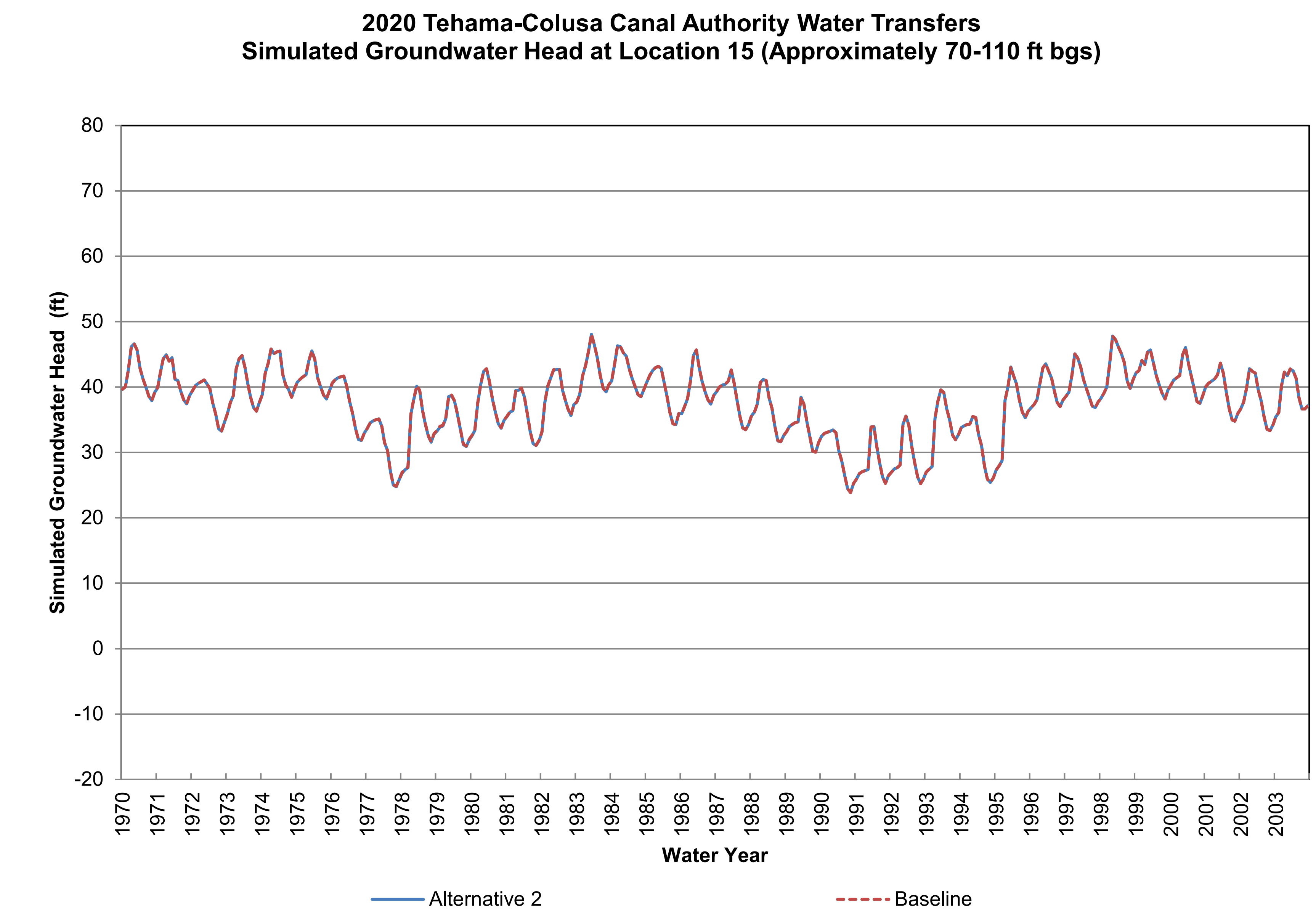
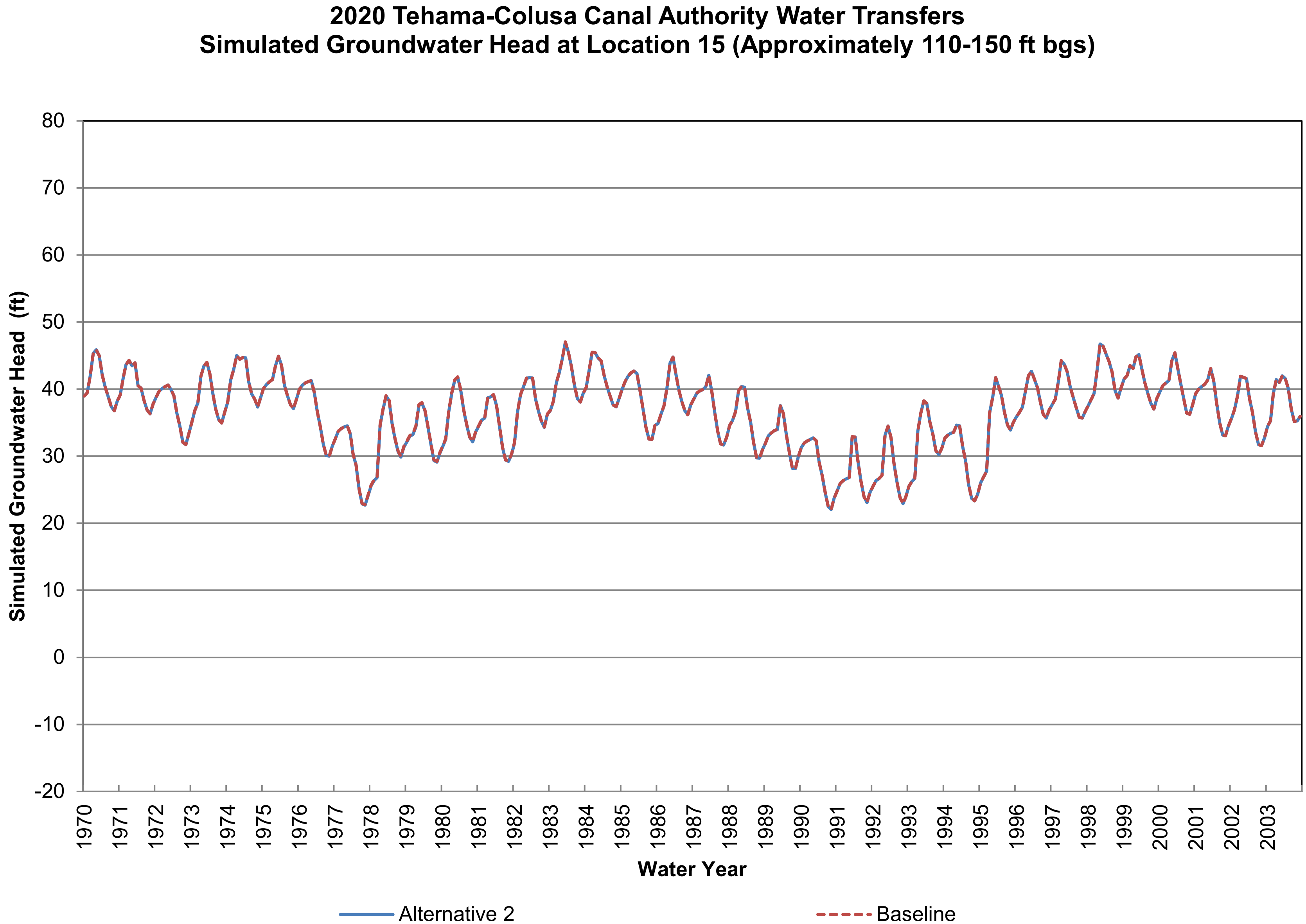
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 15 (Approximately 30-70 ft bgs)



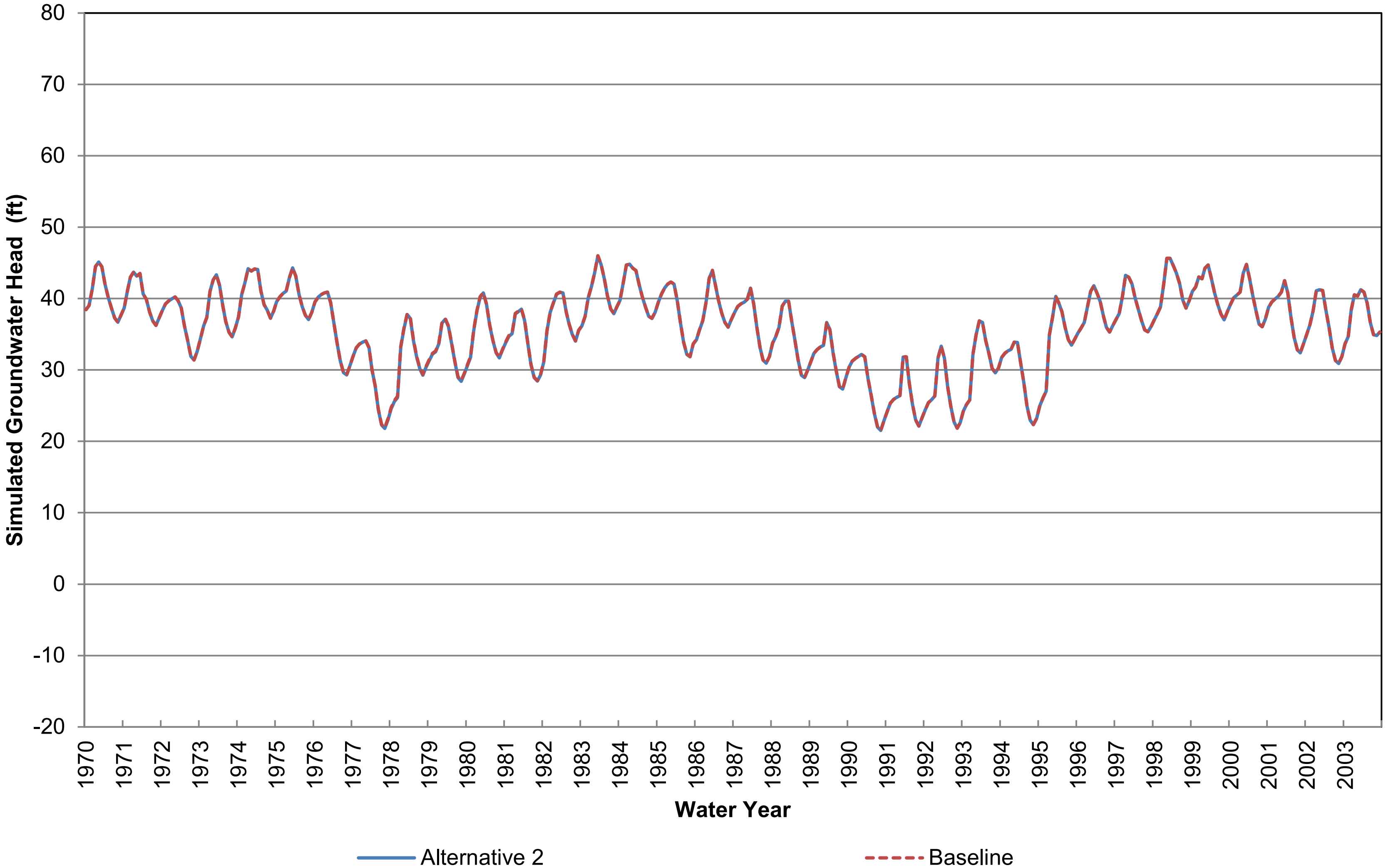


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 70-110 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

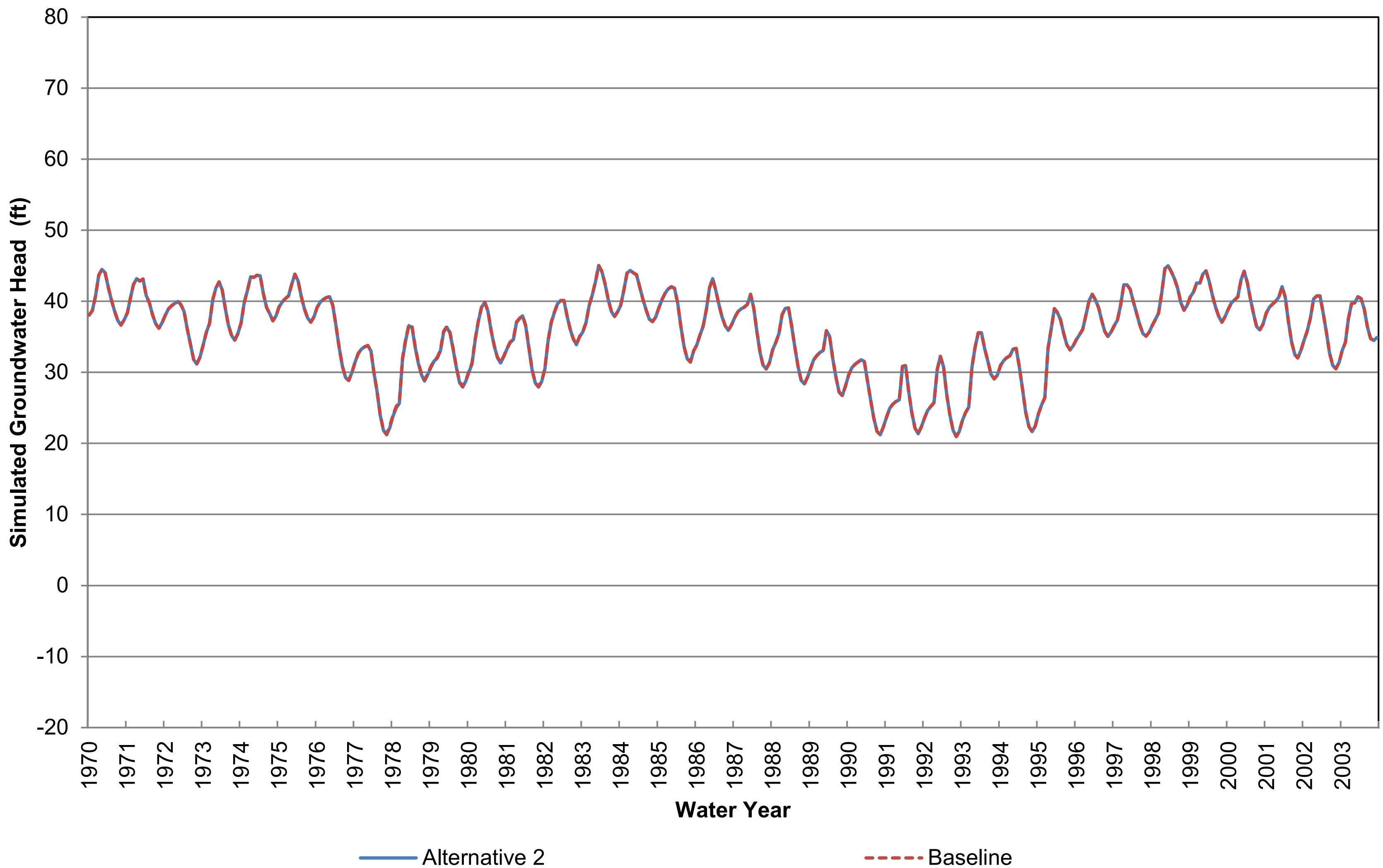


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 110-150 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

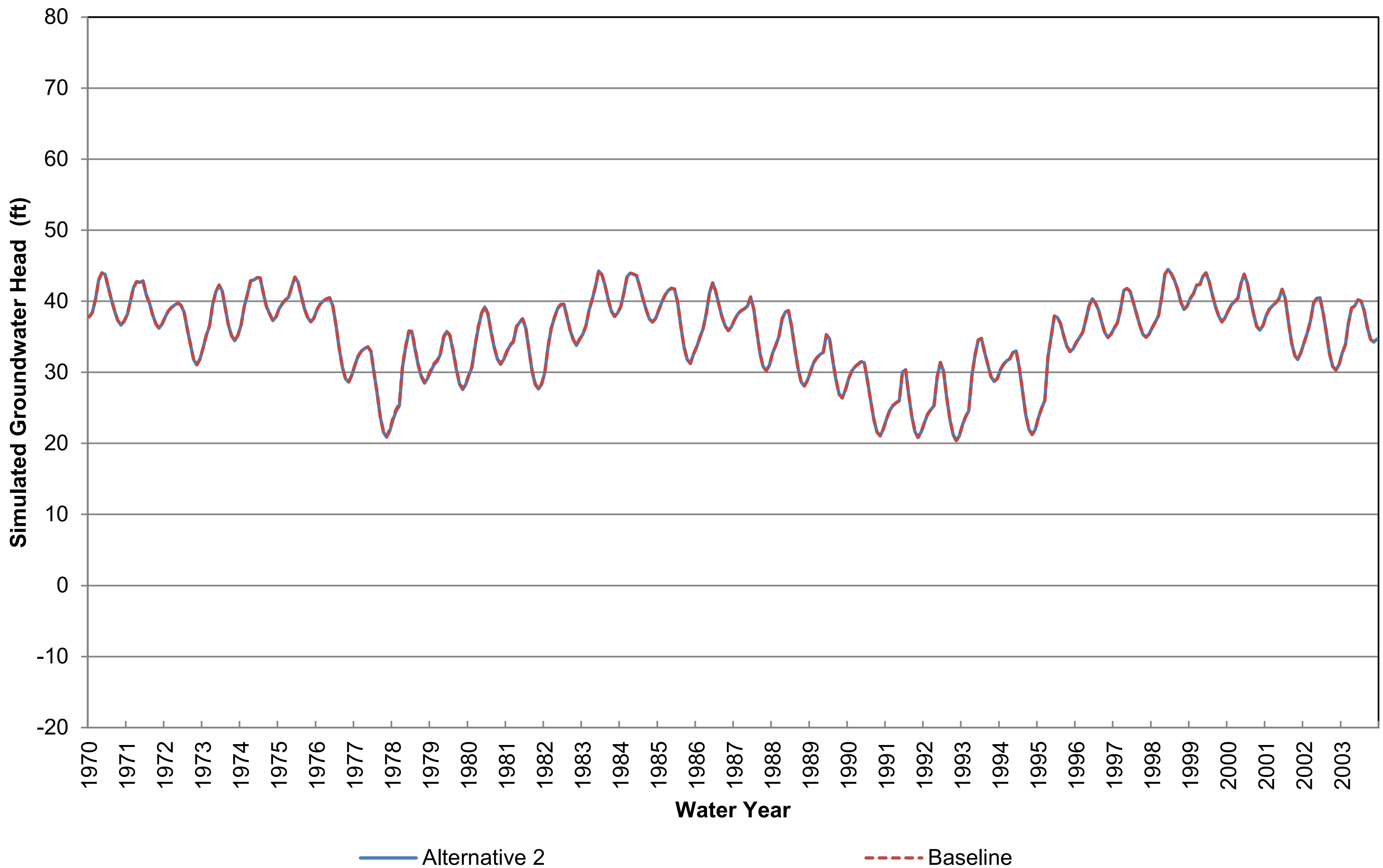
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 15 (Approximately 150-200 ft bgs)

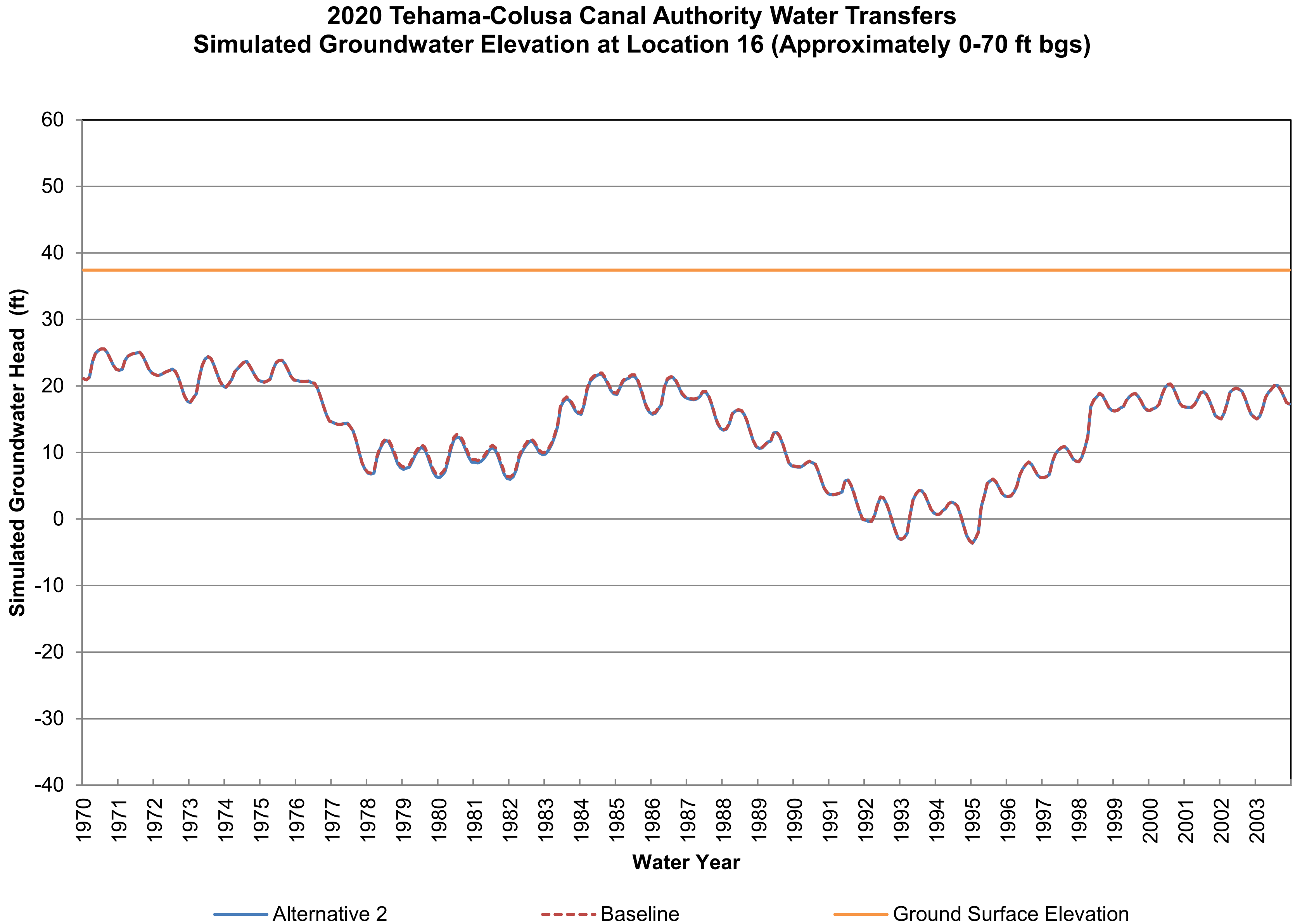


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 15 (Approximately 200-270 ft bgs)



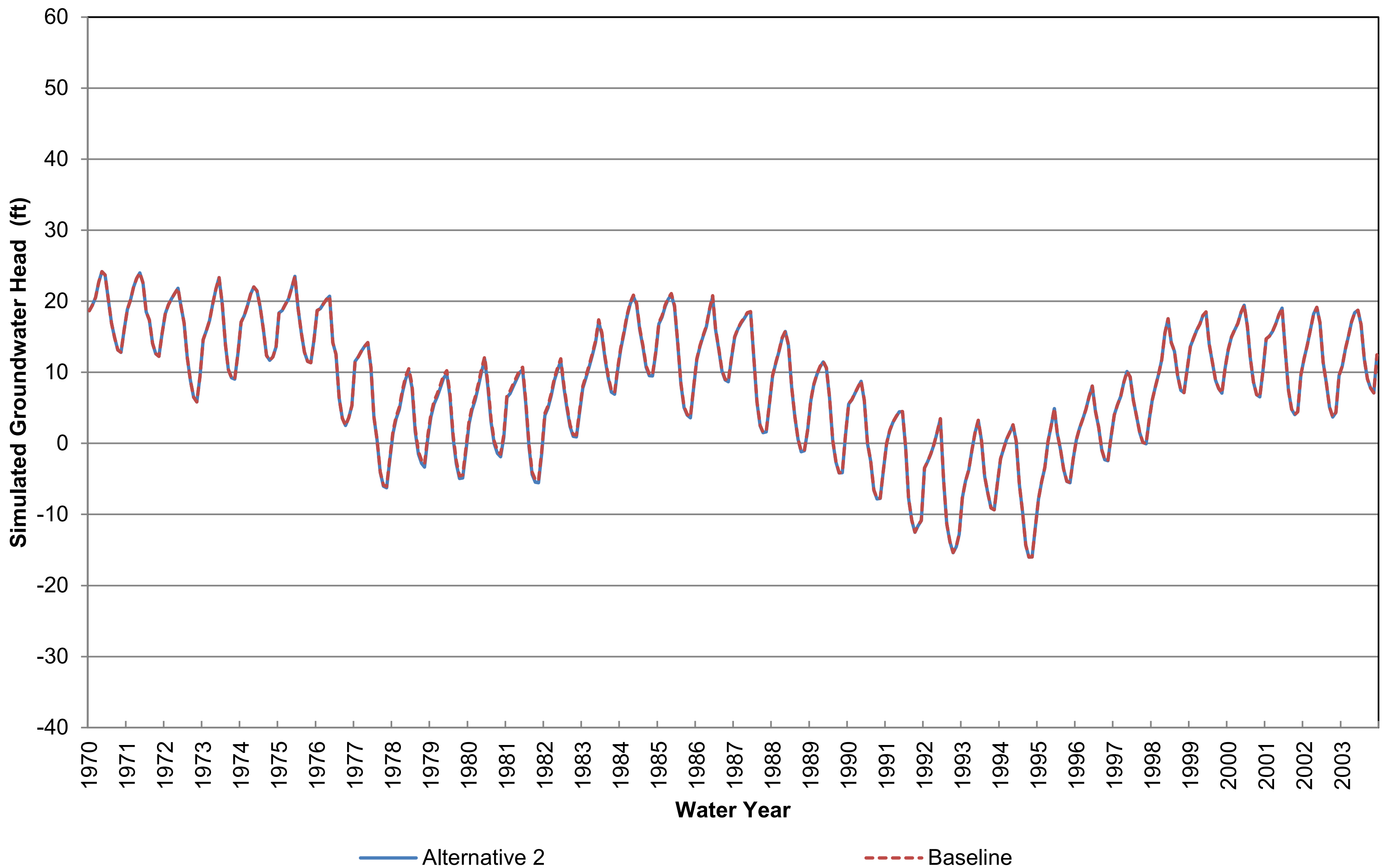
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 15 (Approximately 270-360 ft bgs)

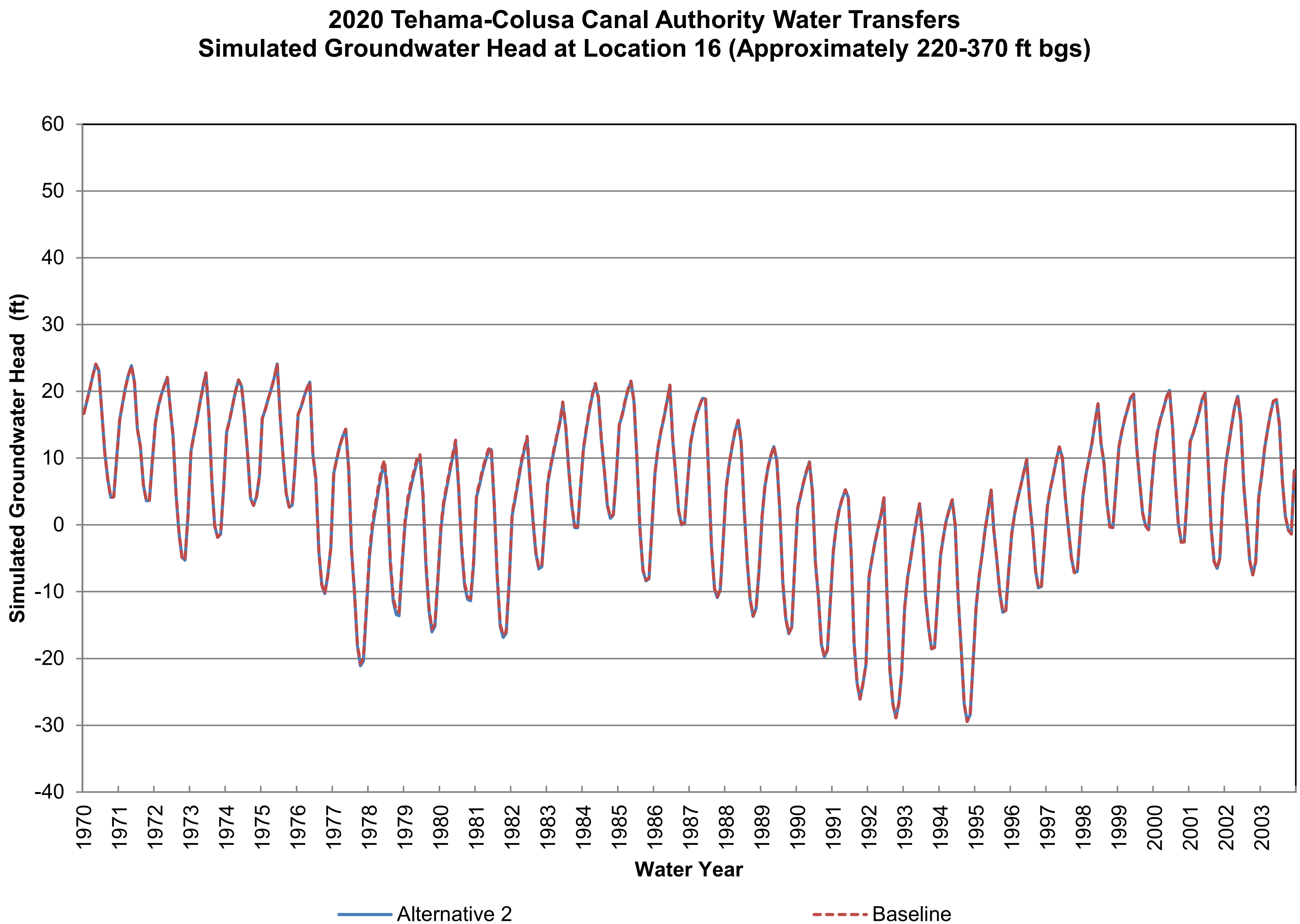




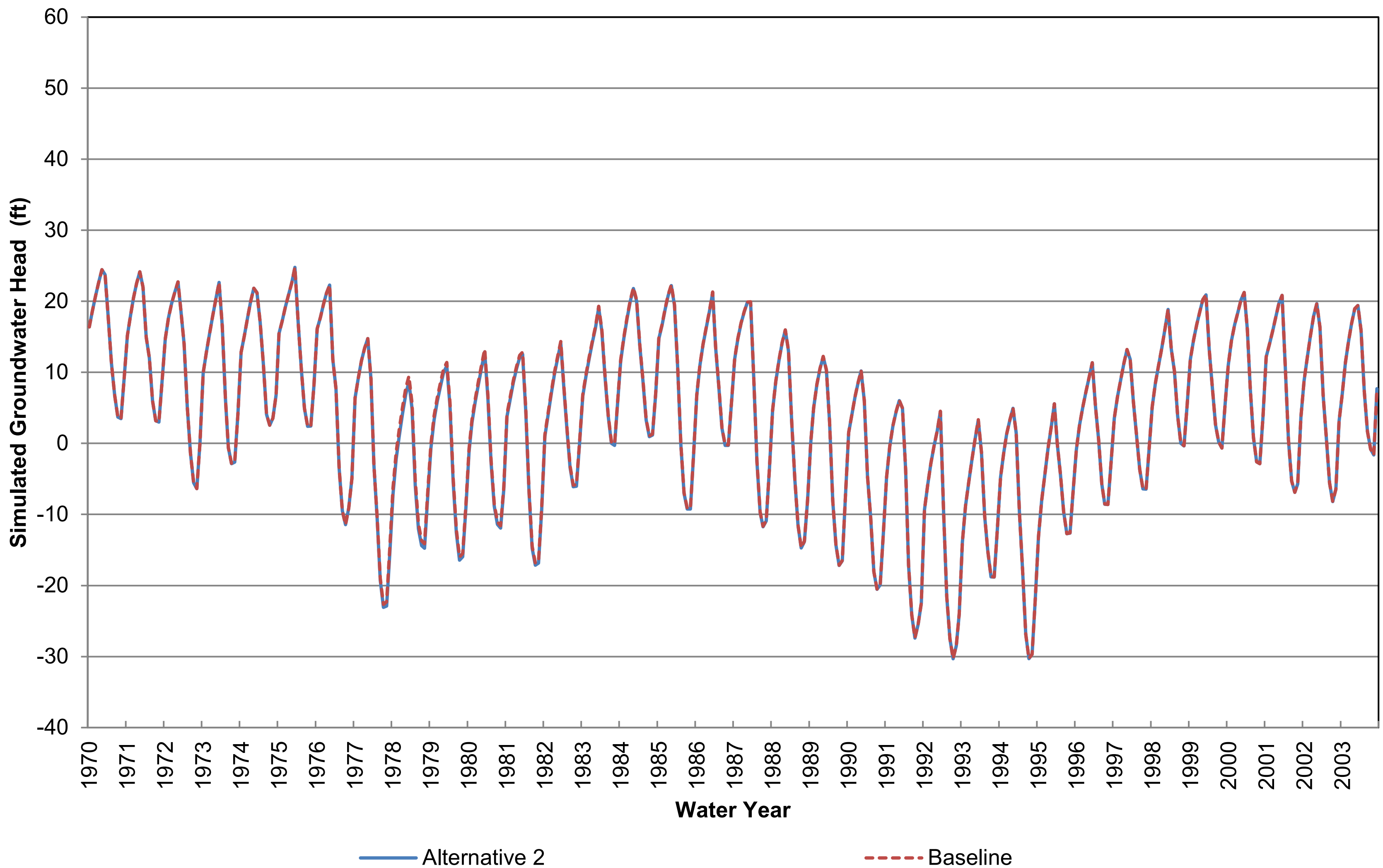
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 16 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

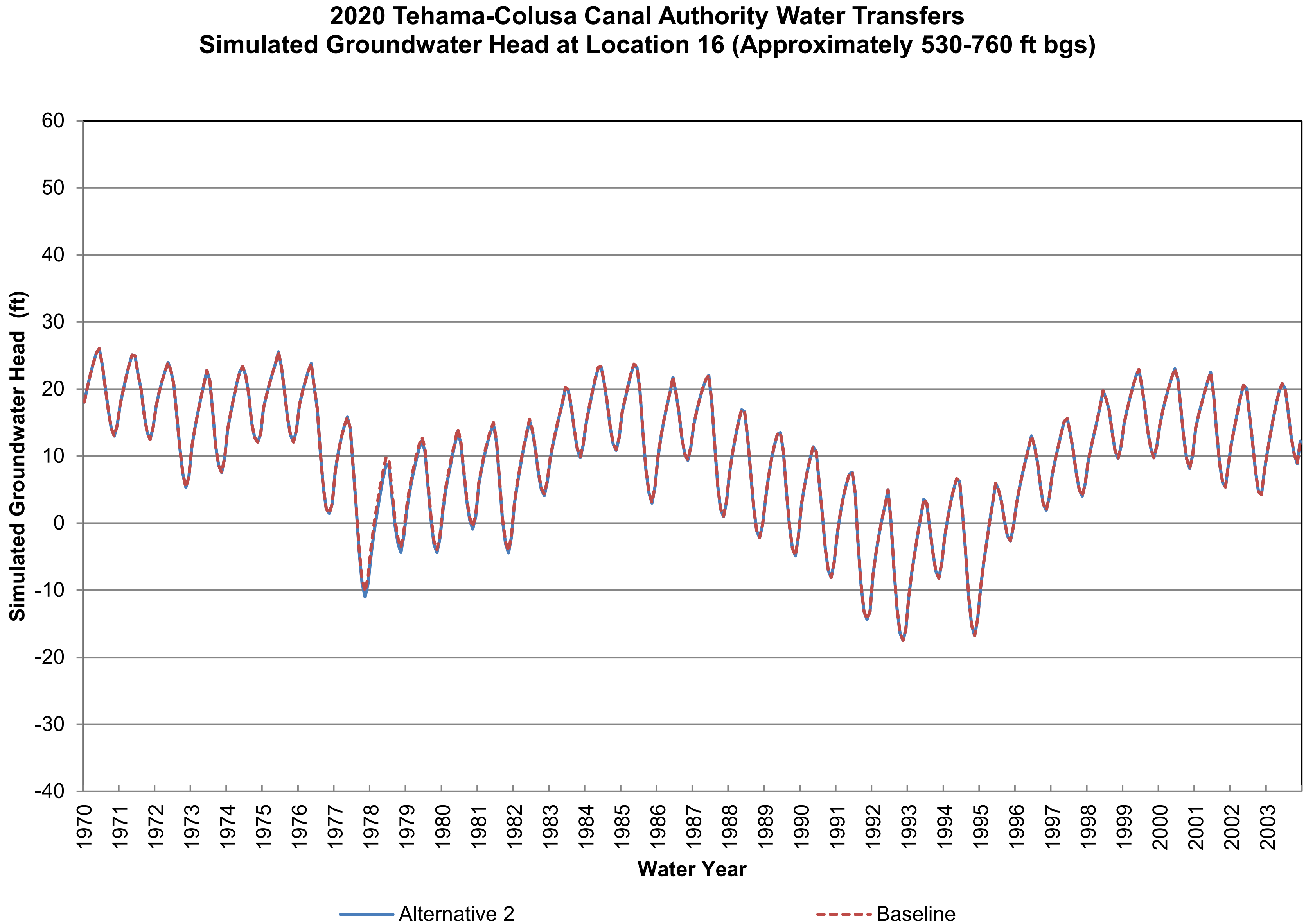
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 16 (Approximately 70-220 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 220-370 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

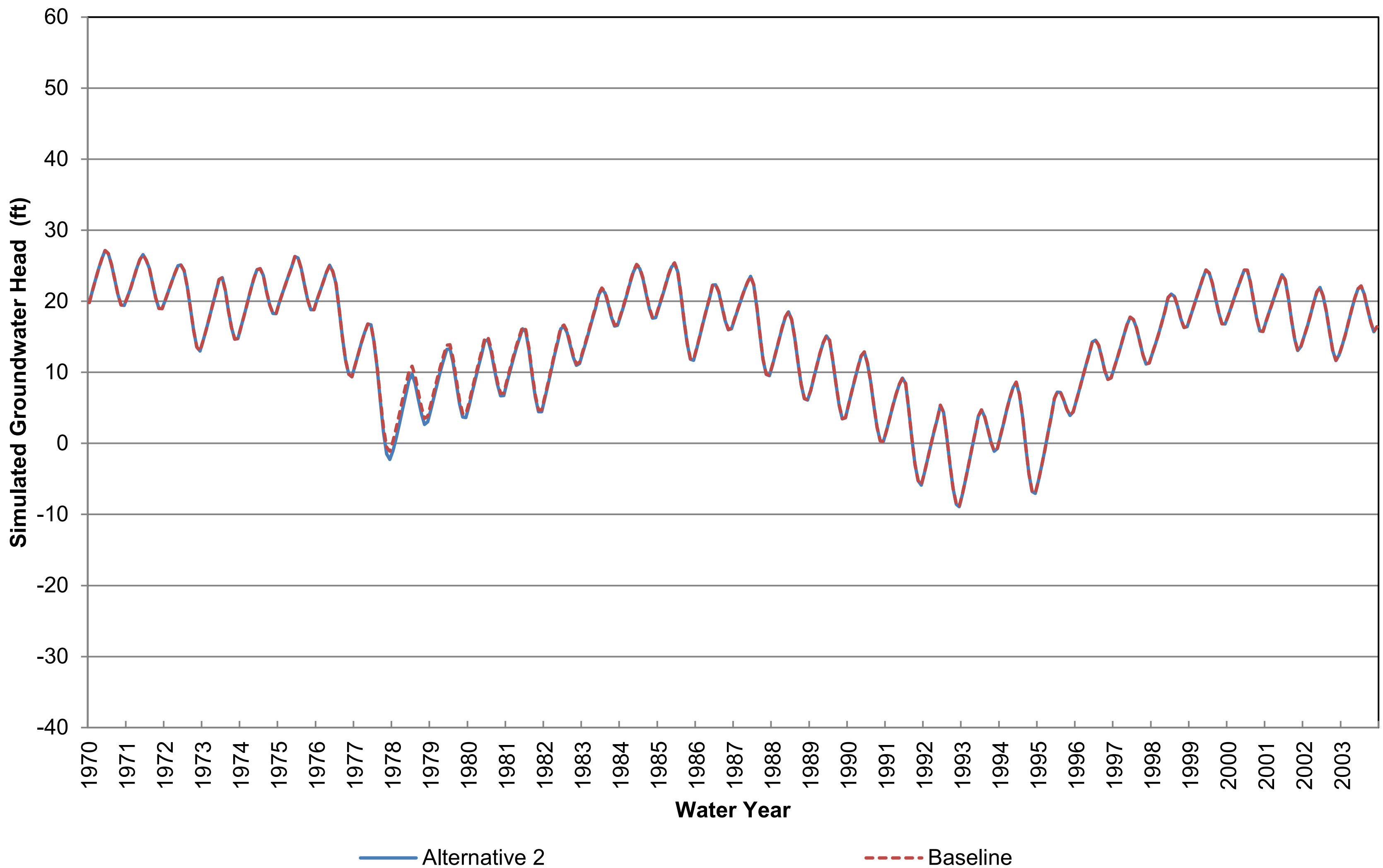
**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 16 (Approximately 370-530 ft bgs)**



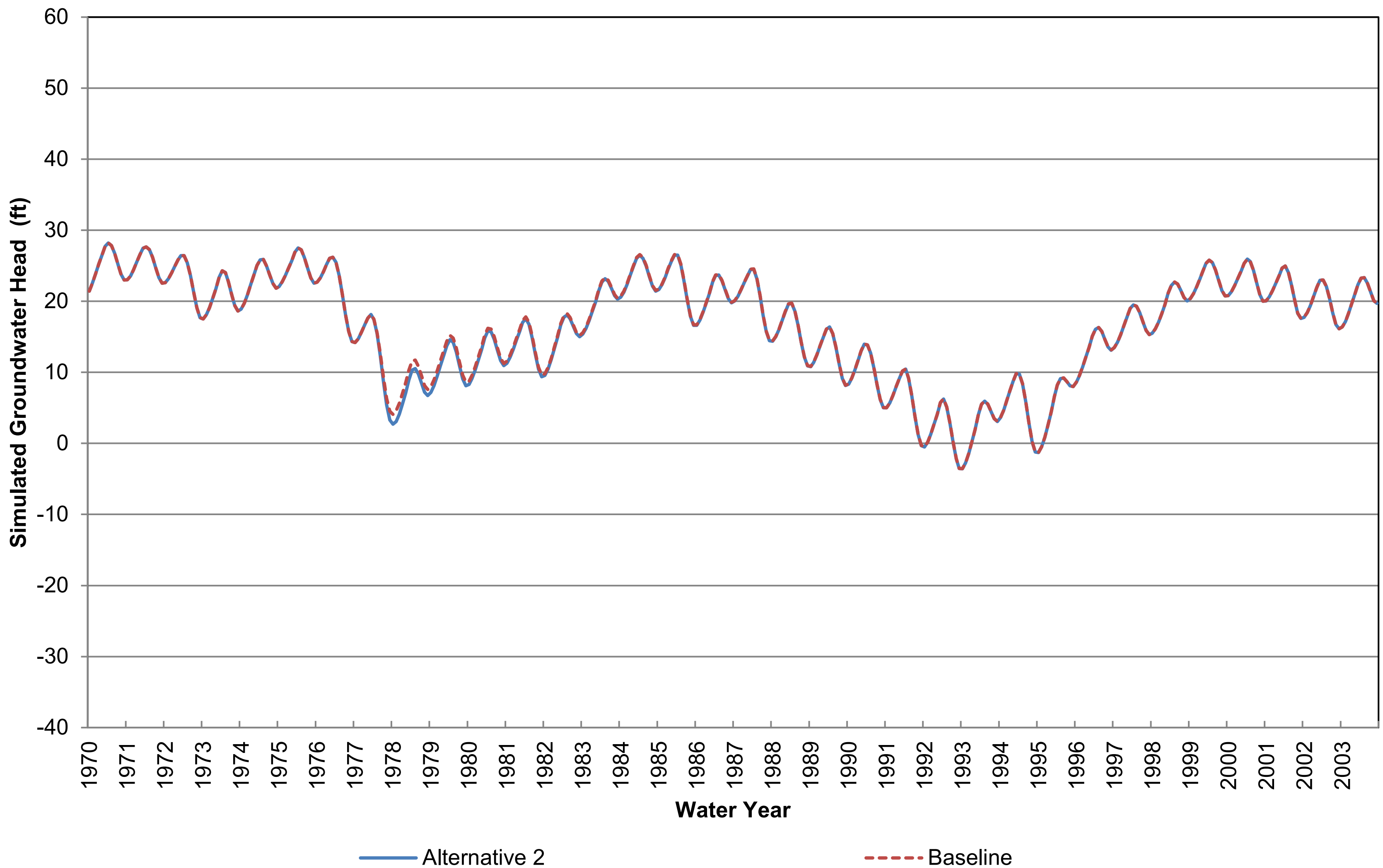


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 530-760 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

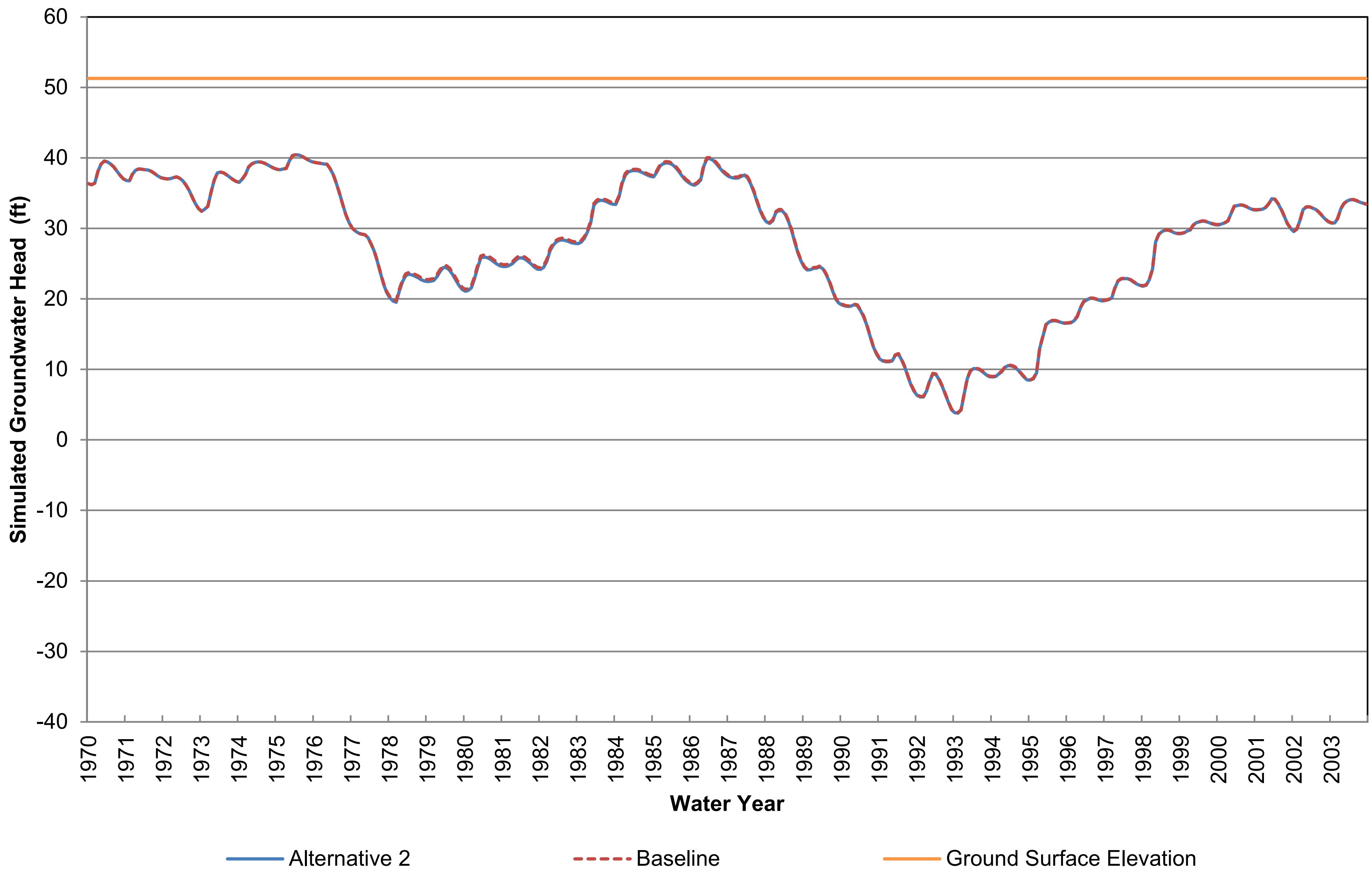
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 16 (Approximately 760-1020 ft bgs)

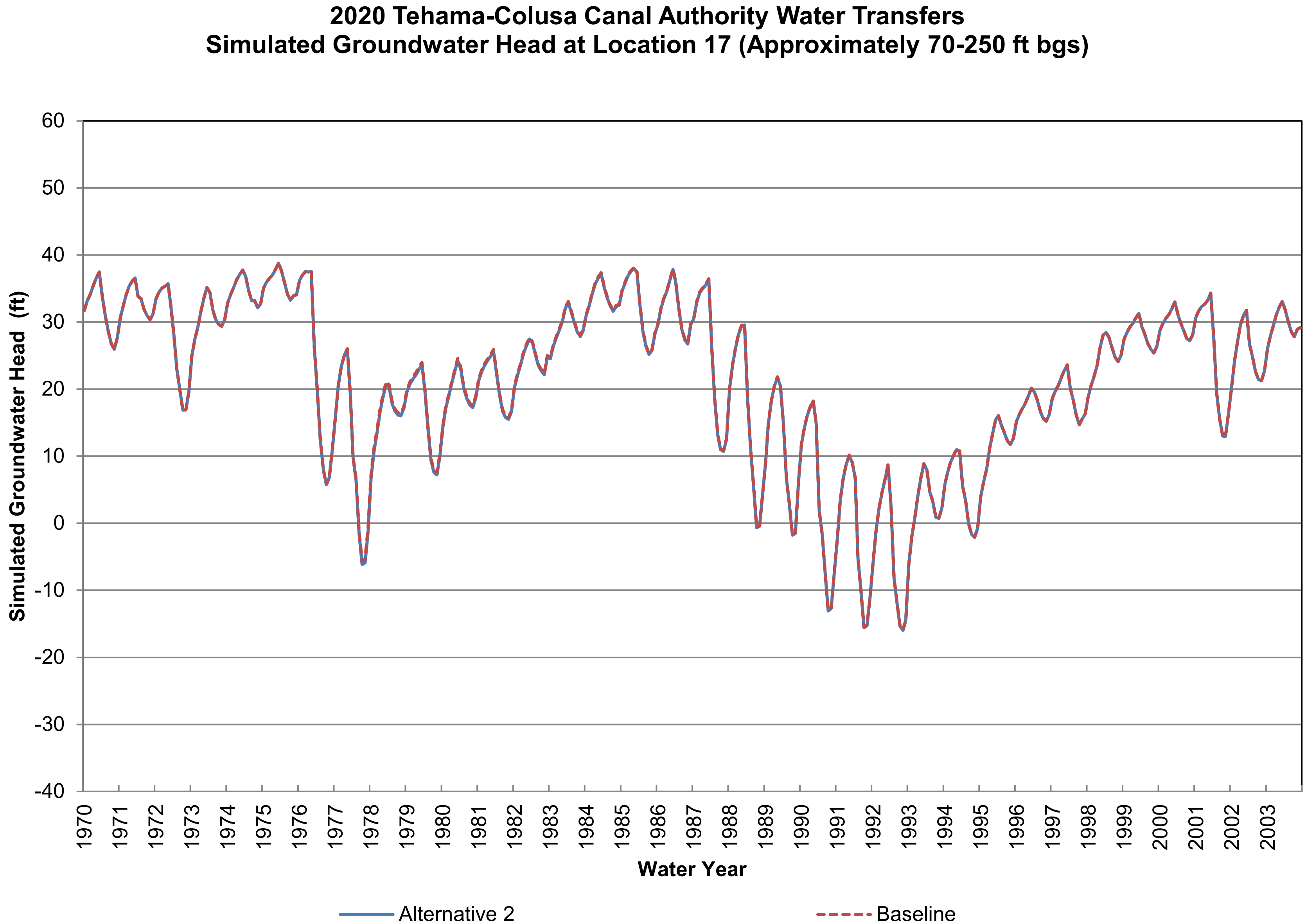


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 1020-1390 ft bgs)

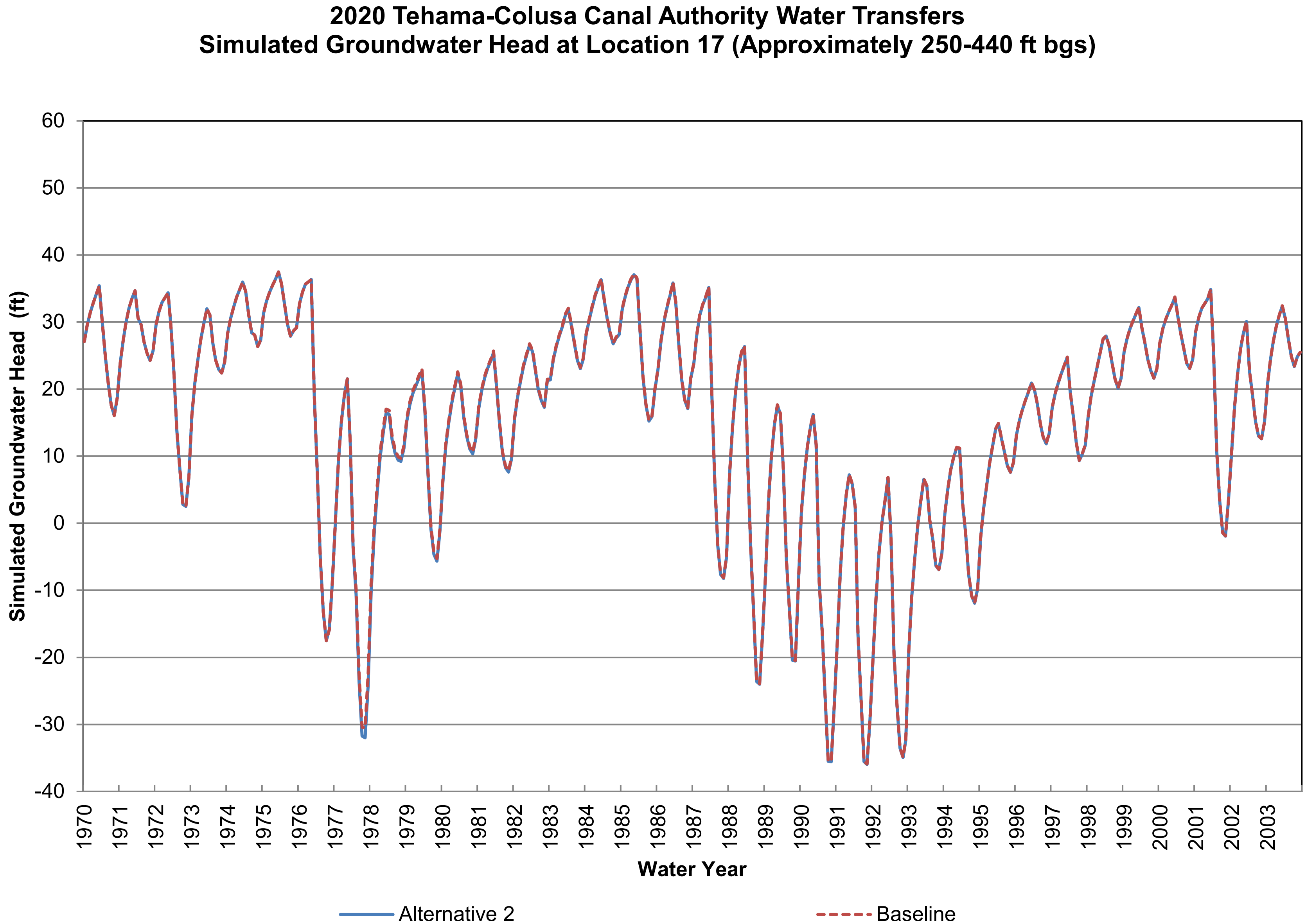


**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Elevation at Location 17 (Approximately 0-70 ft bgs)**

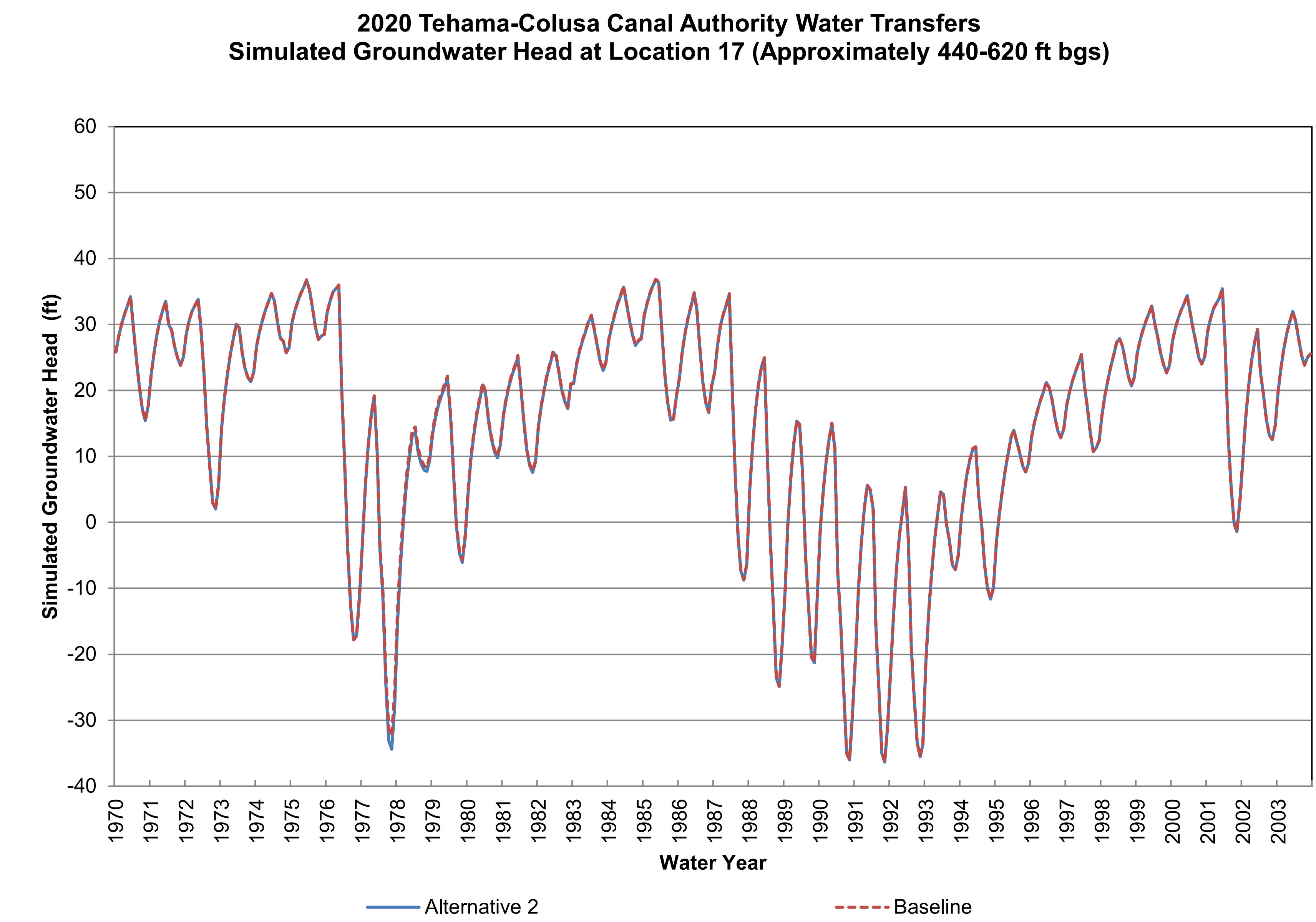




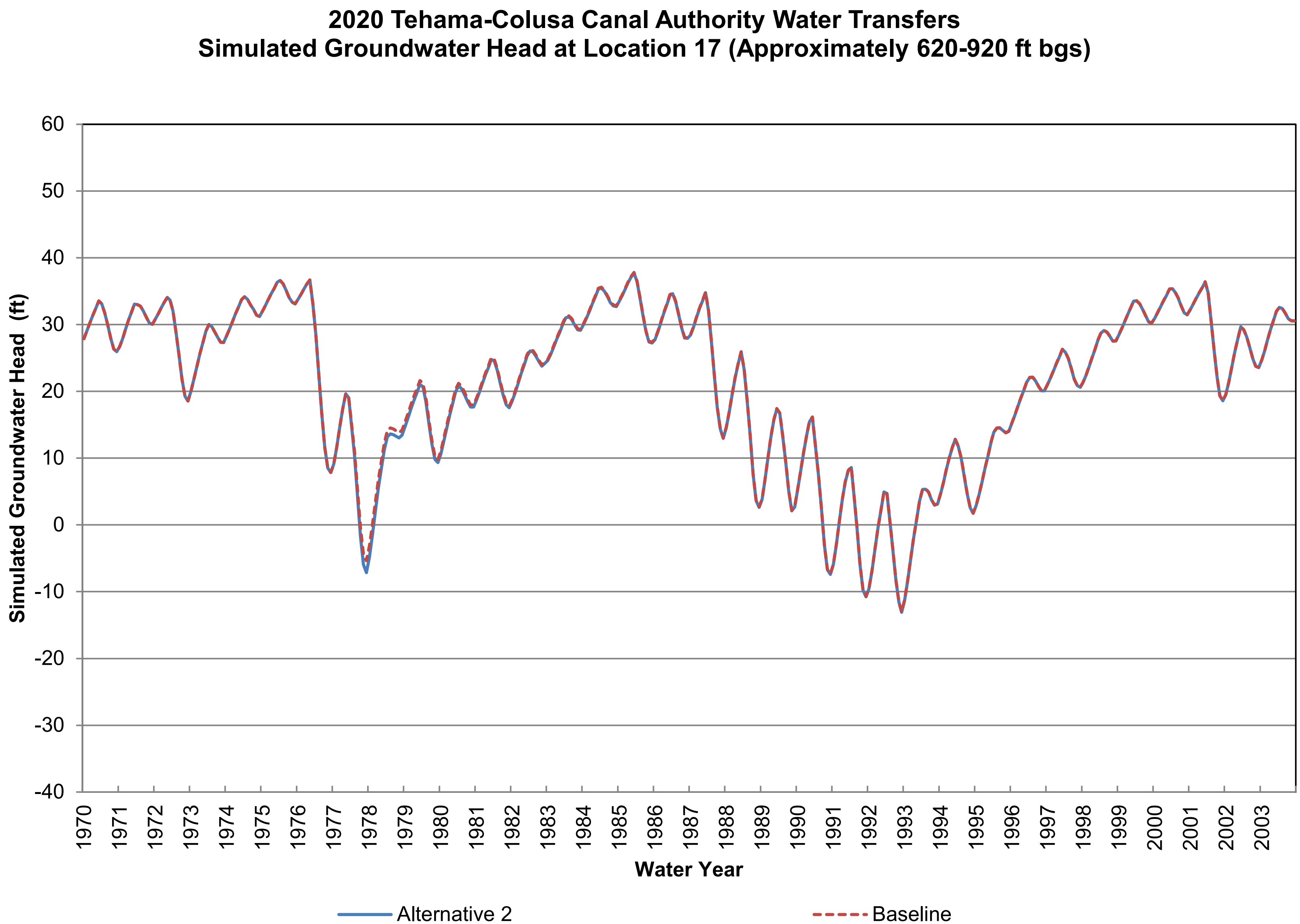
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 70-250 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 250-440 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

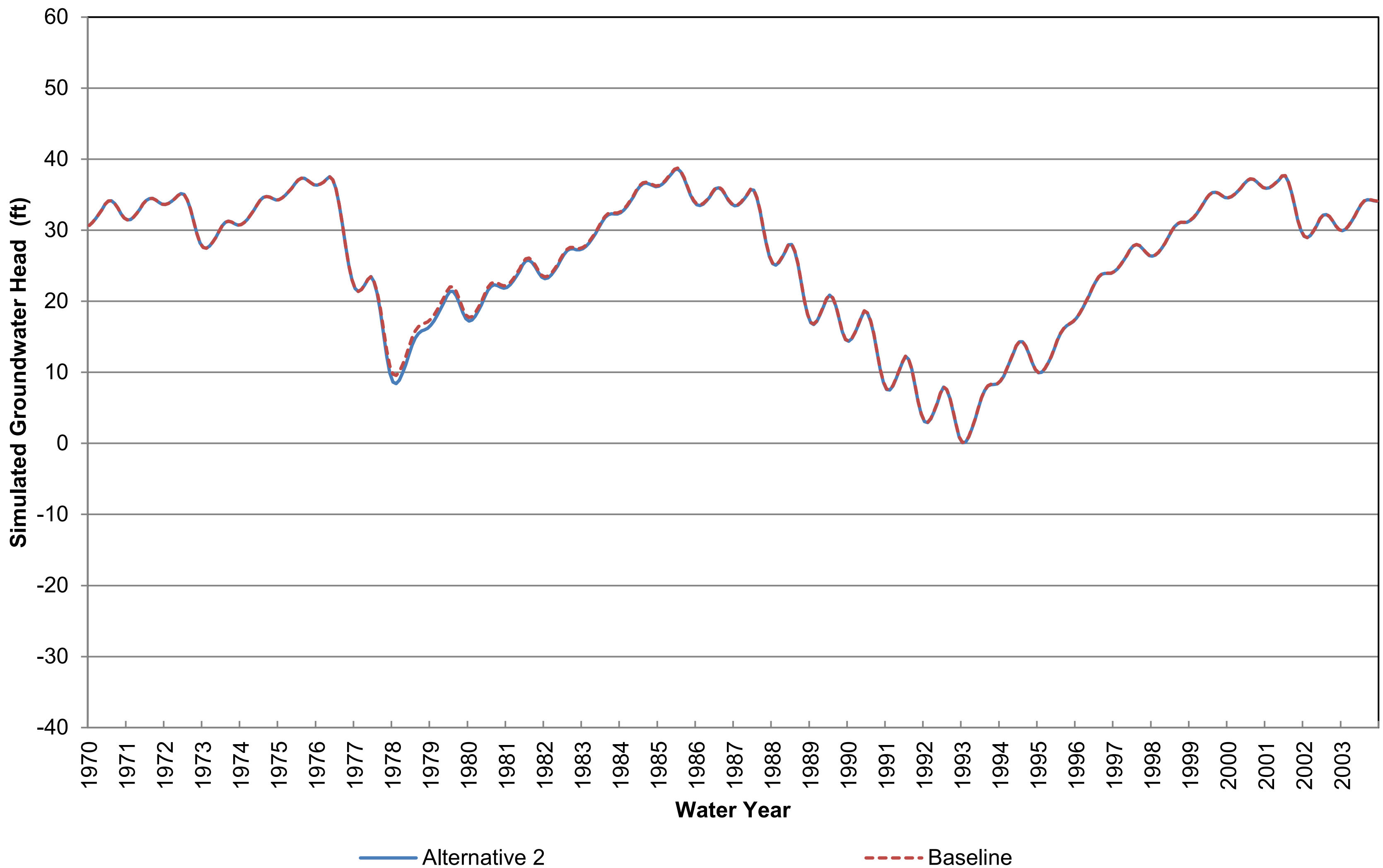


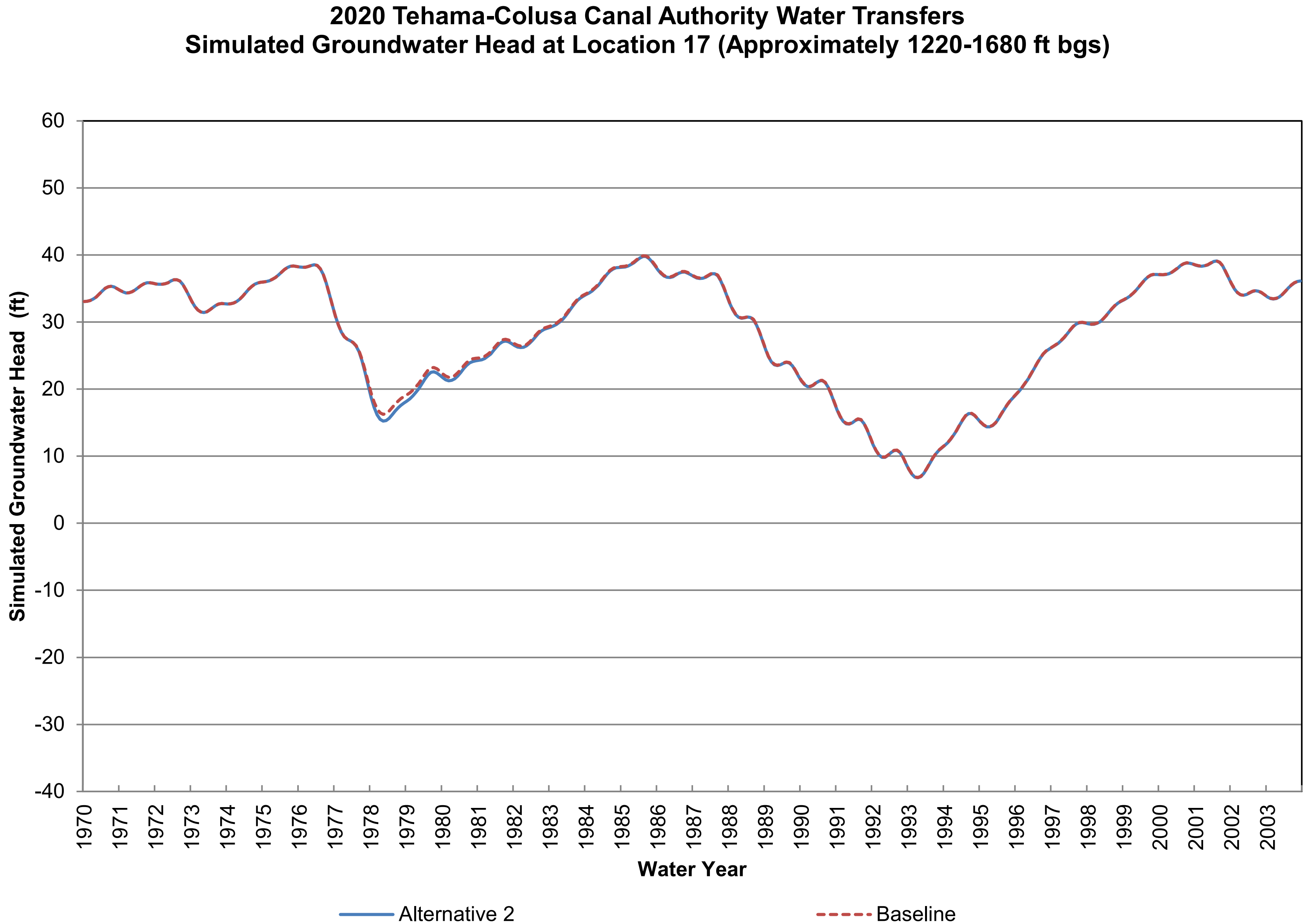
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 440-620 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 620-920 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

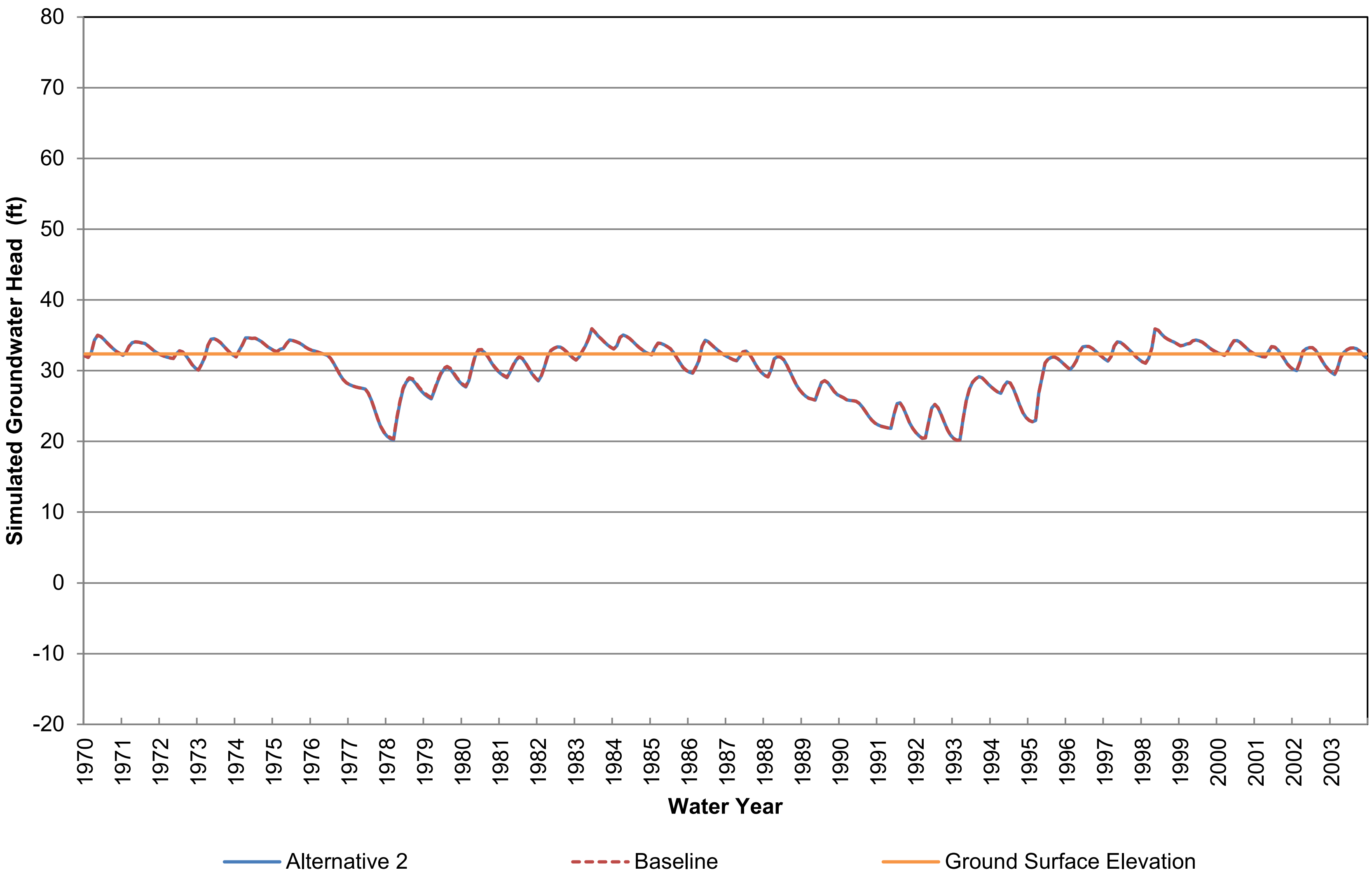
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 17 (Approximately 920-1220 ft bgs)

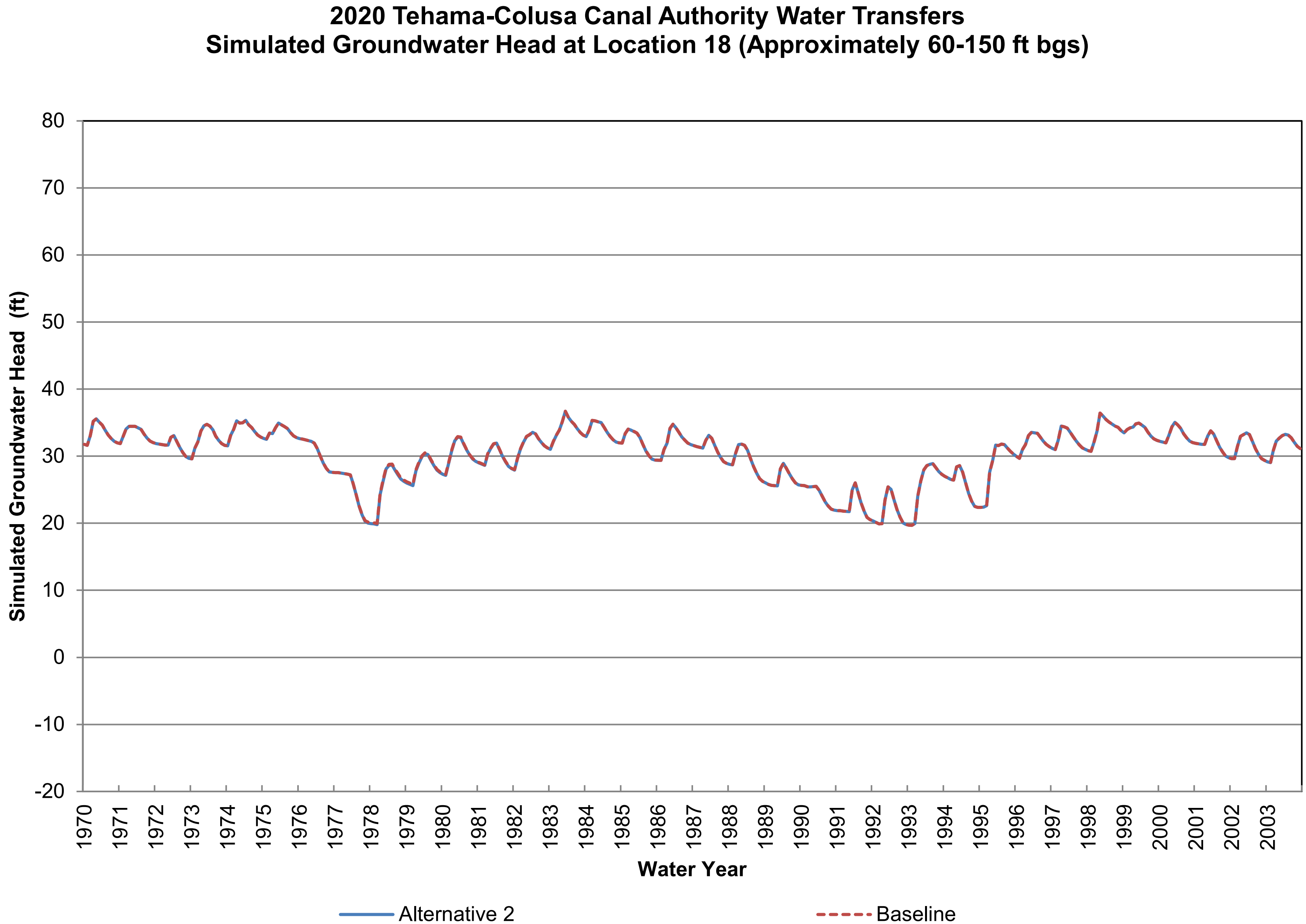




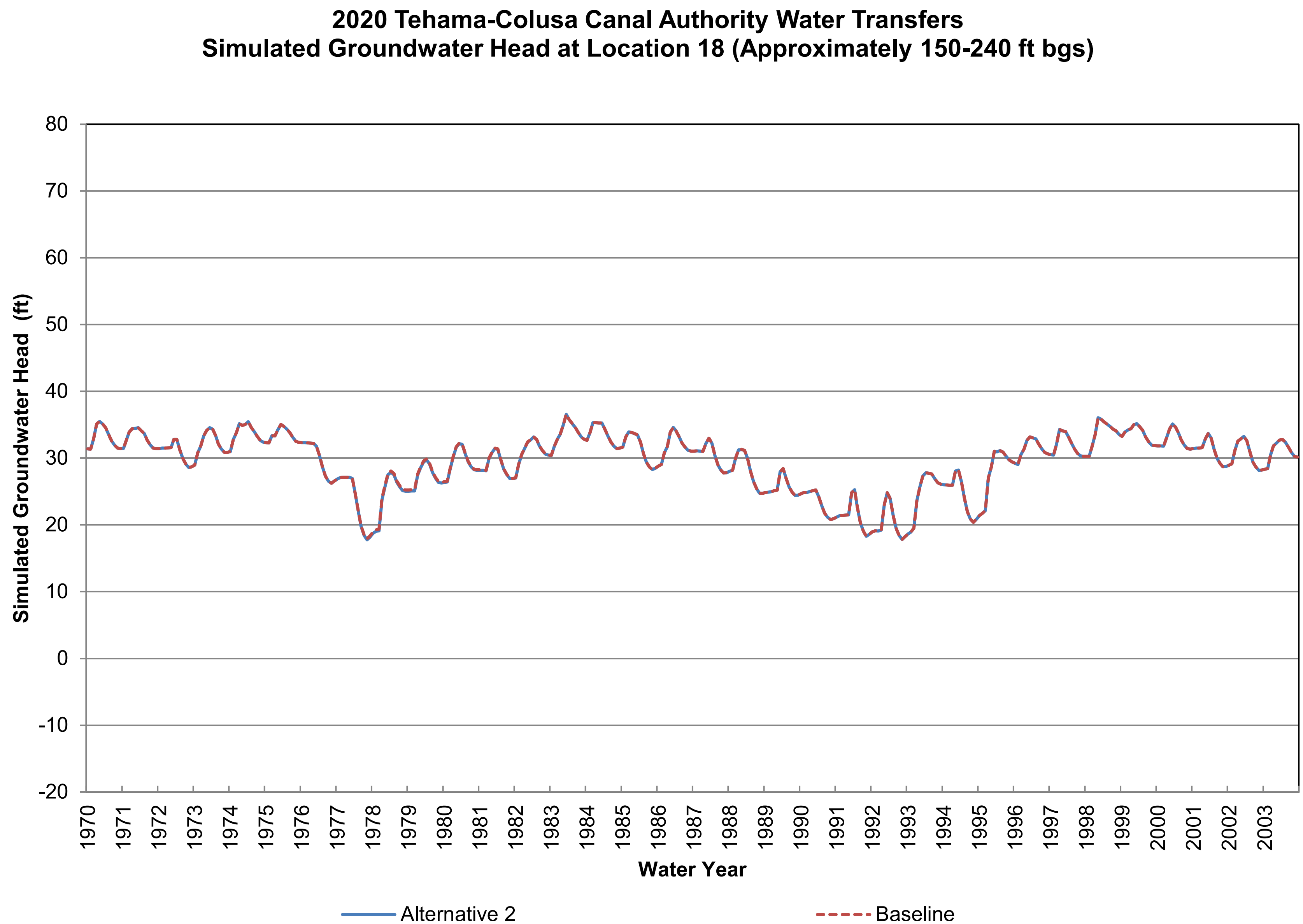
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 1220-1680 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 18 (Approximately 0-60 ft bgs)

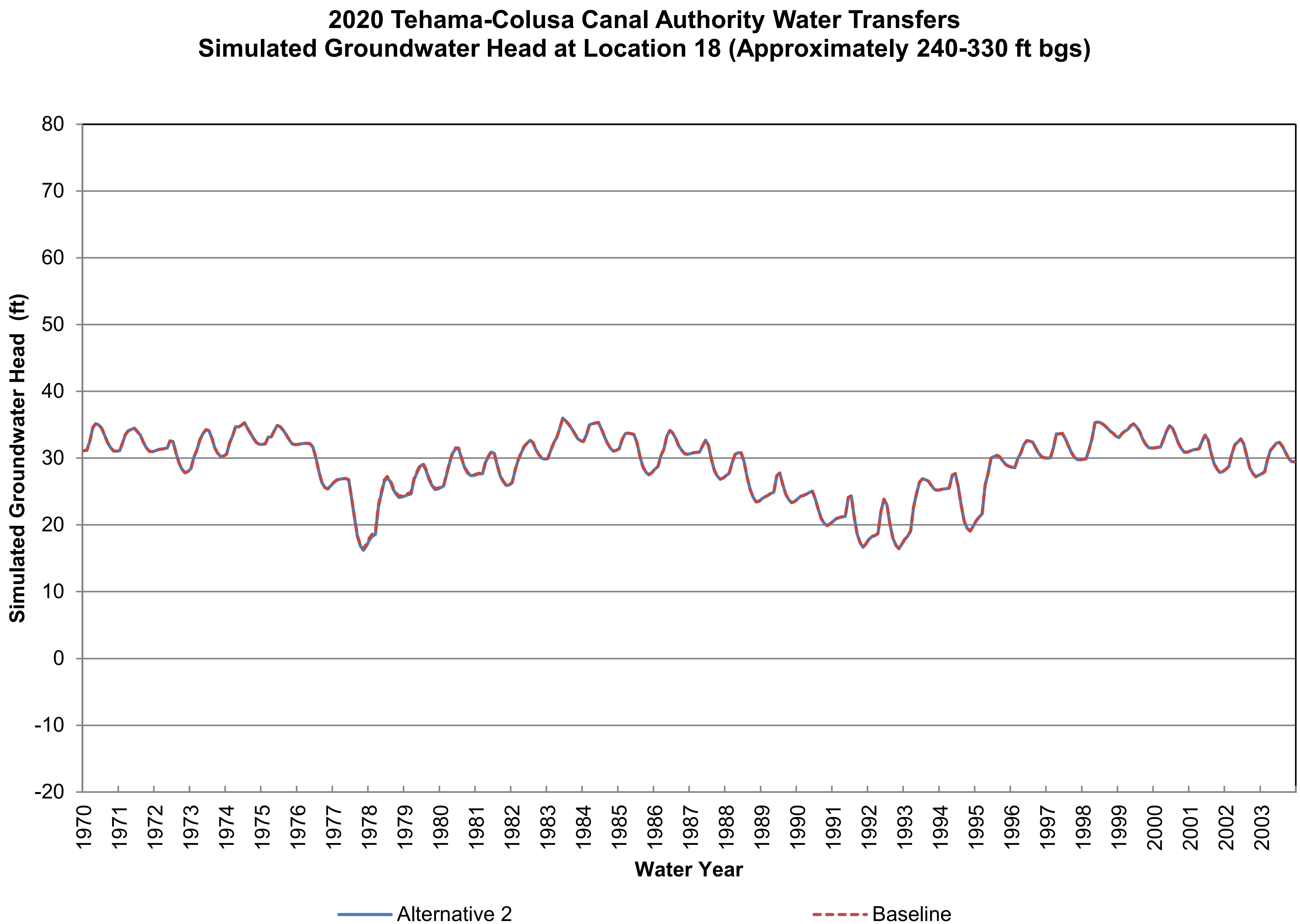


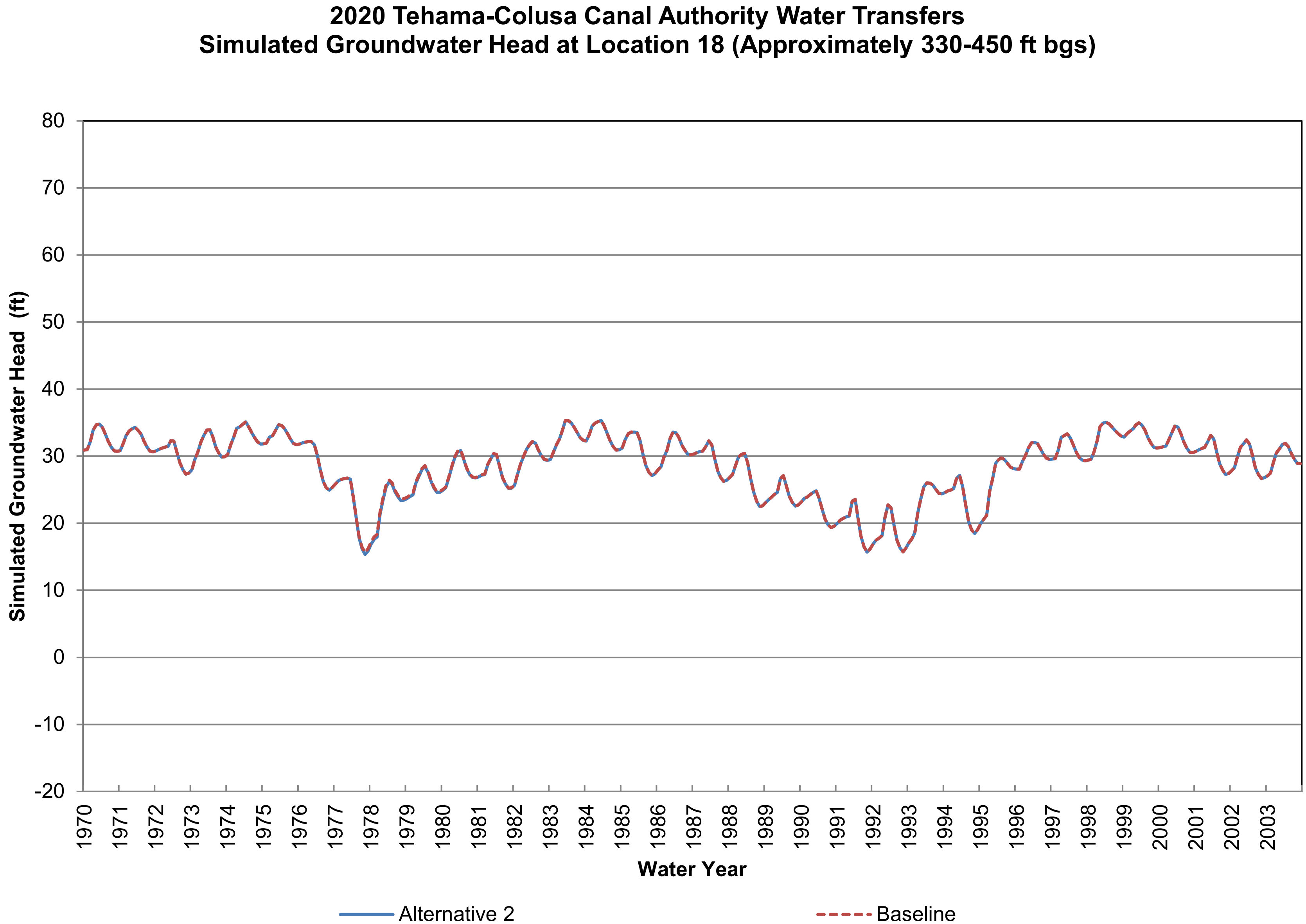


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 60-150 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

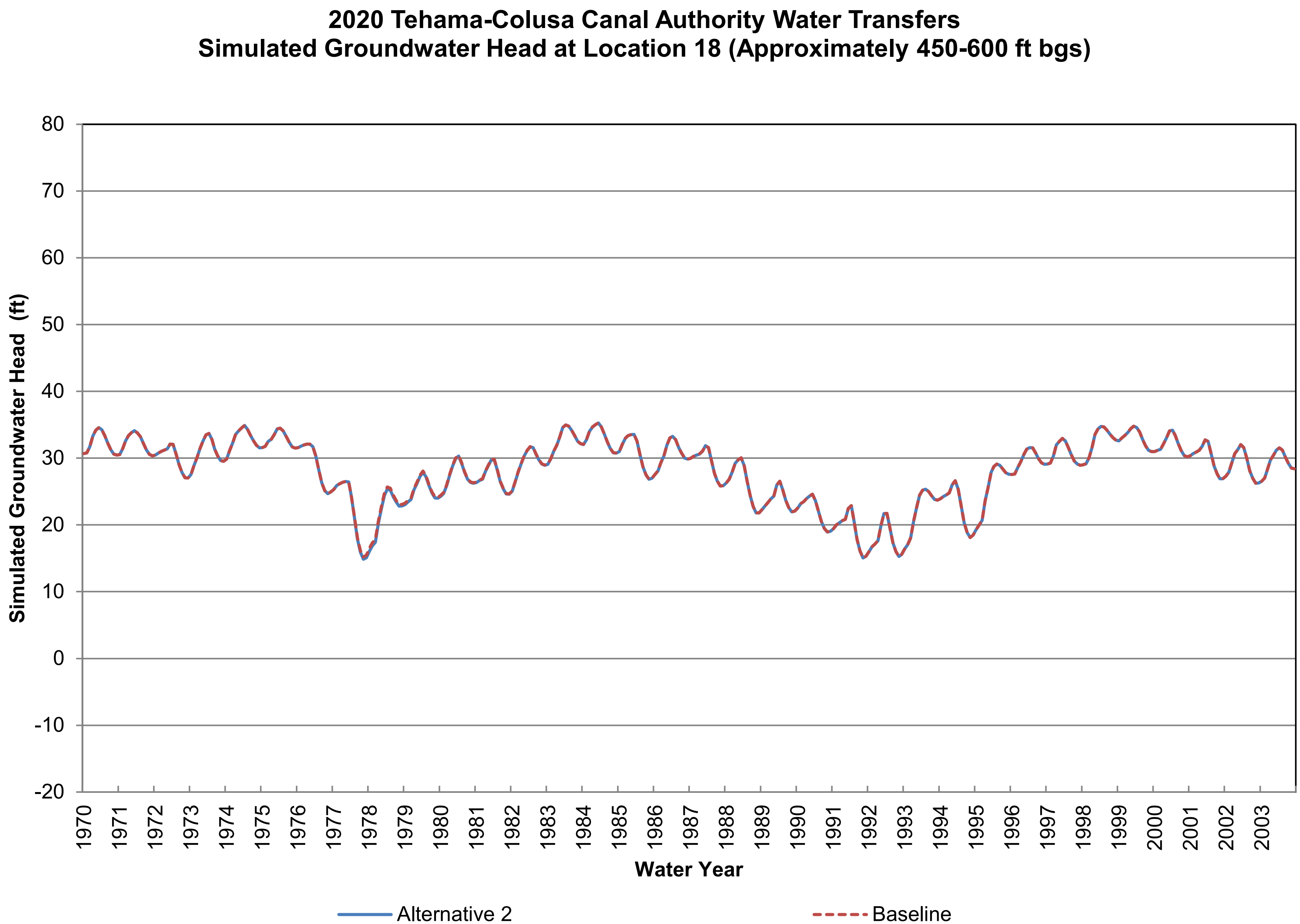


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 150-240 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

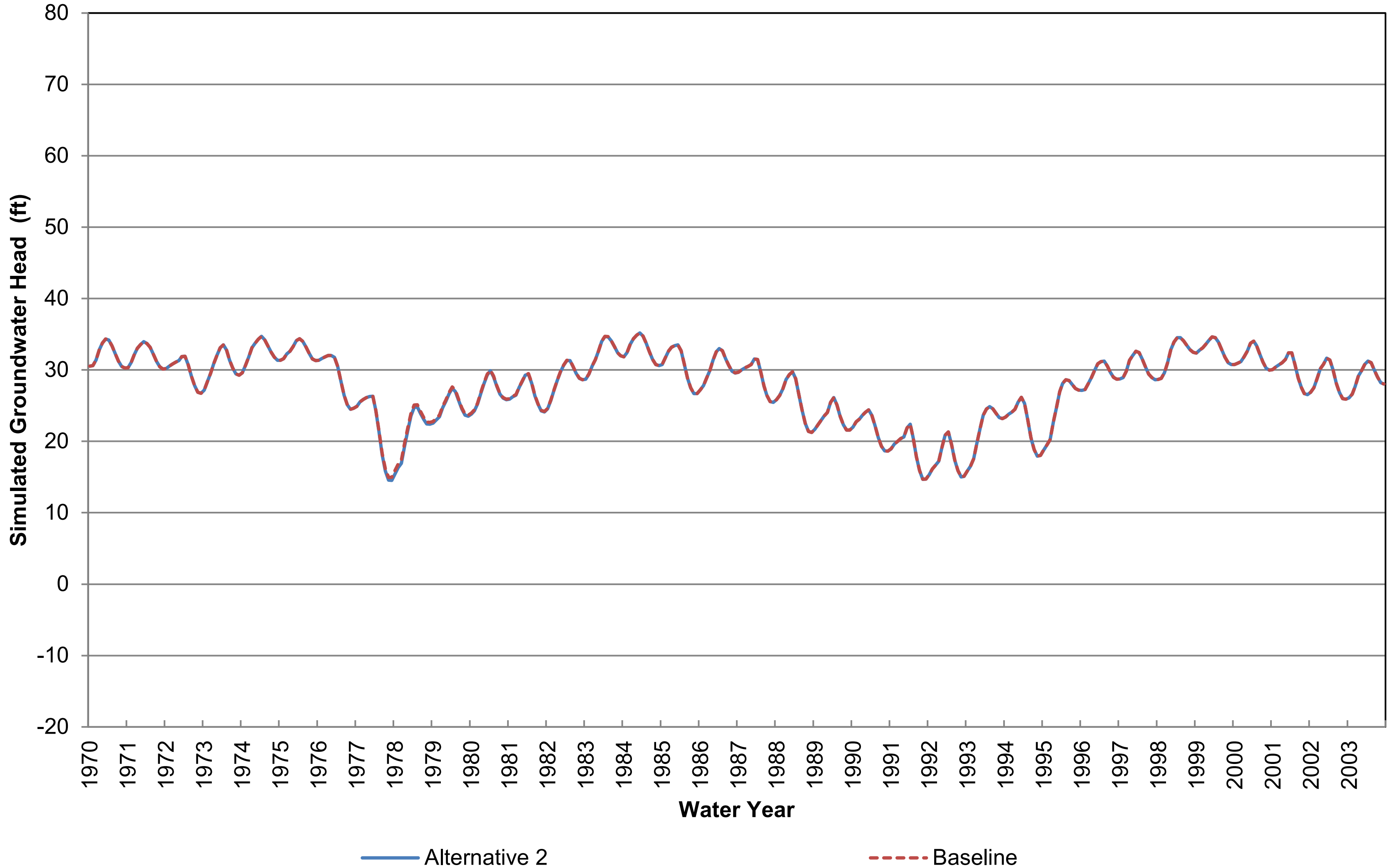

2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 240-330 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

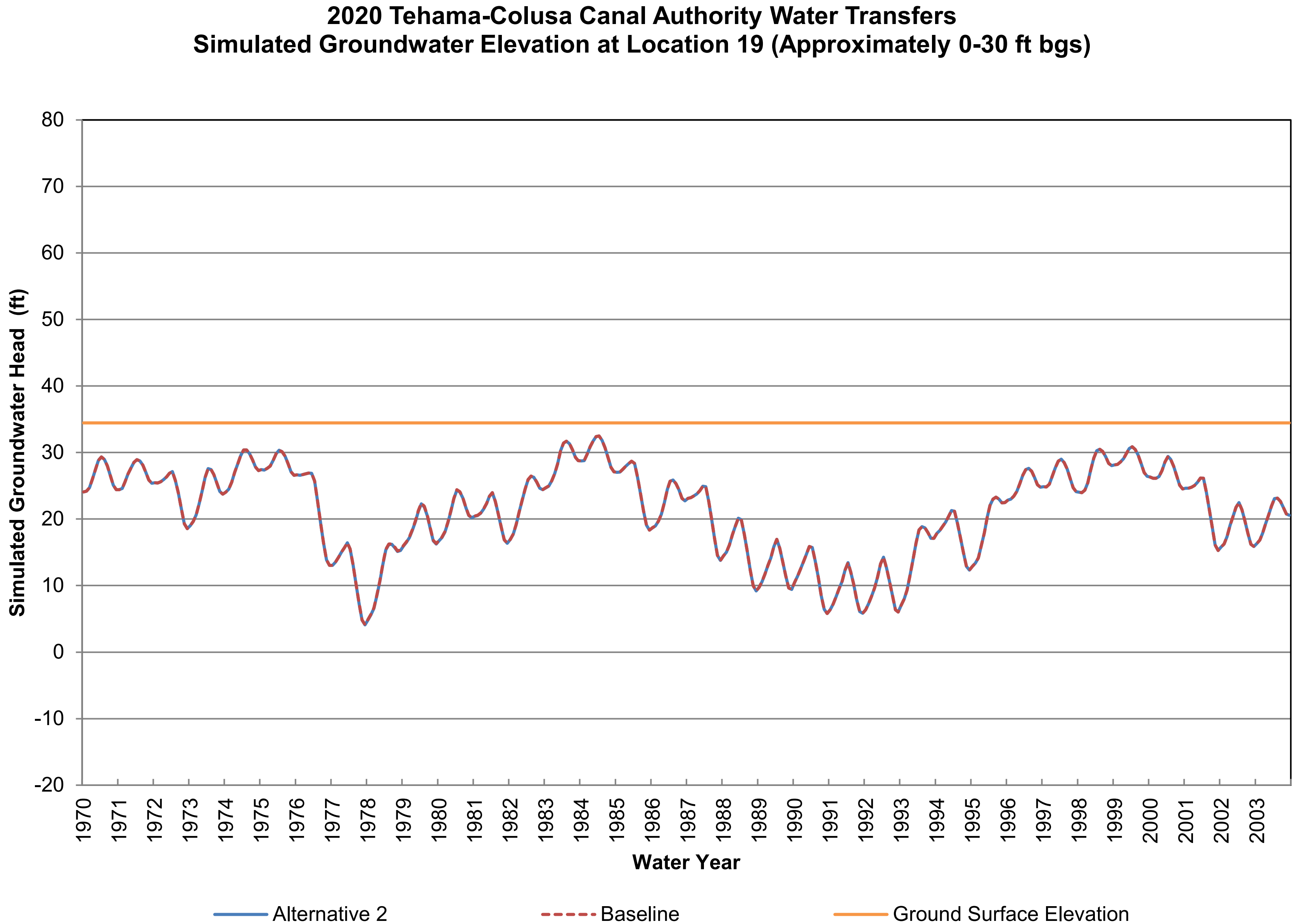


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 330-450 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

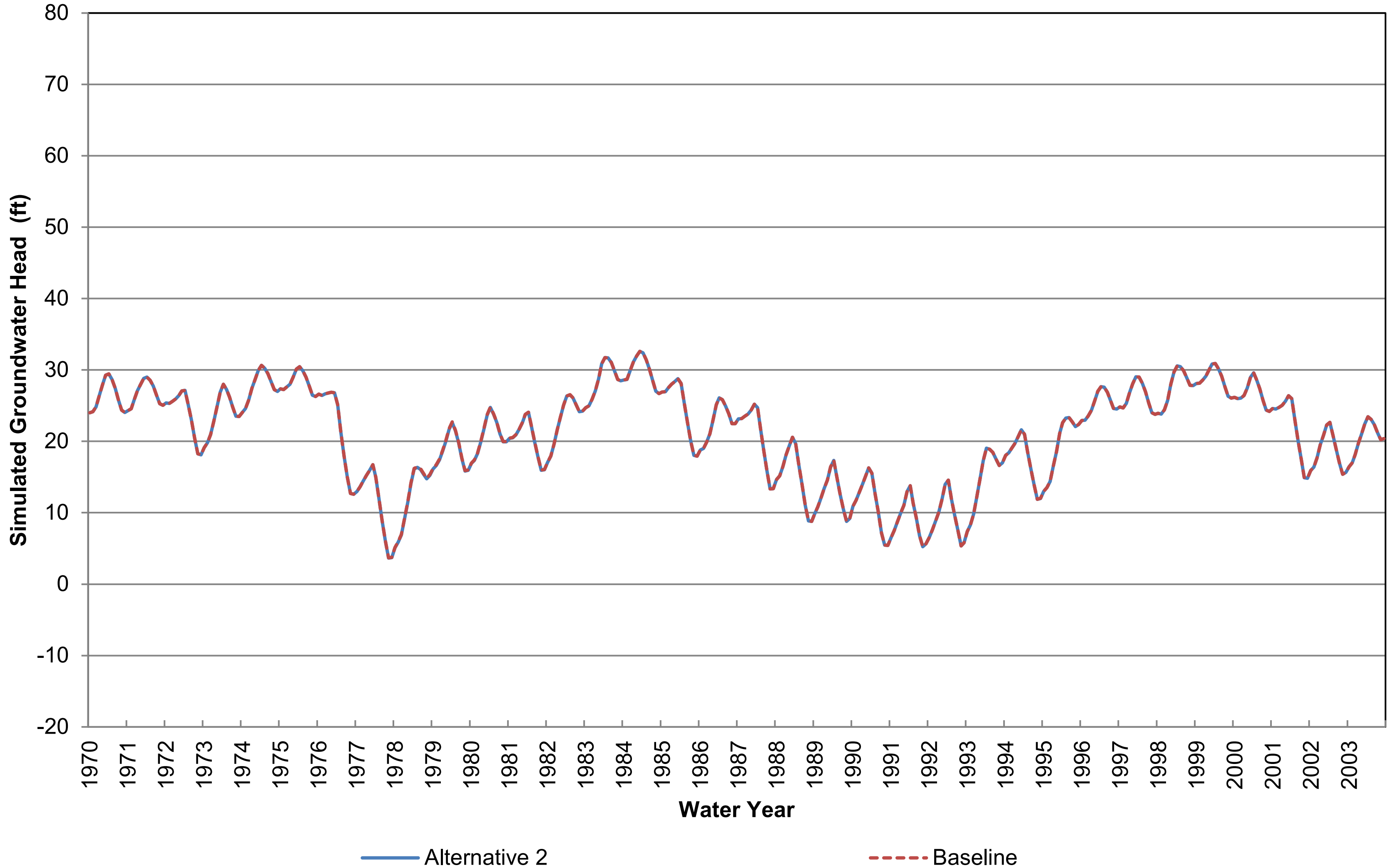

2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 450-600 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 600-820 ft bgs)

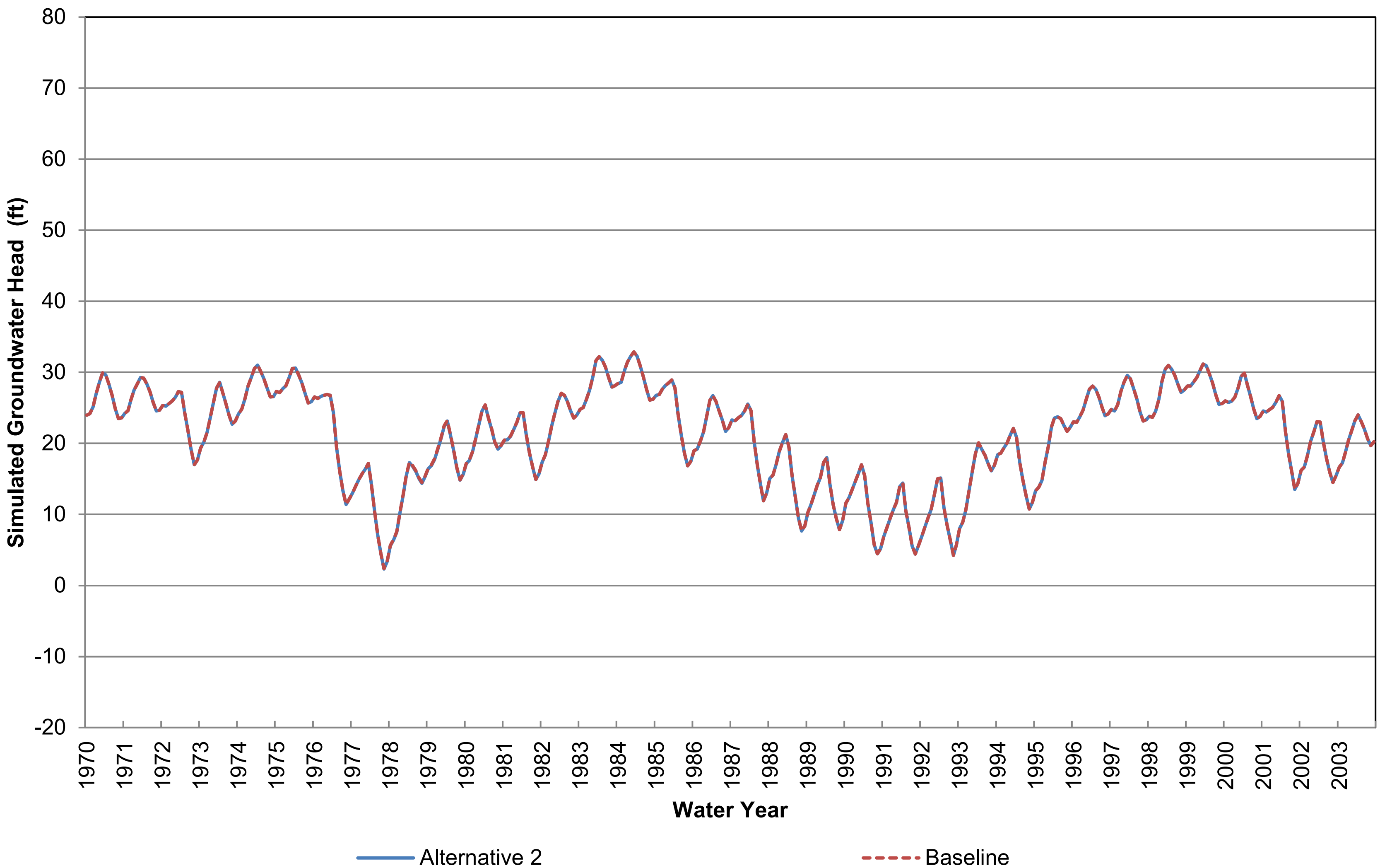



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 19 (Approximately 0-30 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

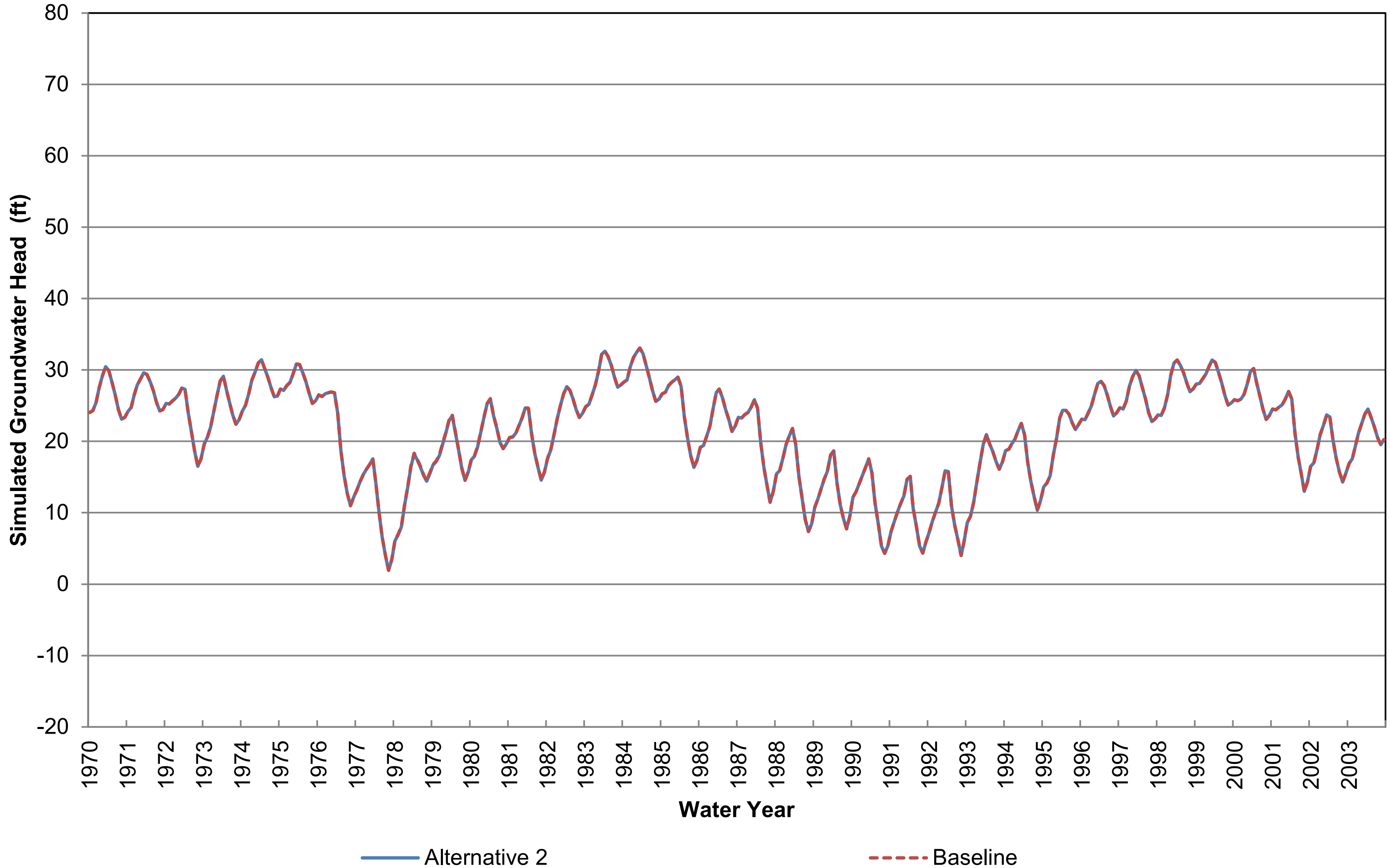
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 19 (Approximately 30-70 ft bgs)



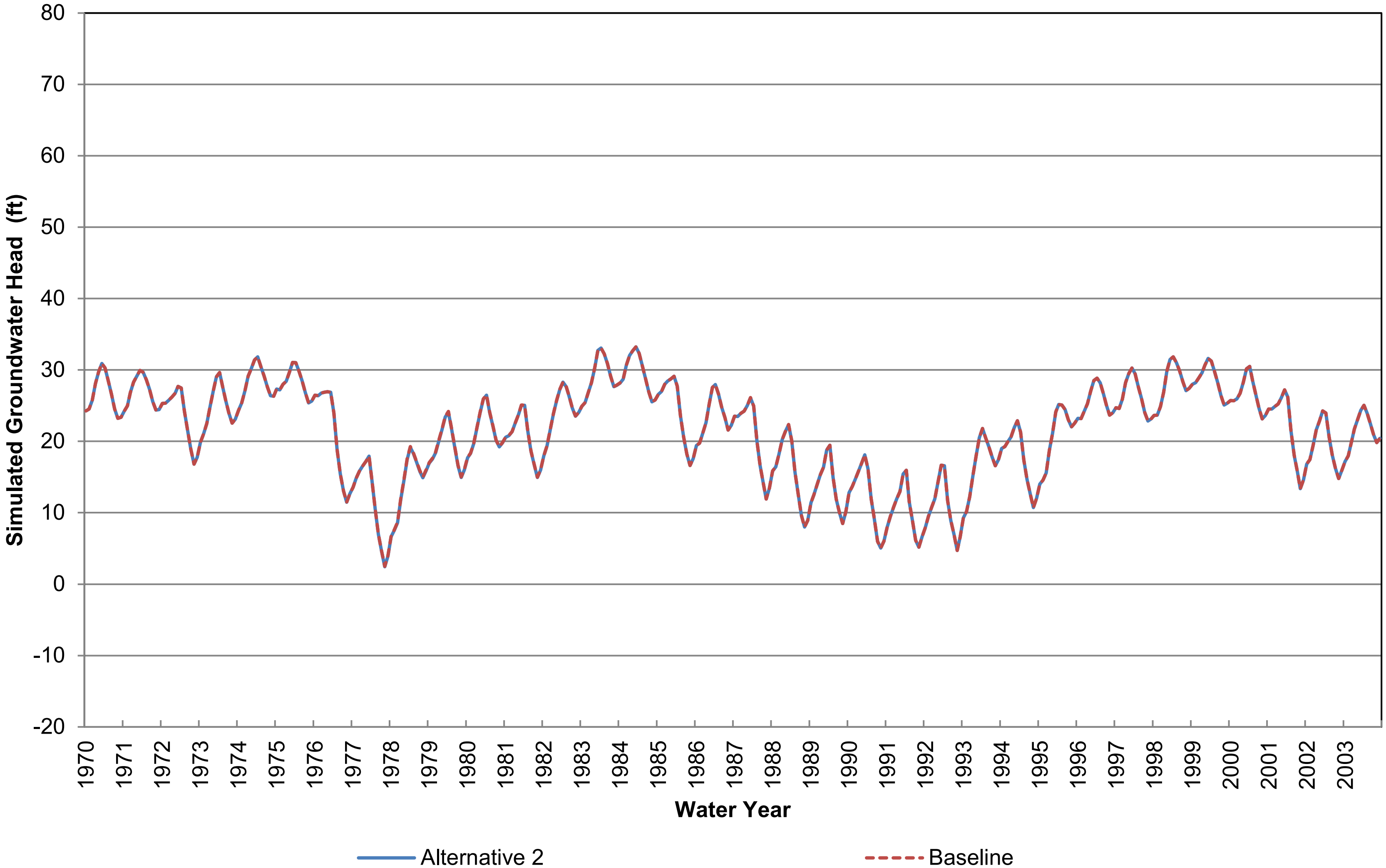
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 19 (Approximately 70-120 ft bgs)

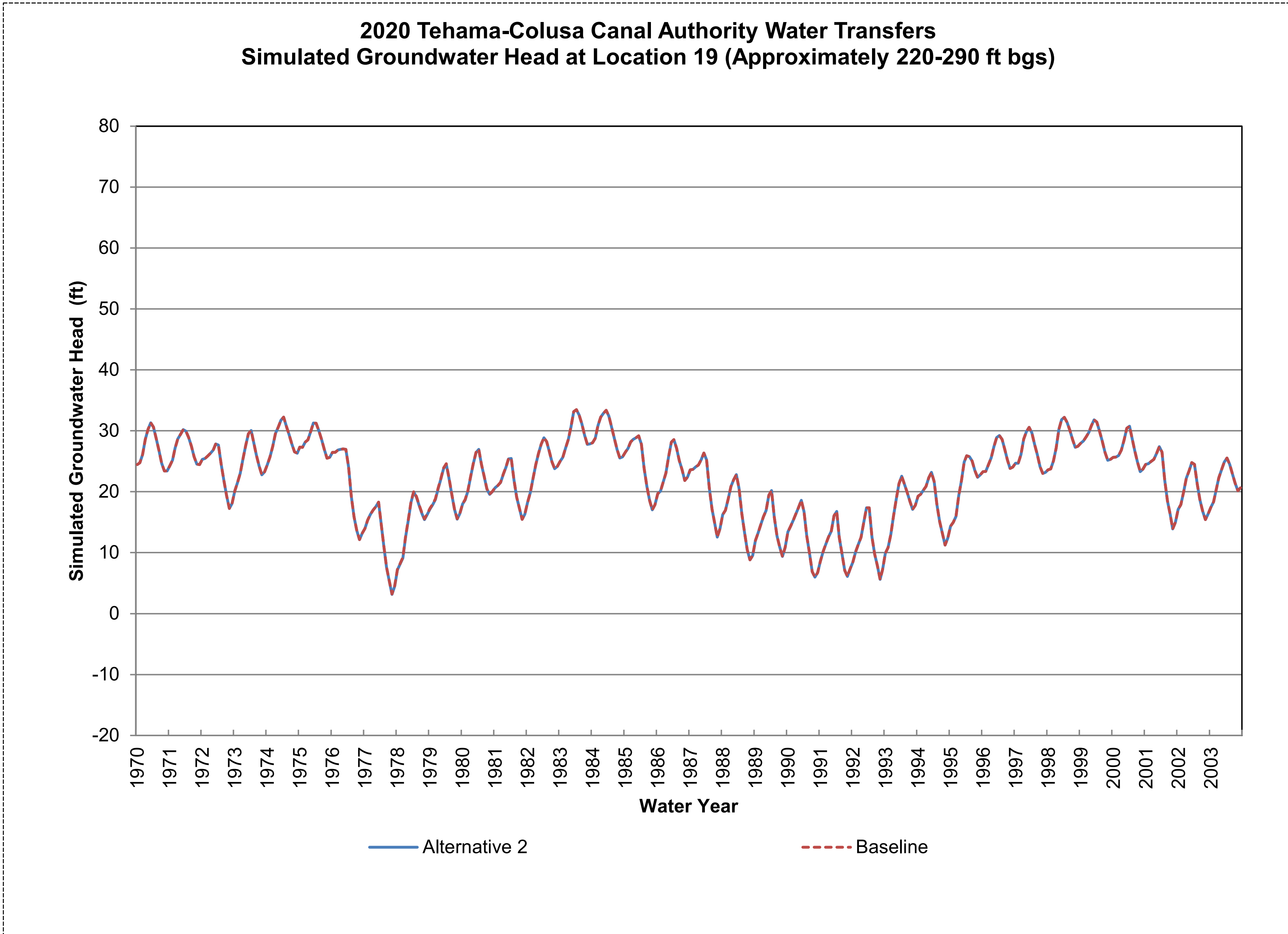


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 19 (Approximately 120-160 ft bgs)



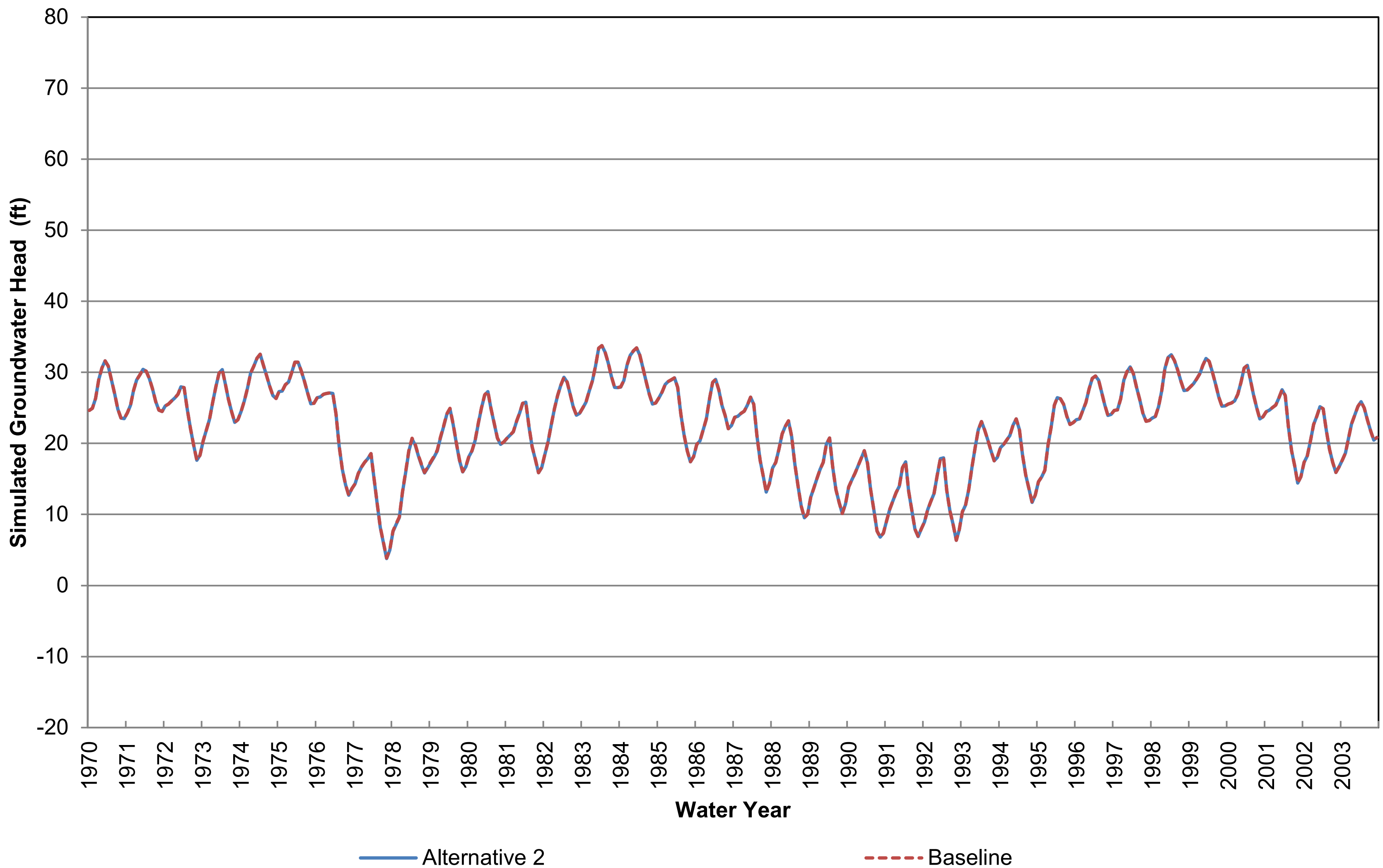
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 19 (Approximately 160-220 ft bgs)





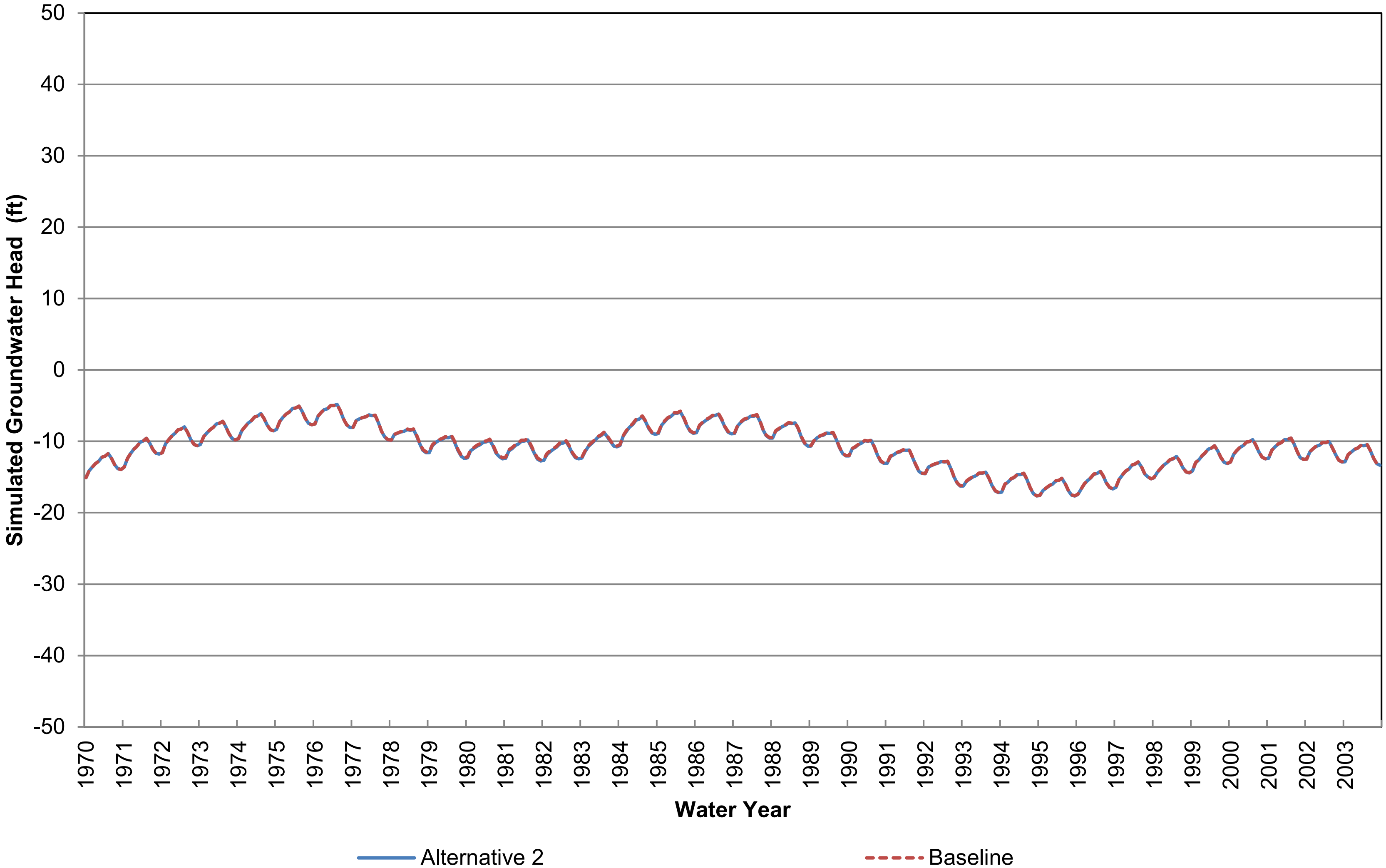
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 220-290 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 19 (Approximately 290-400 ft bgs)

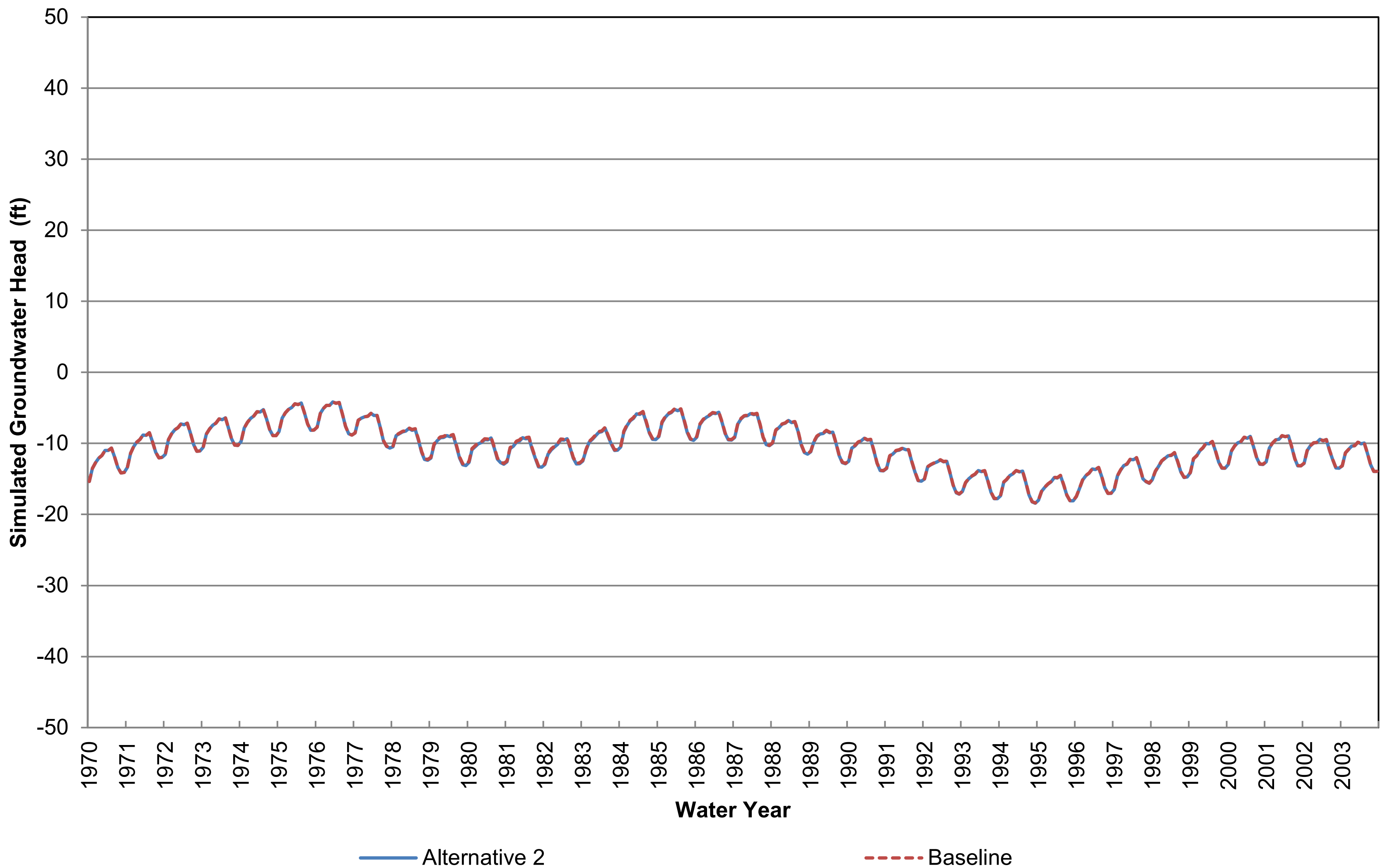


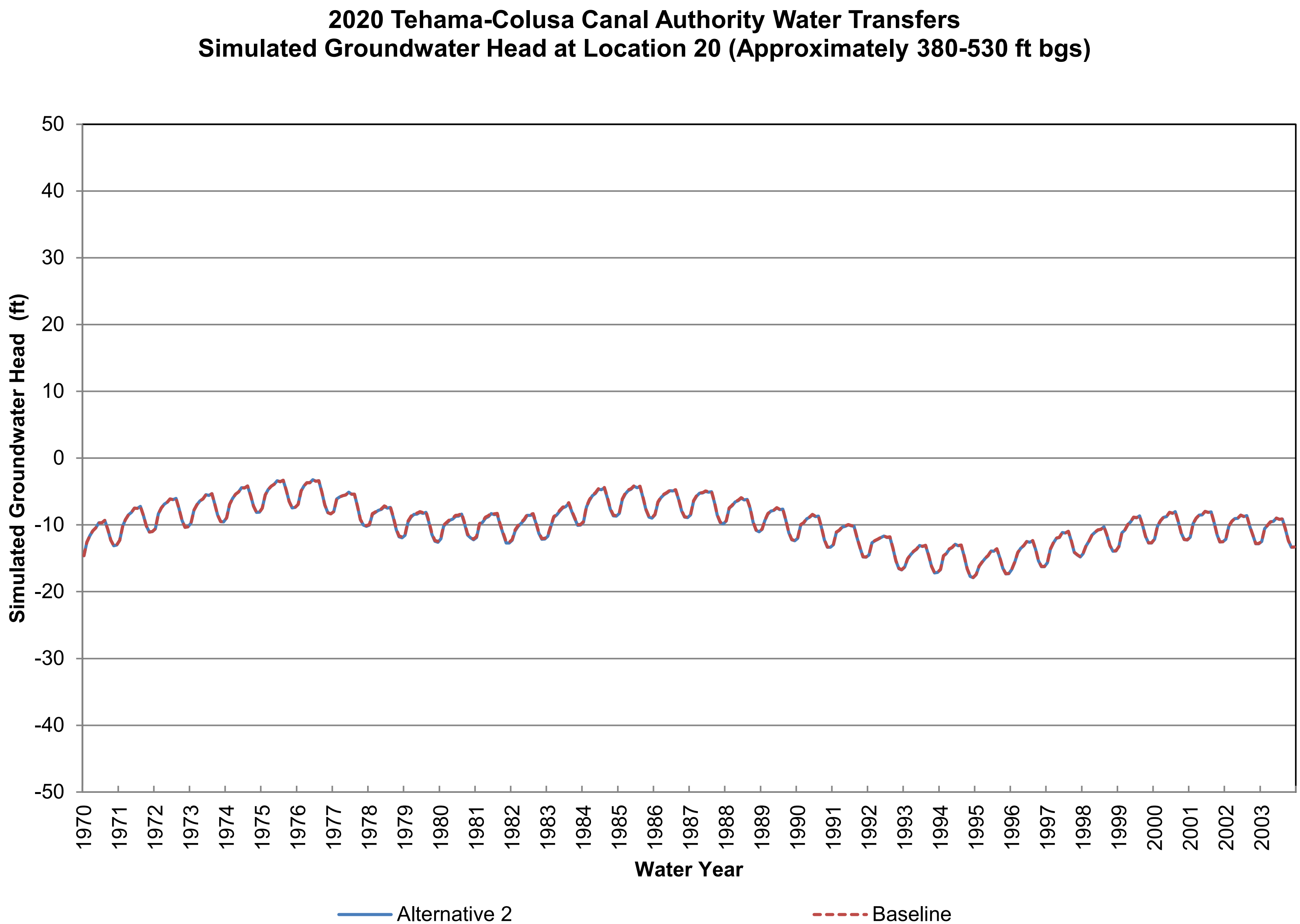
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 20 (Approximately 0-70 ft bgs)

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 20 (Approximately 70-230 ft bgs)

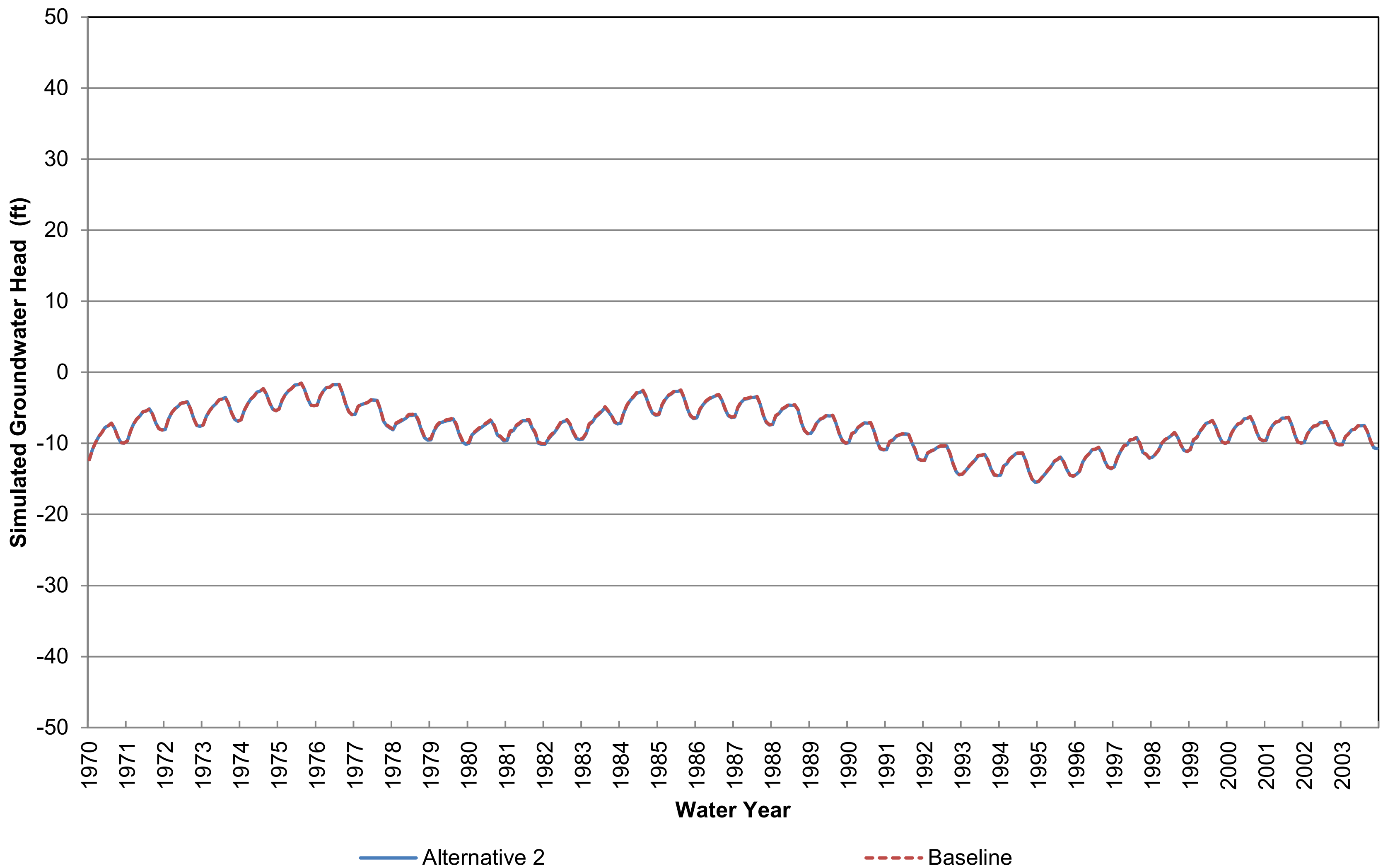


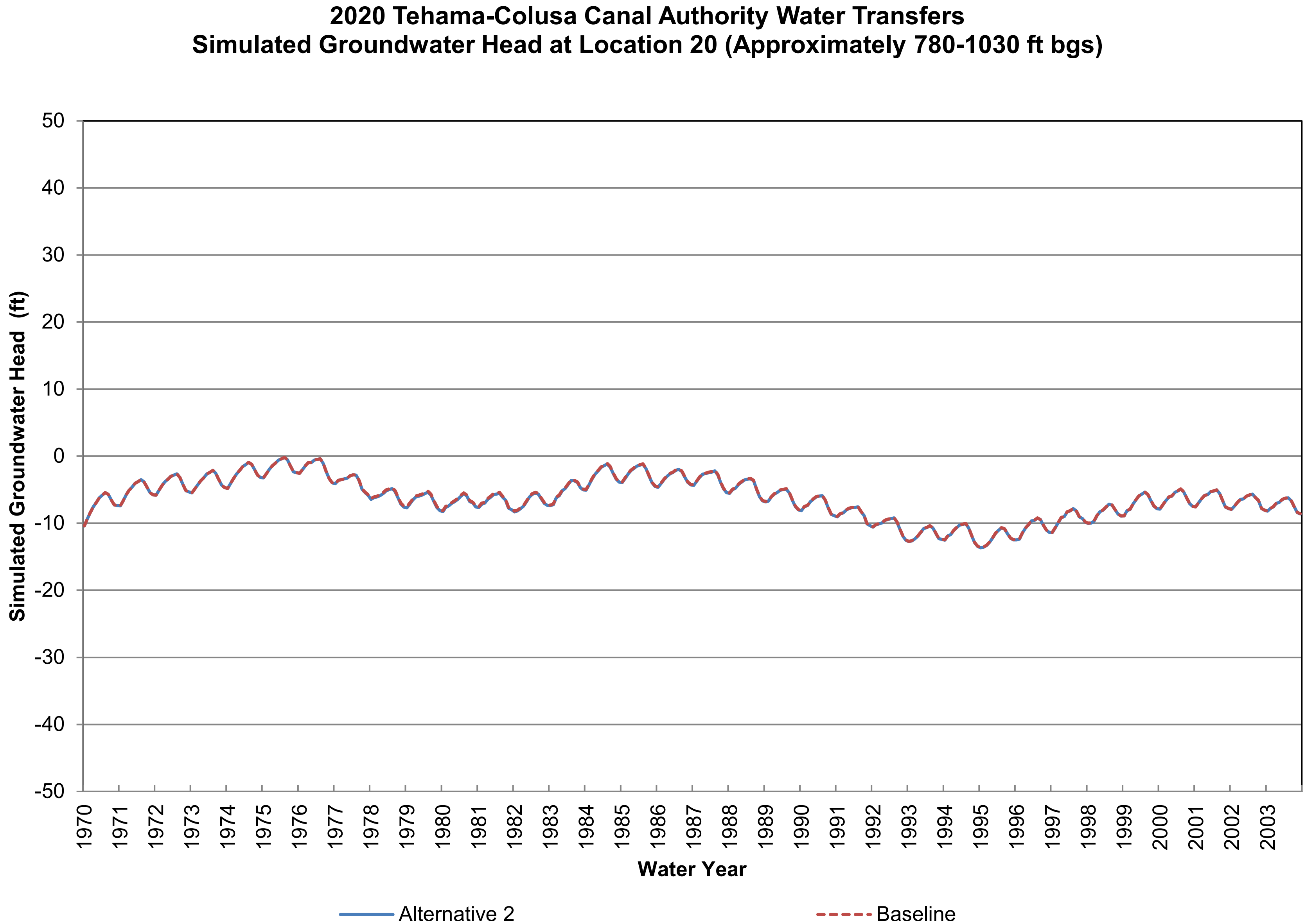
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 20 (Approximately 230-380 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 380-530 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 20 (Approximately 530-780 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 780-1030 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
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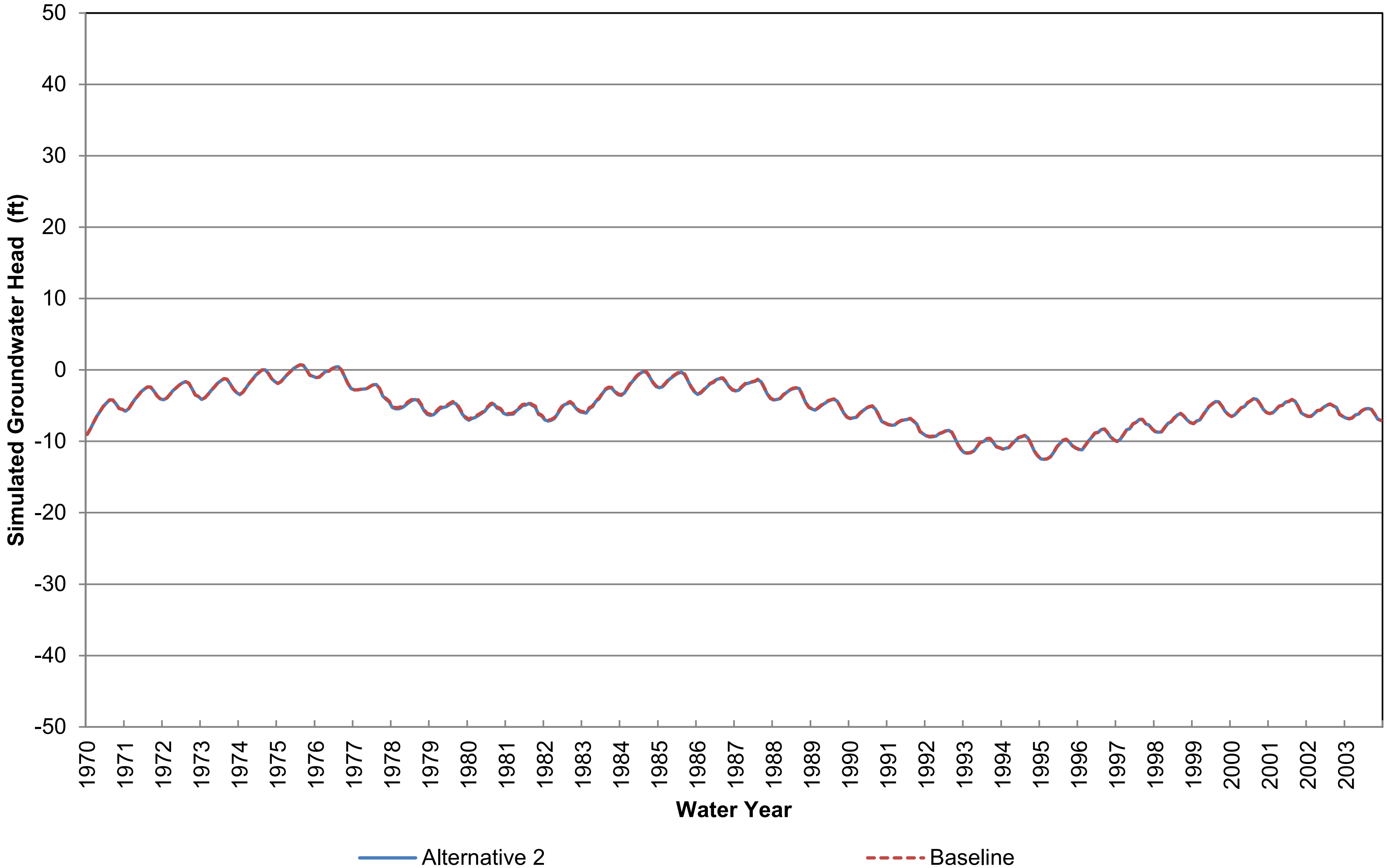
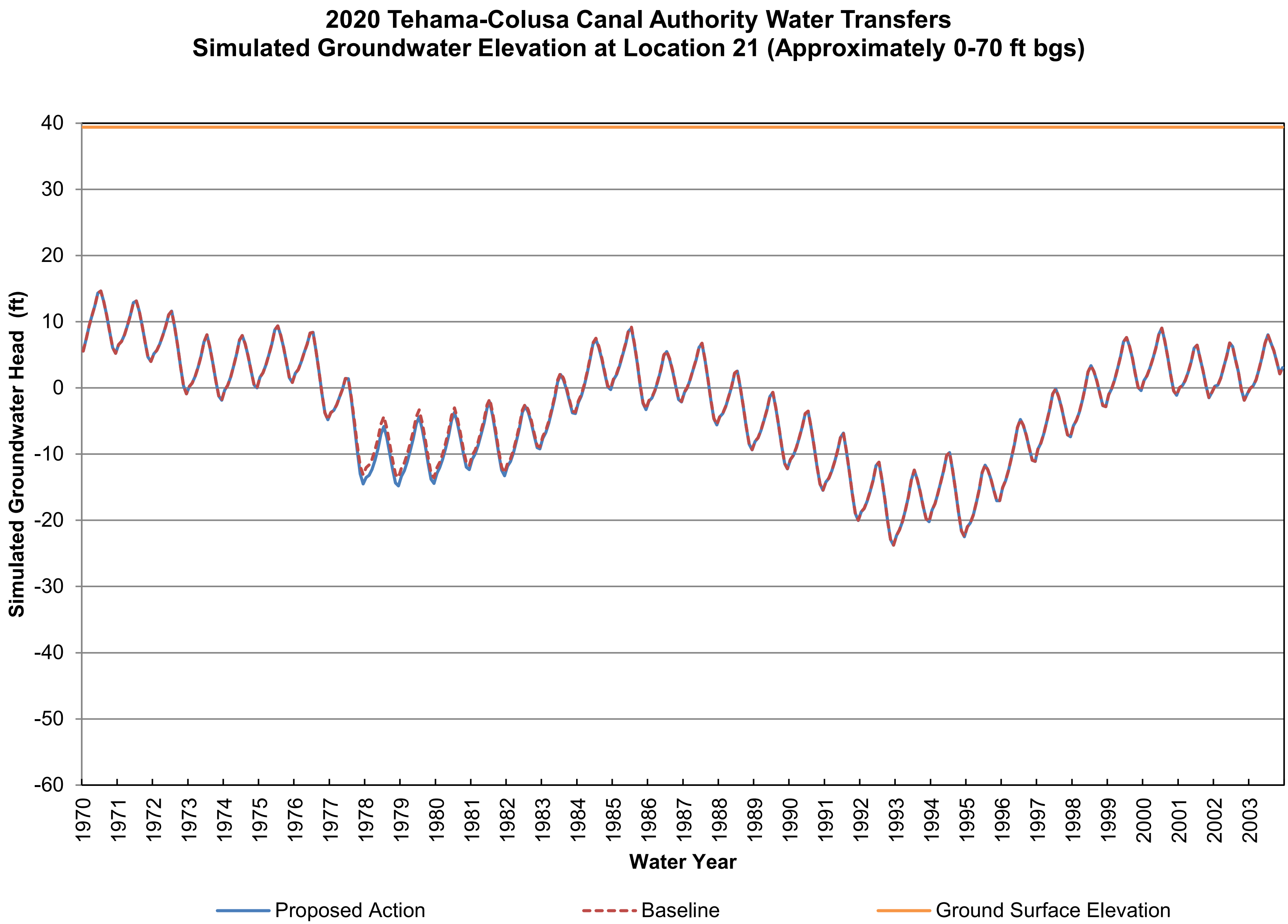
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 20 (Approximately 1030-1420 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 21 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
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1989
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1992
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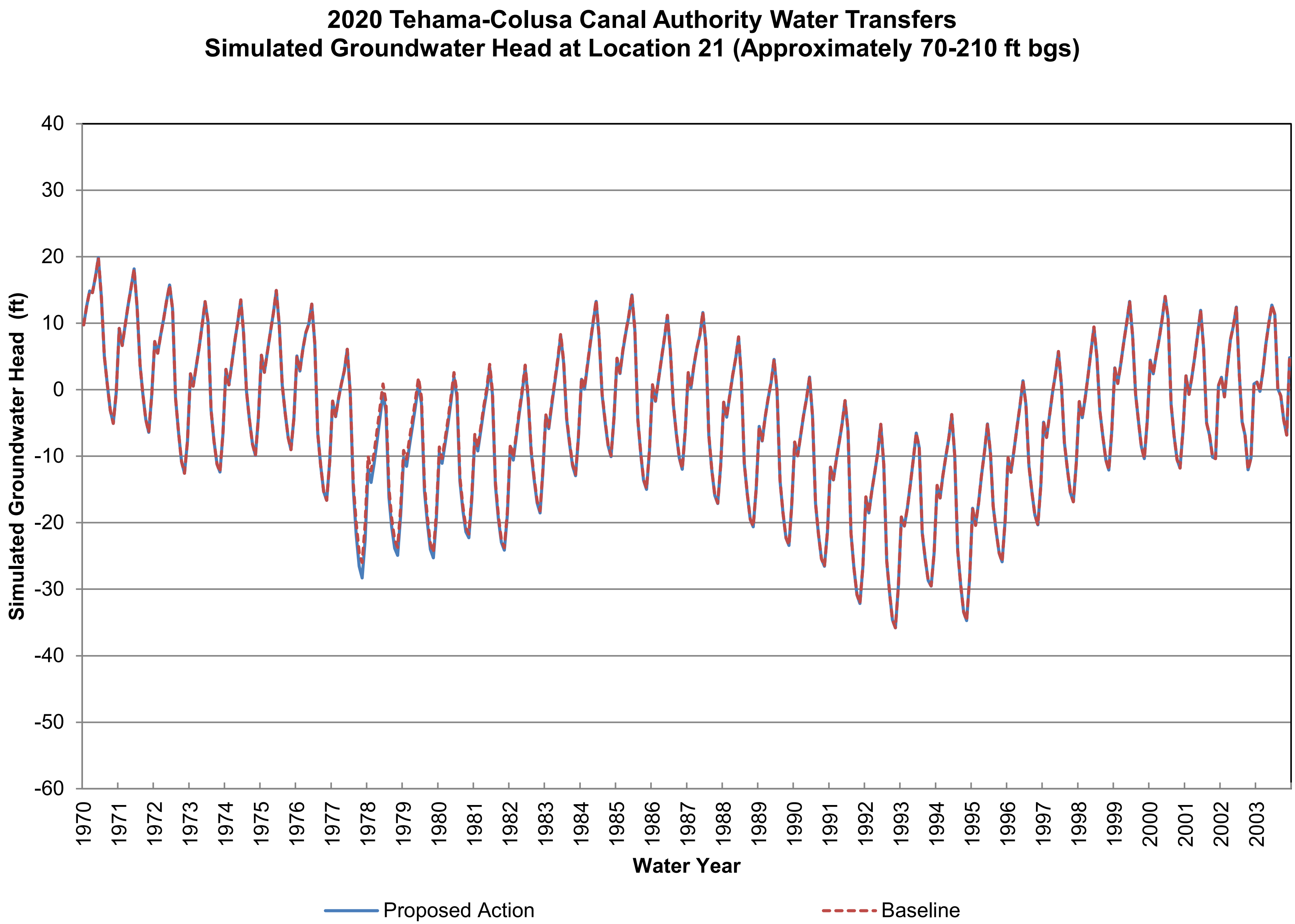
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline
Ground Surface Elevation



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 70-210 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
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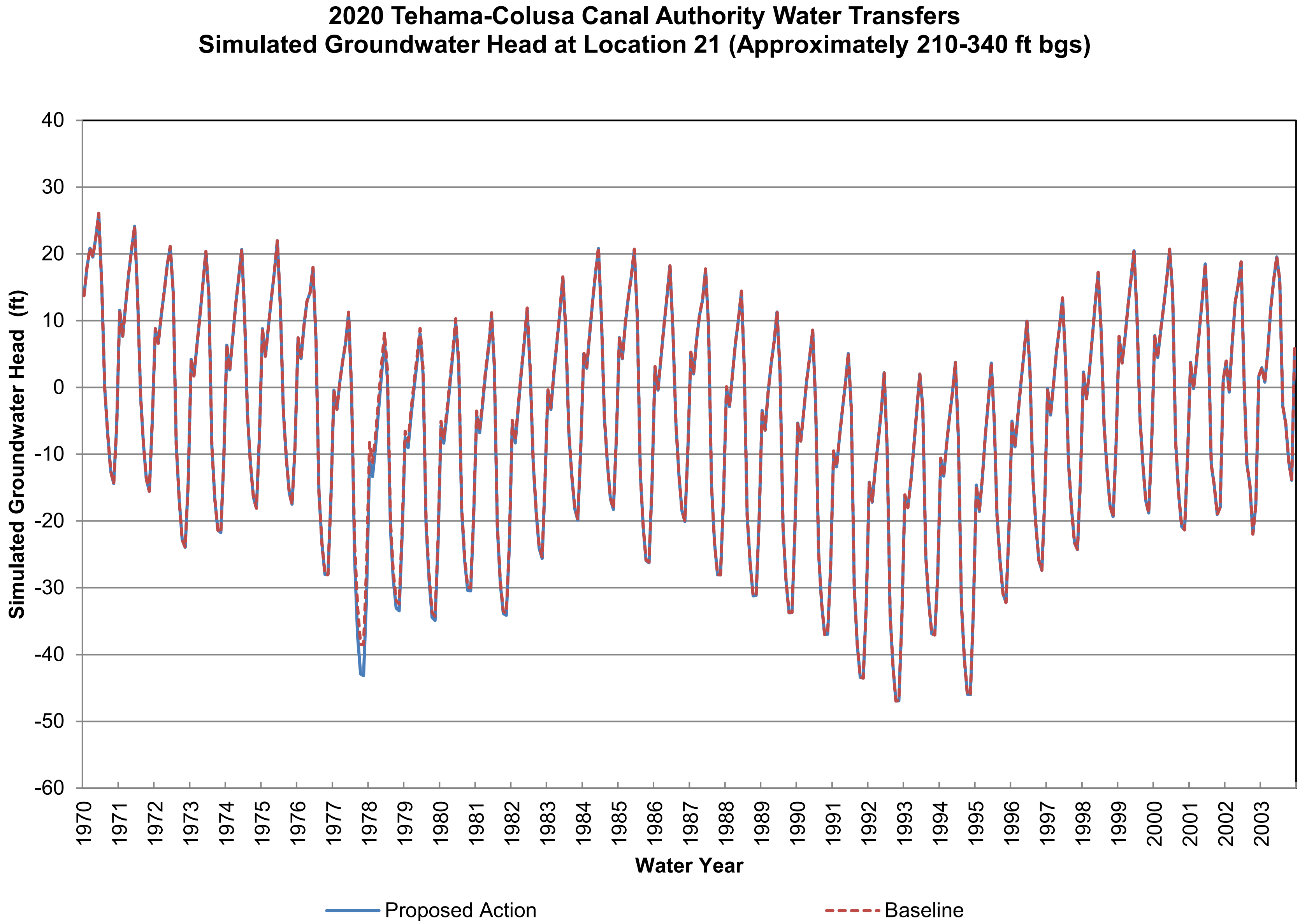
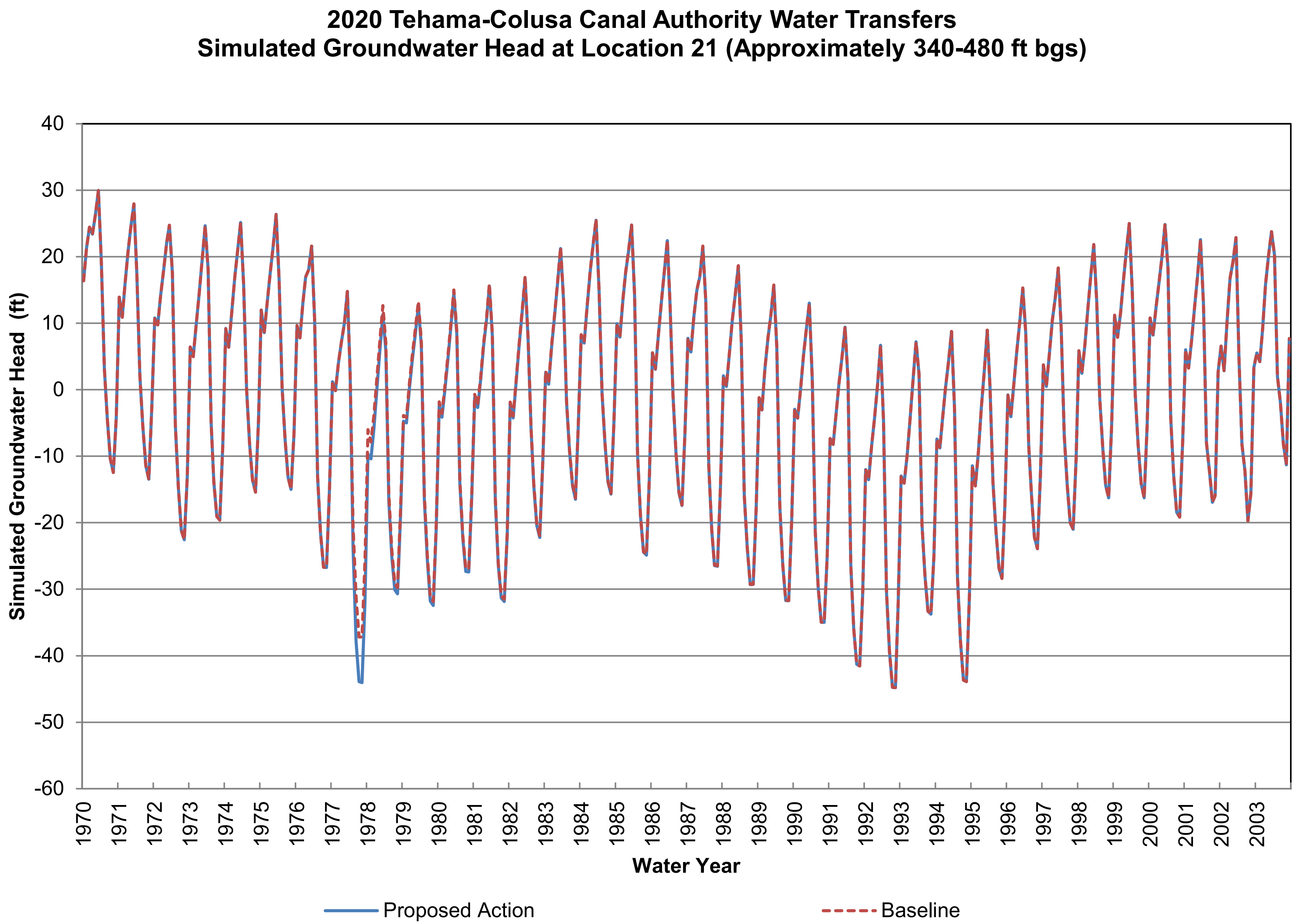
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 210-340 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 340-480 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
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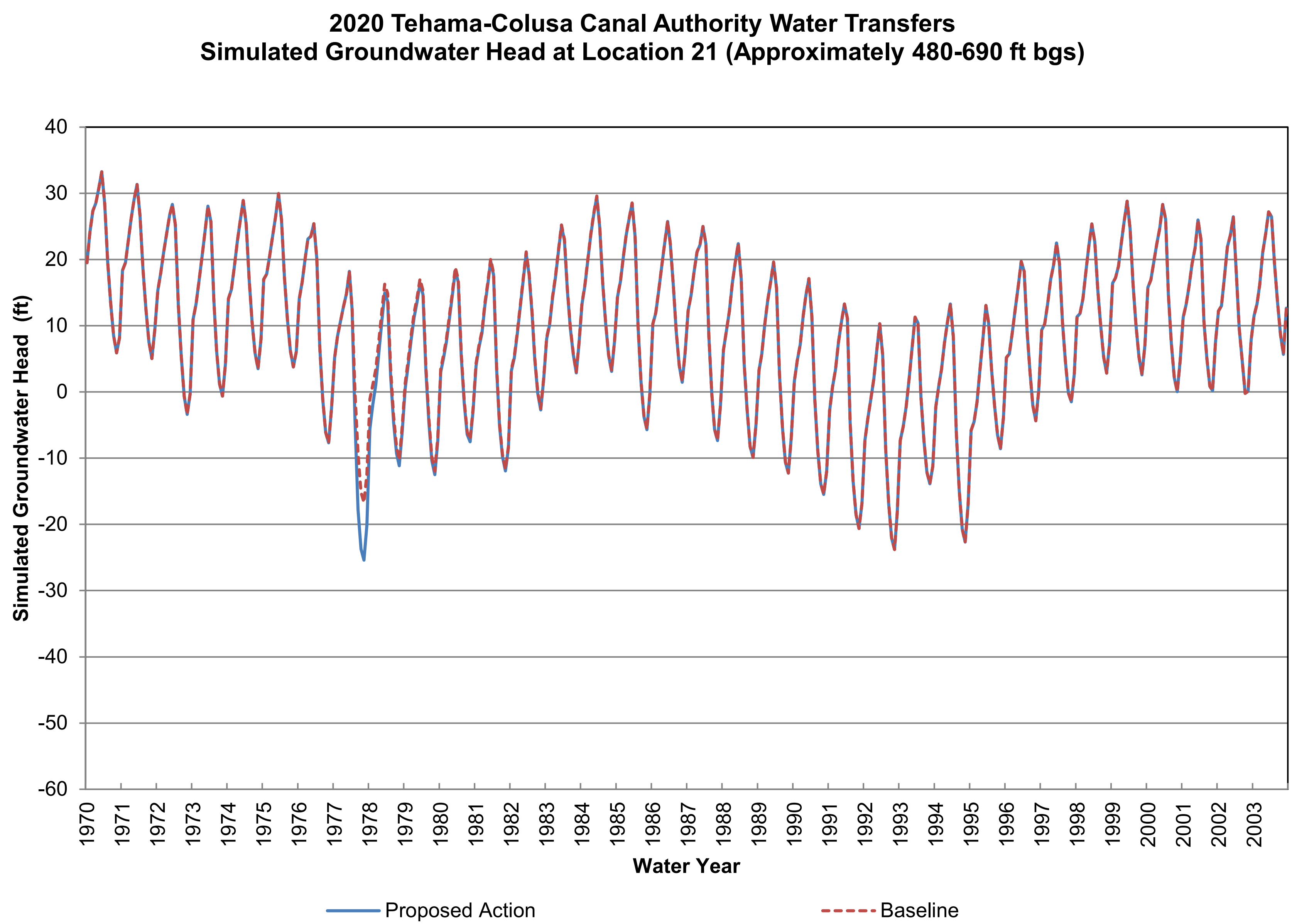
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 480-690 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
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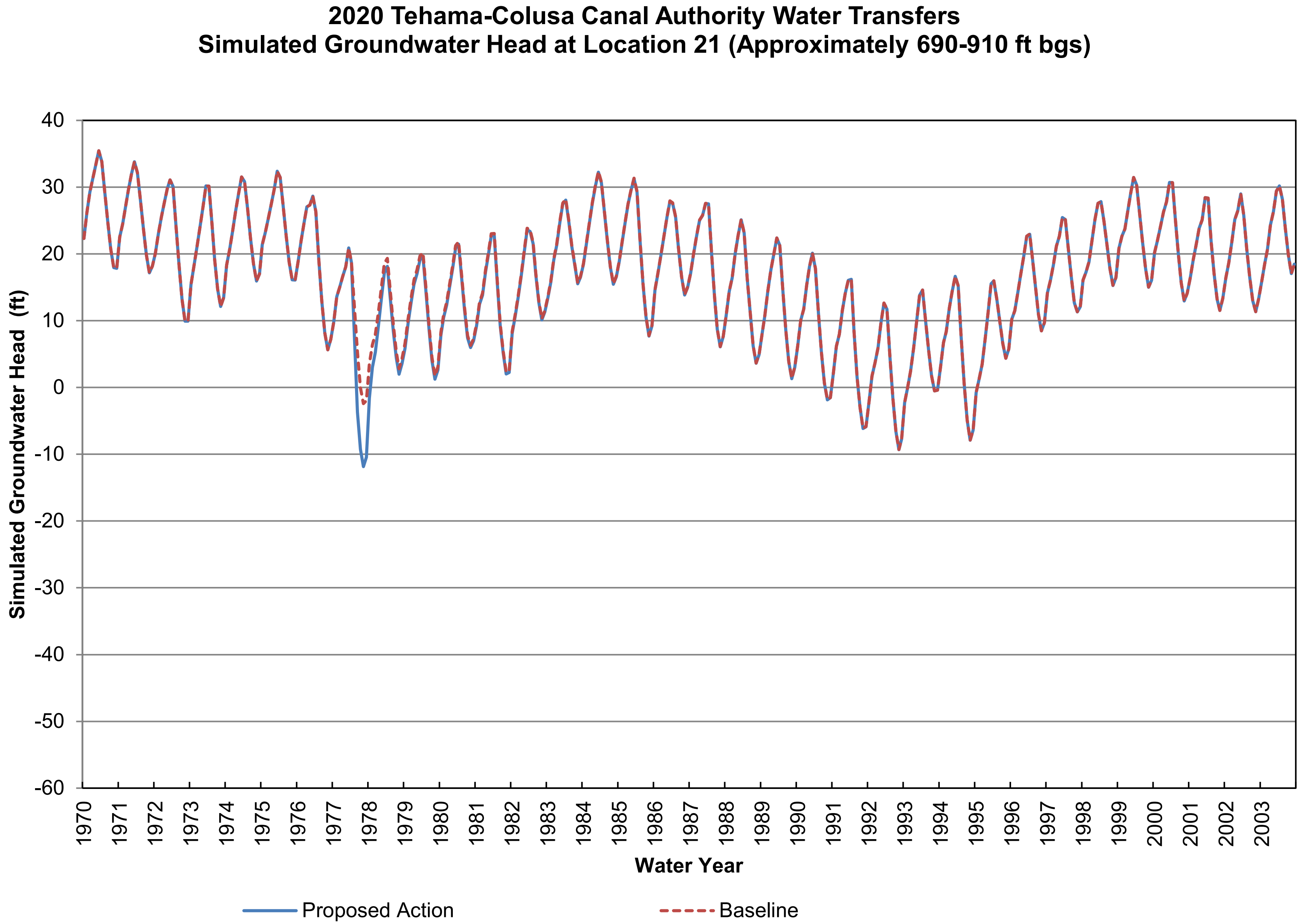
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 690-910 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
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1995
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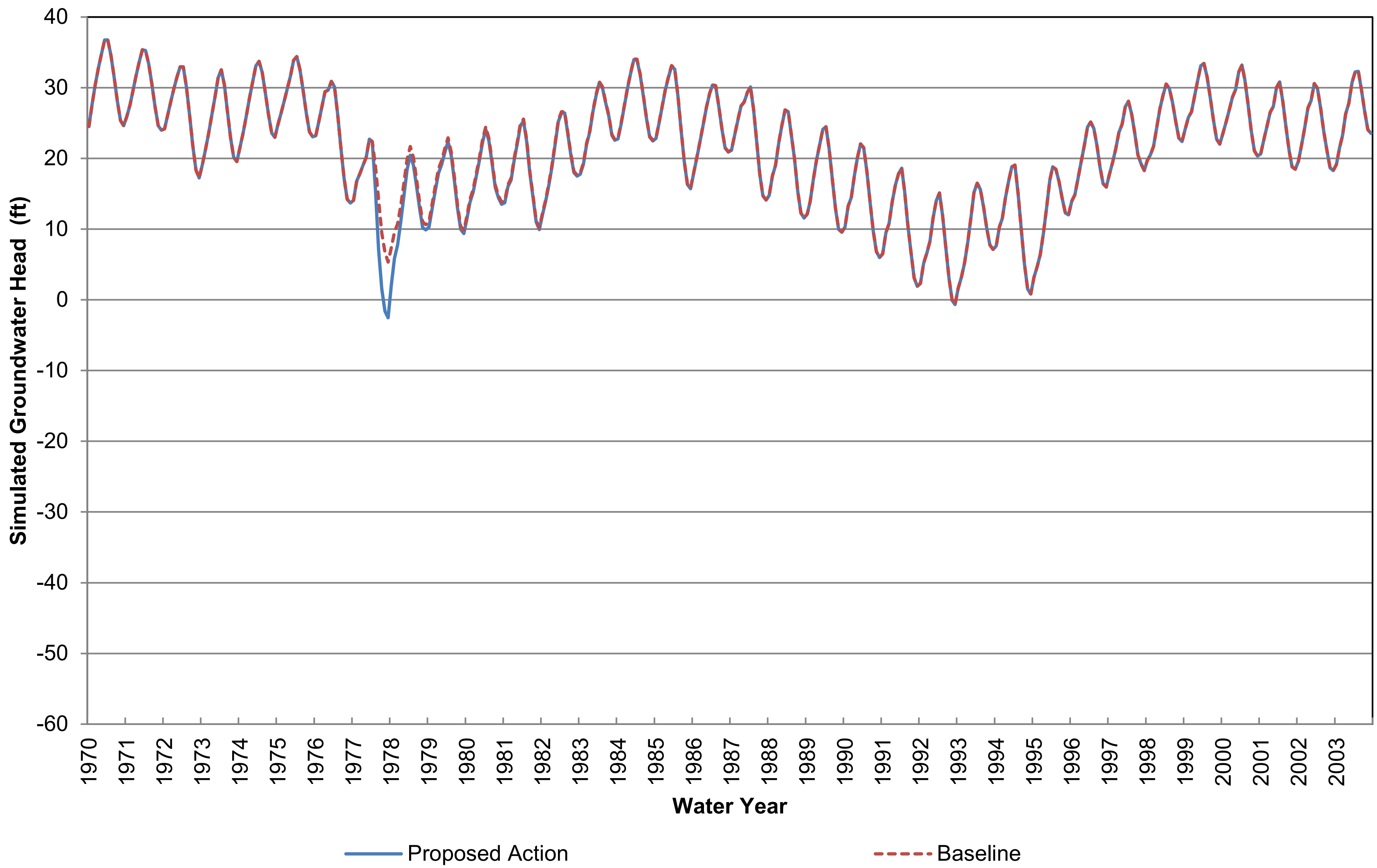
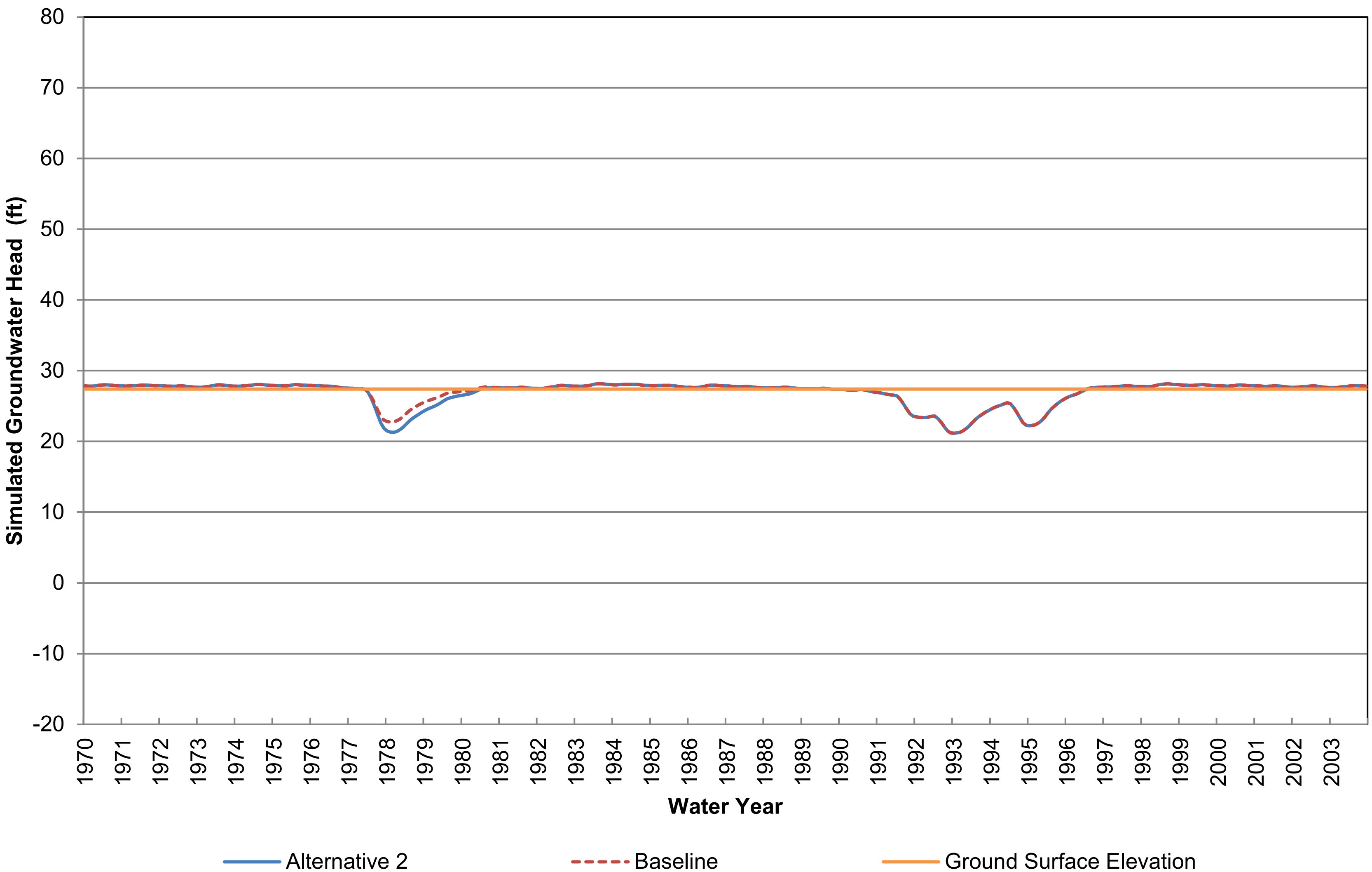
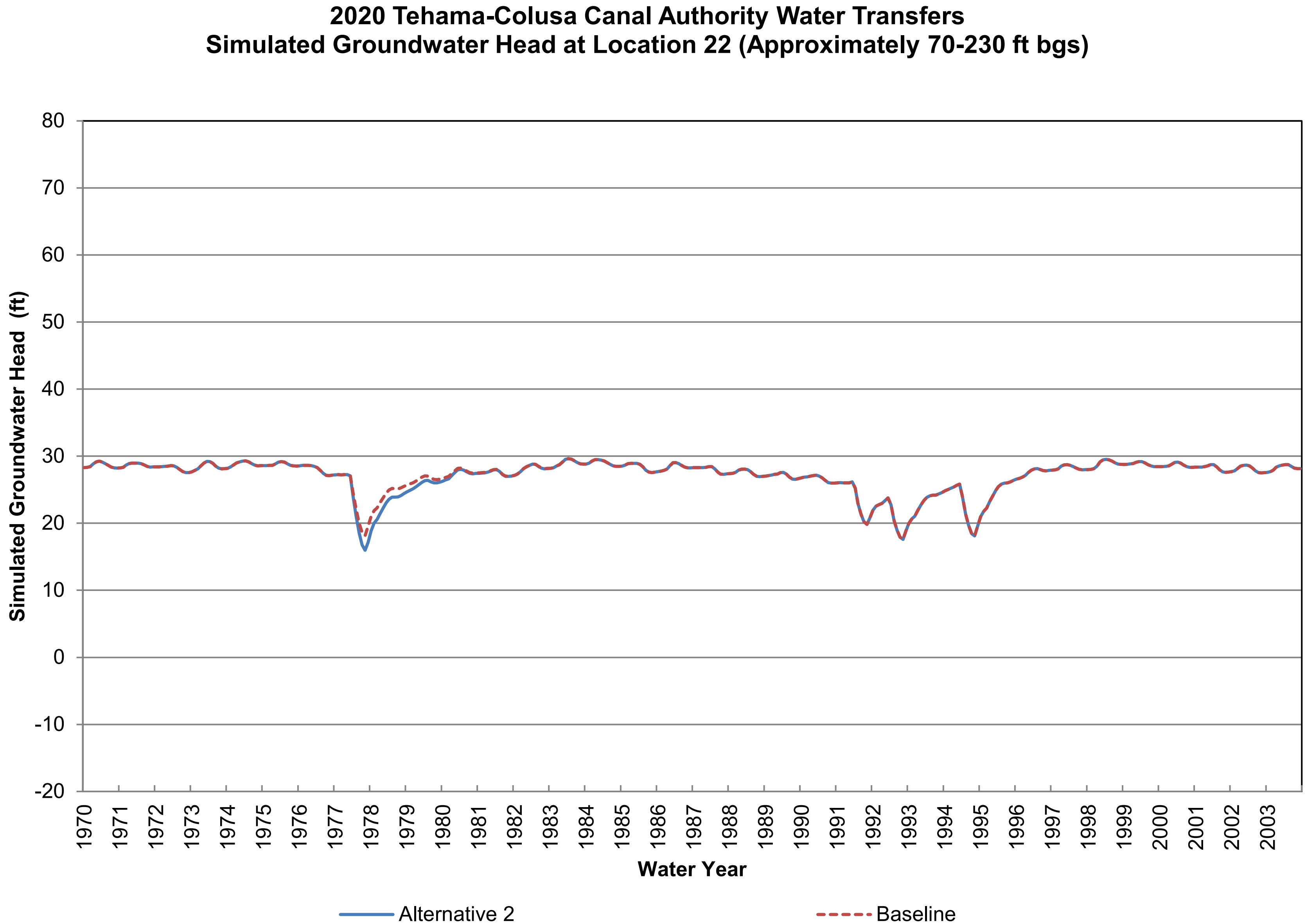
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 21 (Approximately 910-1250 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 22 (Approximately 0-70 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 70-230 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
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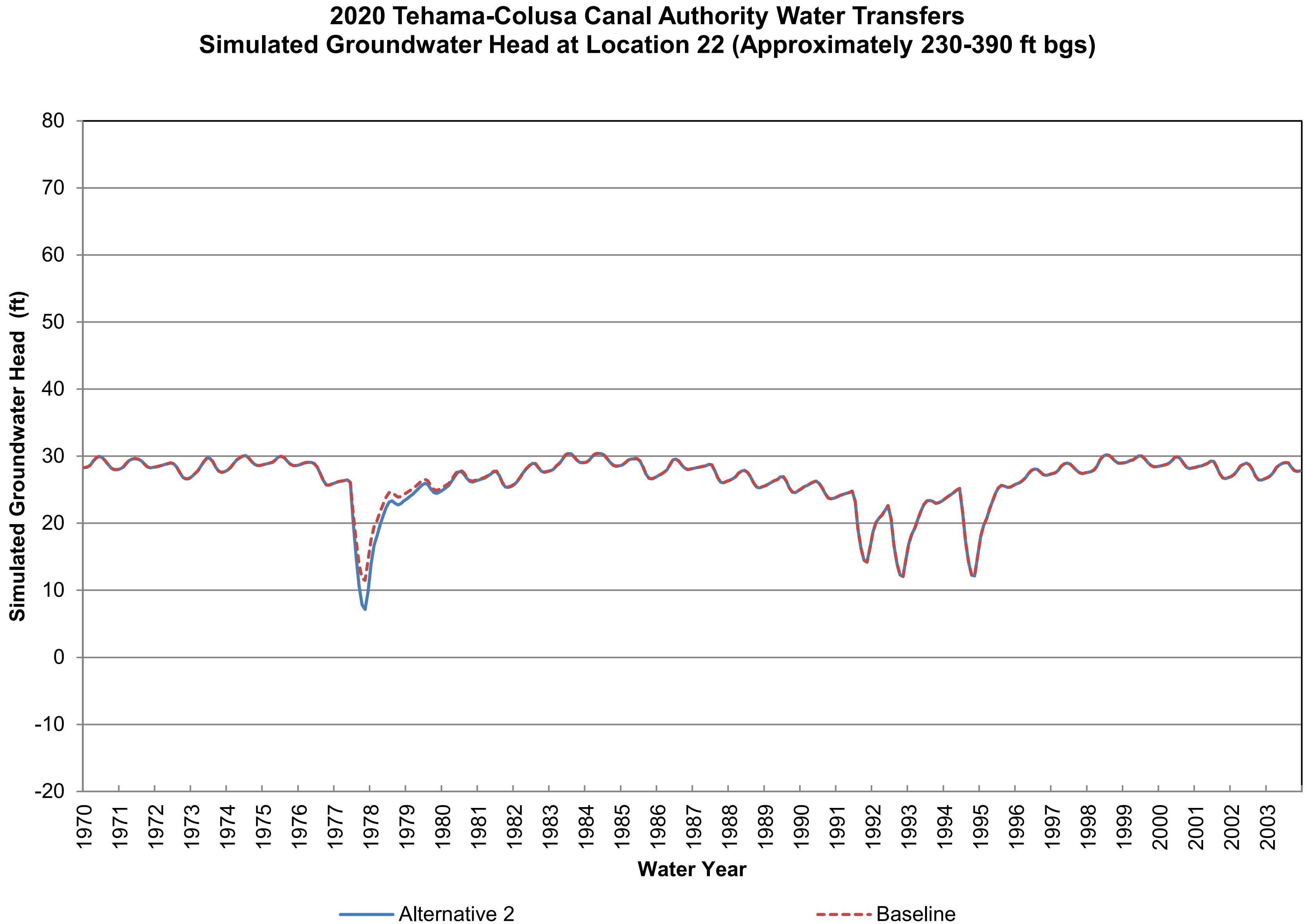
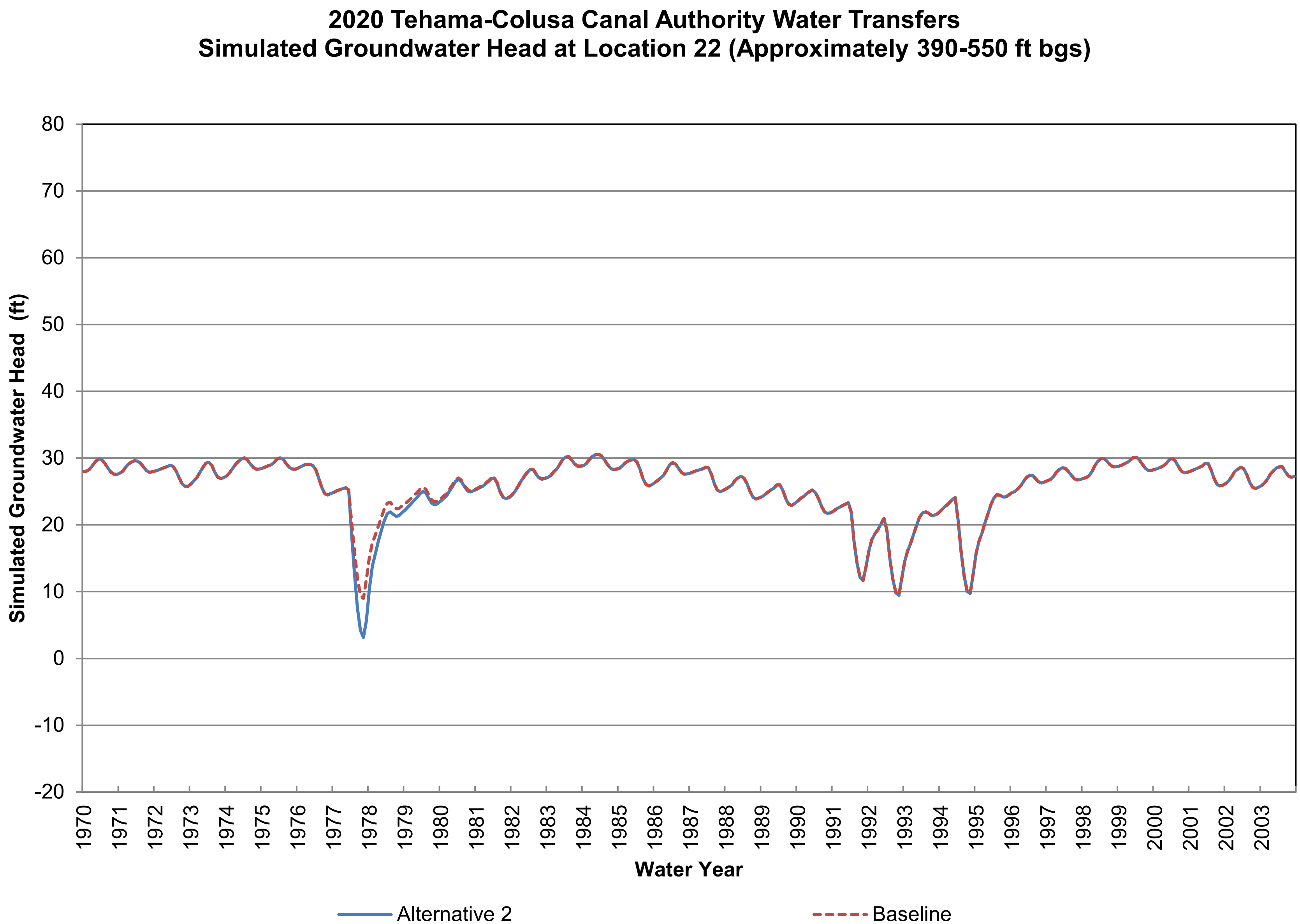
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 230-390 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 390-550 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
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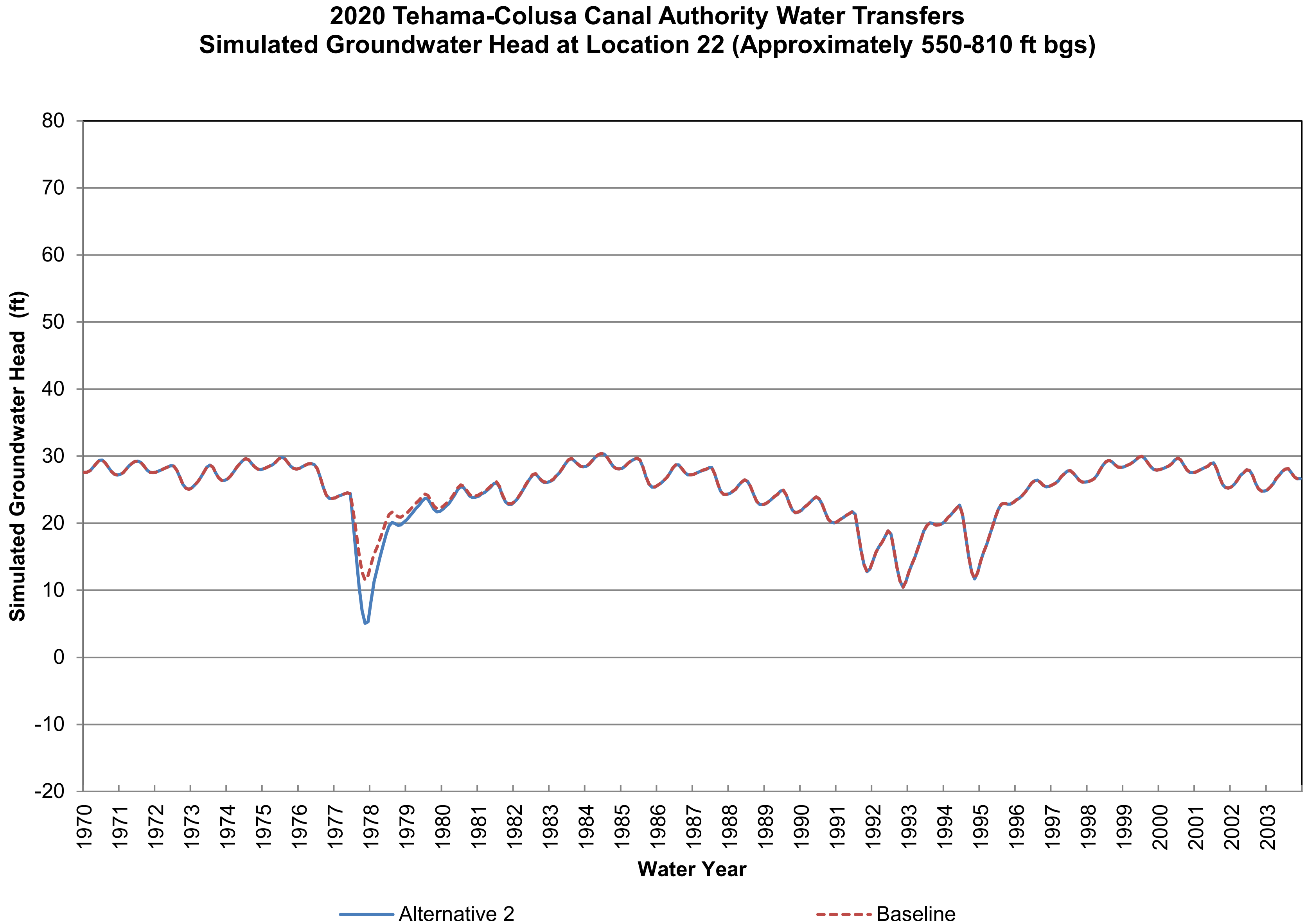
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 550-810 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
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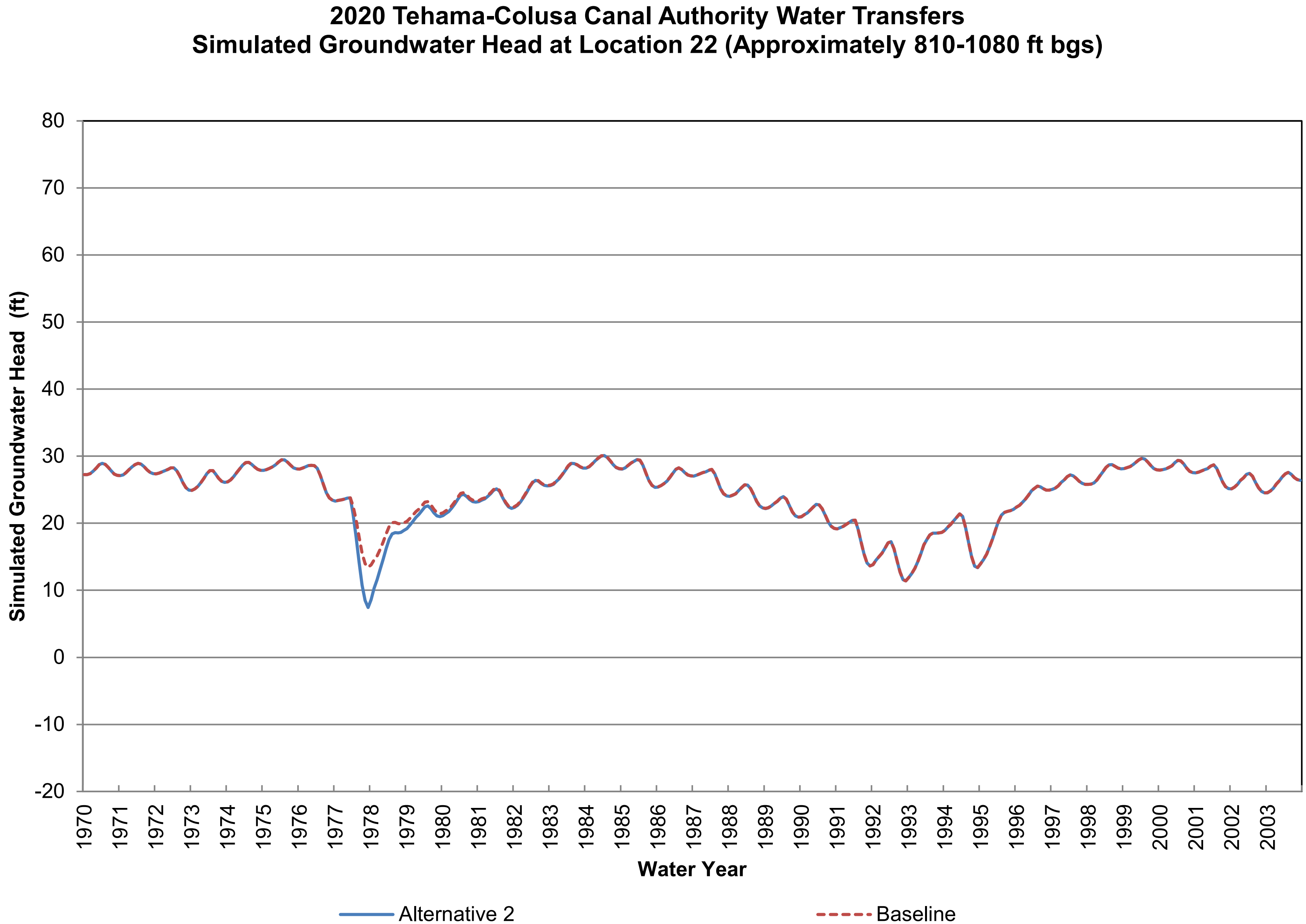
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 810-1080 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1987
1988
1989
1990
1991
1992
1993
1994
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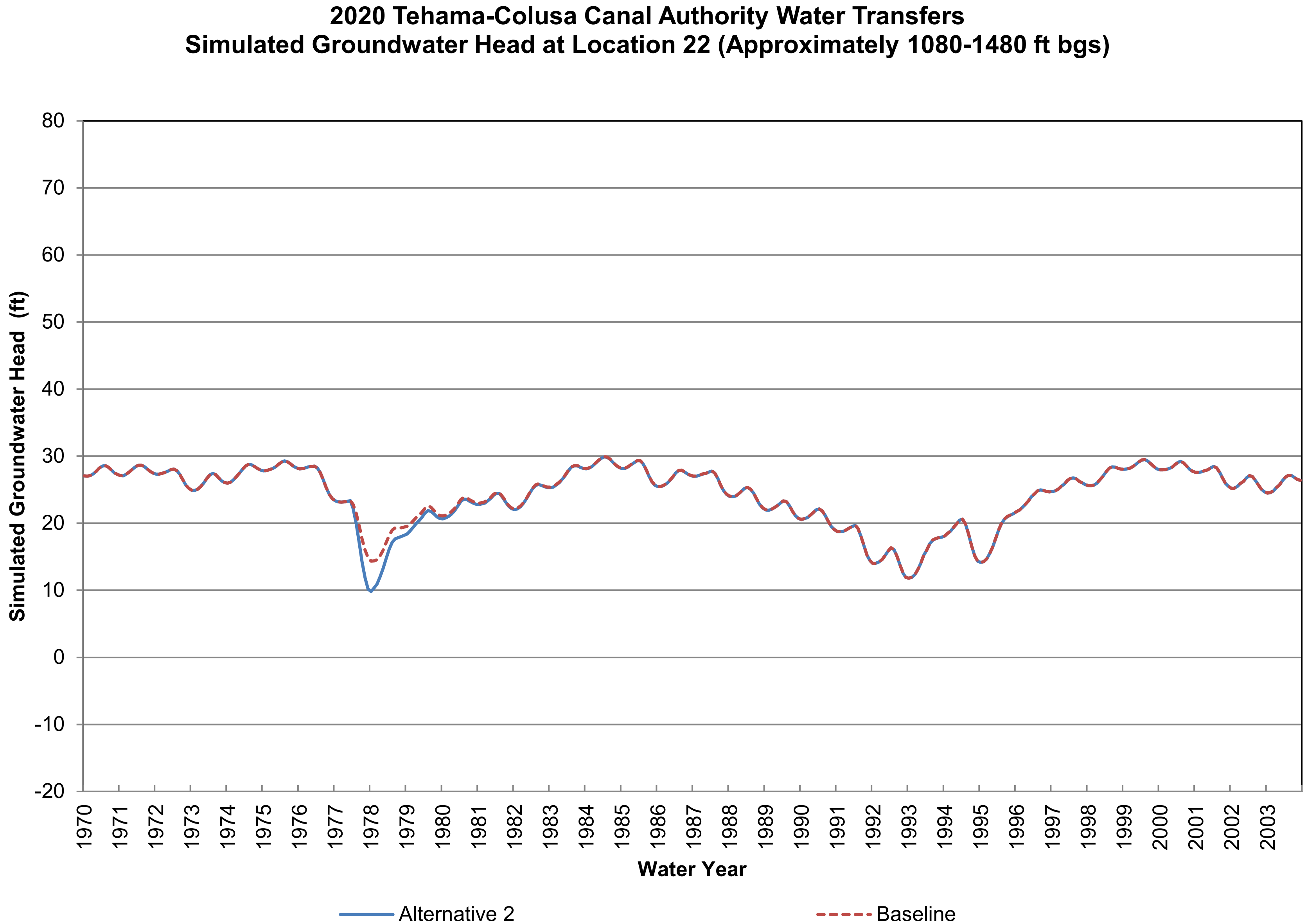
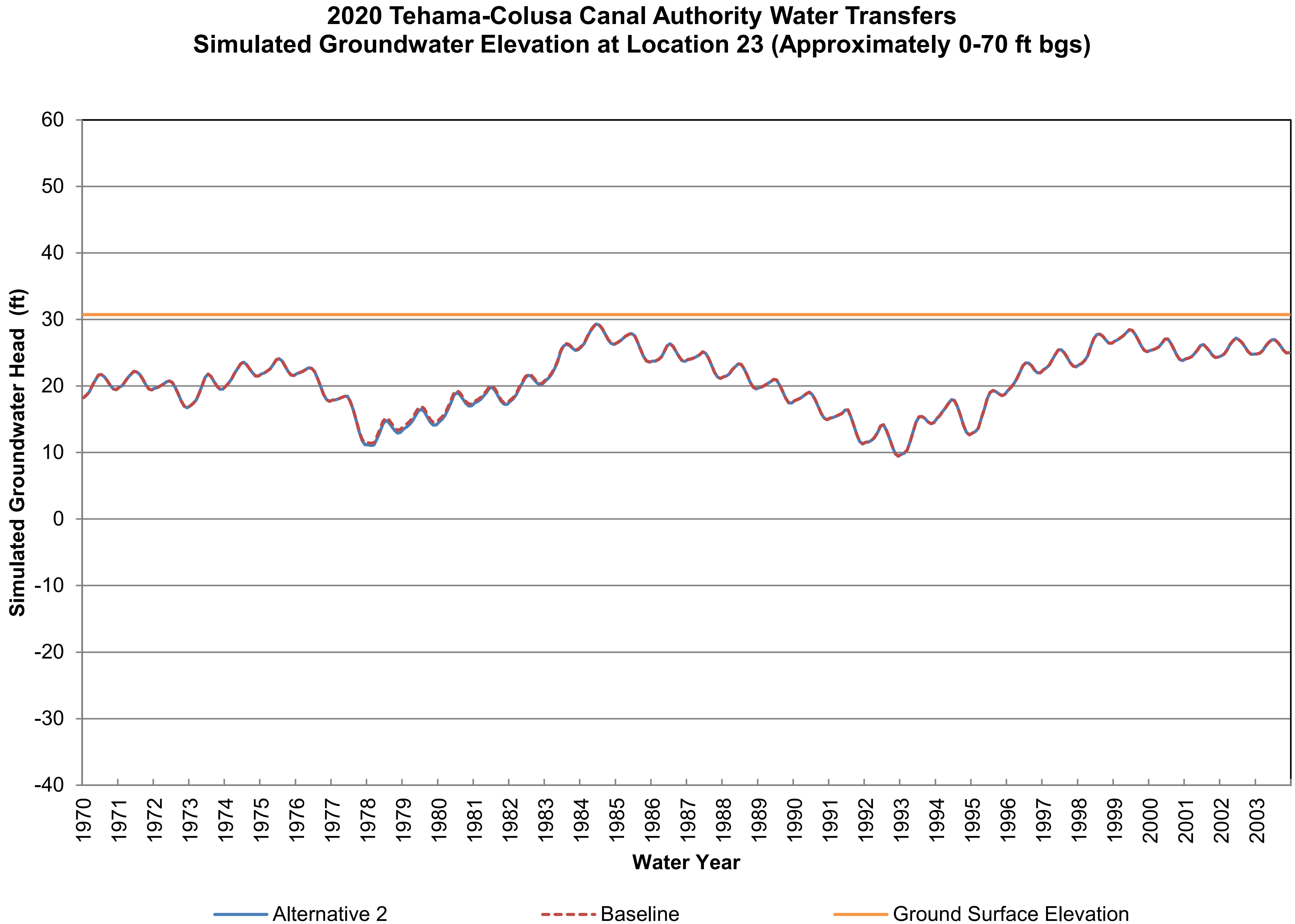
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 1080-1480 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 23 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1986
1987
1988
1989
1990
1991
1992
1993
1994
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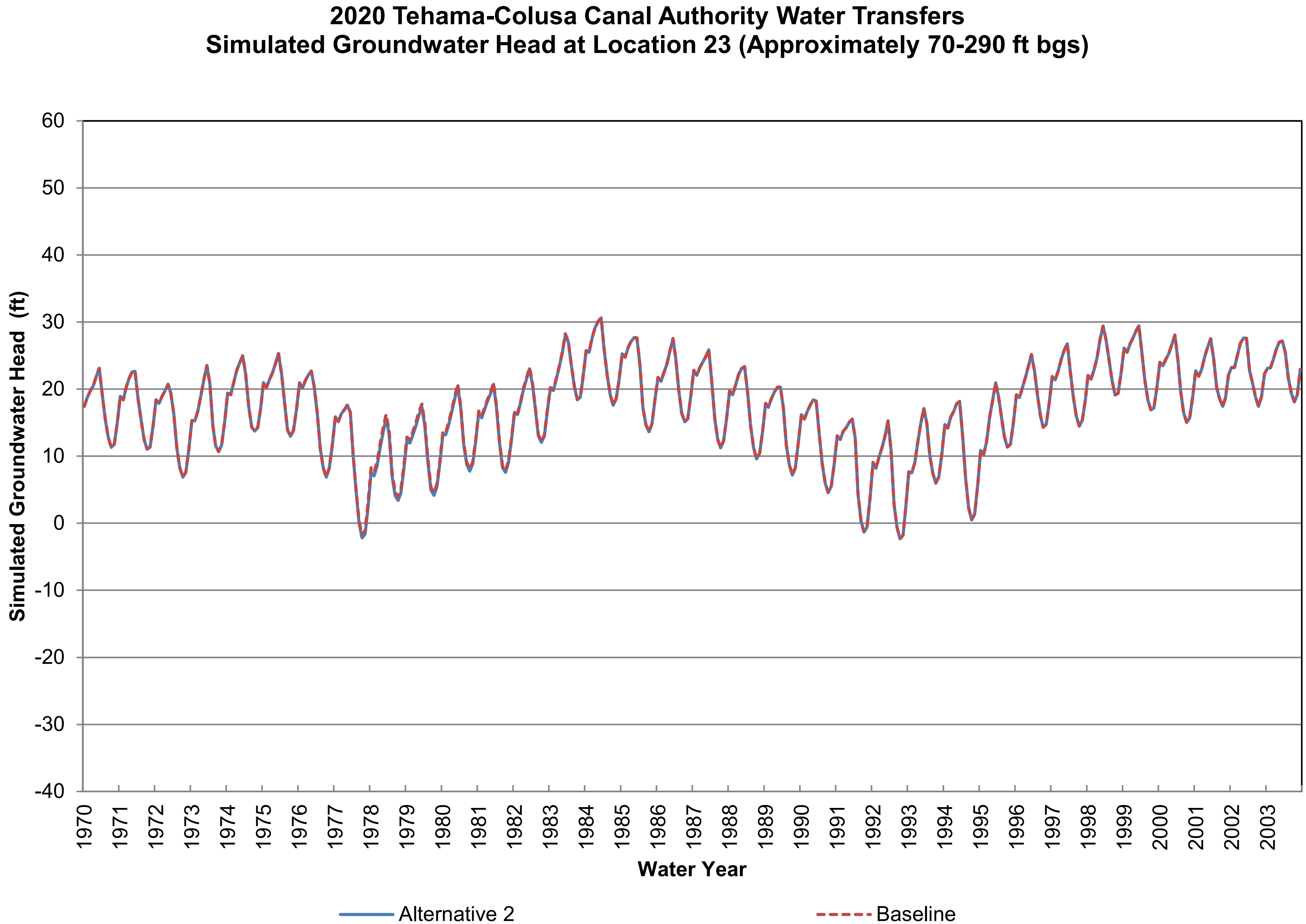
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 70-290 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1987
1988
1989
1990
1991
1992
1993
1994
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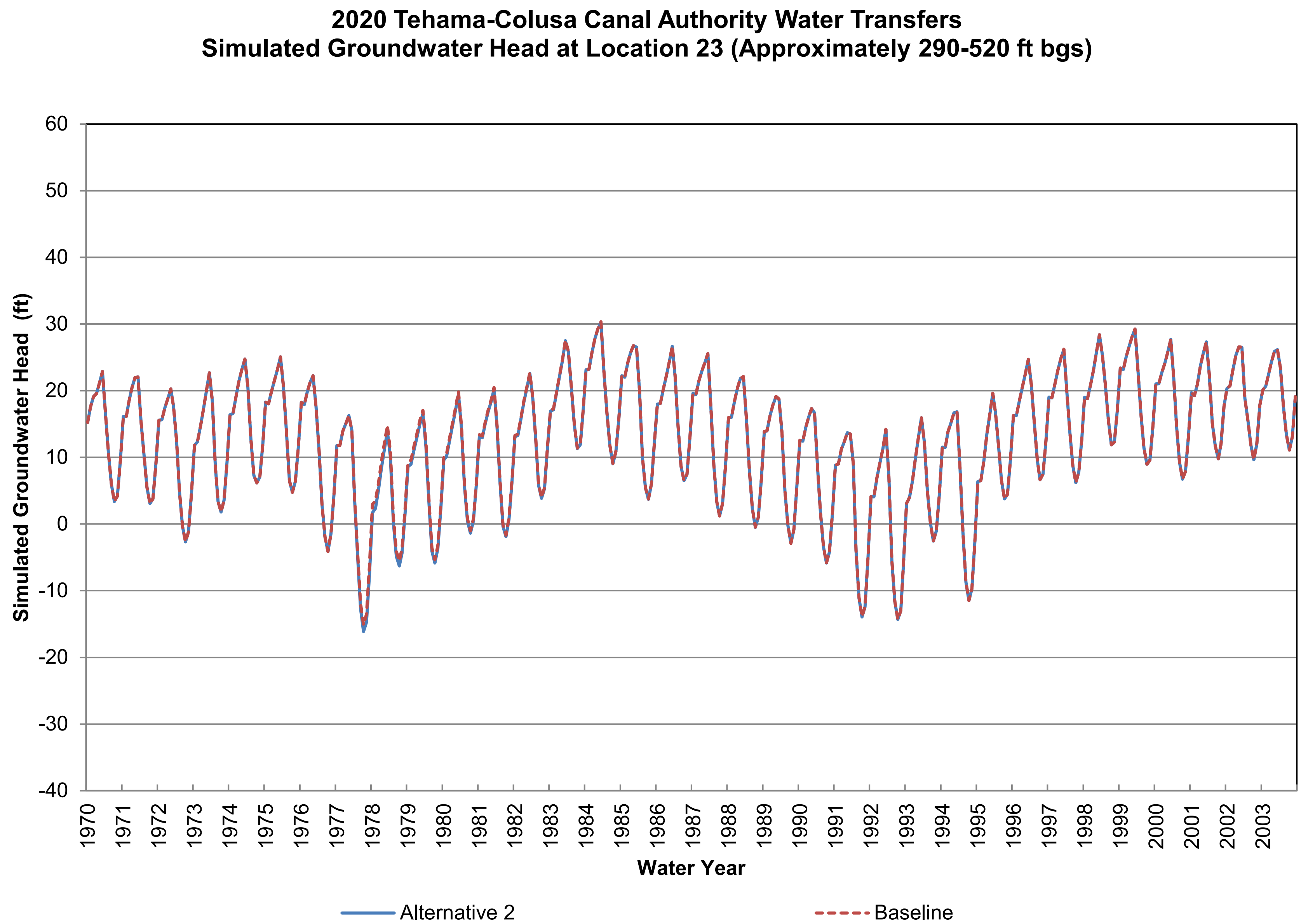
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 290-520 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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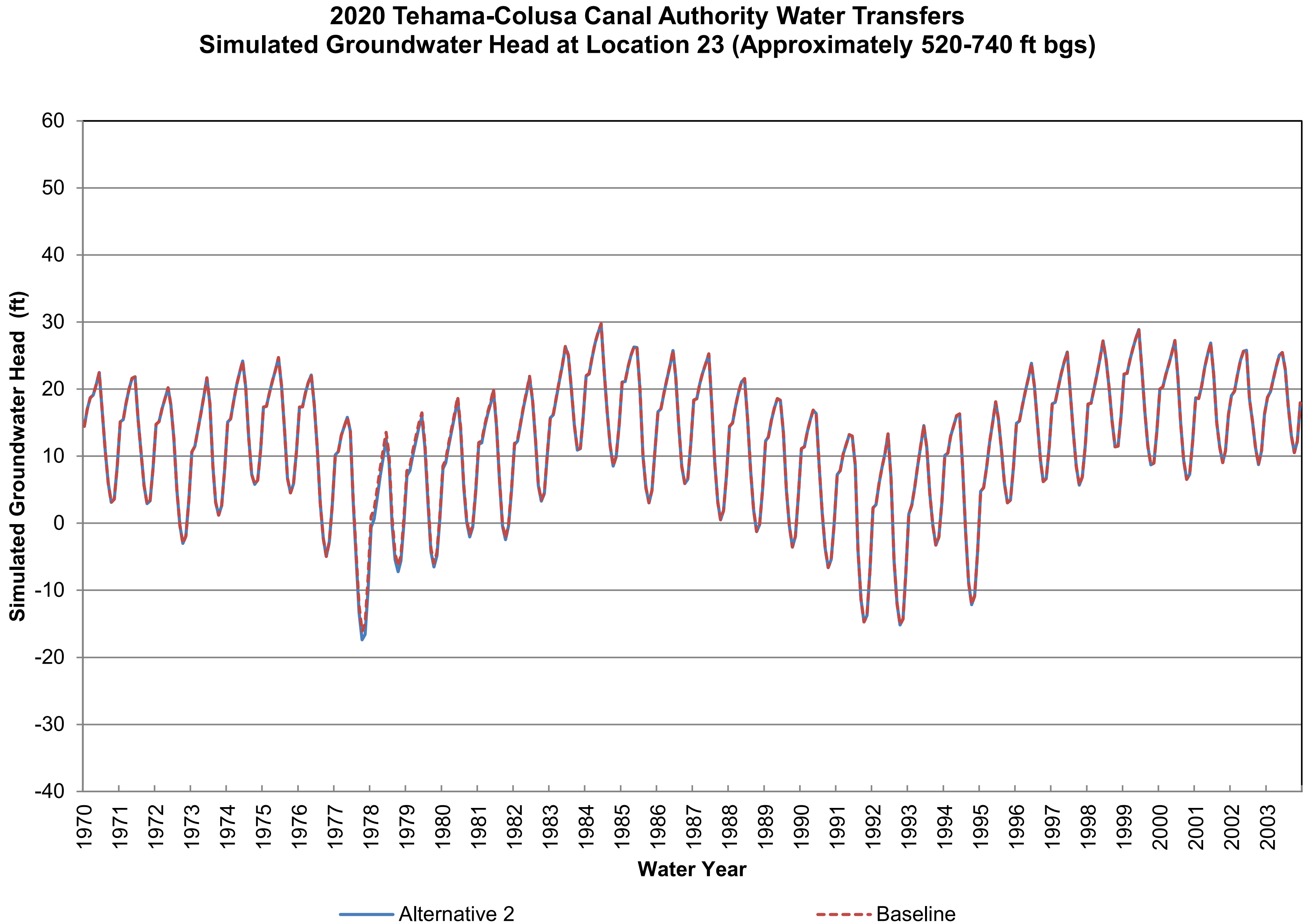
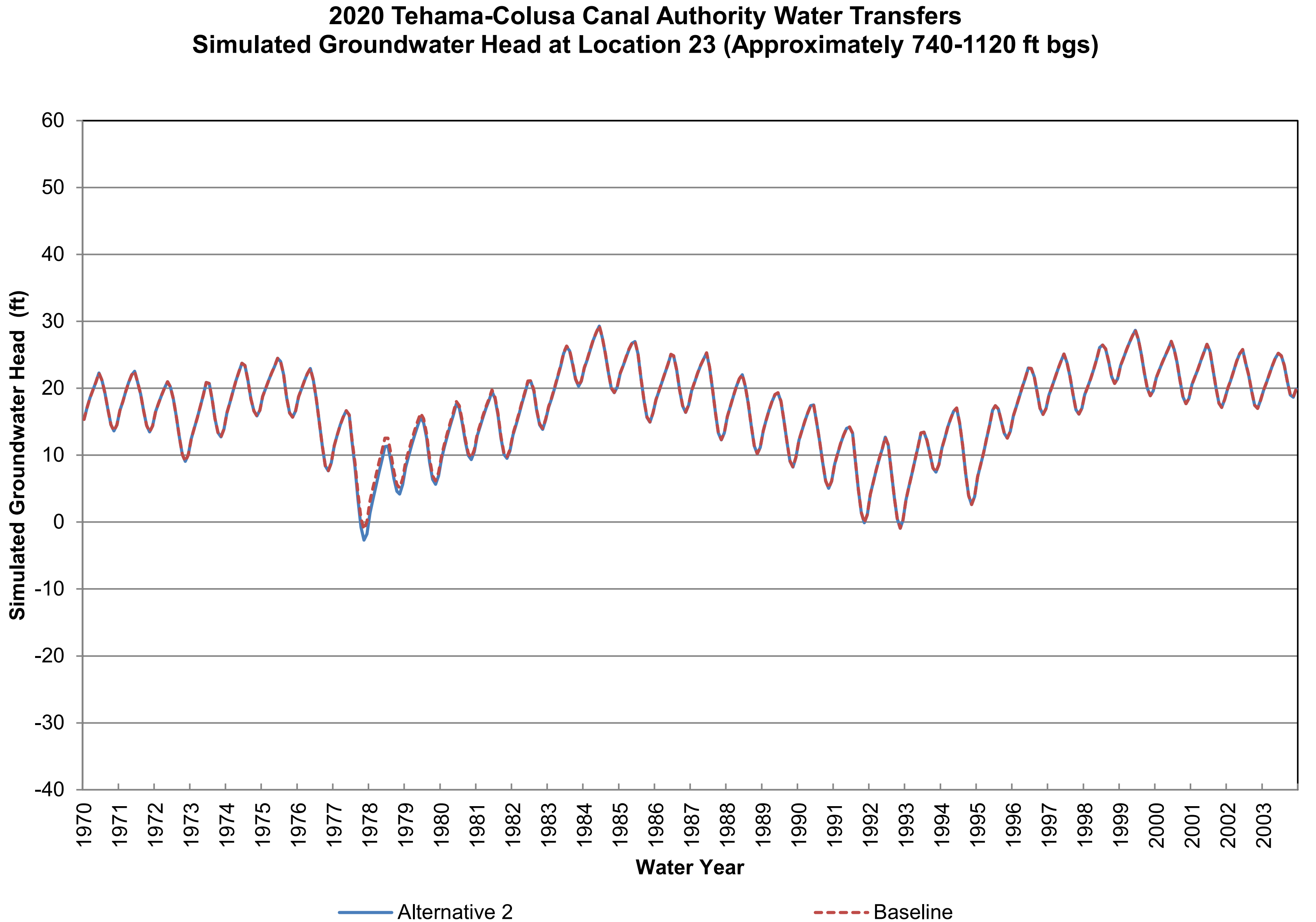
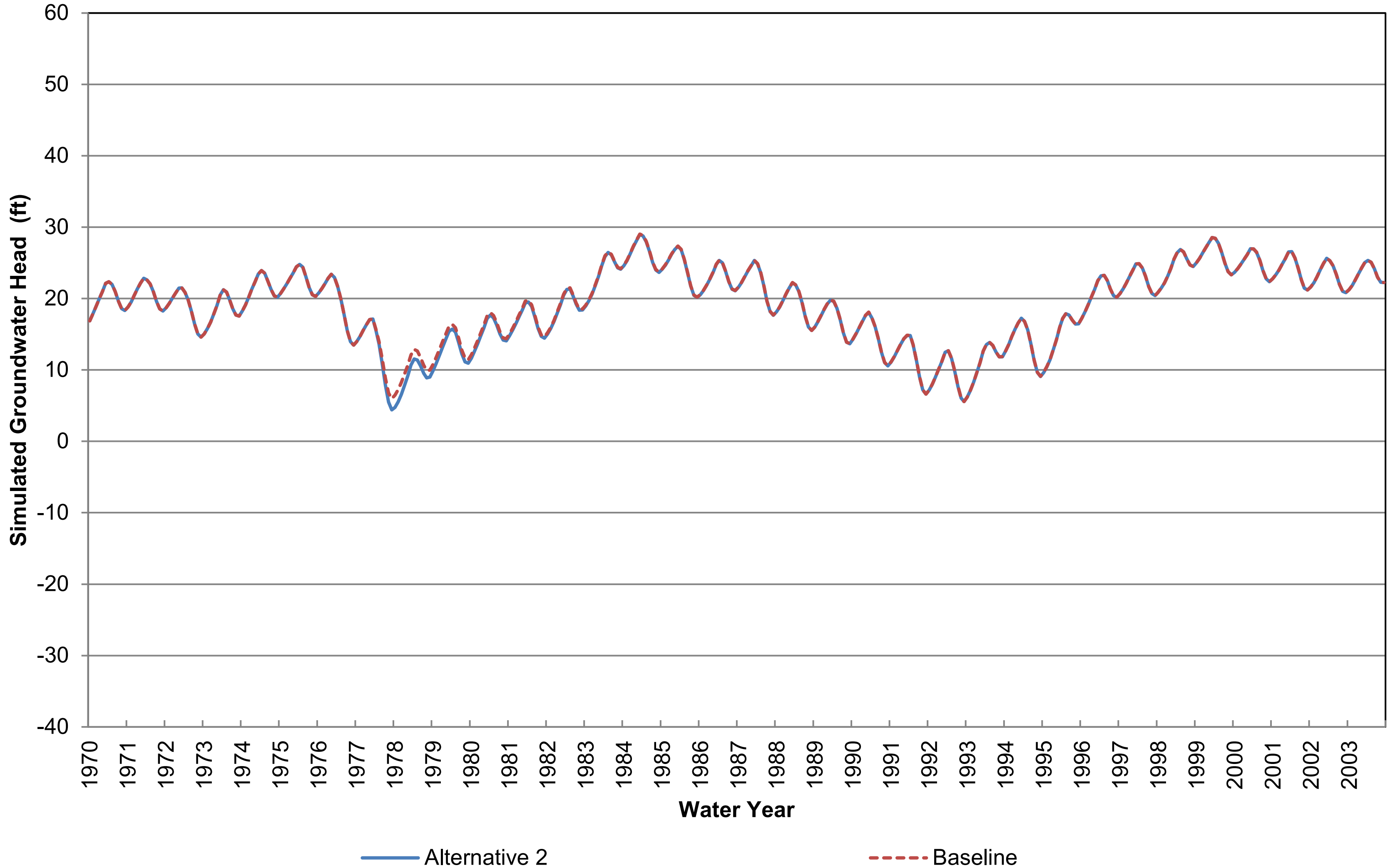
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

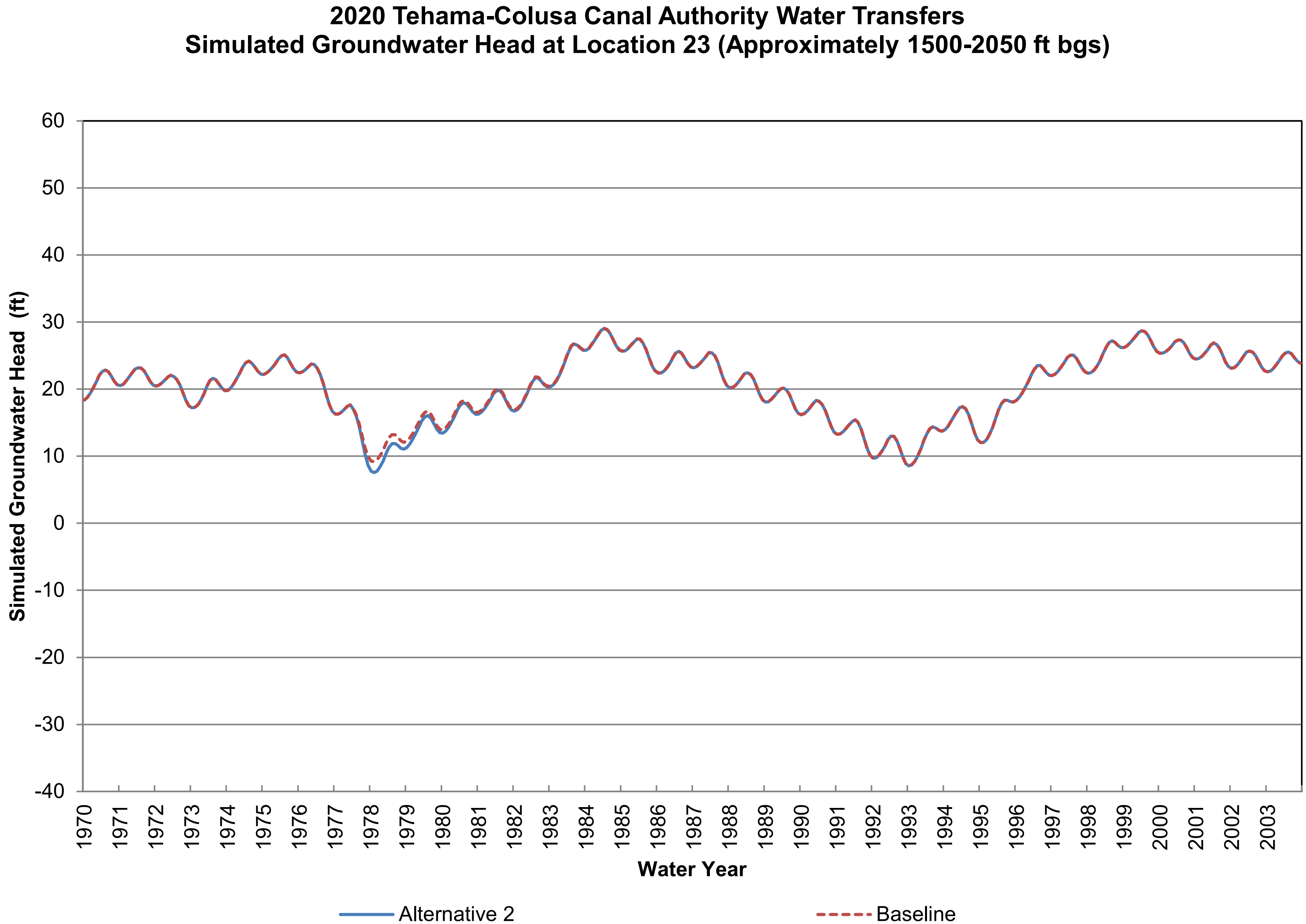


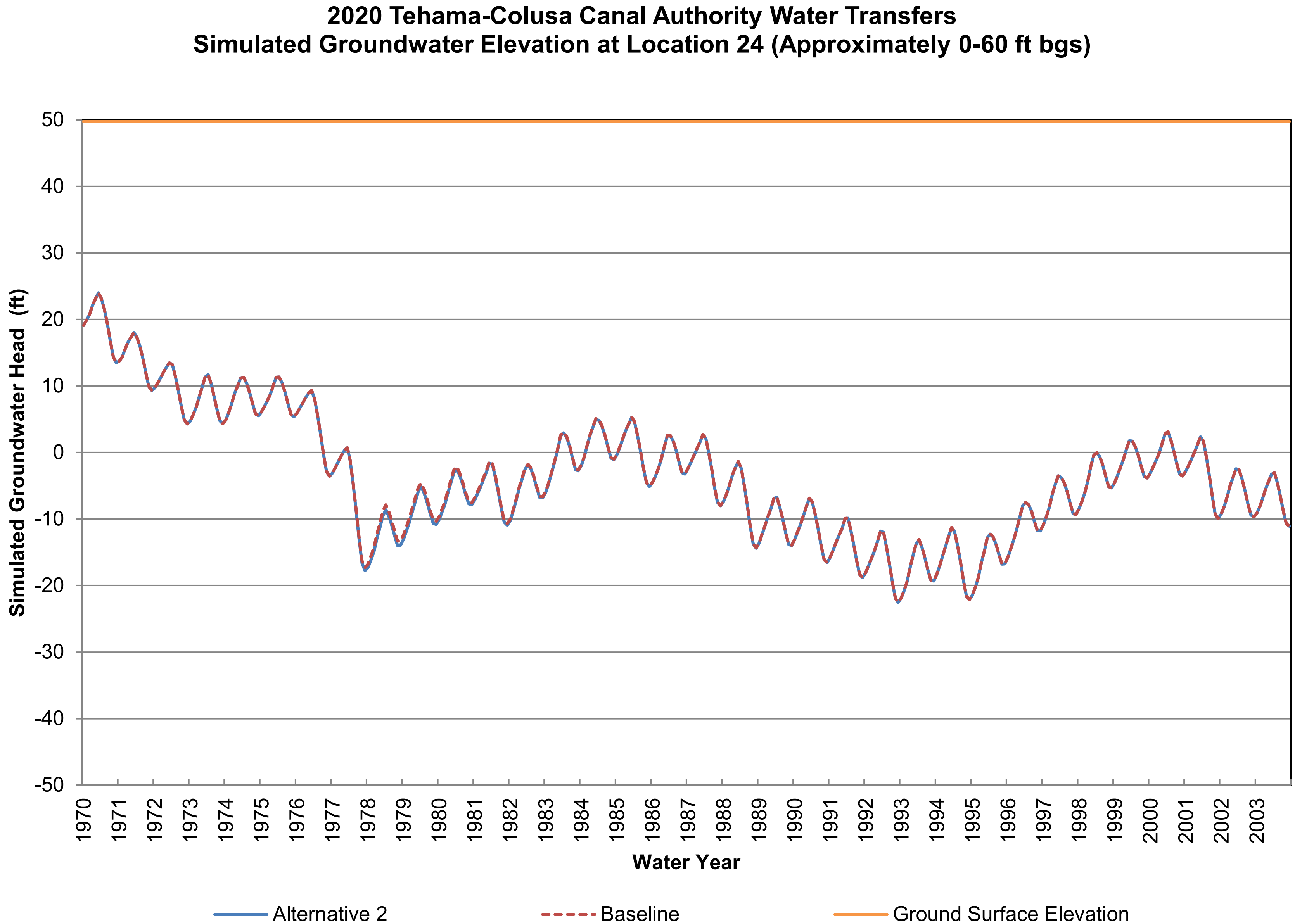
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 520-740 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 740-1120 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 23 (Approximately 1120-1500 ft bgs)

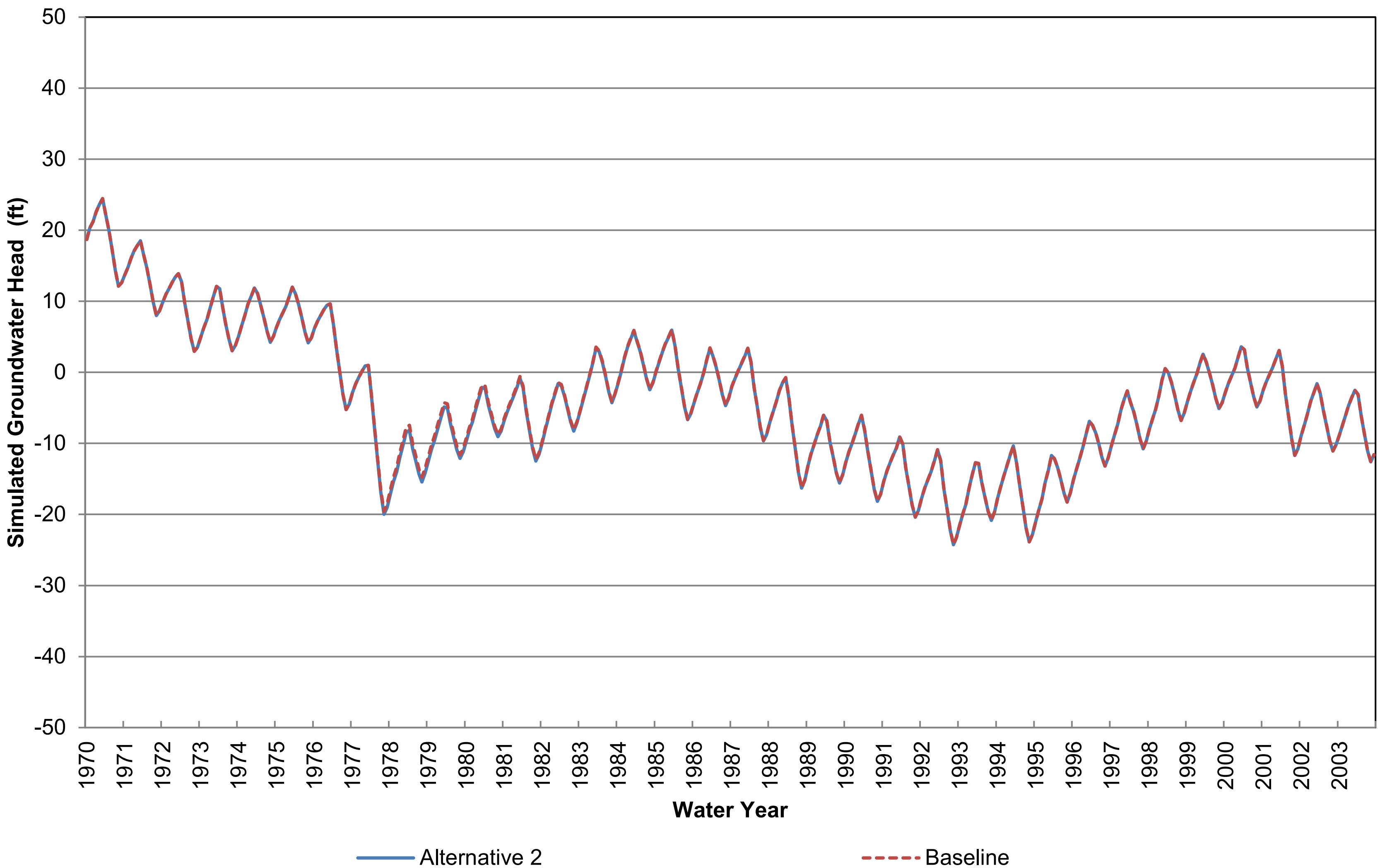


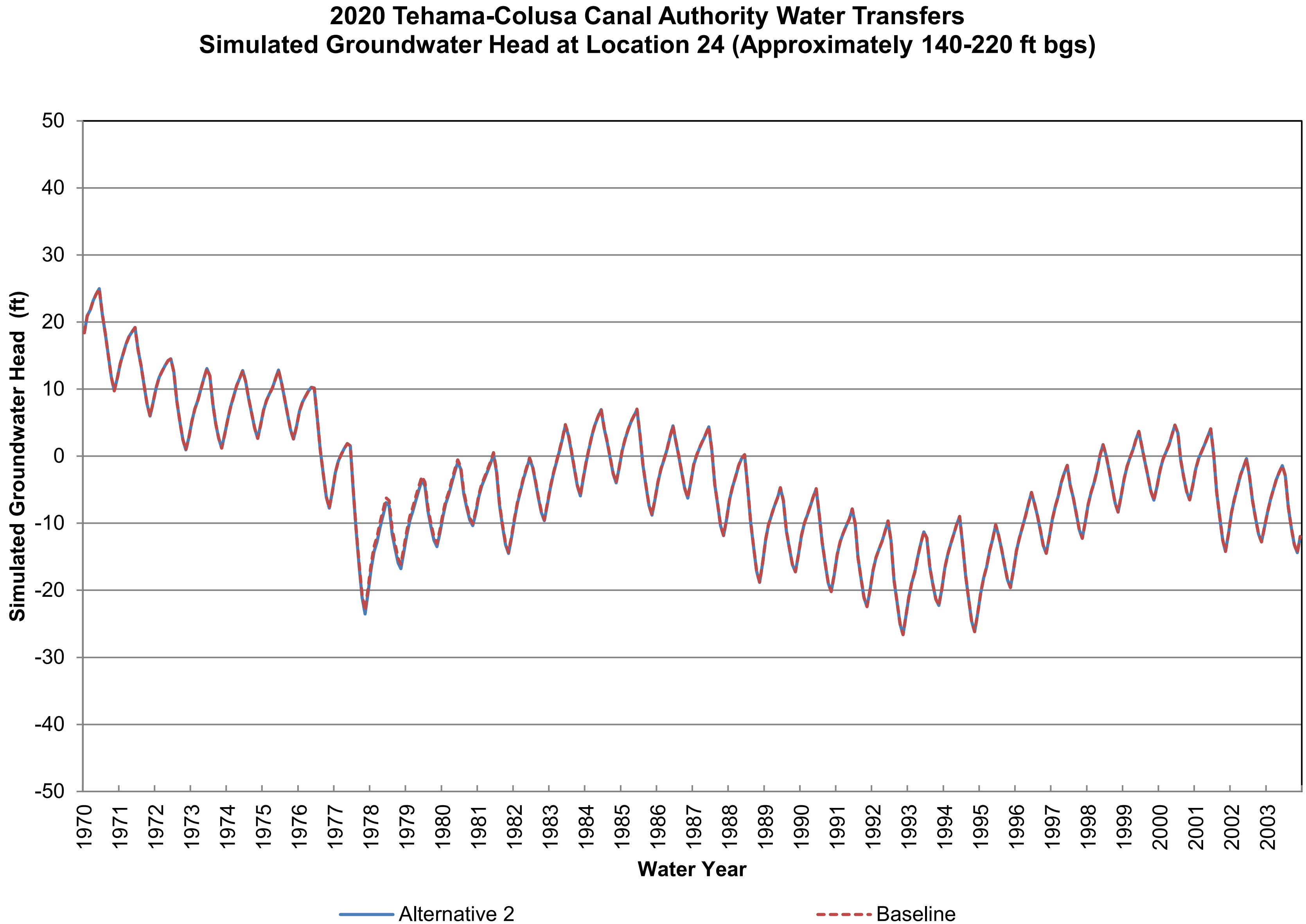

2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 1500-2050 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 24 (Approximately 0-60 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 24 (Approximately 60-140 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 140-220 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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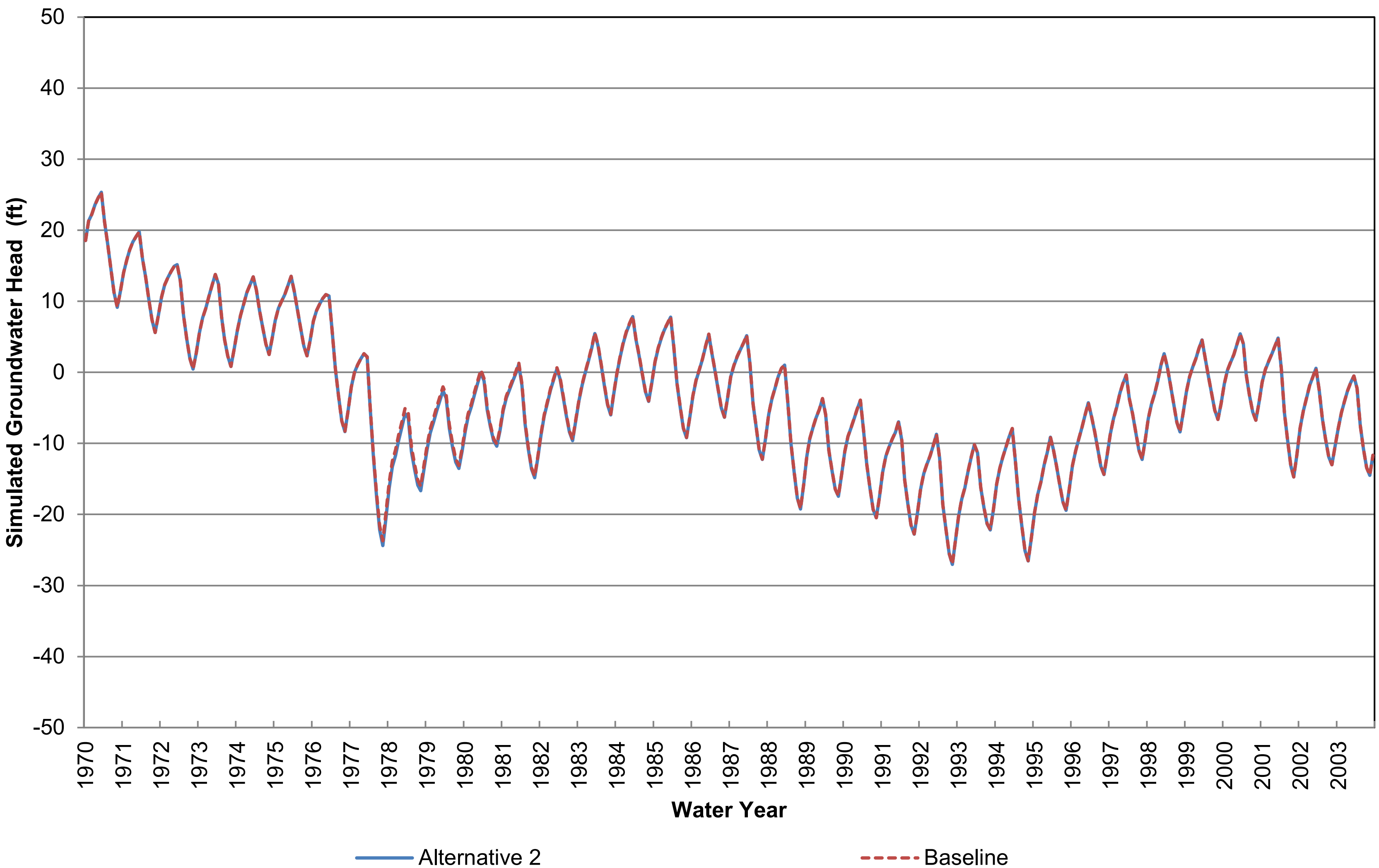
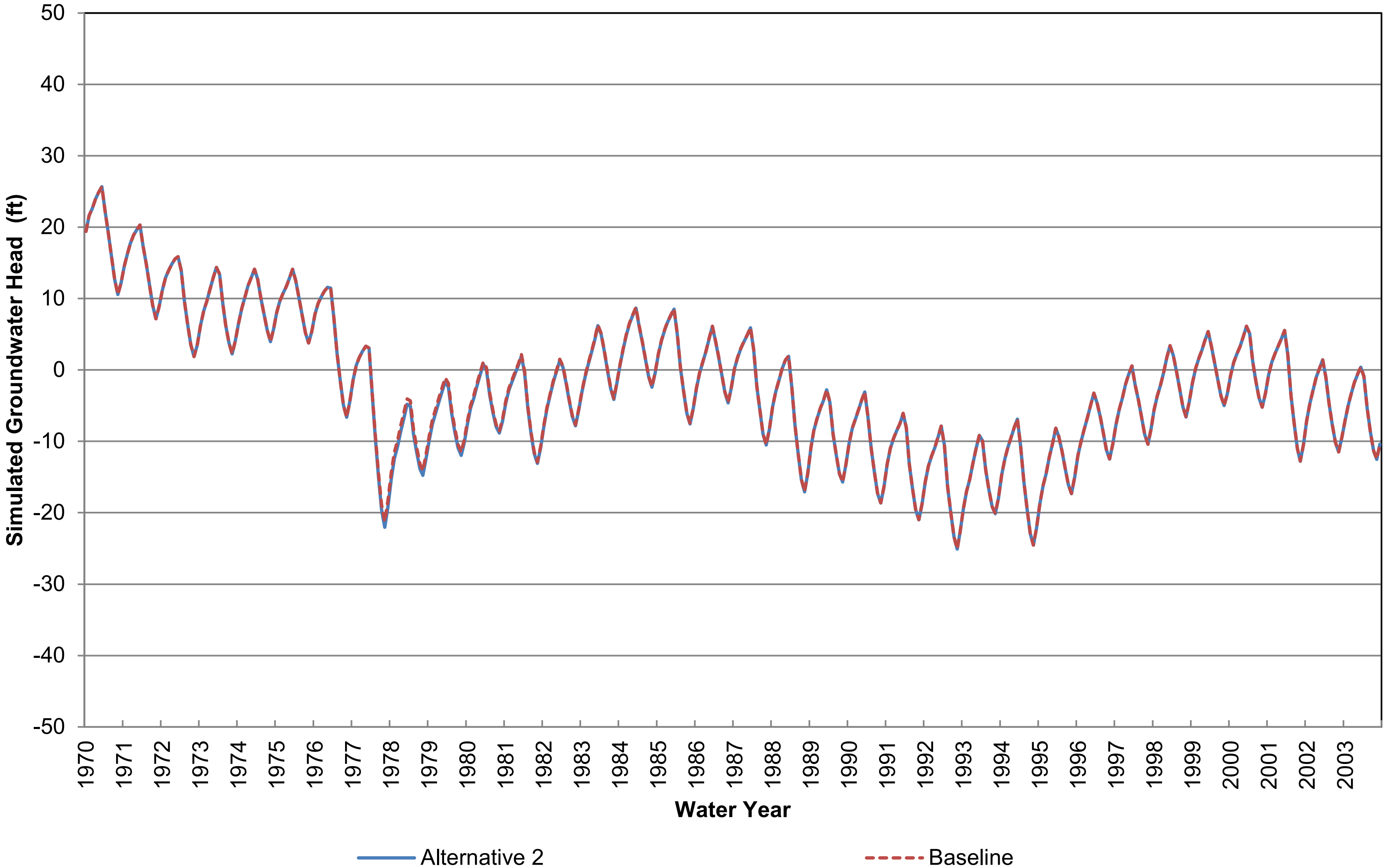
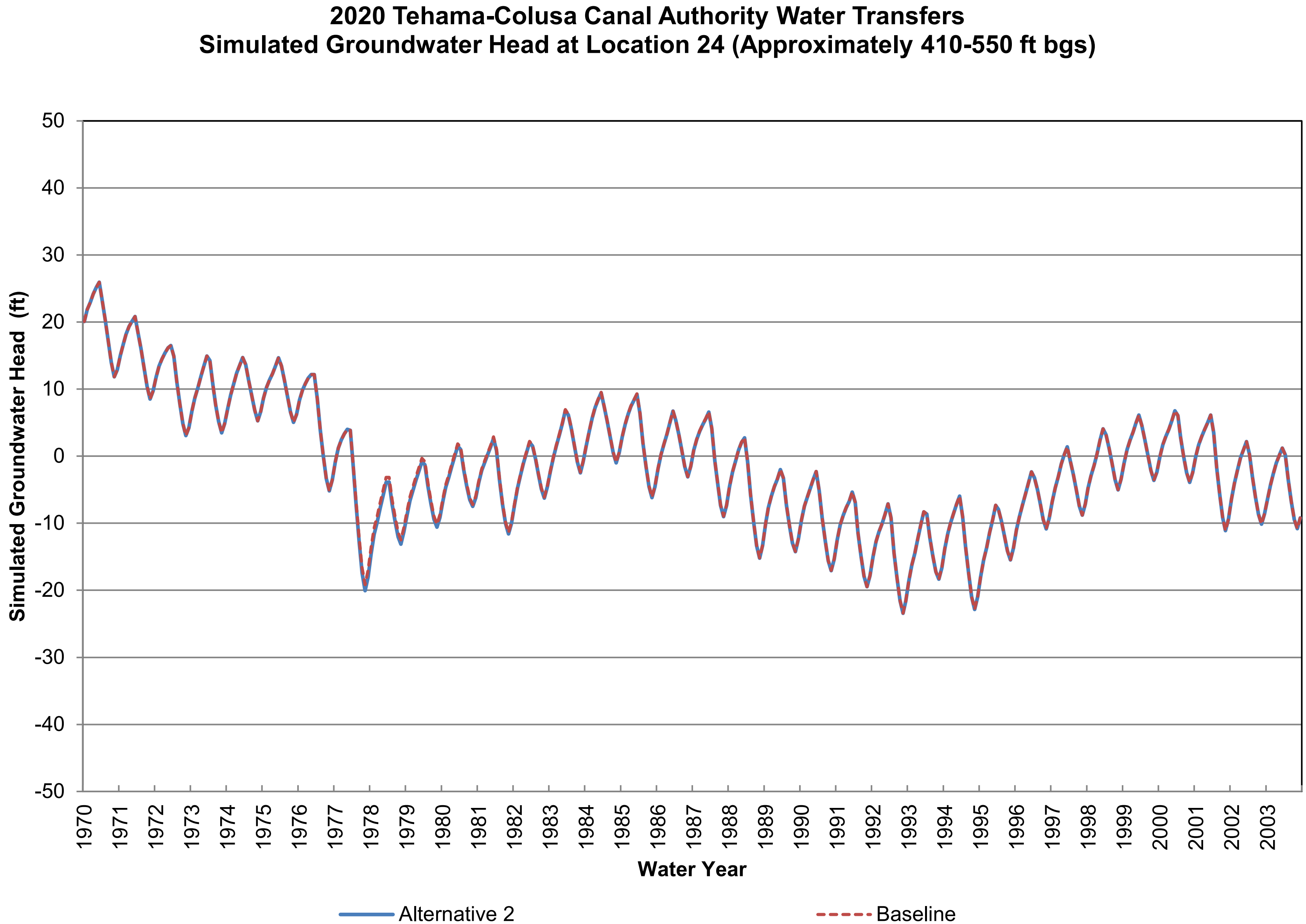
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 24 (Approximately 220-300 ft bgs)**



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 24 (Approximately 300-410 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 410-550 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1983
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1990
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1993
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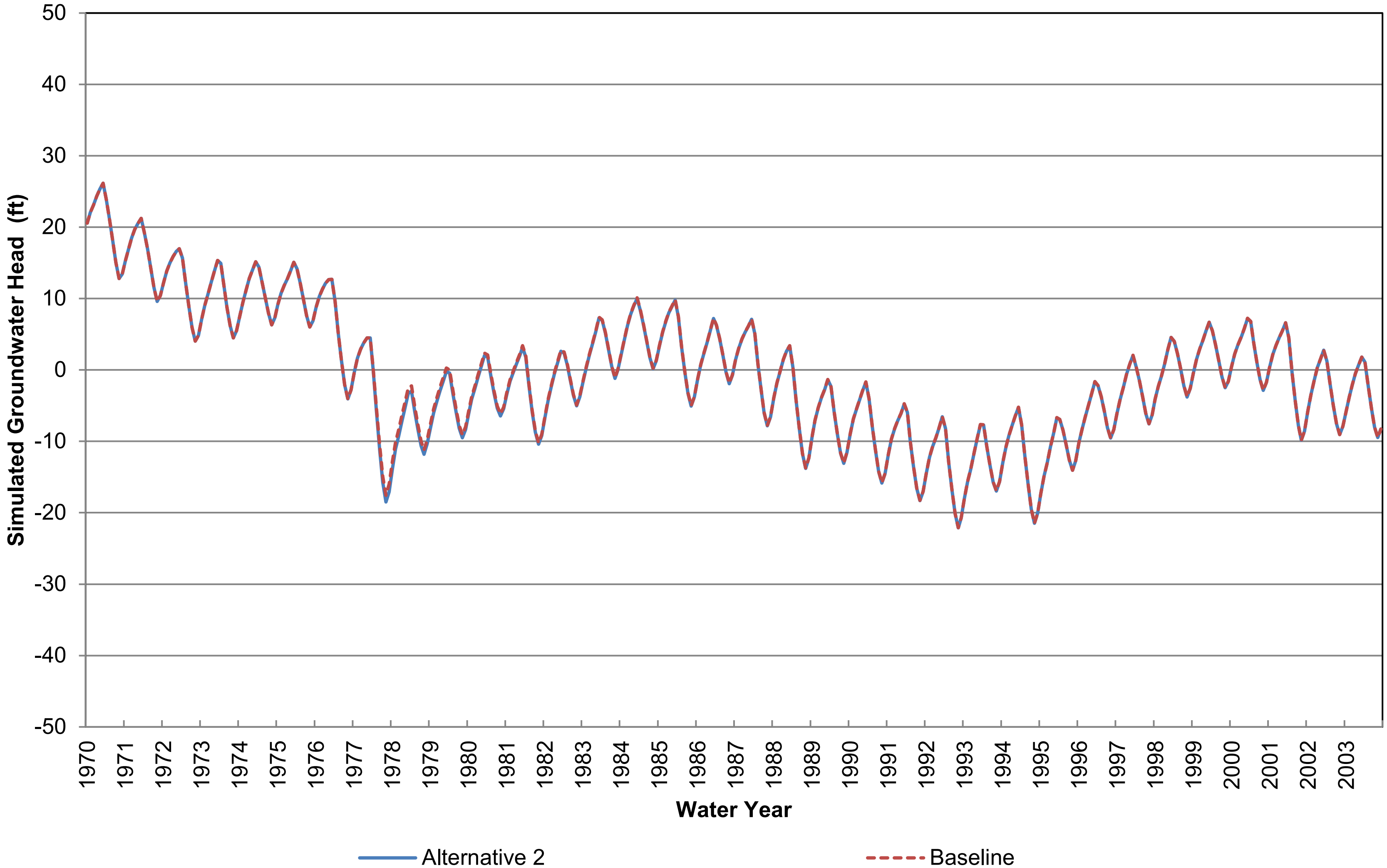
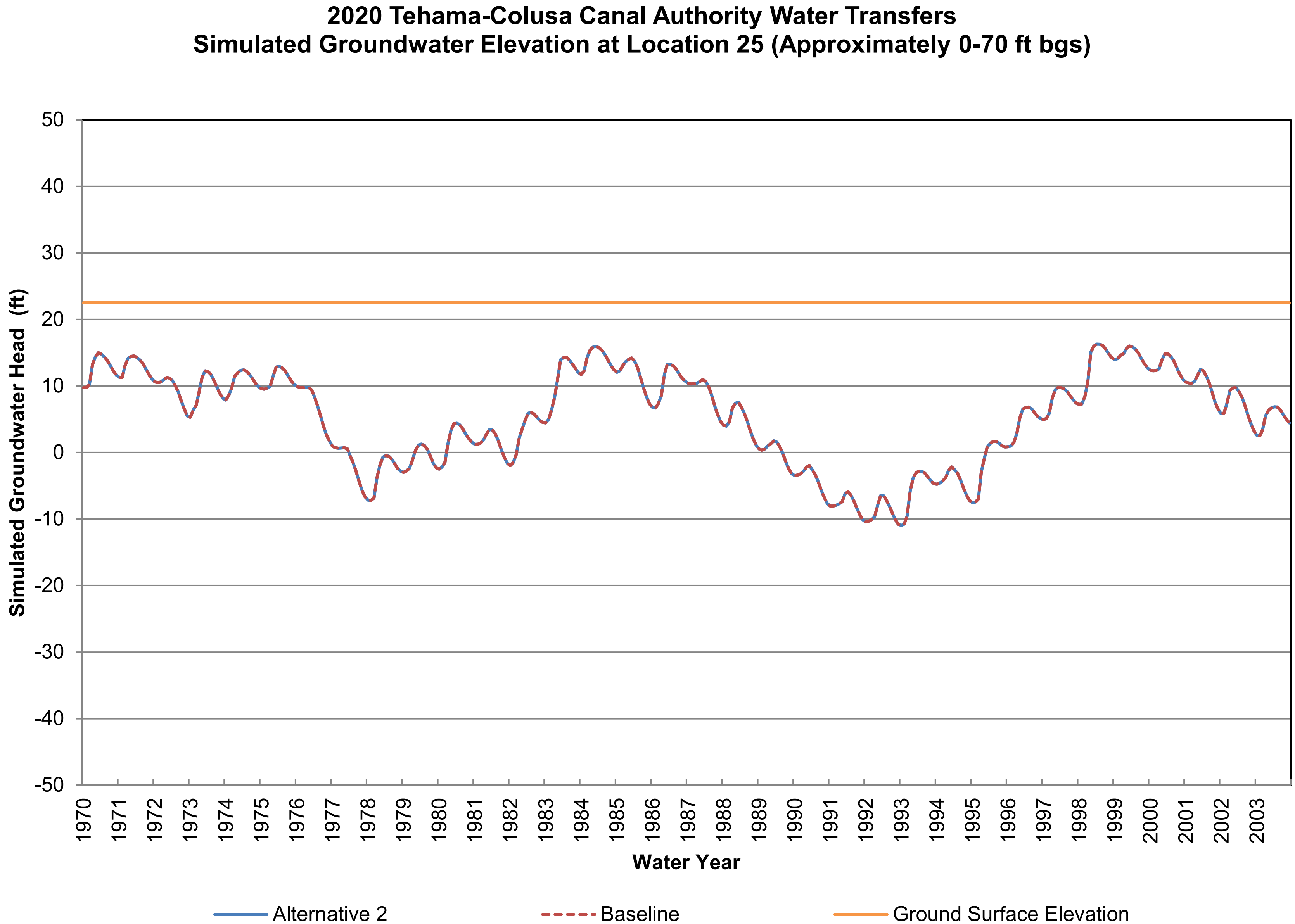
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 24 (Approximately 550-750 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 25 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
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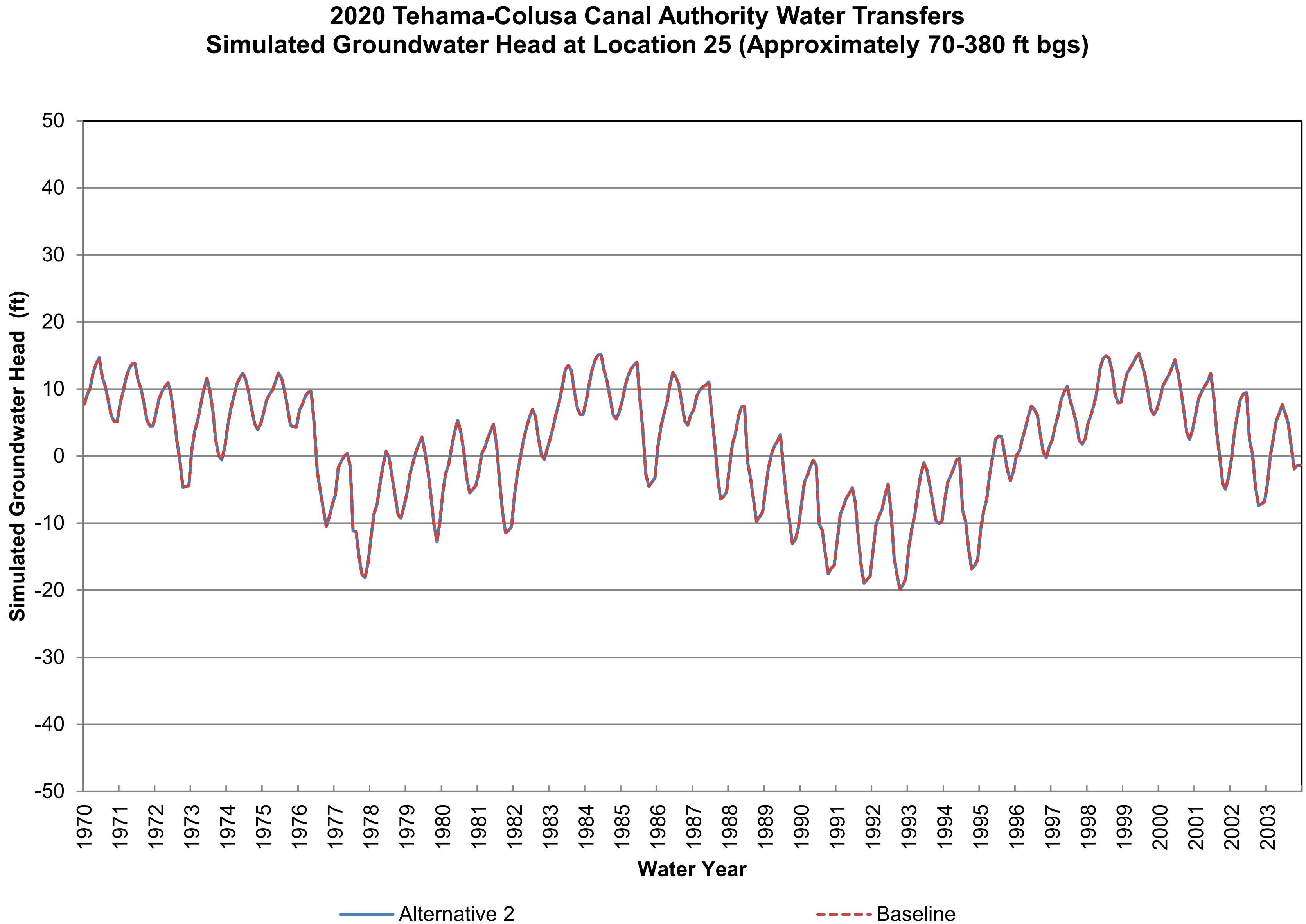
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 70-380 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
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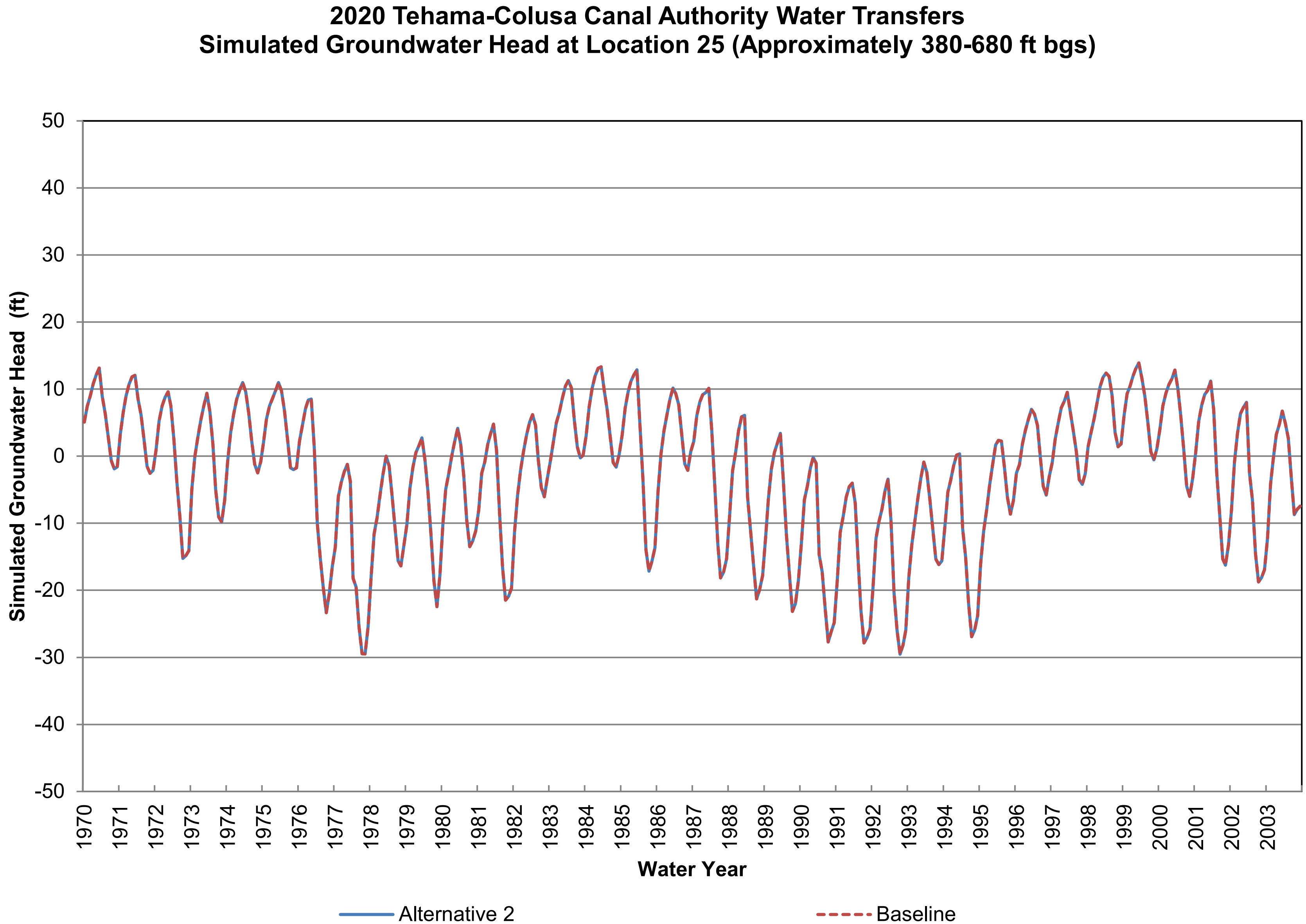
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 380-680 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
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1989
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1991
1992
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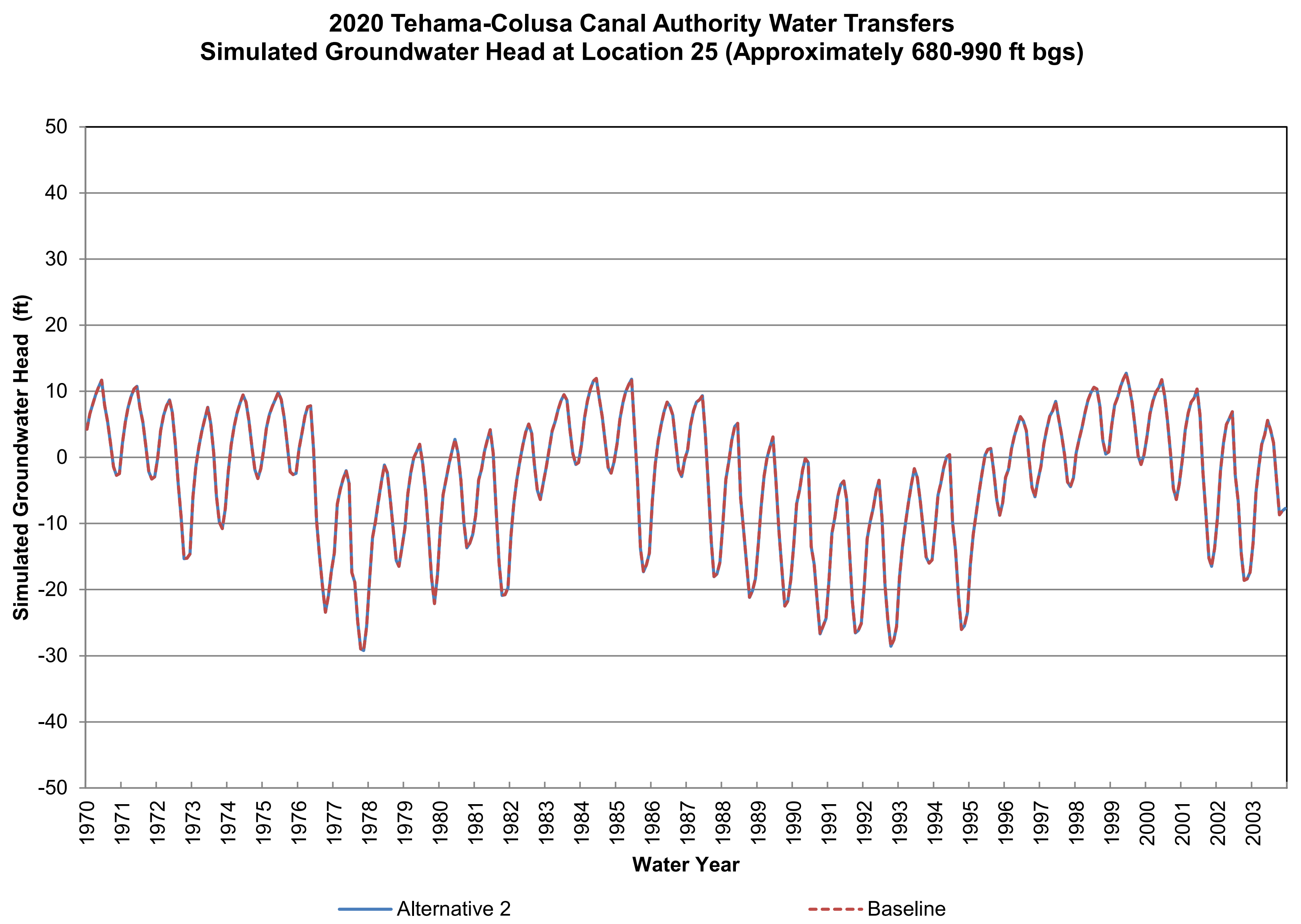
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 680-990 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
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1998
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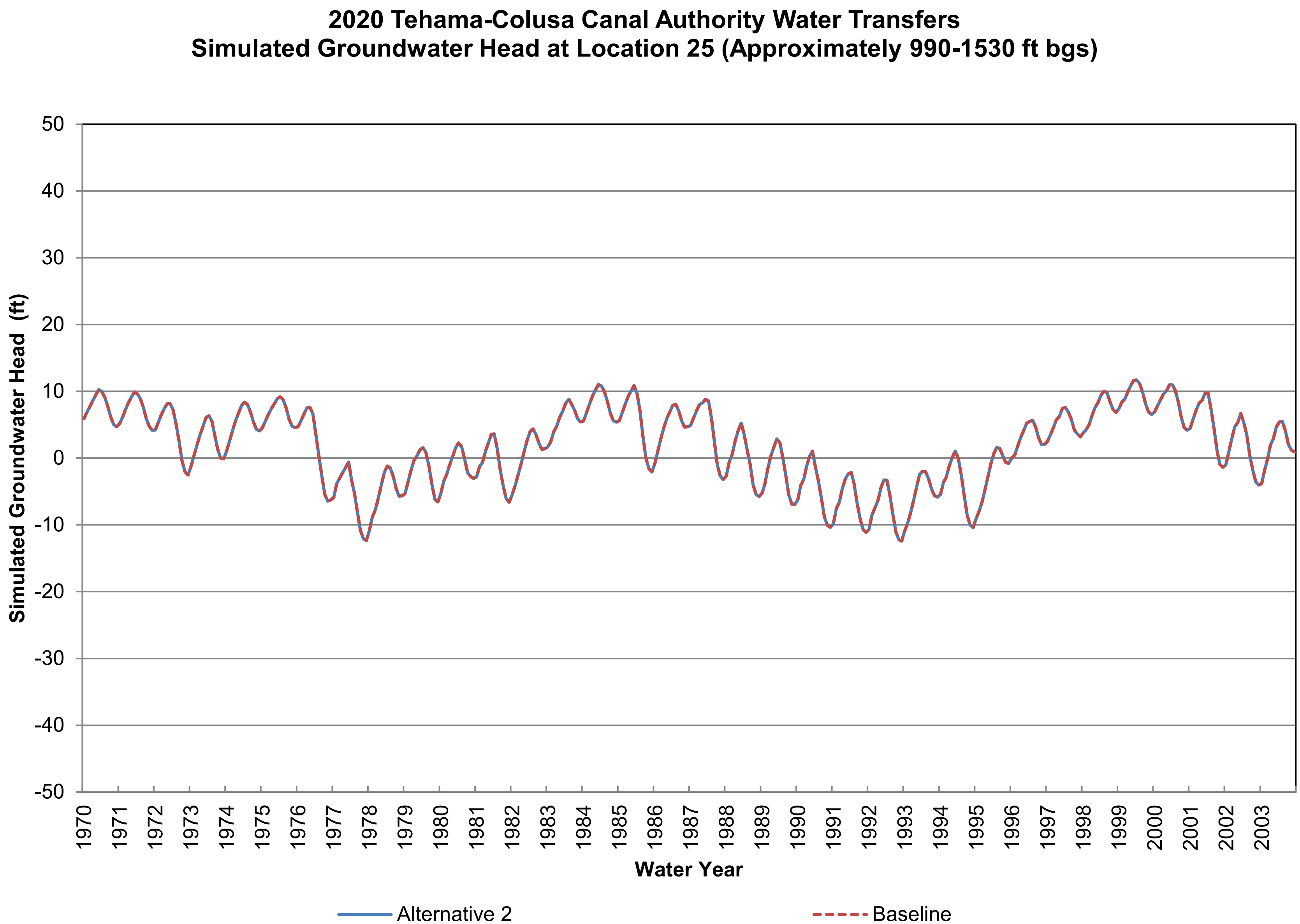
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 990-1530 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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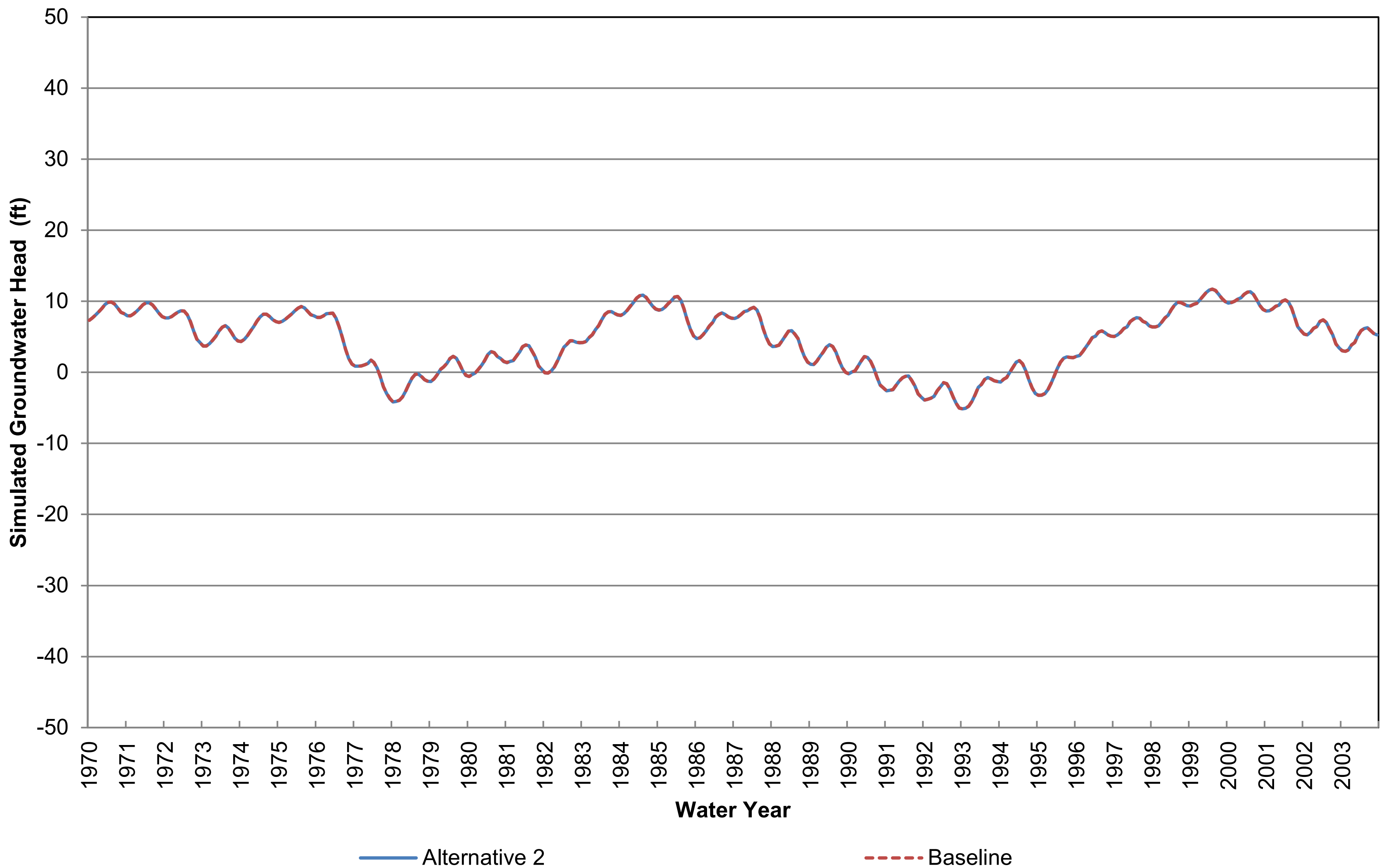
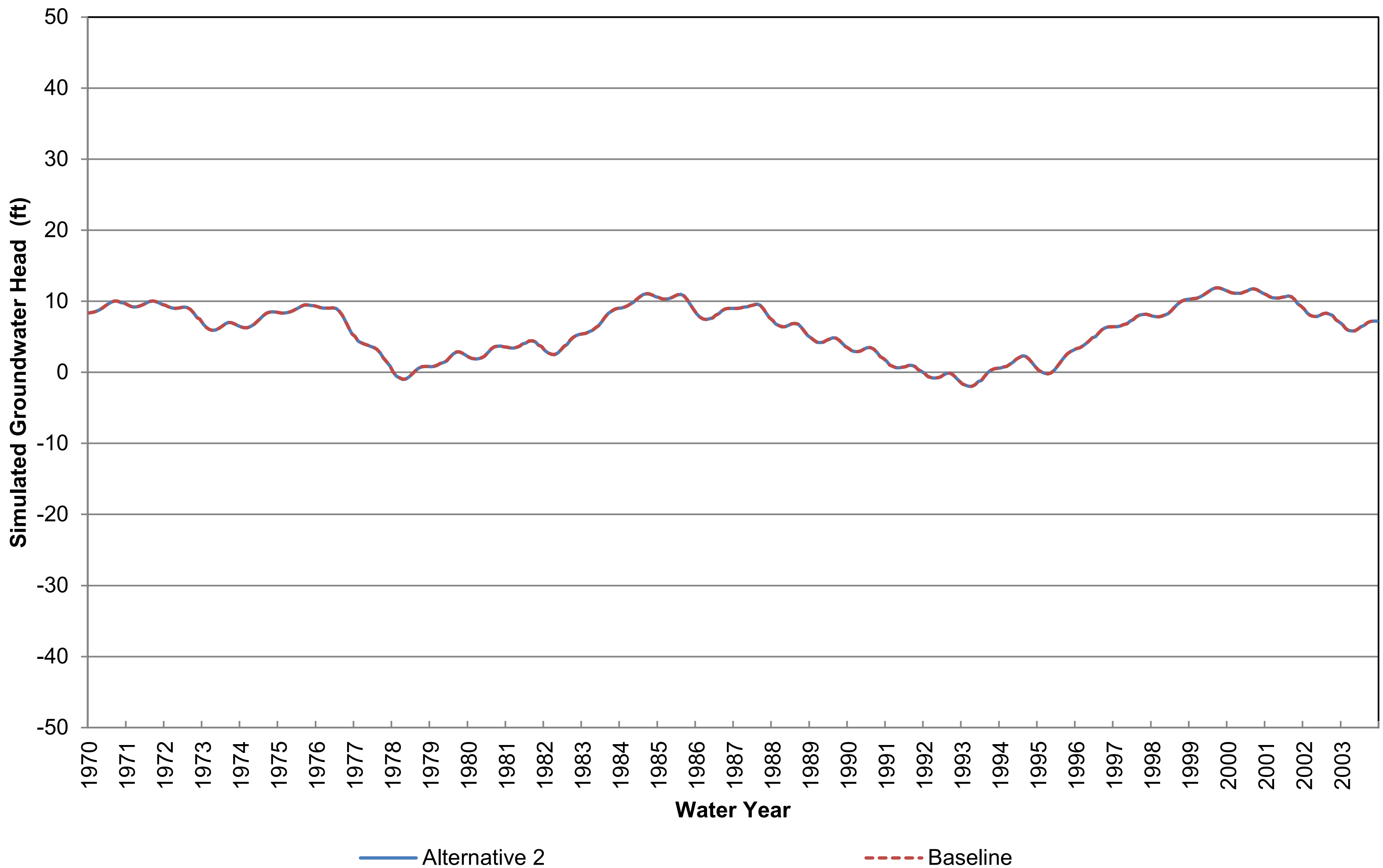
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

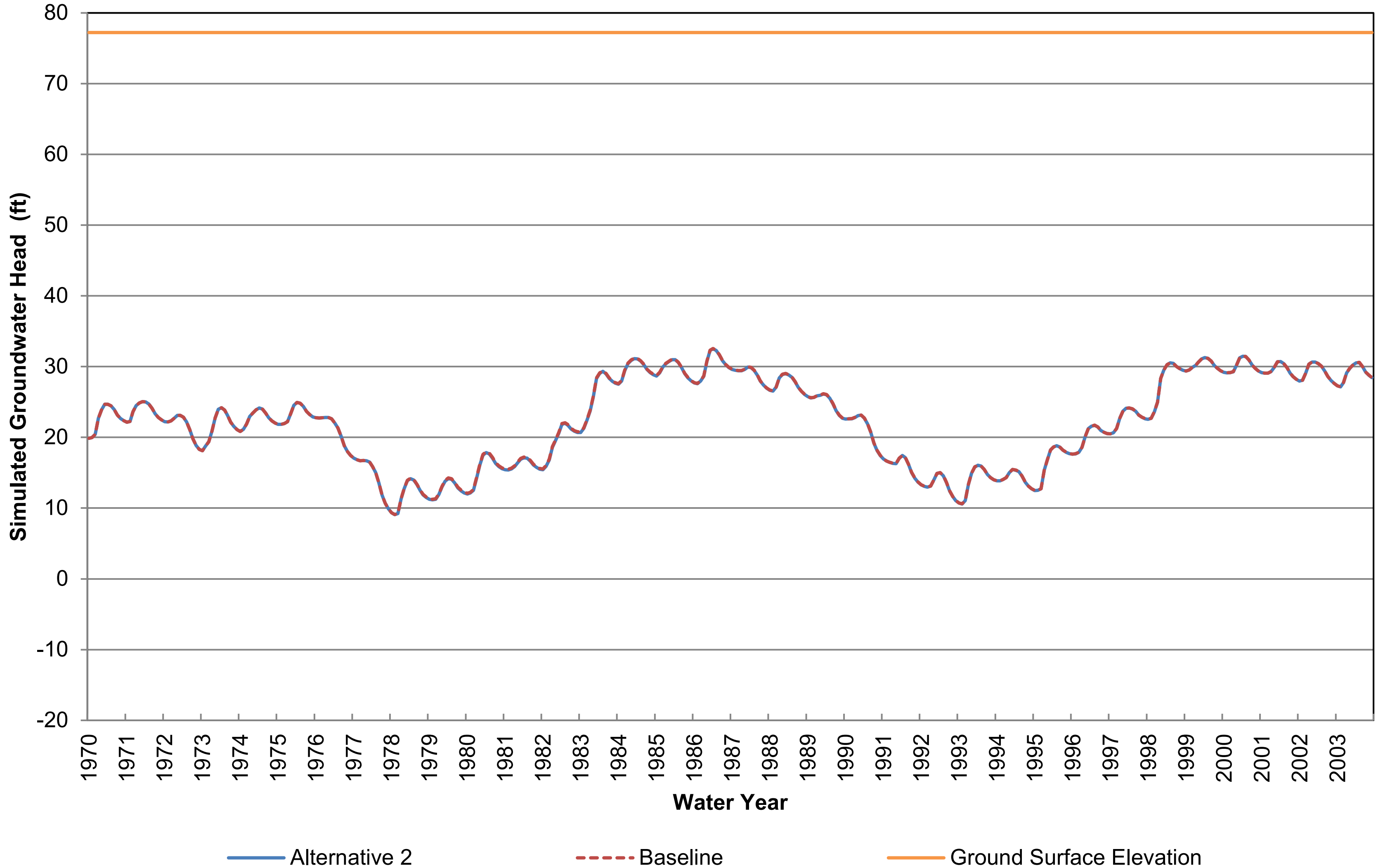
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 25 (Approximately 1530-2040 ft bgs)

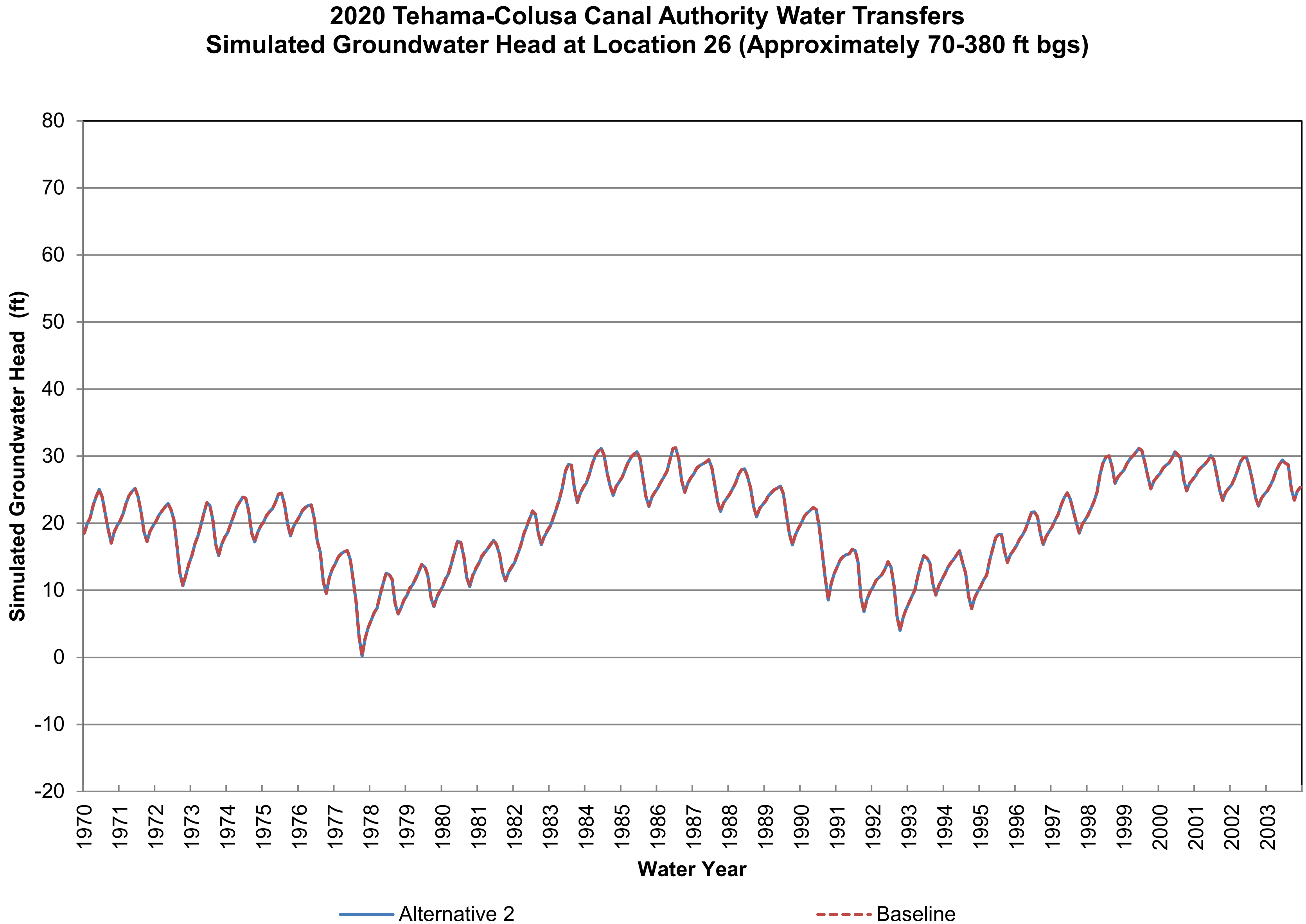


**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 25 (Approximately 2040-2800 ft bgs)**



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 26 (Approximately 0-70 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 70-380 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1987
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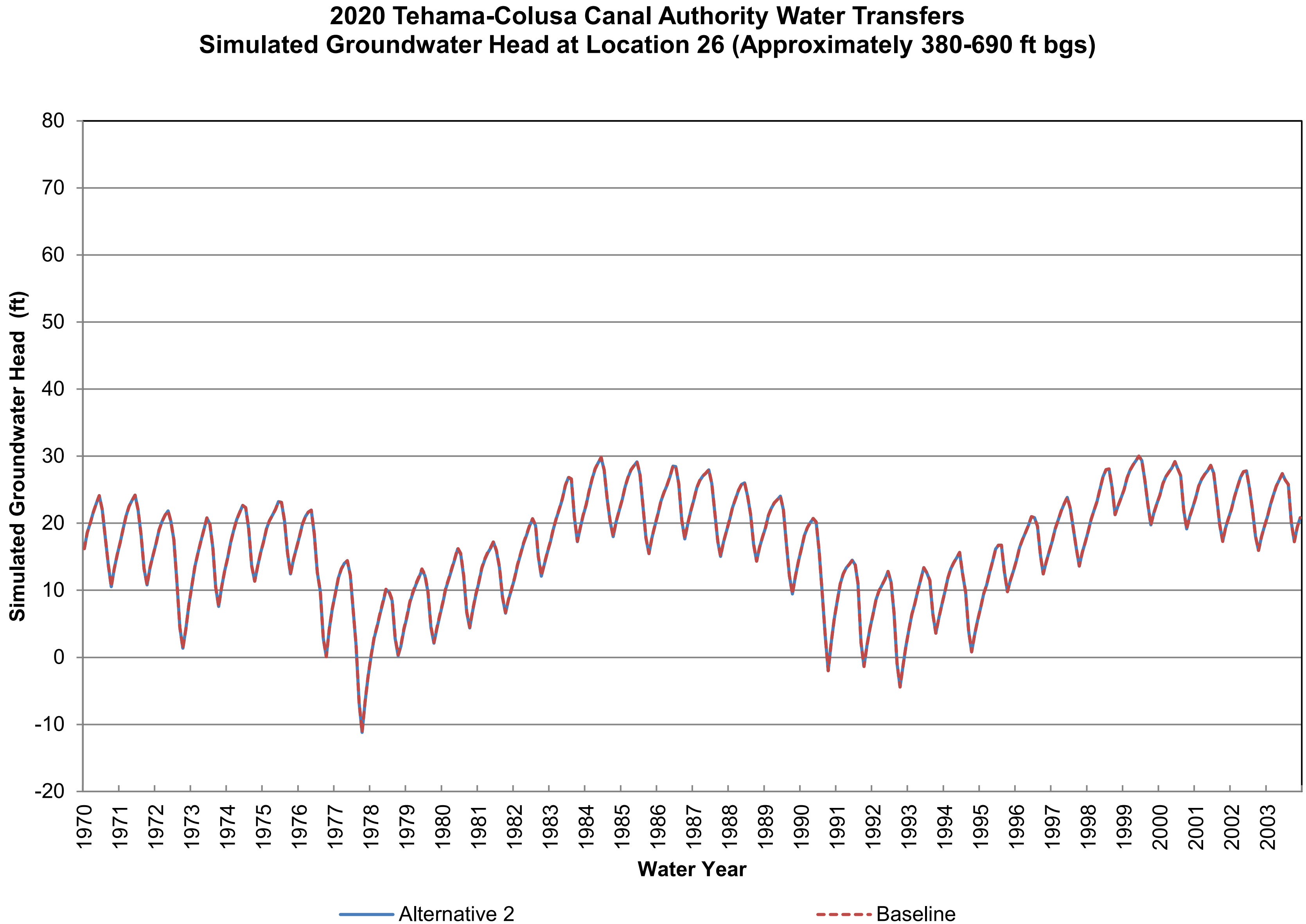
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 380-690 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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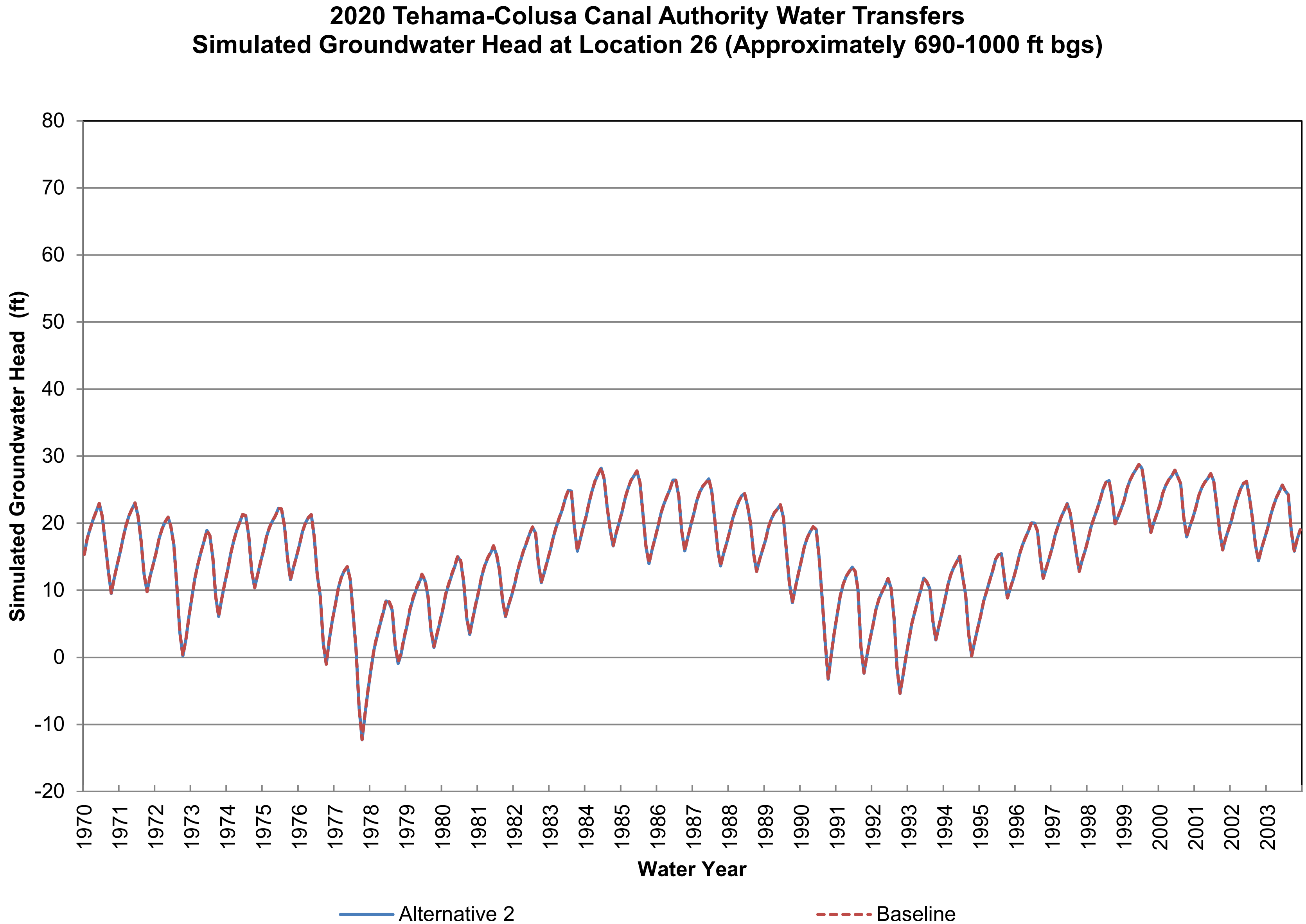
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 690-1000 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1986
1987
1988
1989
1990
1991
1992
1993
1994
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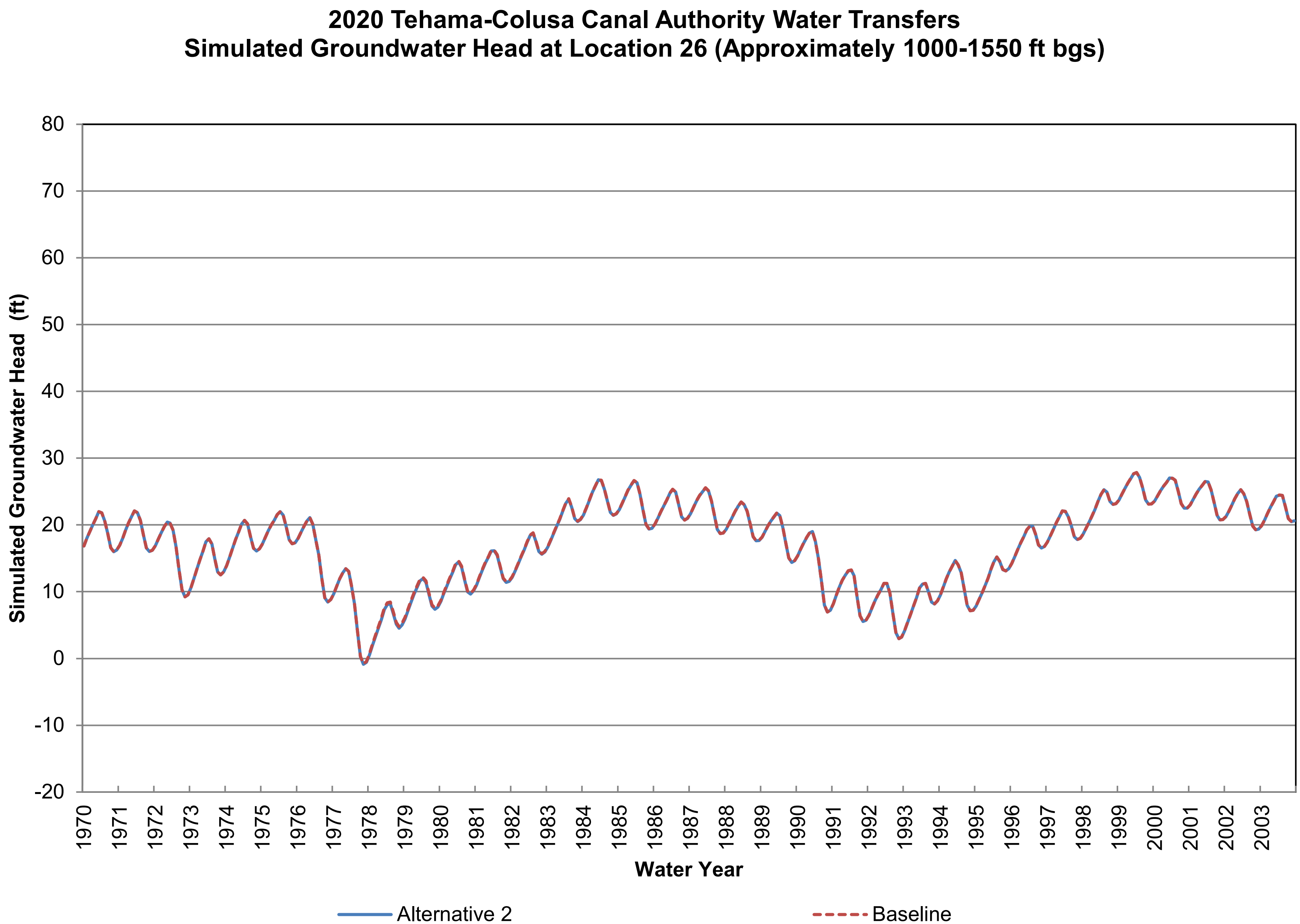
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 1000-1550 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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1988
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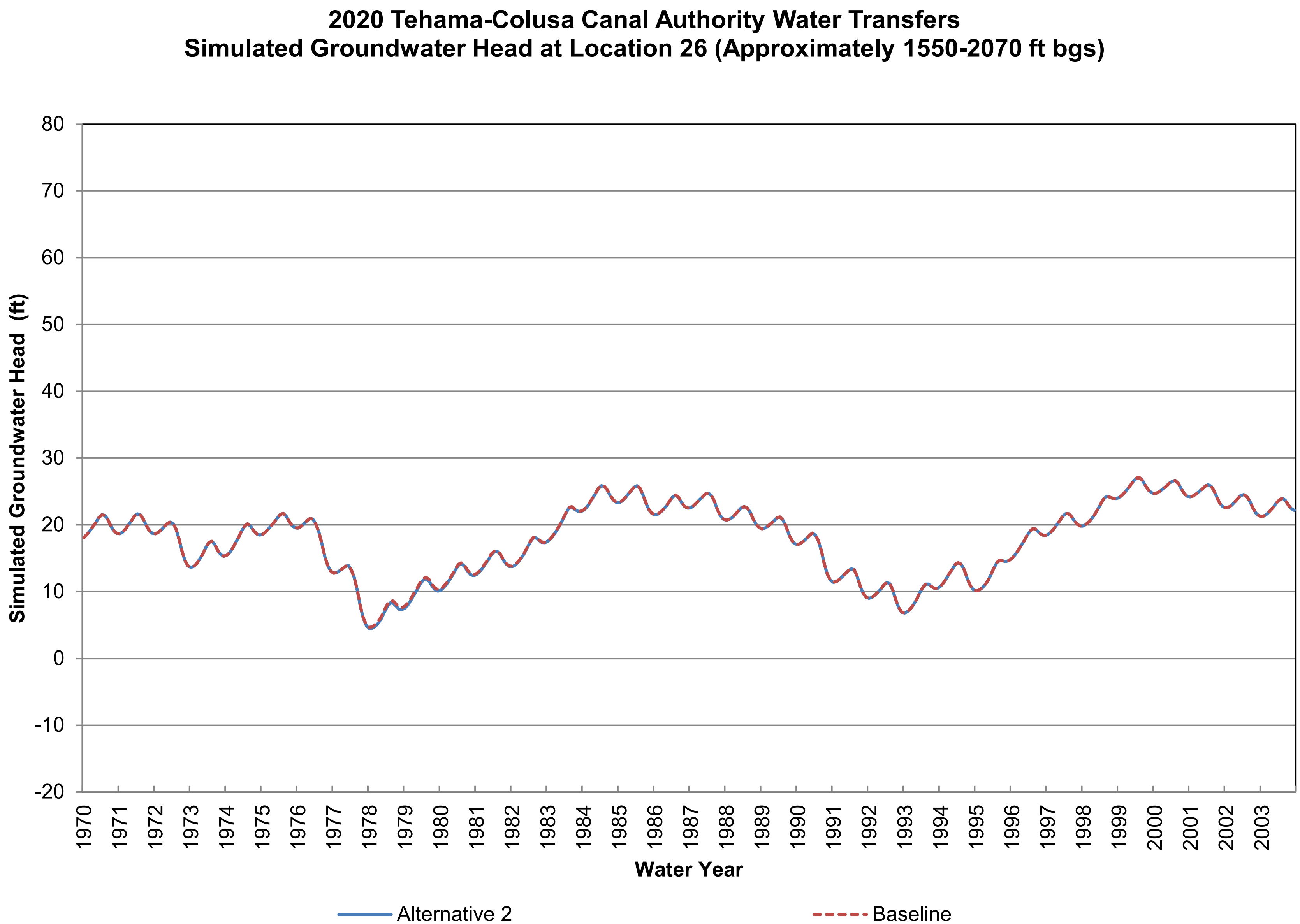
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 1550-2070 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
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1991
1992
1993
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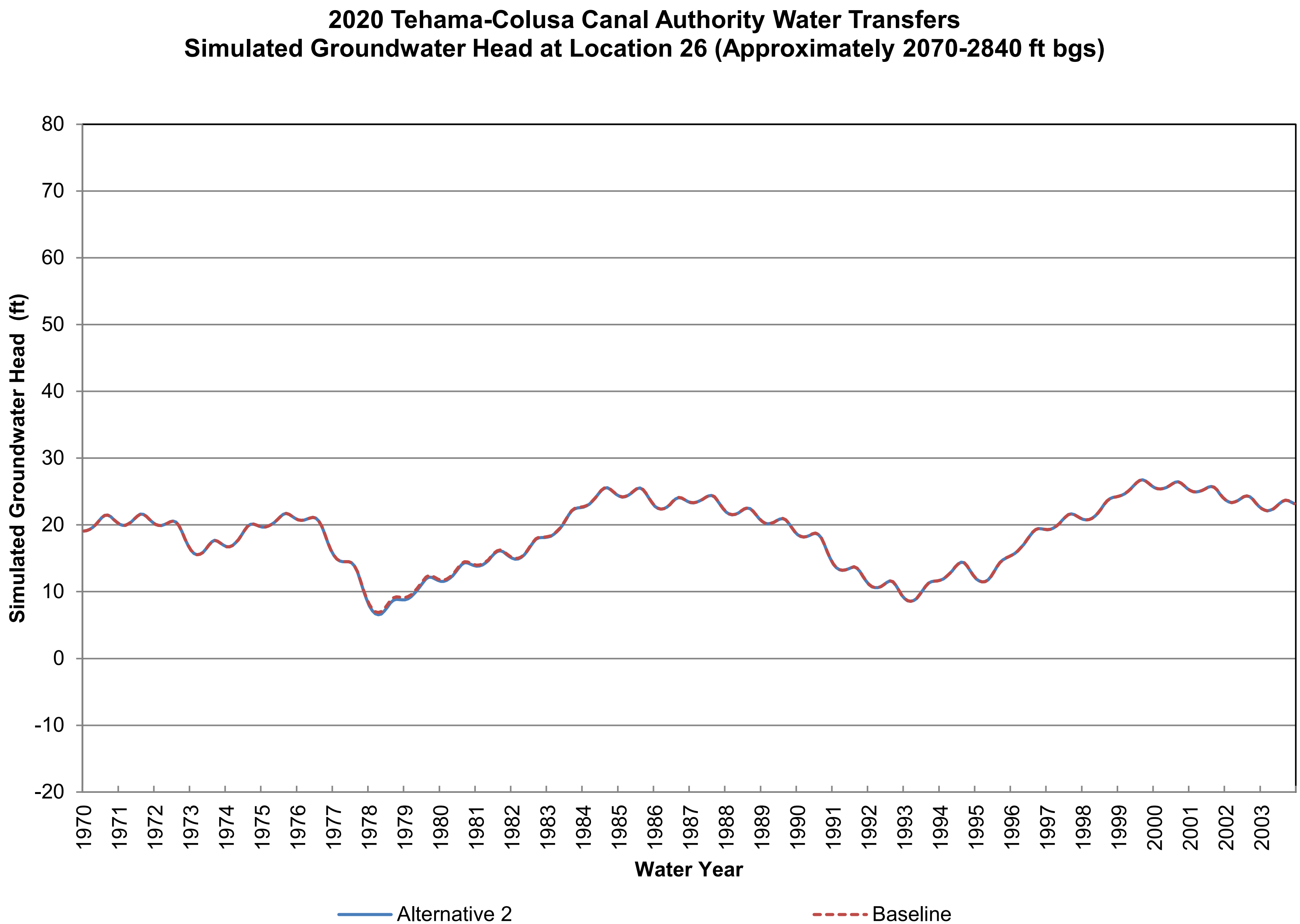
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 2070-2840 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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1985
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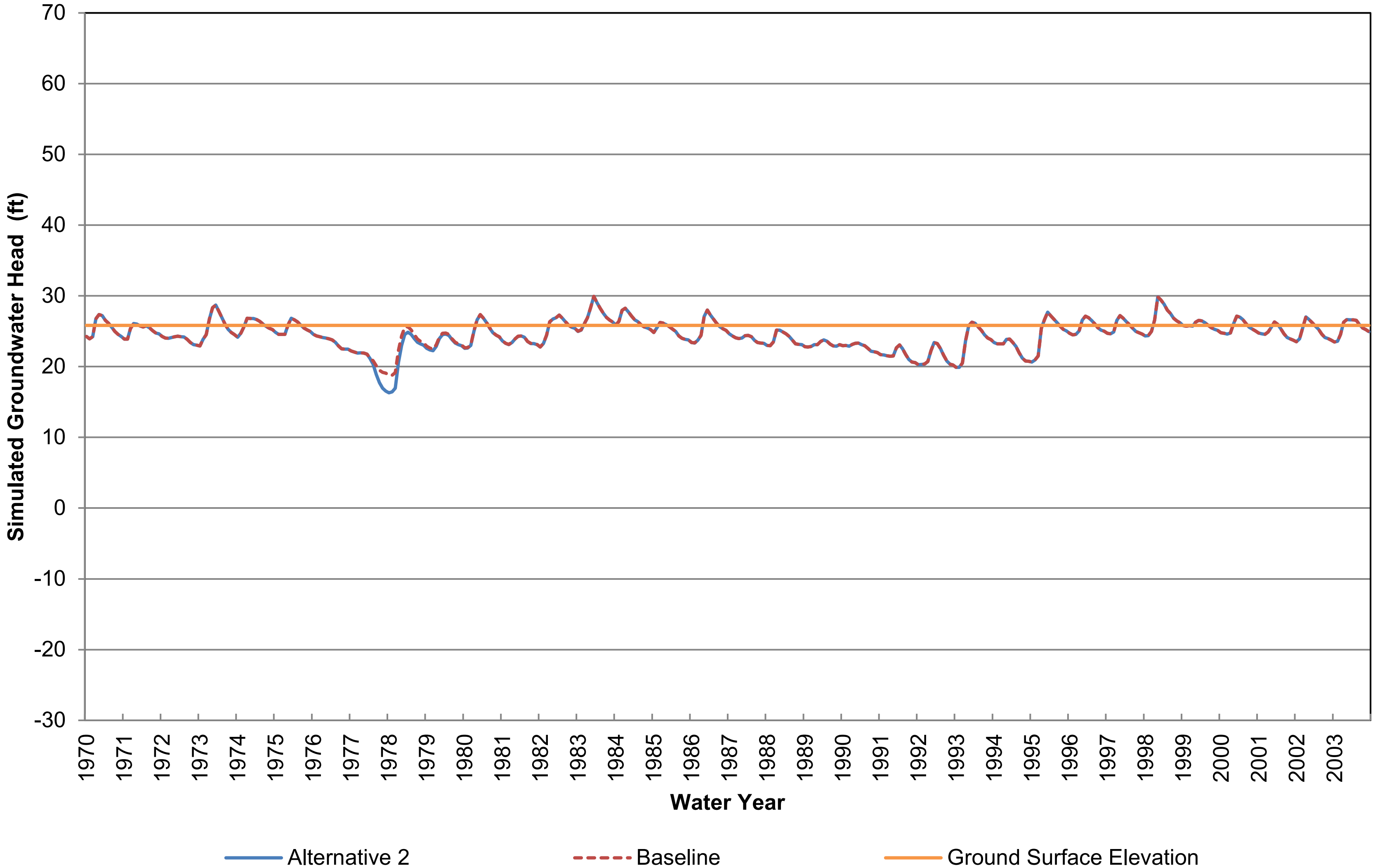
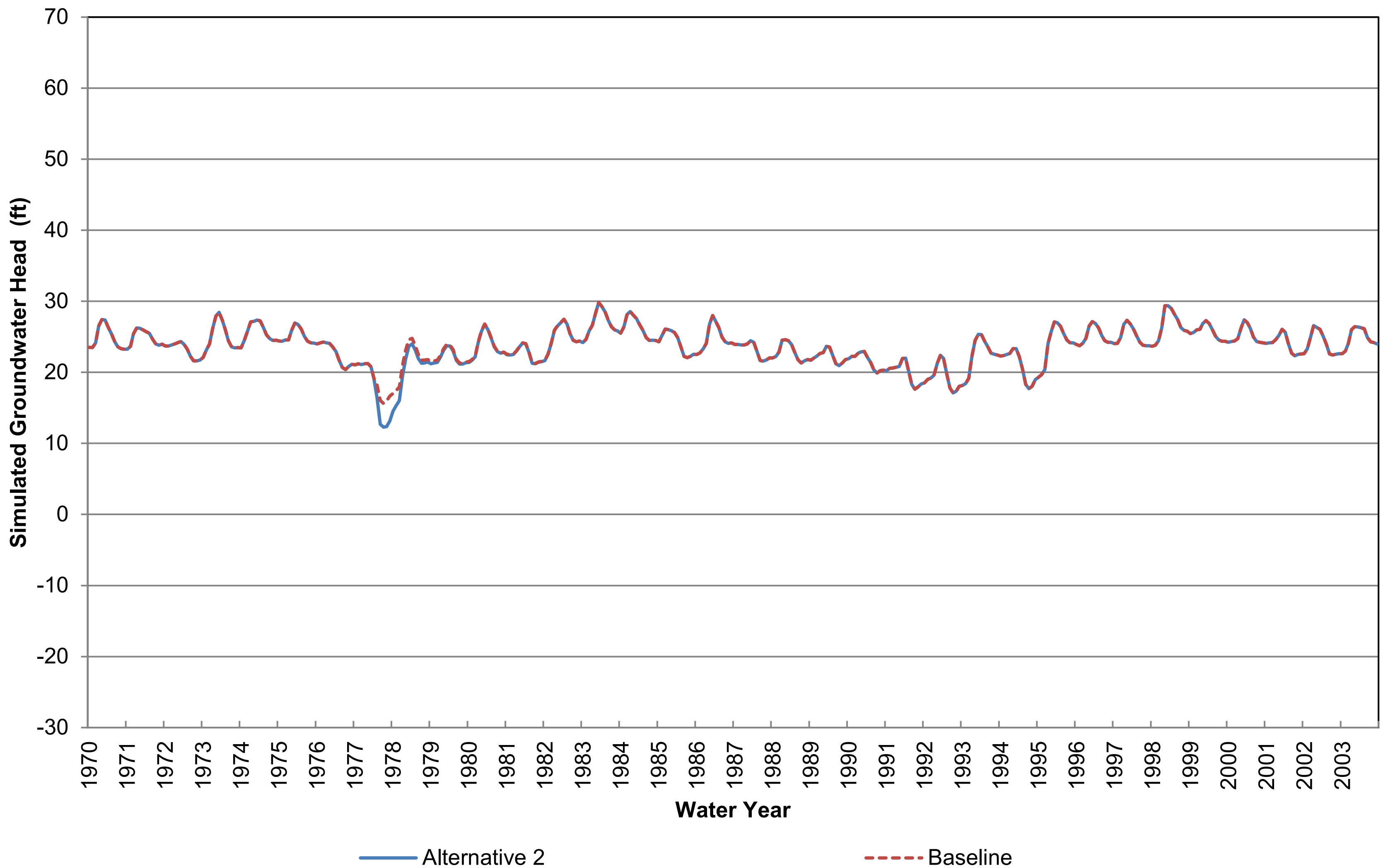
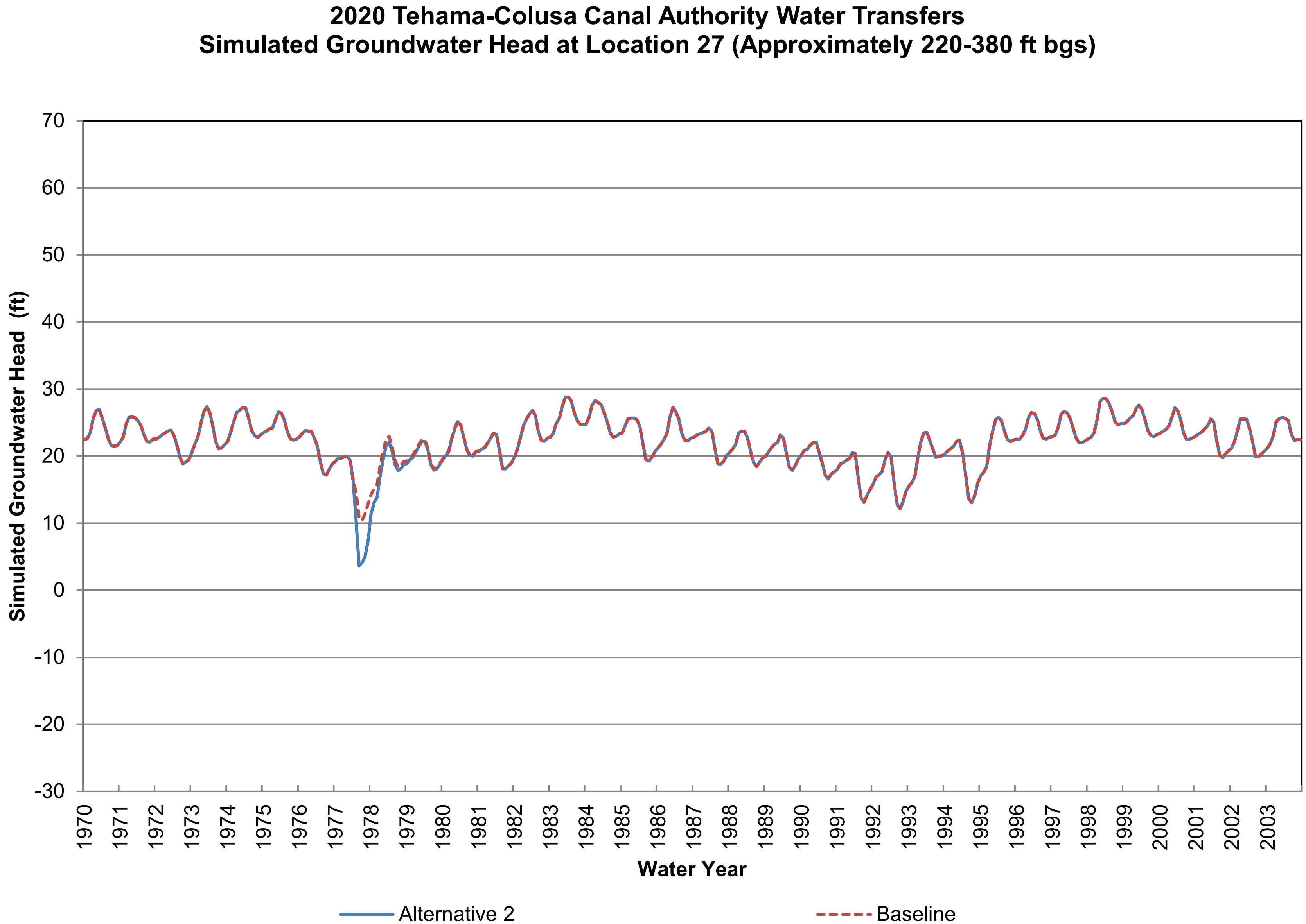
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Elevation at Location 27 (Approximately 0-70 ft bgs)**



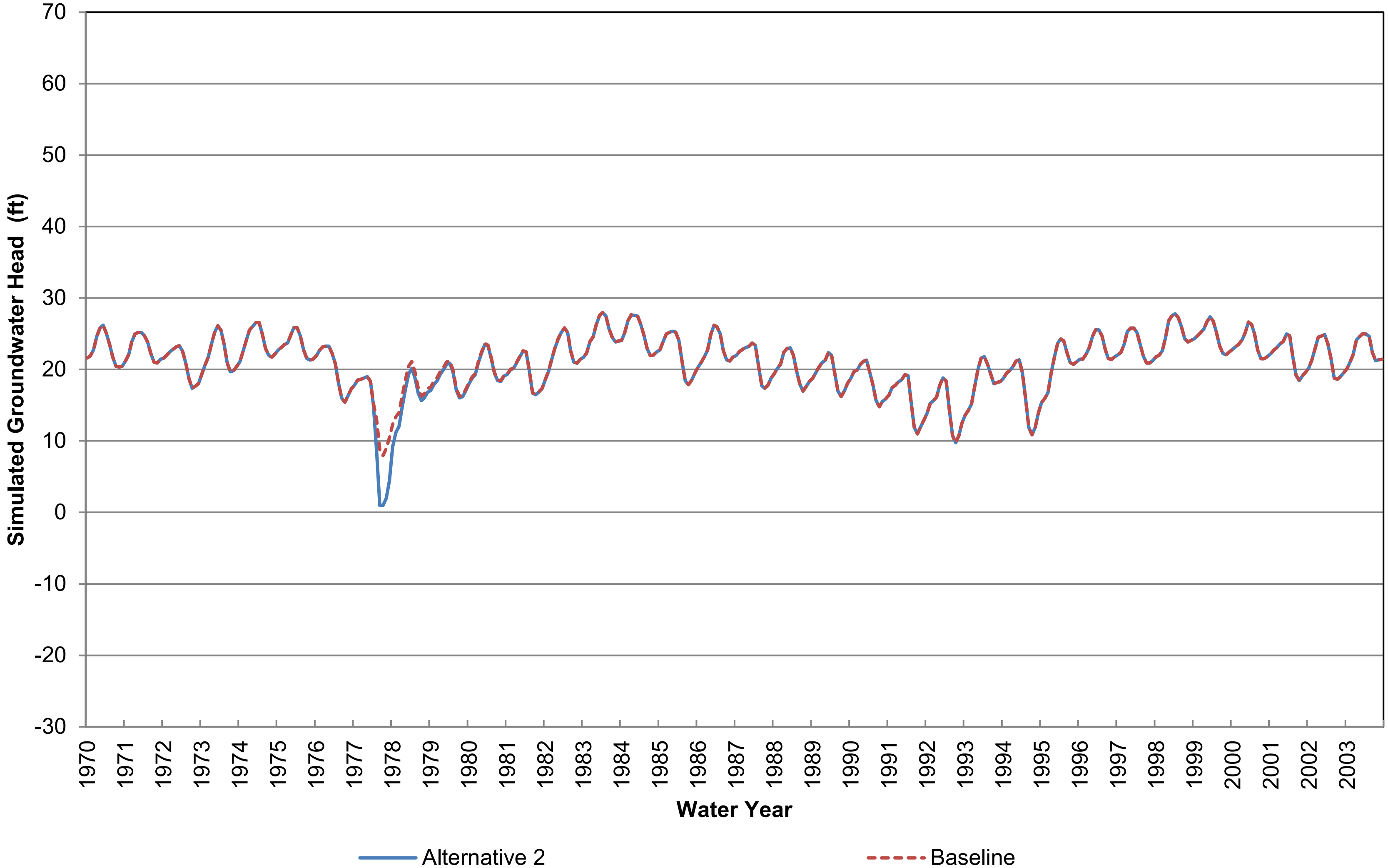
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 27 (Approximately 70-220 ft bgs)



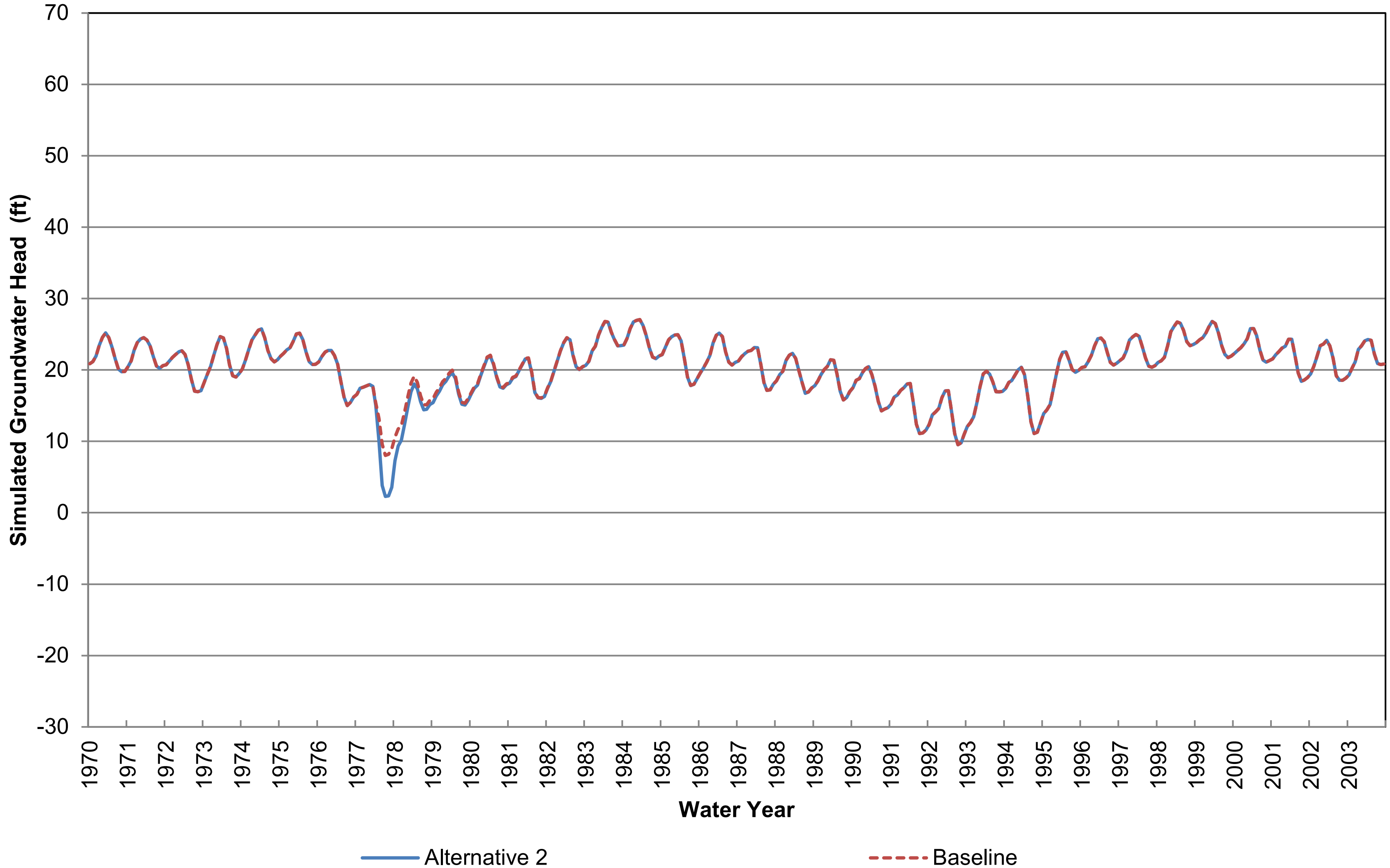


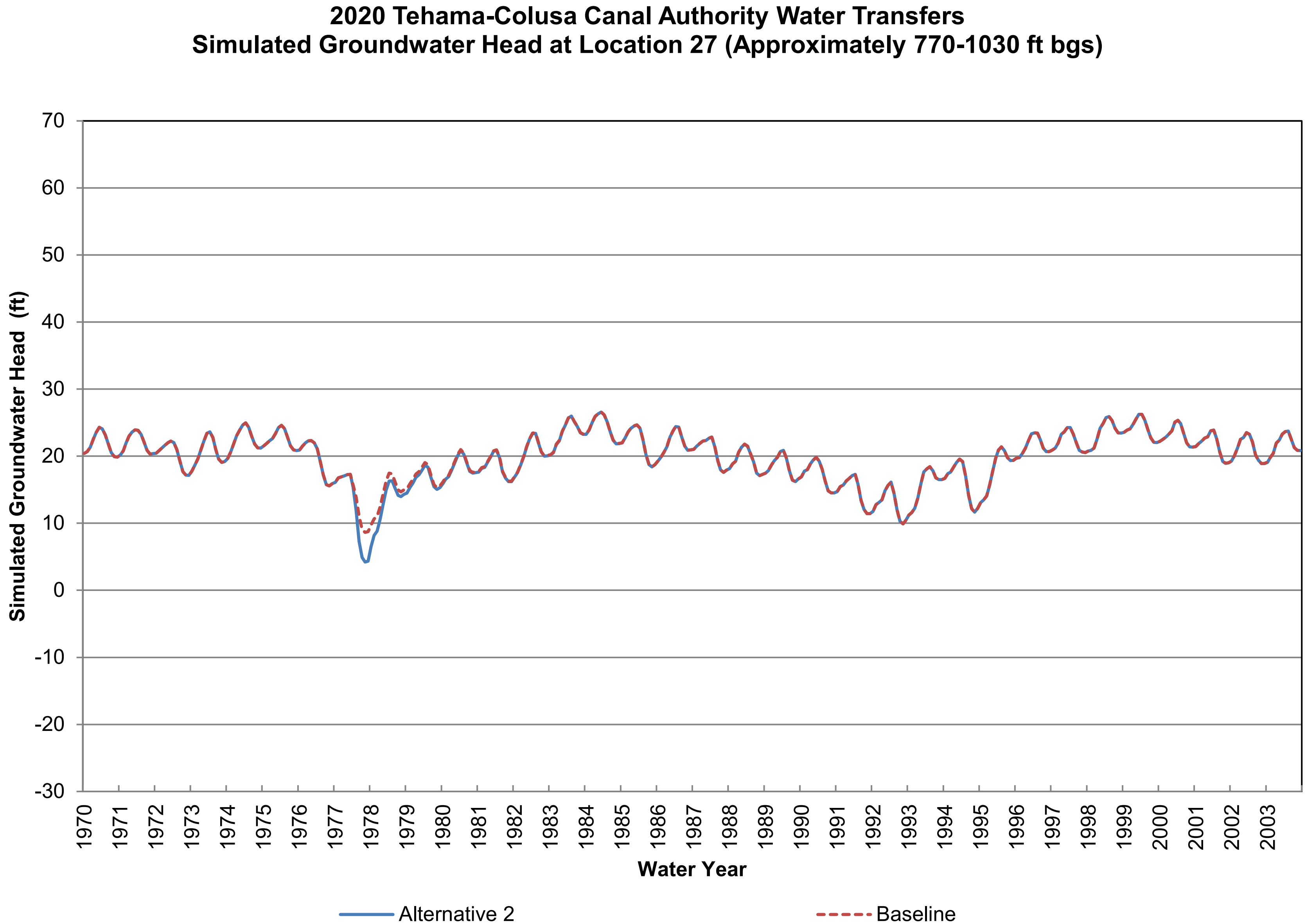
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 220-380 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 27 (Approximately 380-530 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 27 (Approximately 530-770 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 770-1030 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
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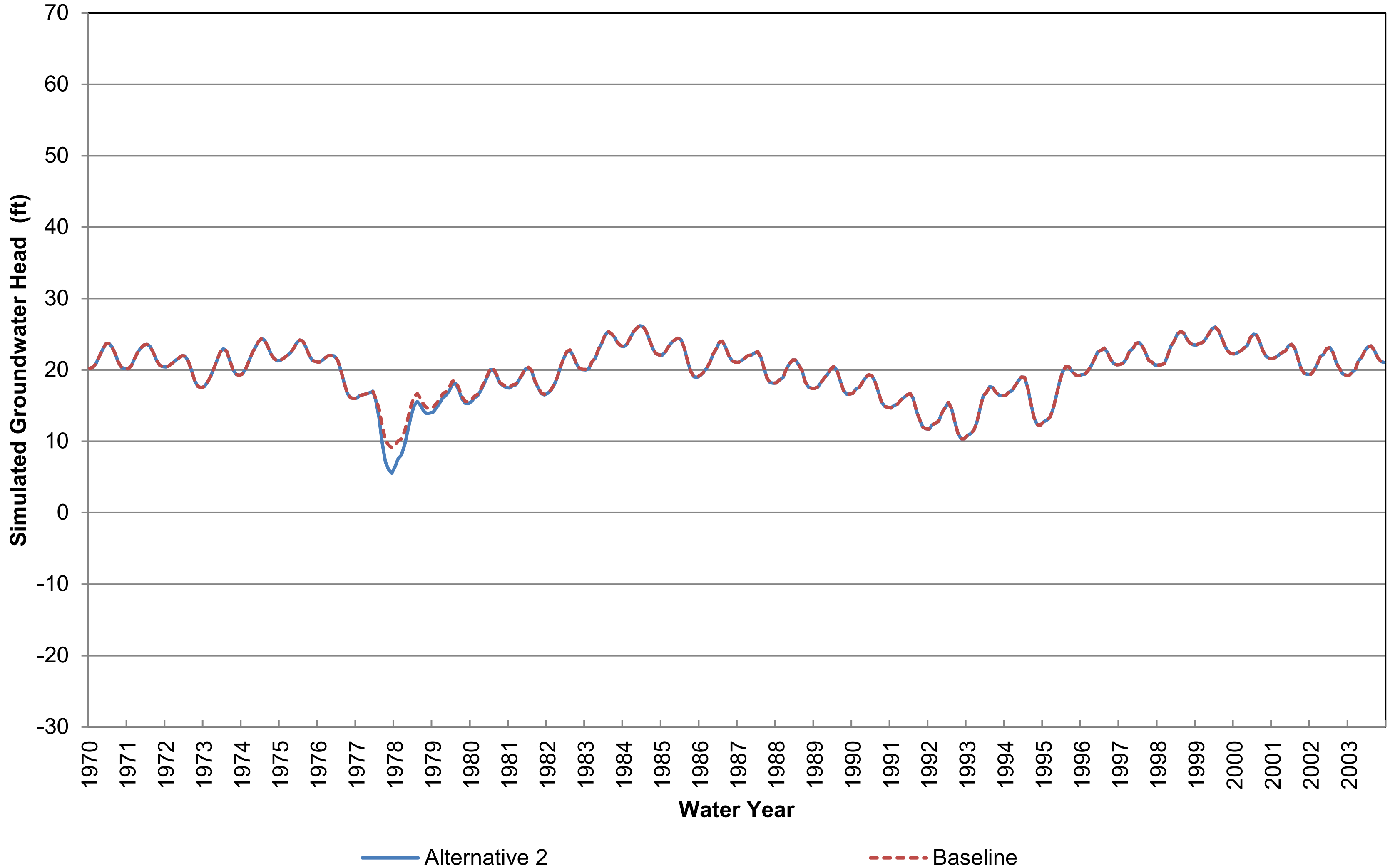
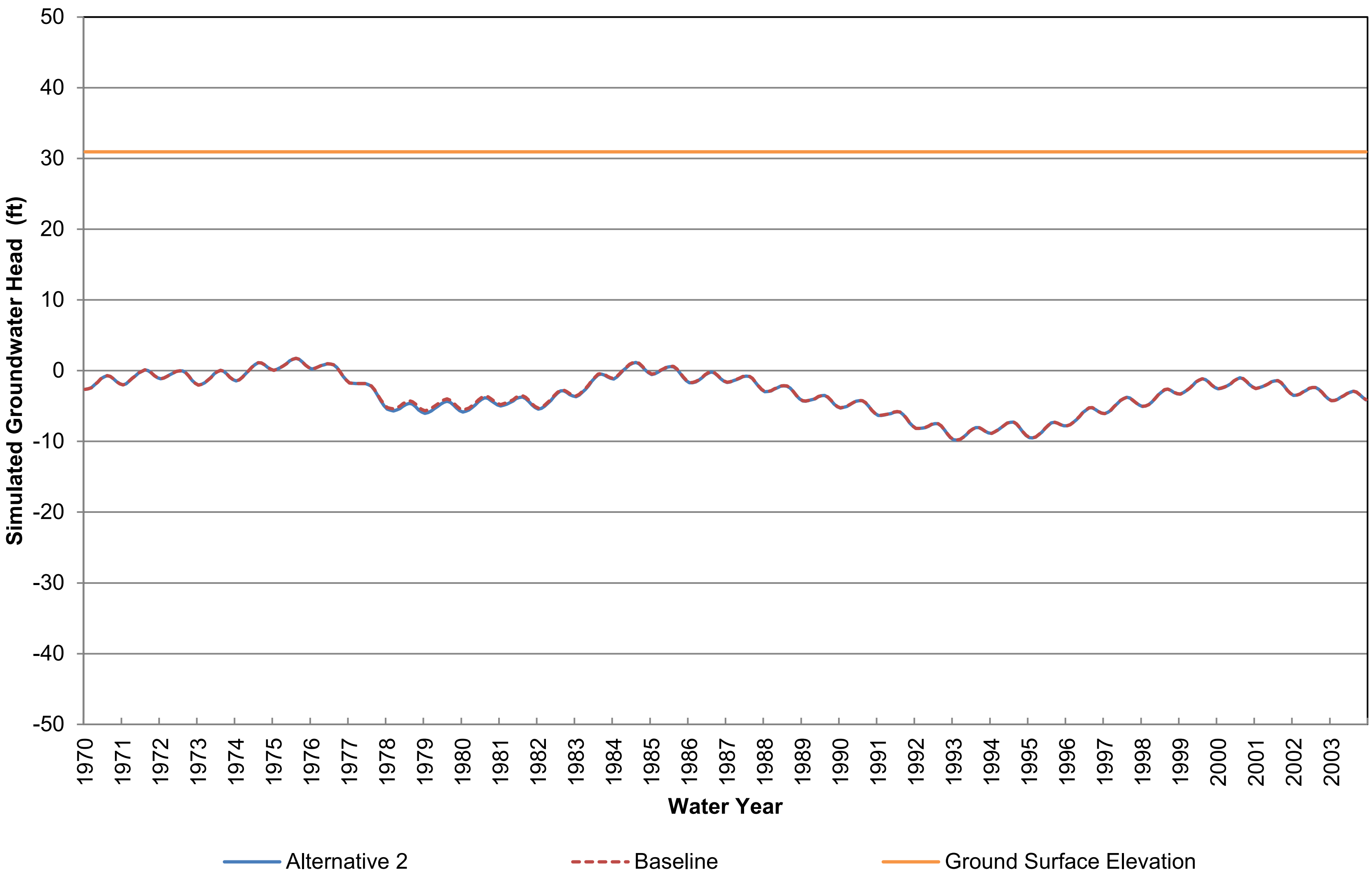
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

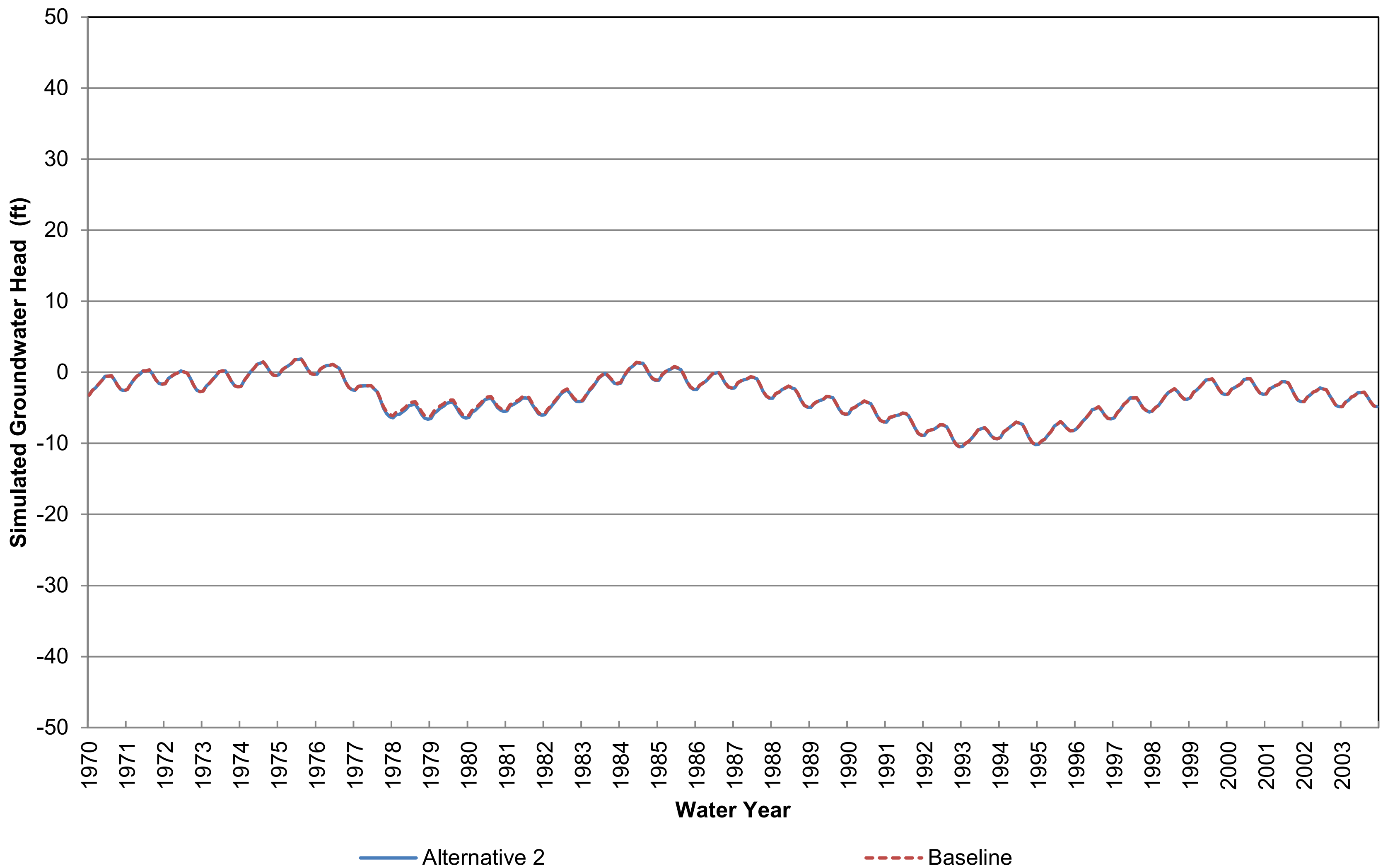
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 1030-1410 ft bgs)



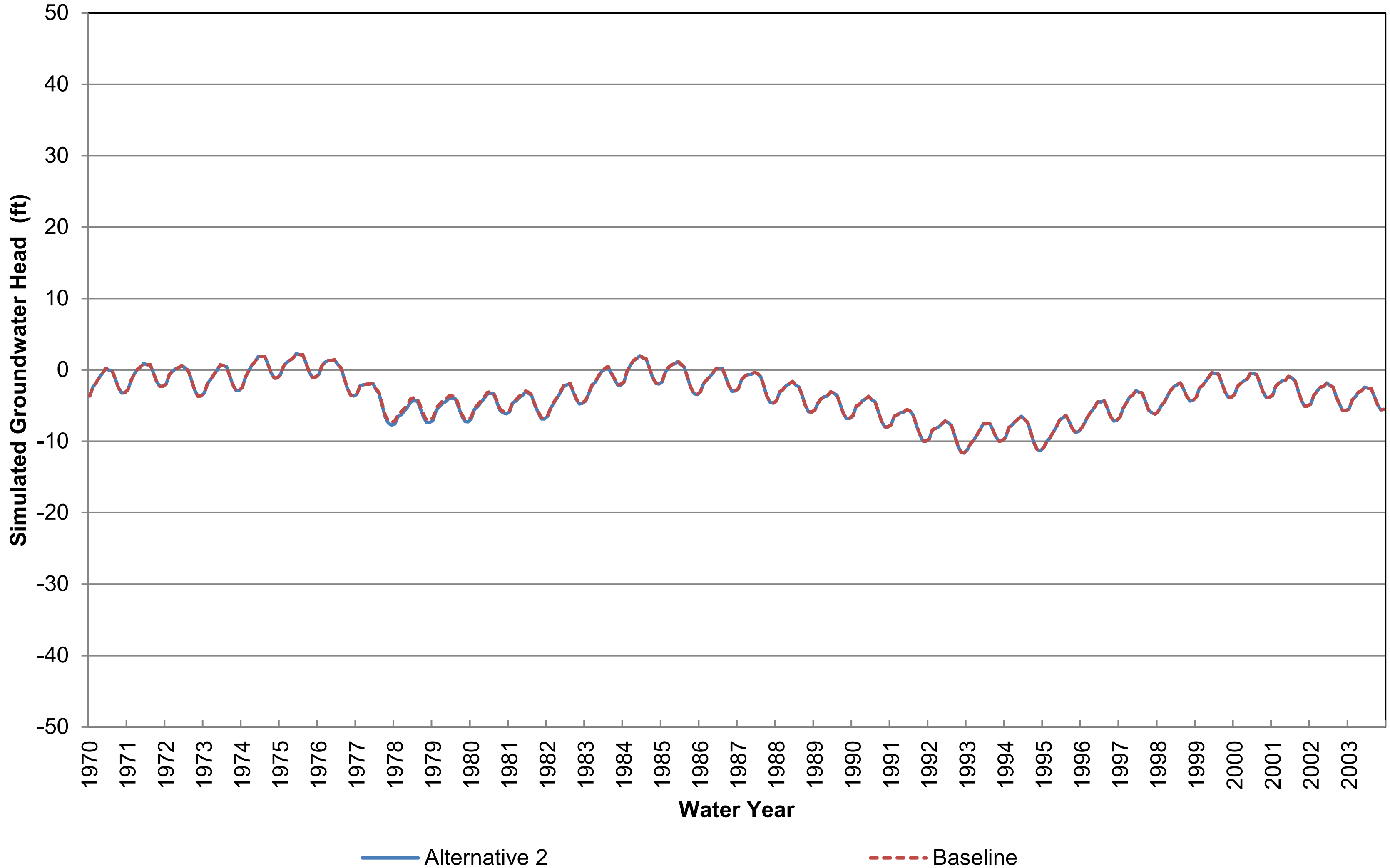
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 28 (Approximately 0-70 ft bgs)

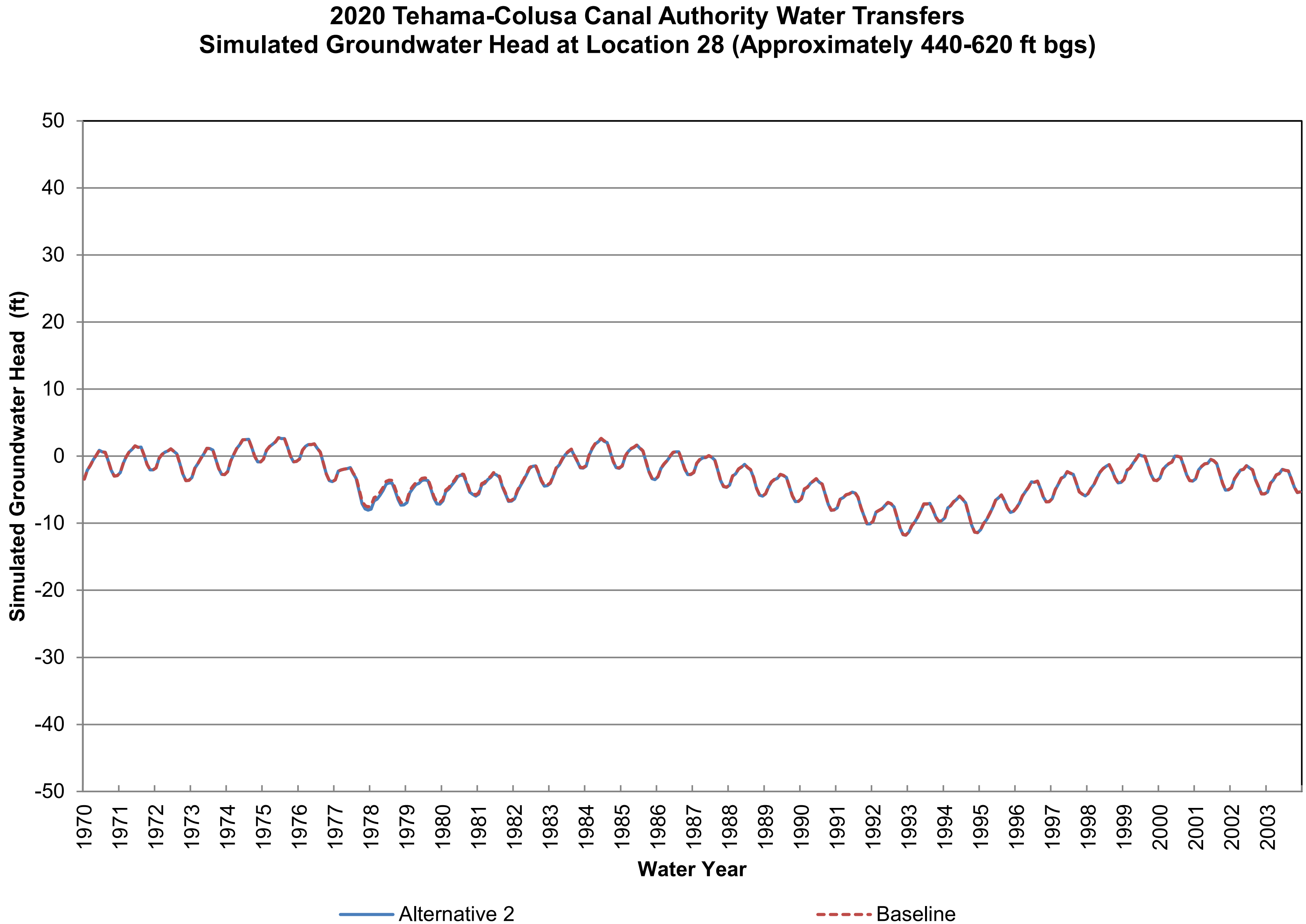


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 28 (Approximately 70-250 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 28 (Approximately 250-440 ft bgs)





2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 440-620 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
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1989
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1992
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1994
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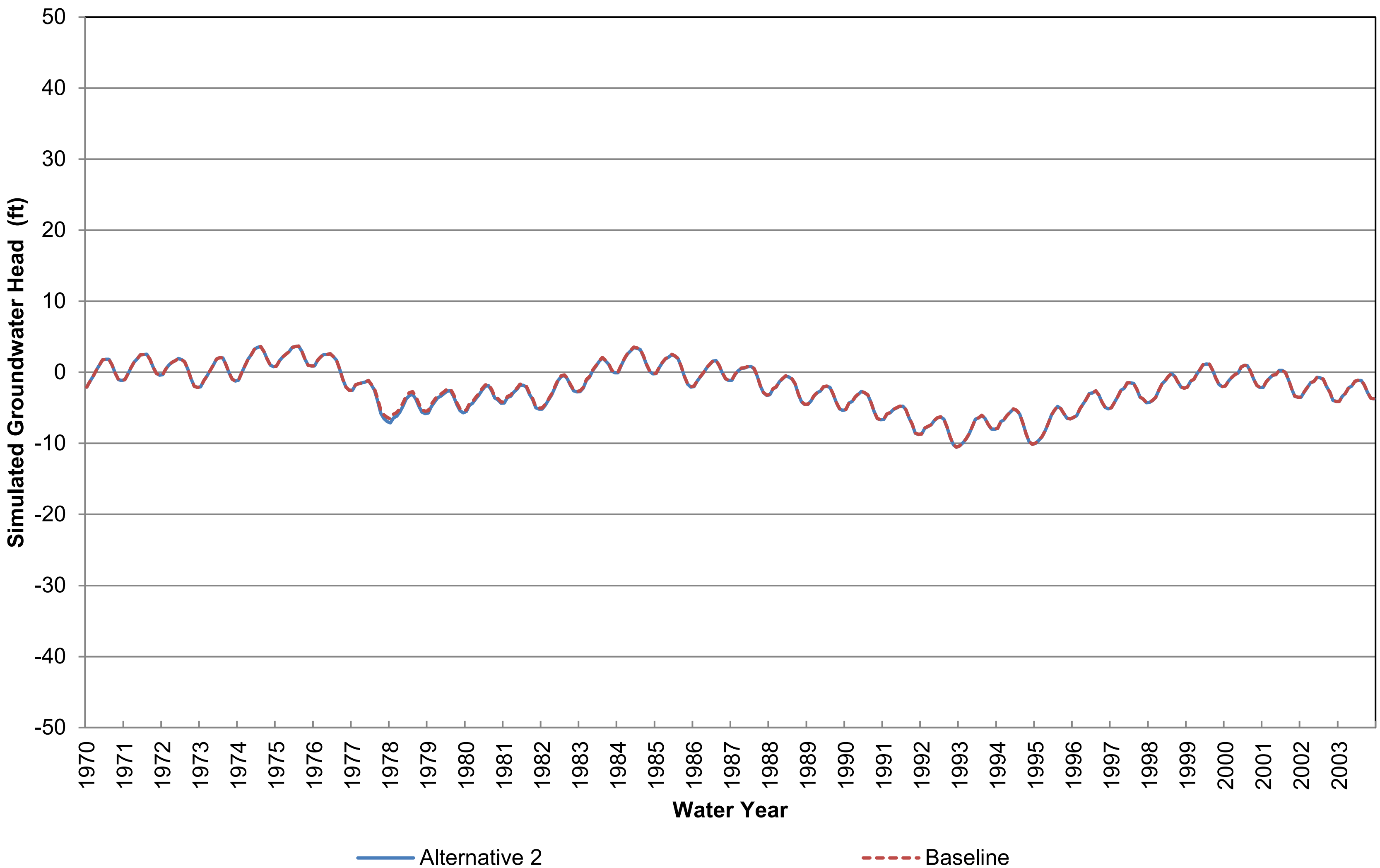
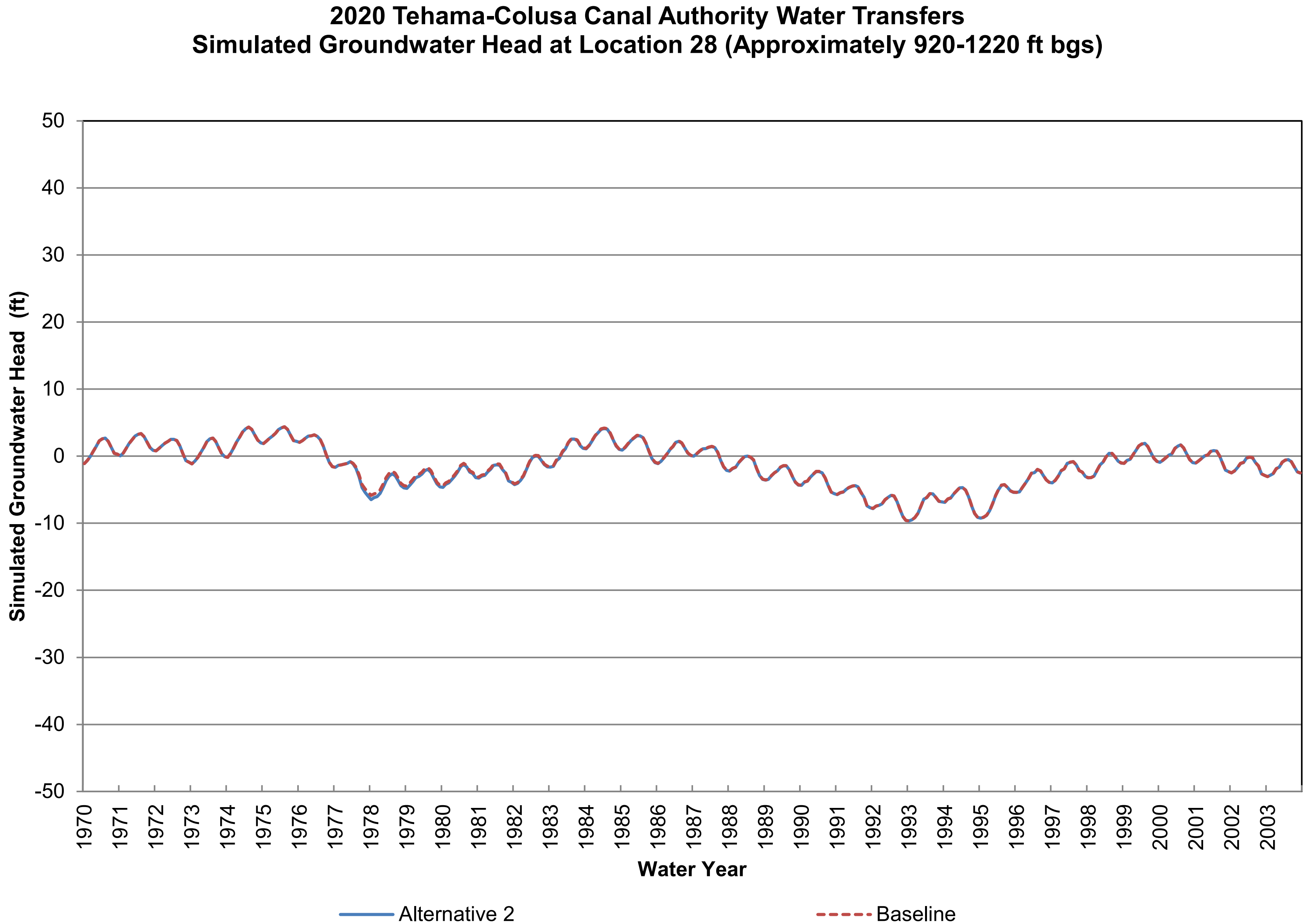
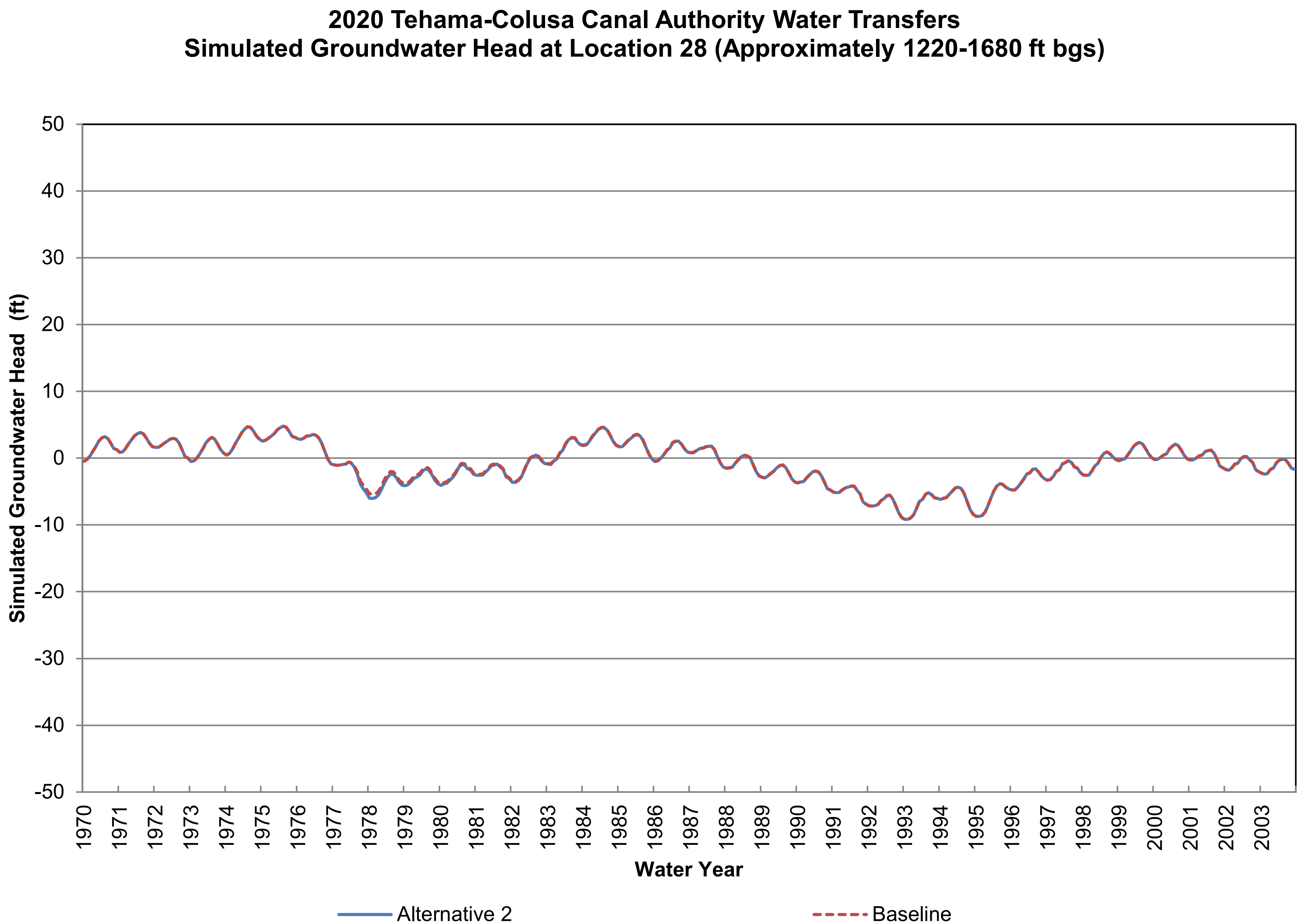
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 28 (Approximately 620-920 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 920-1220 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 1220-1680 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1983
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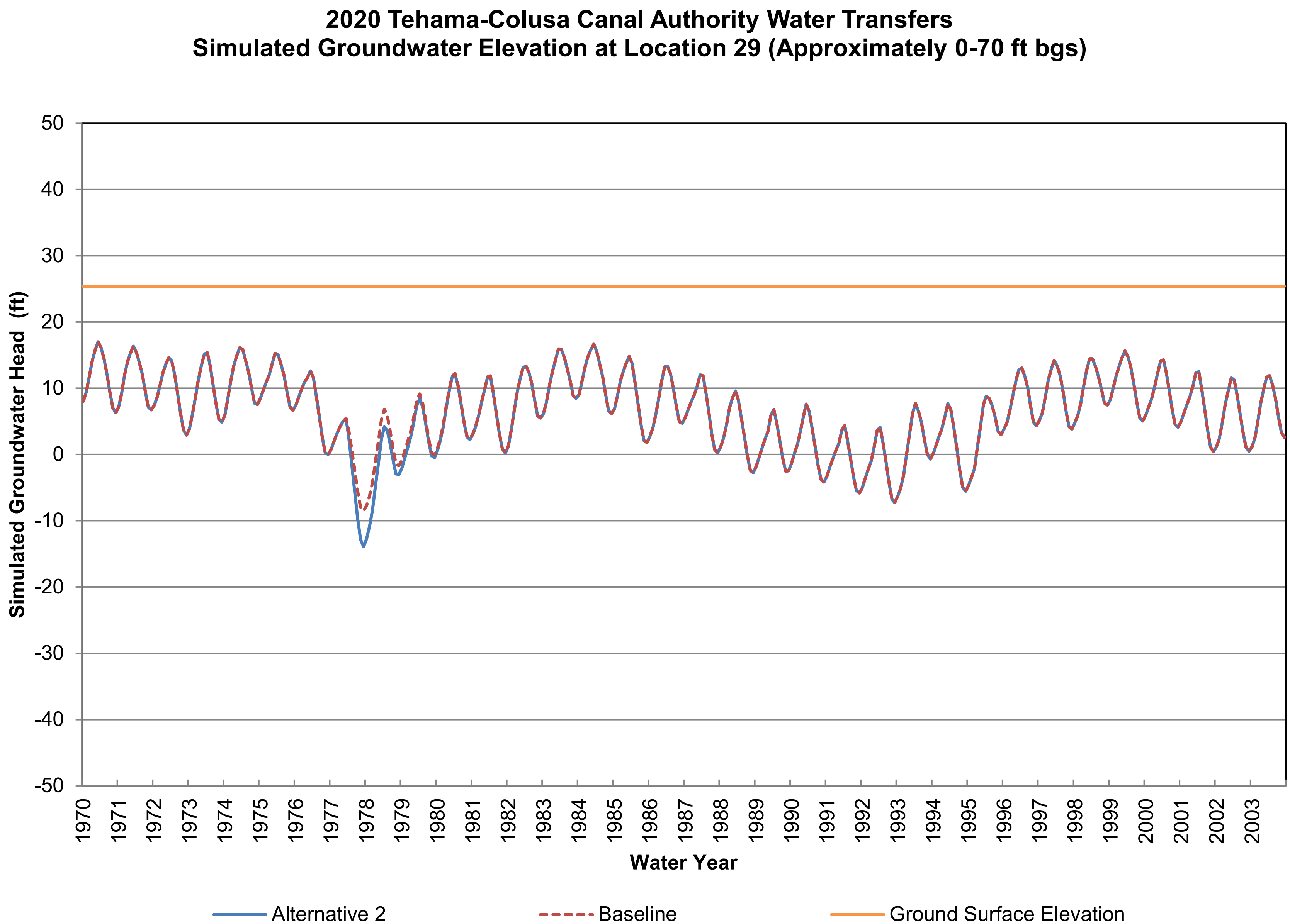
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 29 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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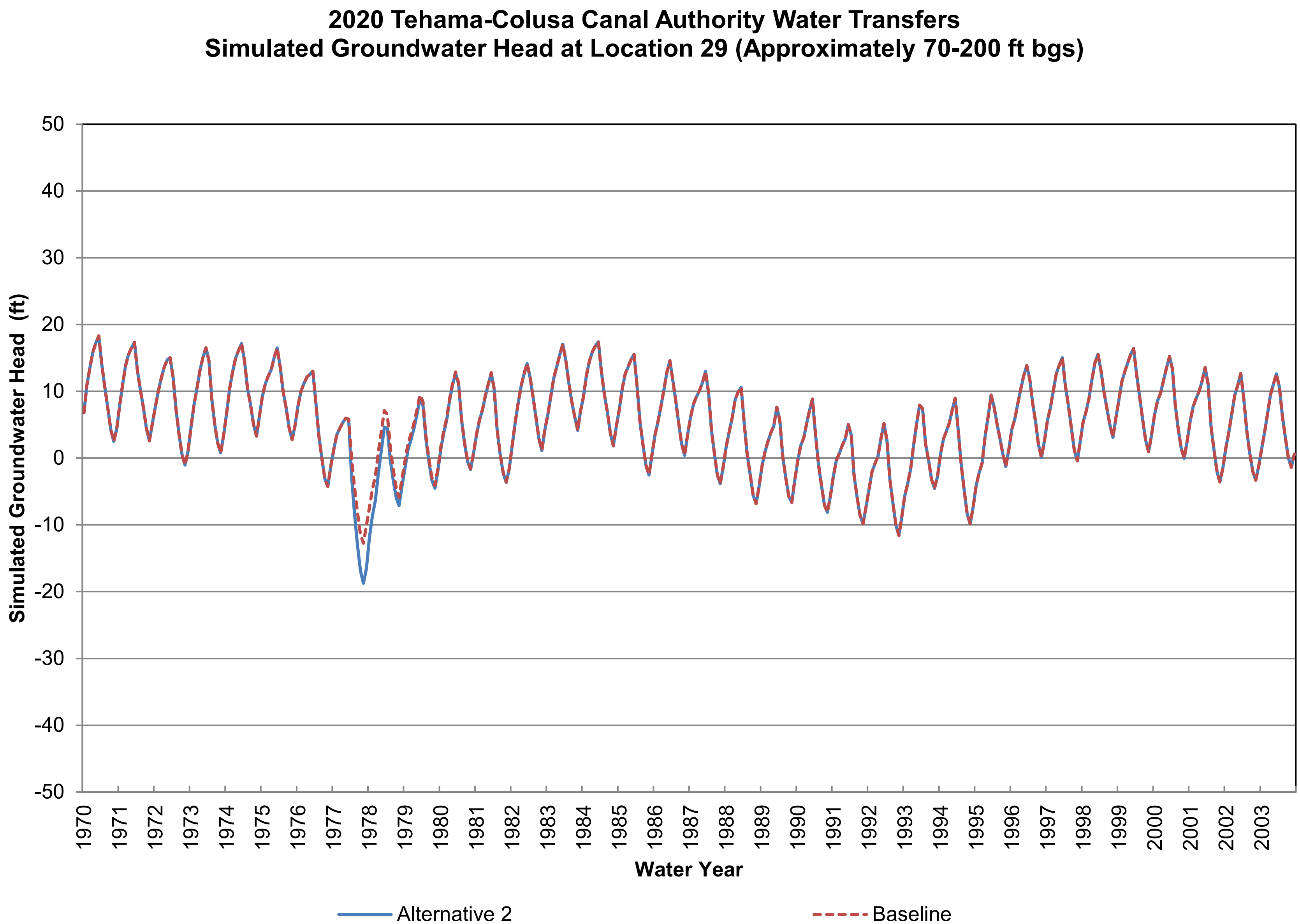
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 70-200 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
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1978
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1988
1989
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1991
1992
1993
1994
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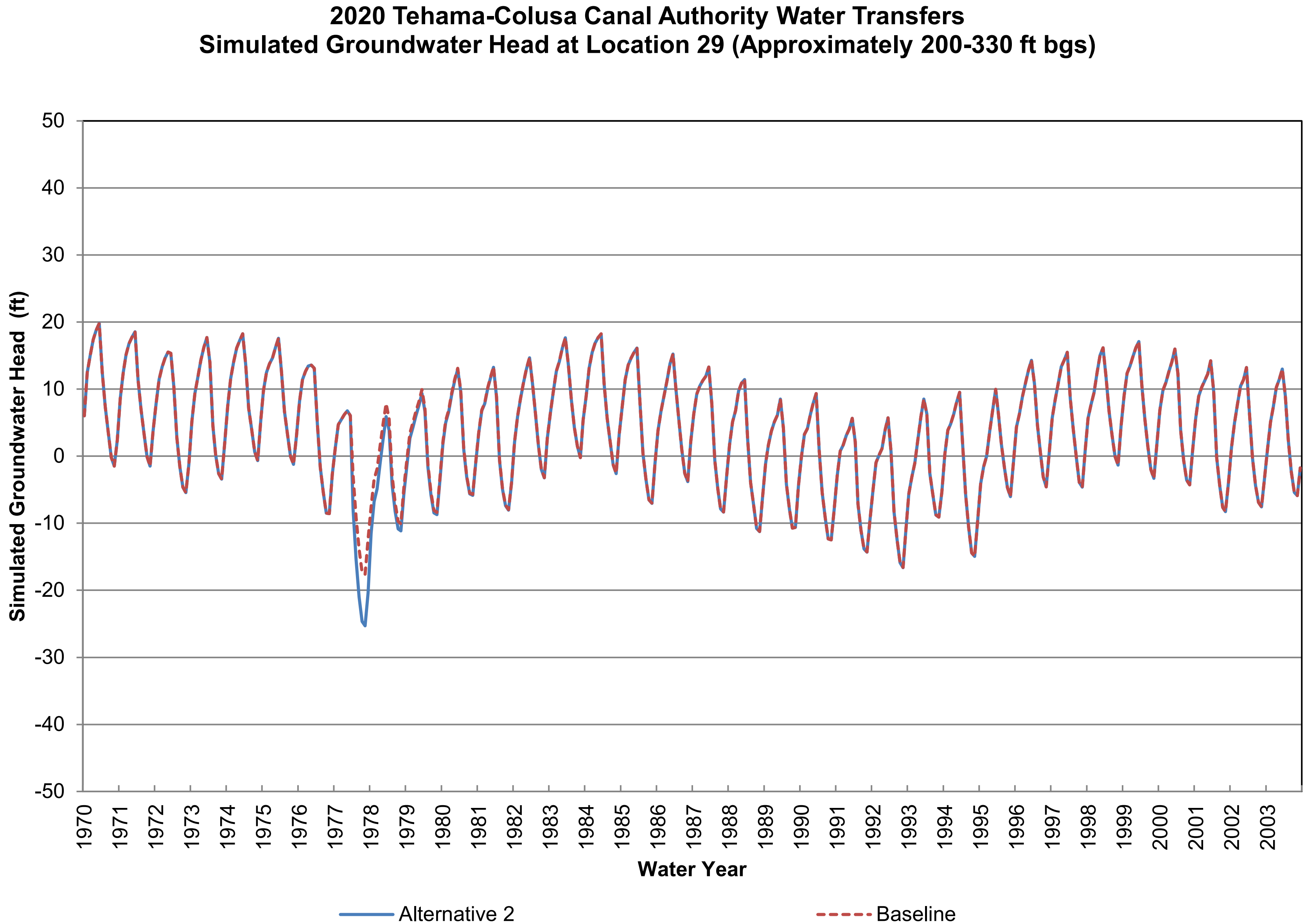
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 200-330 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
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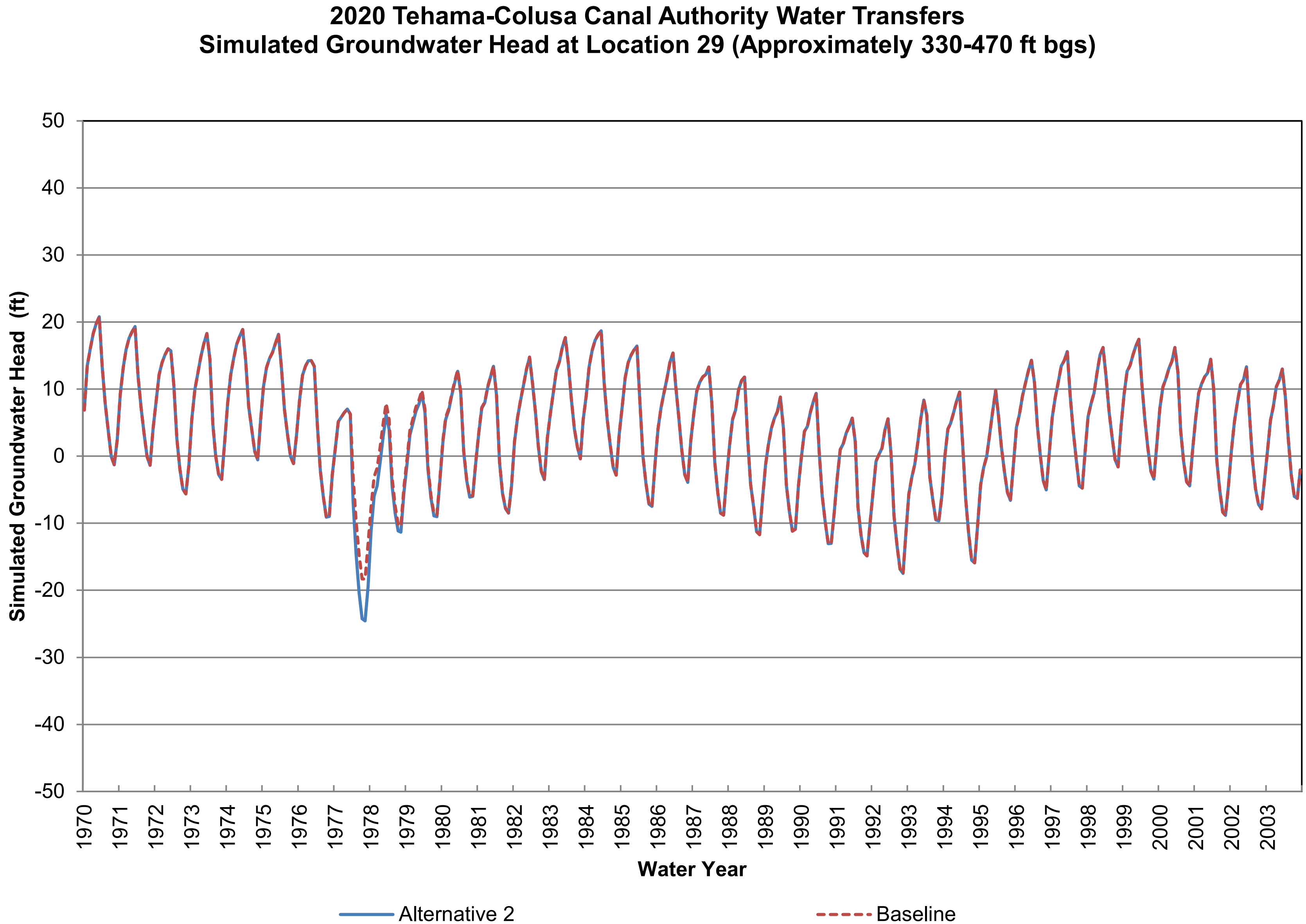
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 330-470 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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1983
1984
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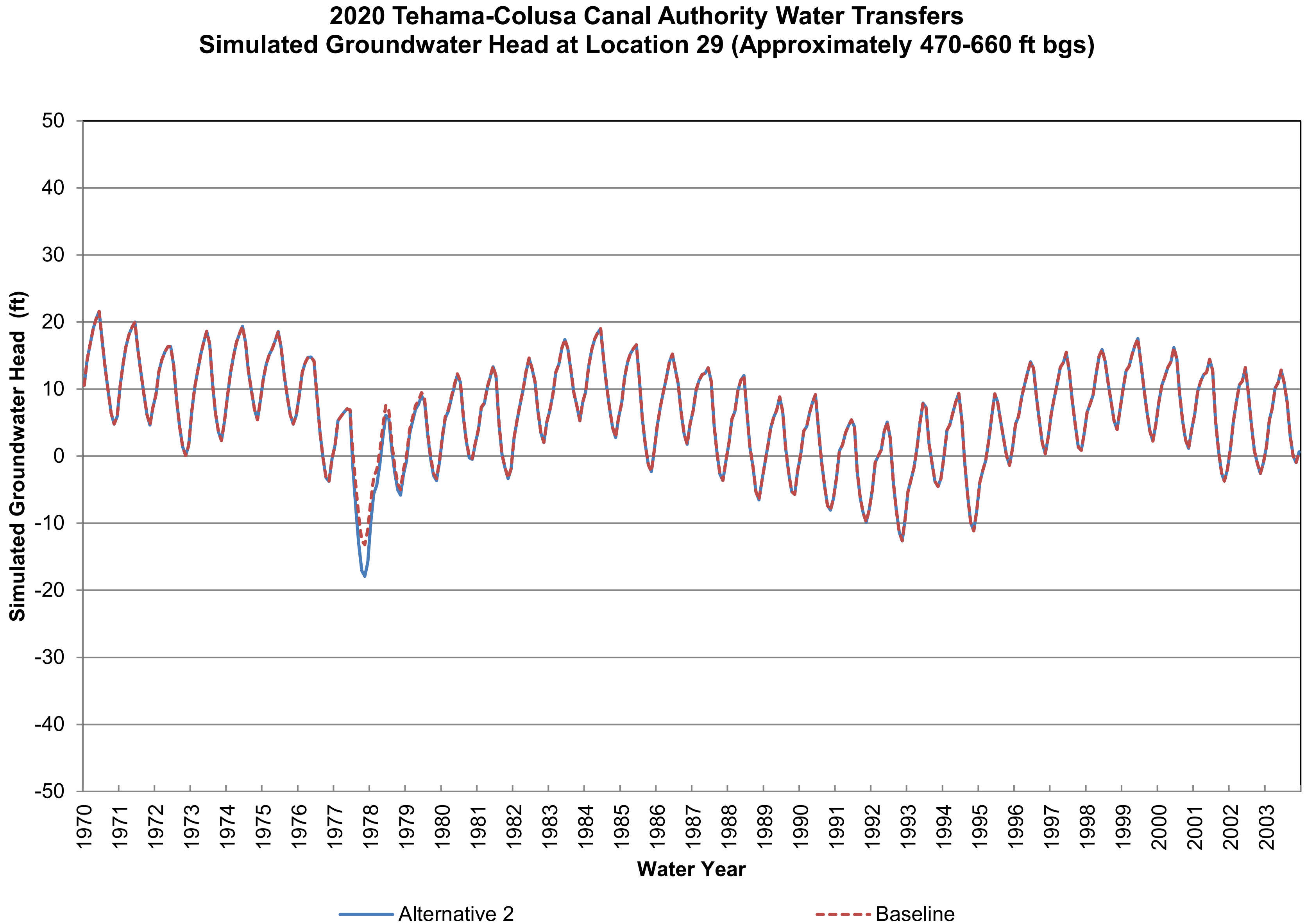
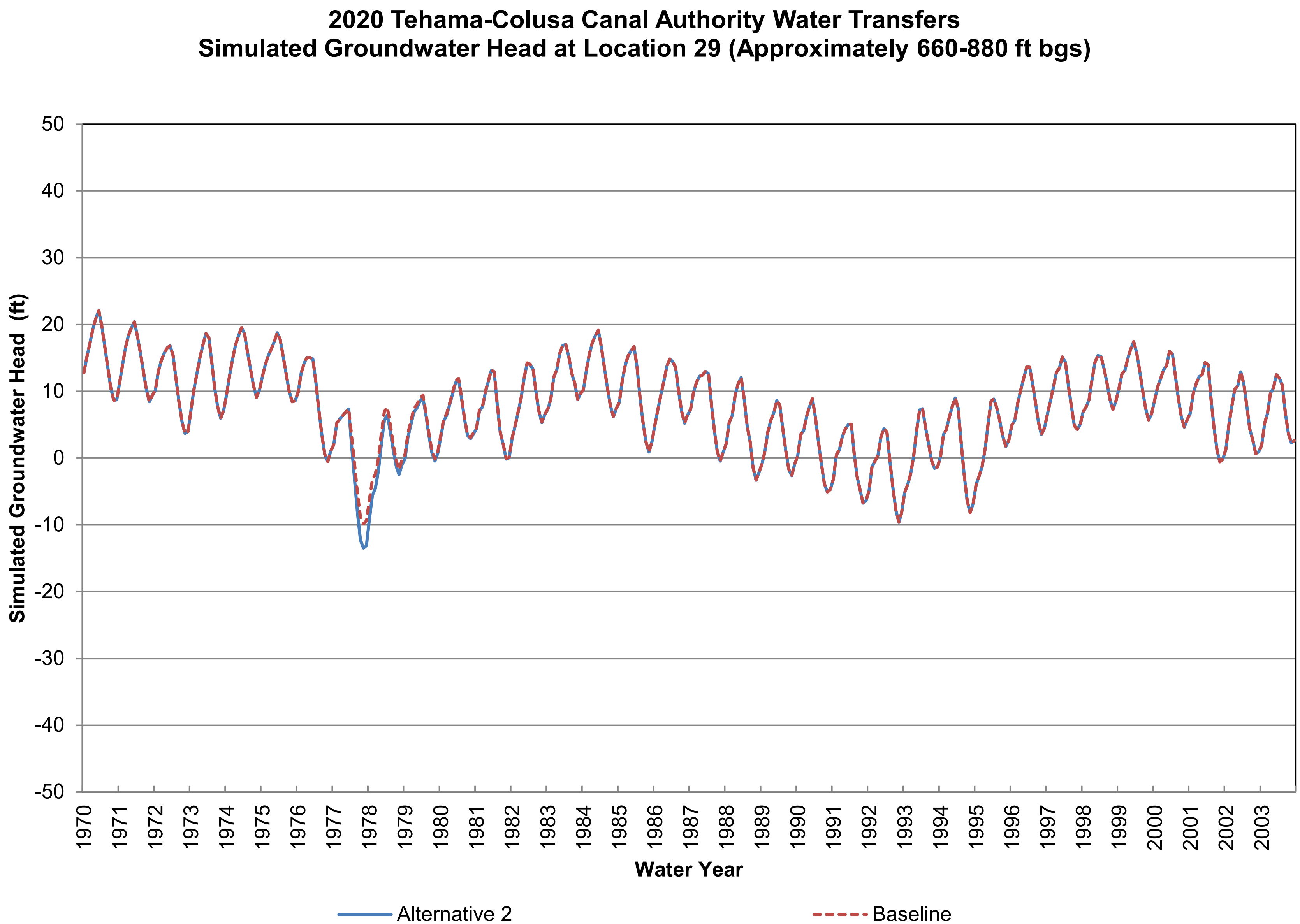
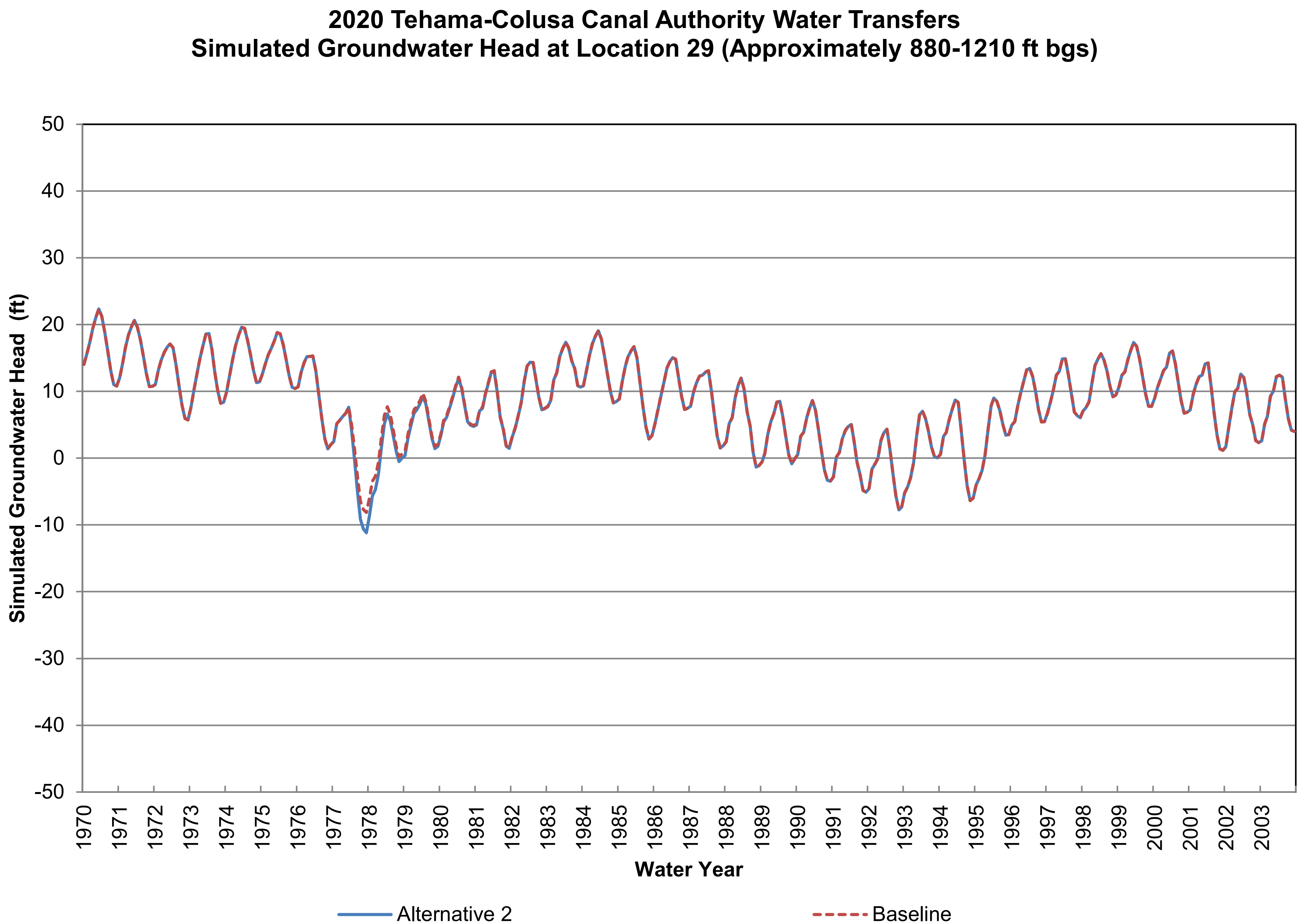
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



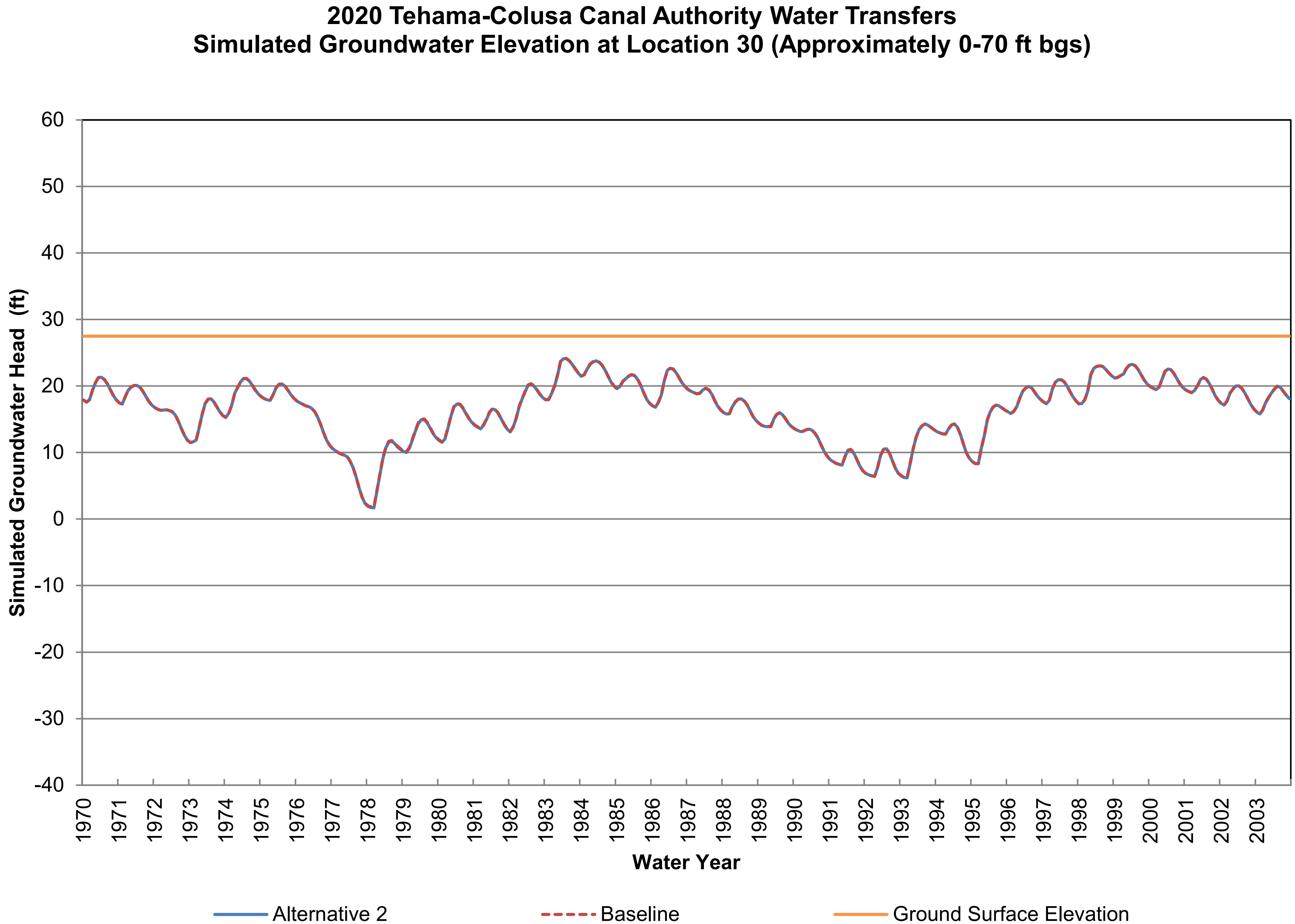
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 470-660 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 660-880 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

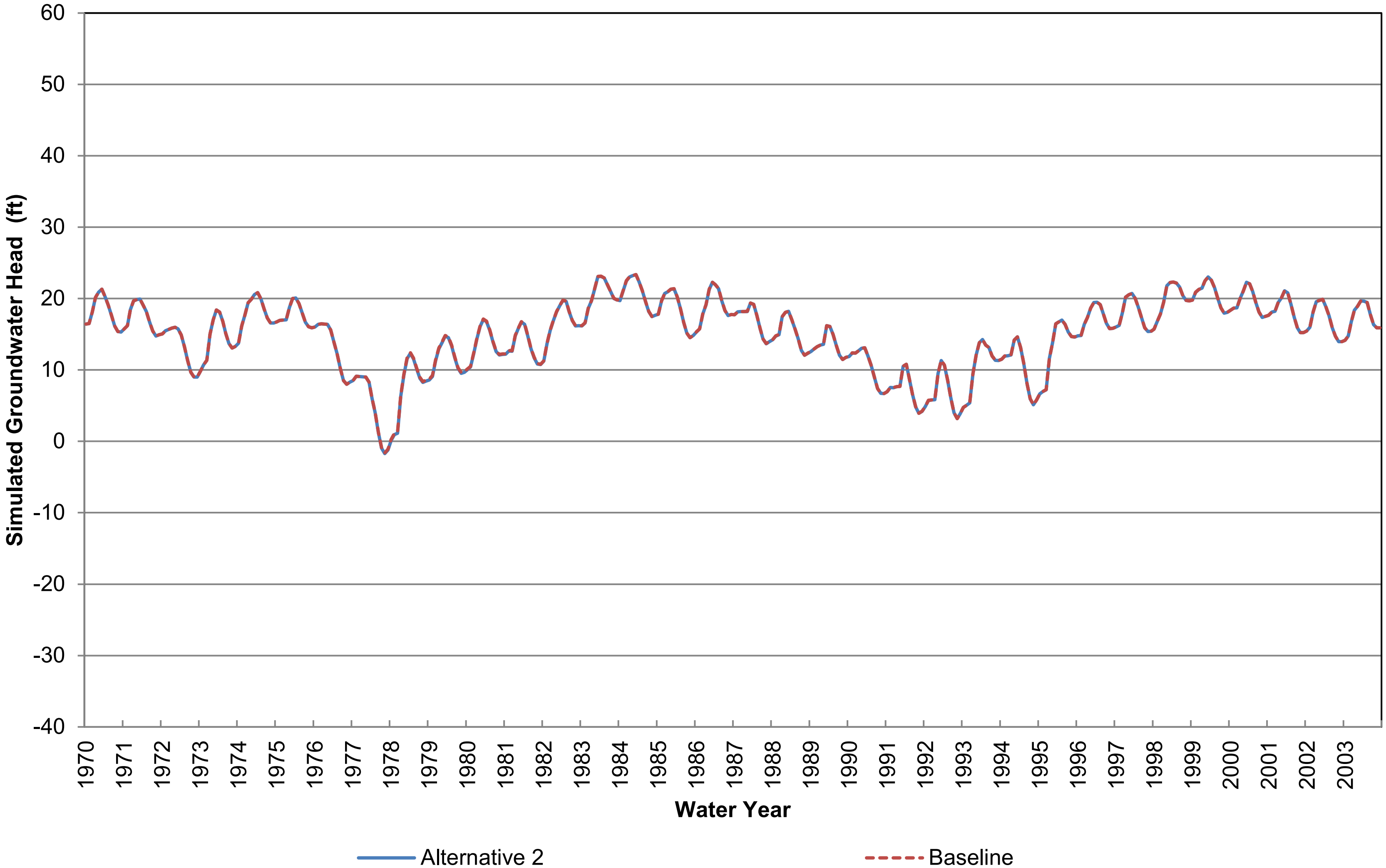


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 880-1210 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

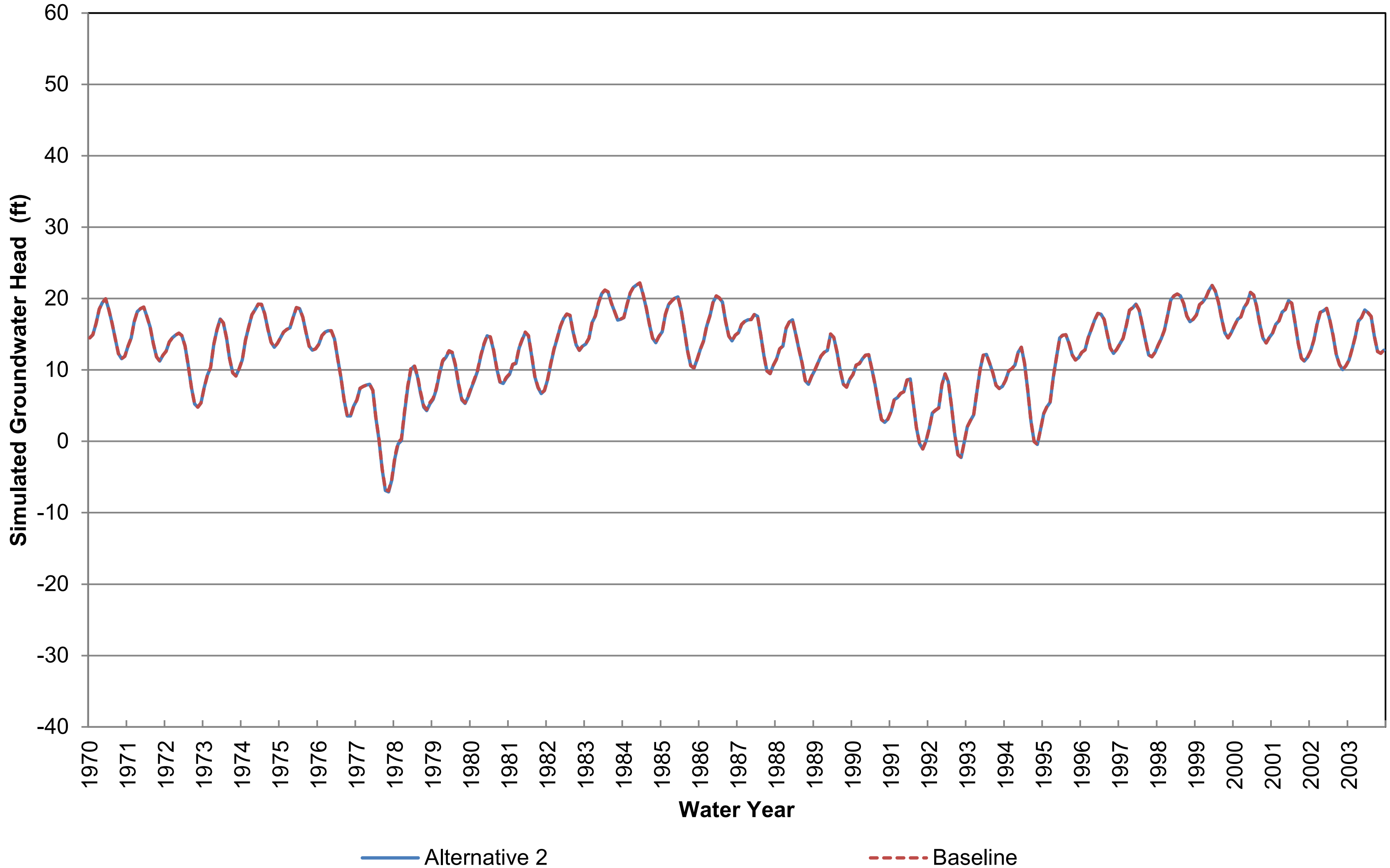


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 30 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

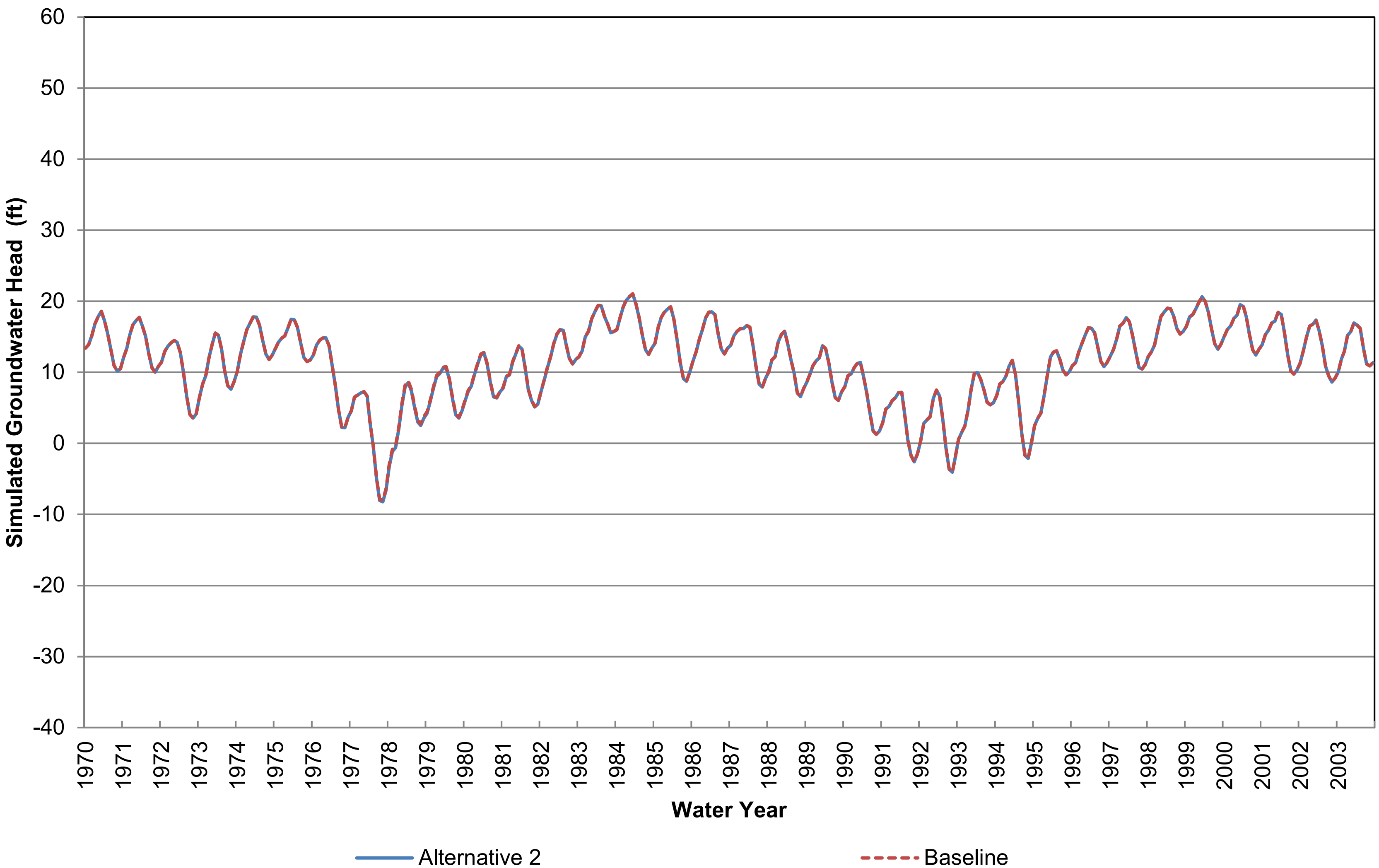
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 30 (Approximately 70-340 ft bgs)

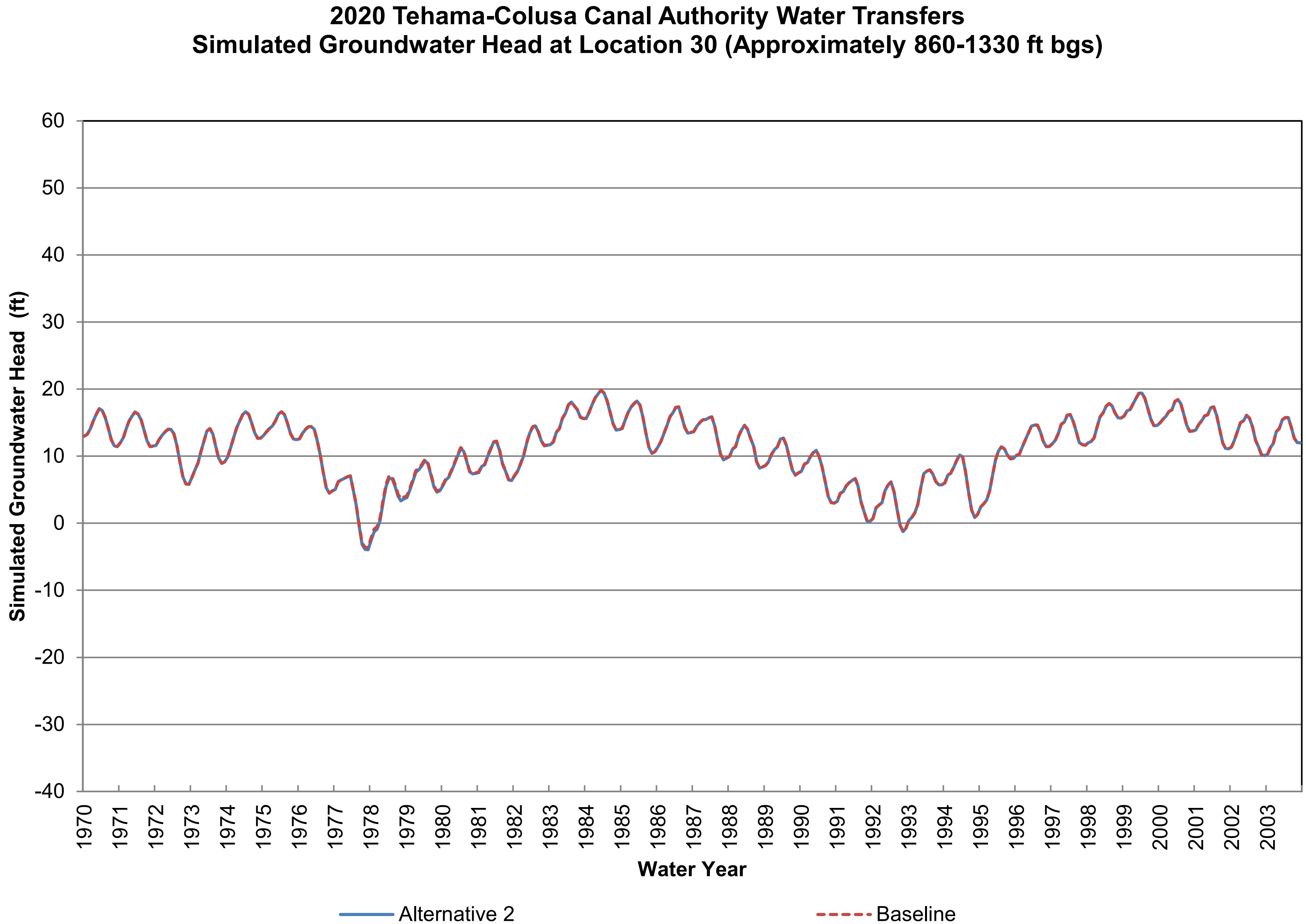


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 30 (Approximately 340-600 ft bgs)



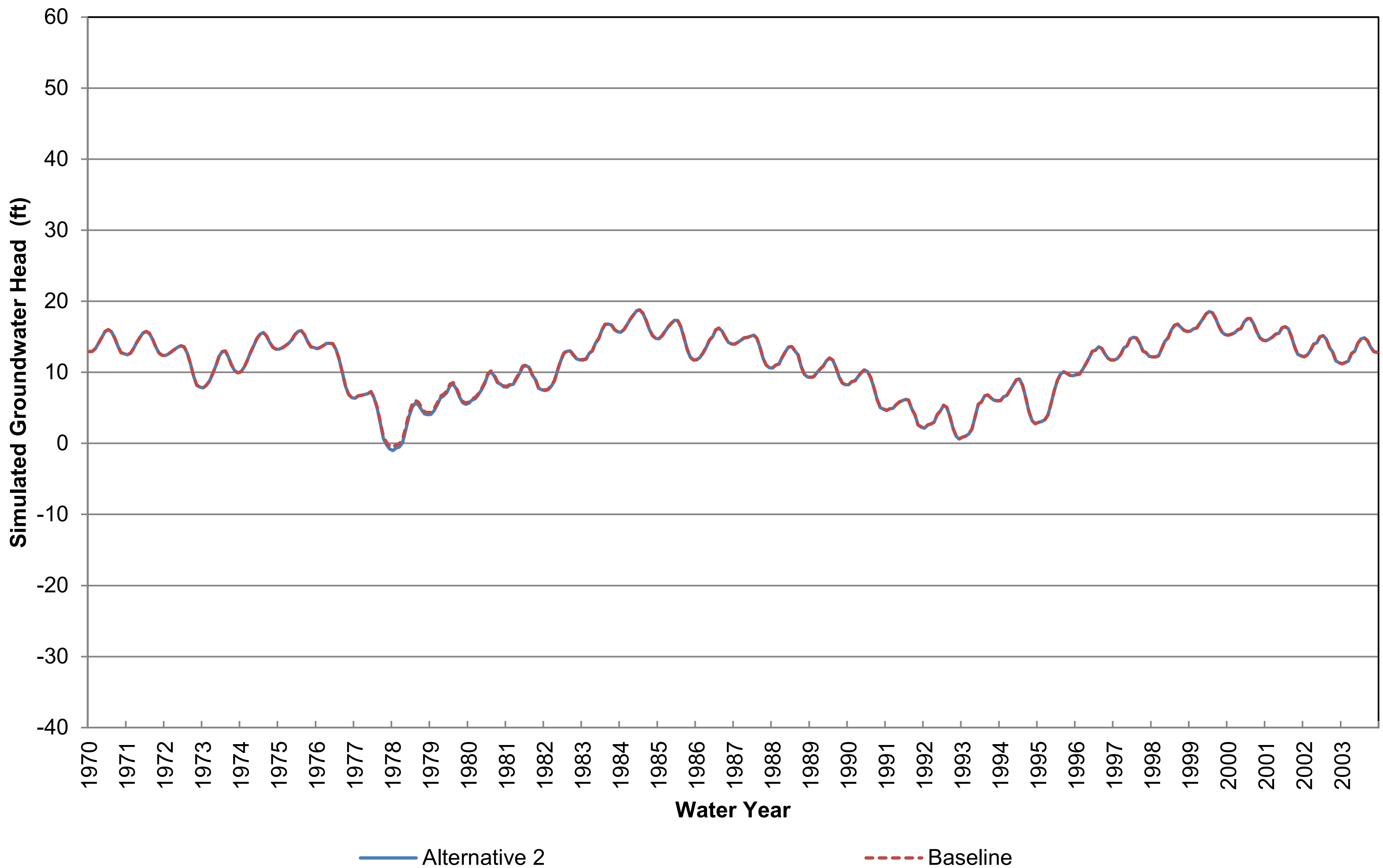
**2020 Tehama-Colusa Canal Authority Water Transfers**
**Simulated Groundwater Head at Location 30 (Approximately 600-860 ft bgs)**

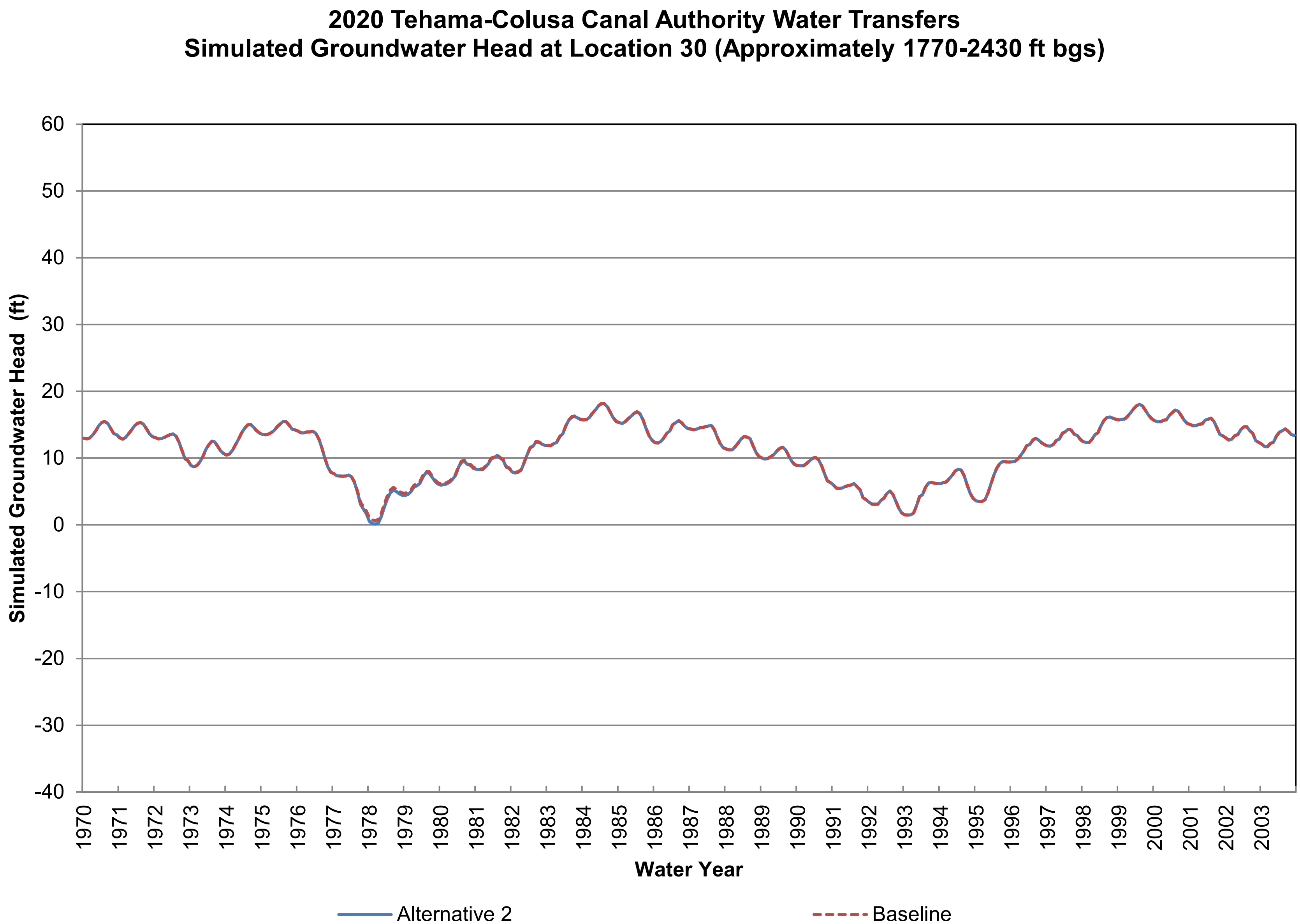




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 860-1330 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

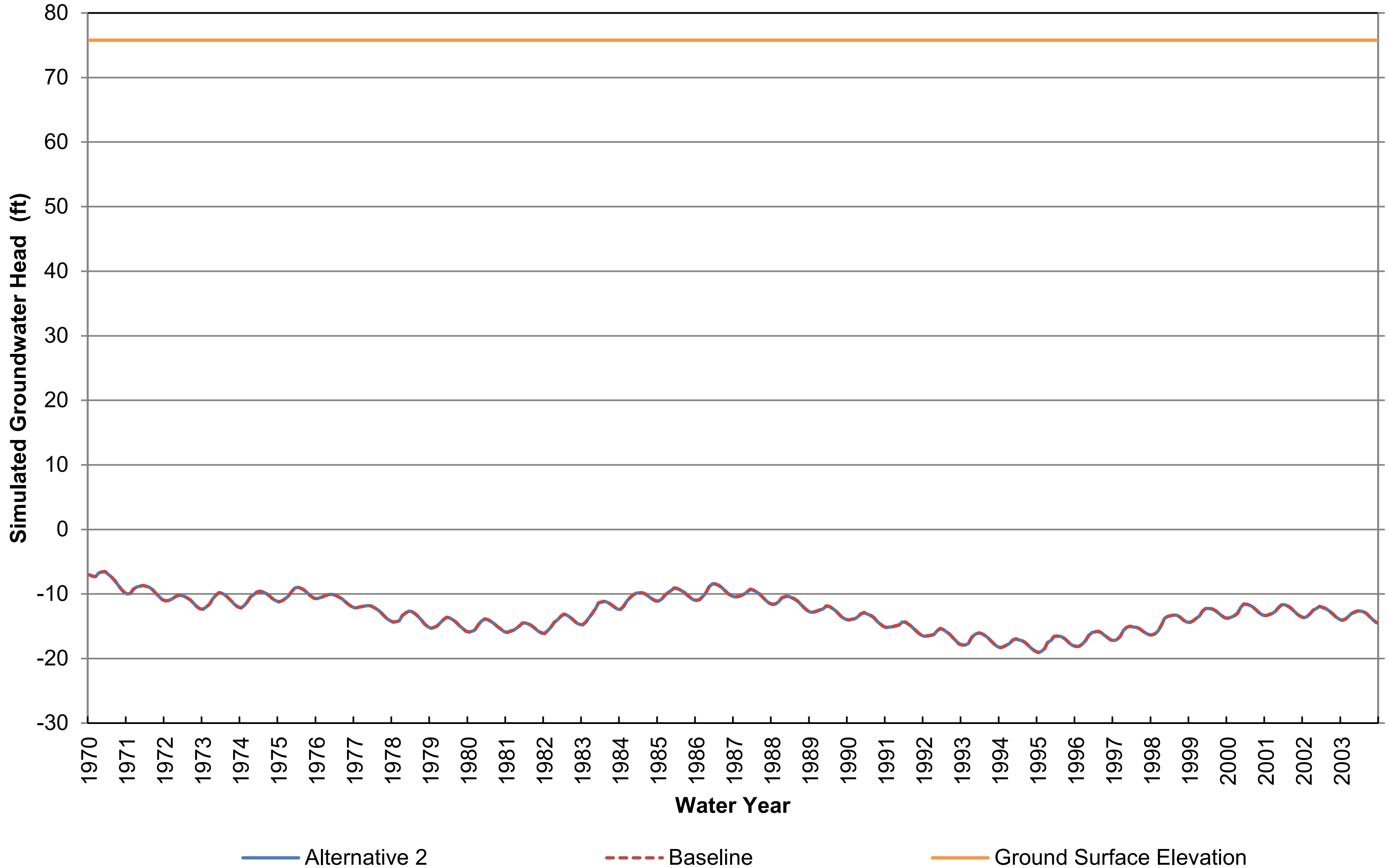
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 30 (Approximately 1330-1770 ft bgs)

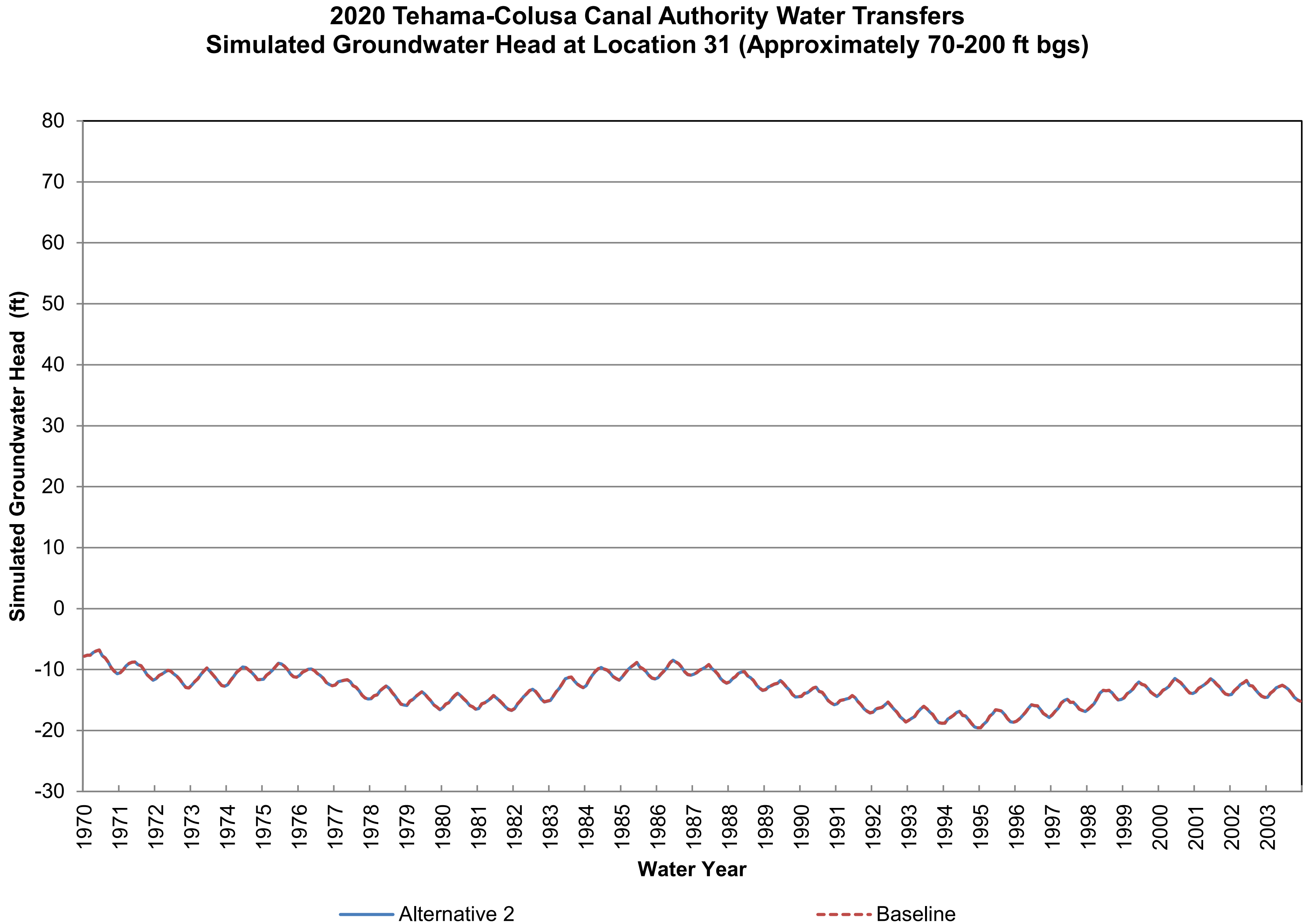




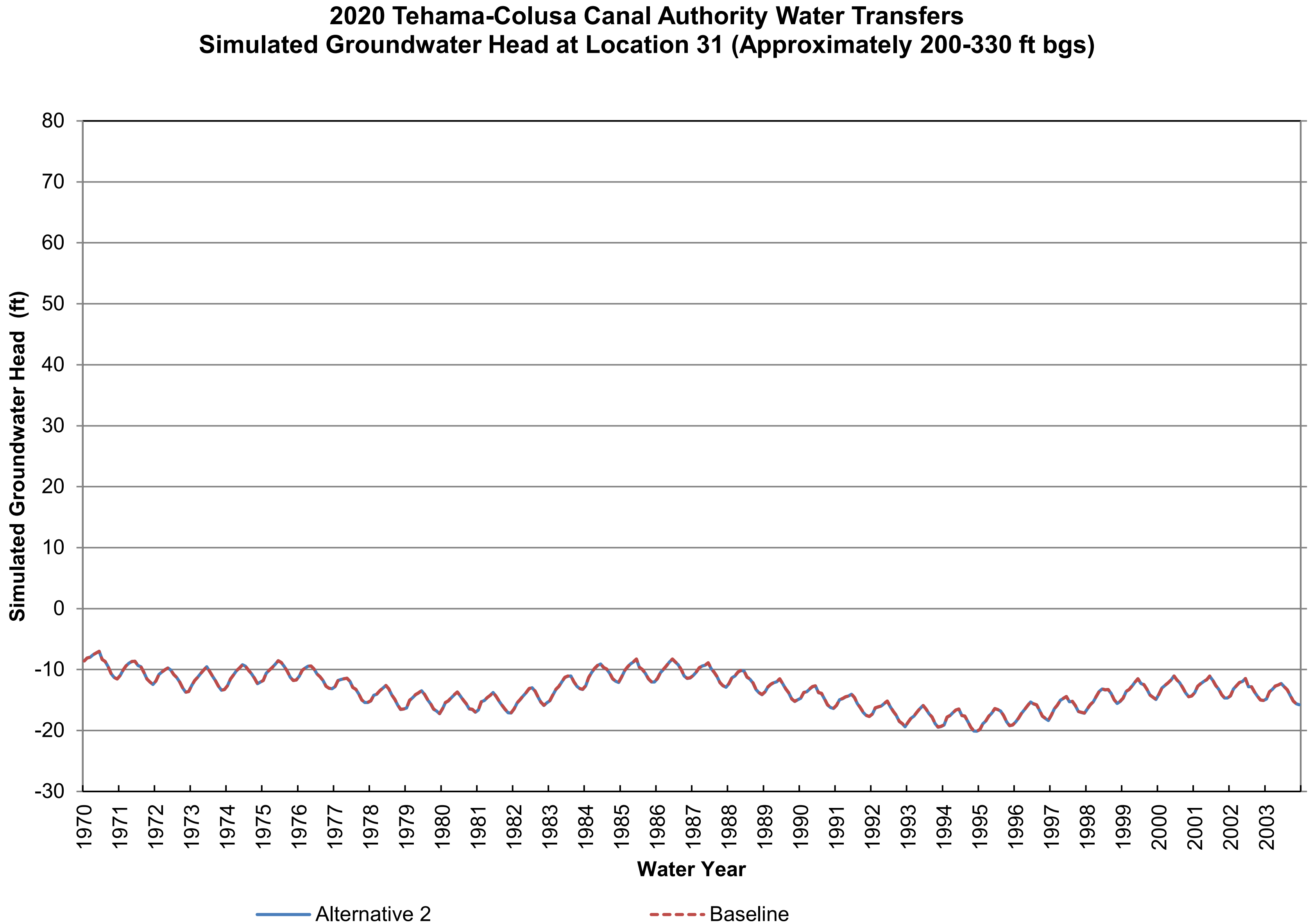
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 1770-2430 ft bgs)
60
50
40
30
20
10
0
-10
-20
-30
-40
Simulated Groundwater Head (ft)
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 31 (Approximately 0-70 ft bgs)

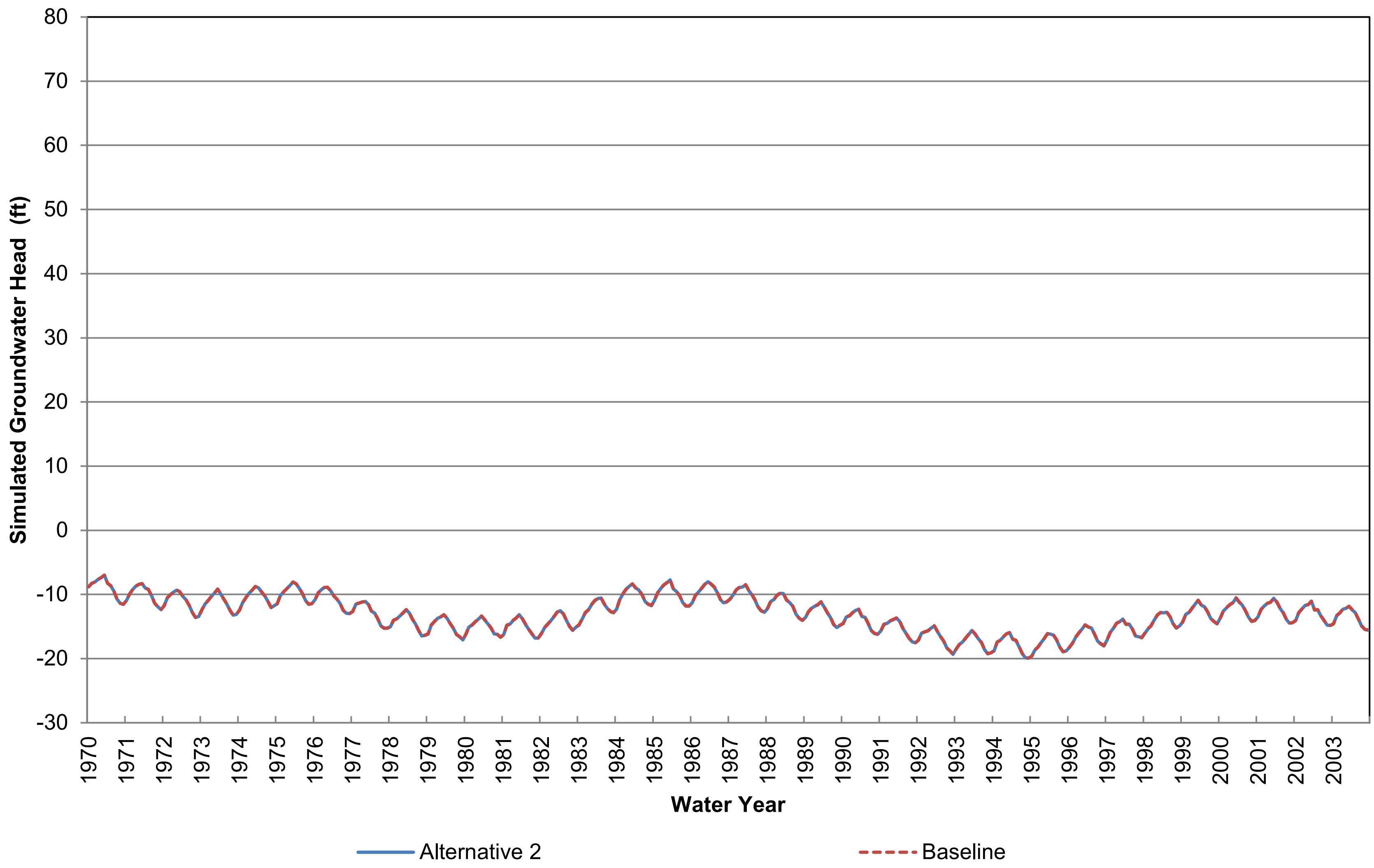


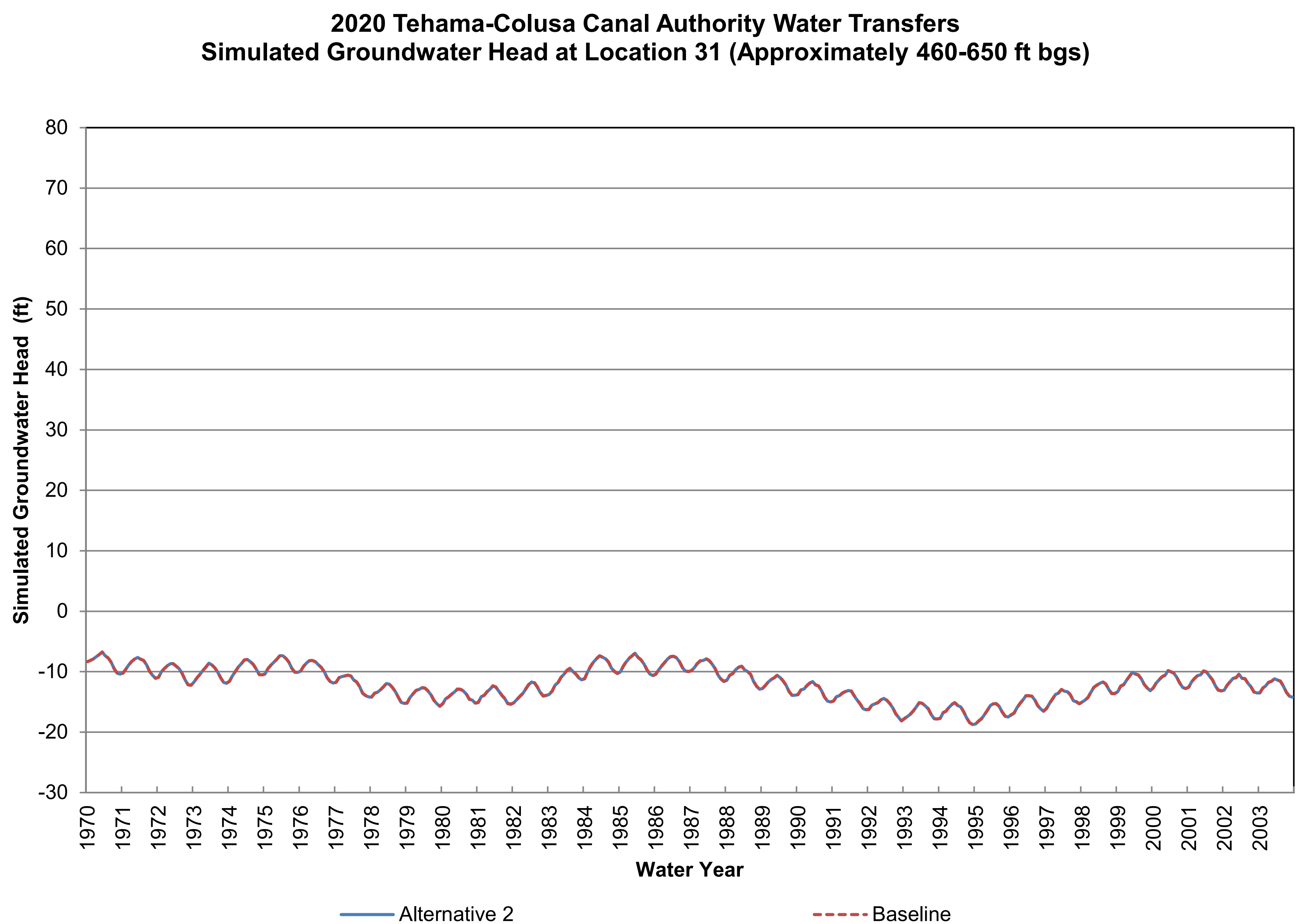


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 70-200 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 200-330 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

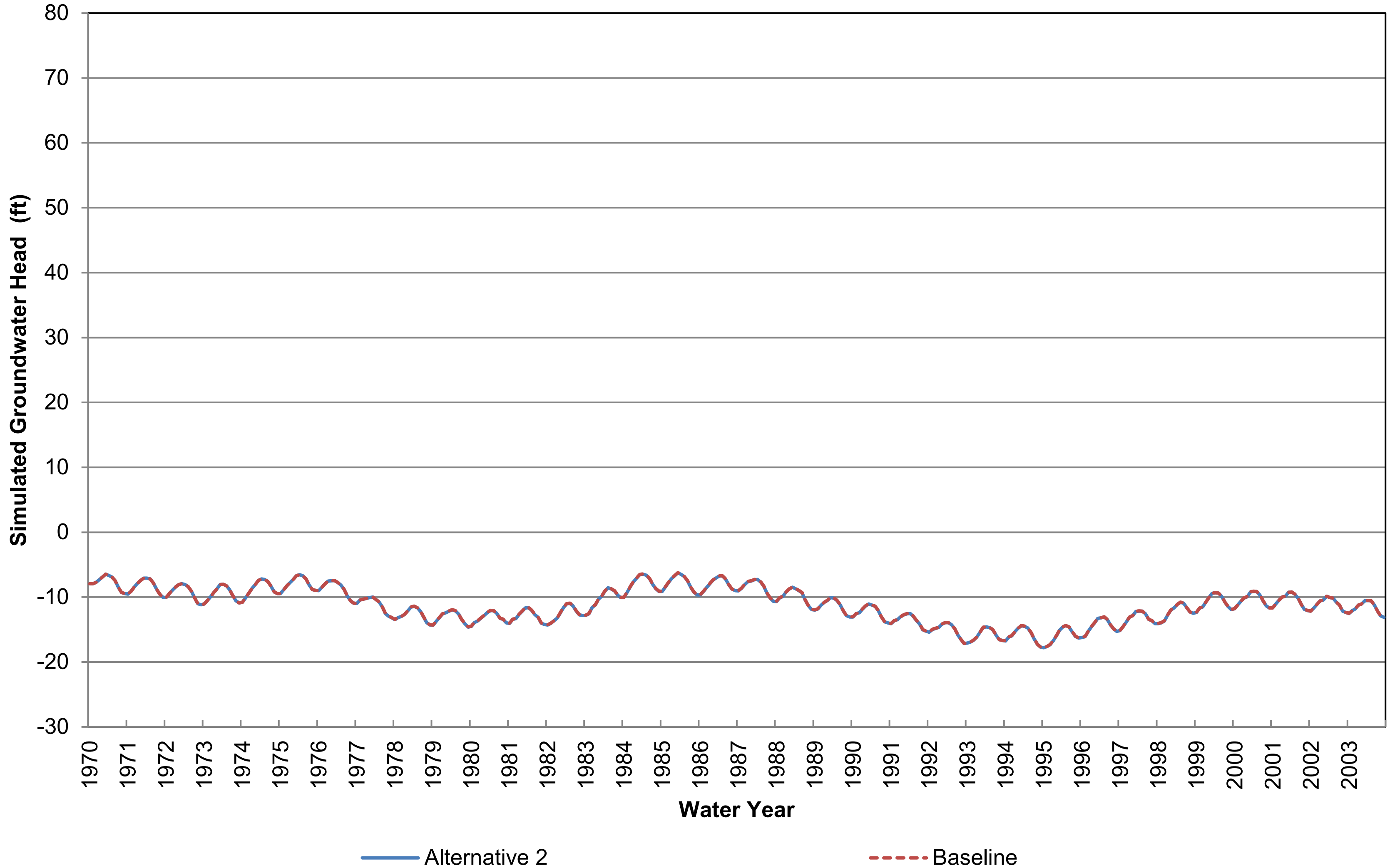
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 31 (Approximately 330-460 ft bgs)



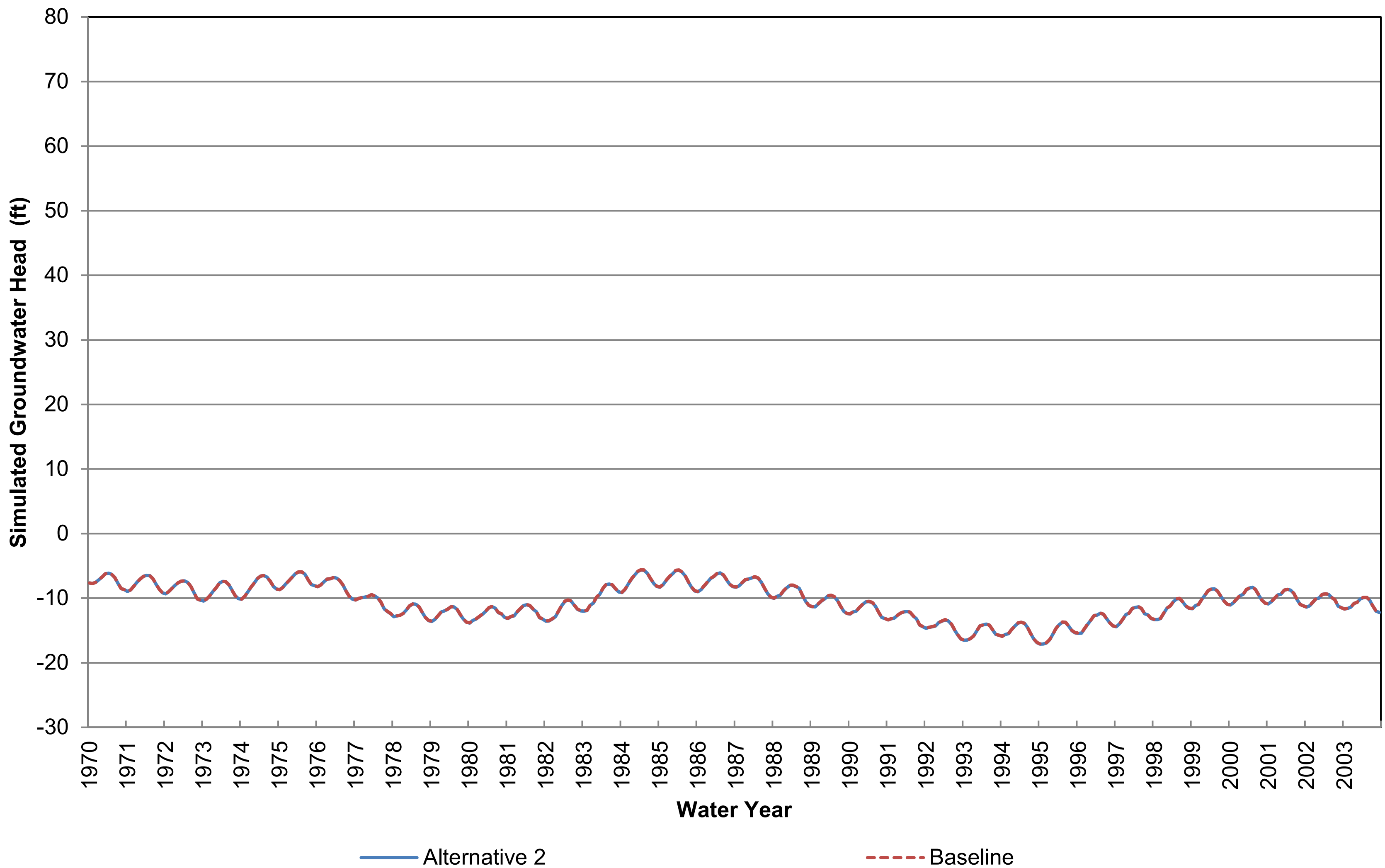


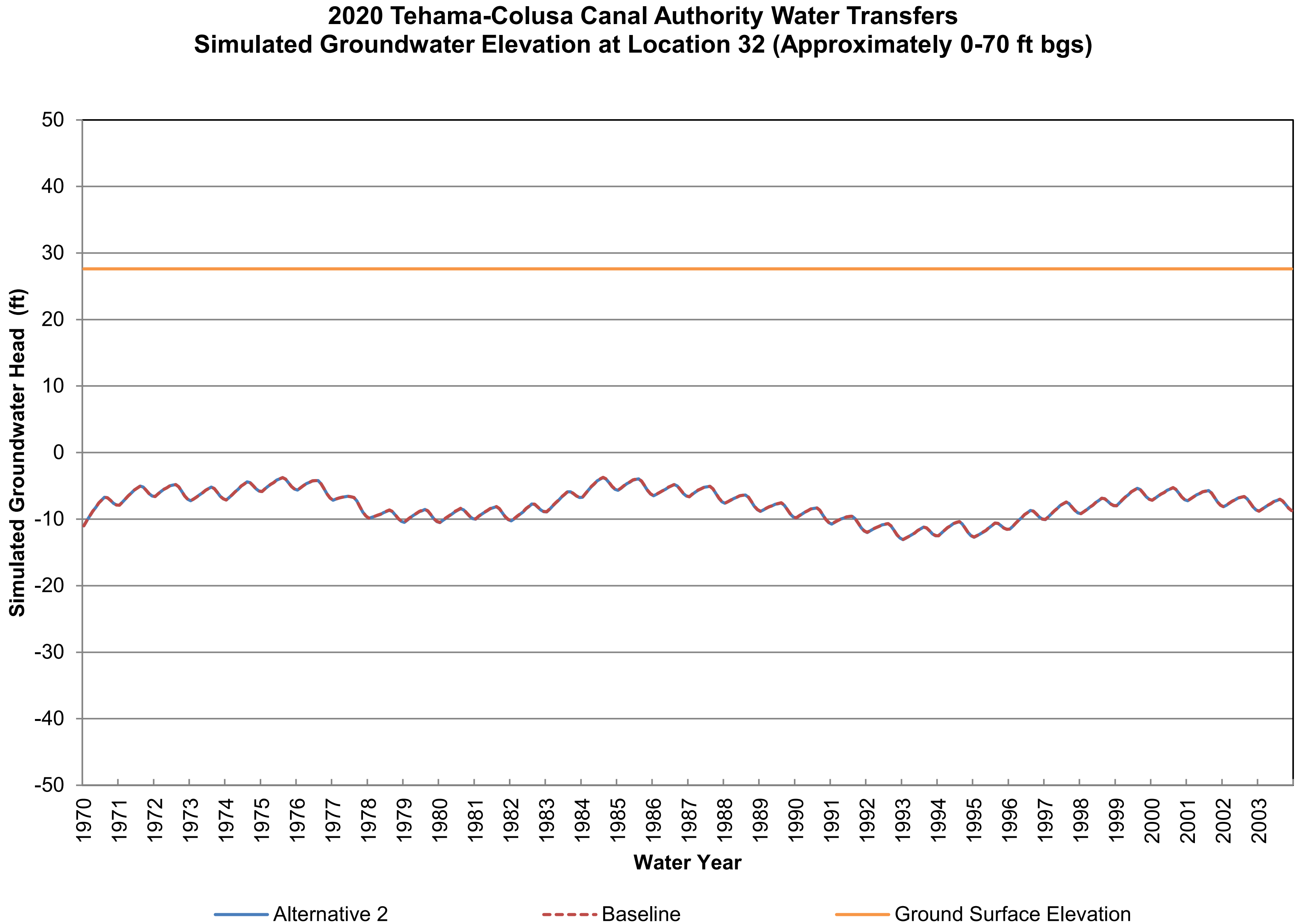
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 460-650 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 31 (Approximately 650-870 ft bgs)

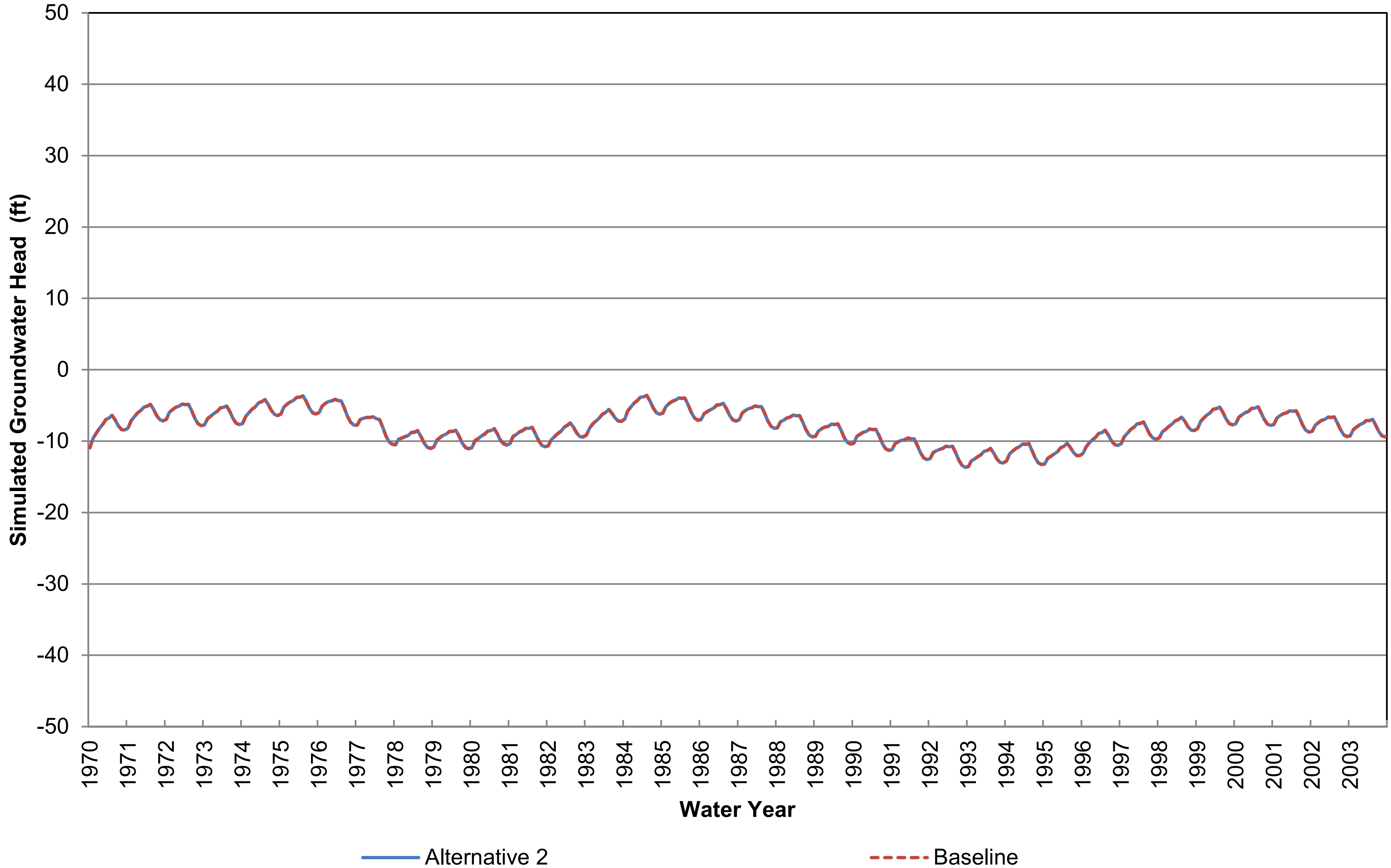


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 31 (Approximately 870-1190 ft bgs)

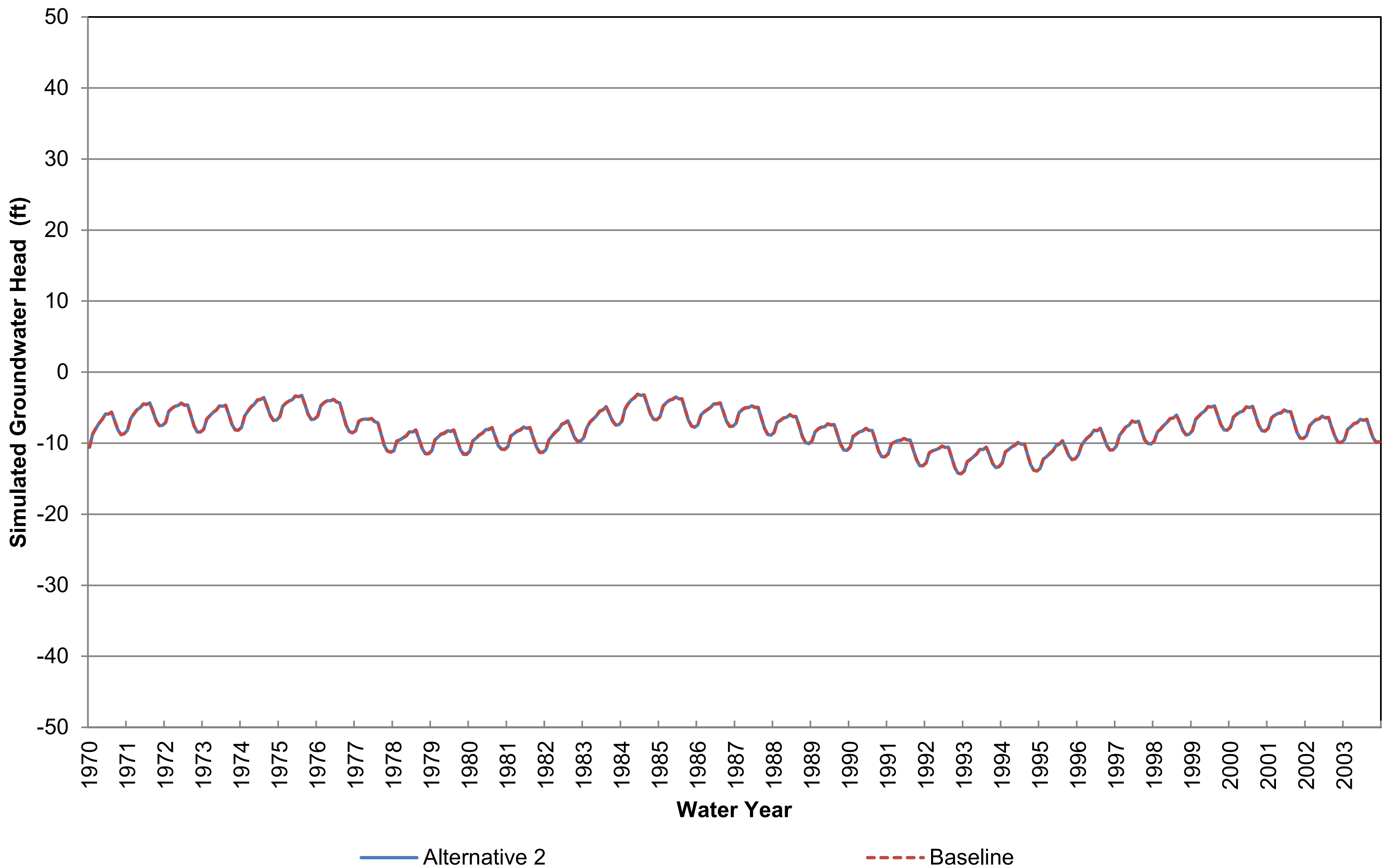



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 32 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

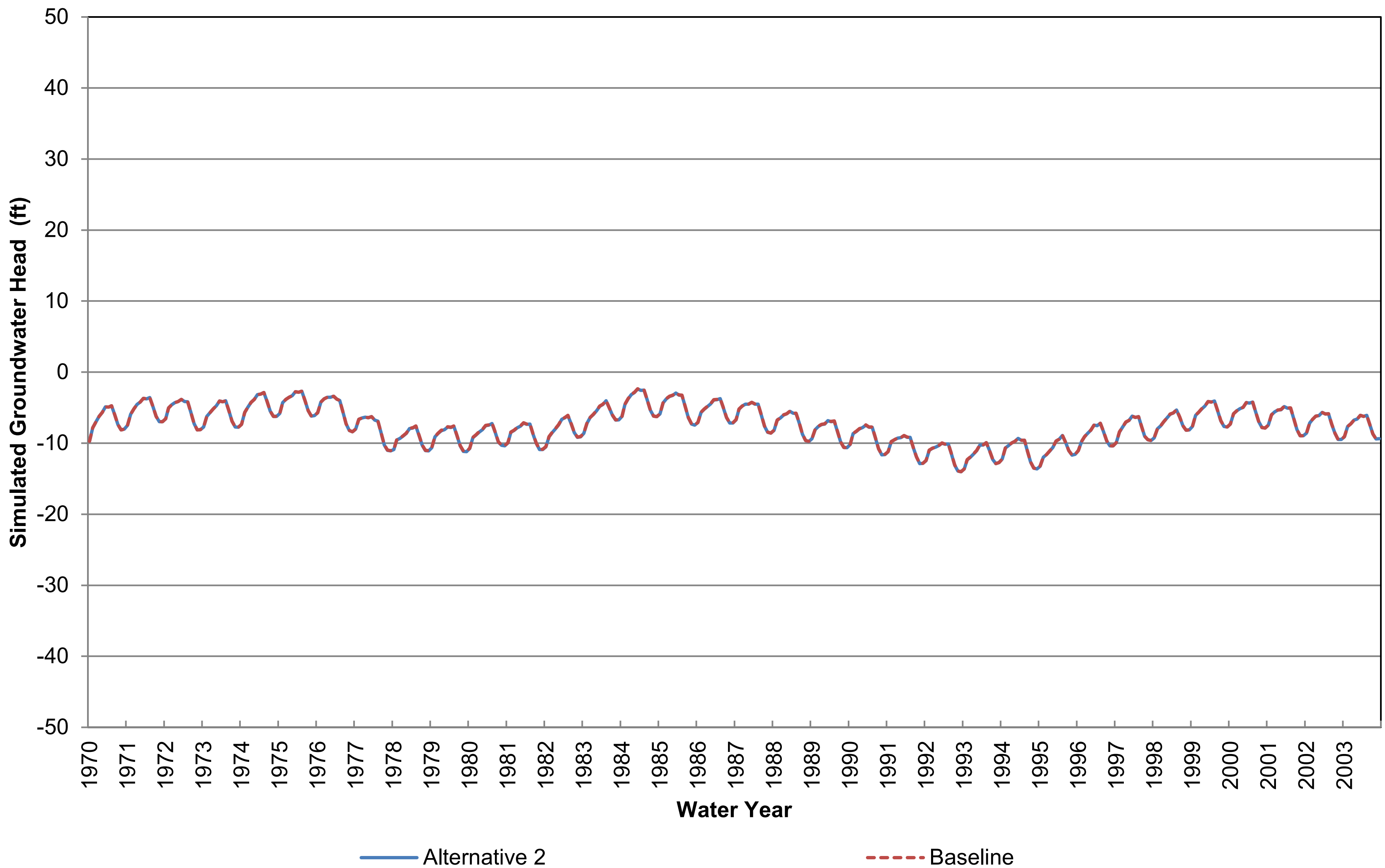
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 32 (Approximately 70-240 ft bgs)

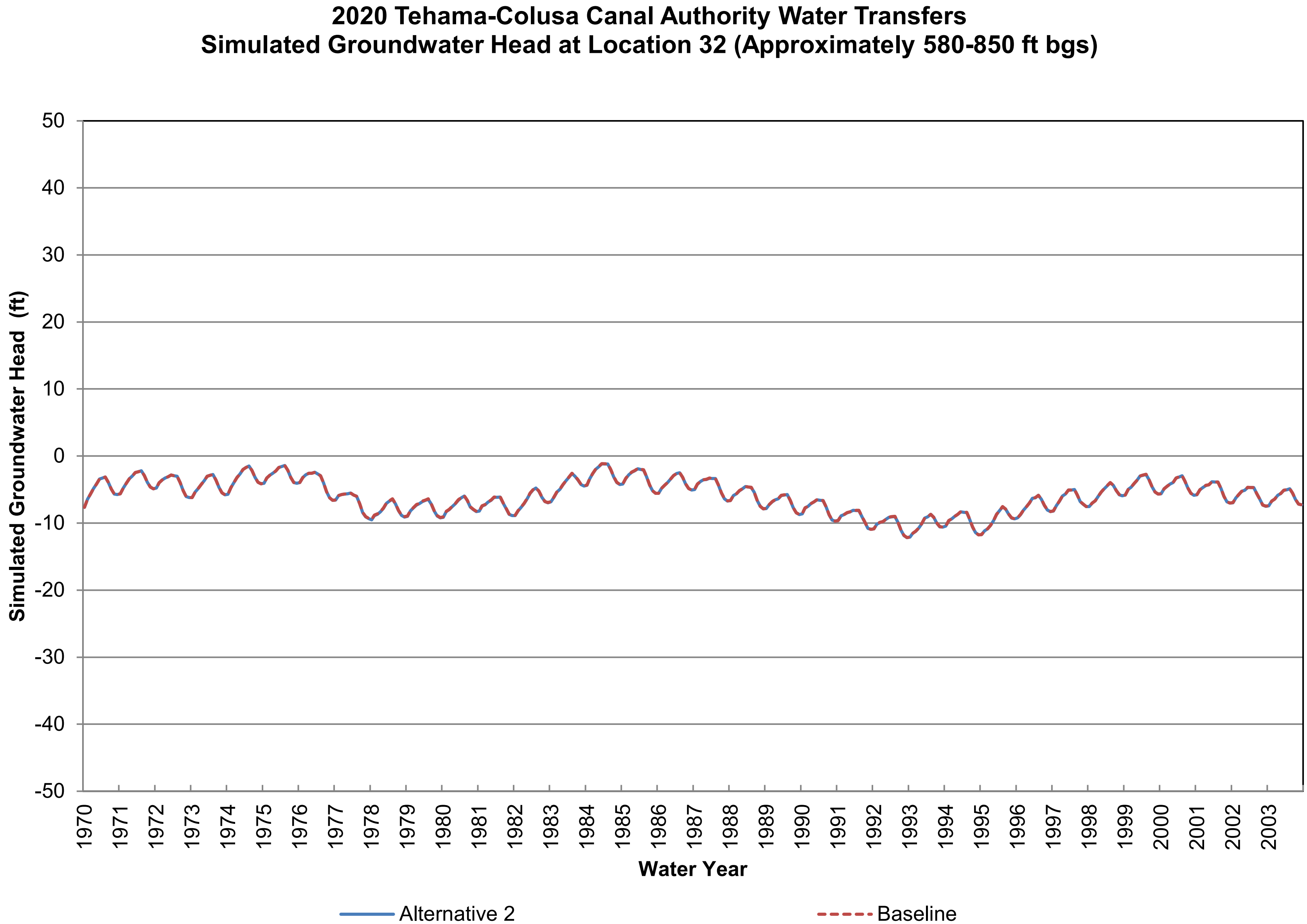


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 32 (Approximately 240-410 ft bgs)

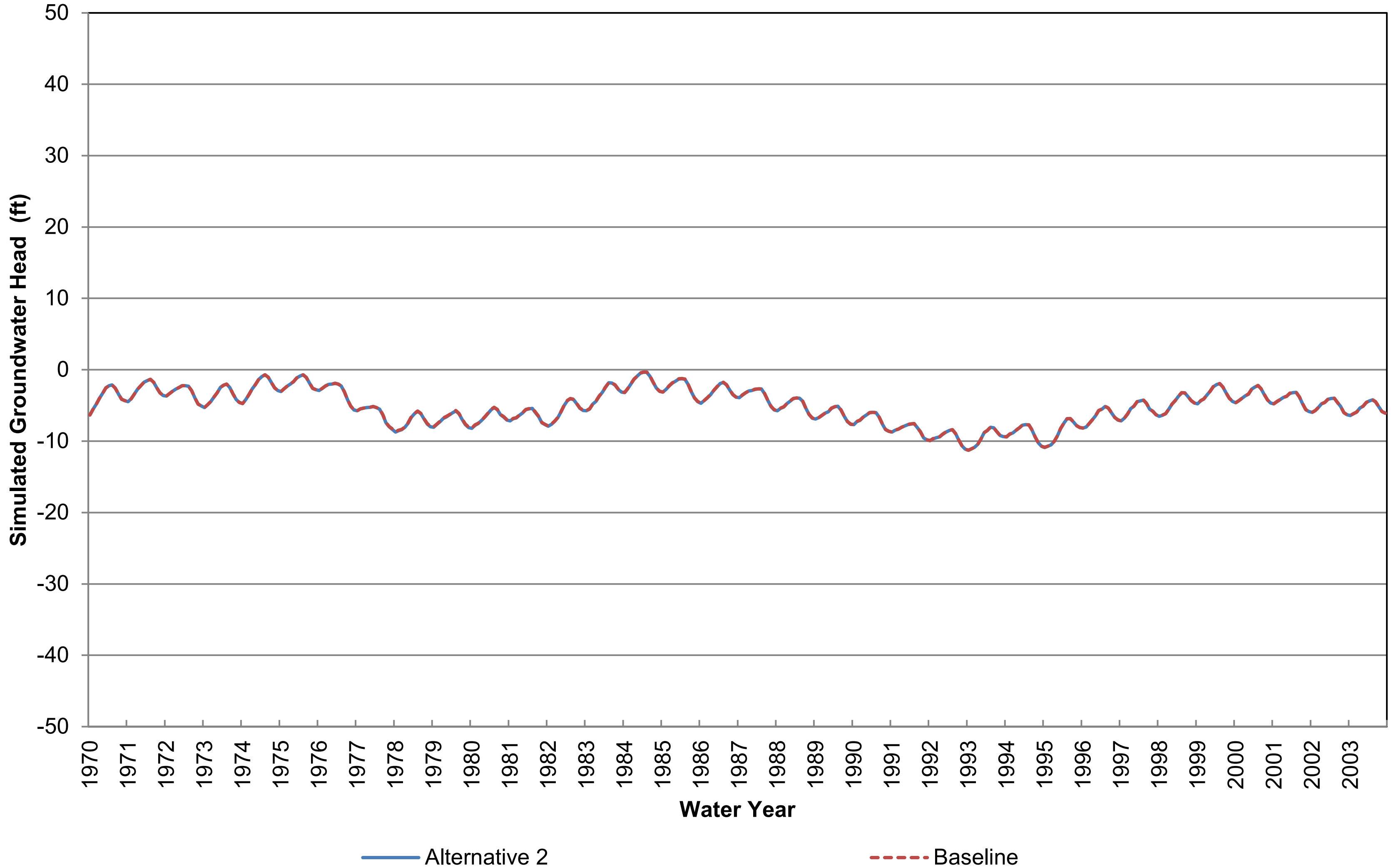


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 32 (Approximately 410-580 ft bgs)

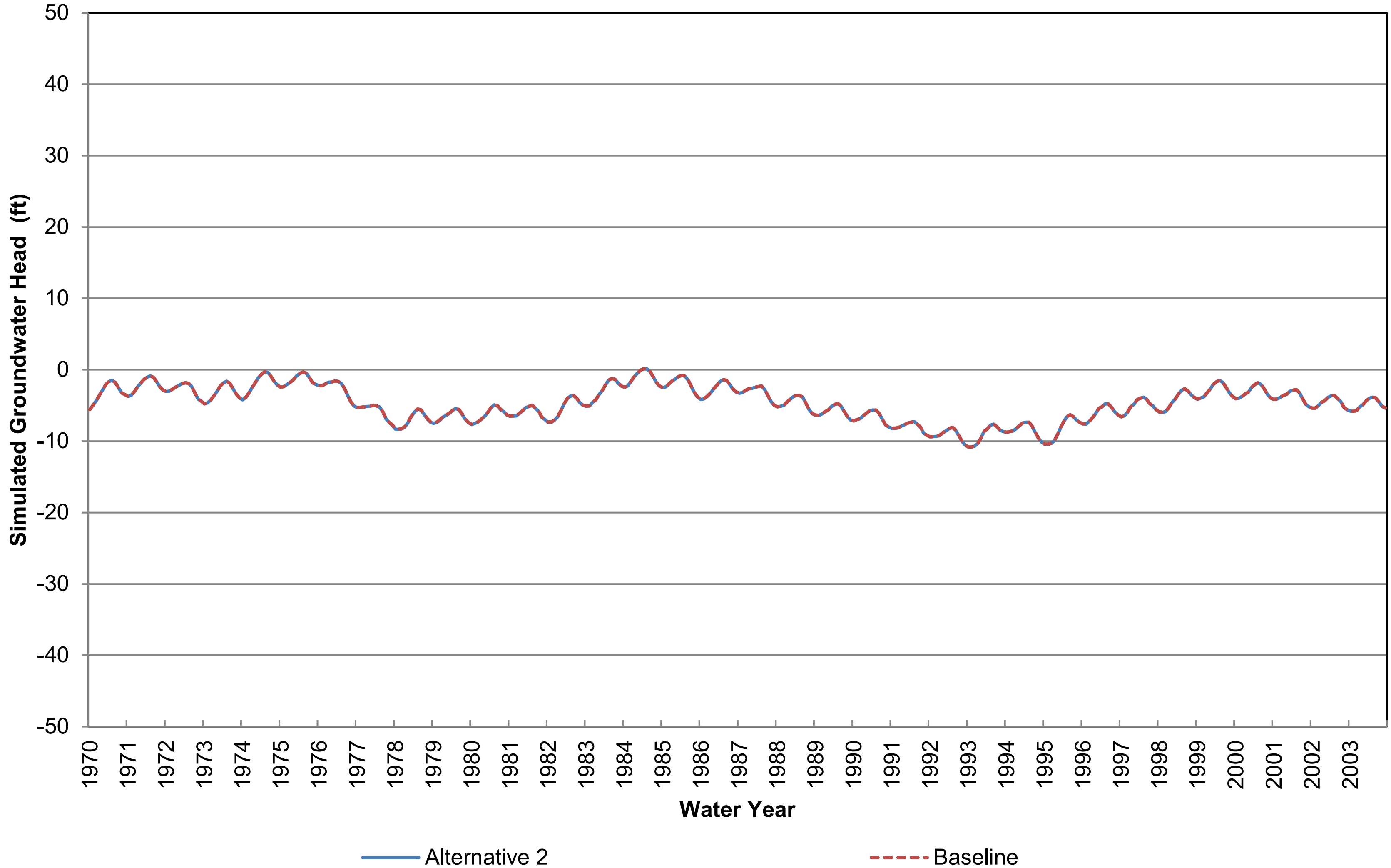



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 580-850 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

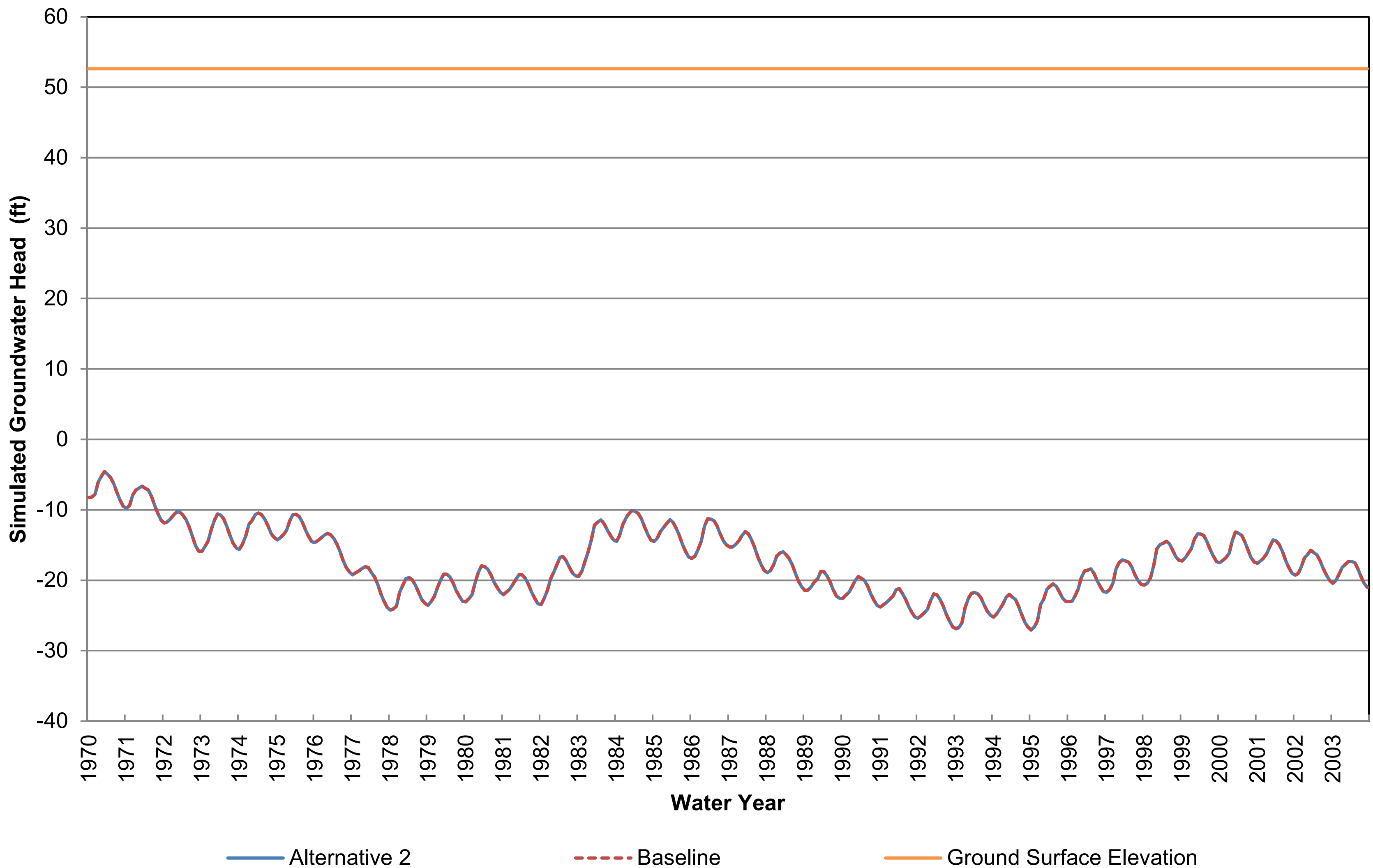
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 32 (Approximately 850-1140 ft bgs)



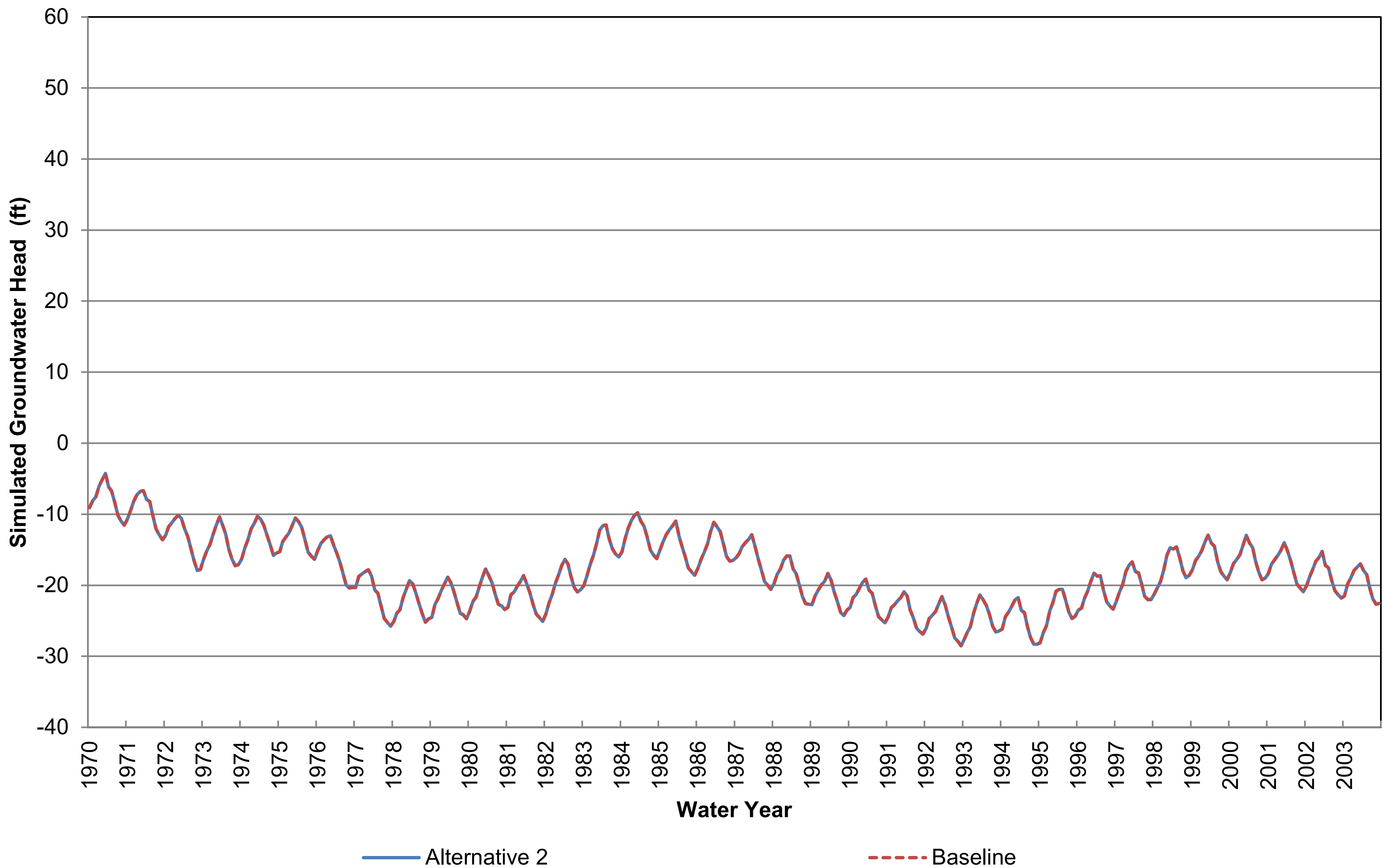
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 1140-1560 ft bgs)

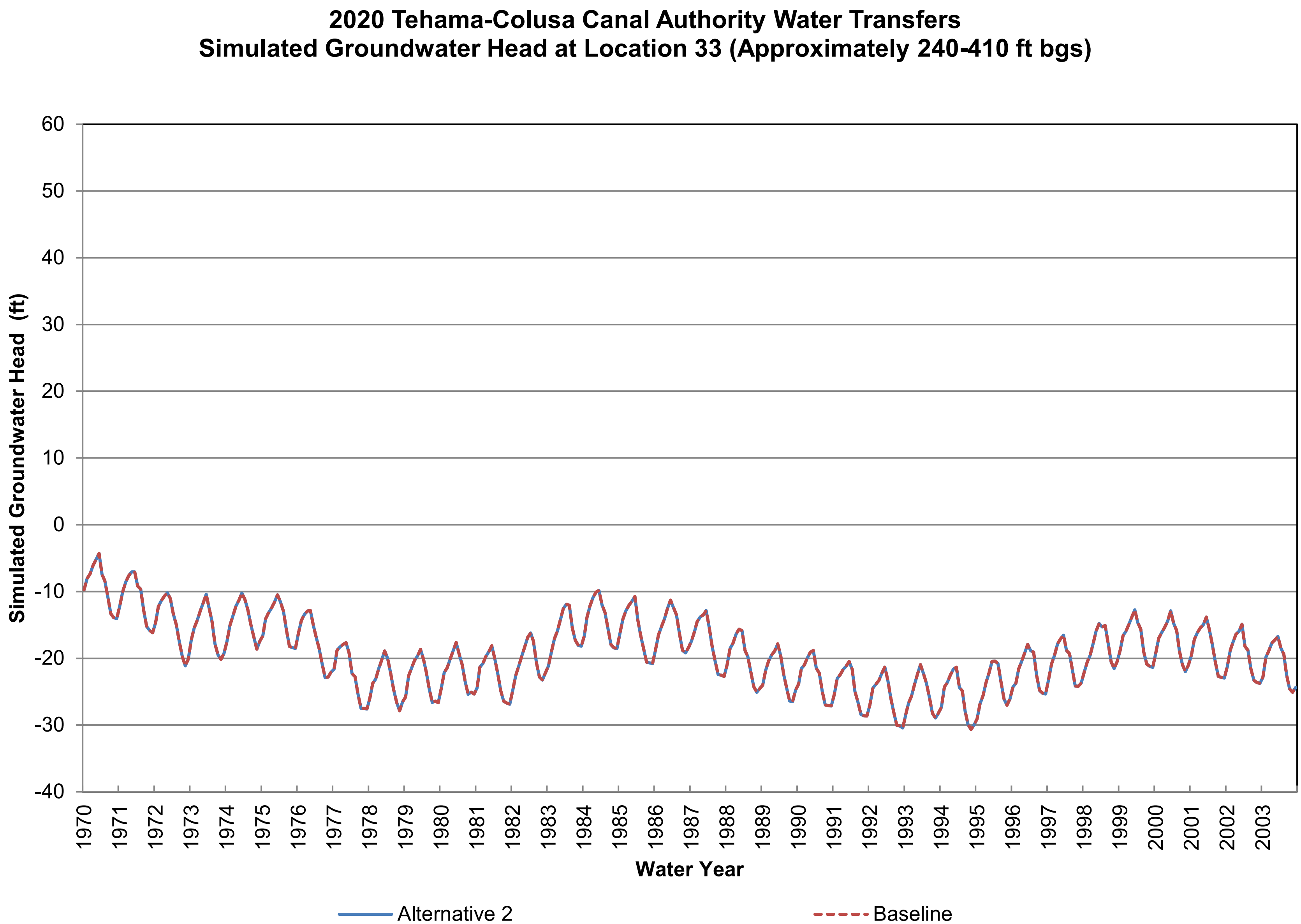


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 33 (Approximately 0-70 ft bgs)

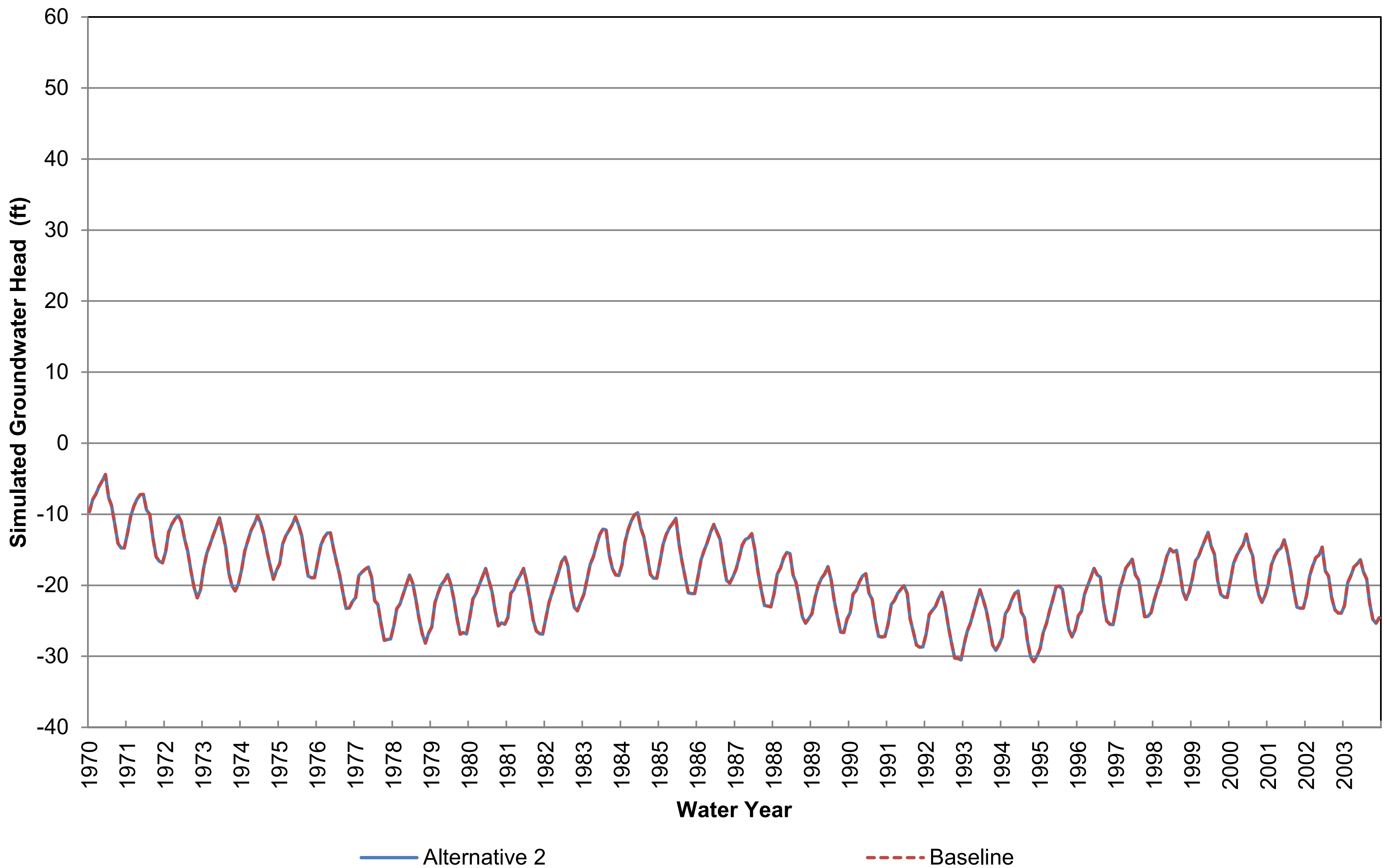


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 33 (Approximately 70-240 ft bgs)

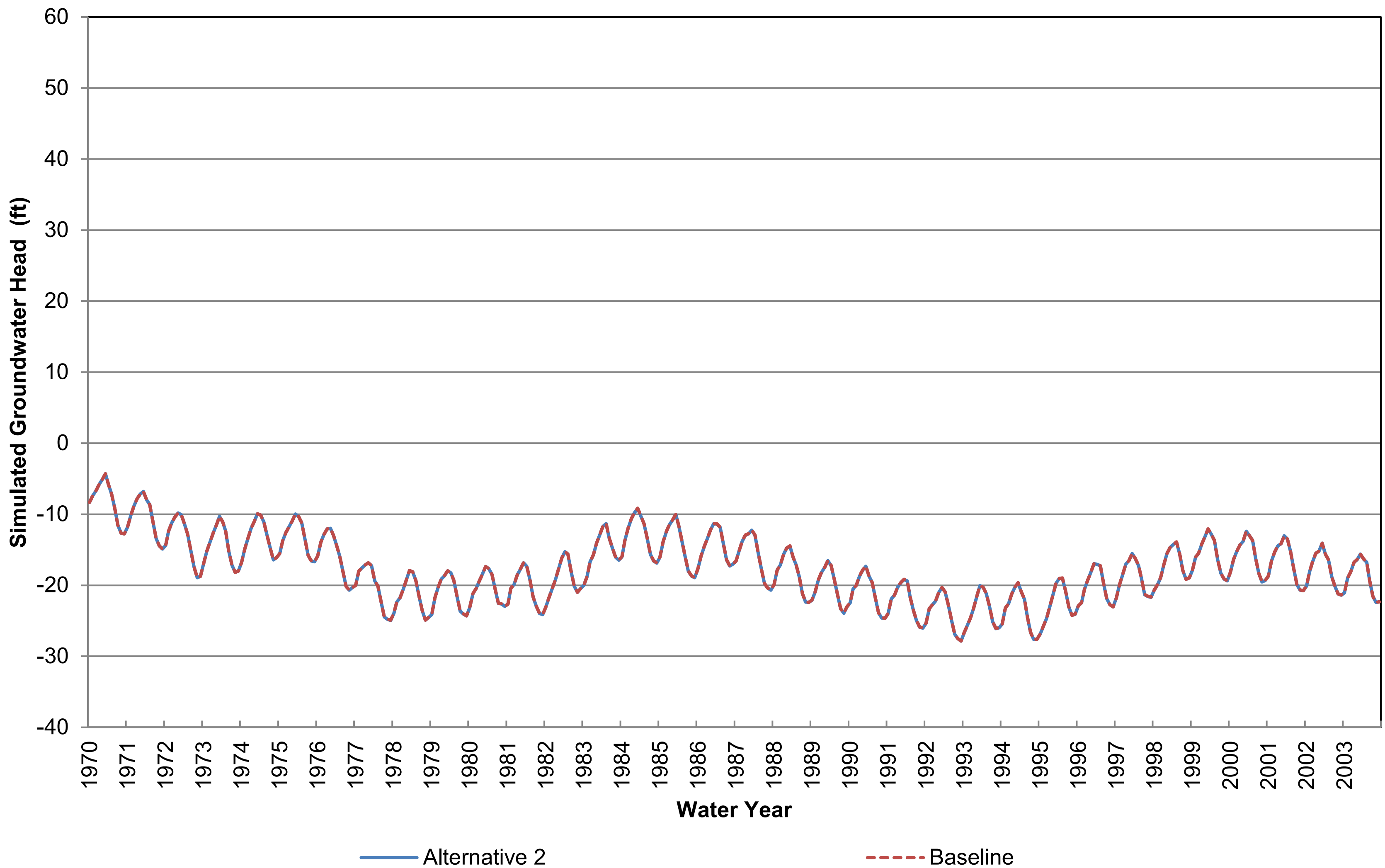



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 240-410 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

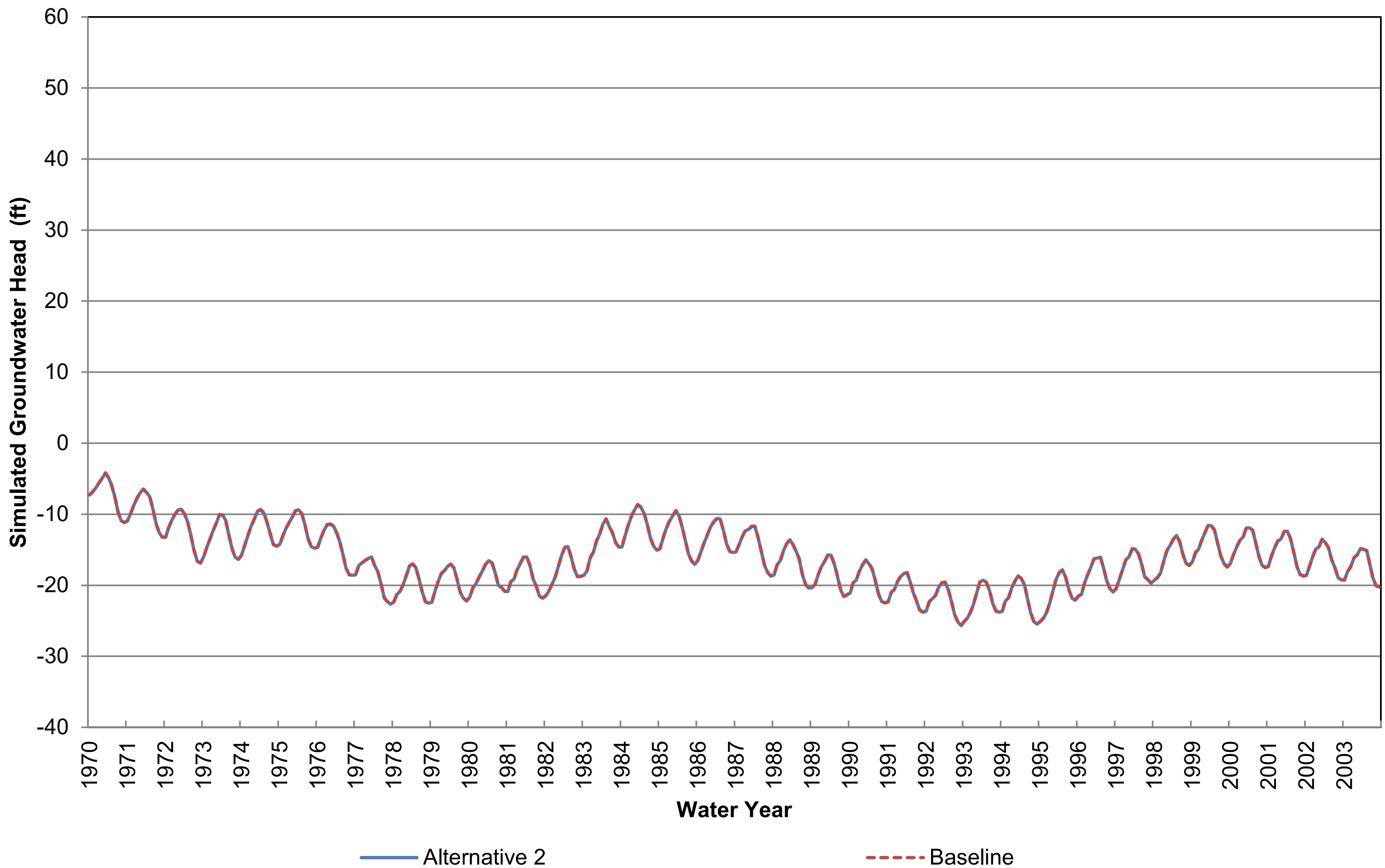
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 33 (Approximately 410-570 ft bgs)

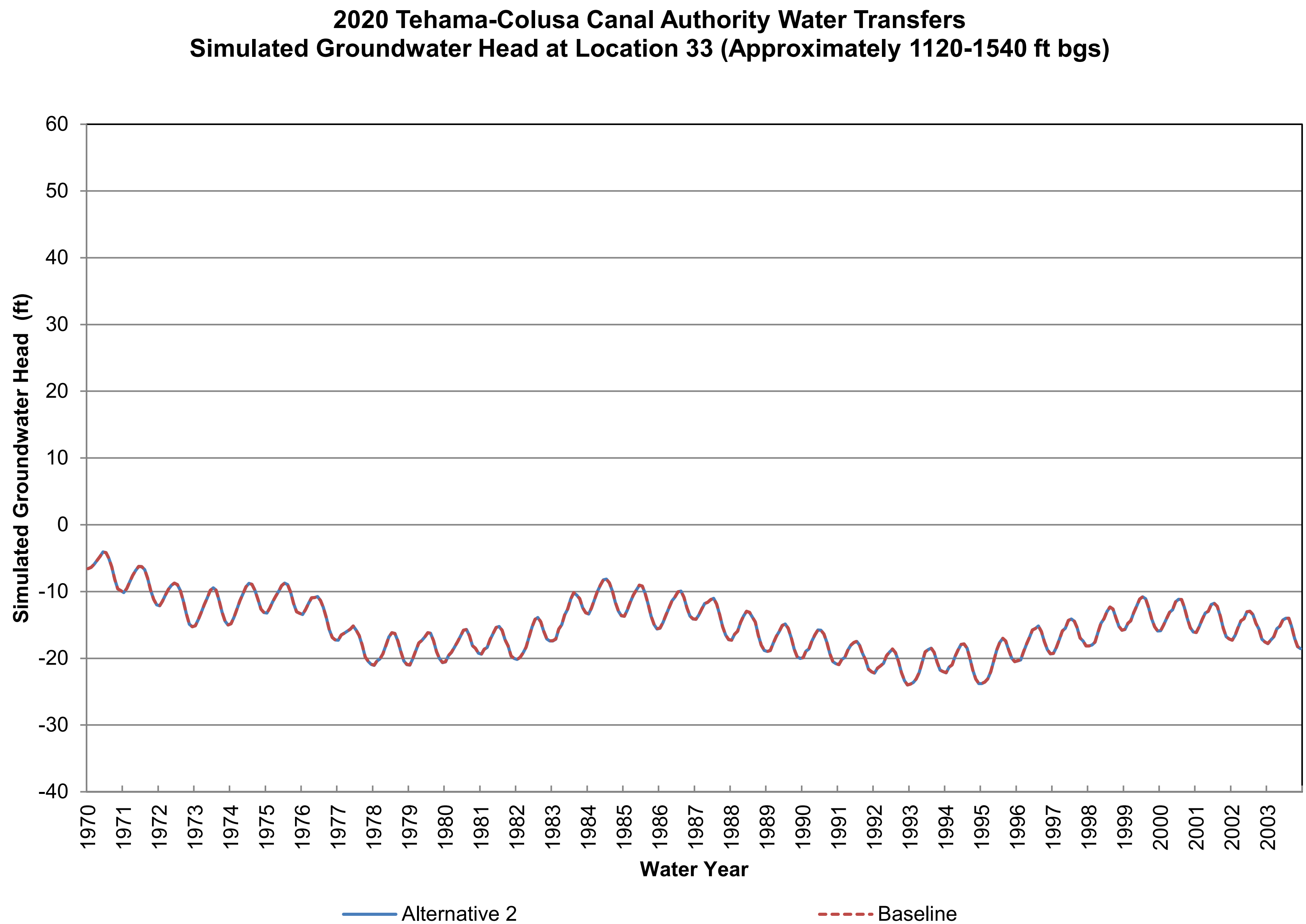


## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 33 (Approximately 570-840 ft bgs)



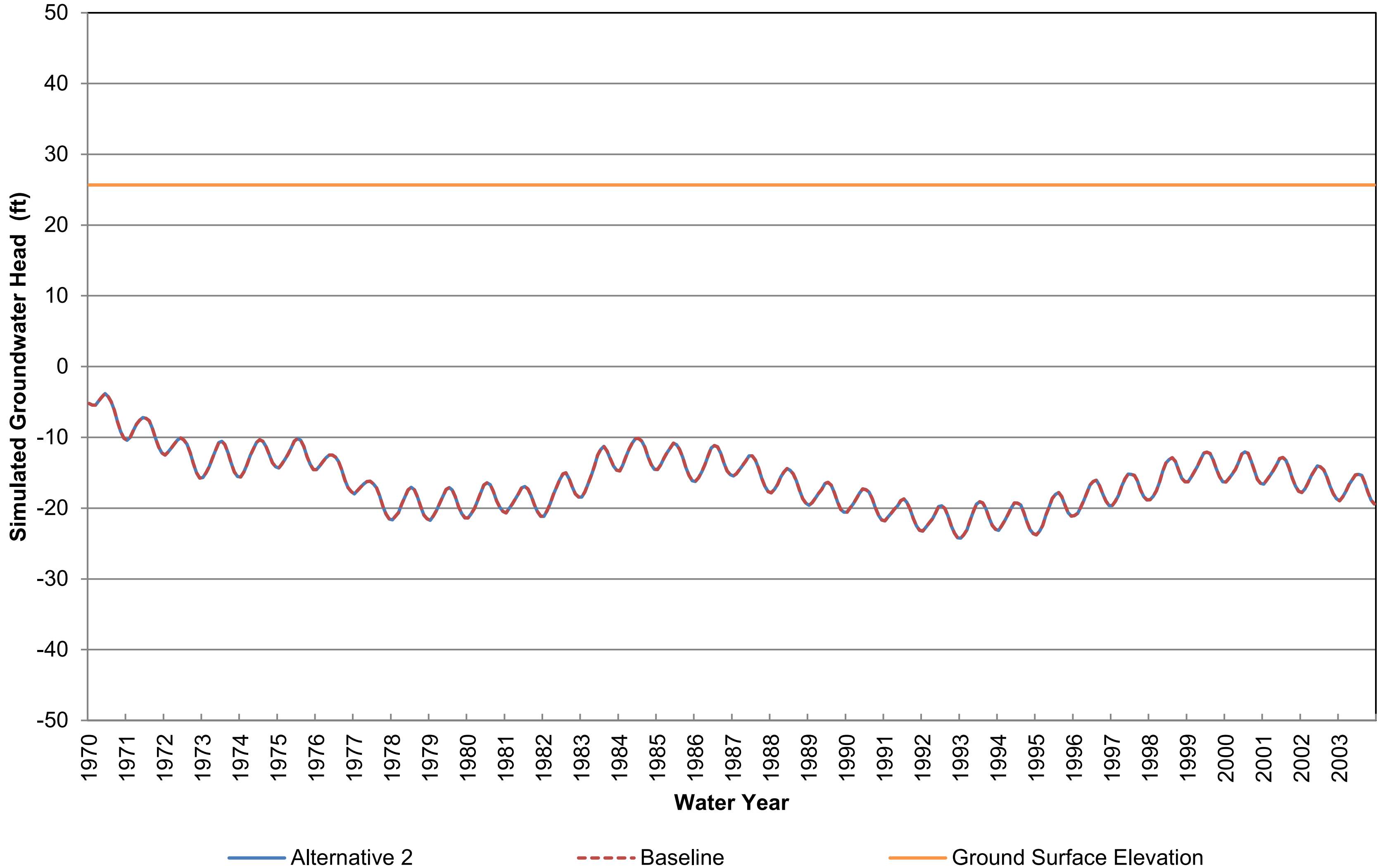
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 33 (Approximately 840-1120 ft bgs)

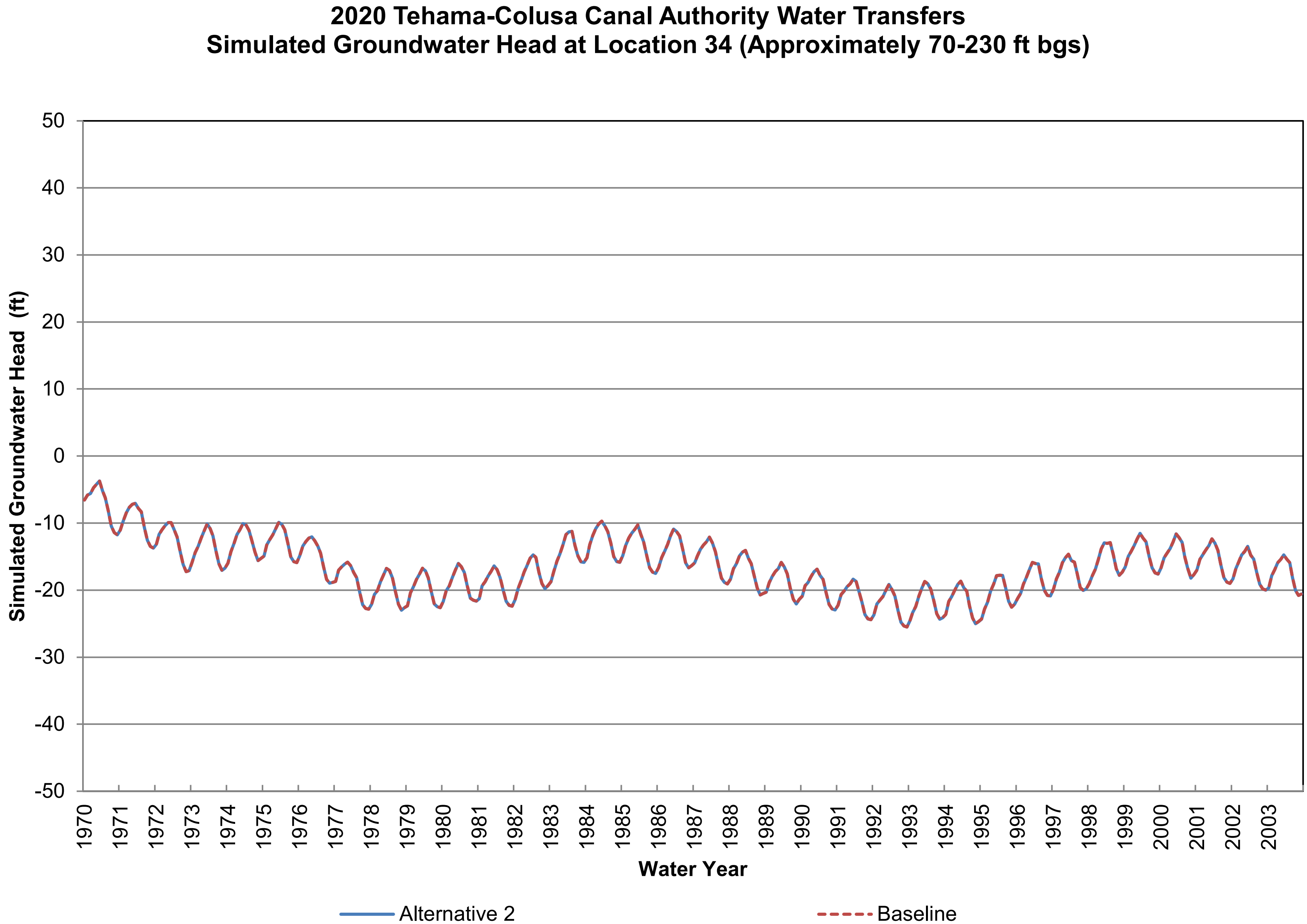




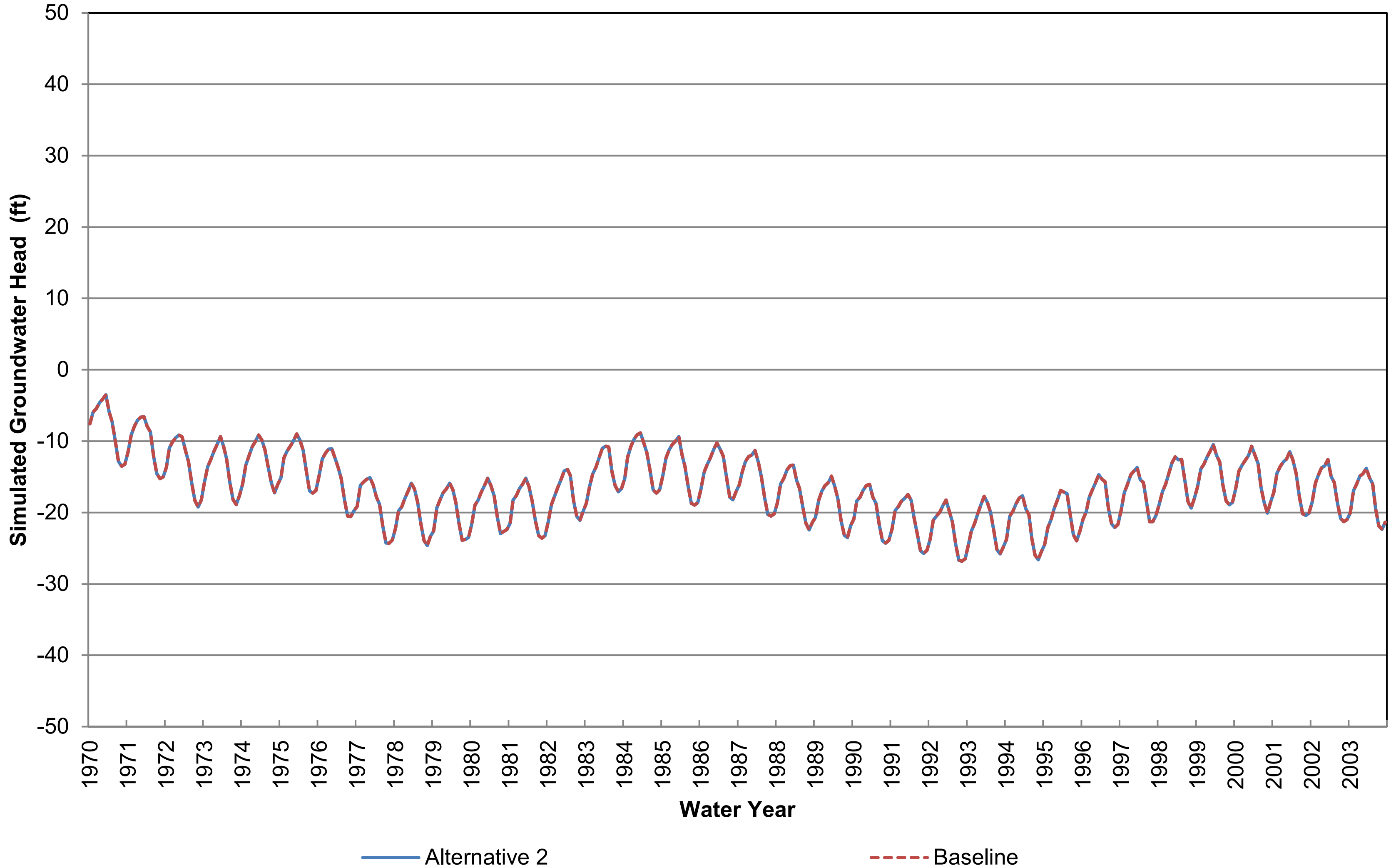
2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 1120-1540 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Elevation at Location 34 (Approximately 0-70 ft bgs)

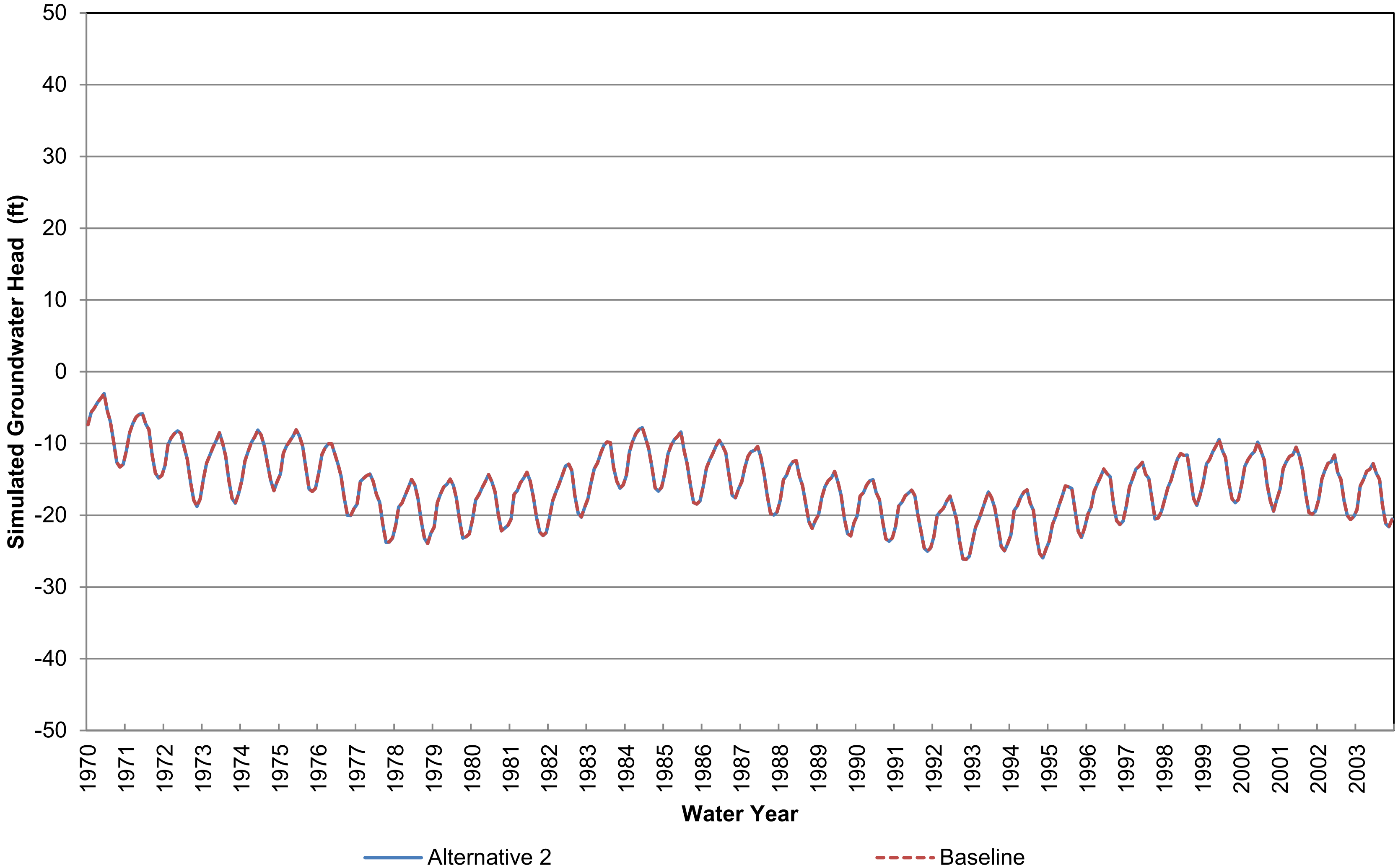



2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 70-230 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

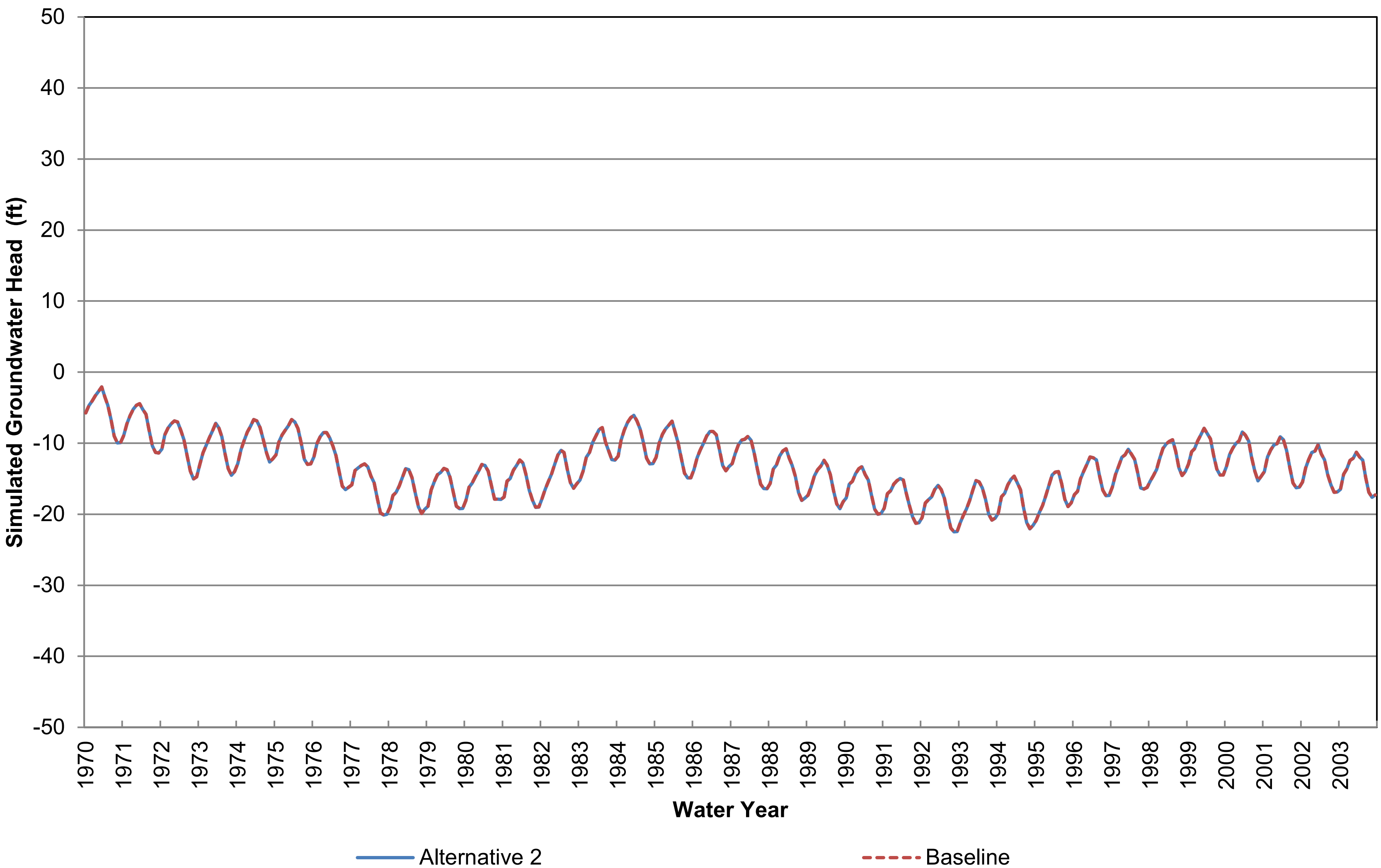
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 34 (Approximately 230-380 ft bgs)

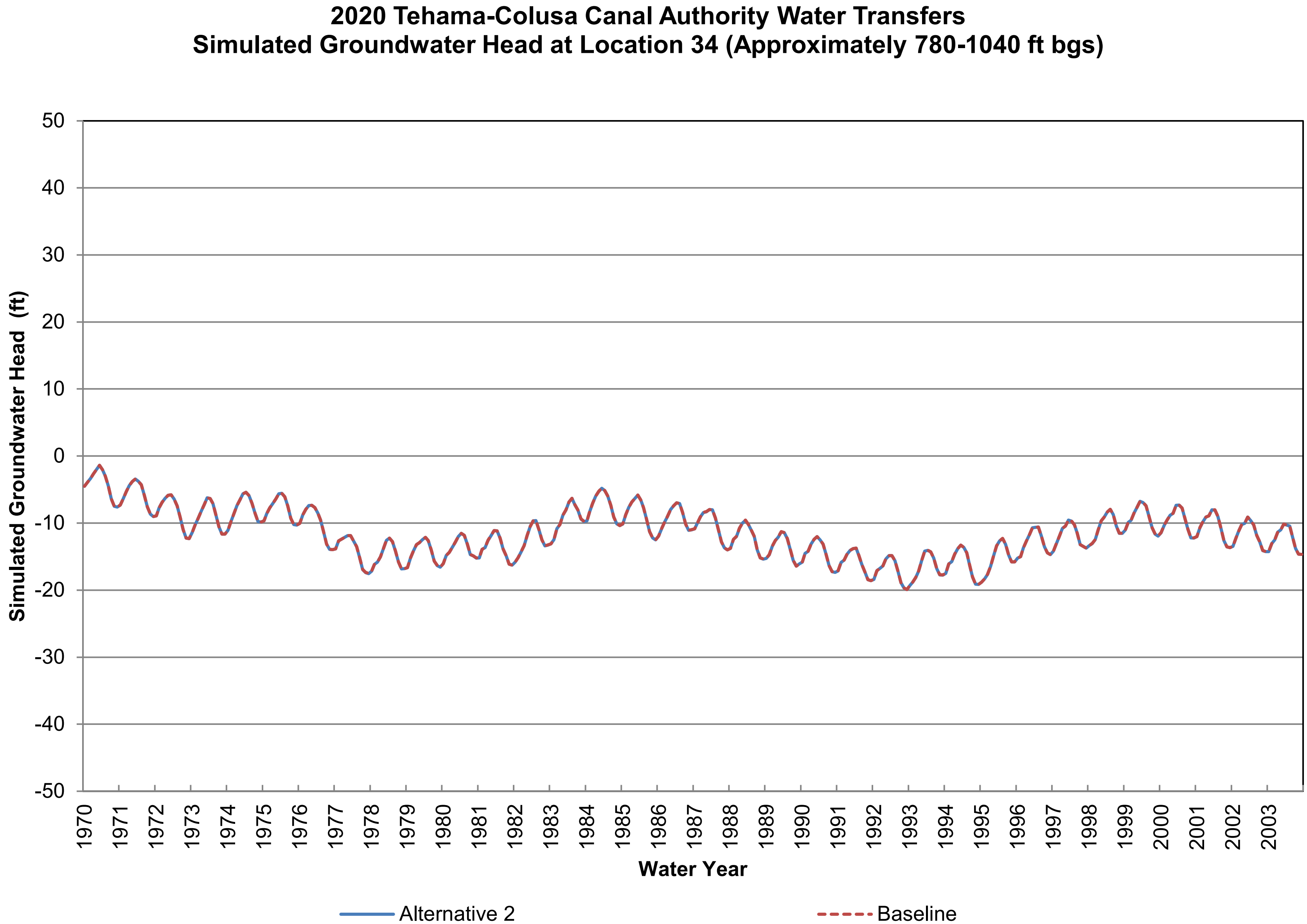


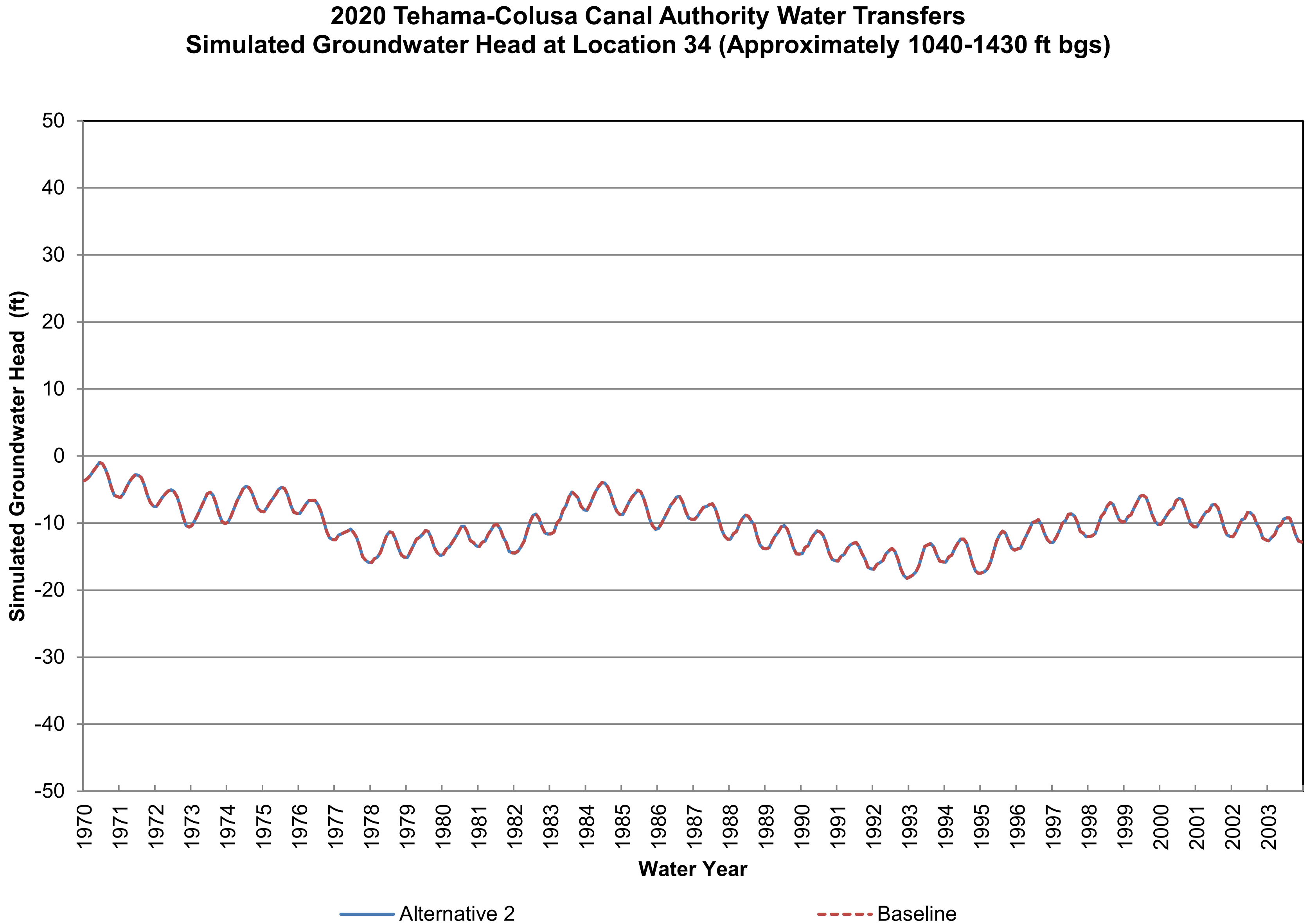
## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 34 (Approximately 380-540 ft bgs)



## 2020 Tehama-Colusa Canal Authority Water Transfers
## Simulated Groundwater Head at Location 34 (Approximately 540-780 ft bgs)




2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 780-1040 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2020 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 1040-1430 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

# Appendix I

# 2015 Water Transfers Data Reports

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# Anderson-Cottonwood Irrigation District

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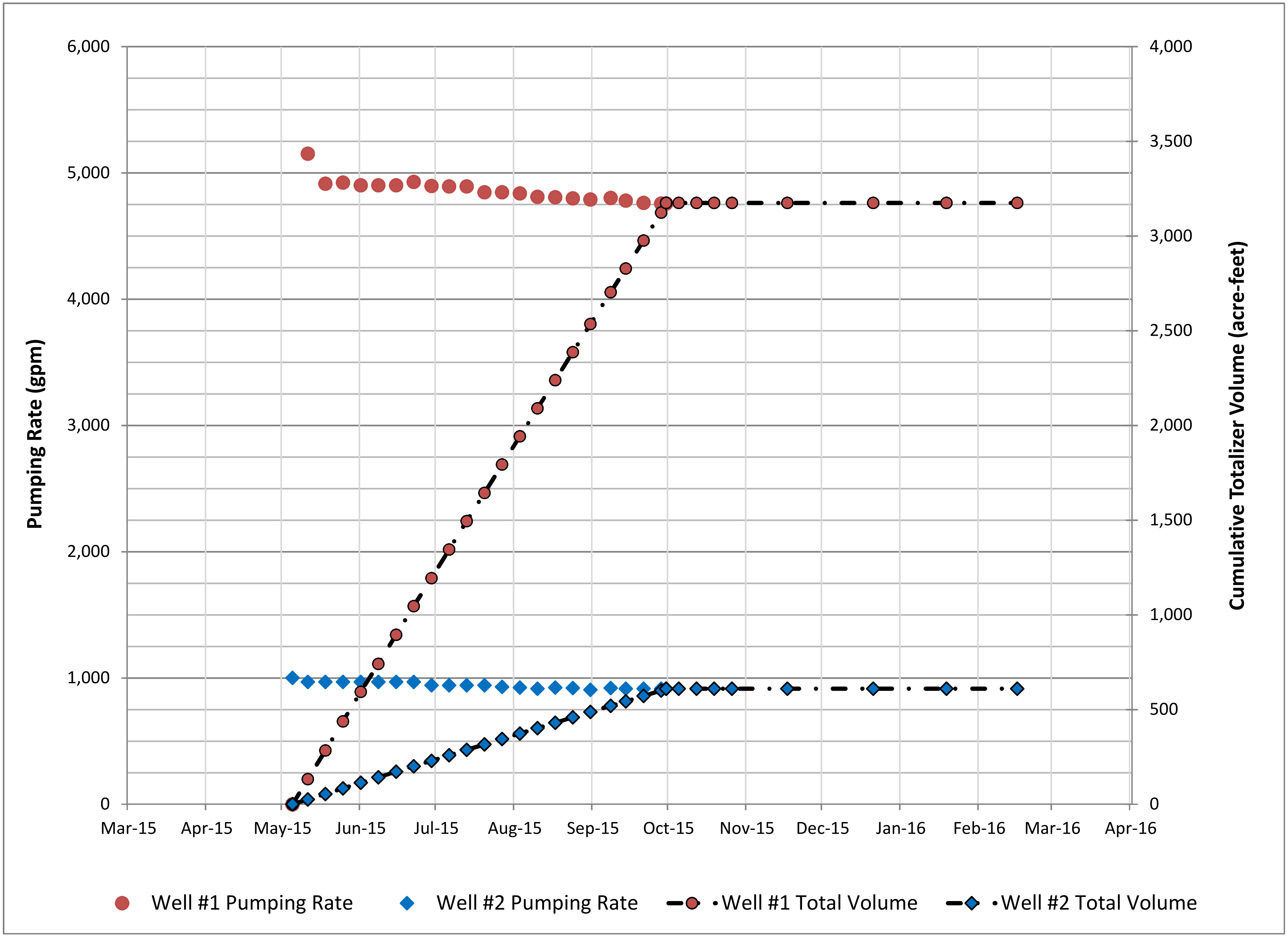
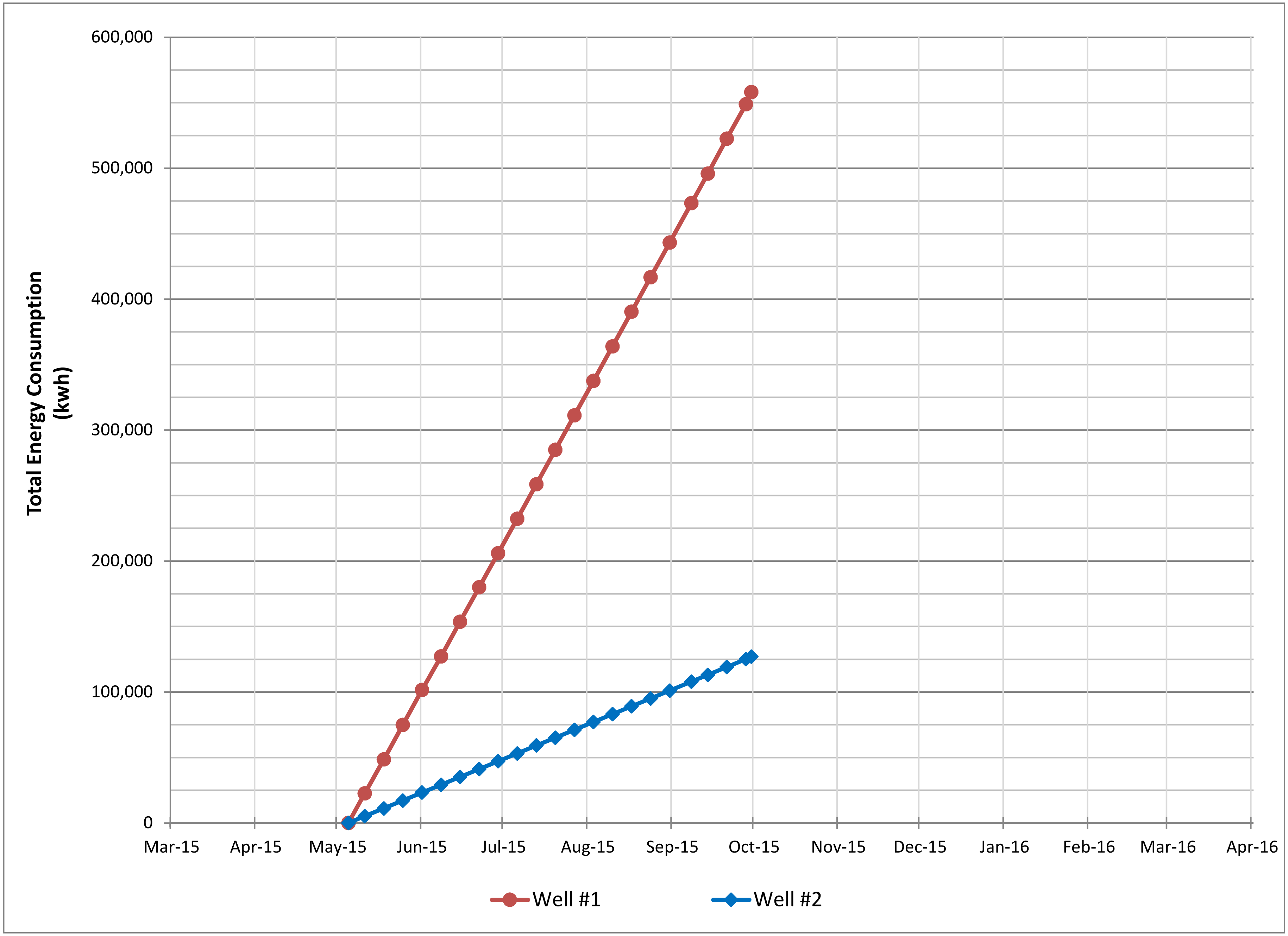
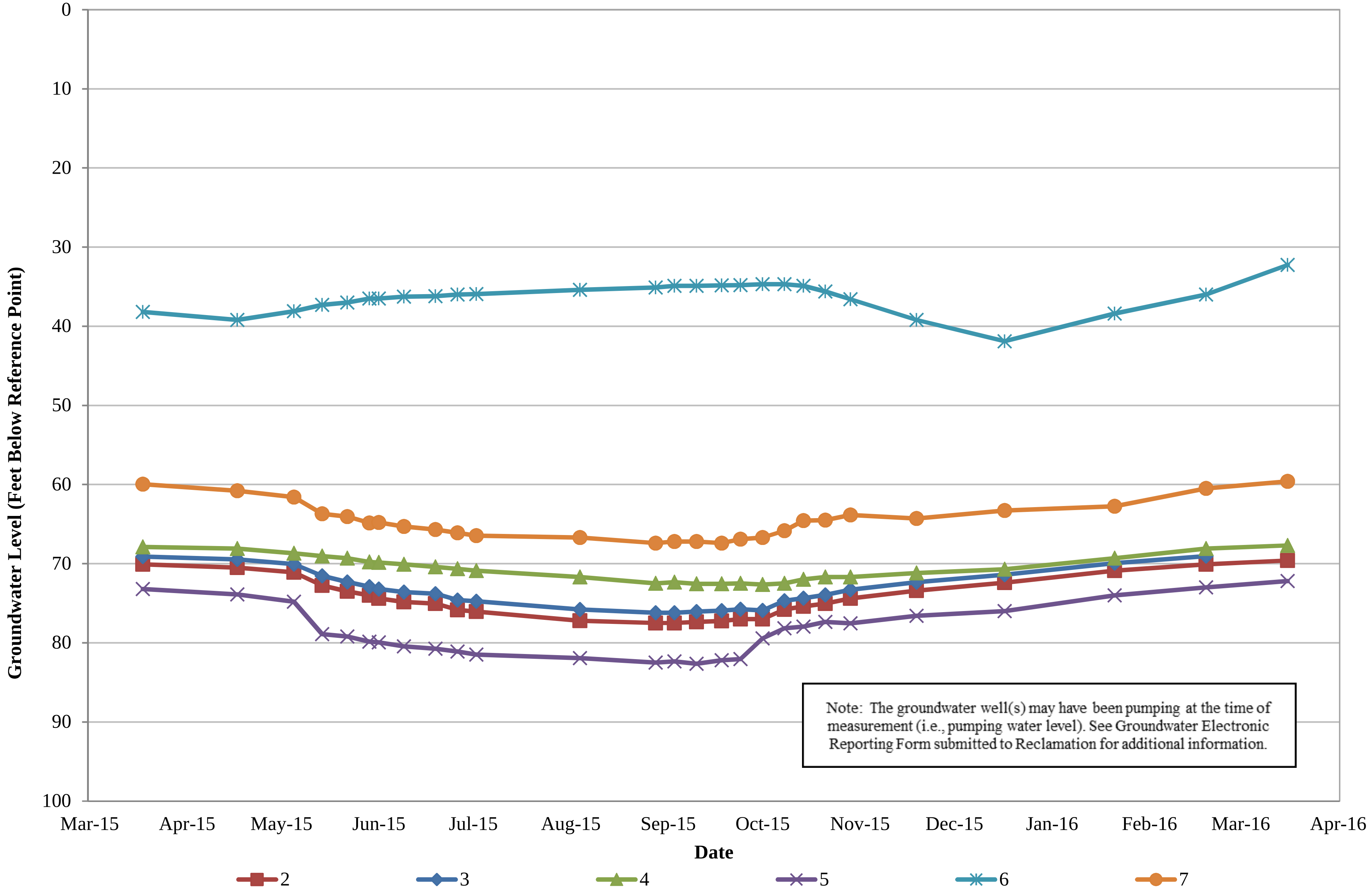


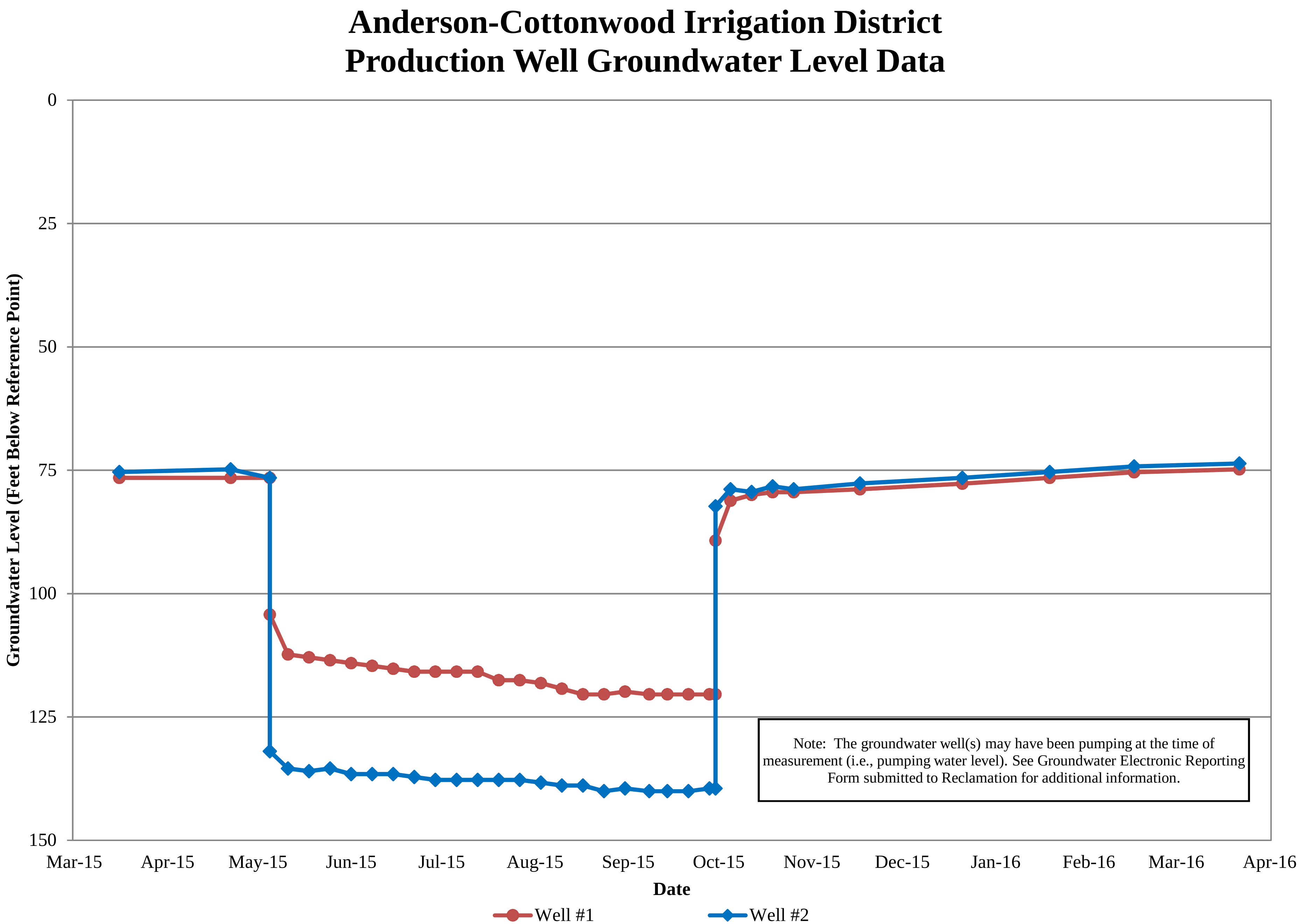
6,000
5,000
4,000
3,000
2,000
1,000
0
Pumping Rate (gpm)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Cumulative Totalizer Volume (acre-feet)
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1 Pumping Rate
Well #2 Pumping Rate
Well #1 Total Volume
Well #2 Total Volume



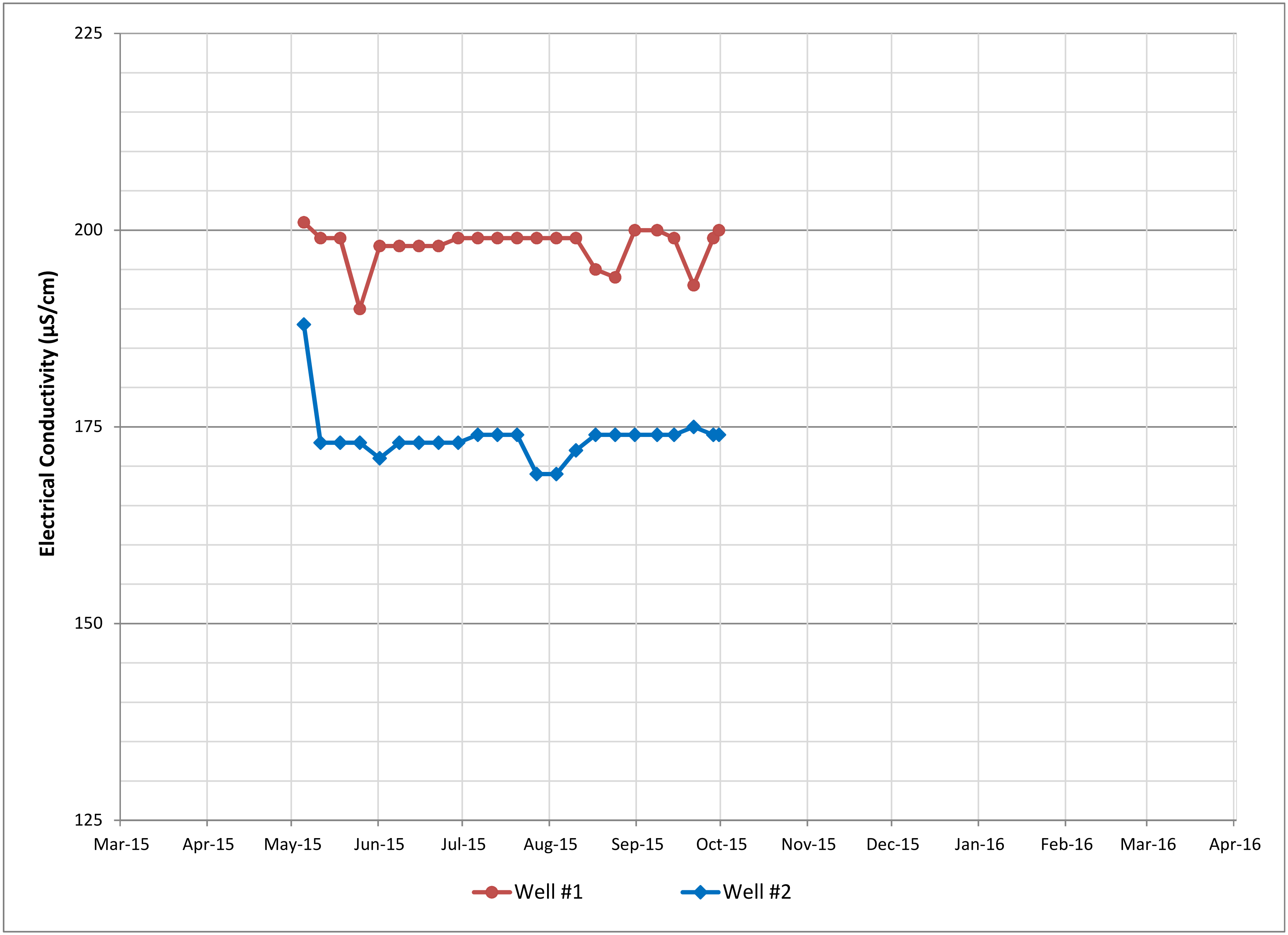
Total Energy Consumption
(kwh)
600,000
500,000
400,000
300,000
200,000
100,000
0
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1
Well #2

# Anderson-Cottonwood Irrigation District
# Monitoring Well Groundwater Level Data

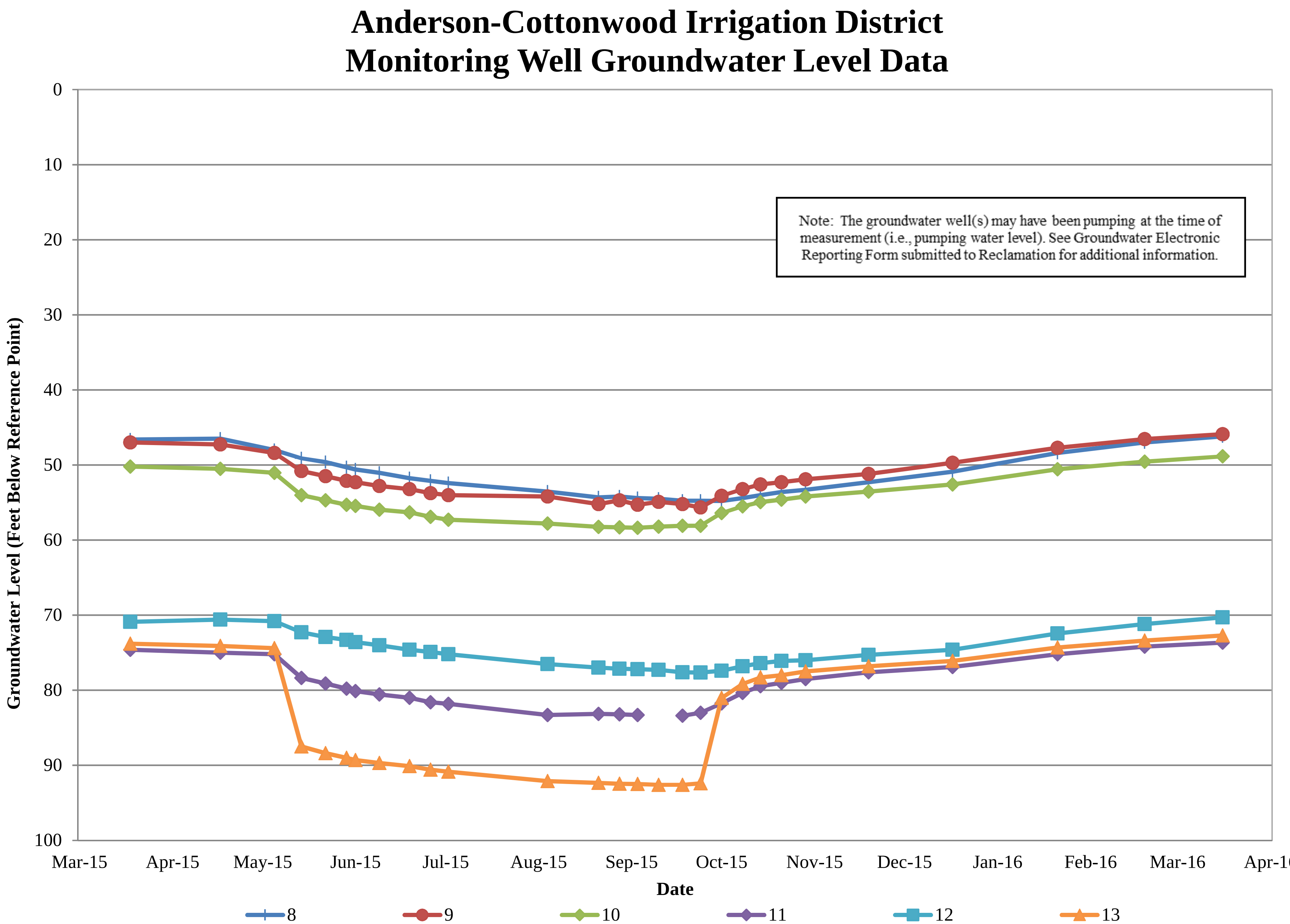




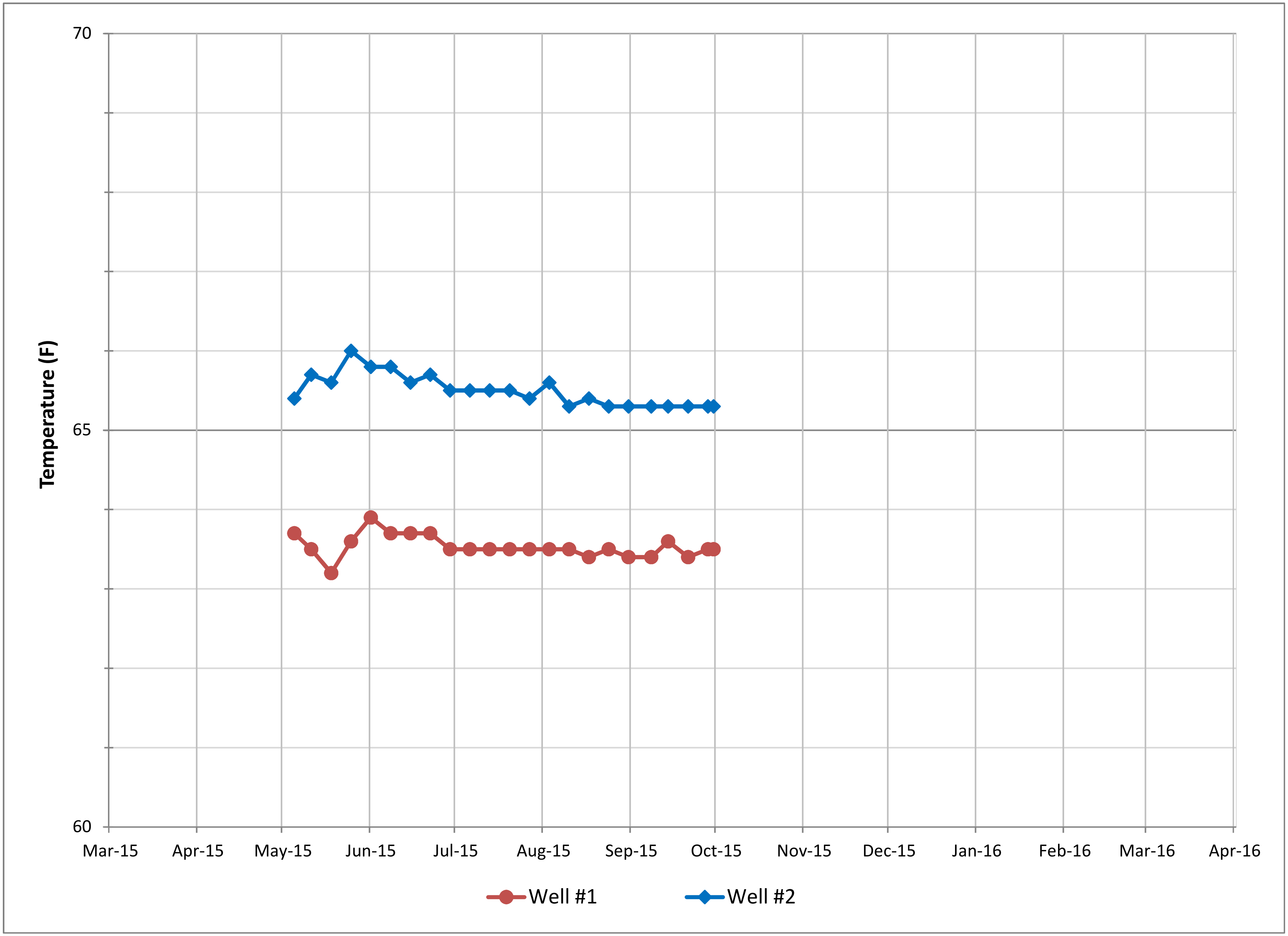
Anderson-Cottonwood Irrigation District
Production Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
25
50
75
100
125
150
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Well #1
Well #2
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.



Electrical Conductivity (µS/cm)
225
200
175
150
125
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1
Well #2



Anderson-Cottonwood Irrigation District
Monitoring Well Groundwater Level Data
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
Groundwater Level (Feet Below Reference Point)
0
10
20
30
40
50
60
70
80
90
100
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
8
9
10
11
12
13



70
65
60
Temperature (F)
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1
Well #2

# Canal Farms

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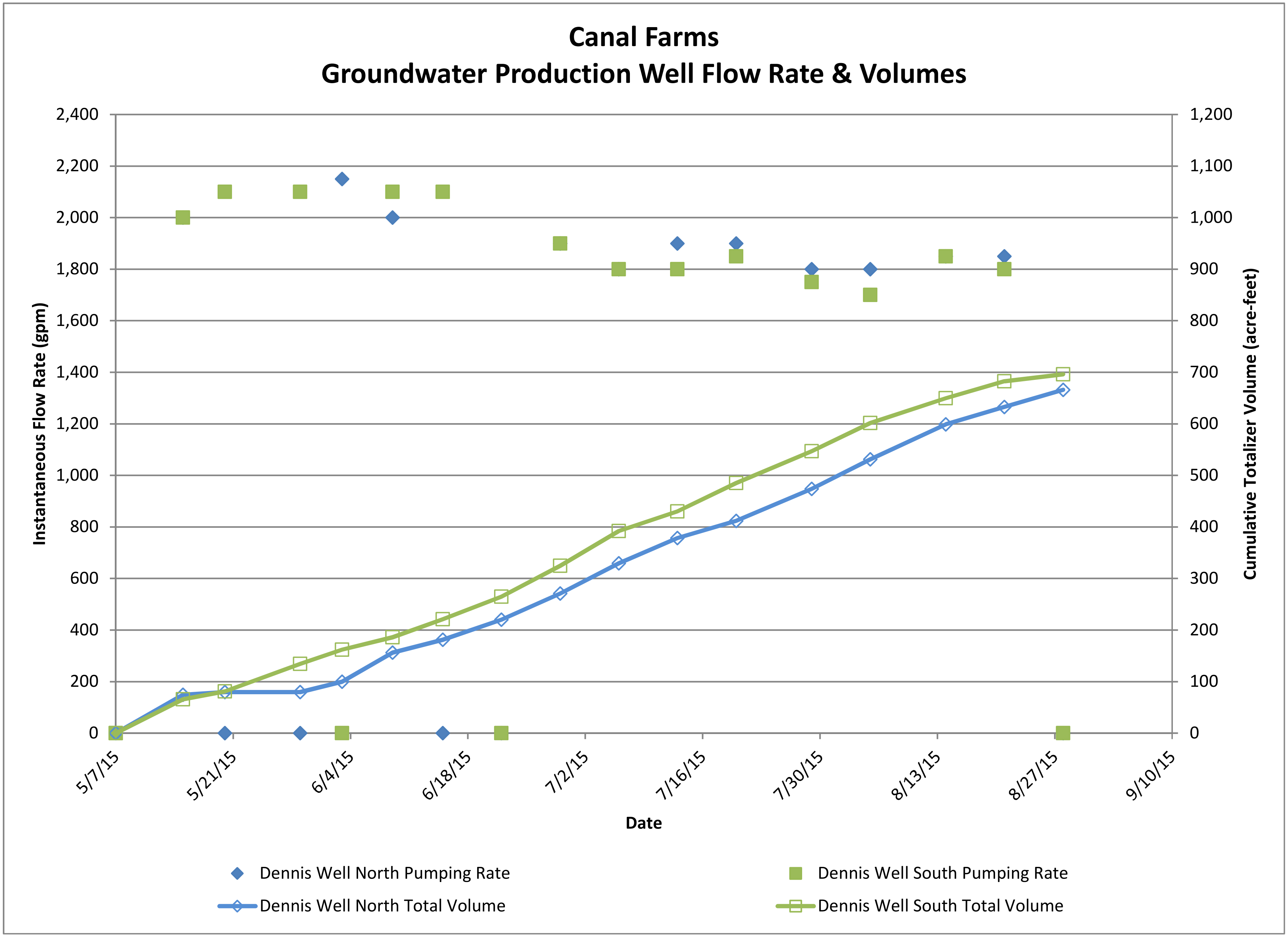
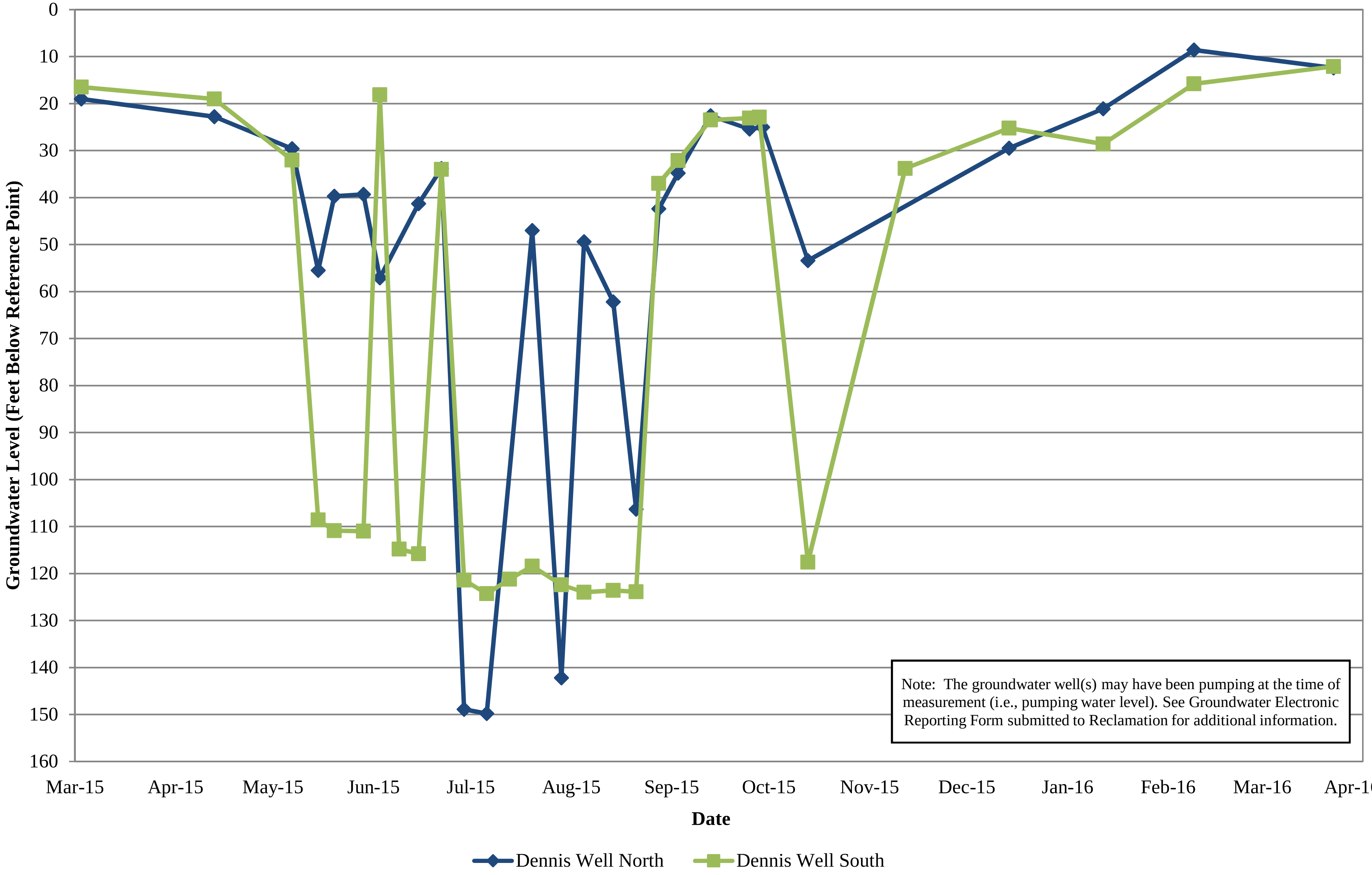
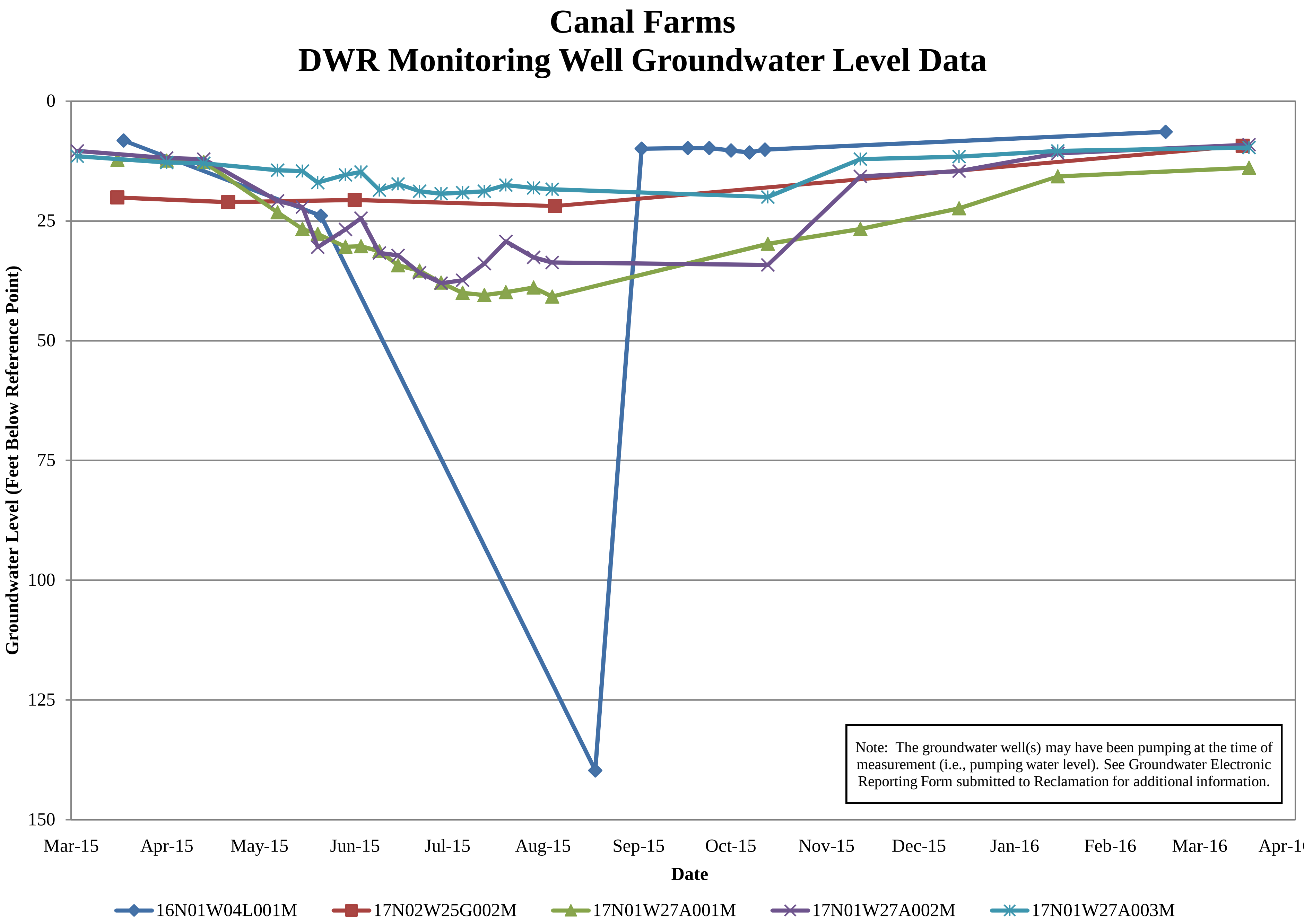
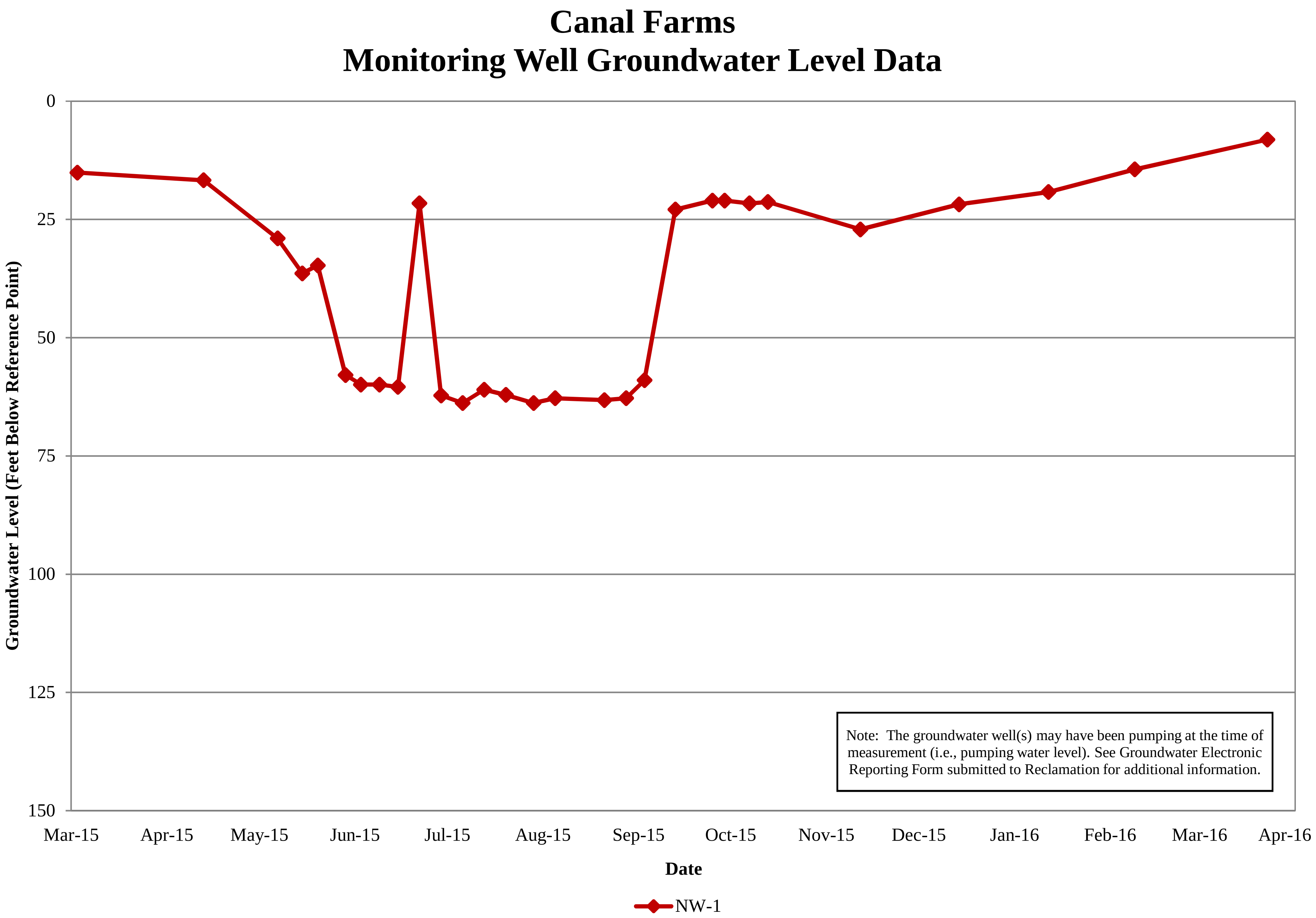


Canal Farms
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/7/15
5/21/15
6/4/15
6/18/15
7/2/15
7/16/15
7/30/15
8/13/15
8/27/15
9/10/15
Date
Dennis Well North Pumping Rate
Dennis Well South Pumping Rate
Dennis Well North Total Volume
Dennis Well South Total Volume

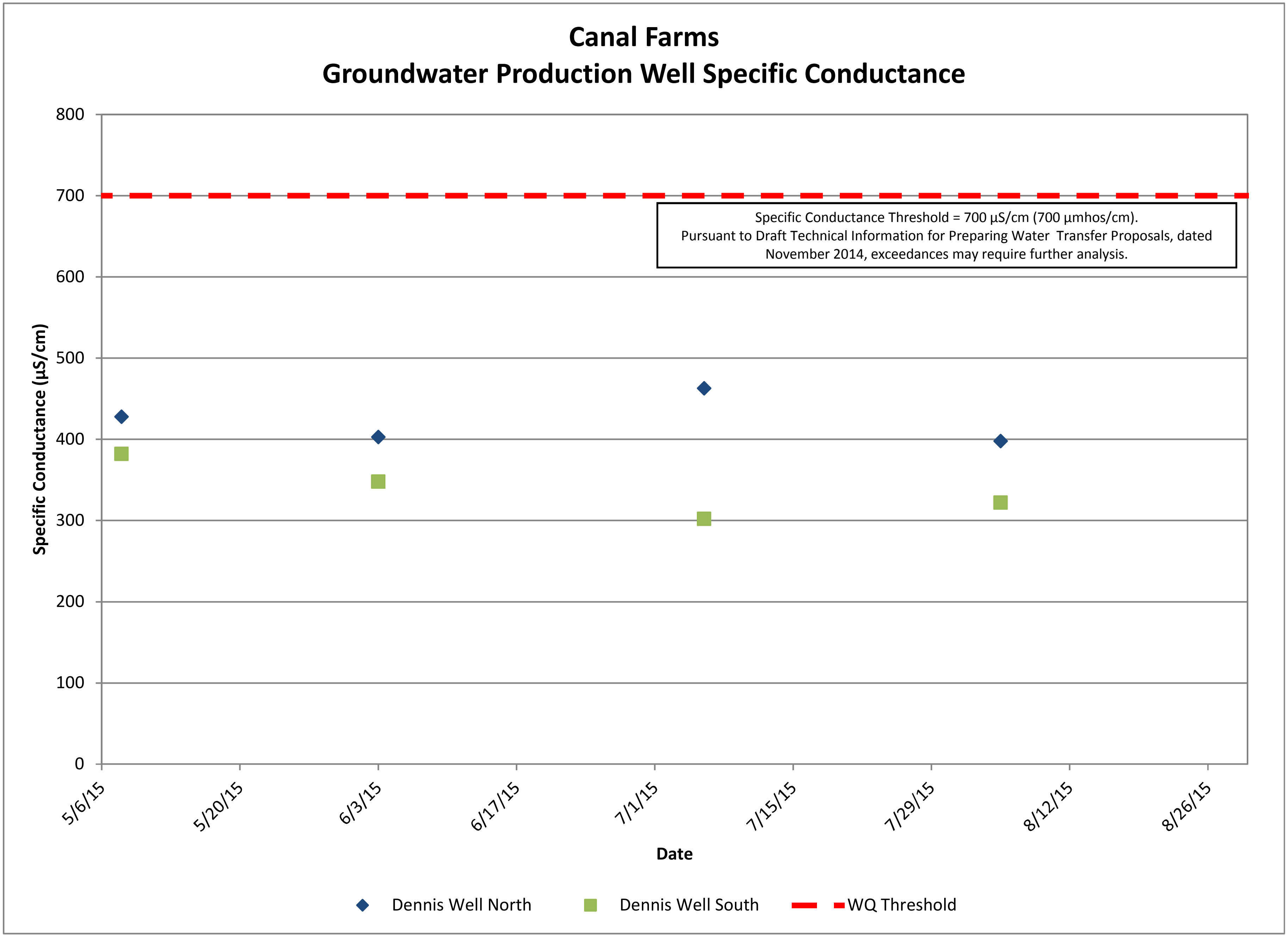
# Canal Farms
# Production Well Groundwater Level Data




Canal Farms
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
25
50
75
100
125
150
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
16N01W04L001M
17N02W25G002M
17N01W27A001M
17N01W27A002M
17N01W27A003M



Canal Farms
Monitoring Well Groundwater Level Data
0
25
50
75
100
125
150
Groundwater Level (Feet Below Reference Point)
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
NW-1
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.



Canal Farms
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
5/6/15
5/20/15
6/3/15
6/17/15
7/1/15
7/15/15
7/29/15
8/12/15
8/26/15
Date
Dennis Well North
Dennis Well South
WQ Threshold

# Conaway Preservation Group

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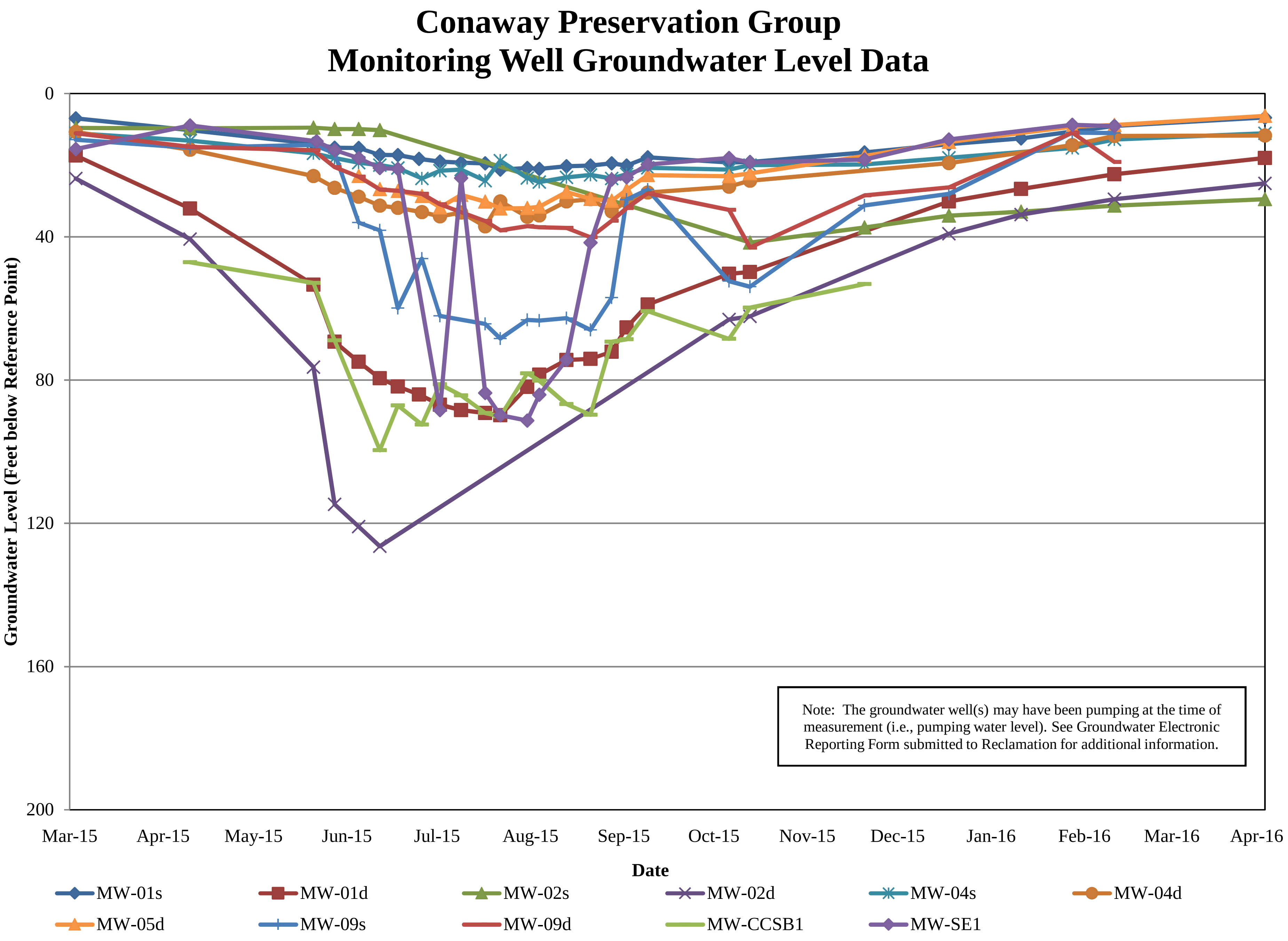
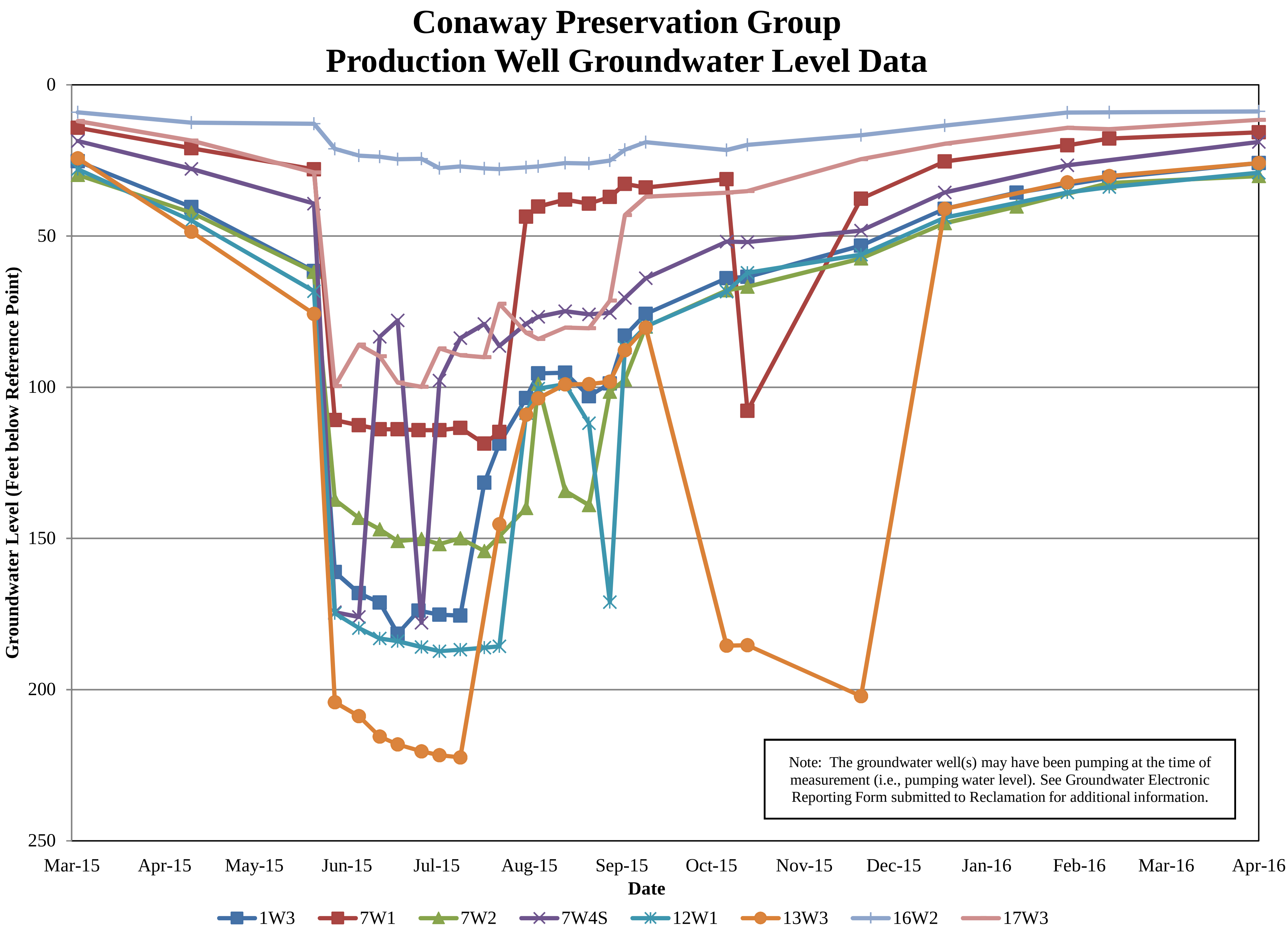
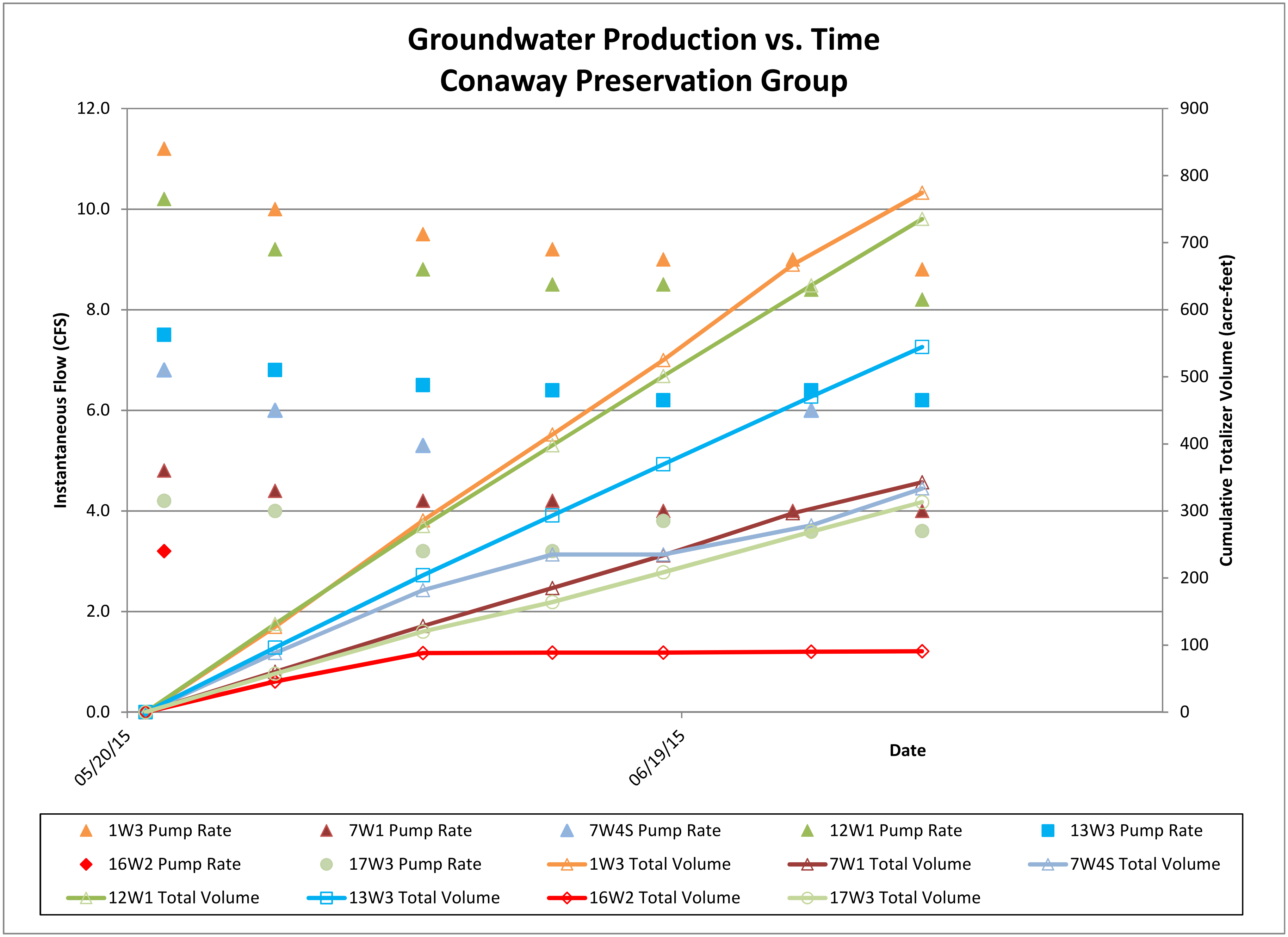
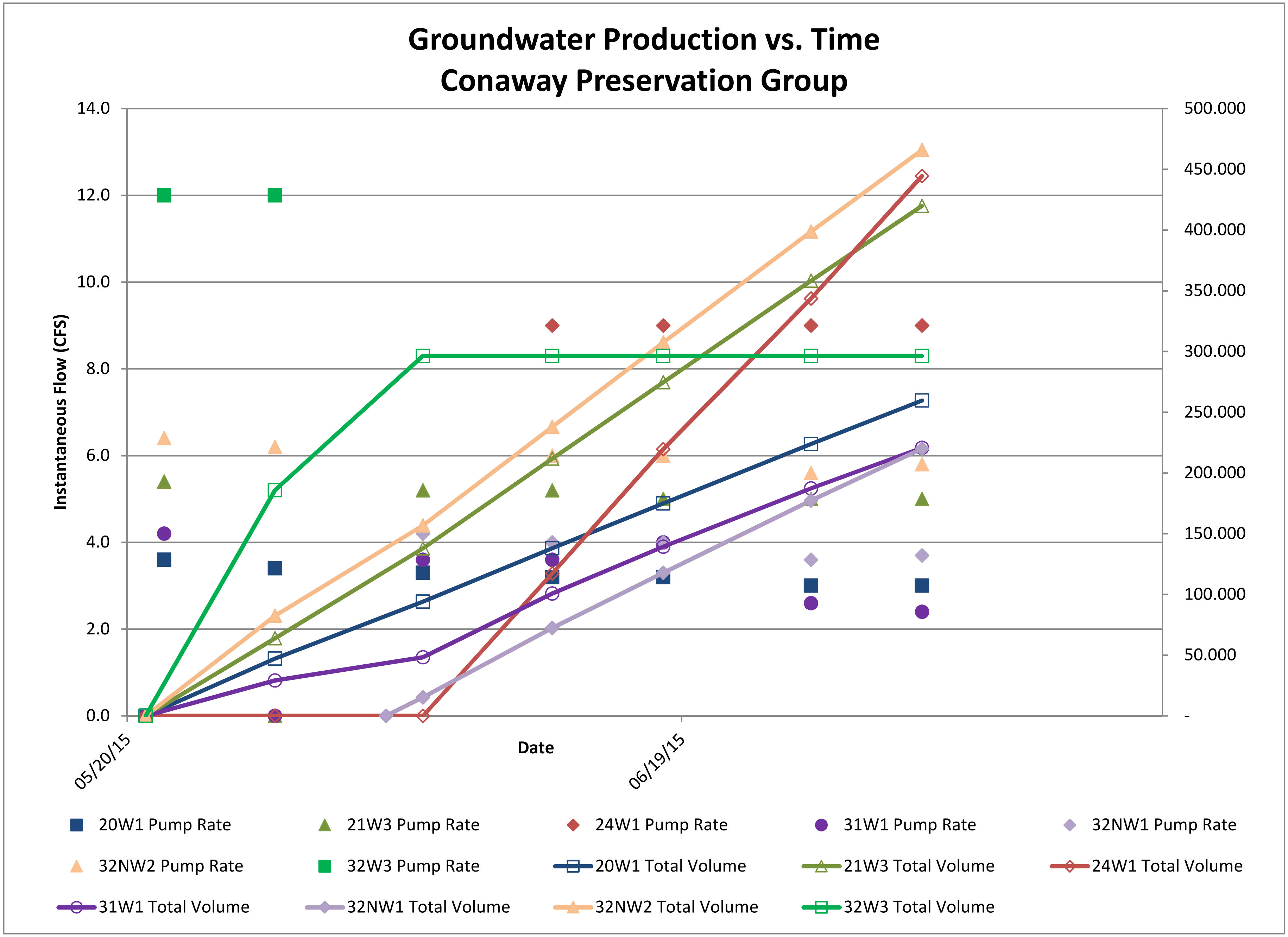


Conaway Preservation Group
Monitoring Well Groundwater Level Data
Groundwater Level (Feet below Reference Point)
0
40
80
120
160
200
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
MW-01s
MW-01d
MW-02s
MW-02d
MW-04s
MW-04d
MW-05d
MW-09s
MW-09d
MW-CCSB1
MW-SE1
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.

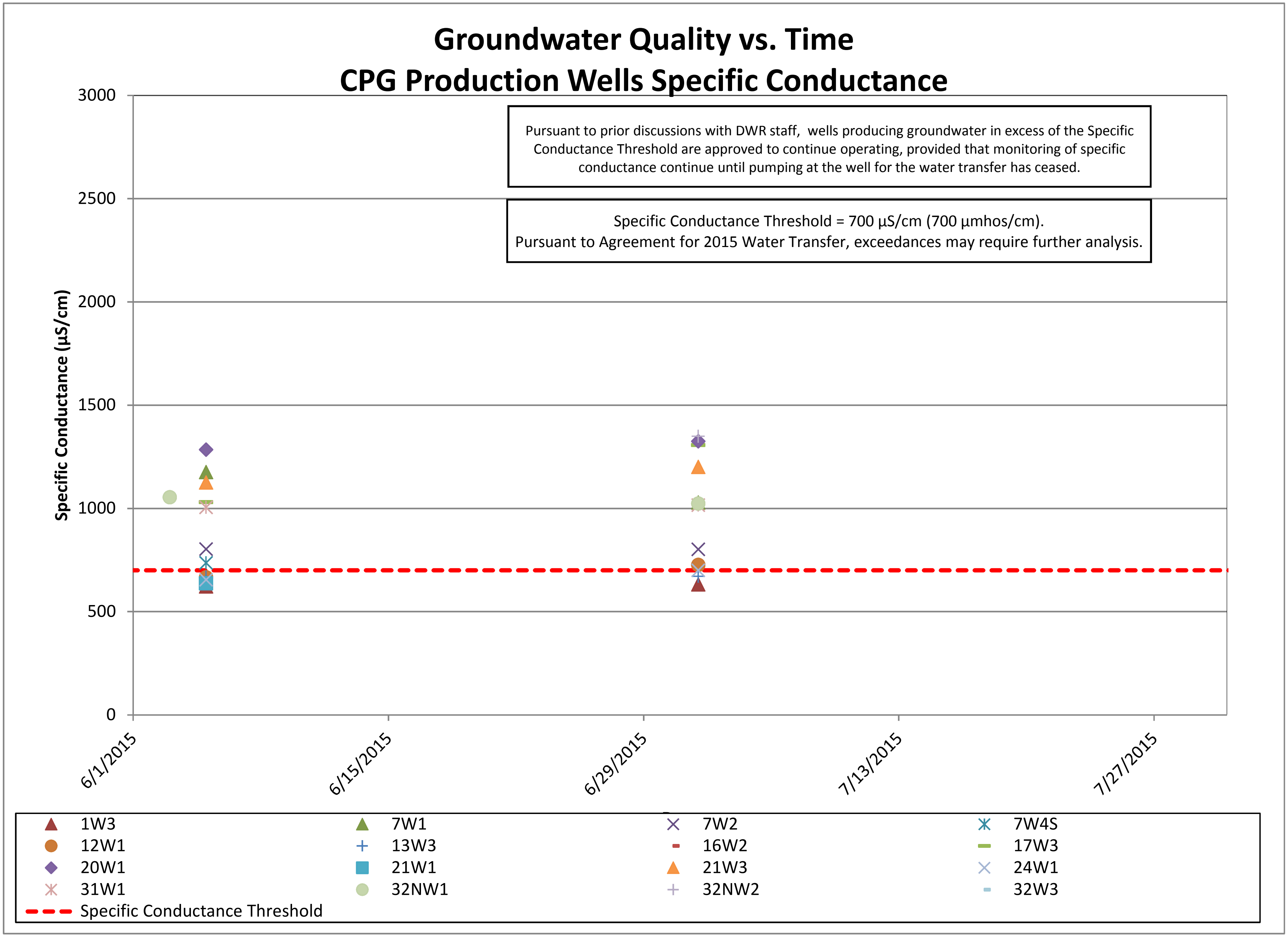

Conaway Preservation Group
Production Well Groundwater Level Data
Groundwater Level (Feet below Reference Point)
0
50
100
150
200
250
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
1W3
7W1
7W2
7W4S
12W1
13W3
16W2
17W3
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.



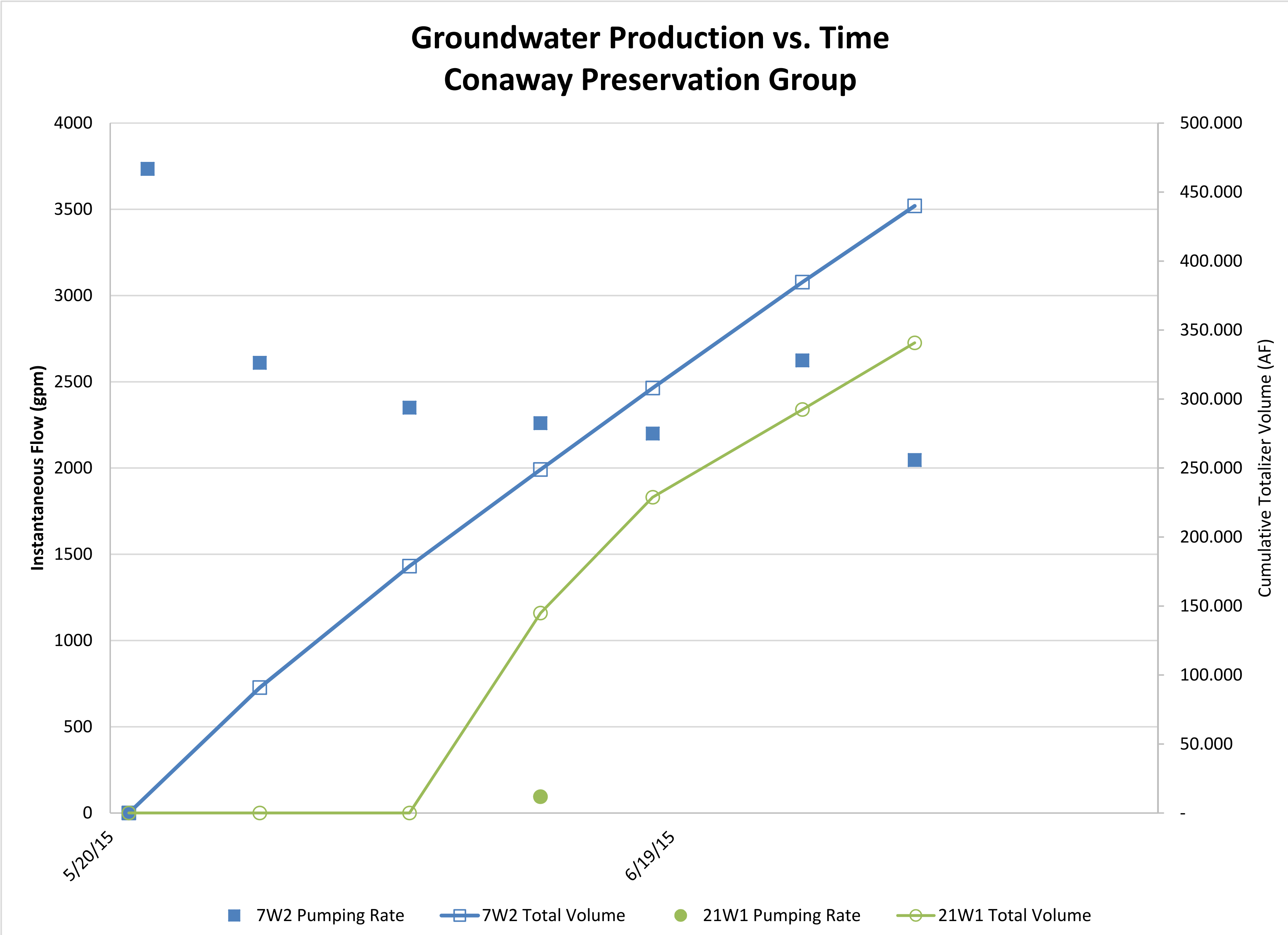
Groundwater Production vs. Time
Conaway Preservation Group
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
900
800
700
600
500
400
300
200
100
0
05/20/15
06/19/15
Date
1W3 Pump Rate
7W1 Pump Rate
7W4S Pump Rate
12W1 Pump Rate
13W3 Pump Rate
16W2 Pump Rate
17W3 Pump Rate
1W3 Total Volume
7W1 Total Volume
7W4S Total Volume
12W1 Total Volume
13W3 Total Volume
16W2 Total Volume
17W3 Total Volume



Groundwater Production vs. Time
Conaway Preservation Group
Instantaneous Flow (CFS)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
500.000
450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
-
05/20/15
06/19/15
Date
20W1 Pump Rate
21W3 Pump Rate
24W1 Pump Rate
31W1 Pump Rate
32NW1 Pump Rate
32NW2 Pump Rate
32W3 Pump Rate
20W1 Total Volume
21W3 Total Volume
24W1 Total Volume
31W1 Total Volume
32NW1 Total Volume
32NW2 Total Volume
32W3 Total Volume

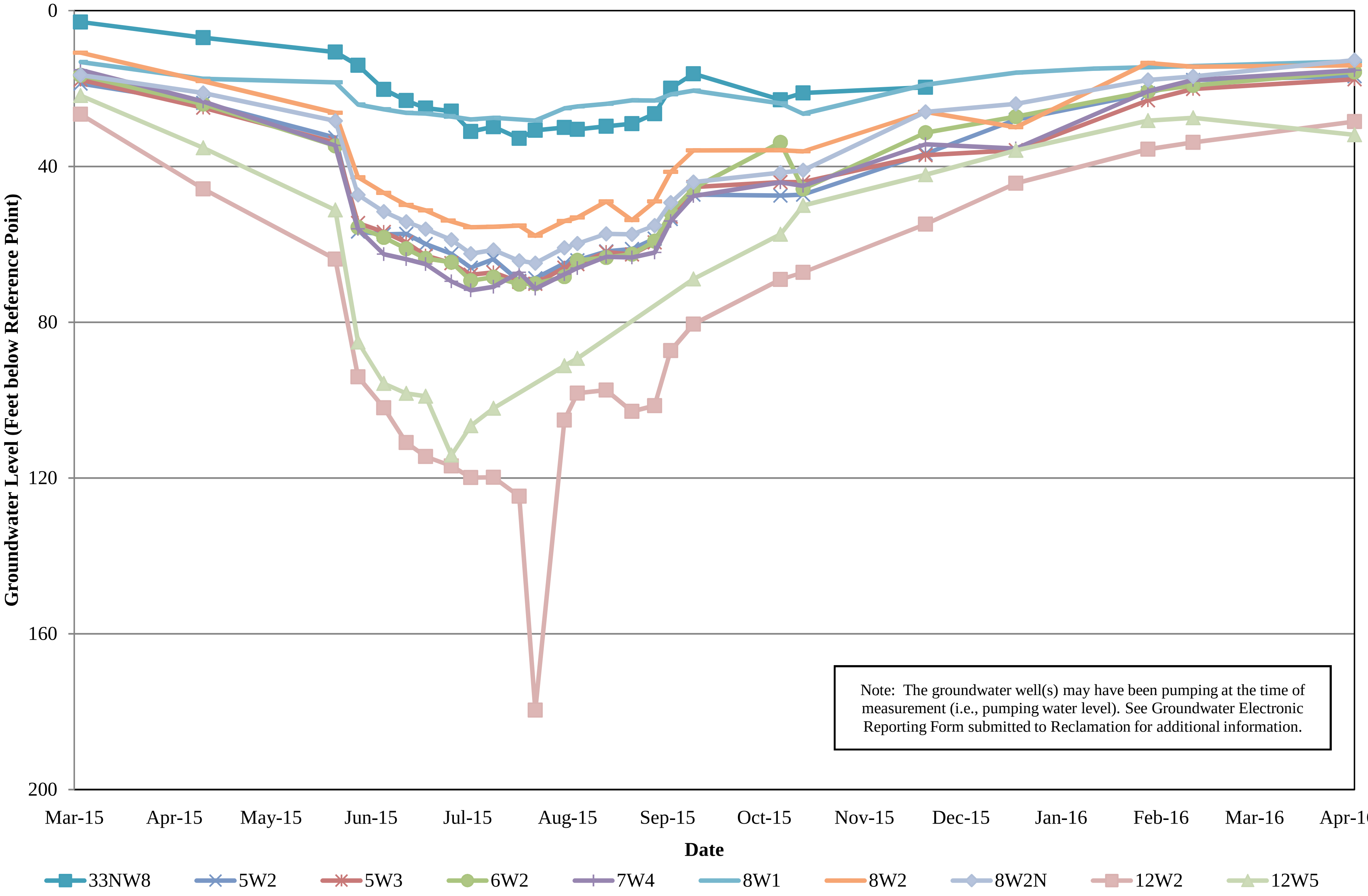


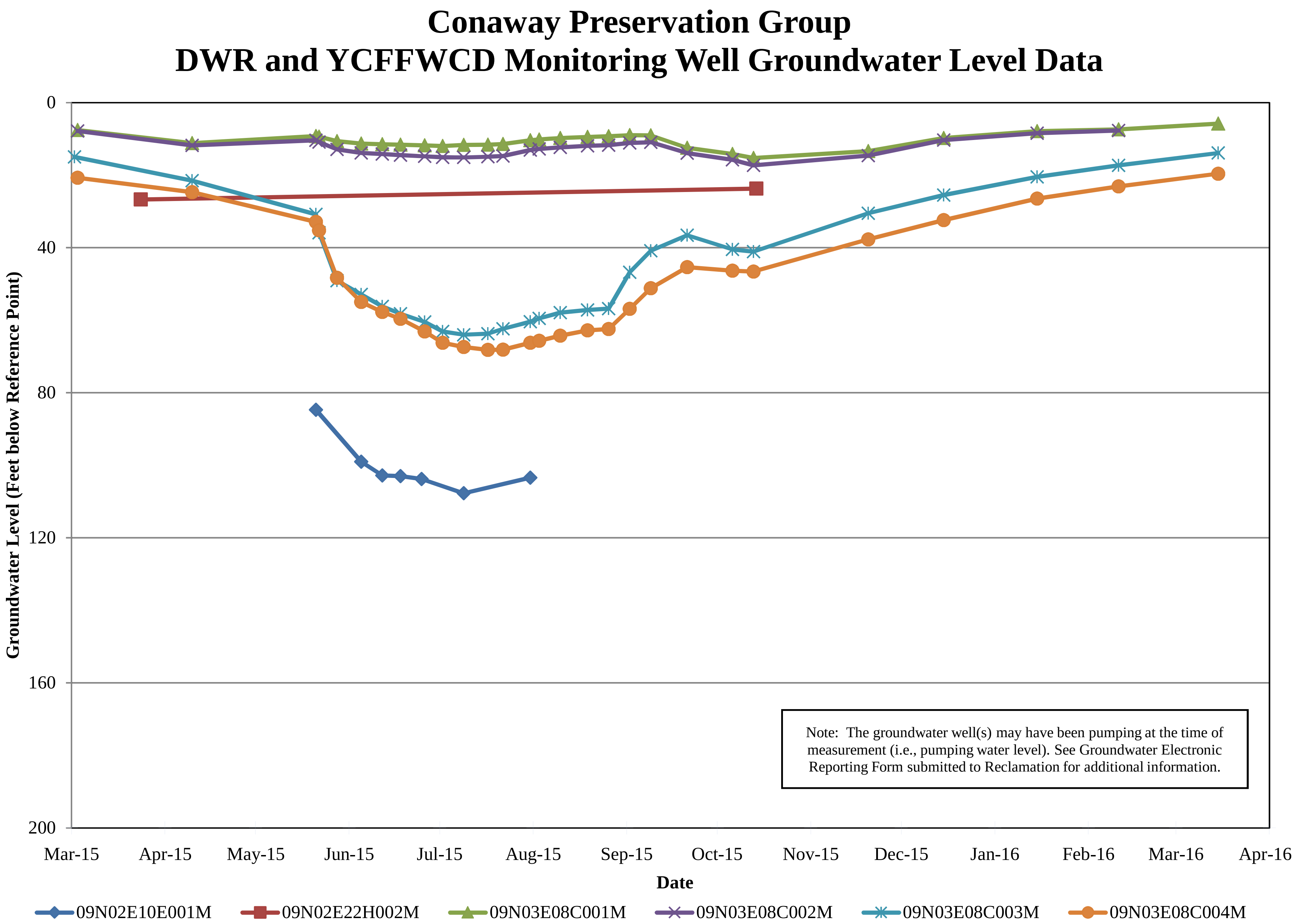
Groundwater Quality vs. Time
CPG Production Wells Specific Conductance
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Agreement for 2015 Water Transfer, exceedances may require further analysis.
Specific Conductance (µS/cm)
3000
2500
2000
1500
1000
500
0
6/1/2015
6/15/2015
6/29/2015
7/13/2015
7/27/2015
1W3
7W1
7W2
7W4S
12W1
13W3
16W2
17W3
20W1
21W1
21W3
24W1
31W1
32NW1
32NW2
32W3
Specific Conductance Threshold



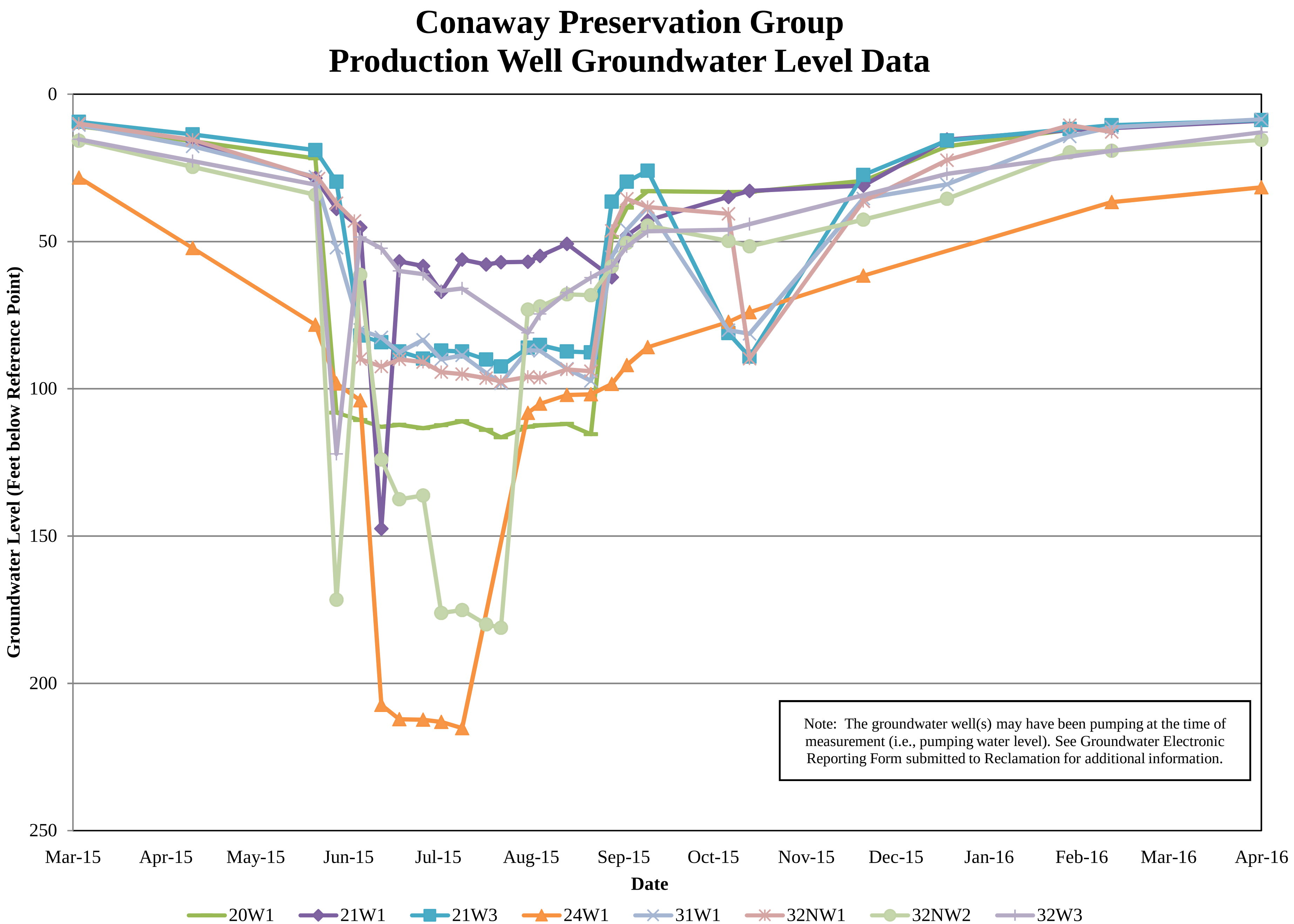
Groundwater Production vs. Time
Conaway Preservation Group
Instantaneous Flow (gpm)
4000
3500
3000
2500
2000
1500
1000
500
0
Cumulative Totalizer Volume (AF)
500.000
450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
-
5/20/15
6/19/15
7W2 Pumping Rate
7W2 Total Volume
21W1 Pumping Rate
21W1 Total Volume

# Conaway Preservation Group
# Monitoring Well Groundwater Level Data





Conaway Preservation Group
DWR and YCFFWCD Monitoring Well Groundwater Level Data
Groundwater Level (Feet below Reference Point)
0
40
80
120
160
200
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
09N02E10E001M
09N02E22H002M
09N03E08C001M
09N03E08C002M
09N03E08C003M
09N03E08C004M


Conaway Preservation Group
Production Well Groundwater Level Data
Groundwater Level (Feet below Reference Point)
0
50
100
150
200
250
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
20W1
21W1
21W3
24W1
31W1
32NW1
32NW2
32W3

# Eastside Mutual Water Company

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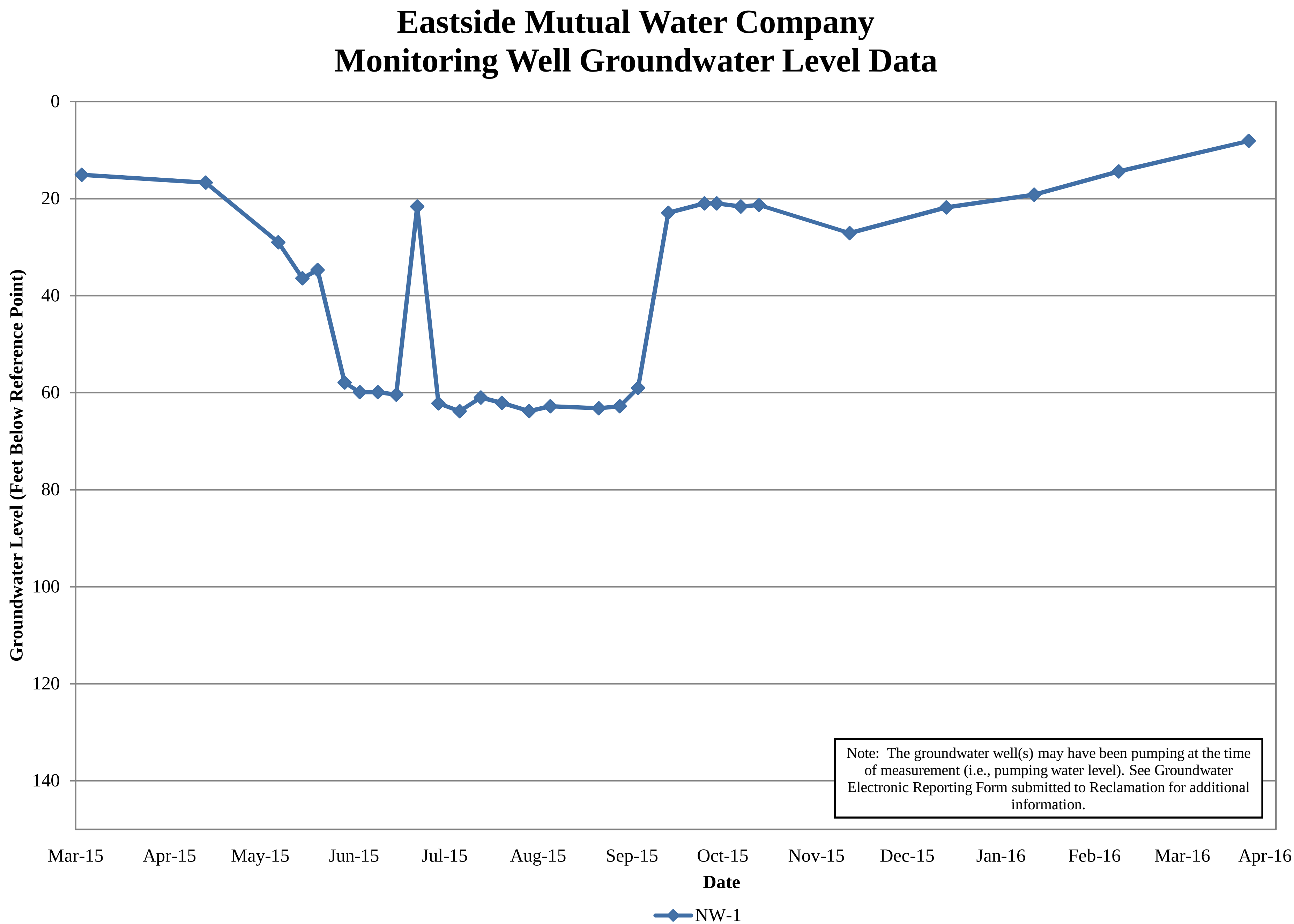
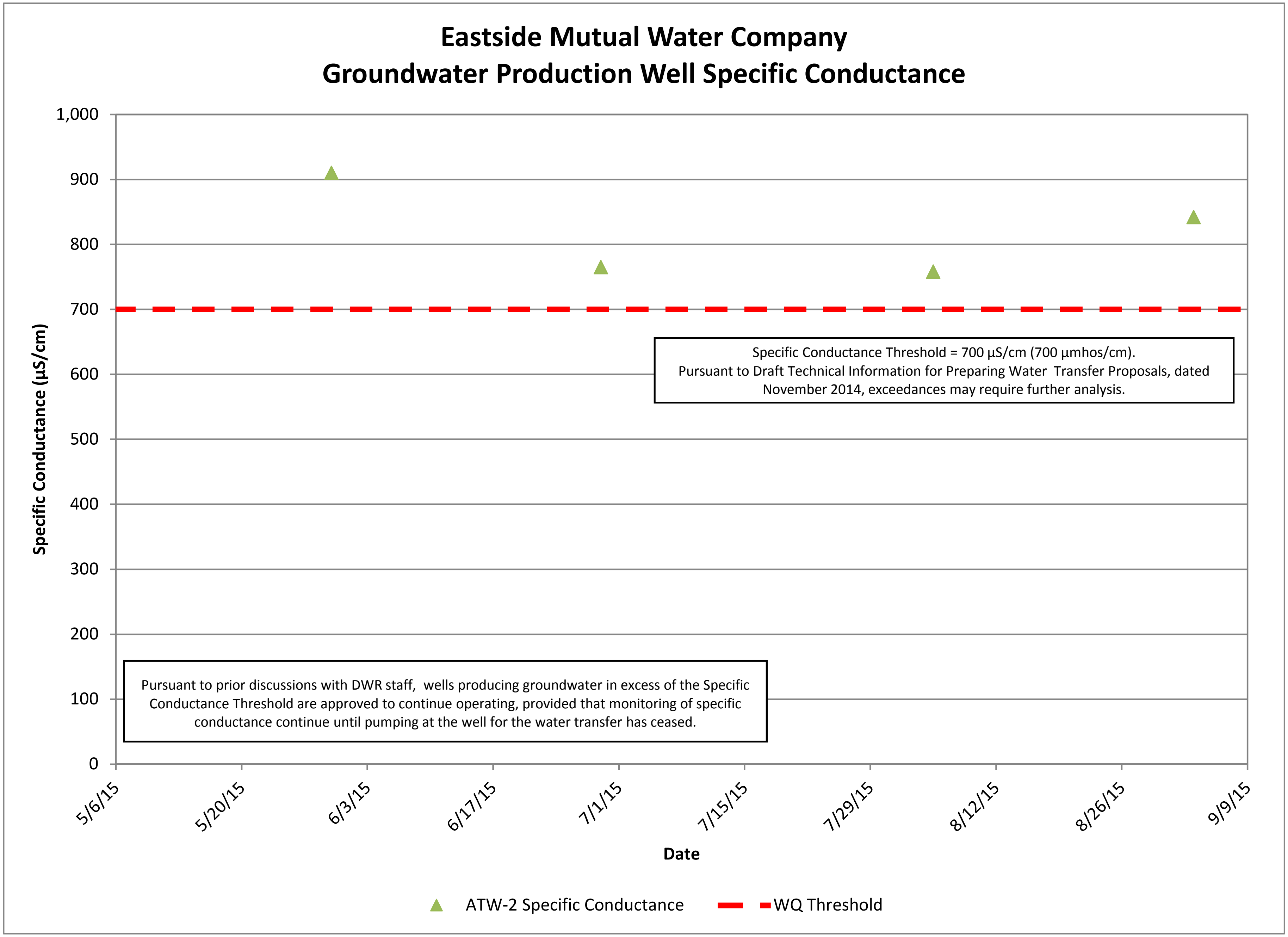
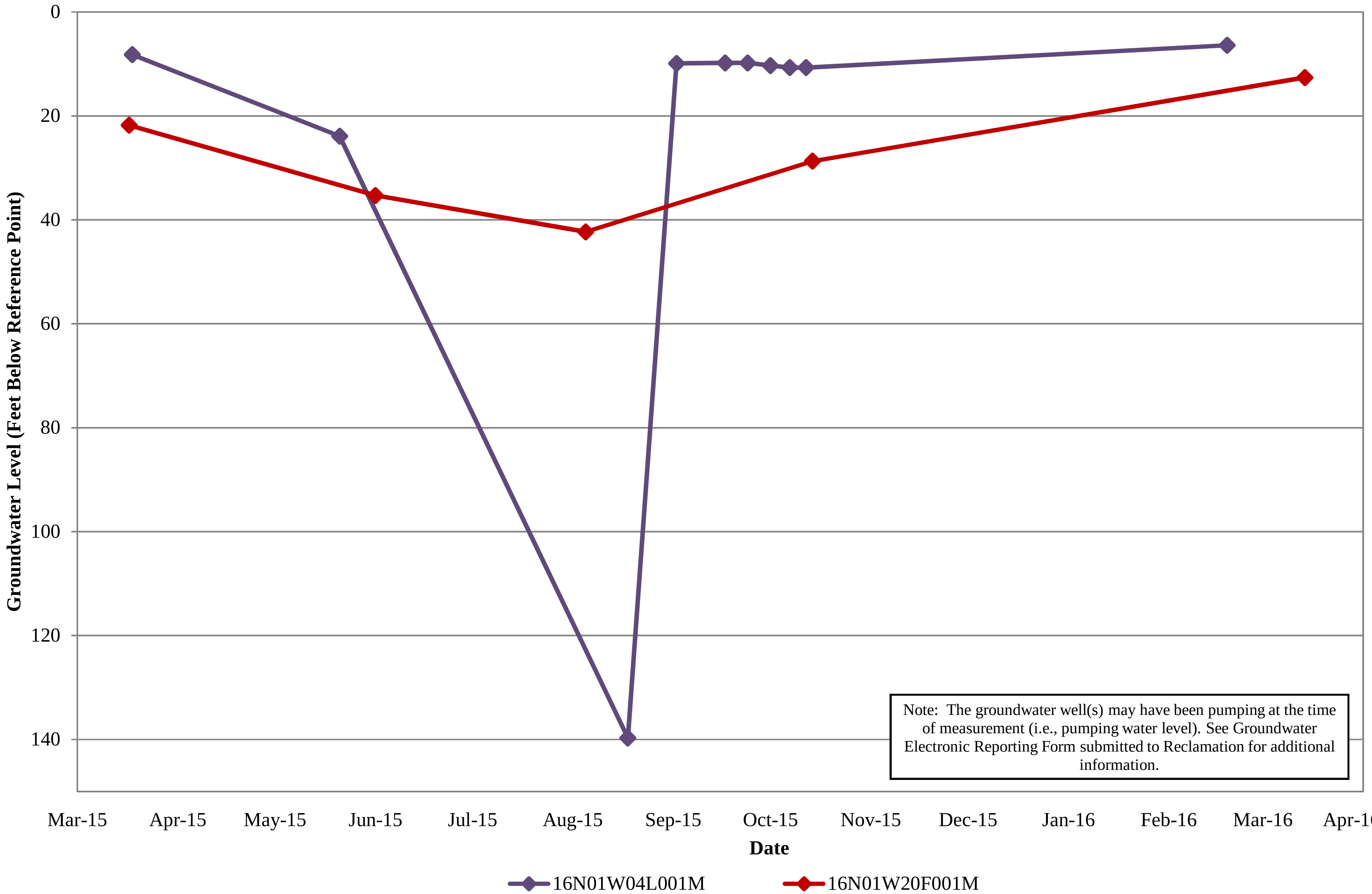

Eastside Mutual Water Company
Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
20
40
60
80
100
120
140
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
NW-1

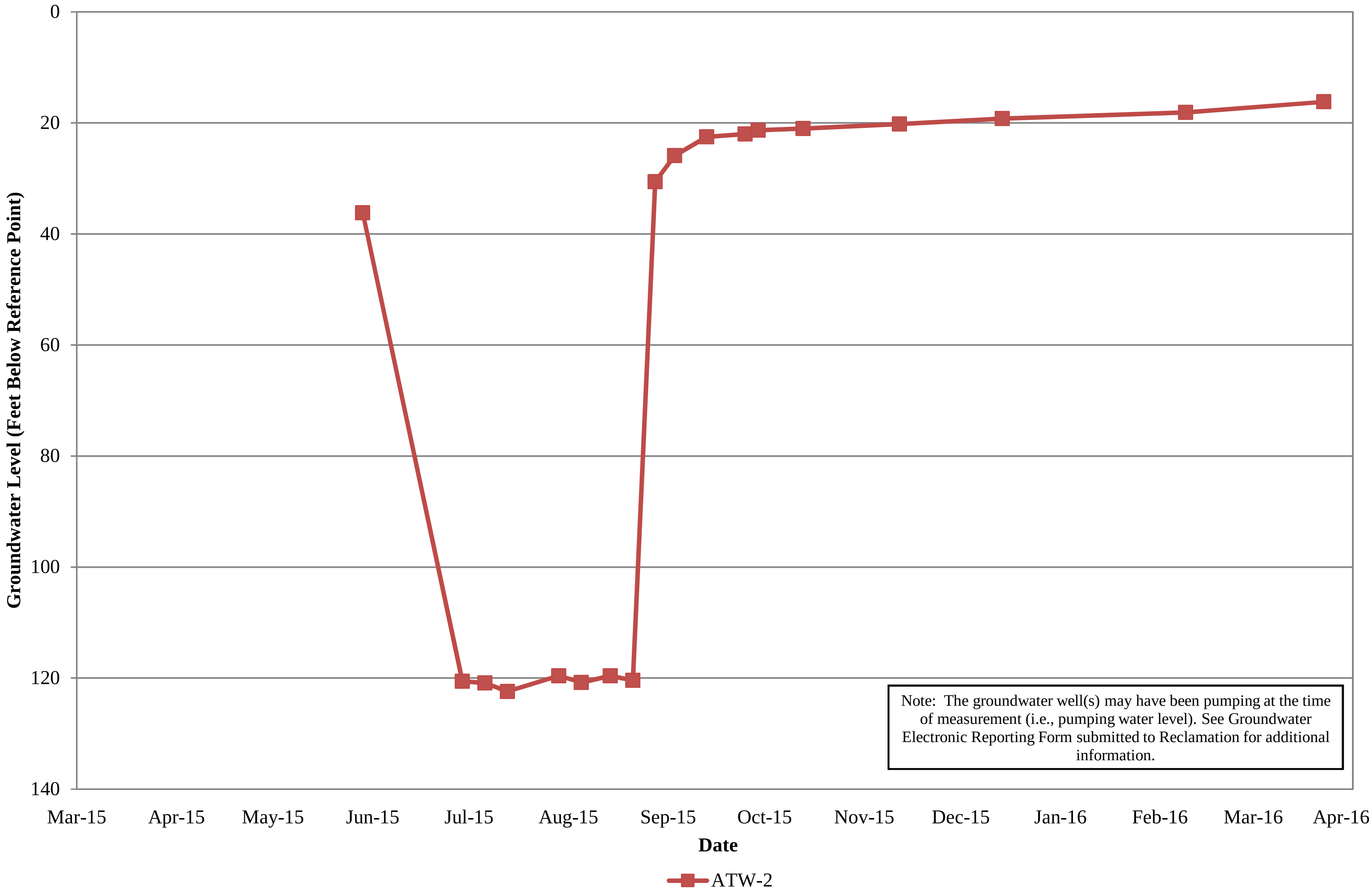


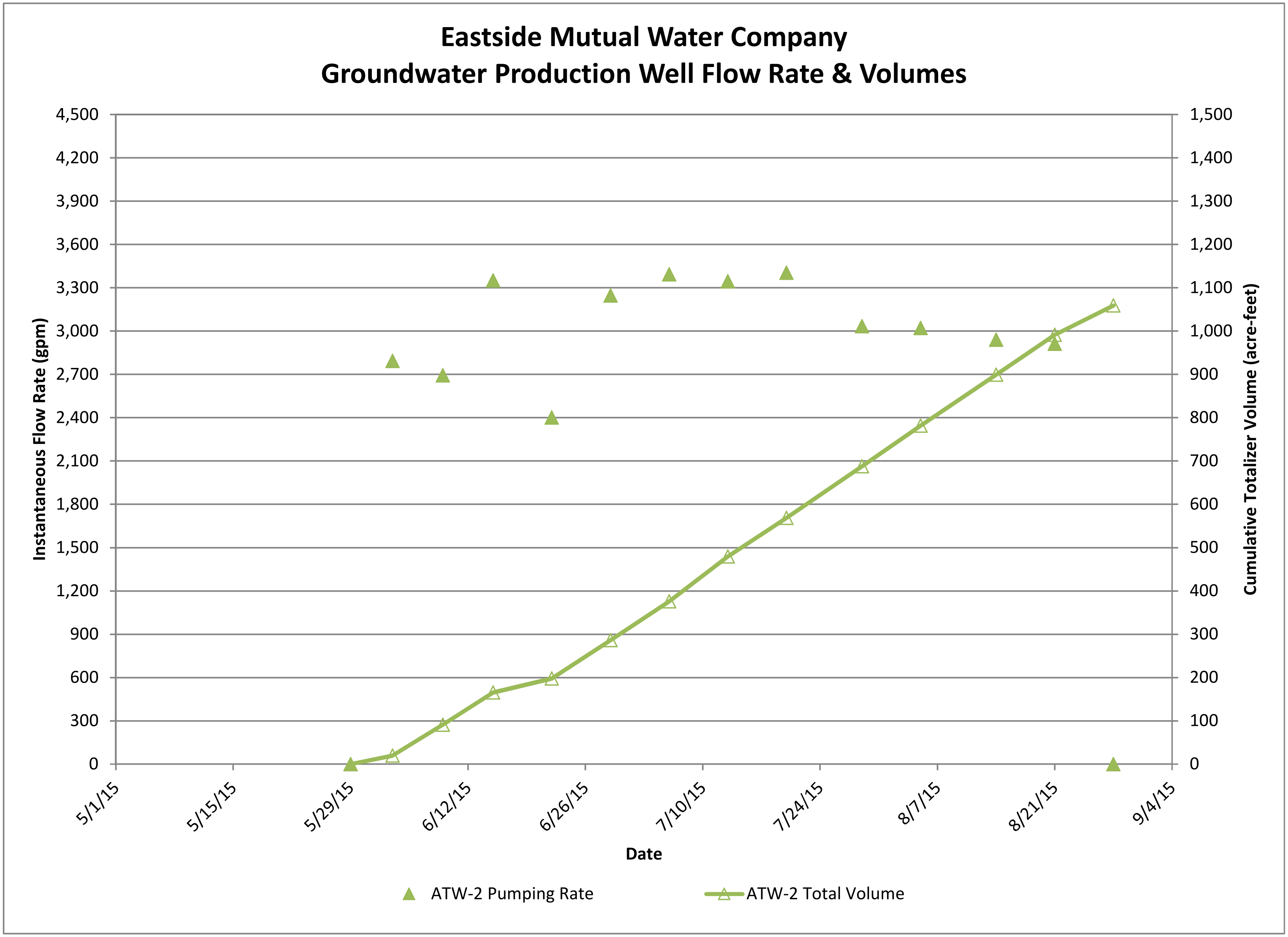
Eastside Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
1,000
900
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
5/6/15
5/20/15
6/3/15
6/17/15
7/1/15
7/15/15
7/29/15
8/12/15
8/26/15
9/9/15
Date
ATW-2 Specific Conductance
WQ Threshold

# Eastside Mutual Water Company
# DWR Monitoring Well Groundwater Level Data



# Eastside Mutual Water Company
# Production Well Groundwater Collection Data




Eastside Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
4,500
4,200
3,900
3,600
3,300
3,000
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
0
Cumulative Totalizer Volume (acre-feet)
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
8/21/15
9/4/15
Date
ATW-2 Pumping Rate
ATW-2 Total Volume

# Glenn-Colusa Irrigation District

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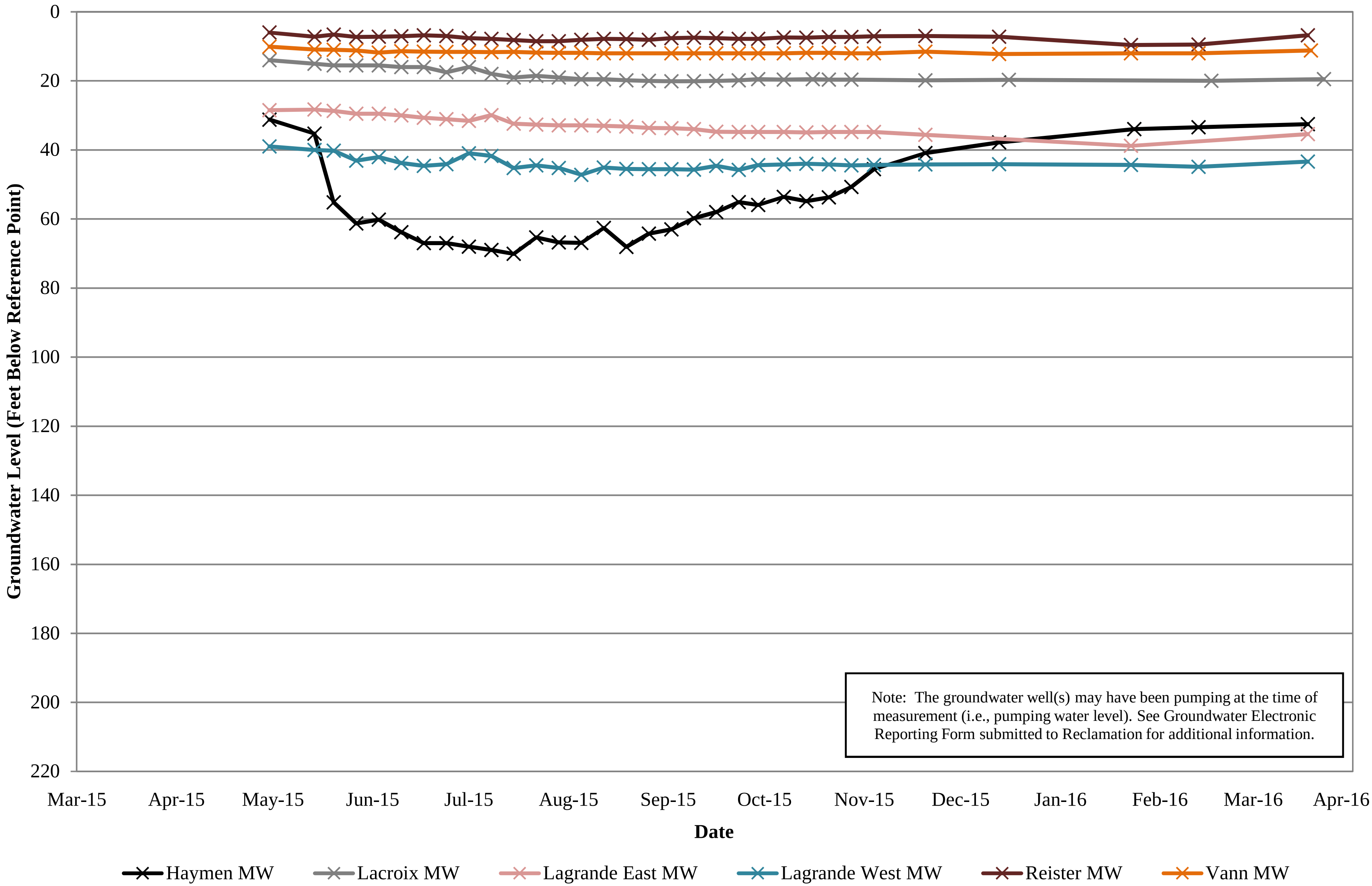
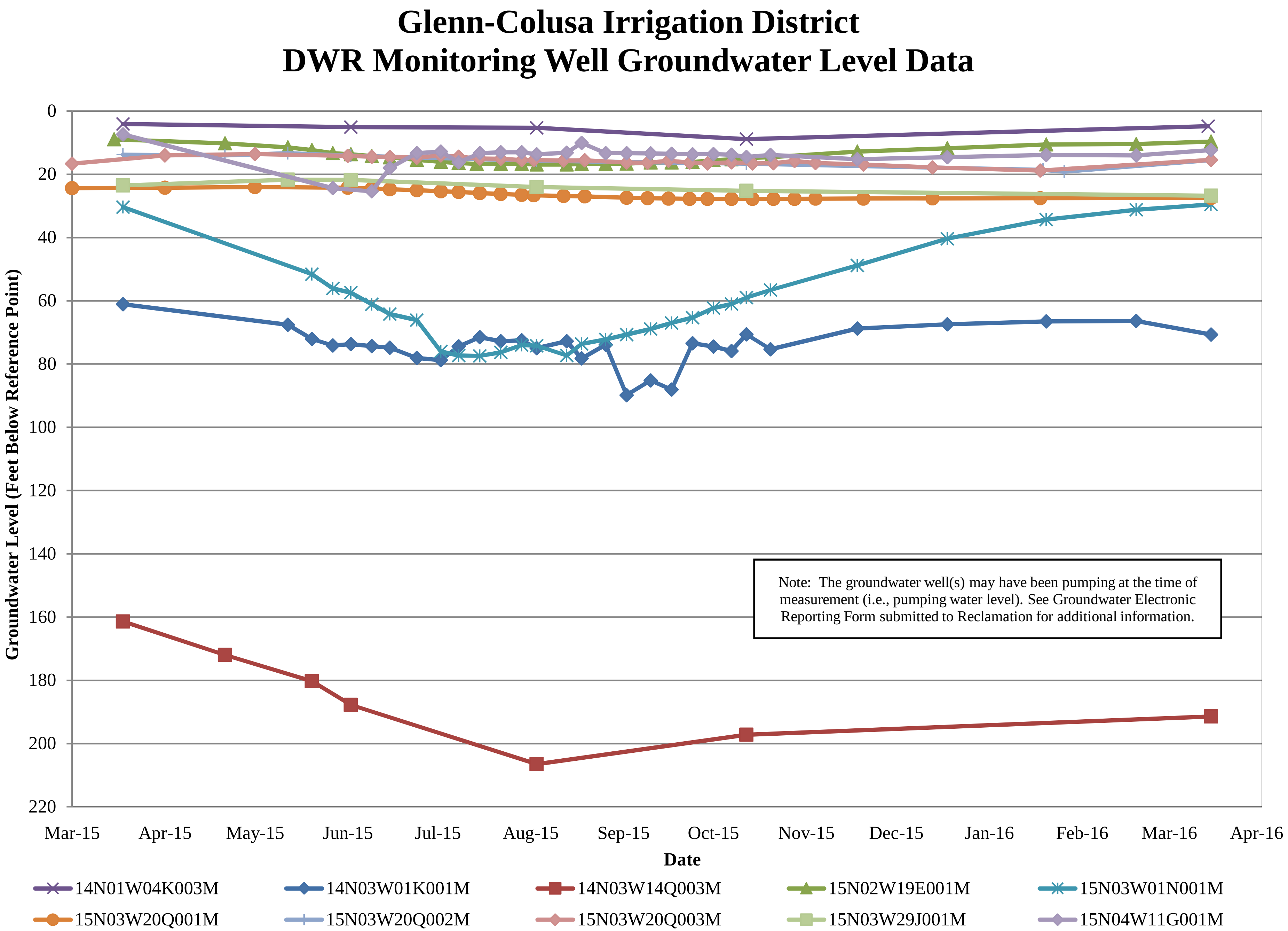
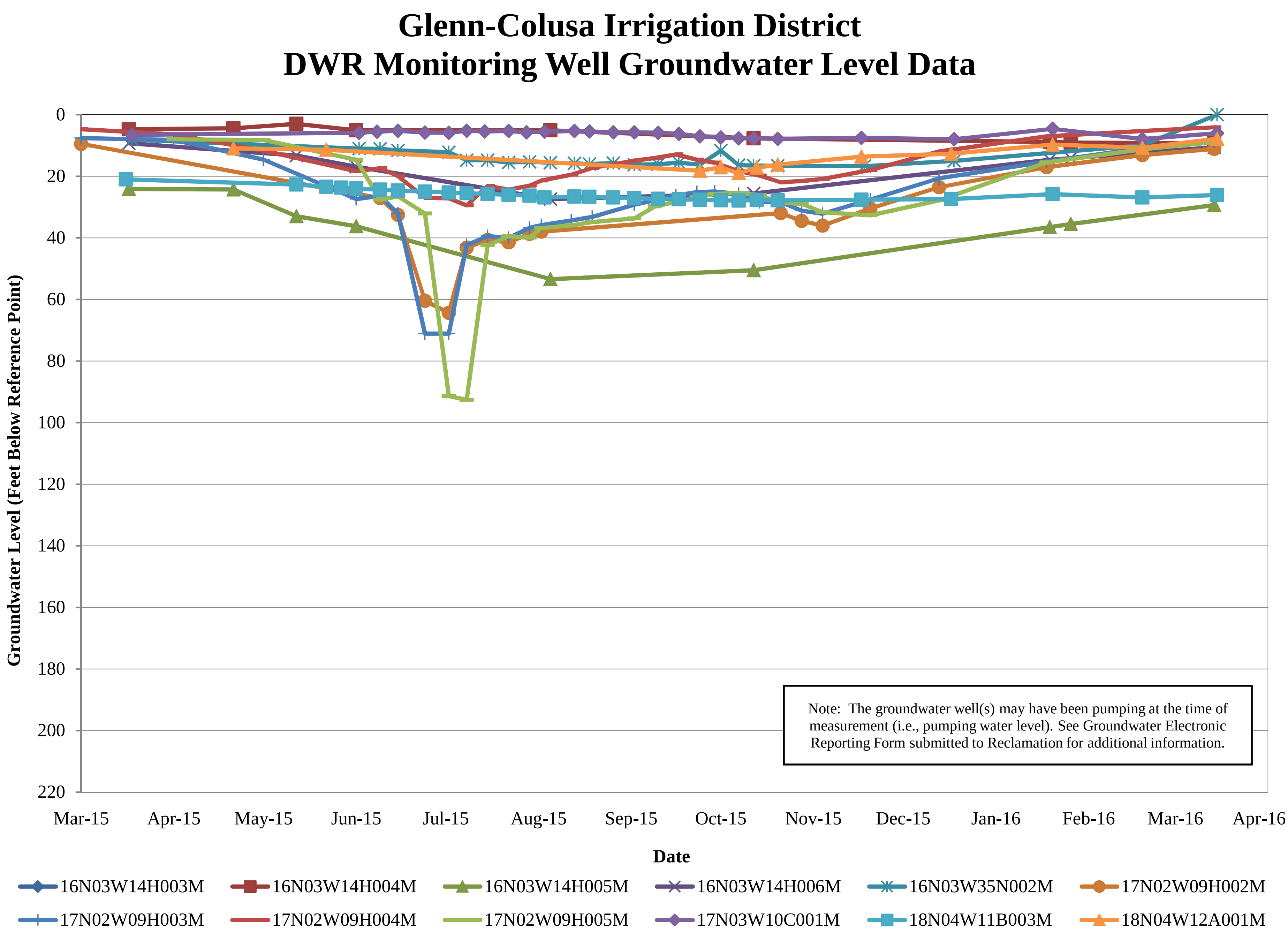
# Glenn-Colusa Irrigation District
# Monitoring Well Groundwater Level Data

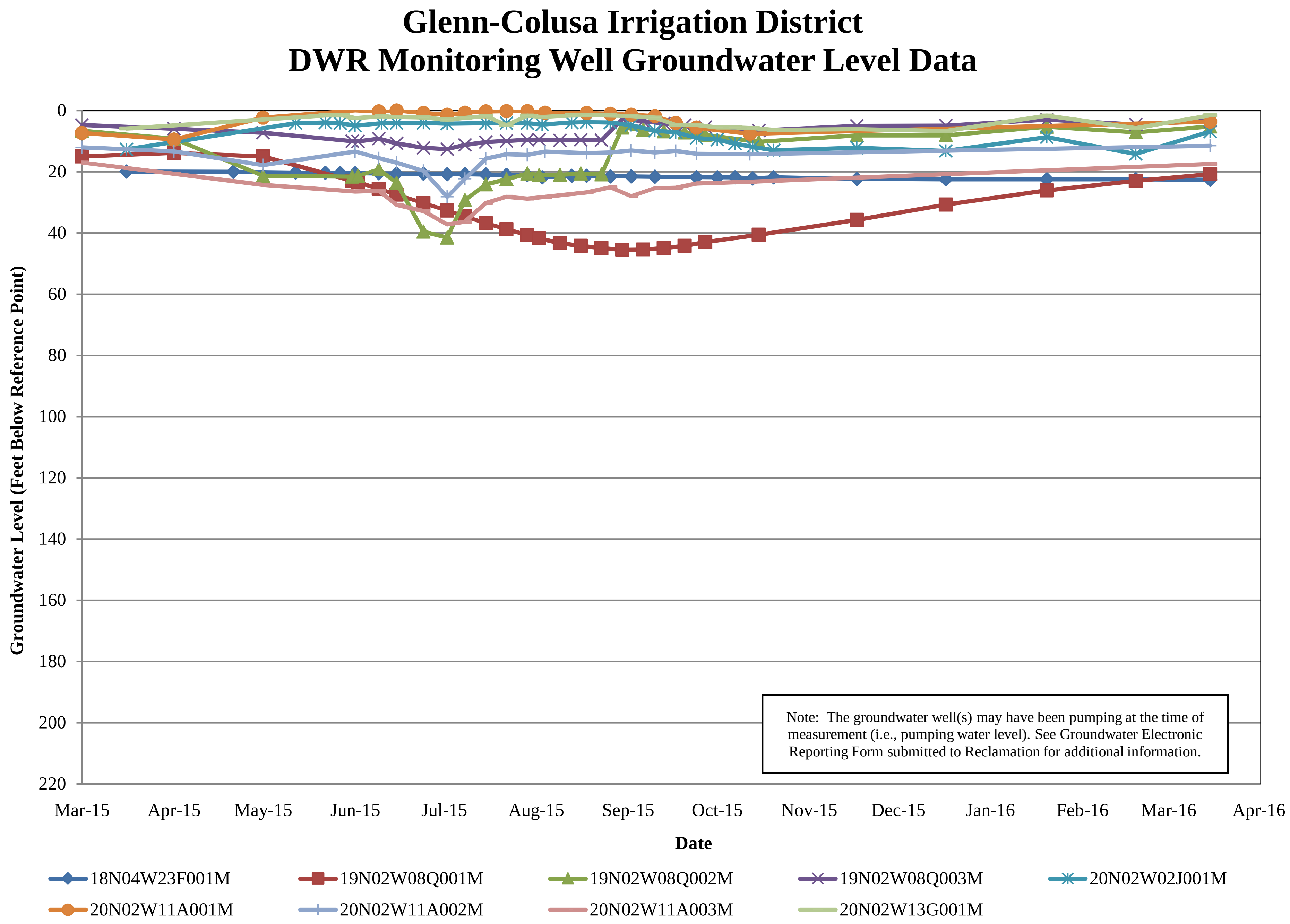




Glenn-Colusa Irrigation District
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
20
40
60
80
100
120
140
160
180
200
220
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
14N01W04K003M
14N03W01K001M
14N03W14Q003M
15N02W19E001M
15N03W01N001M
15N03W20Q001M
15N03W20Q002M
15N03W20Q003M
15N03W29J001M
15N04W11G001M

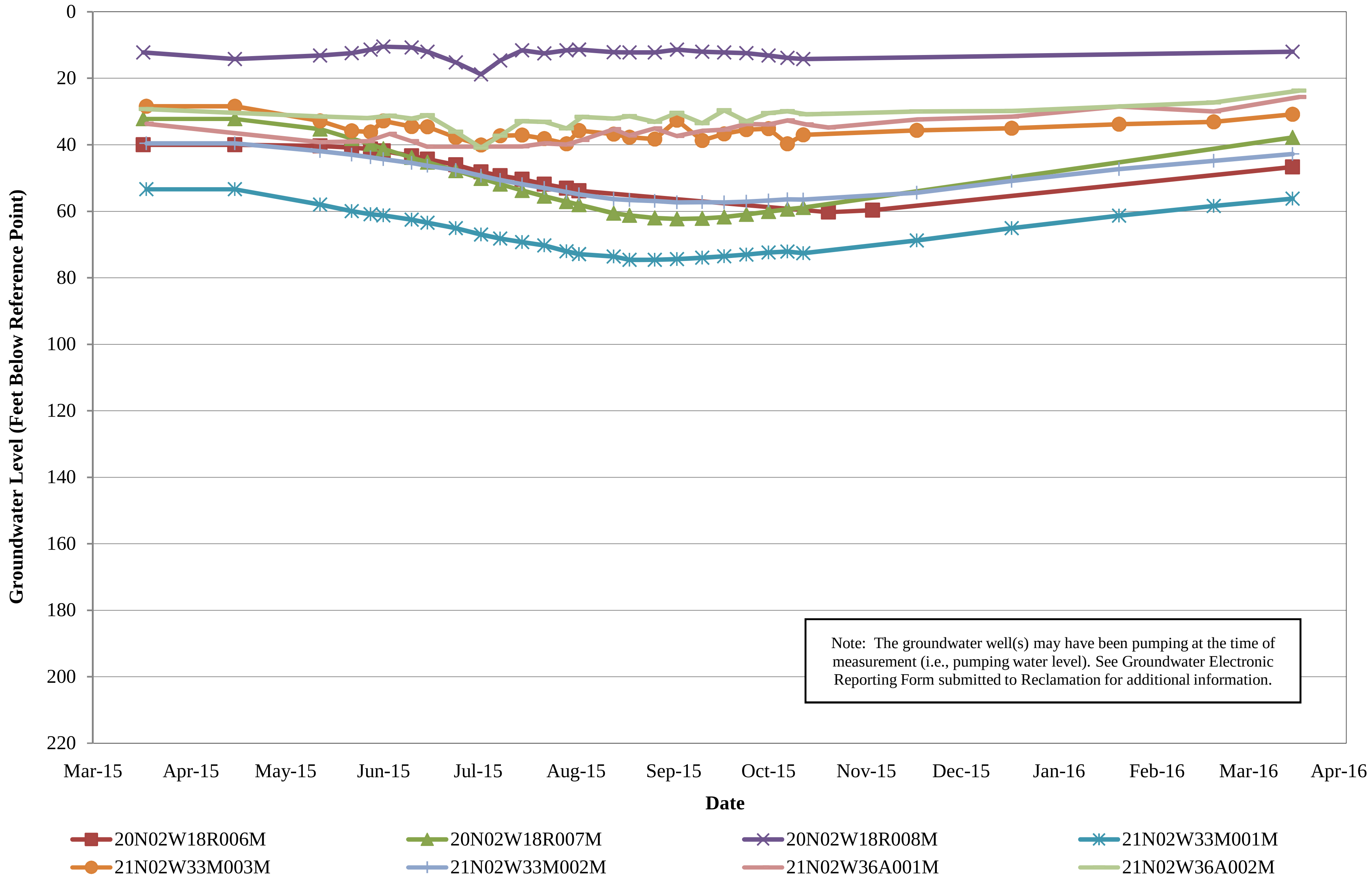


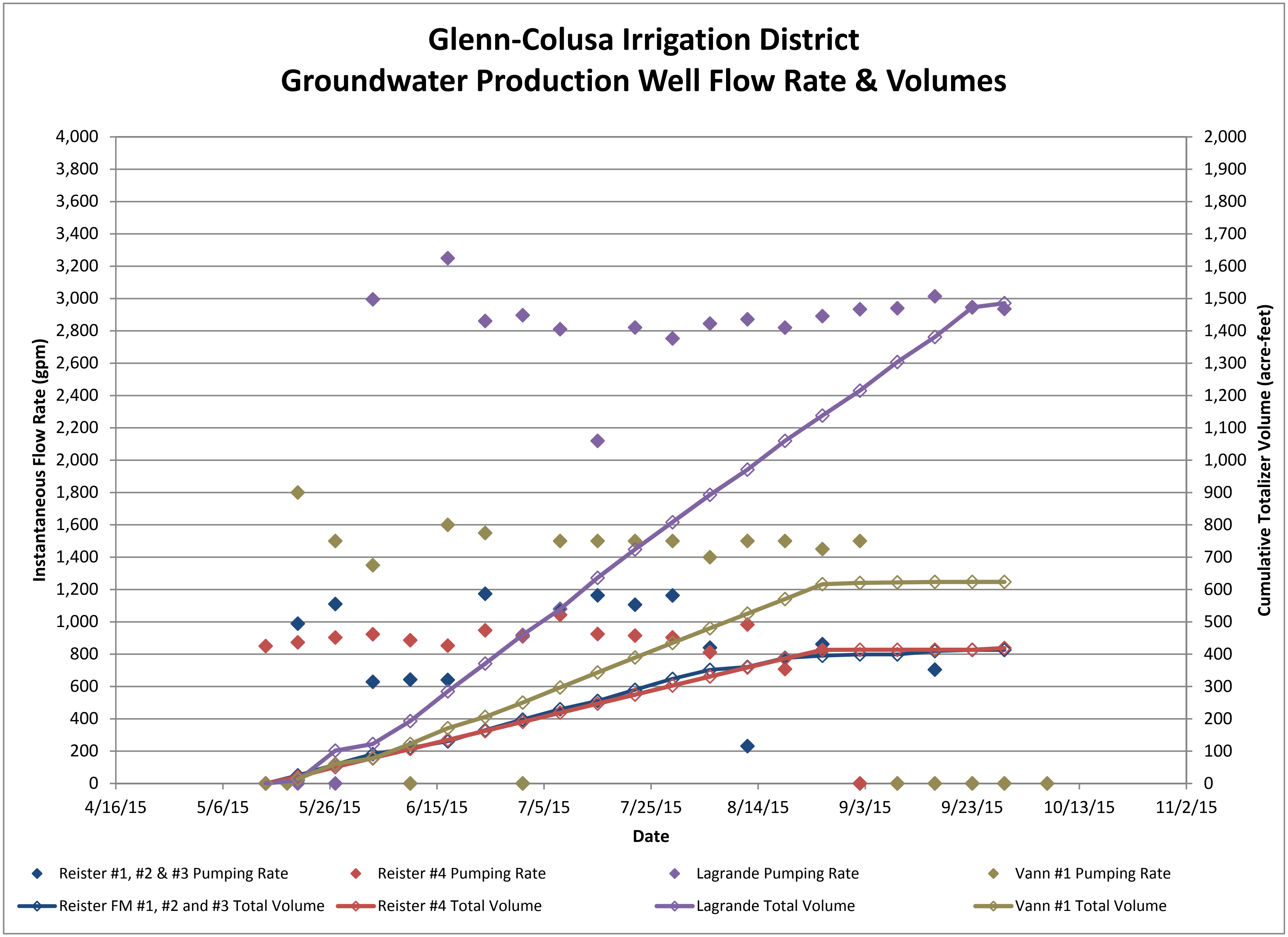
Glenn-Colusa Irrigation District
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
20
40
60
80
100
120
140
160
180
200
220
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
16N03W14H003M
16N03W14H004M
16N03W14H005M
16N03W14H006M
16N03W35N002M
17N02W09H002M
17N02W09H003M
17N02W09H004M
17N02W09H005M
17N03W10C001M
18N04W11B003M
18N04W12A001M



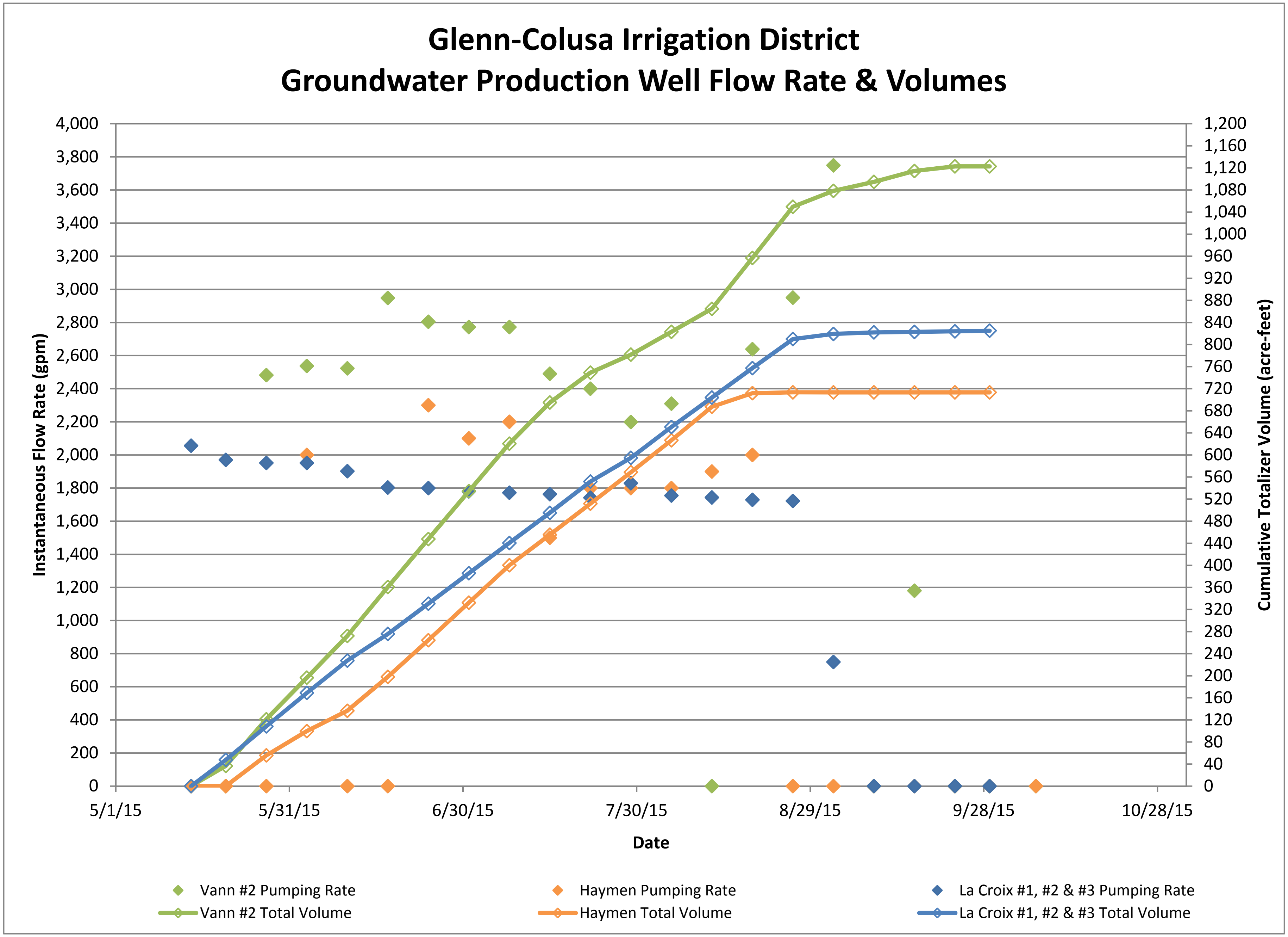
Glenn-Colusa Irrigation District
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
20
40
60
80
100
120
140
160
180
200
220
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
18N04W23F001M
19N02W08Q001M
19N02W08Q002M
19N02W08Q003M
20N02W02J001M
20N02W11A001M
20N02W11A002M
20N02W11A003M
20N02W13G001M

# Glenn-Colusa Irrigation District
# DWR Monitoring Well Groundwater Level Data

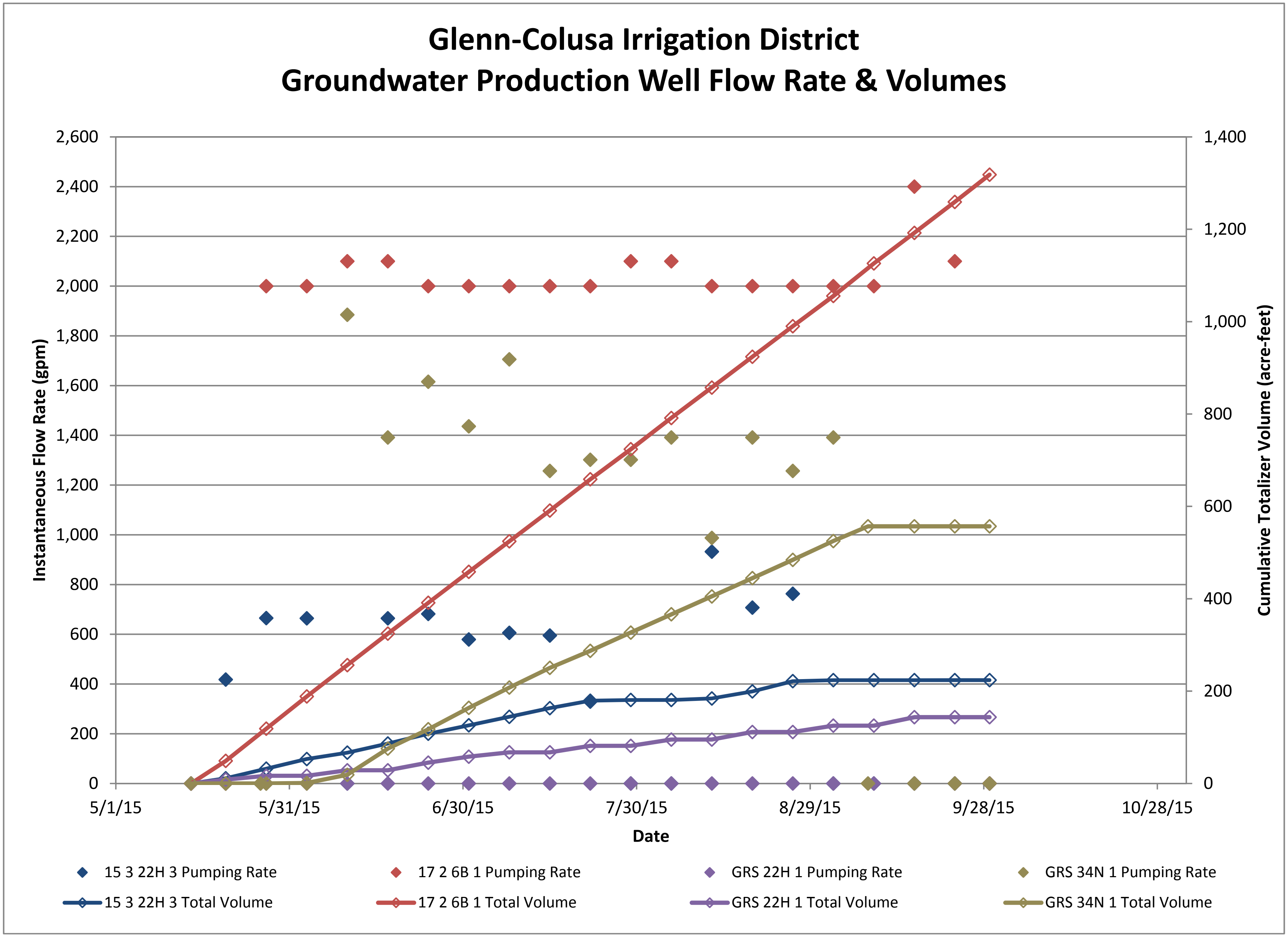




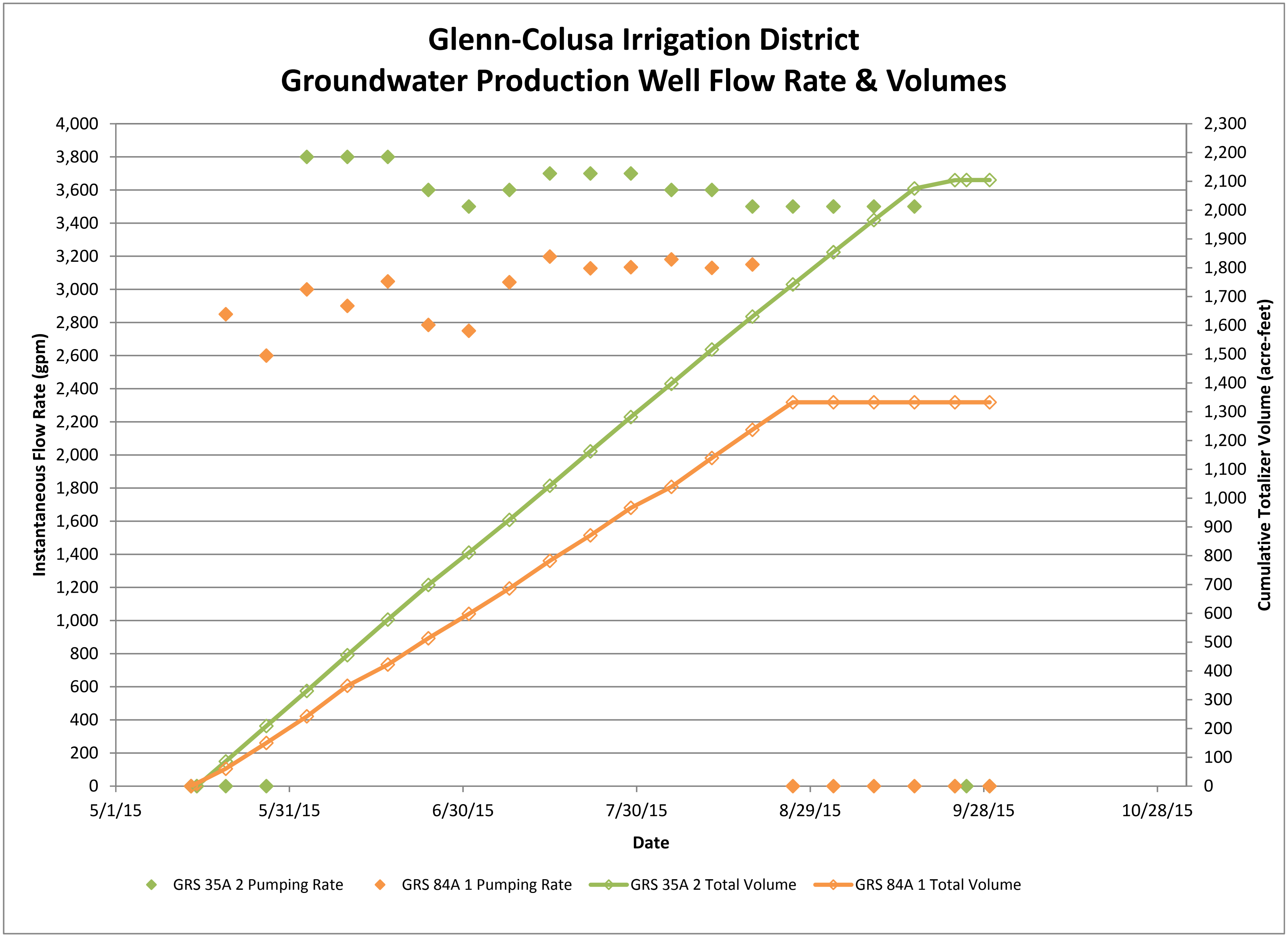
Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4/16/15
5/6/15
5/26/15
6/15/15
7/5/15
7/25/15
8/14/15
9/3/15
9/23/15
10/13/15
11/2/15
Reister #1, #2 & #3 Pumping Rate
Reister #4 Pumping Rate
Lagrande Pumping Rate
Vann #1 Pumping Rate
Reister FM #1, #2 and #3 Total Volume
Reister #4 Total Volume
Lagrande Total Volume
Vann #1 Total Volume



Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Cumulative Totalizer Volume (acre-feet)
1,200
1,160
1,120
1,080
1,040
1,000
960
920
880
840
800
760
720
680
640
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
5/1/15
5/31/15
6/30/15
7/30/15
8/29/15
9/28/15
10/28/15
Date
Vann #2 Pumping Rate
Haymen Pumping Rate
La Croix #1, #2 & #3 Pumping Rate
Vann #2 Total Volume
Haymen Total Volume
La Croix #1, #2 & #3 Total Volume

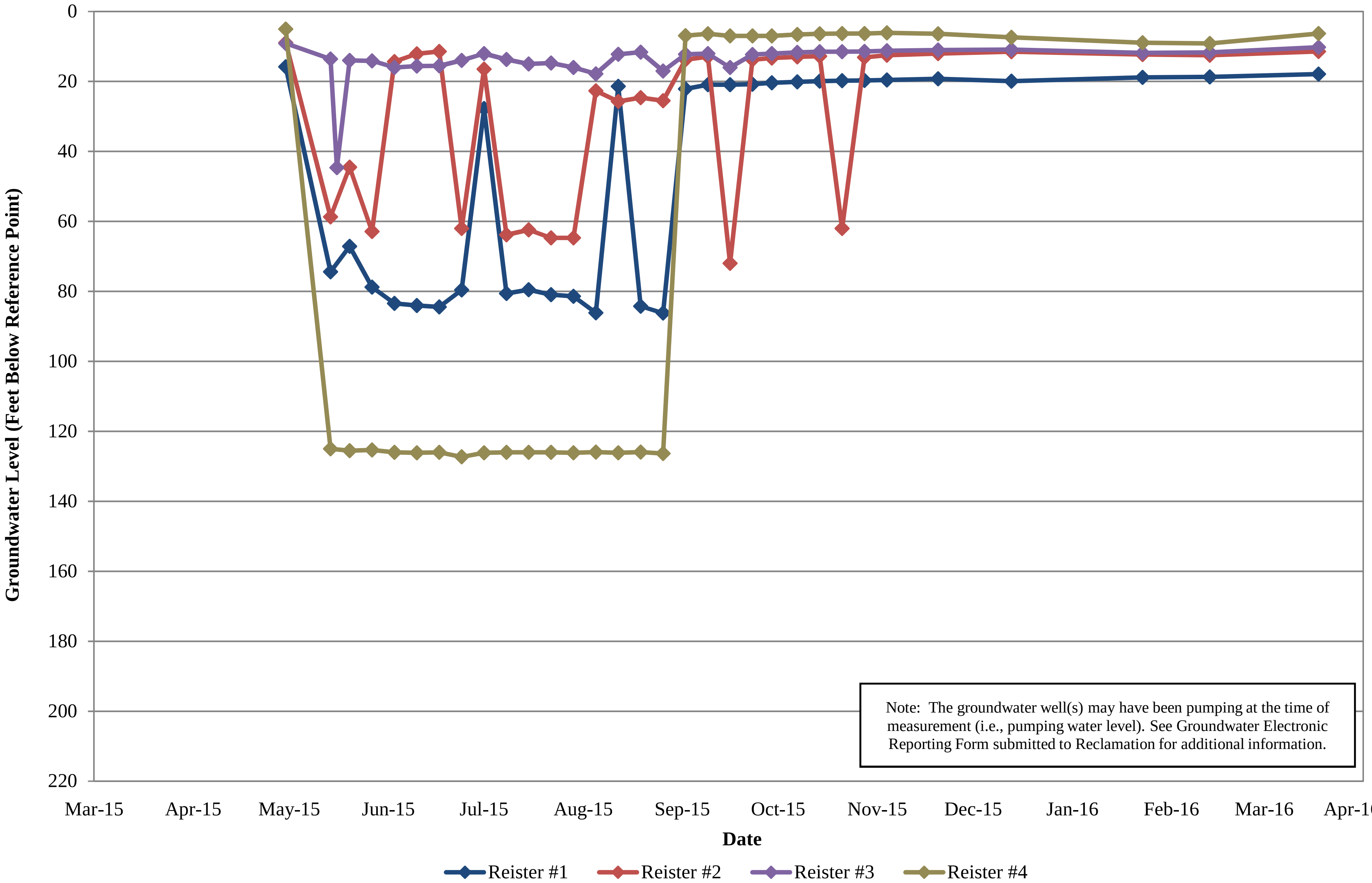


Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,400
1,200
1,000
800
600
400
200
0
5/1/15
5/31/15
6/30/15
7/30/15
8/29/15
9/28/15
10/28/15
Date
15 3 22H 3 Pumping Rate
17 2 6B 1 Pumping Rate
GRS 22H 1 Pumping Rate
GRS 34N 1 Pumping Rate
15 3 22H 3 Total Volume
17 2 6B 1 Total Volume
GRS 22H 1 Total Volume
GRS 34N 1 Total Volume

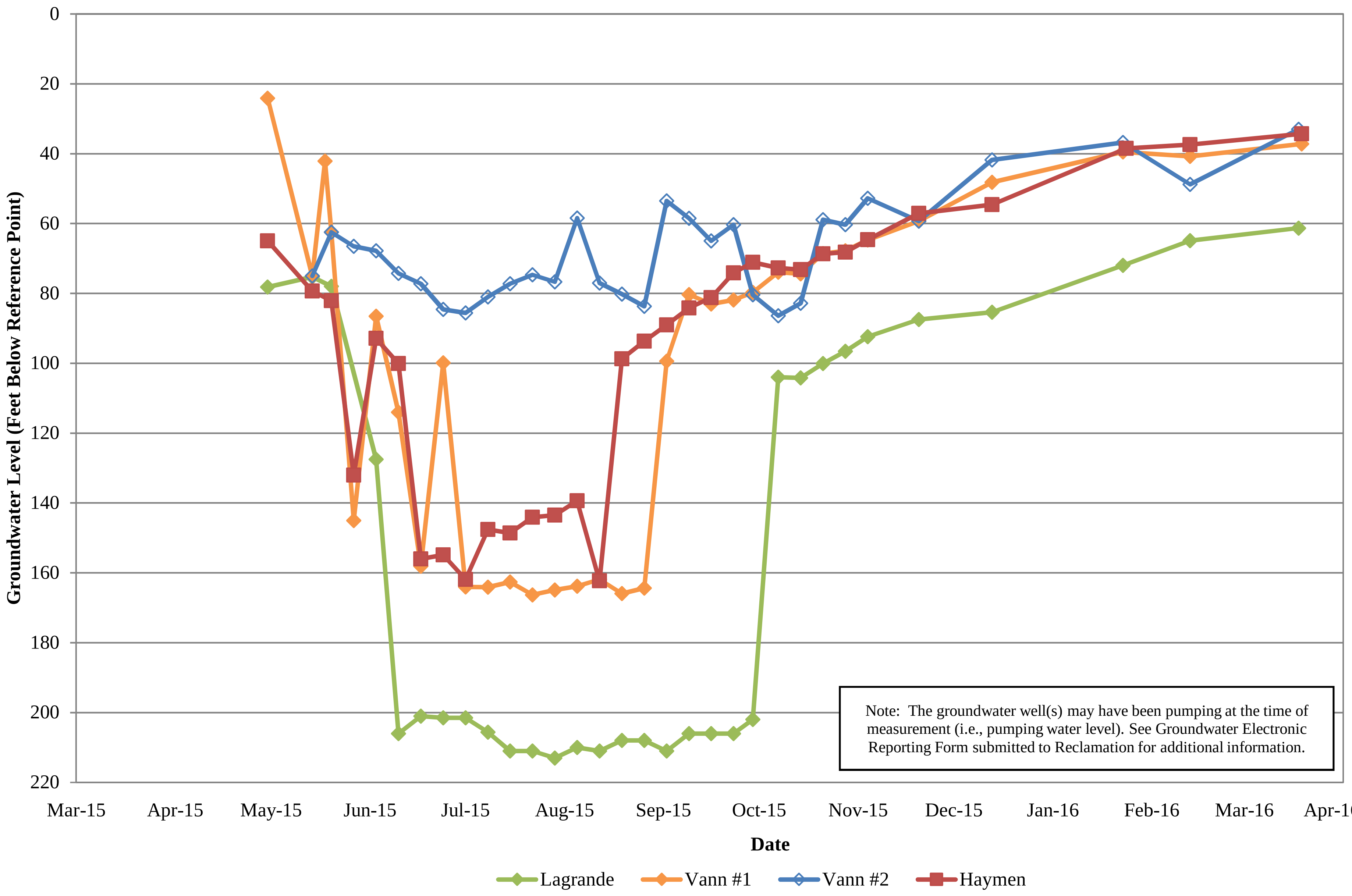


Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
3,400
3,600
3,800
4,000
100
300
500
700
900
1,100
1,300
1,500
1,700
1,900
2,100
2,300
5/1/15
5/31/15
6/30/15
7/30/15
8/29/15
9/28/15
10/28/15
GRS 35A 2 Pumping Rate
GRS 84A 1 Pumping Rate
GRS 35A 2 Total Volume
GRS 84A 1 Total Volume

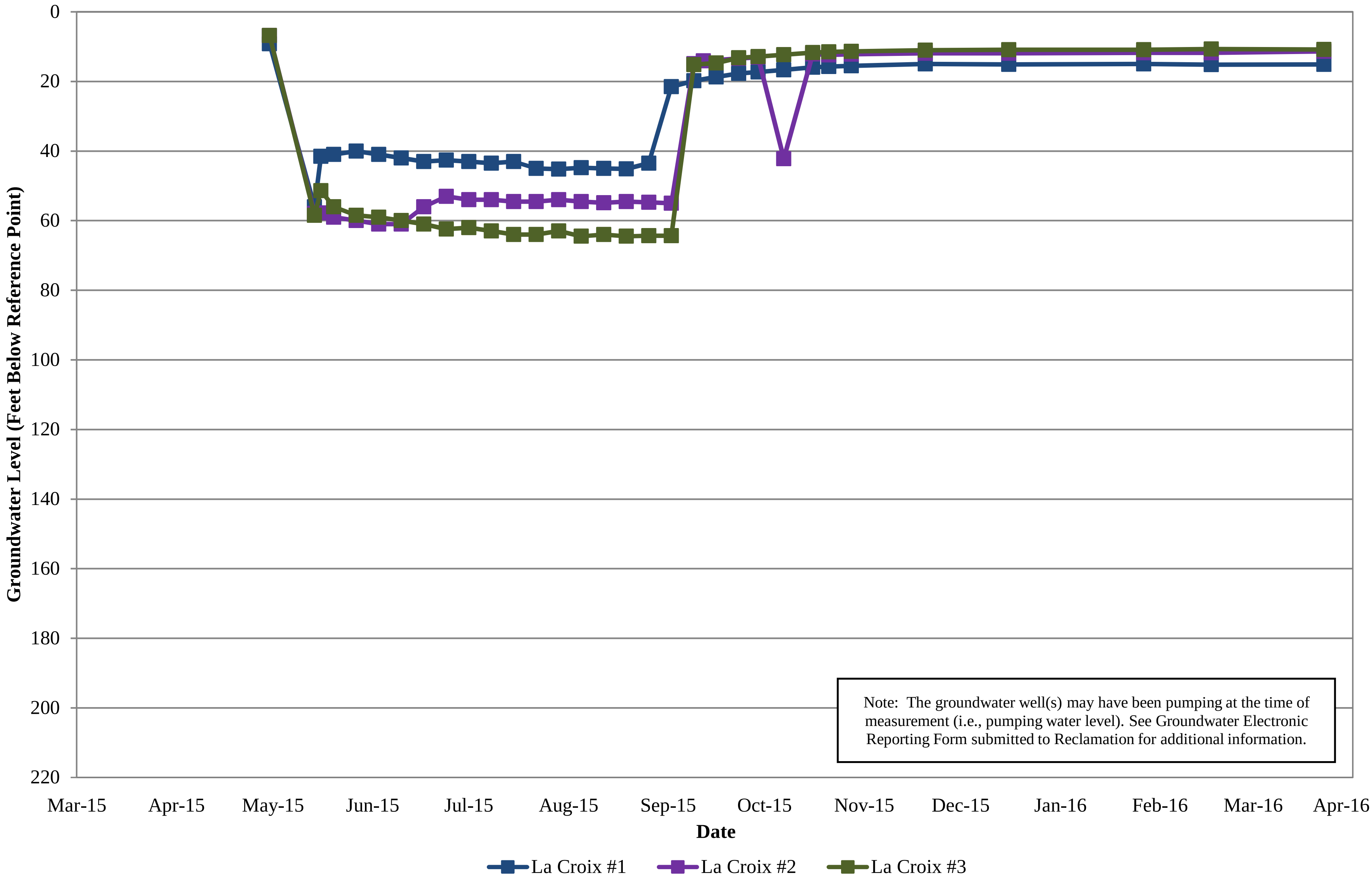
# Glenn-Colusa Irrigation District
# Production Well Groundwater Level Data



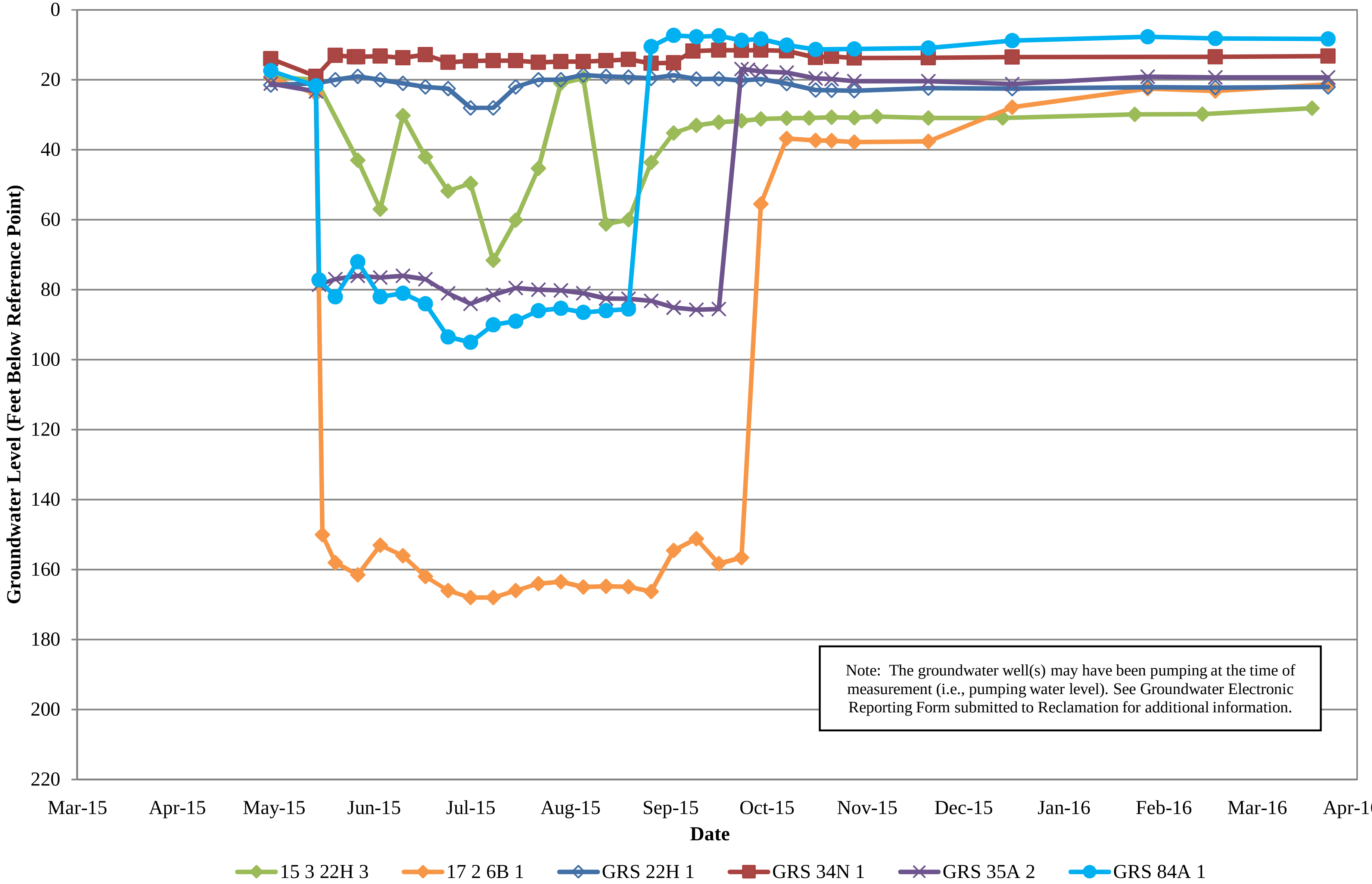
# Glenn-Colusa Irrigation District
# Production Well Groundwater Level Data

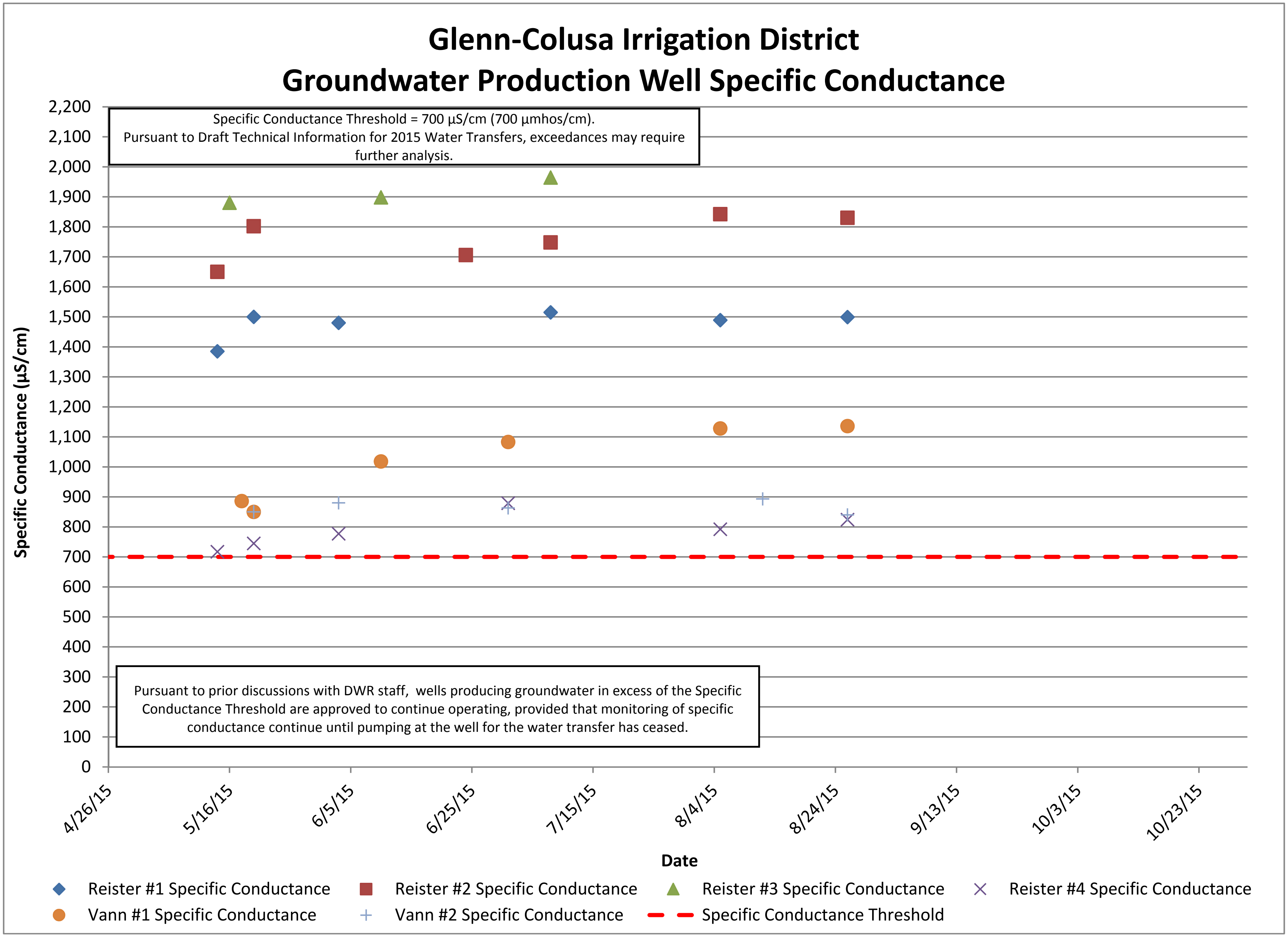


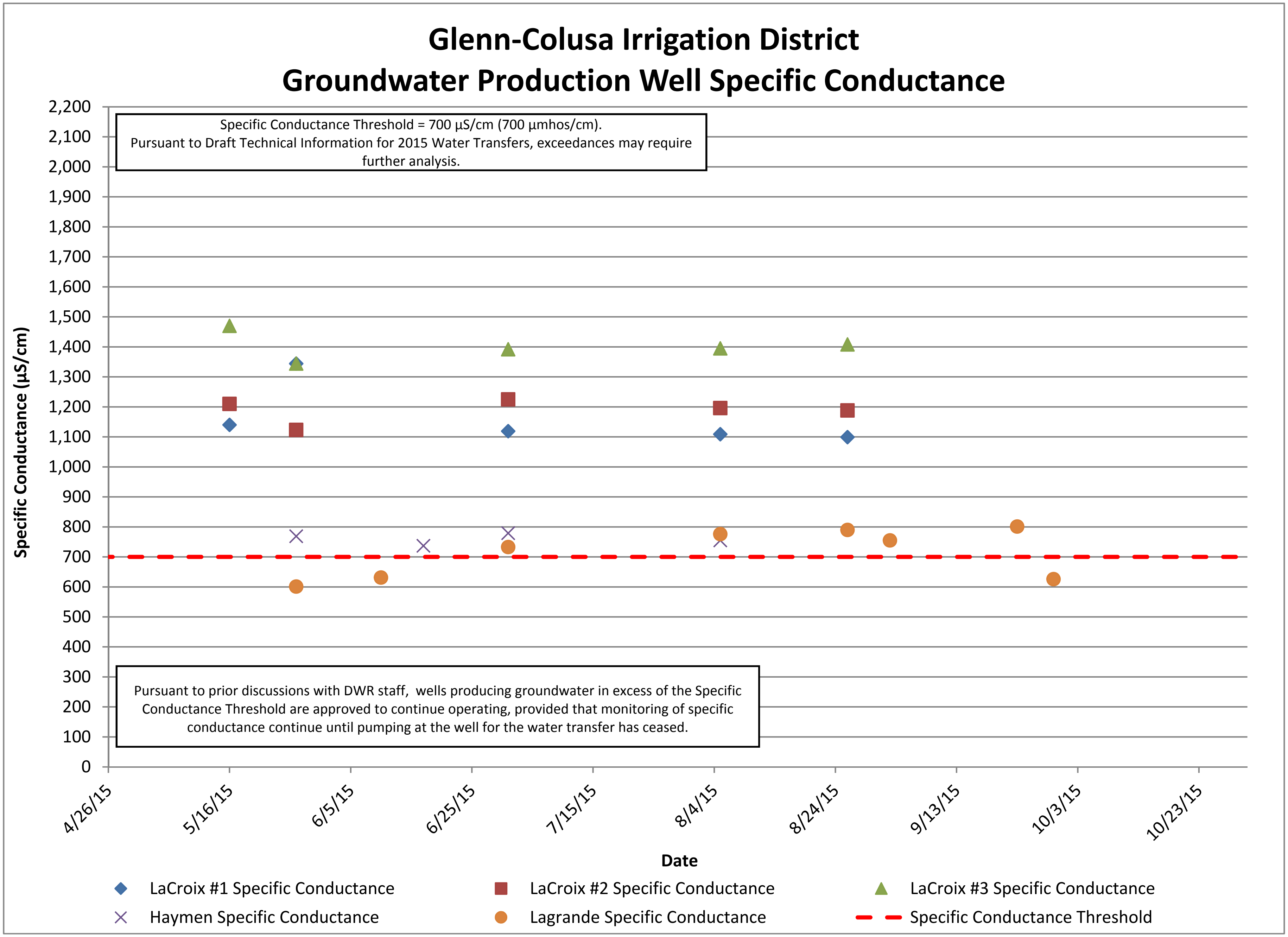
# Glenn-Colusa Irrigation District
# Production Well Groundwater Level Data



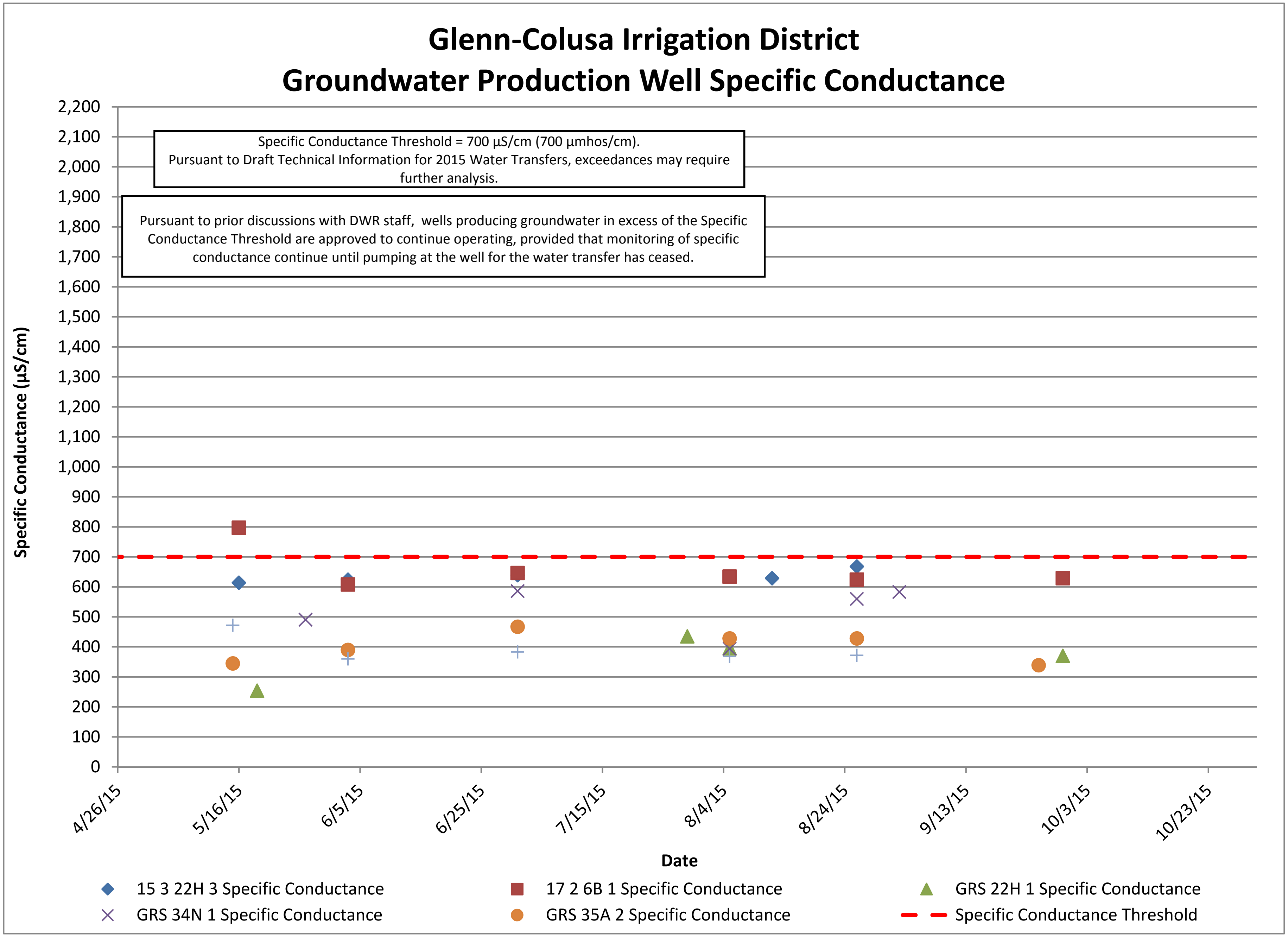
# Glenn-Colusa Irrigation District
# Production Well Groundwater Level Data




Glenn-Colusa Irrigation District
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance (µS/cm)
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4/26/15
5/16/15
6/5/15
6/25/15
7/15/15
8/4/15
8/24/15
9/13/15
10/3/15
10/23/15
Date
Reister #1 Specific Conductance
Reister #2 Specific Conductance
Reister #3 Specific Conductance
Reister #4 Specific Conductance
Vann #1 Specific Conductance
Vann #2 Specific Conductance
Specific Conductance Threshold



Glenn-Colusa Irrigation District
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance (µS/cm)
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4/26/15
5/16/15
6/5/15
6/25/15
7/15/15
8/4/15
8/24/15
9/13/15
10/3/15
10/23/15
Date
LaCroix #1 Specific Conductance
LaCroix #2 Specific Conductance
LaCroix #3 Specific Conductance
Haymen Specific Conductance
Lagrande Specific Conductance
Specific Conductance Threshold



Glenn-Colusa Irrigation District
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance (µS/cm)
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4/26/15
5/16/15
6/5/15
6/25/15
7/15/15
8/4/15
8/24/15
9/13/15
10/3/15
10/23/15
Date
15 3 22H 3 Specific Conductance
17 2 6B 1 Specific Conductance
GRS 22H 1 Specific Conductance
GRS 34N 1 Specific Conductance
GRS 35A 2 Specific Conductance
Specific Conductance Threshold

# Garden Highway Mutual Water Company

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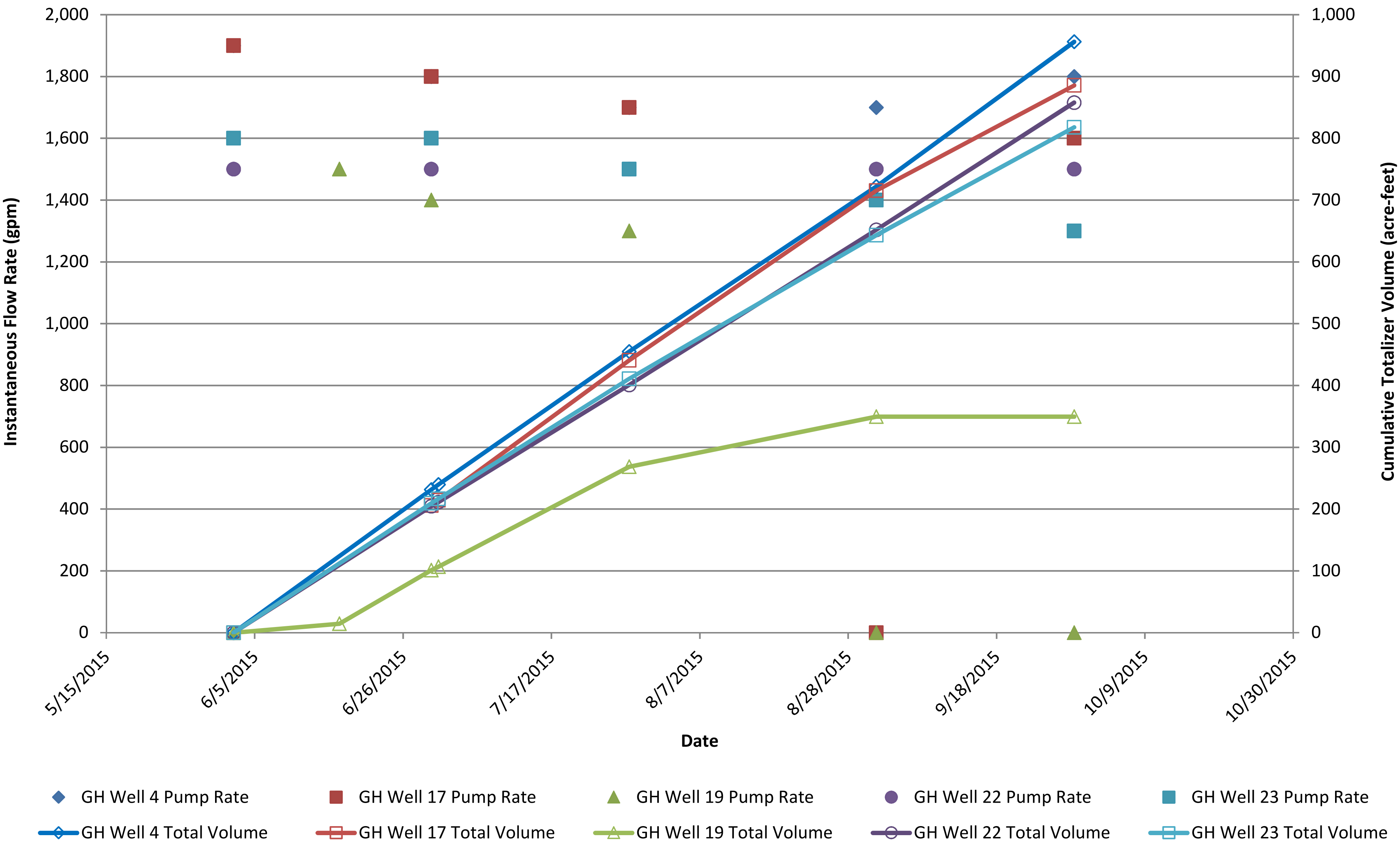
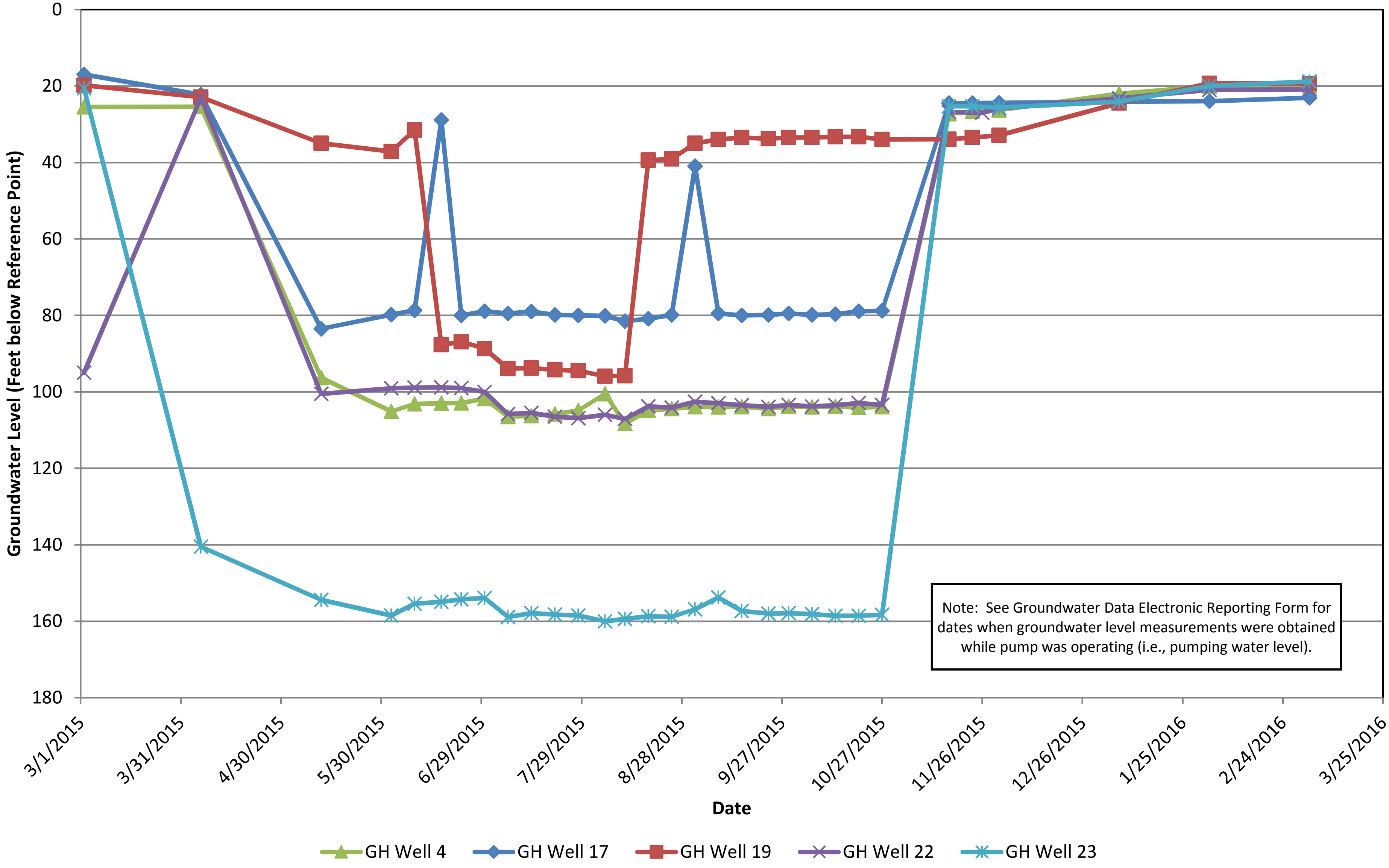
# Figure 2
# Garden Highway Mutual Water Company
# Groundwater Production Well Flow Rates & Volumes



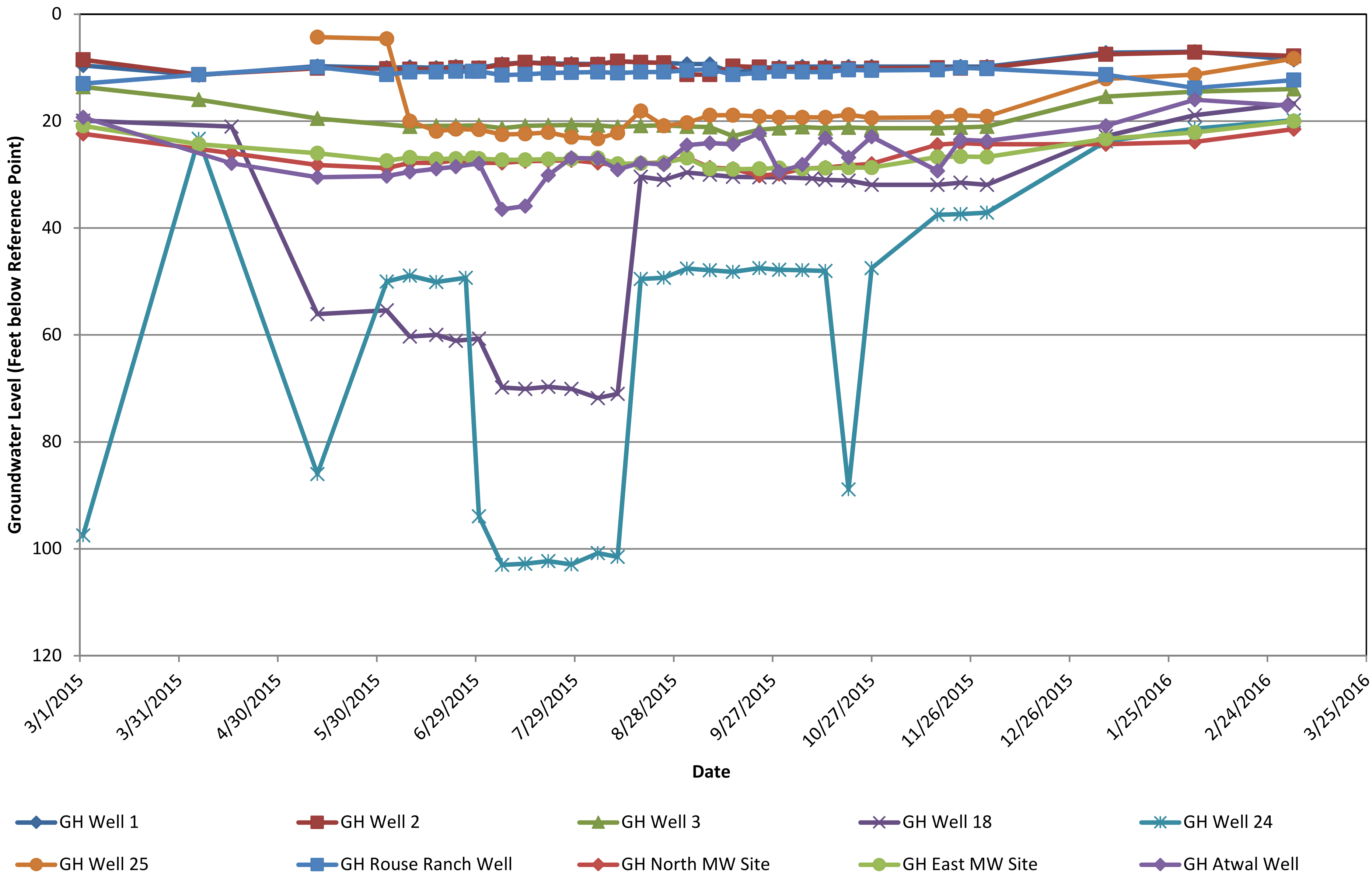



C:\Users\woodruffam\AppData\Local\Temp\Temp1_2015 WT Groundwater Data Electronic Reporting Forms 08.05.2016.zip\GHMWC Groundwater Data Electronic Reporting Form 05.31.2016.xlsx
Tab: Production Data

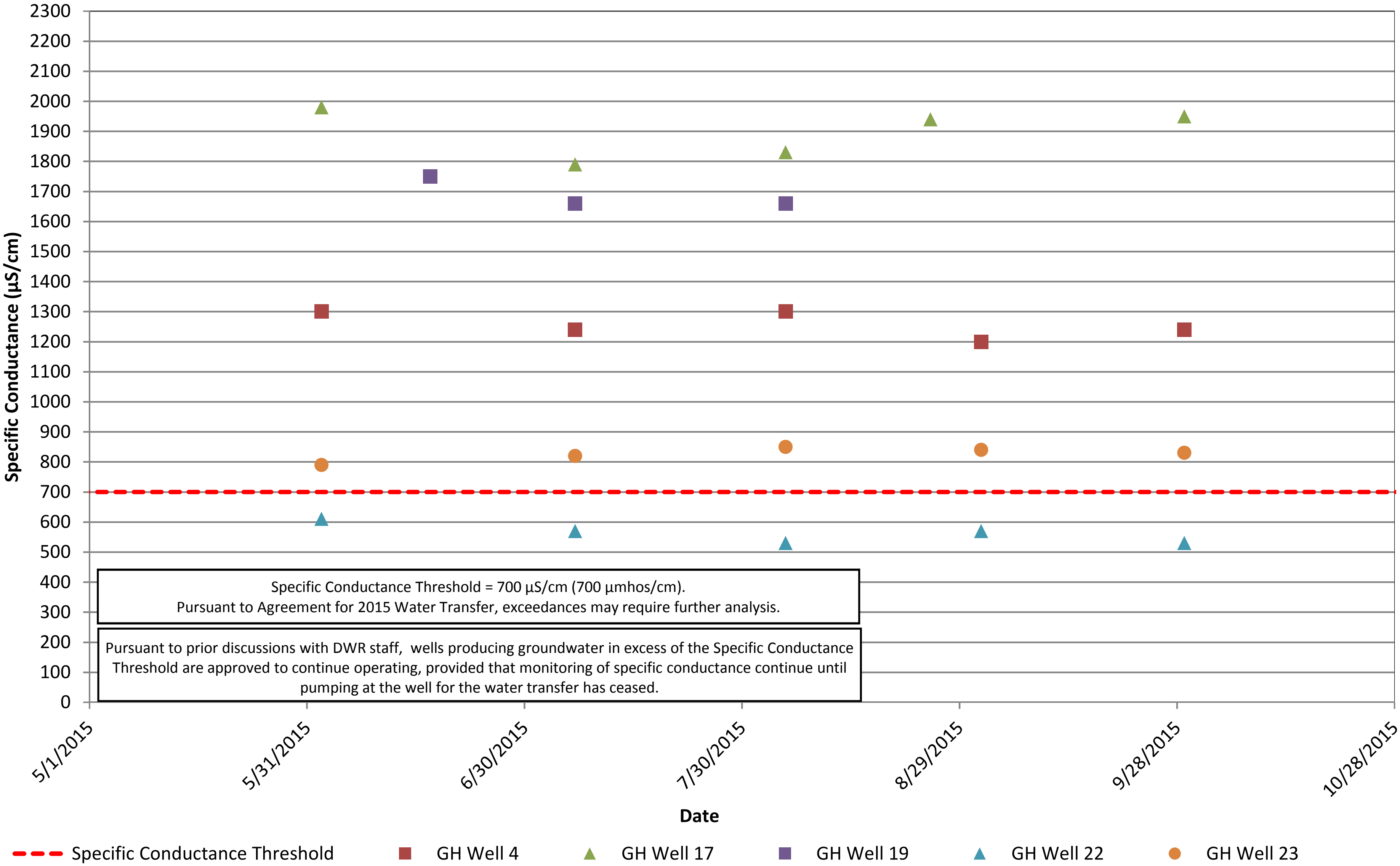
# Figure 3A
# Garden Highway Mutual Water Company
# Production Well Groundwater Level Data



# Figure 3B
# Garden Highway Mutual Water Company
# Monitoring Well Groundwater Level Data



# Figure 7
# Garden Highway Mutual Water Company
# Groundwater Production Well Specific Conductance

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Tab: Water Quality Data

# Natomas Central Mutual Water Company

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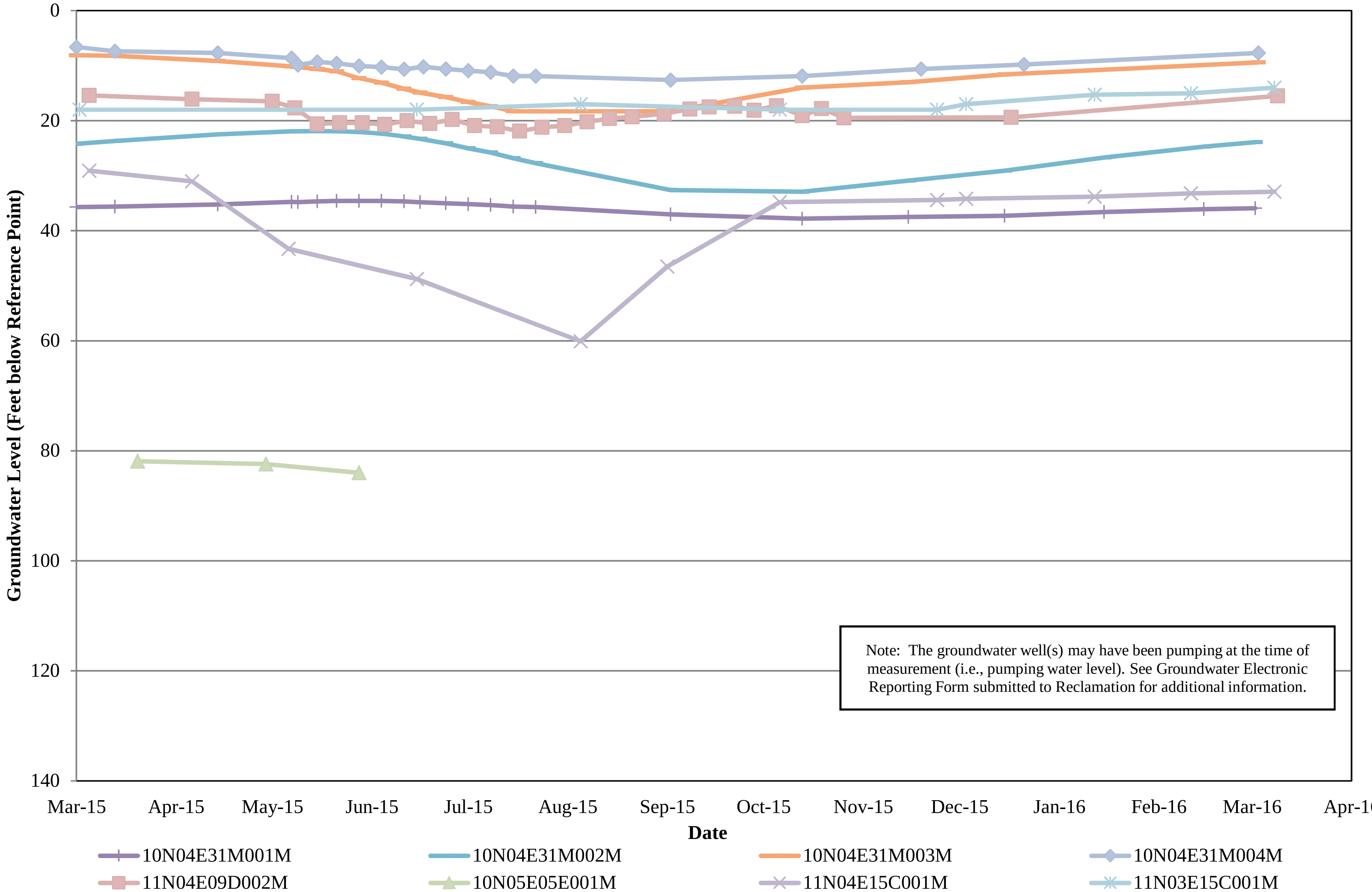
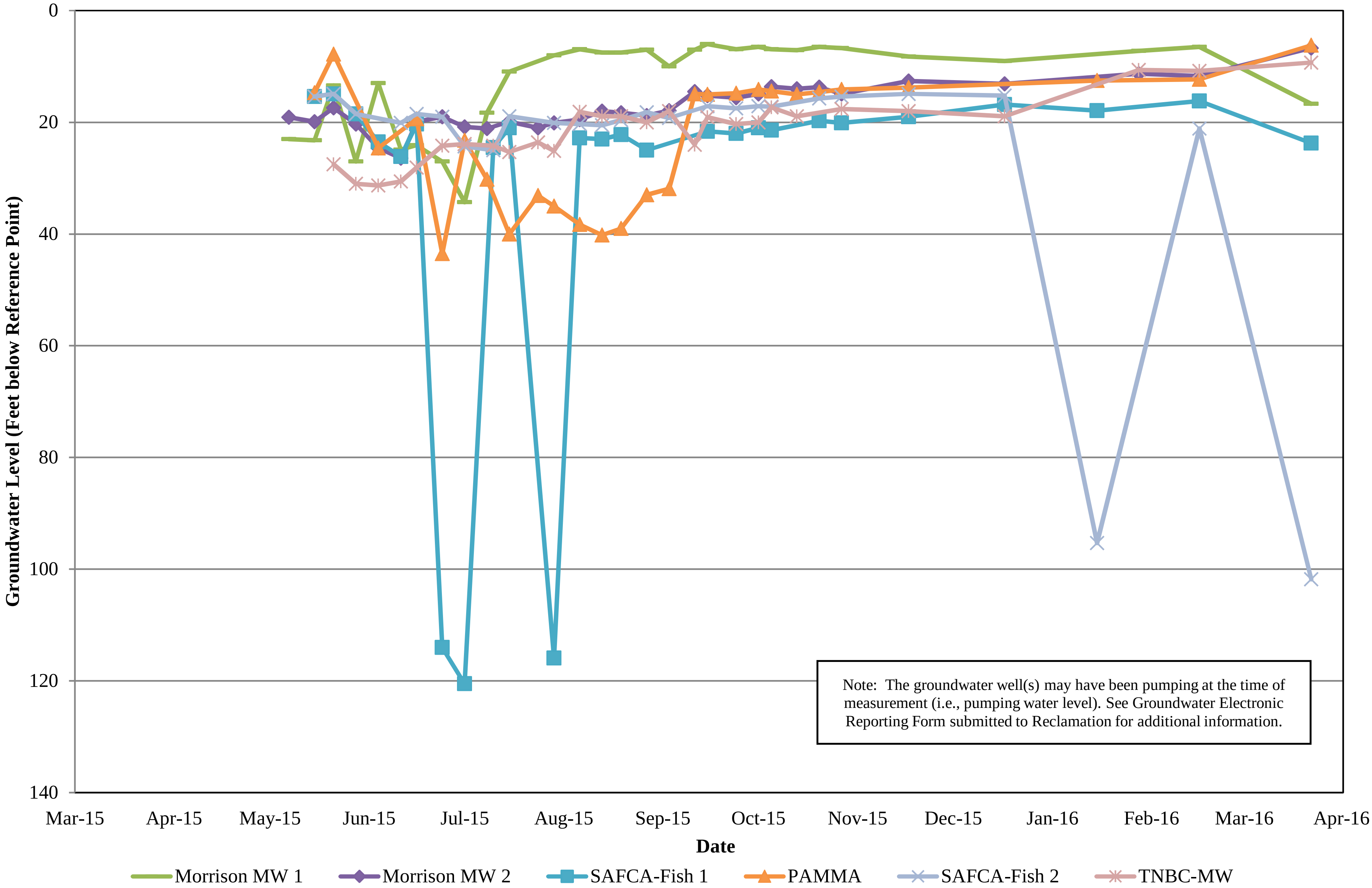
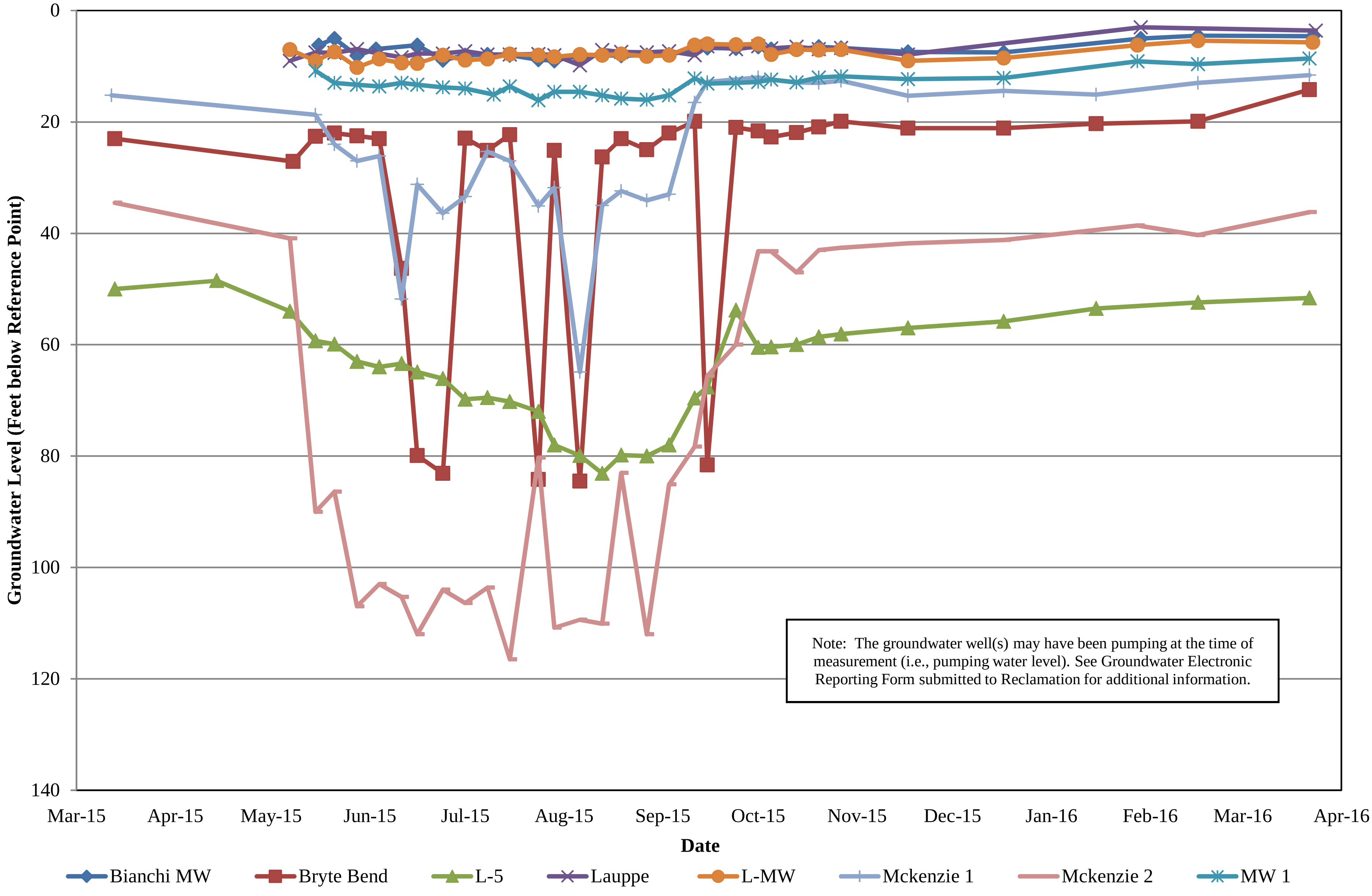
# Natomas Central Mutual Water Company
# DWR Monitoring Well Groundwater Level Data

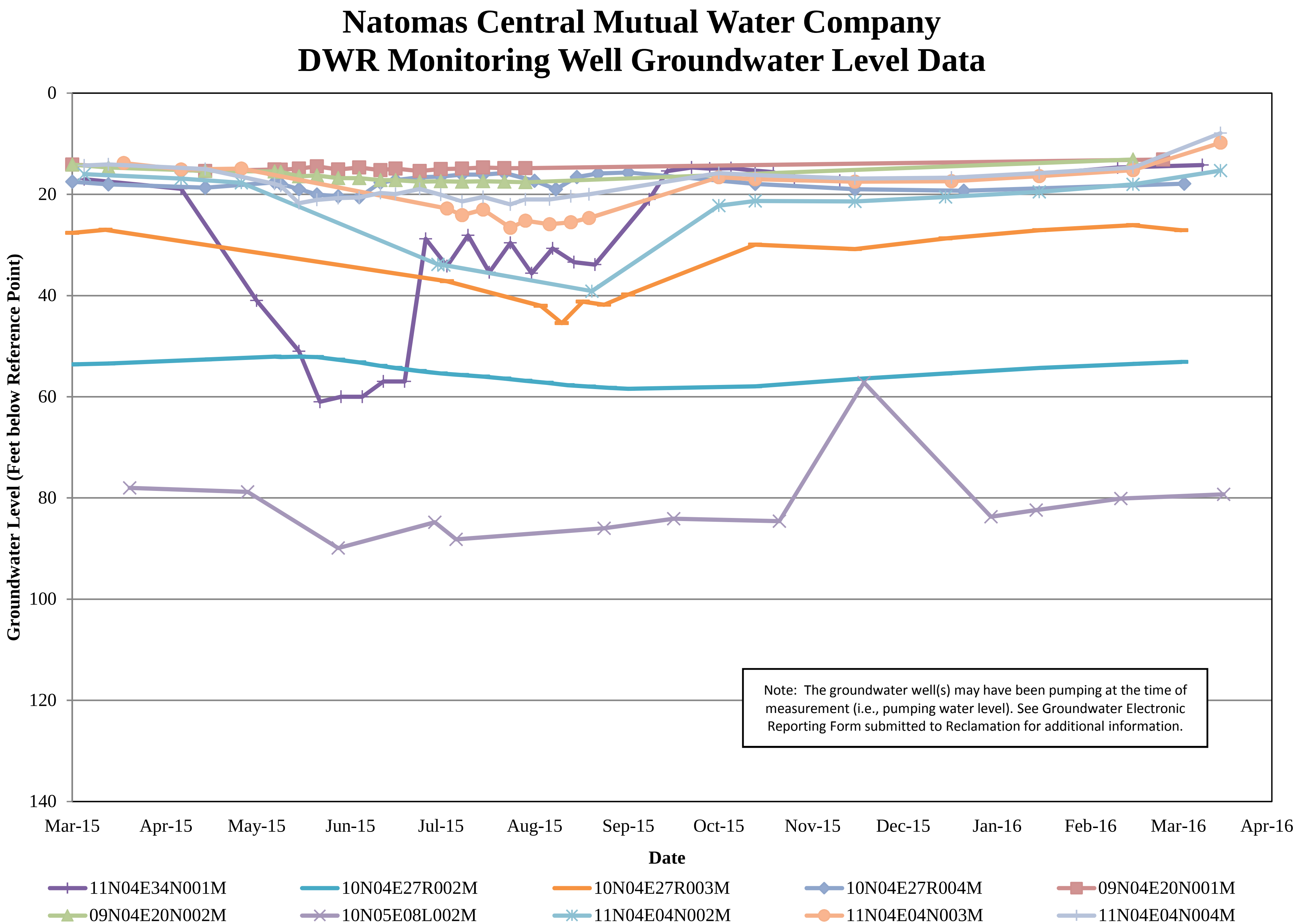


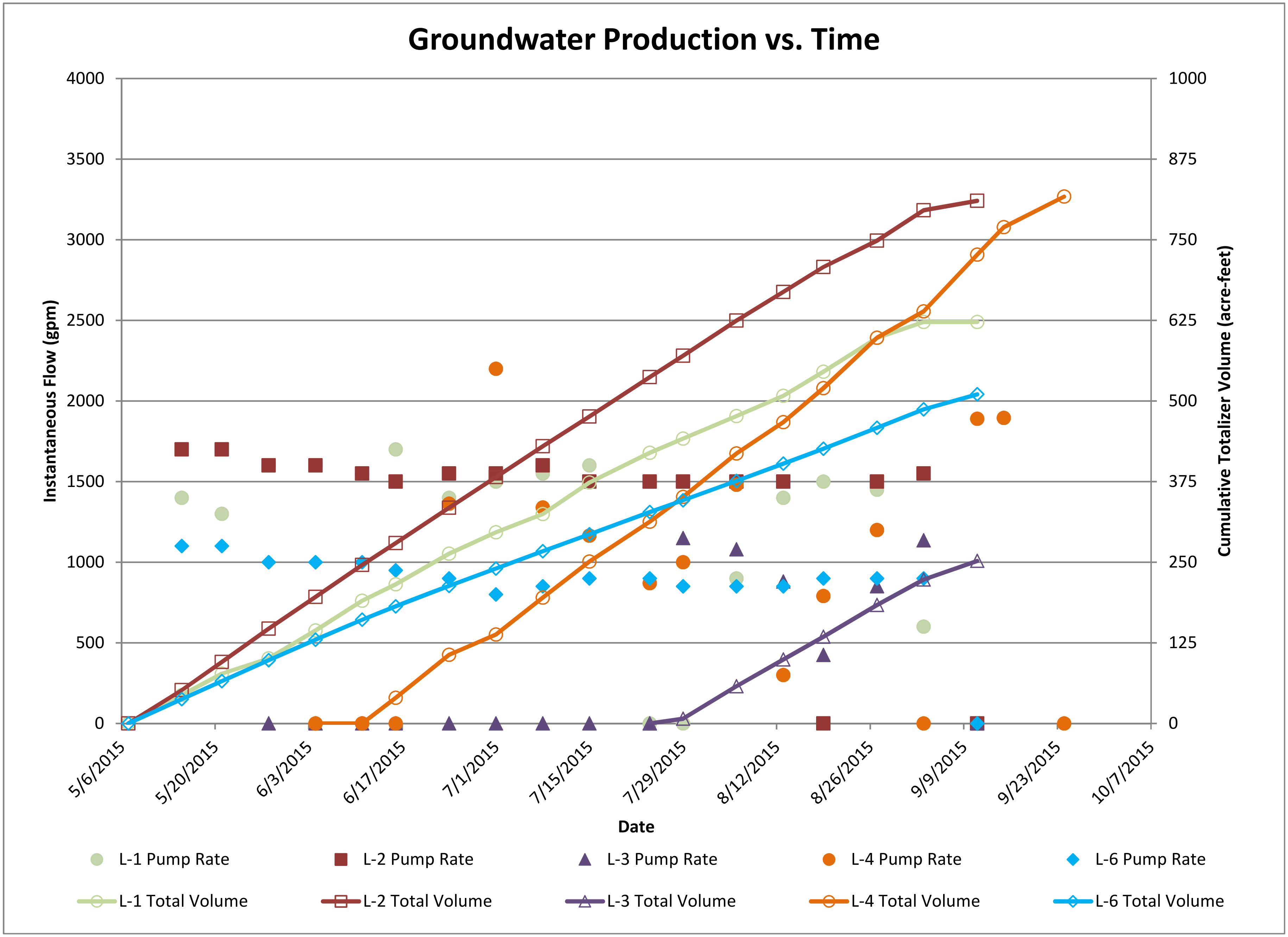
# Natomas Central Mutual Water Company
# Monitoring Well Groundwater Level Data



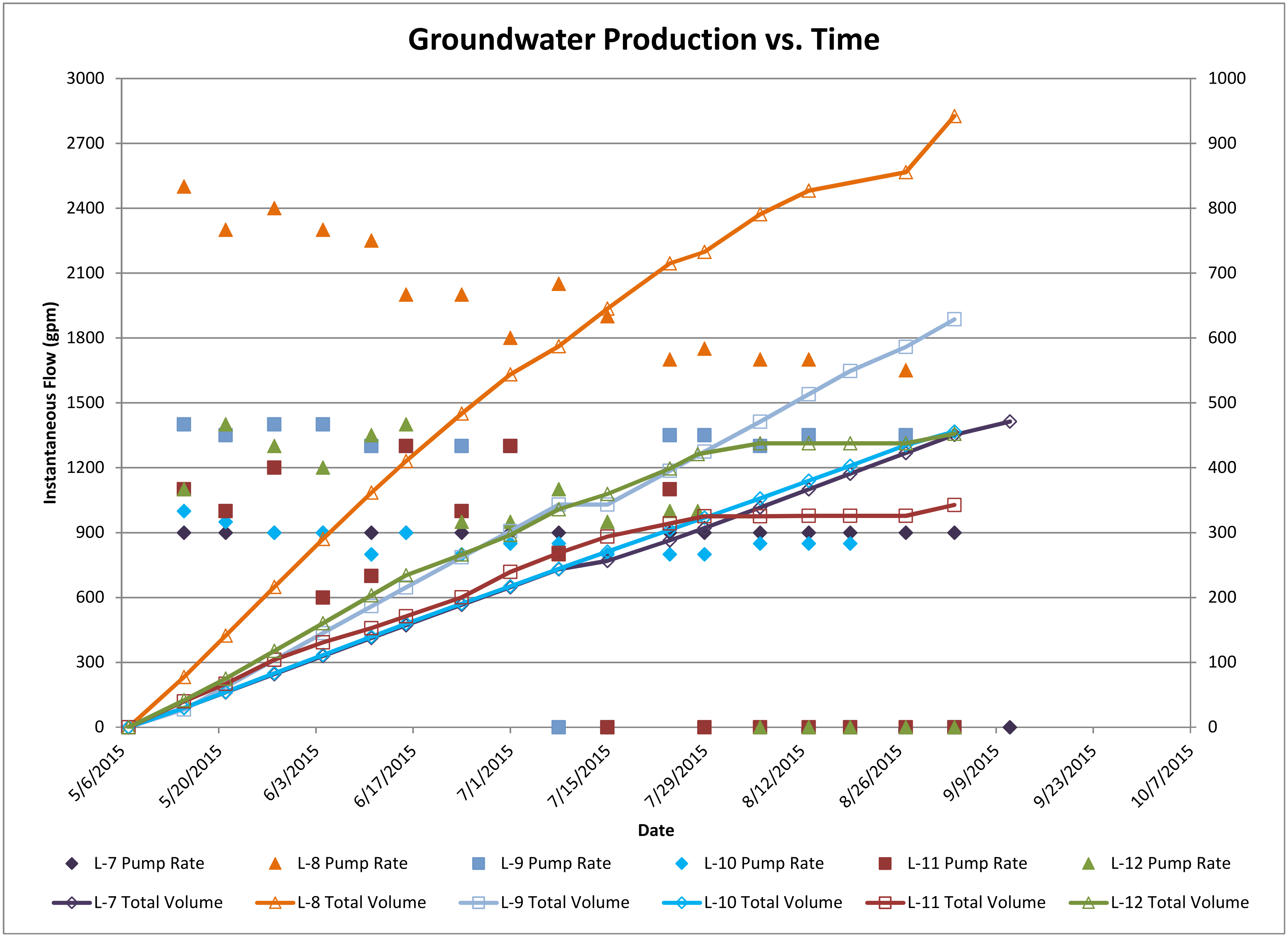
# Natomas Central Mutual Water Company
# Monitoring Well Groundwater Level Data

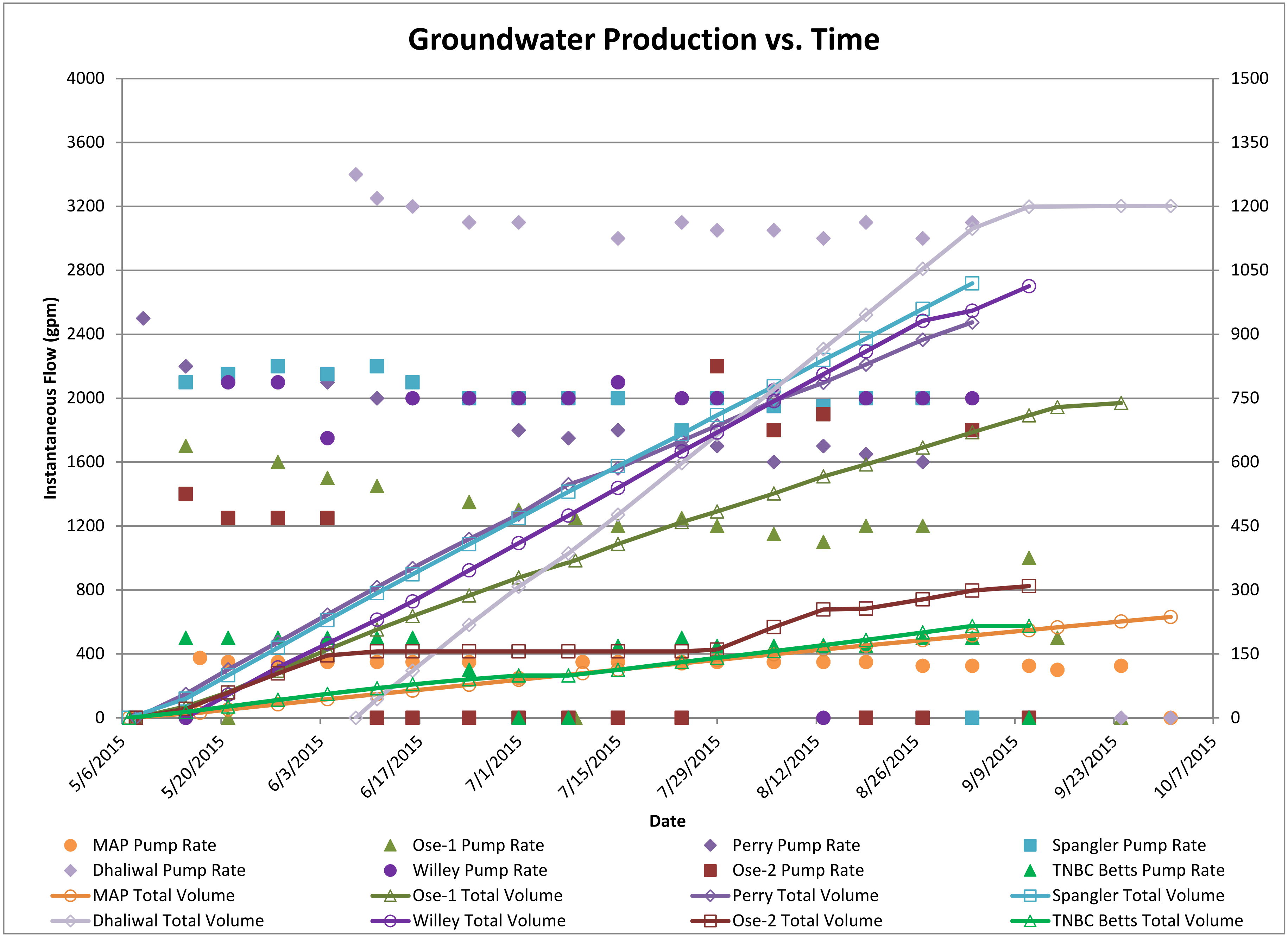



Natomas Central Mutual Water Company
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet below Reference Point)
0
20
40
60
80
100
120
140
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
11N04E34N001M
10N04E27R002M
10N04E27R003M
10N04E27R004M
09N04E20N001M
09N04E20N002M
10N05E08L002M
11N04E04N002M
11N04E04N003M
11N04E04N004M

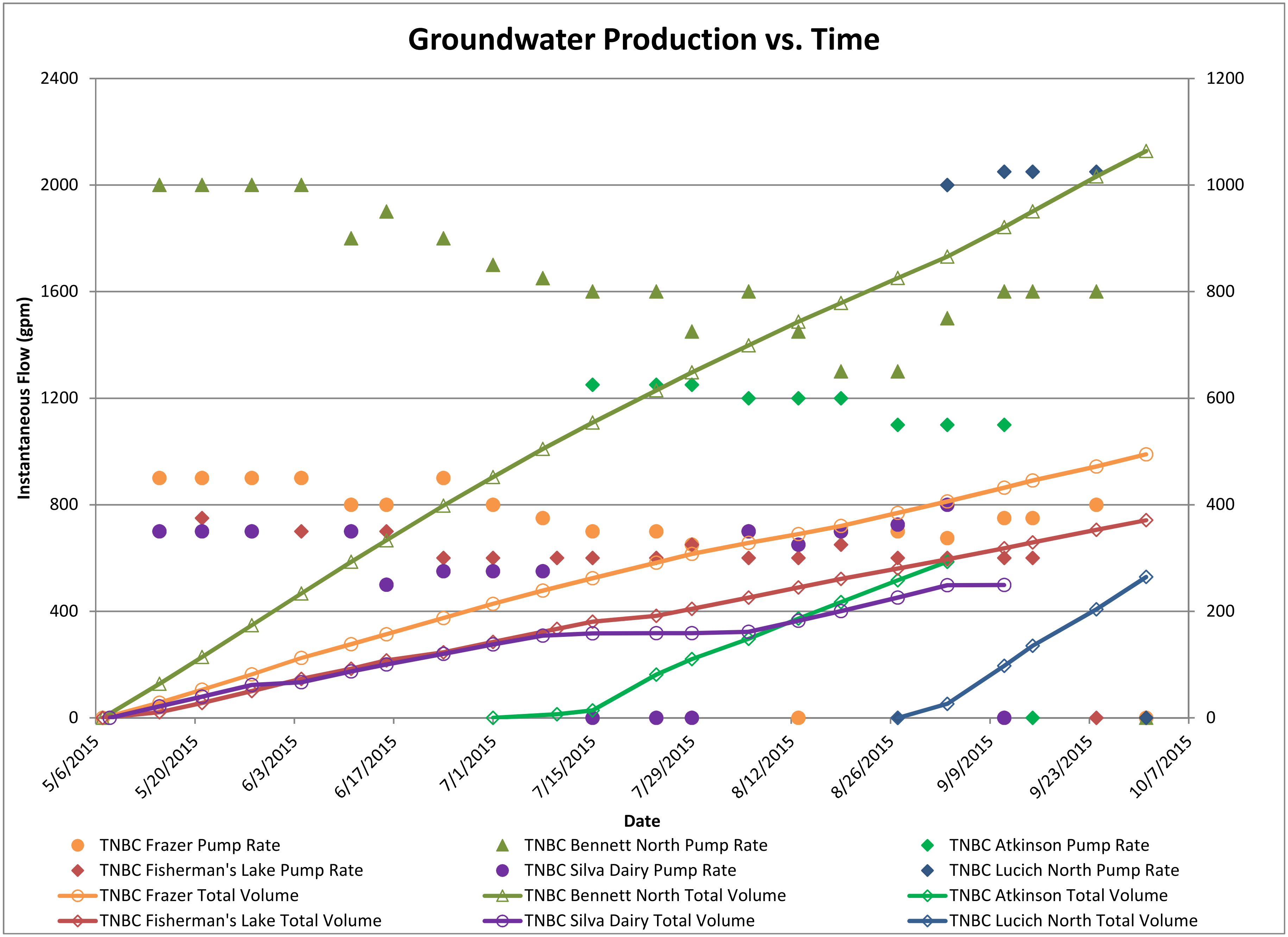


Groundwater Production vs. Time
Instantaneous Flow (gpm)
4000
3500
3000
2500
2000
1500
1000
500
0
Cumulative Totalizer Volume (acre-feet)
1000
875
750
625
500
375
250
125
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
L-1 Pump Rate
L-2 Pump Rate
L-3 Pump Rate
L-4 Pump Rate
L-6 Pump Rate
L-1 Total Volume
L-2 Total Volume
L-3 Total Volume
L-4 Total Volume
L-6 Total Volume


Groundwater Production vs. Time
Instantaneous Flow (gpm)
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
1000
900
800
700
600
500
400
300
200
100
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
L-7 Pump Rate
L-8 Pump Rate
L-9 Pump Rate
L-10 Pump Rate
L-11 Pump Rate
L-12 Pump Rate
L-7 Total Volume
L-8 Total Volume
L-9 Total Volume
L-10 Total Volume
L-11 Total Volume
L-12 Total Volume

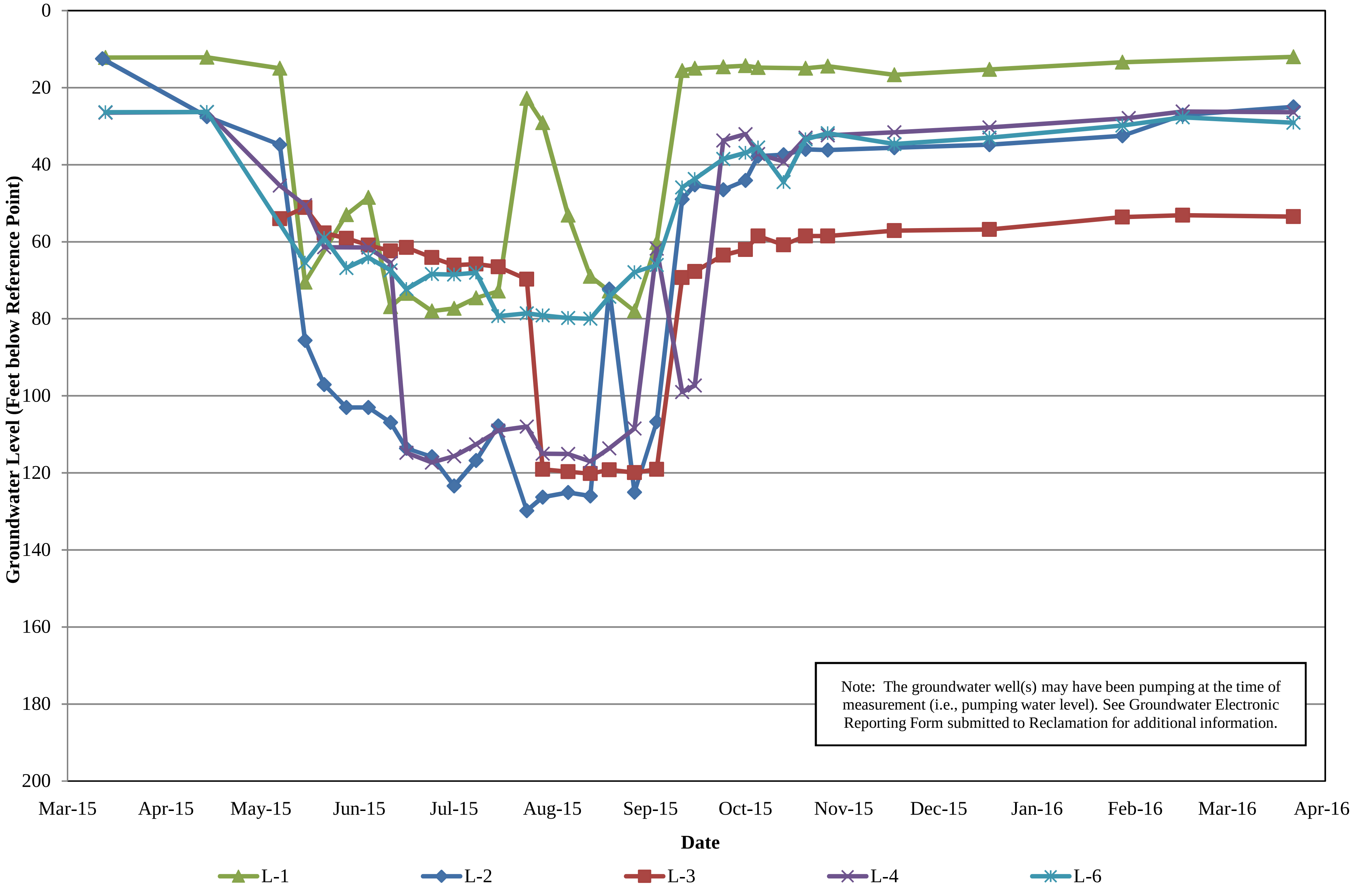


Groundwater Production vs. Time
Instantaneous Flow (gpm)
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
1500
1350
1200
1050
900
750
600
450
300
150
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
MAP Pump Rate
Ose-1 Pump Rate
Perry Pump Rate
Spangler Pump Rate
Dhaliwal Pump Rate
Willey Pump Rate
Ose-2 Pump Rate
TNBC Betts Pump Rate
MAP Total Volume
Ose-1 Total Volume
Perry Total Volume
Spangler Total Volume
Dhaliwal Total Volume
Willey Total Volume
Ose-2 Total Volume
TNBC Betts Total Volume

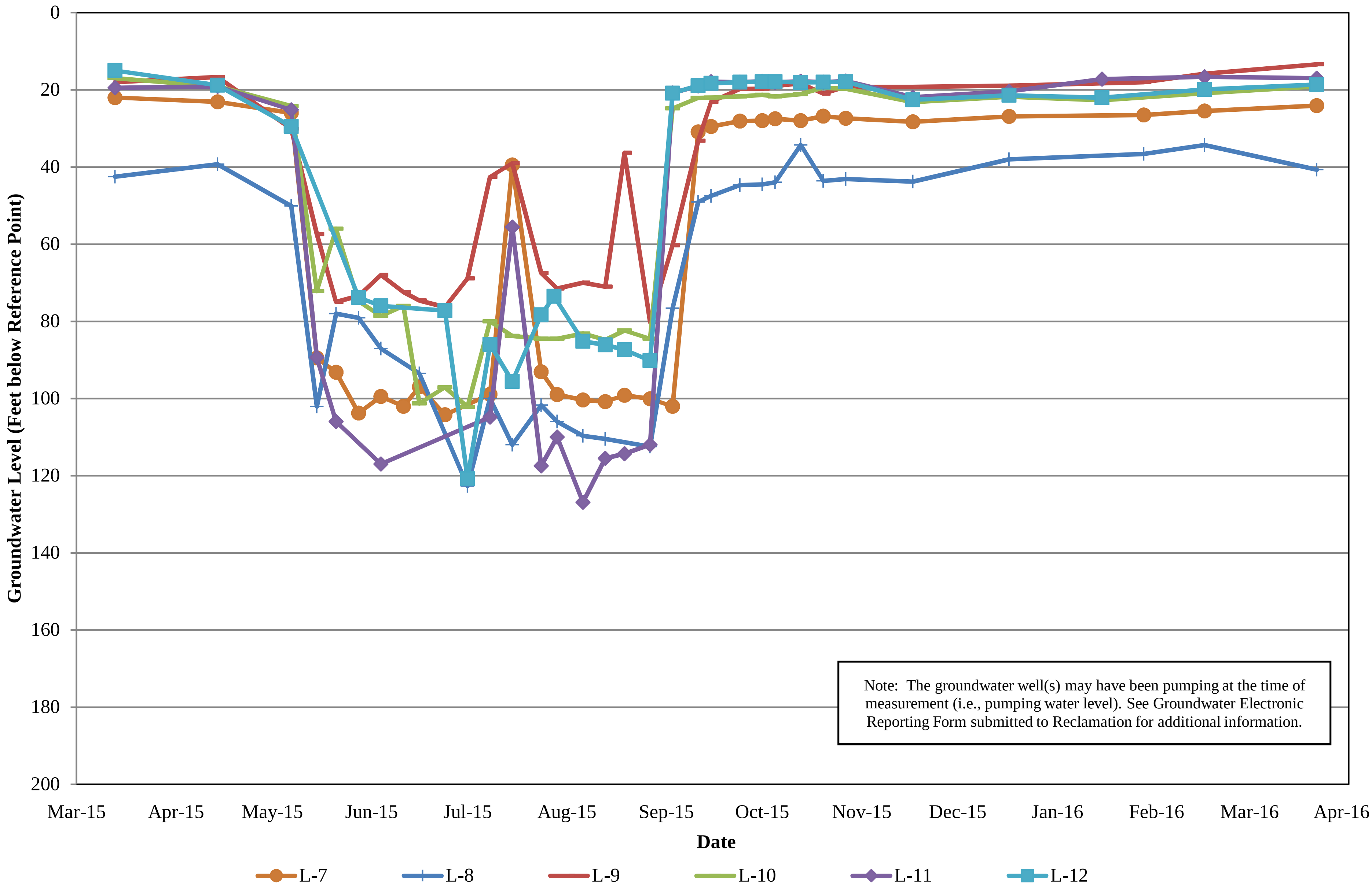


Groundwater Production vs. Time
Instantaneous Flow (gpm)
2400
2000
1600
1200
800
400
0
1200
1000
800
600
400
200
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
TNBC Frazer Pump Rate
TNBC Bennett North Pump Rate
TNBC Atkinson Pump Rate
TNBC Fisherman's Lake Pump Rate
TNBC Silva Dairy Pump Rate
TNBC Lucich North Pump Rate
TNBC Frazer Total Volume
TNBC Bennett North Total Volume
TNBC Atkinson Total Volume
TNBC Fisherman's Lake Total Volume
TNBC Silva Dairy Total Volume
TNBC Lucich North Total Volume

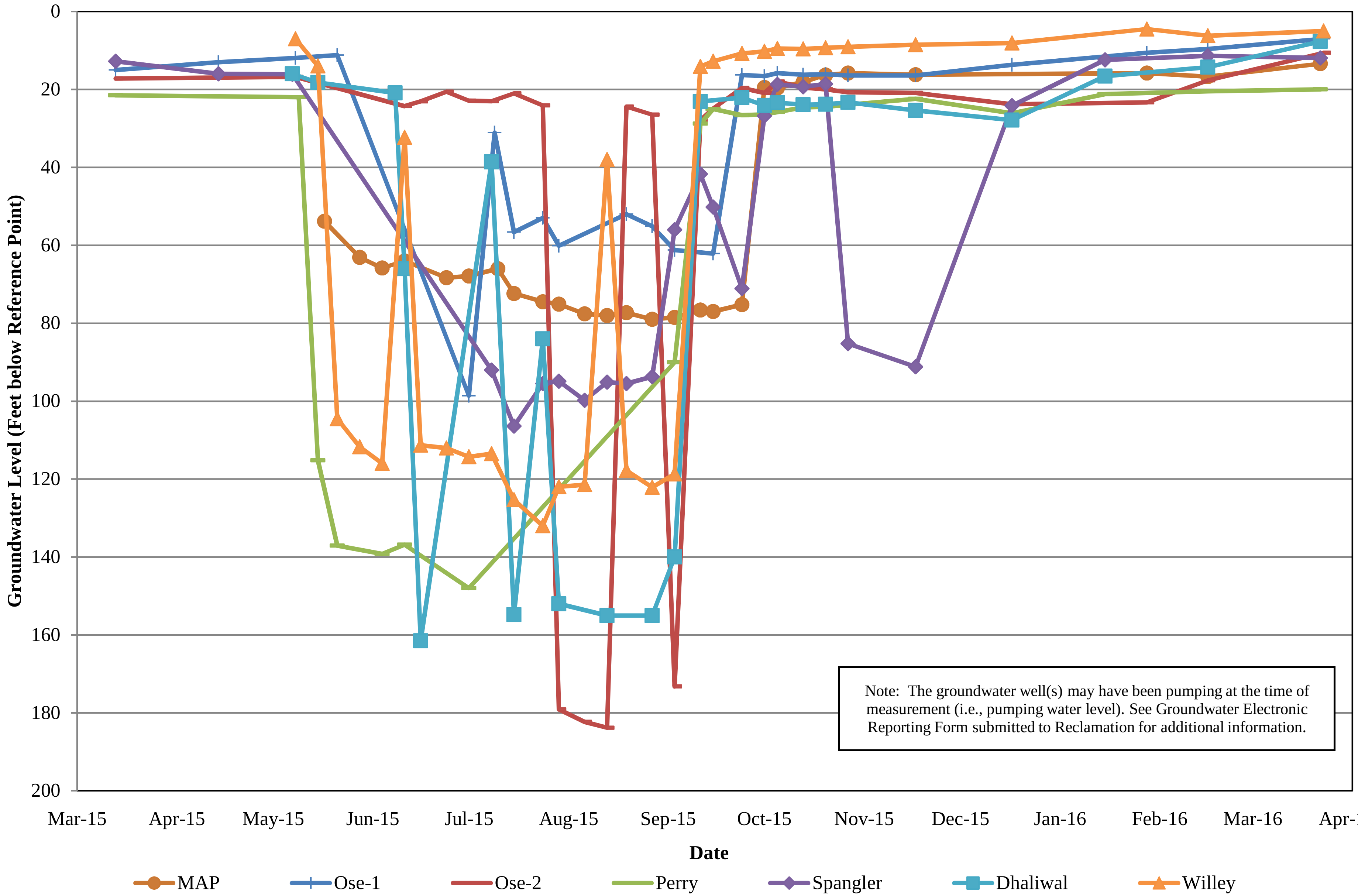
# Natomas Central Mutual Water Company
# Production Well Groundwater Level Data



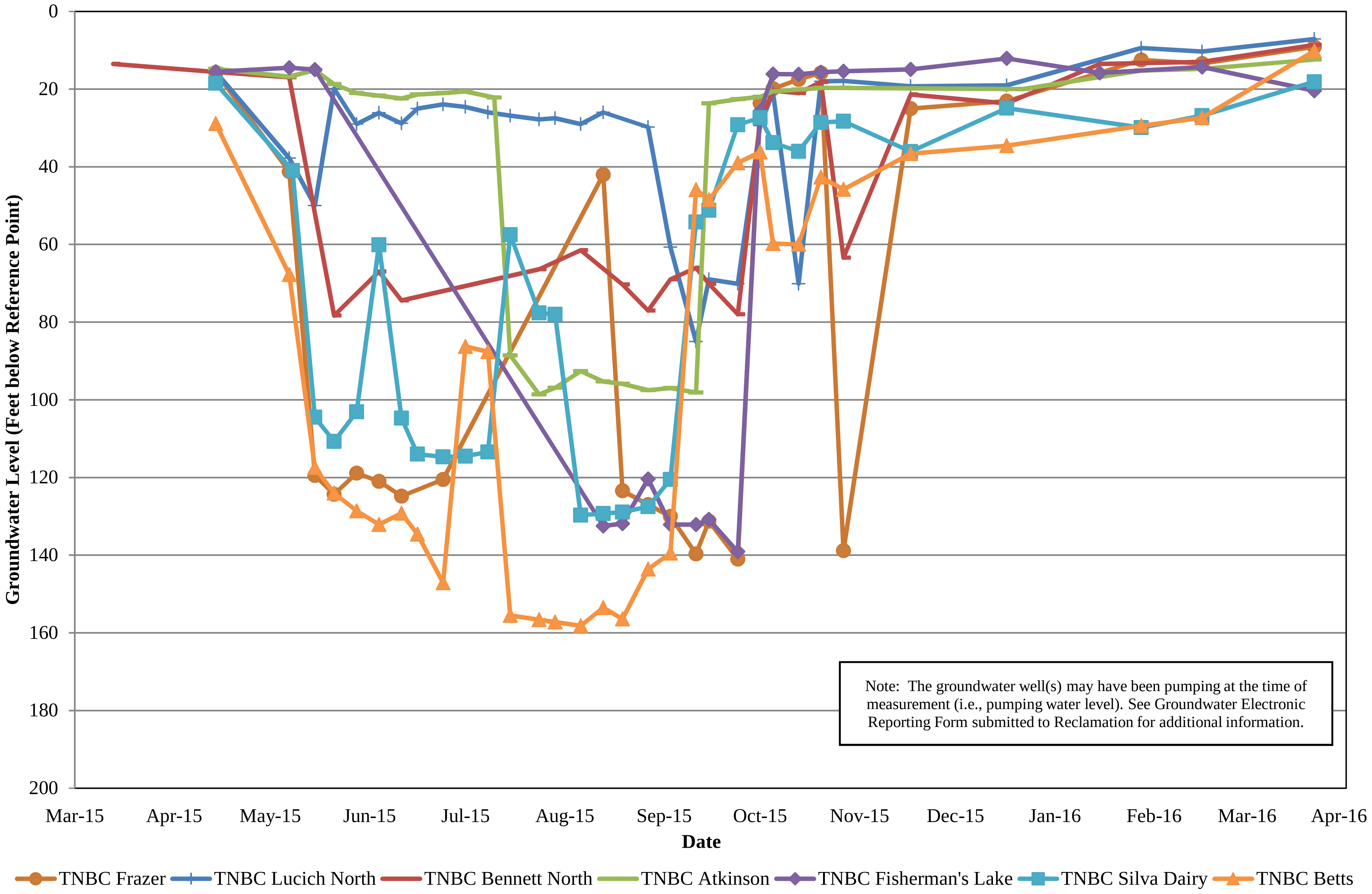
# Natomas Central Mutual Water Company
# Production Well Groundwater Level Data

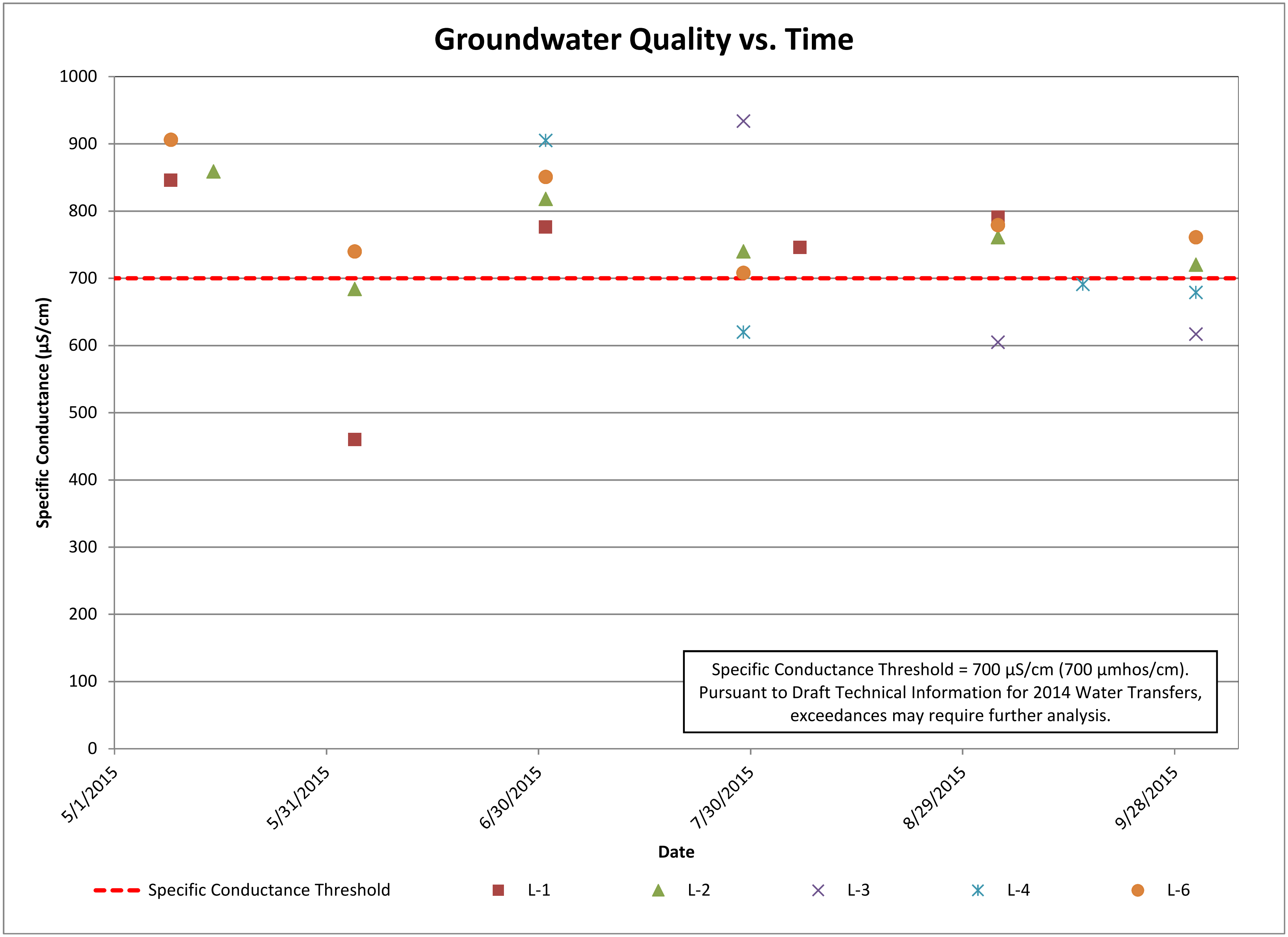


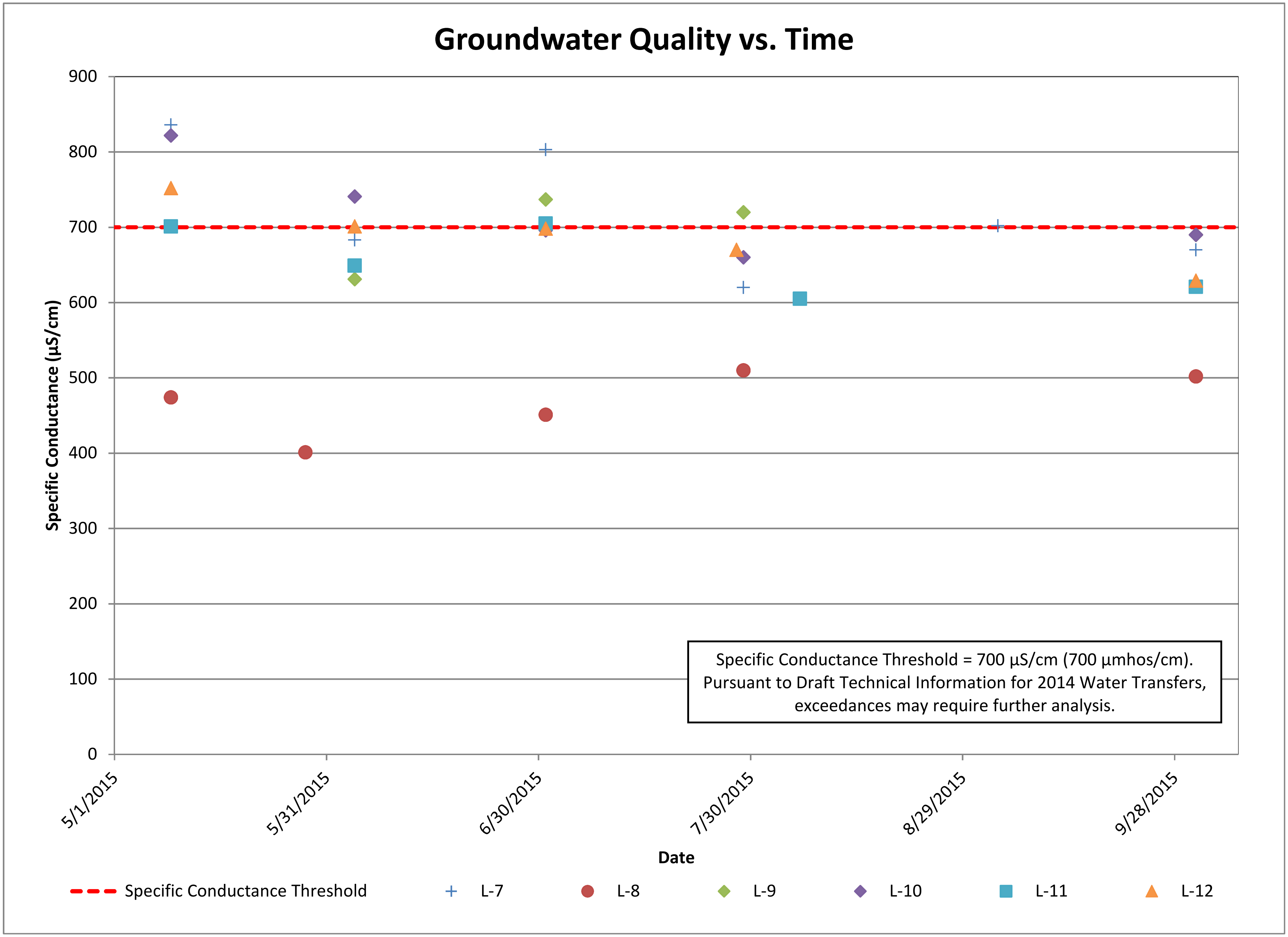
# Natomas Central Mutual Water Company
# Production Well Groundwater Level Data



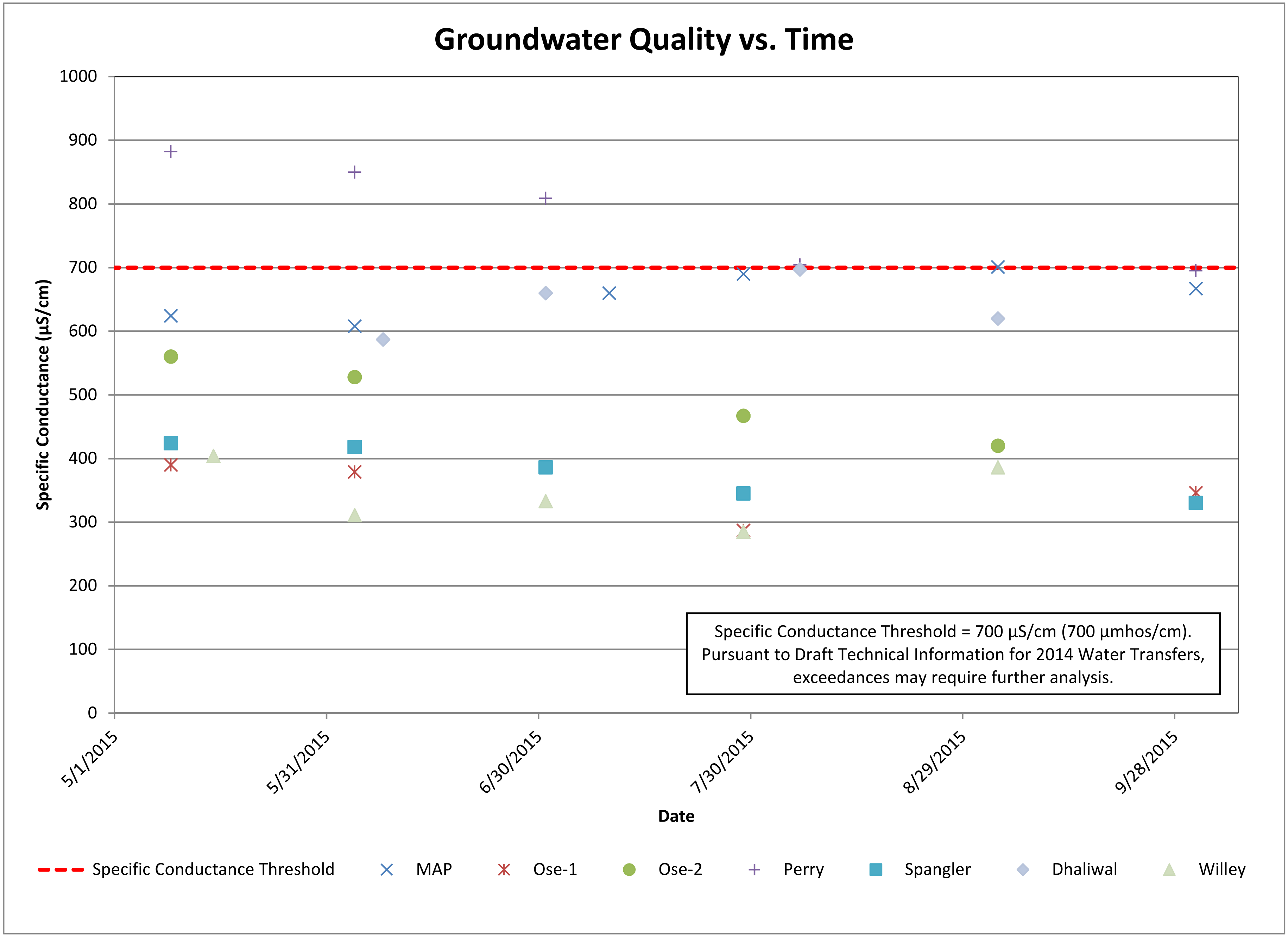
# Natomas Central Mutual Water Company
# Production Well Groundwater Level Data



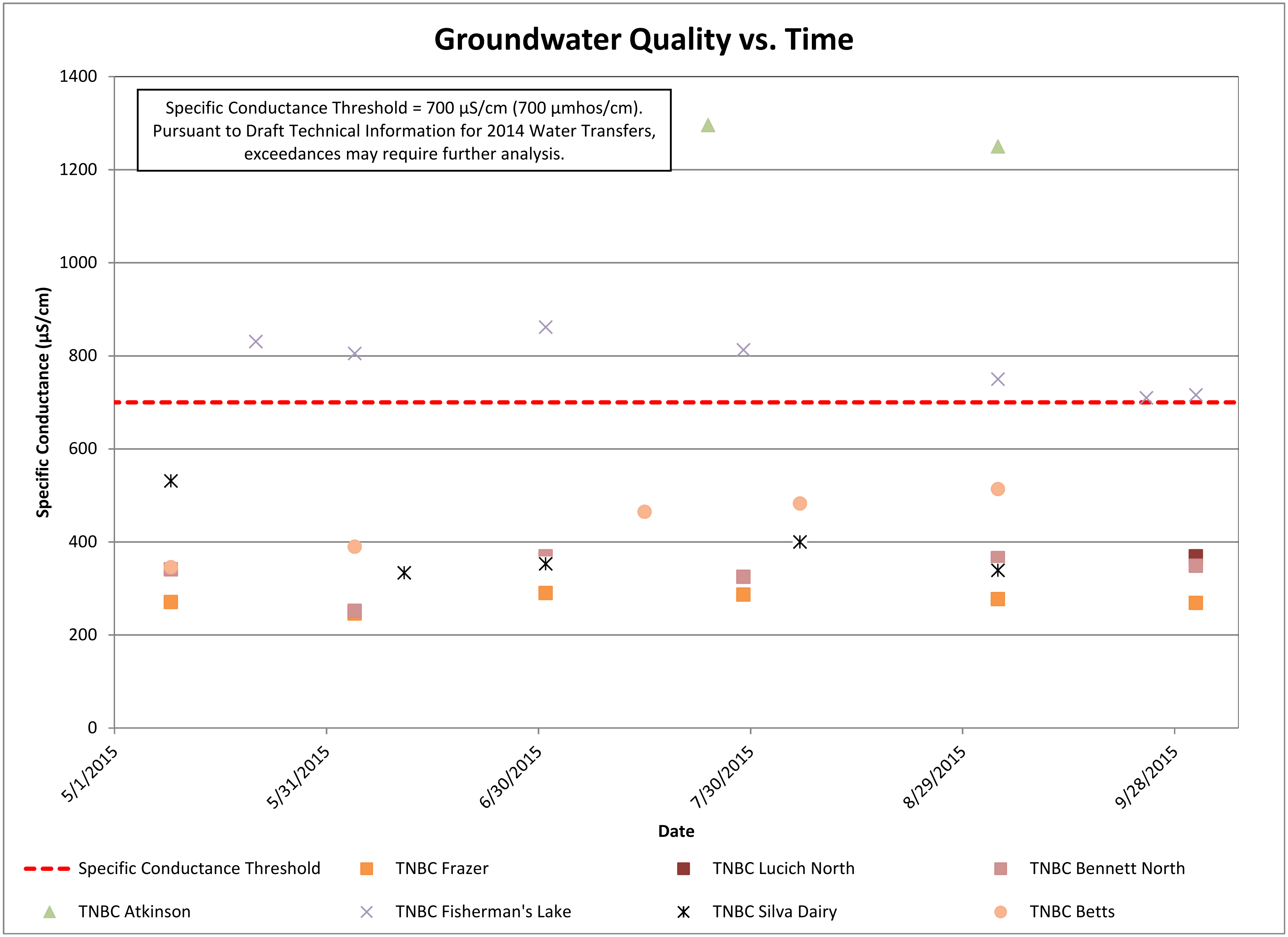

Groundwater Quality vs. Time
Specific Conductance (µS/cm)
1000
900
800
700
600
500
400
300
200
100
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2014 Water Transfers,
exceedances may require further analysis.
Specific Conductance Threshold
L-1
L-2
L-3
L-4
L-6



Groundwater Quality vs. Time
Specific Conductance (µS/cm)
900
800
700
600
500
400
300
200
100
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm). Pursuant to Draft Technical Information for 2014 Water Transfers, exceedances may require further analysis.
Specific Conductance Threshold
L-7
L-8
L-9
L-10
L-11
L-12



Groundwater Quality vs. Time
1000
900
800
700
600
500
400
300
200
100
0
Specific Conductance (µS/cm)
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2014 Water Transfers,
exceedances may require further analysis.
Specific Conductance Threshold
MAP
Ose-1
Ose-2
Perry
Spangler
Dhaliwal
Willey



Groundwater Quality vs. Time
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2014 Water Transfers,
exceedances may require further analysis.
Specific Conductance (µS/cm)
1400
1200
1000
800
600
400
200
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold
TNBC Frazer
TNBC Lucich North
TNBC Bennett North
TNBC Atkinson
TNBC Fisherman's Lake
TNBC Silva Dairy
TNBC Betts

# Pelger Mutual Water Company

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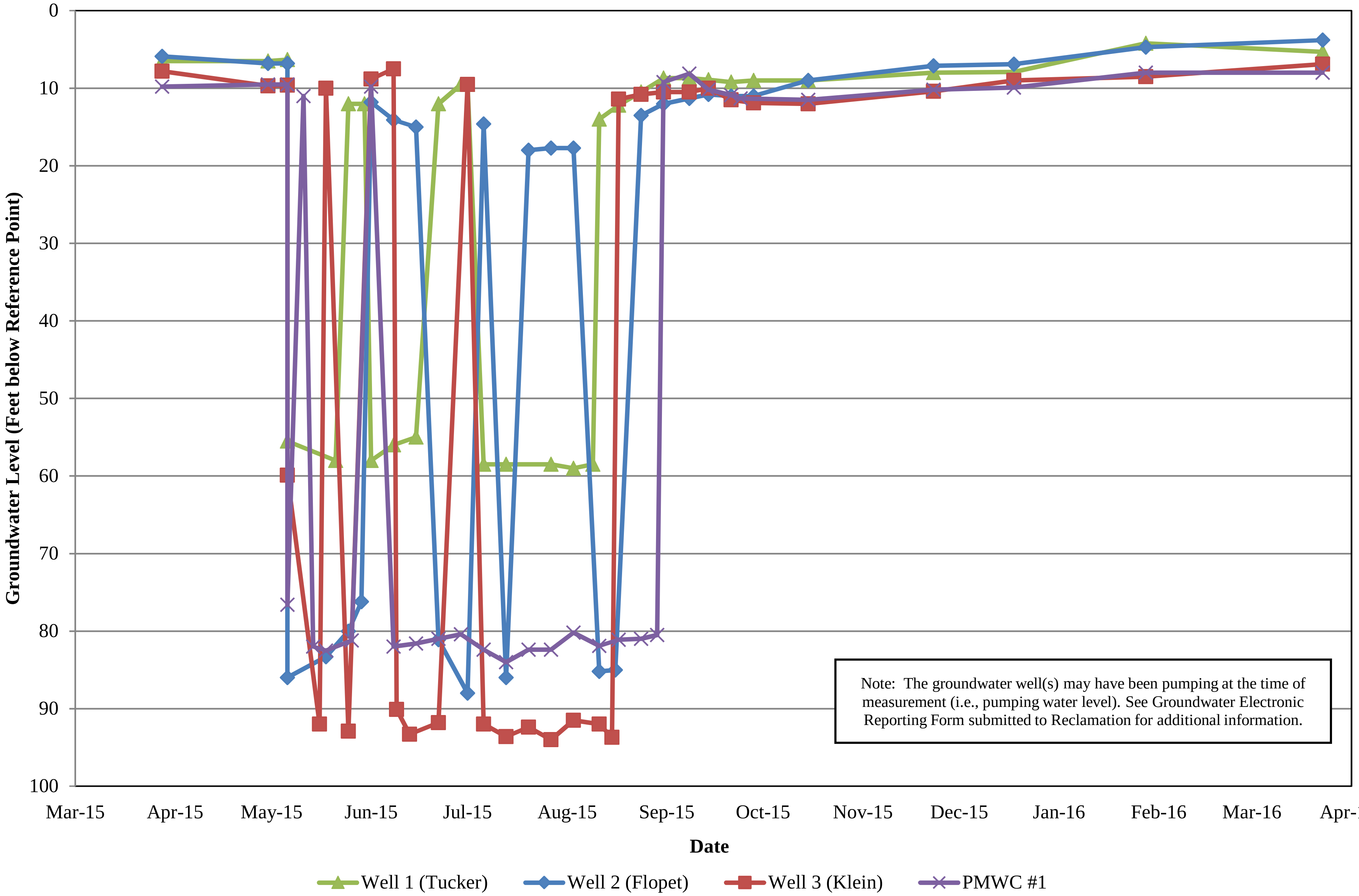
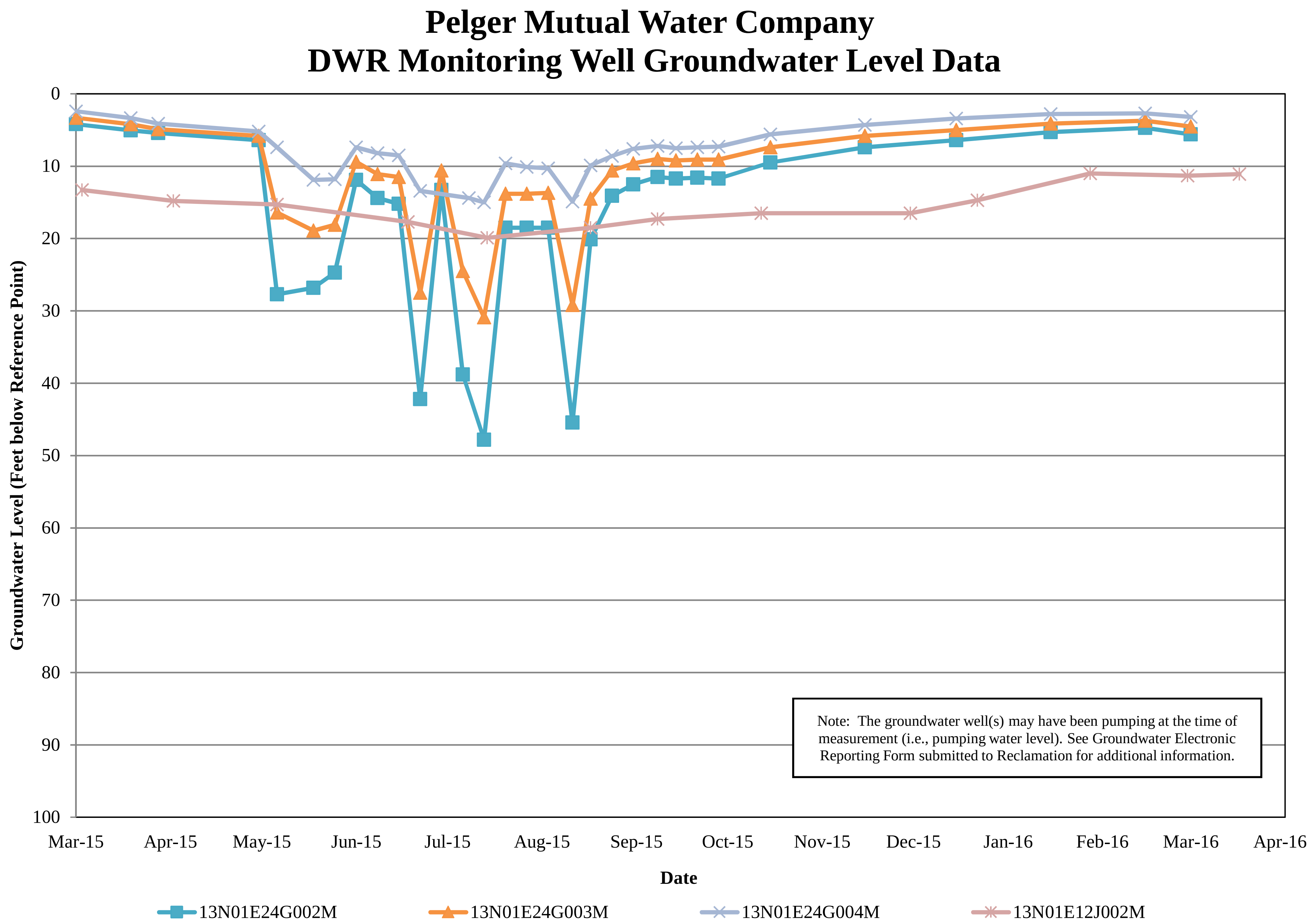
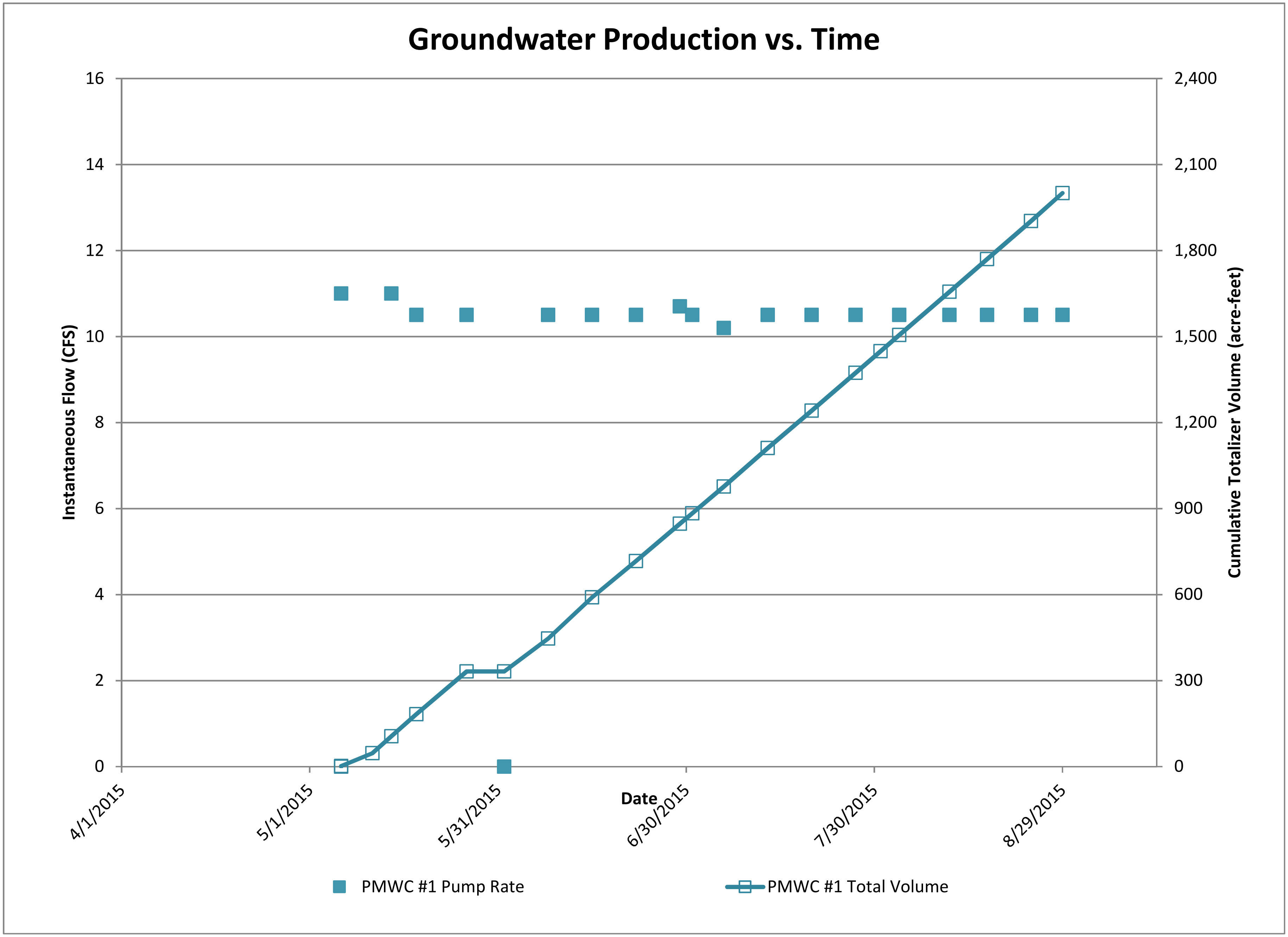
# Pelger Mutual Water Company
# Production Well Groundwater Level Data

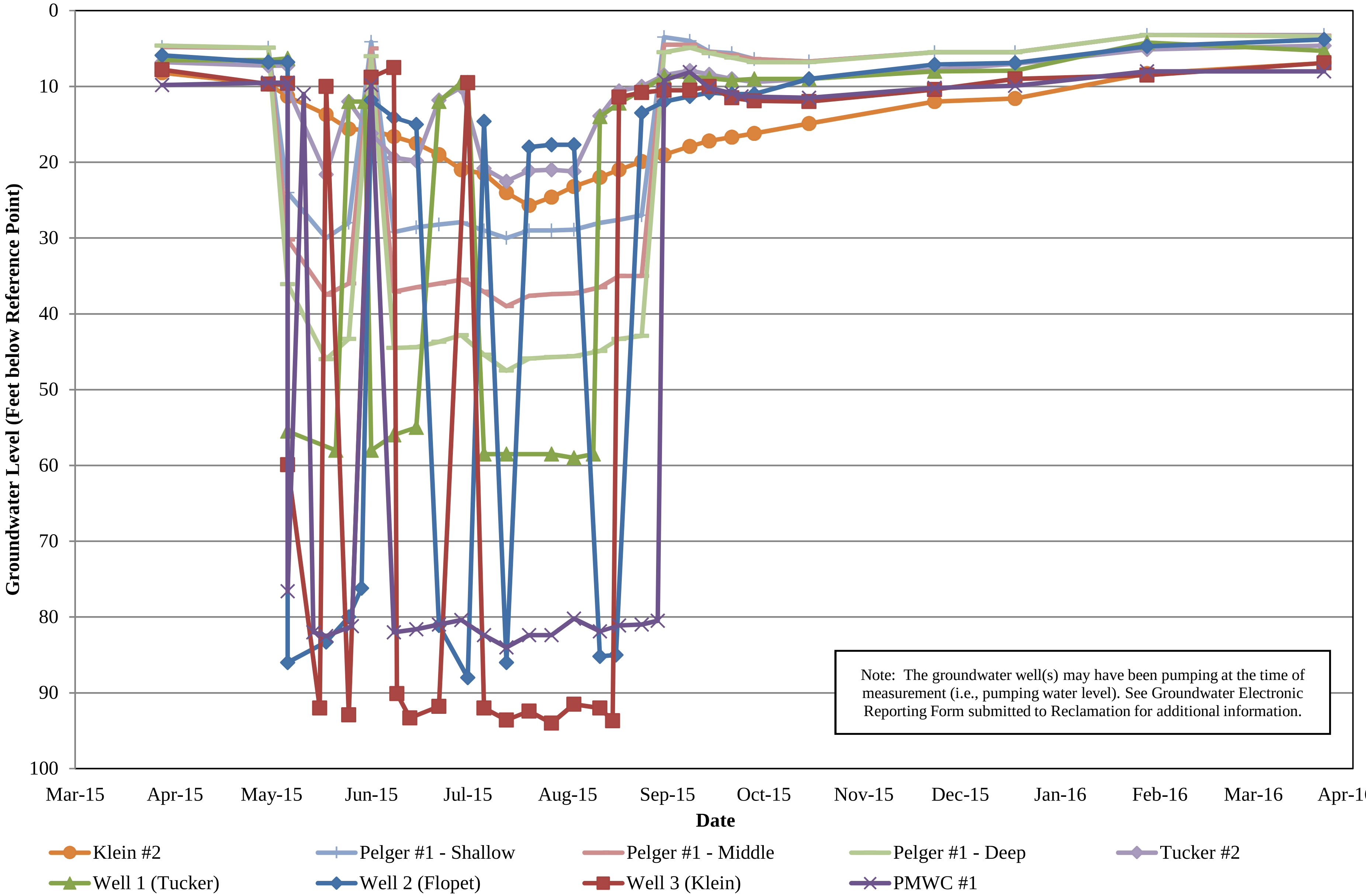


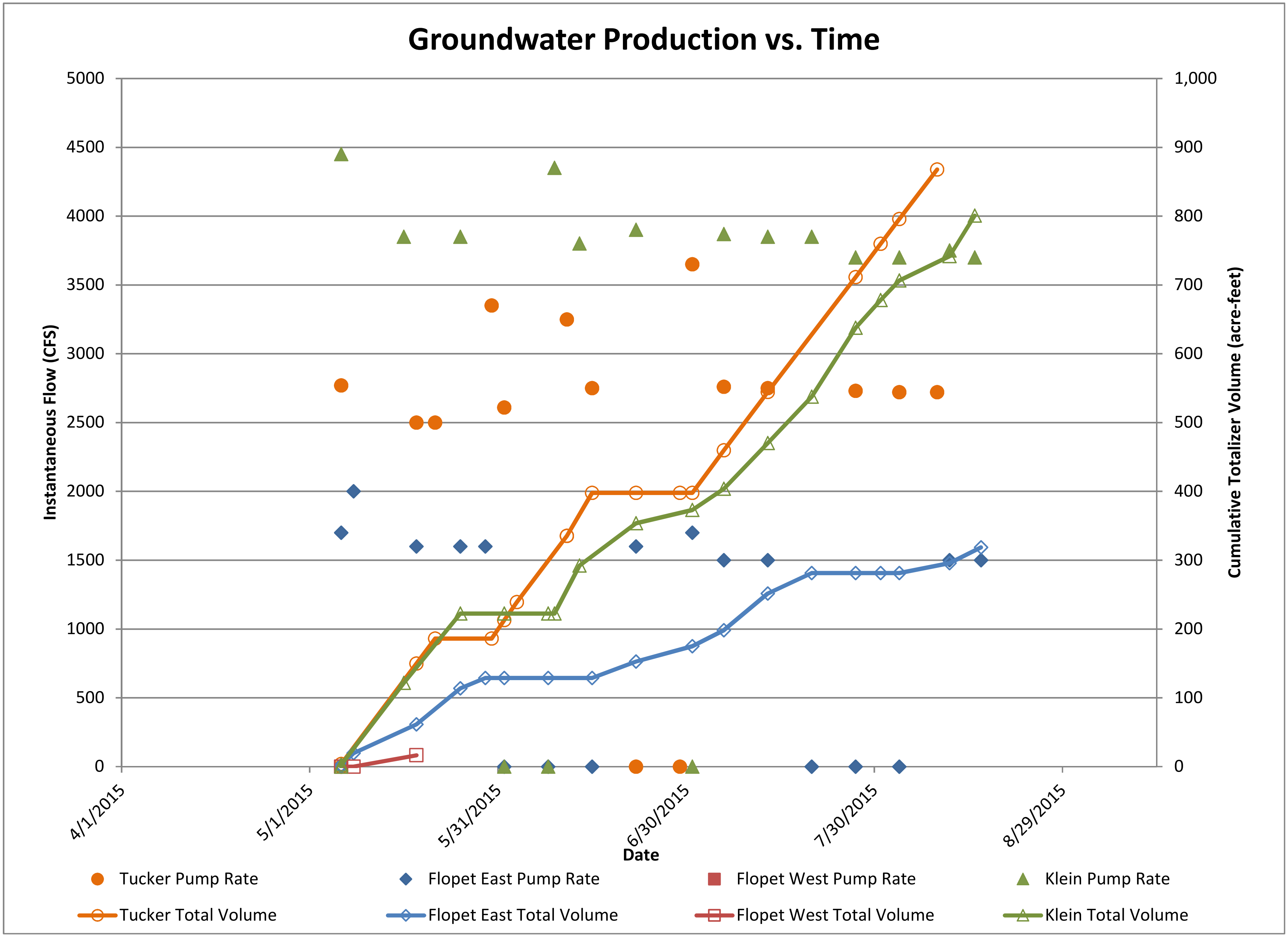

Pelger Mutual Water Company
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet below Reference Point)
0
10
20
30
40
50
60
70
80
90
100
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
13N01E24G002M
13N01E24G003M
13N01E24G004M
13N01E12J002M
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.



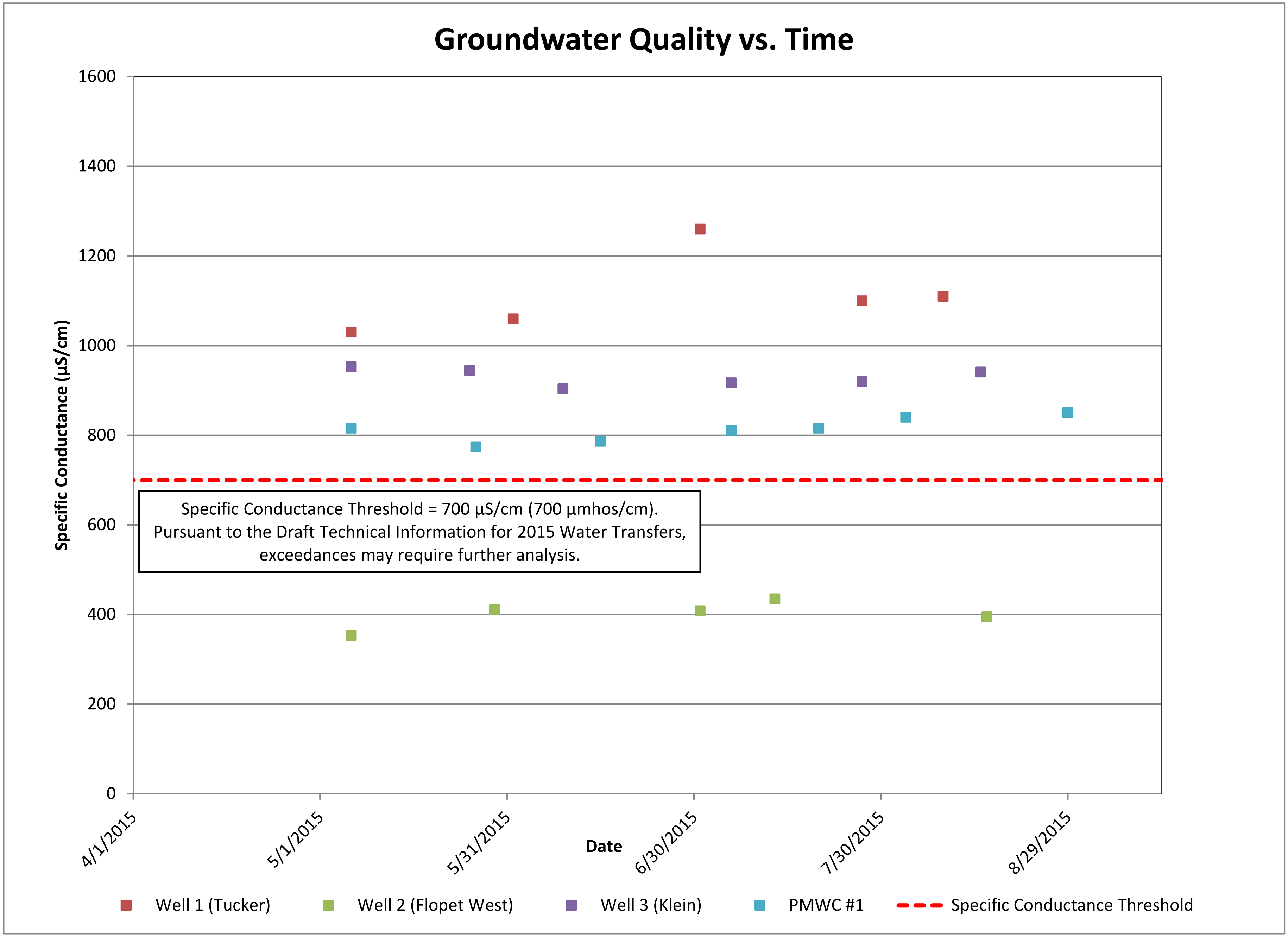
Groundwater Production vs. Time
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
Date
0
2
4
6
8
10
12
14
16
0
300
600
900
1,200
1,500
1,800
2,100
2,400
4/1/2015
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
PMWC #1 Pump Rate
PMWC #1 Total Volume

# Pelger Mutual Water Company
# Monitoring Well Groundwater Level Data





Groundwater Production vs. Time
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1,000
900
800
700
600
500
400
300
200
100
0
4/1/2015
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
Date
Tucker Pump Rate
Flopet East Pump Rate
Flopet West Pump Rate
Klein Pump Rate
Tucker Total Volume
Flopet East Total Volume
Flopet West Total Volume
Klein Total Volume



Groundwater Quality vs. Time
Specific Conductance (µS/cm)
1600
1400
1200
1000
800
600
400
200
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to the Draft Technical Information for 2015 Water Transfers,
exceedances may require further analysis.
4/1/2015
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
Date
Well 1 (Tucker)
Well 2 (Flopet West)
Well 3 (Klein)
PMWC #1
Specific Conductance Threshold

# Pelger Road 1700, LLC

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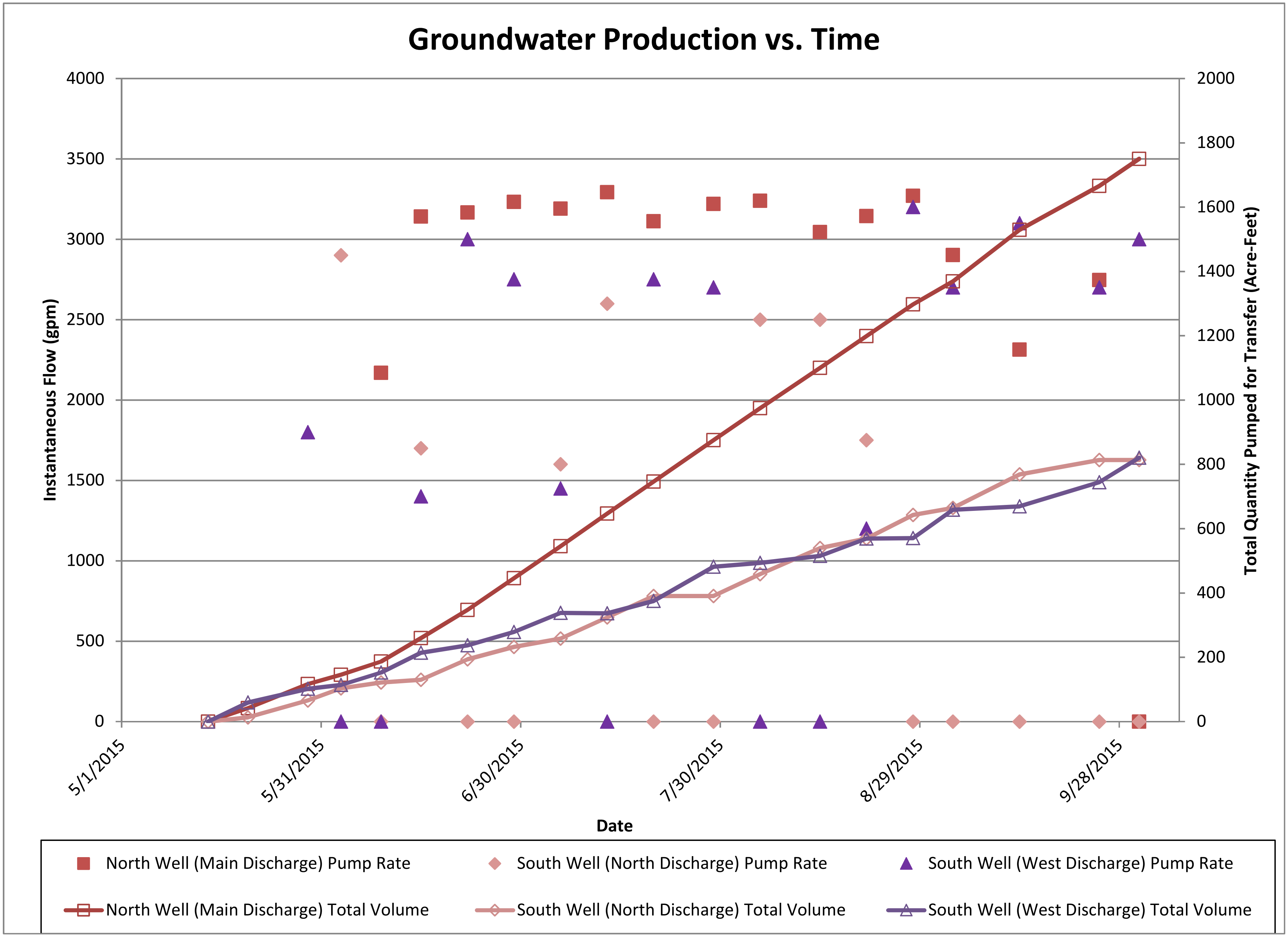
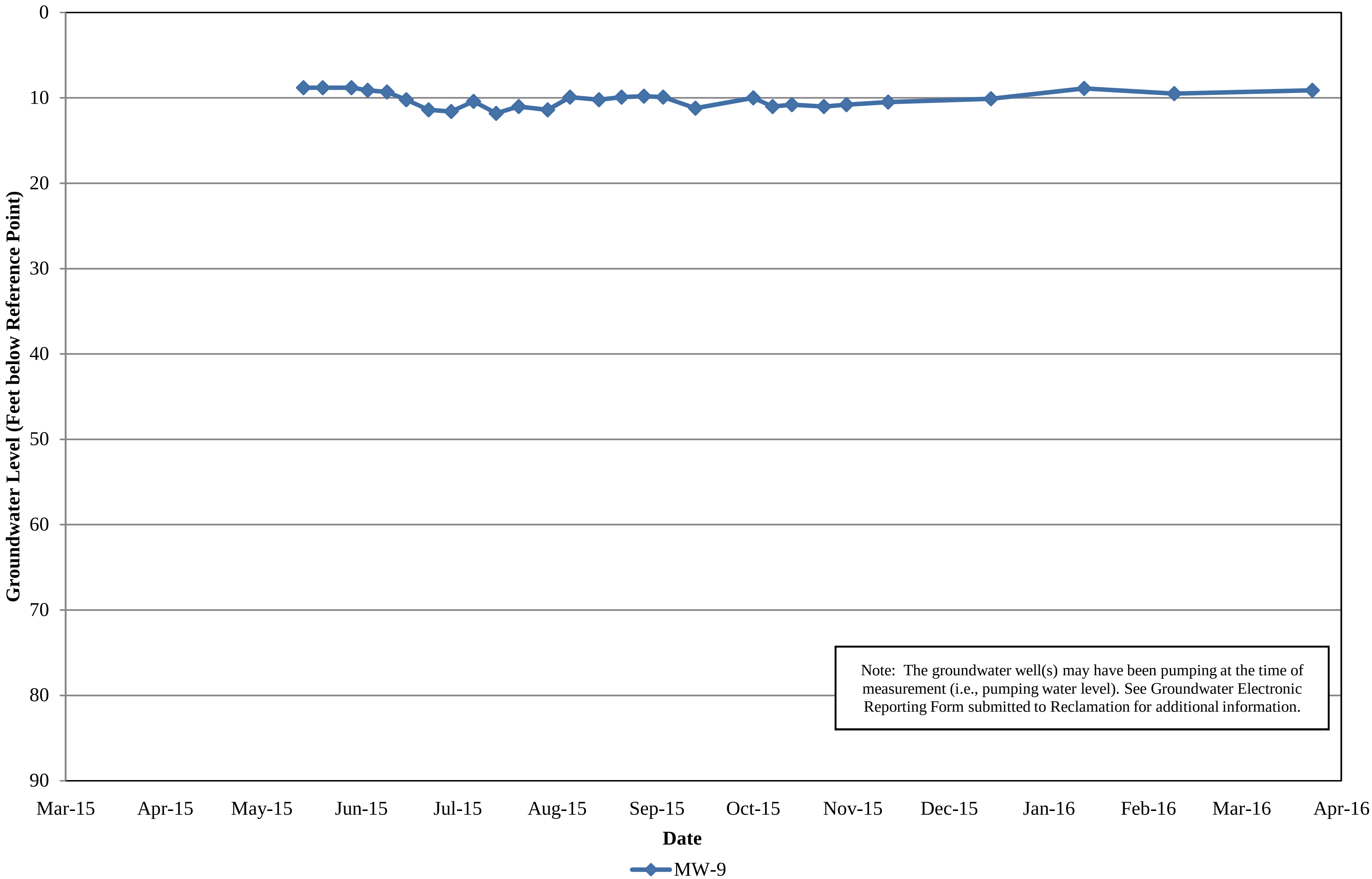
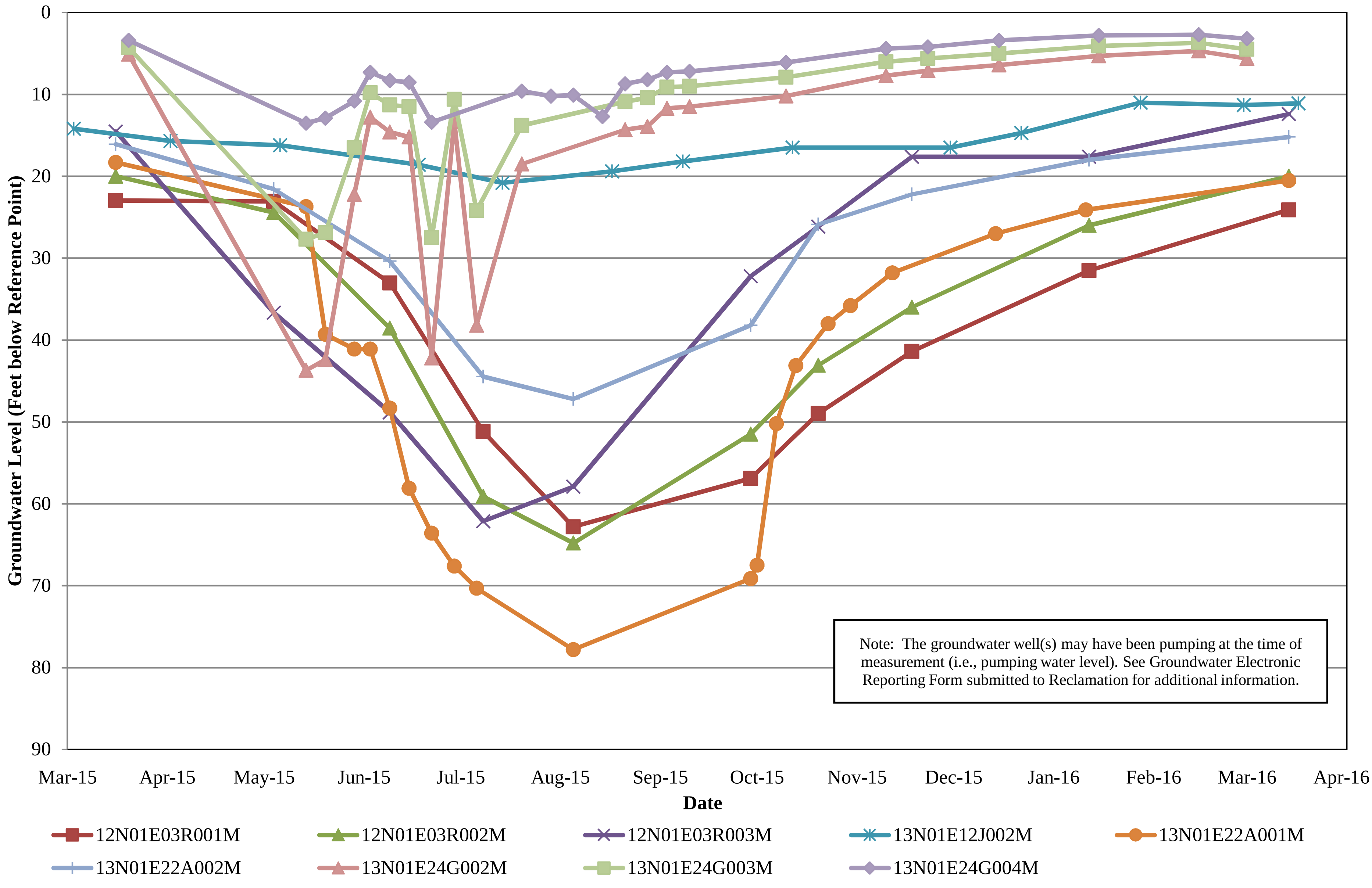


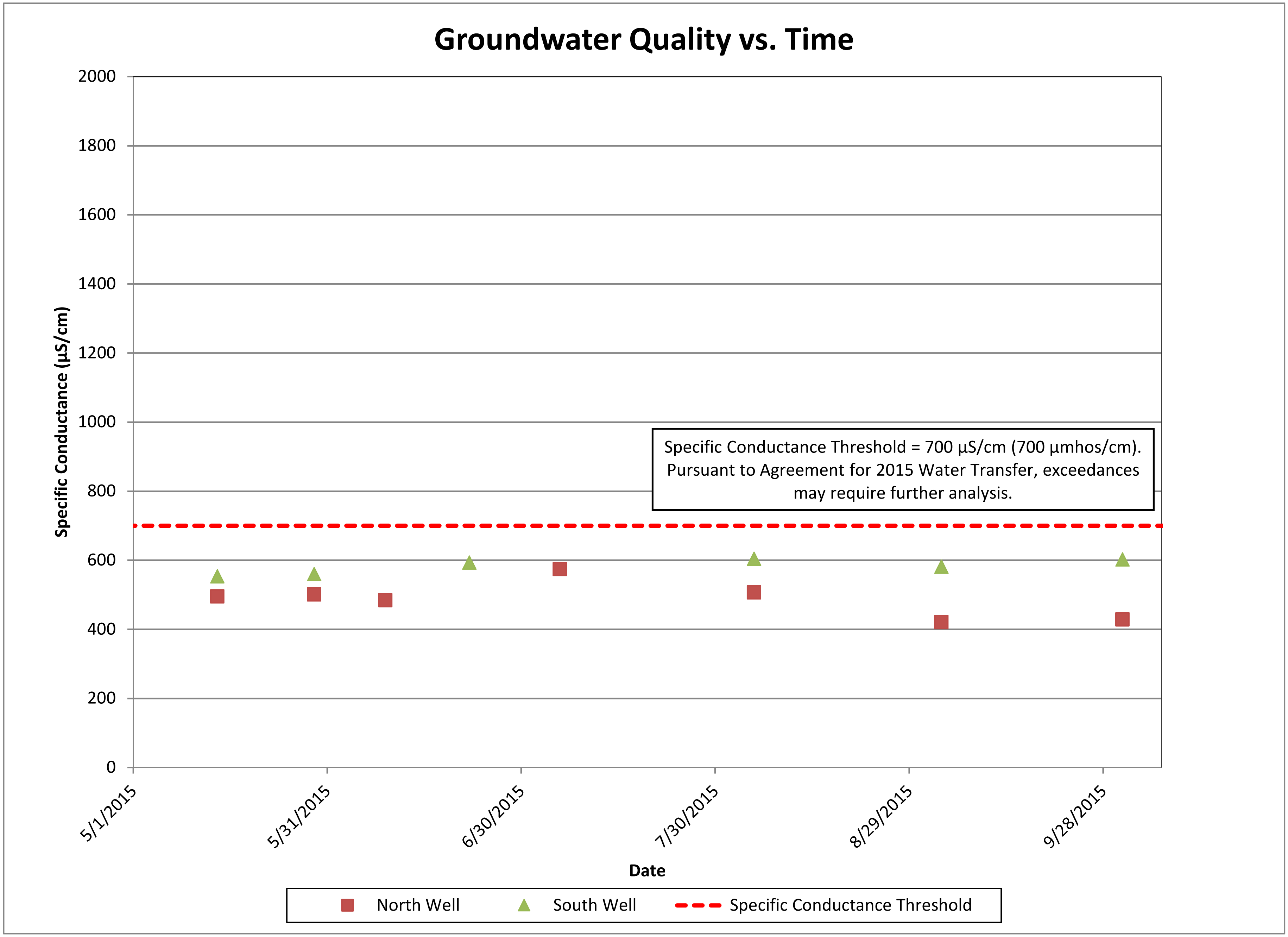
Groundwater Production vs. Time
Instantaneous Flow (gpm)
Total Quantity Pumped for Transfer (Acre-Feet)
0
500
1000
1500
2000
2500
3000
3500
4000
200
400
600
800
1000
1200
1400
1600
1800
2000
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
North Well (Main Discharge) Pump Rate
South Well (North Discharge) Pump Rate
South Well (West Discharge) Pump Rate
North Well (Main Discharge) Total Volume
South Well (North Discharge) Total Volume
South Well (West Discharge) Total Volume

# Pelger Road 1700, LLC
# Monitoring Well Groundwater Level Data



# Pelger Road 1700, LLC
# DWR Monitoring Well Groundwater Level Data




Groundwater Quality vs. Time
Specific Conductance (µS/cm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm). Pursuant to Agreement for 2015 Water Transfer, exceedances may require further analysis.
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
North Well
South Well
Specific Conductance Threshold

# Pleasant Grove-Verona Mutual Water Company

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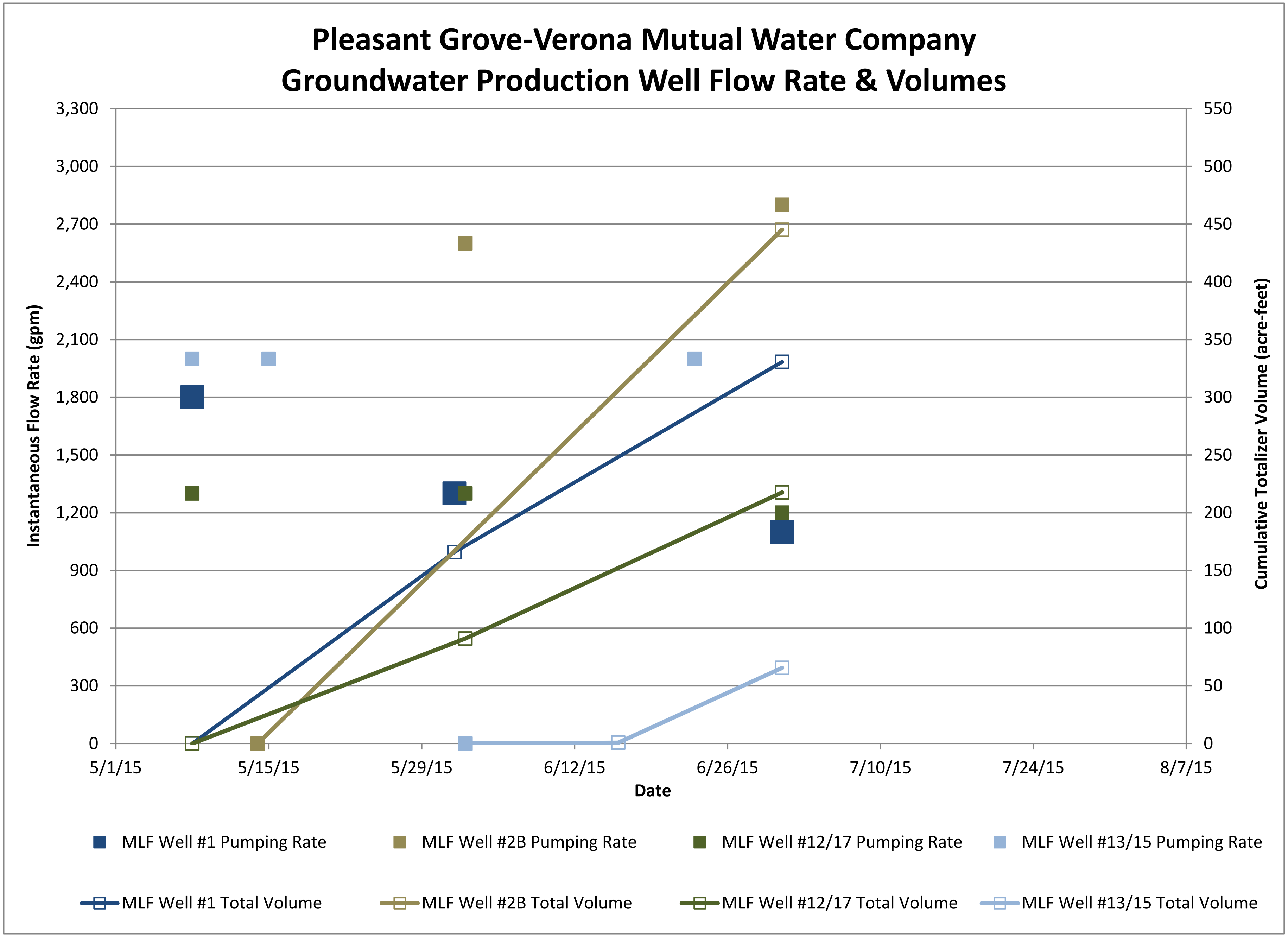
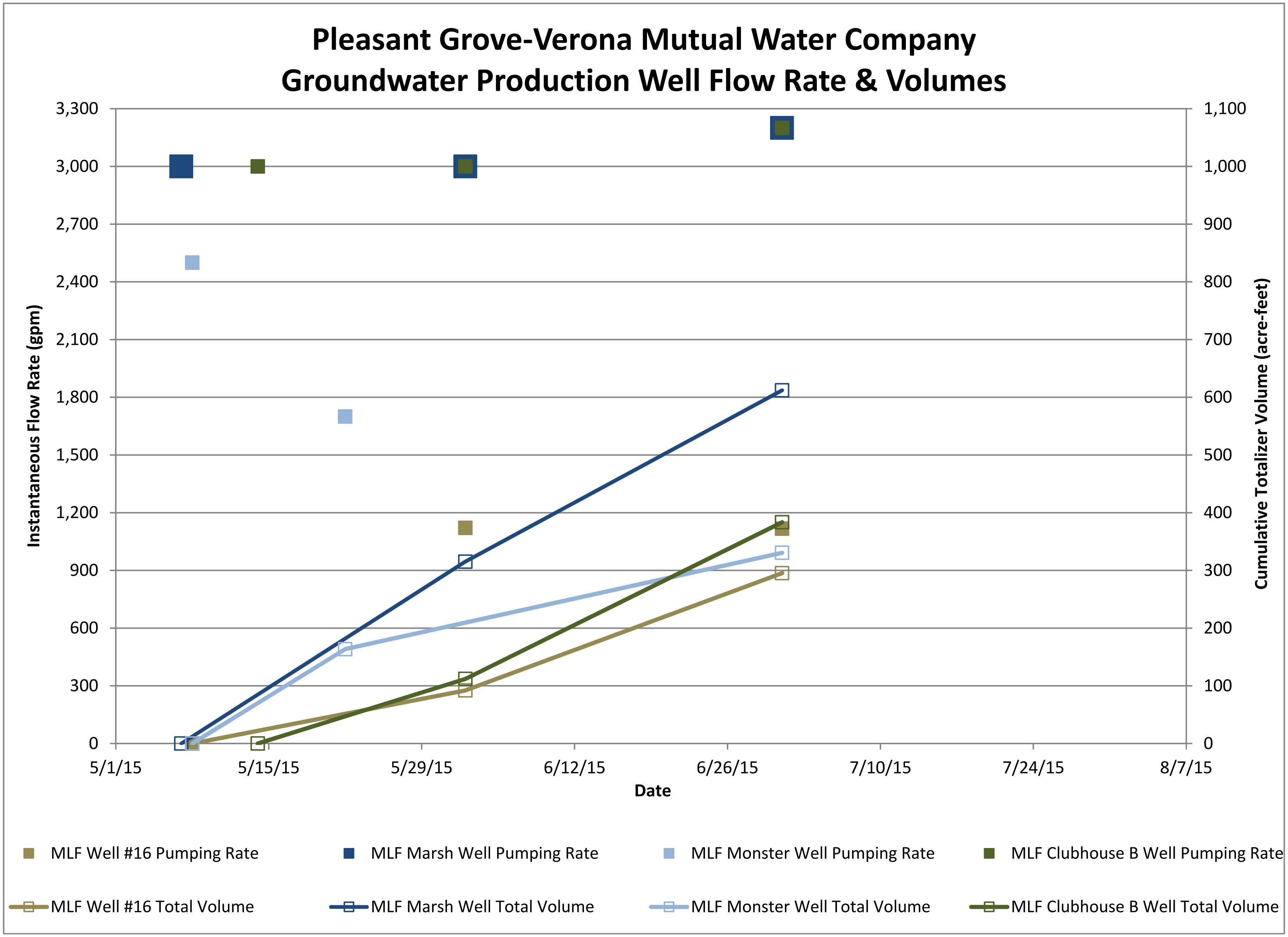
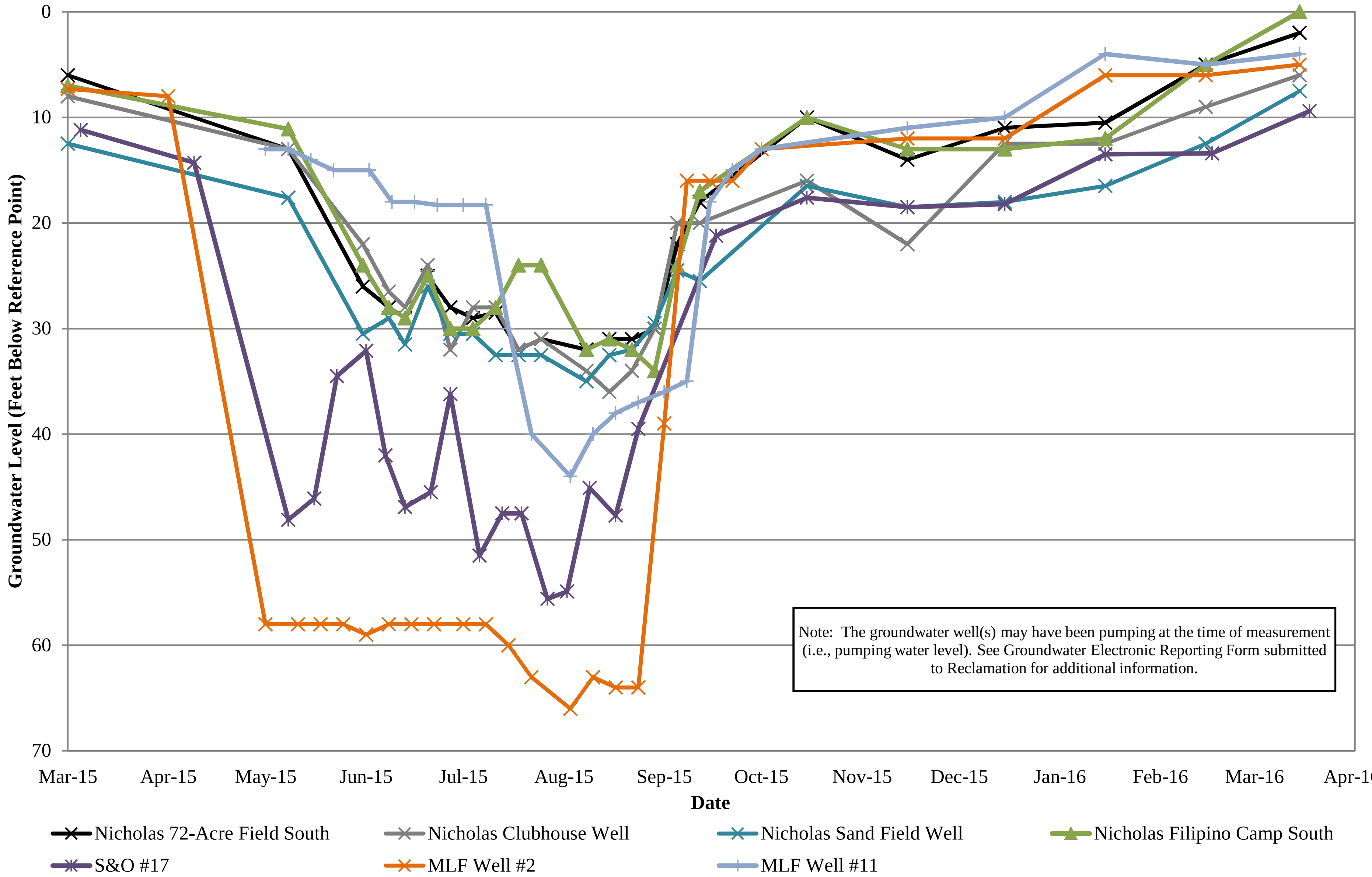
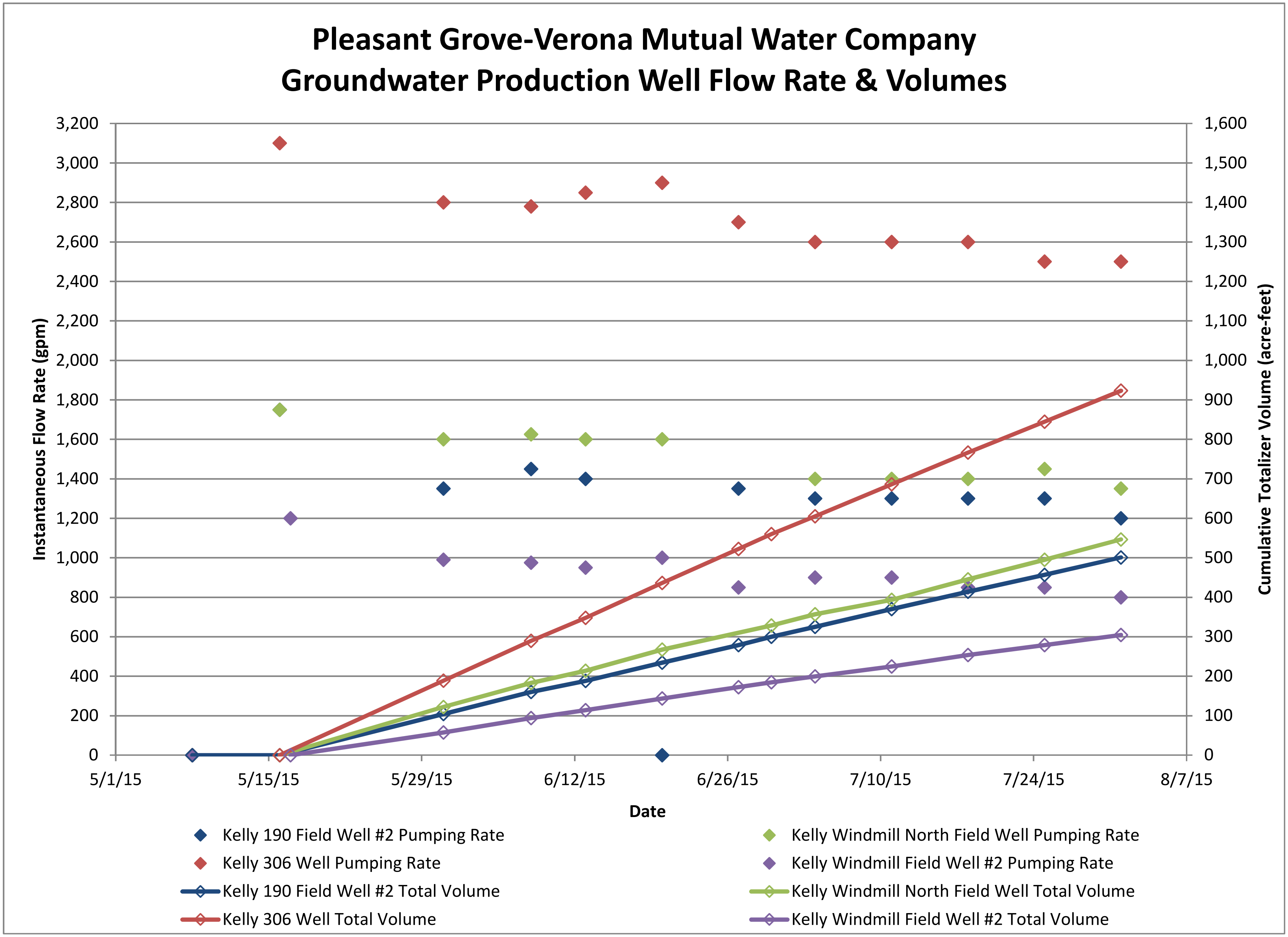

Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
3,300
3,000
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
0
550
500
450
400
350
300
250
200
150
100
50
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
MLF Well #1 Pumping Rate
MLF Well #2B Pumping Rate
MLF Well #12/17 Pumping Rate
MLF Well #13/15 Pumping Rate
MLF Well #1 Total Volume
MLF Well #2B Total Volume
MLF Well #12/17 Total Volume
MLF Well #13/15 Total Volume



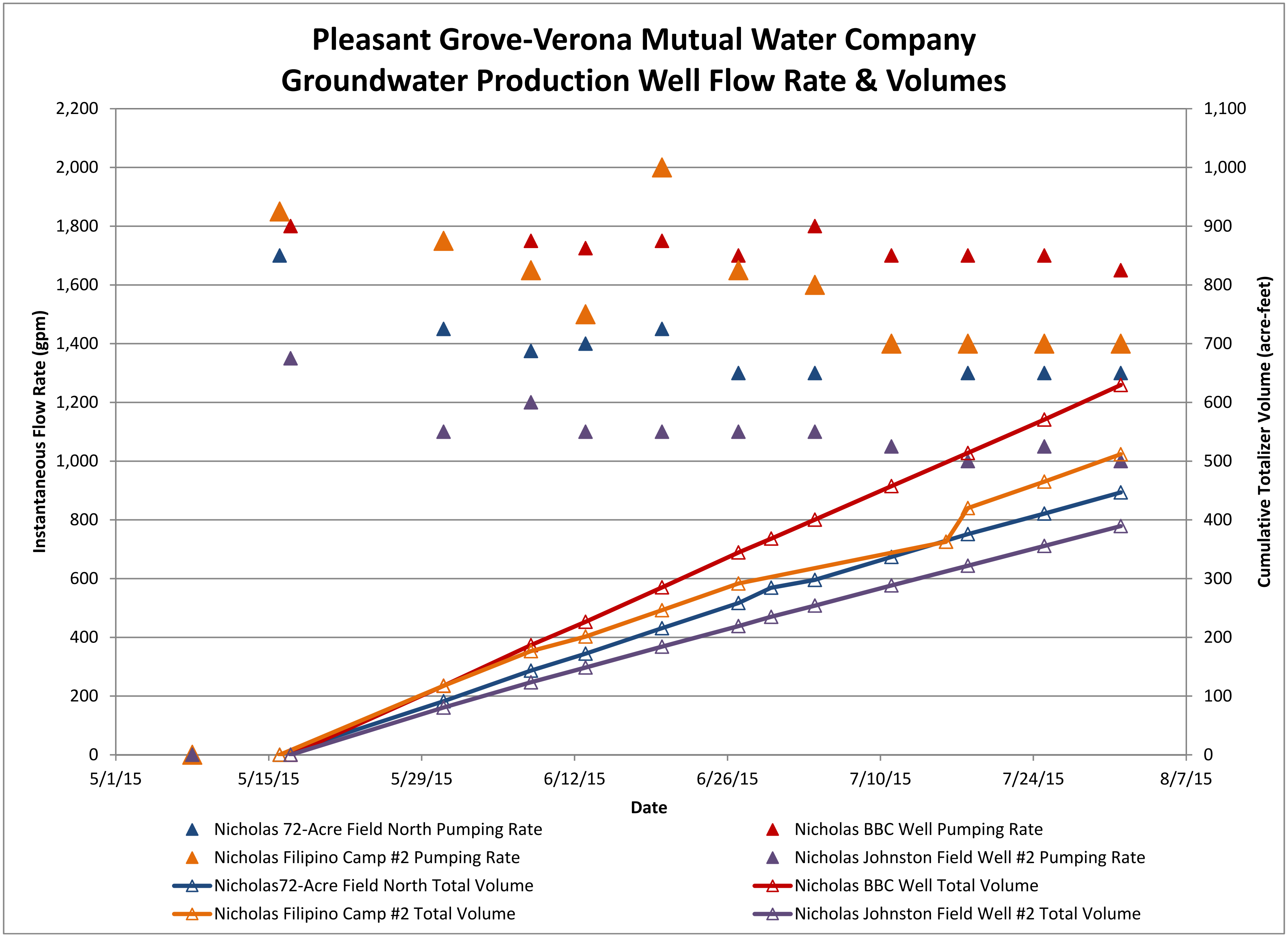
Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
3,300
3,000
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
0
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
MLF Well #16 Pumping Rate
MLF Marsh Well Pumping Rate
MLF Monster Well Pumping Rate
MLF Clubhouse B Well Pumping Rate
MLF Well #16 Total Volume
MLF Marsh Well Total Volume
MLF Monster Well Total Volume
MLF Clubhouse B Well Total Volume

# Pleasant Grove-Verona Mutual Water Company
# Monitoring Well Groundwater Level Data



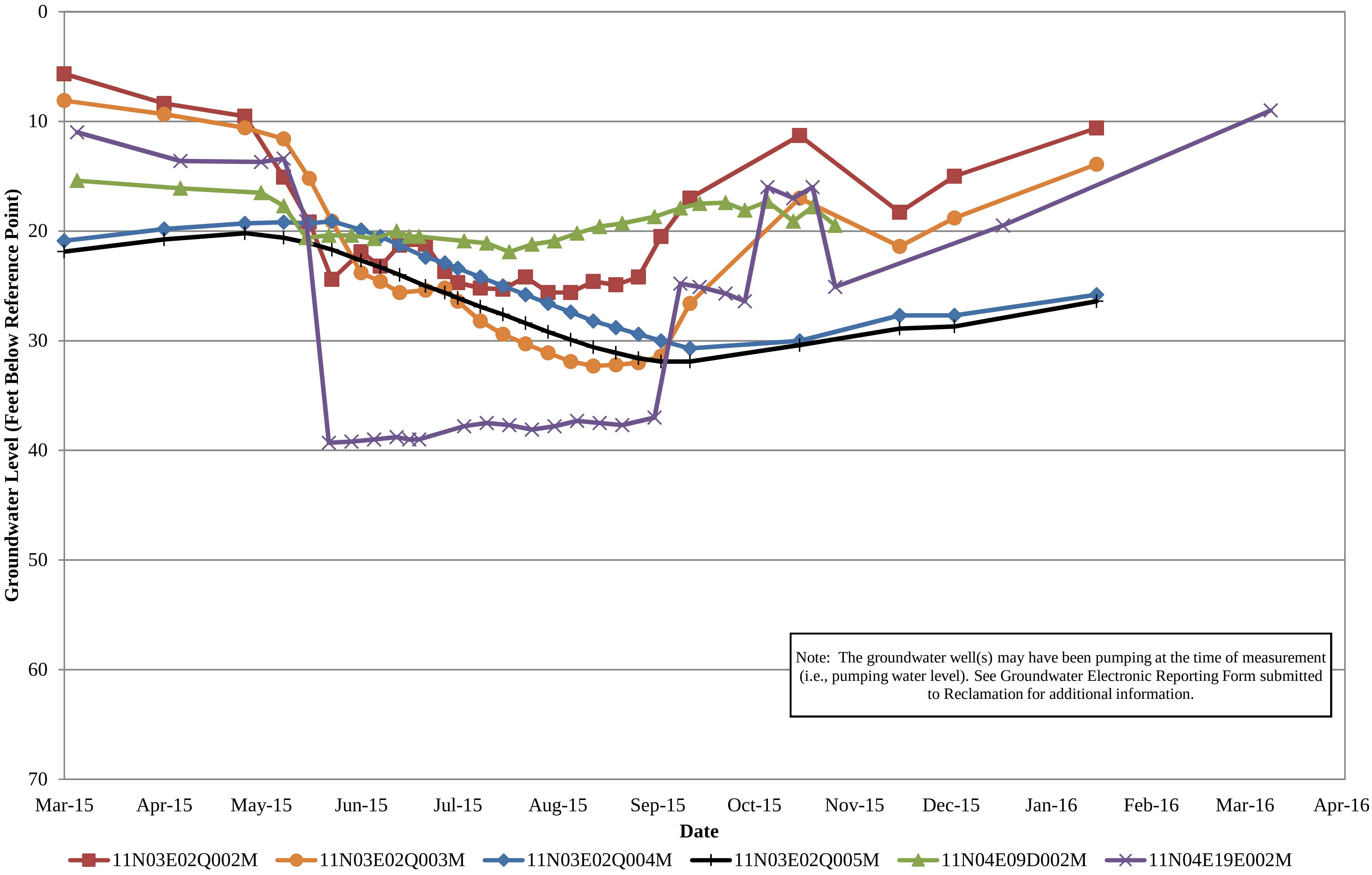


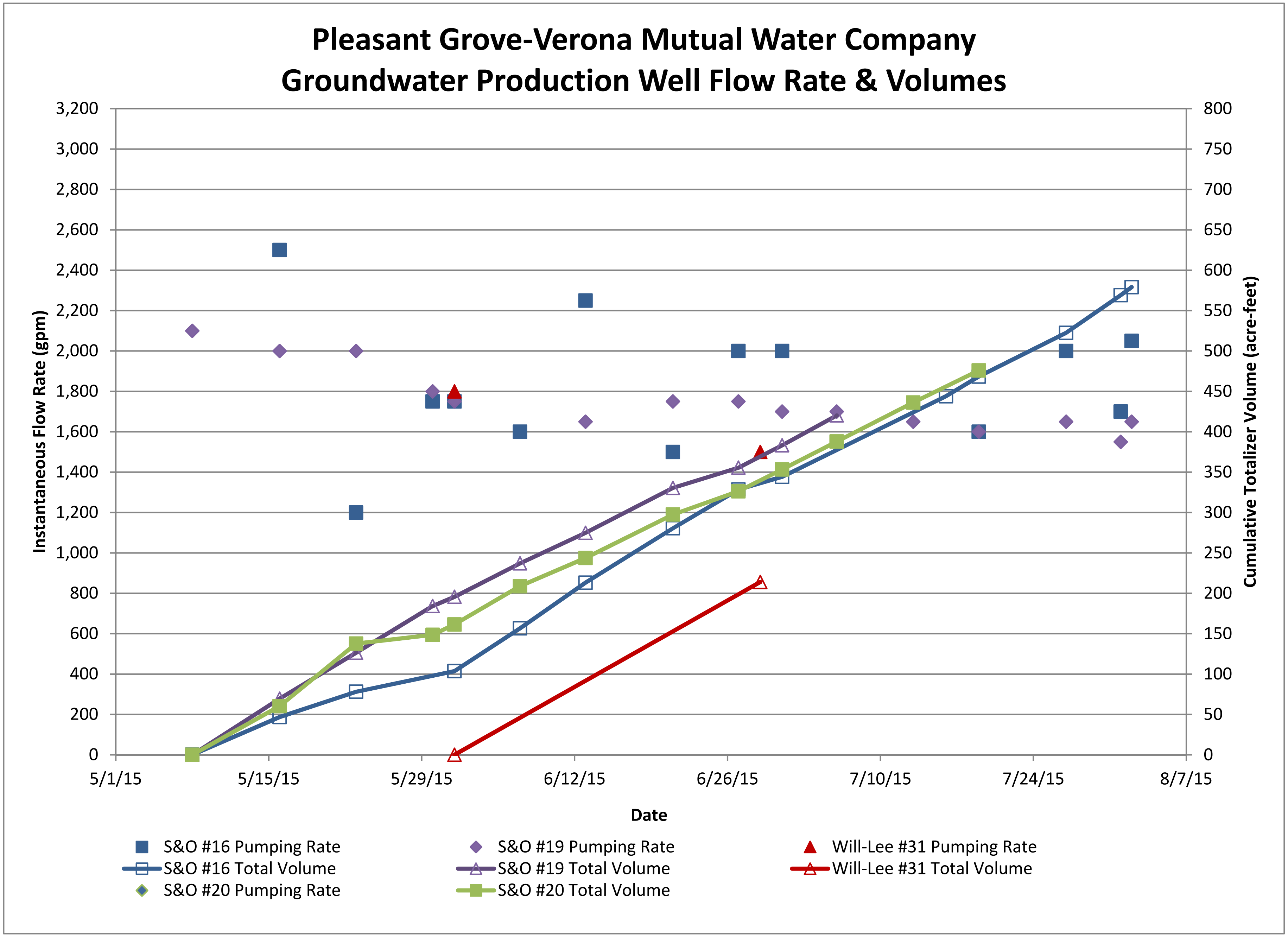
Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
Kelly 190 Field Well #2 Pumping Rate
Kelly 306 Well Pumping Rate
Kelly 190 Field Well #2 Total Volume
Kelly 306 Well Total Volume
Kelly Windmill North Field Well Pumping Rate
Kelly Windmill Field Well #2 Pumping Rate
Kelly Windmill North Field Well Total Volume
Kelly Windmill Field Well #2 Total Volume



Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
Nicholas 72-Acre Field North Pumping Rate
Nicholas BBC Well Pumping Rate
Nicholas Filipino Camp #2 Pumping Rate
Nicholas Johnston Field Well #2 Pumping Rate
Nicholas72-Acre Field North Total Volume
Nicholas BBC Well Total Volume
Nicholas Filipino Camp #2 Total Volume
Nicholas Johnston Field Well #2 Total Volume

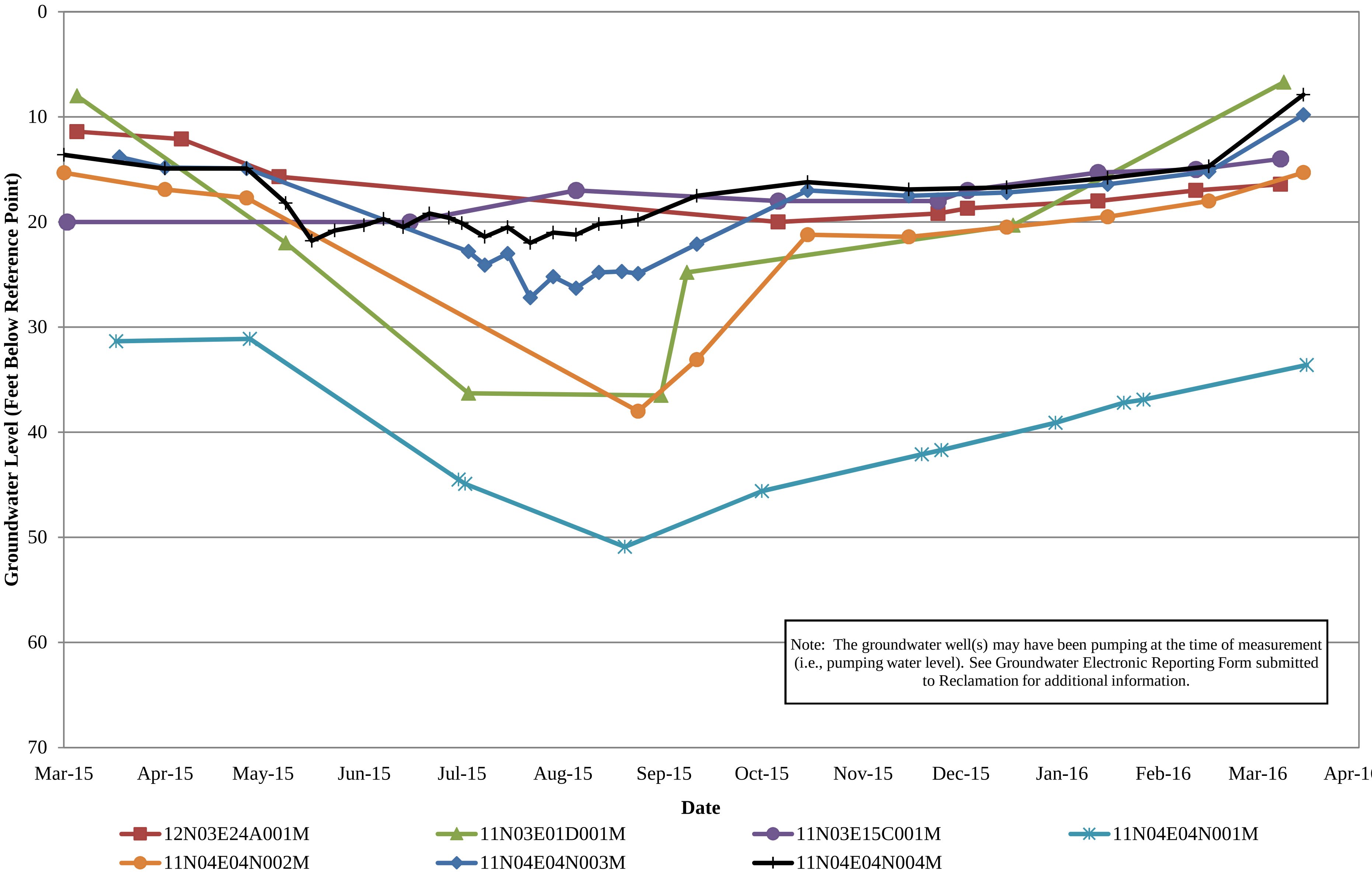
# Pleasant Grove-Verona Mutual Water Company
# DWR Monitoring Well Groundwater Level Data

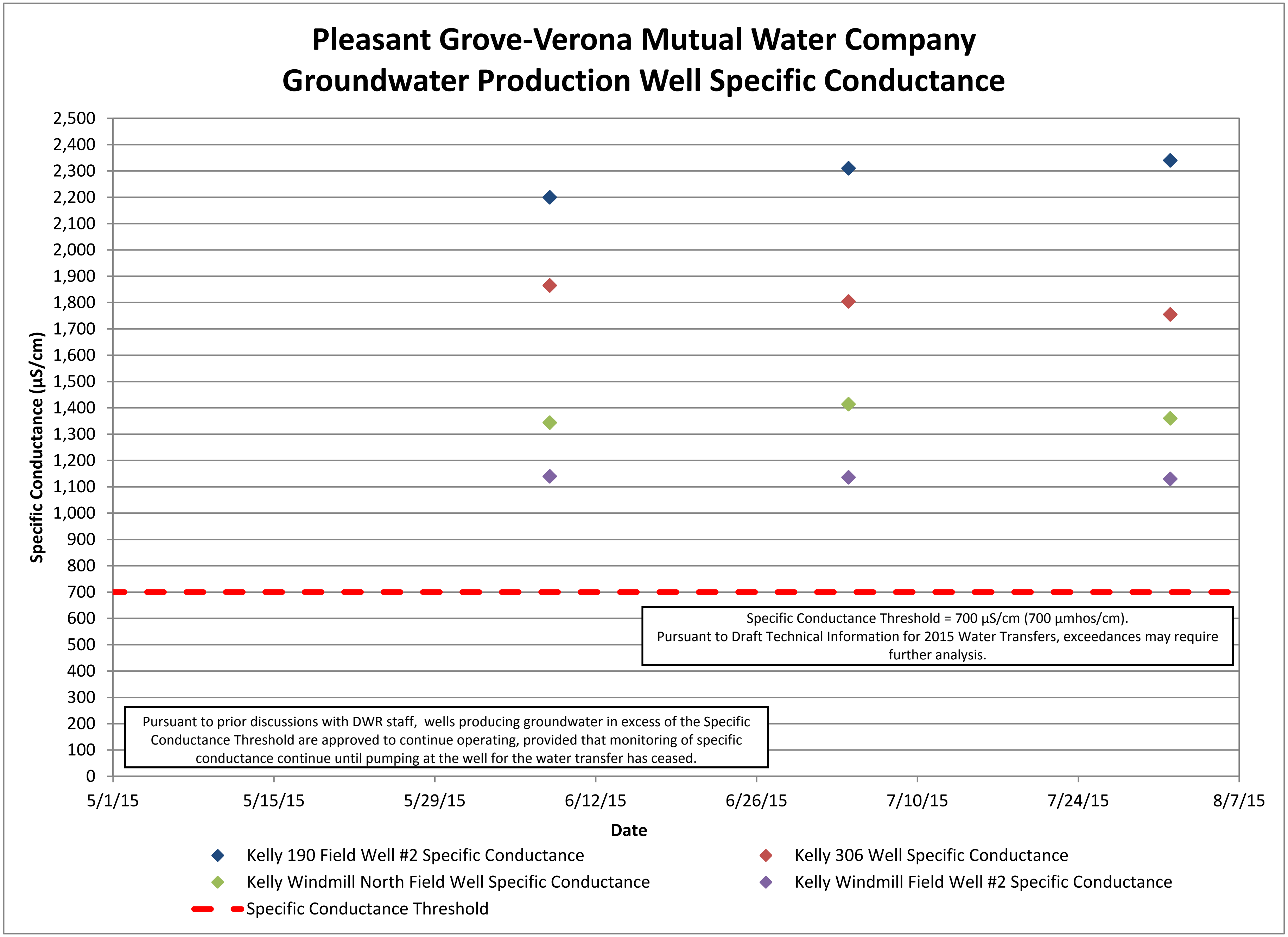




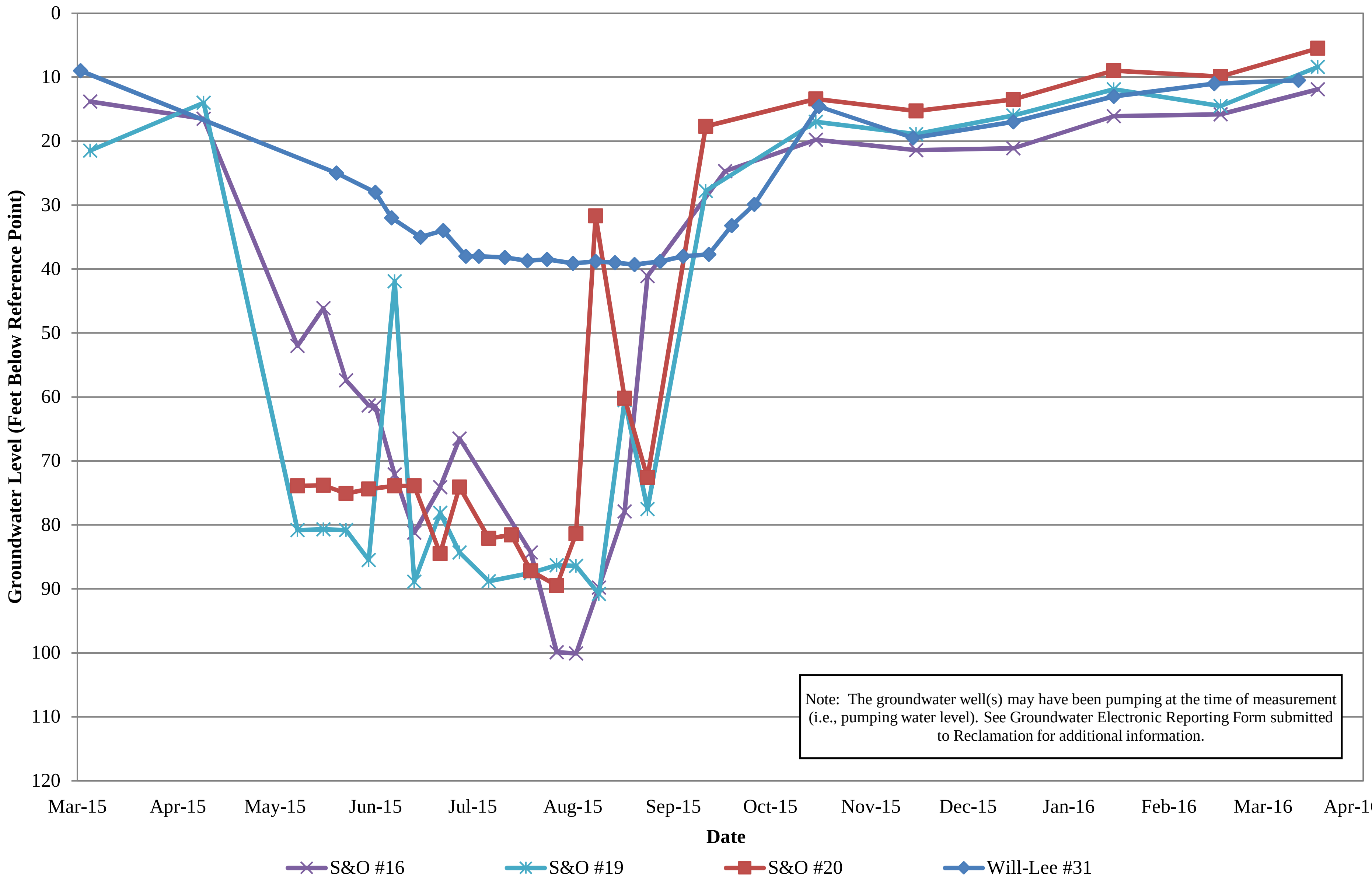
Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
S&O #16 Pumping Rate
S&O #16 Total Volume
S&O #20 Pumping Rate
S&O #19 Pumping Rate
S&O #19 Total Volume
S&O #20 Total Volume
Will-Lee #31 Pumping Rate
Will-Lee #31 Total Volume

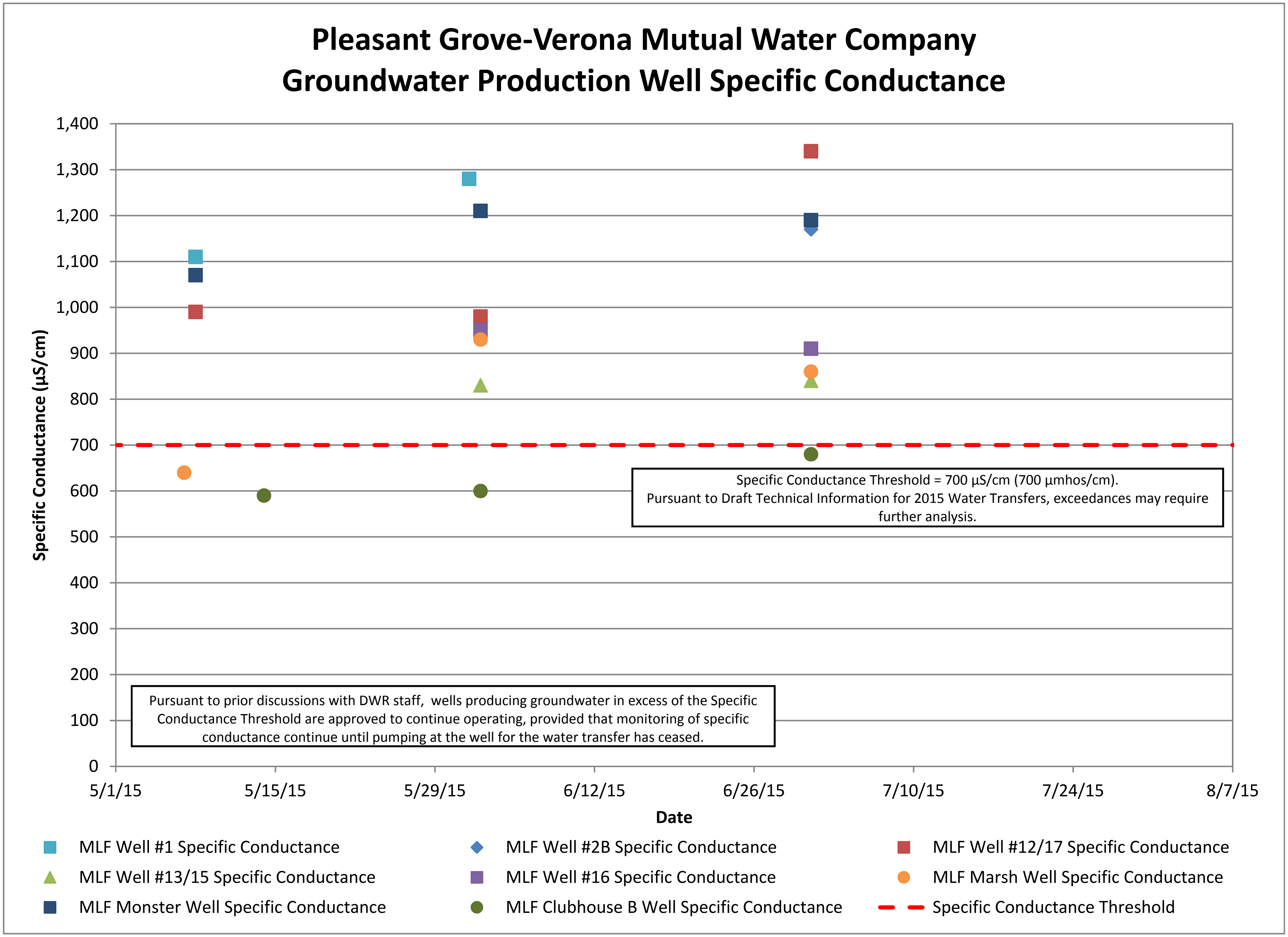
# Pleasant Grove-Verona Mutual Water Company
# DWR Monitoring Well Groundwater Level Data




Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
2,500
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Kelly 190 Field Well #2 Specific Conductance
Kelly 306 Well Specific Conductance
Kelly Windmill North Field Well Specific Conductance
Kelly Windmill Field Well #2 Specific Conductance
Specific Conductance Threshold

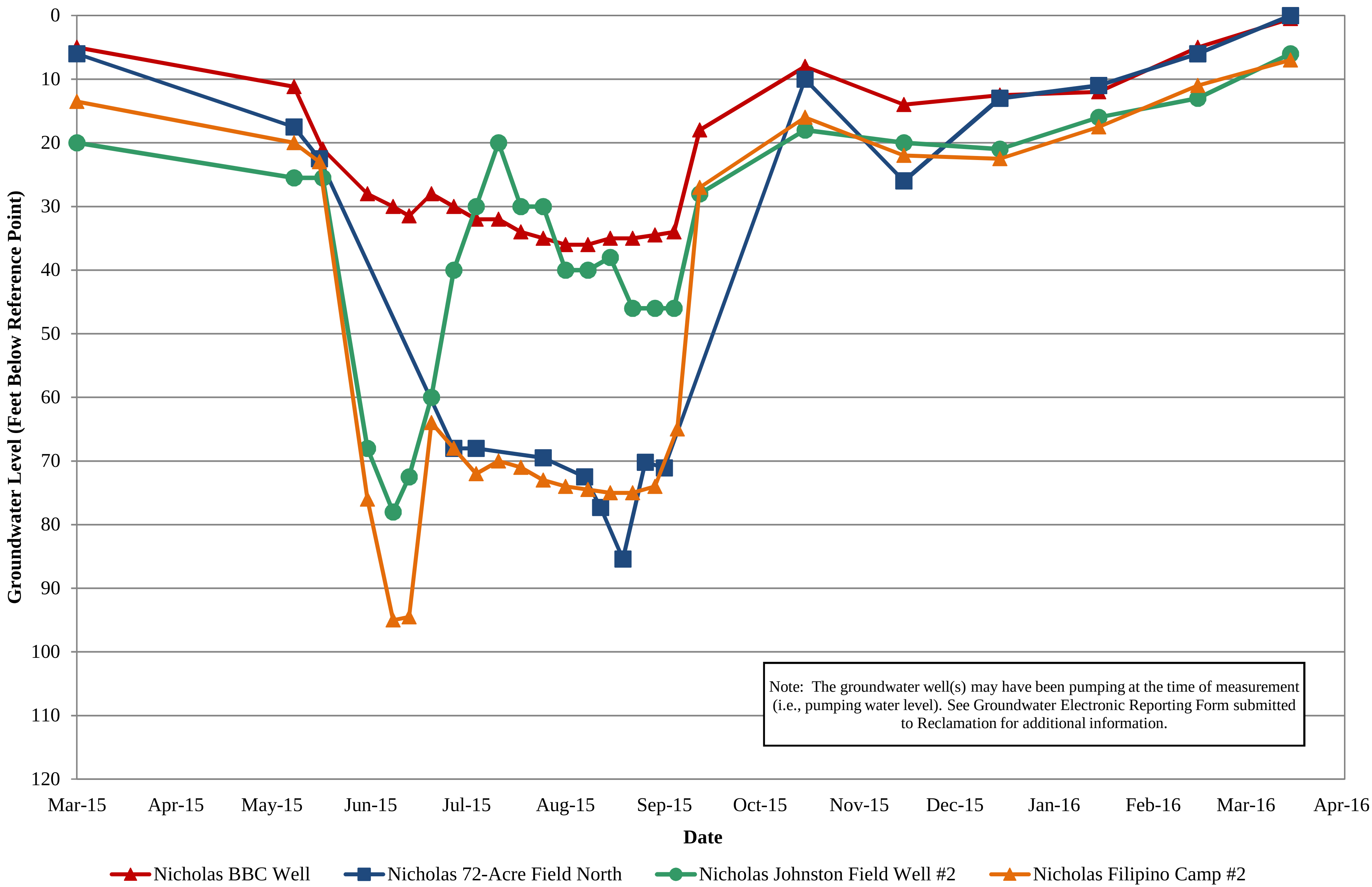
# Pleasant Grove-Verona Mutual Water Company
# Production Well Groundwater Level Data

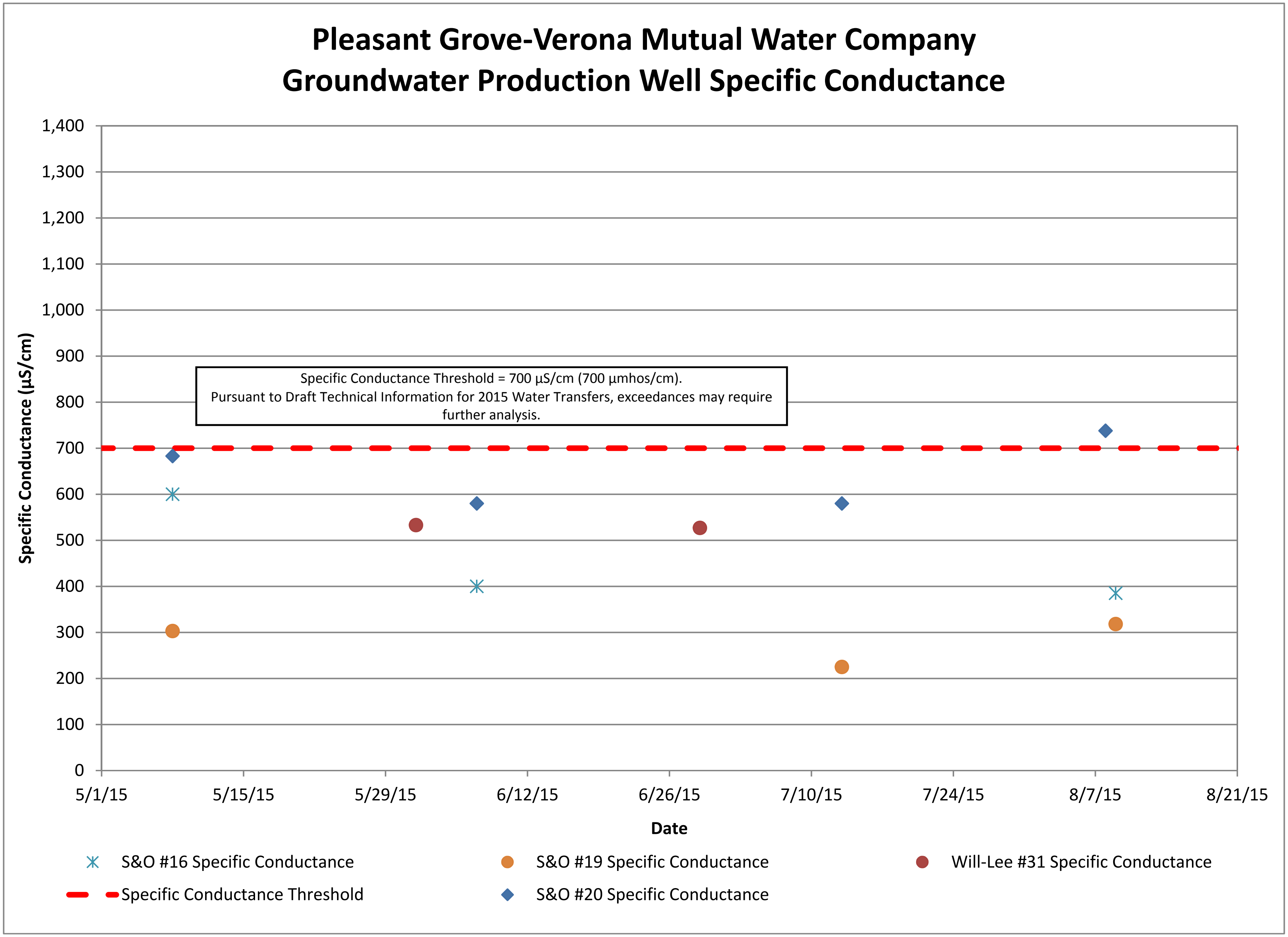




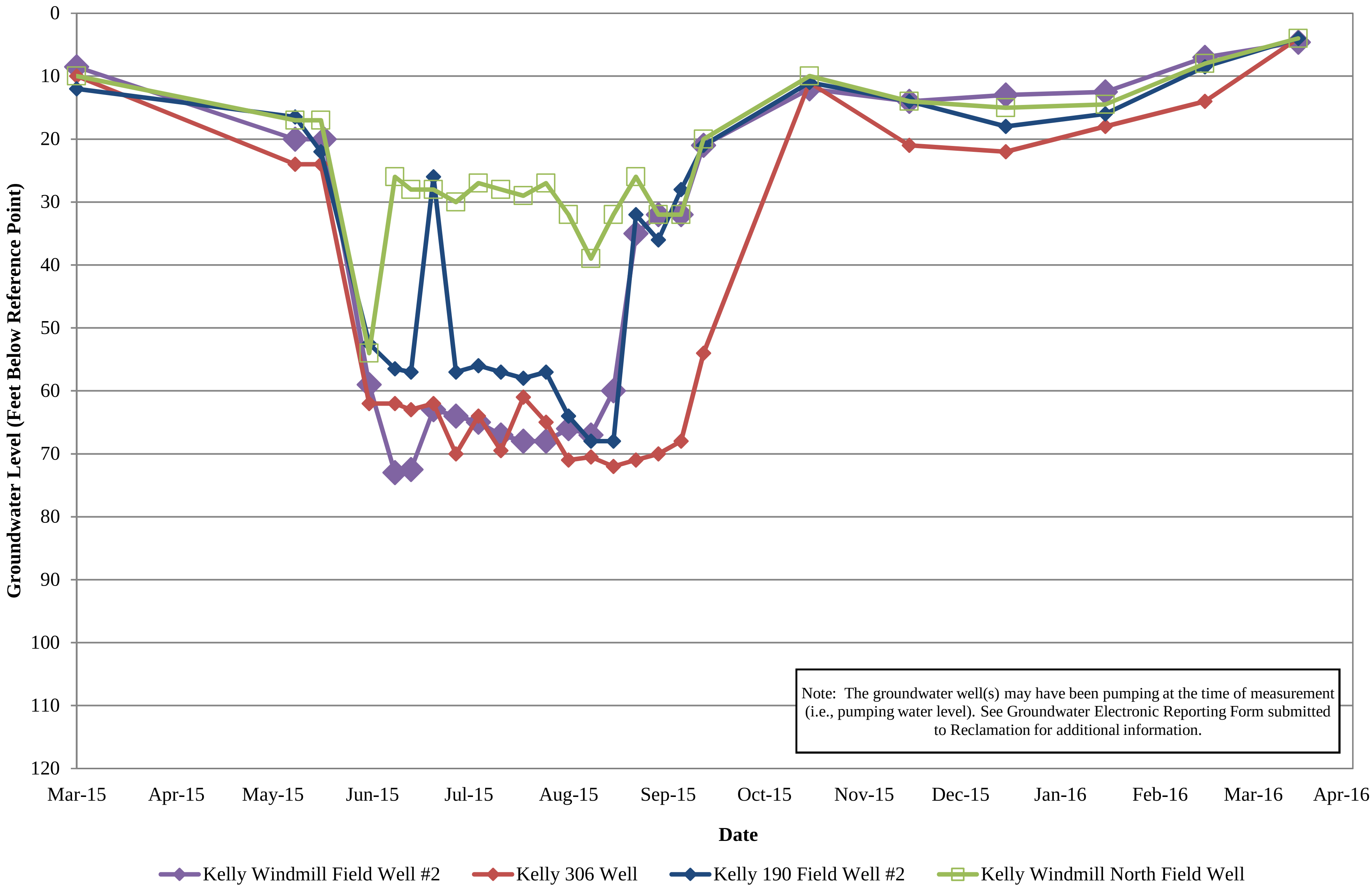
Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
MLF Well #1 Specific Conductance
MLF Well #2B Specific Conductance
MLF Well #12/17 Specific Conductance
MLF Well #13/15 Specific Conductance
MLF Well #16 Specific Conductance
MLF Marsh Well Specific Conductance
MLF Monster Well Specific Conductance
MLF Clubhouse B Well Specific Conductance
Specific Conductance Threshold

# Pleasant Grove-Verona Mutual Water Company
# Production Well Groundwater Level Data

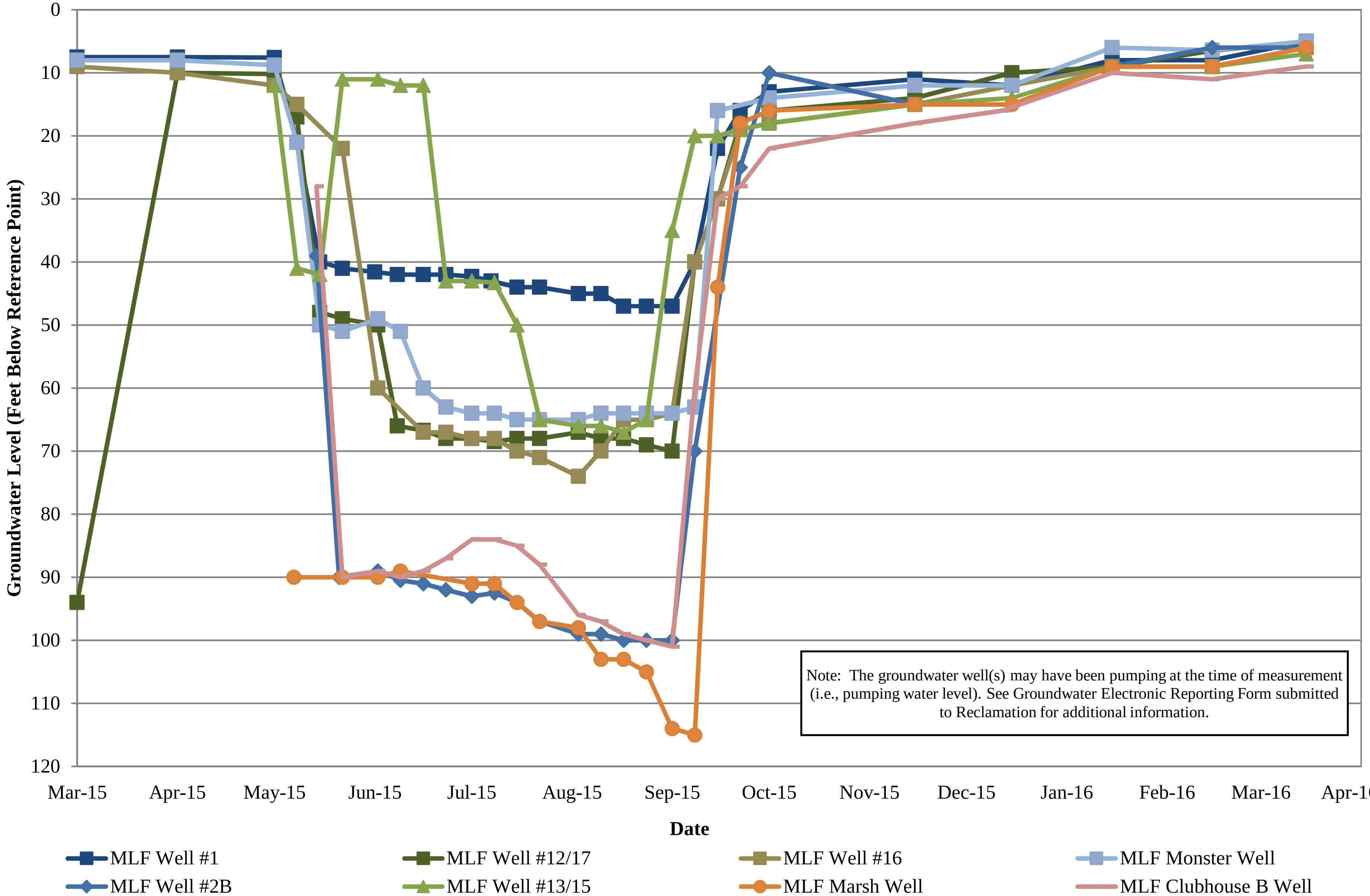


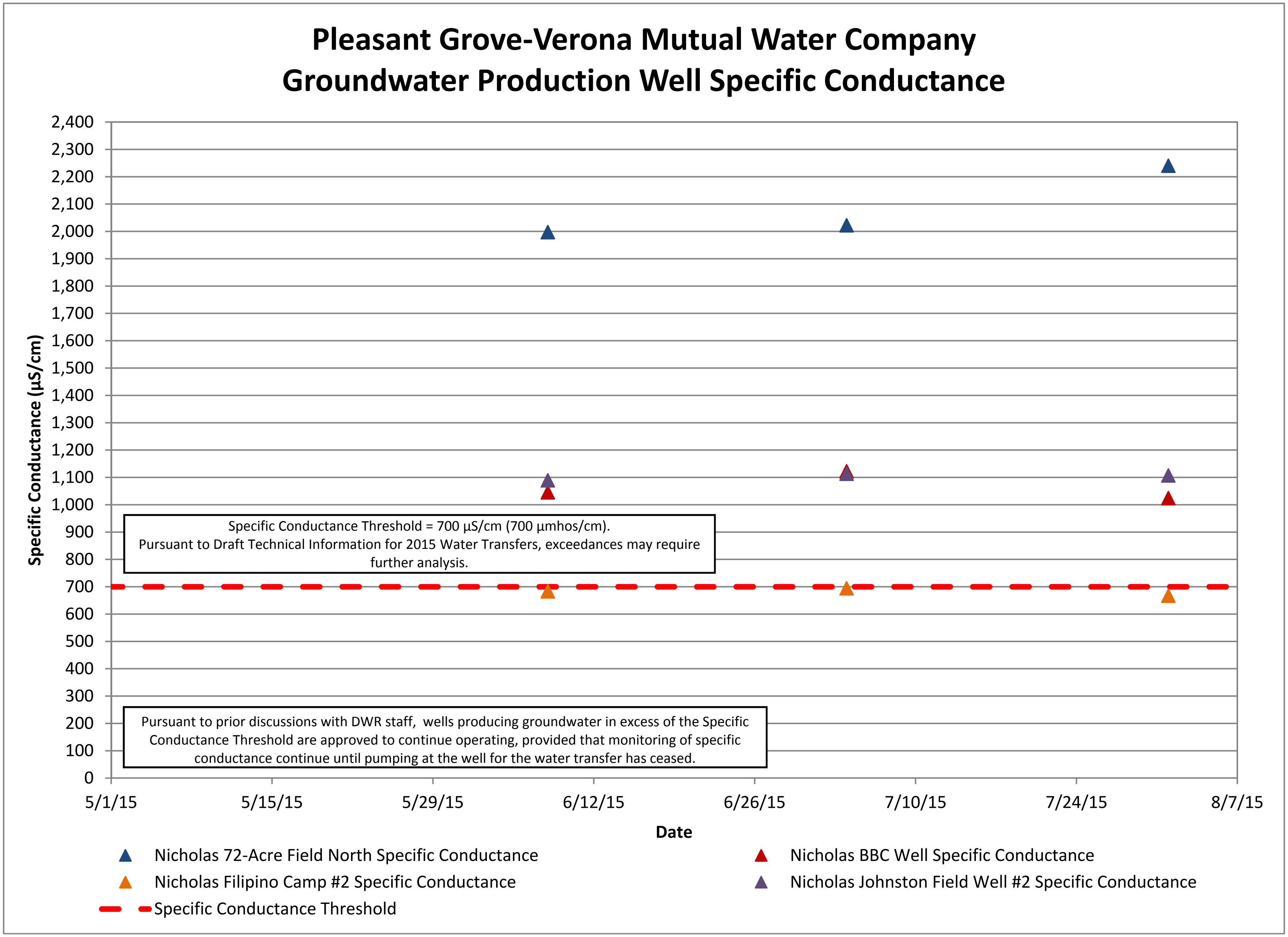

Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Specific Conductance (µS/cm)
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
8/21/15
Date
S&O #16 Specific Conductance
S&O #19 Specific Conductance
Will-Lee #31 Specific Conductance
Specific Conductance Threshold
S&O #20 Specific Conductance

# Pleasant Grove-Verona Mutual Water Company
# Production Well Groundwater Level Data



# Pleasant Grove-Verona Mutual Water Company
# Production Well Groundwater Level Data




Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
Nicholas 72-Acre Field North Specific Conductance
Nicholas BBC Well Specific Conductance
Nicholas Filipino Camp #2 Specific Conductance
Nicholas Johnston Field Well #2 Specific Conductance
Specific Conductance Threshold

# Princeton-Codora-Glenn Irrigation District

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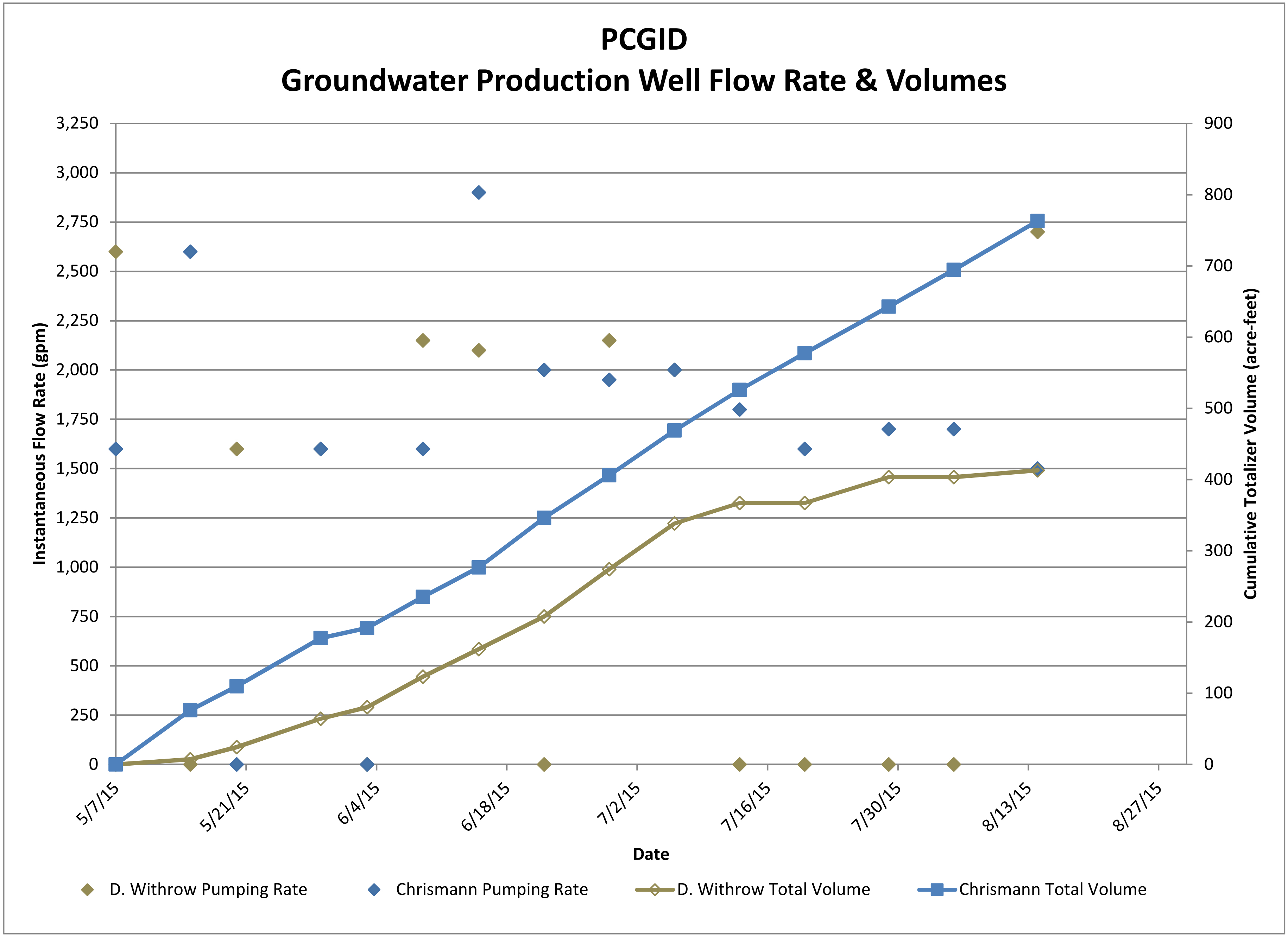
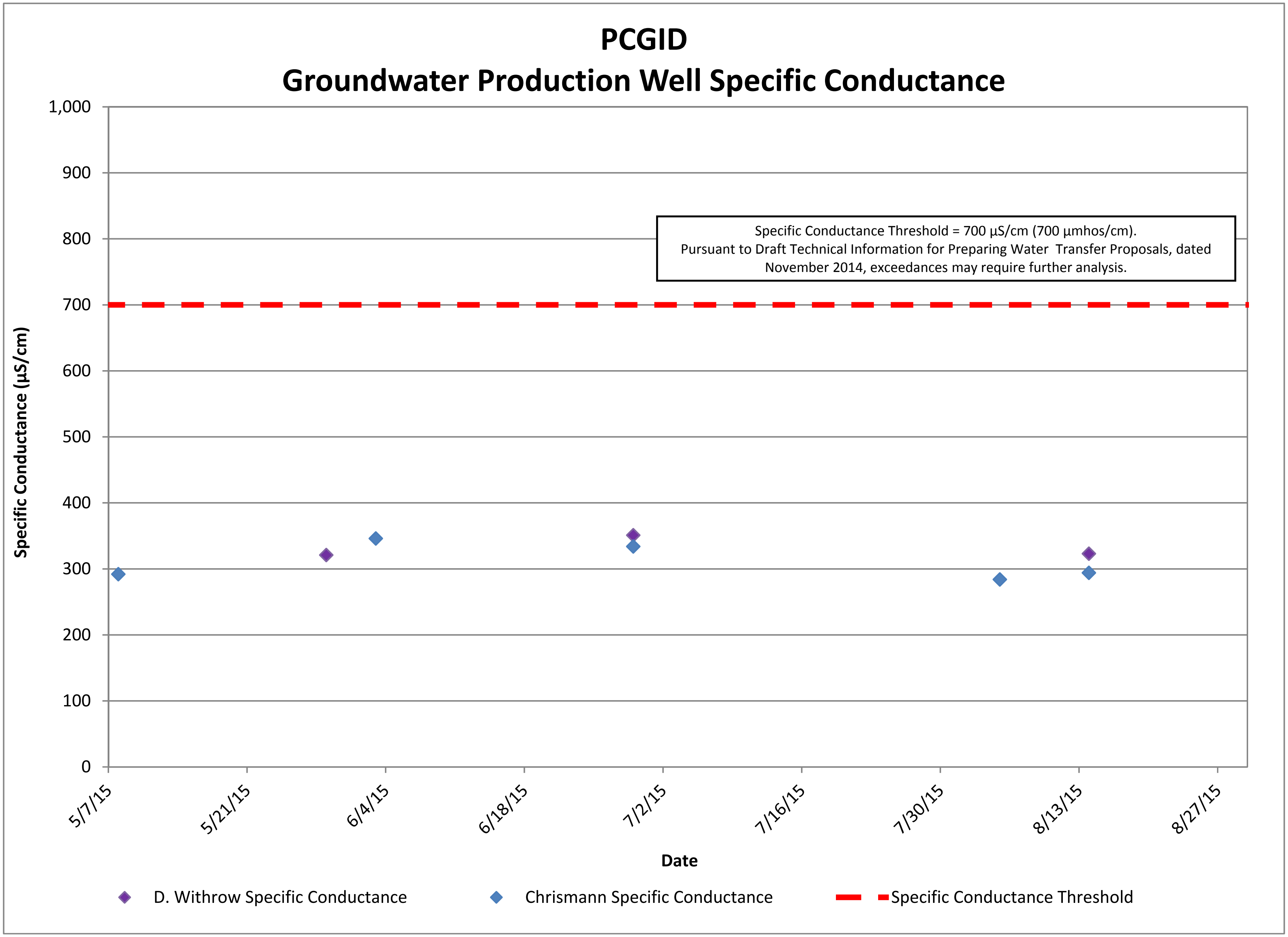
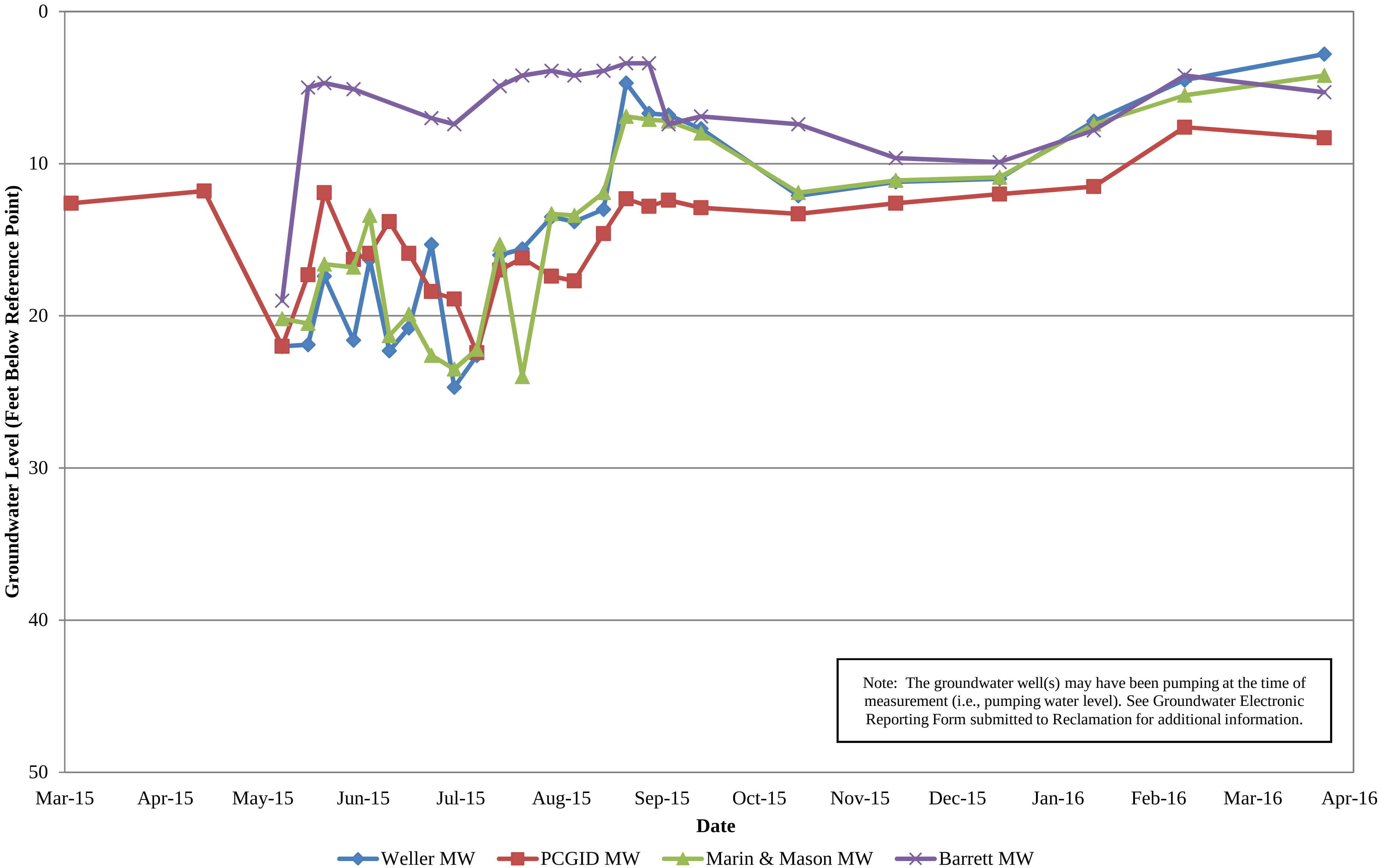


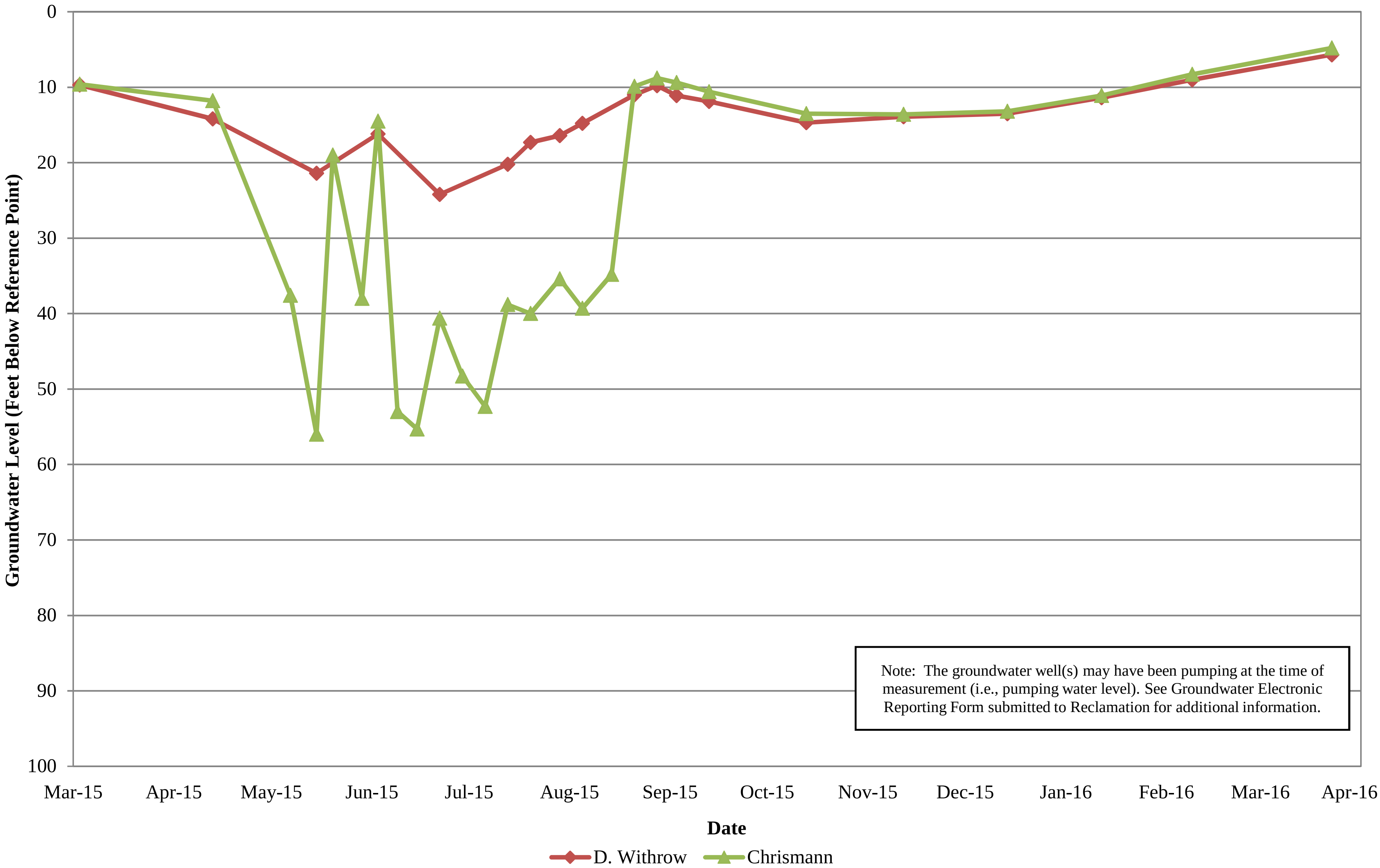
PCGID
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
3,250
3,000
2,750
2,500
2,250
2,000
1,750
1,500
1,250
1,000
750
500
250
0
900
800
700
600
500
400
300
200
100
0
5/7/15
5/21/15
6/4/15
6/18/15
7/2/15
7/16/15
7/30/15
8/13/15
8/27/15
Date
D. Withrow Pumping Rate
Chrismann Pumping Rate
D. Withrow Total Volume
Chrismann Total Volume

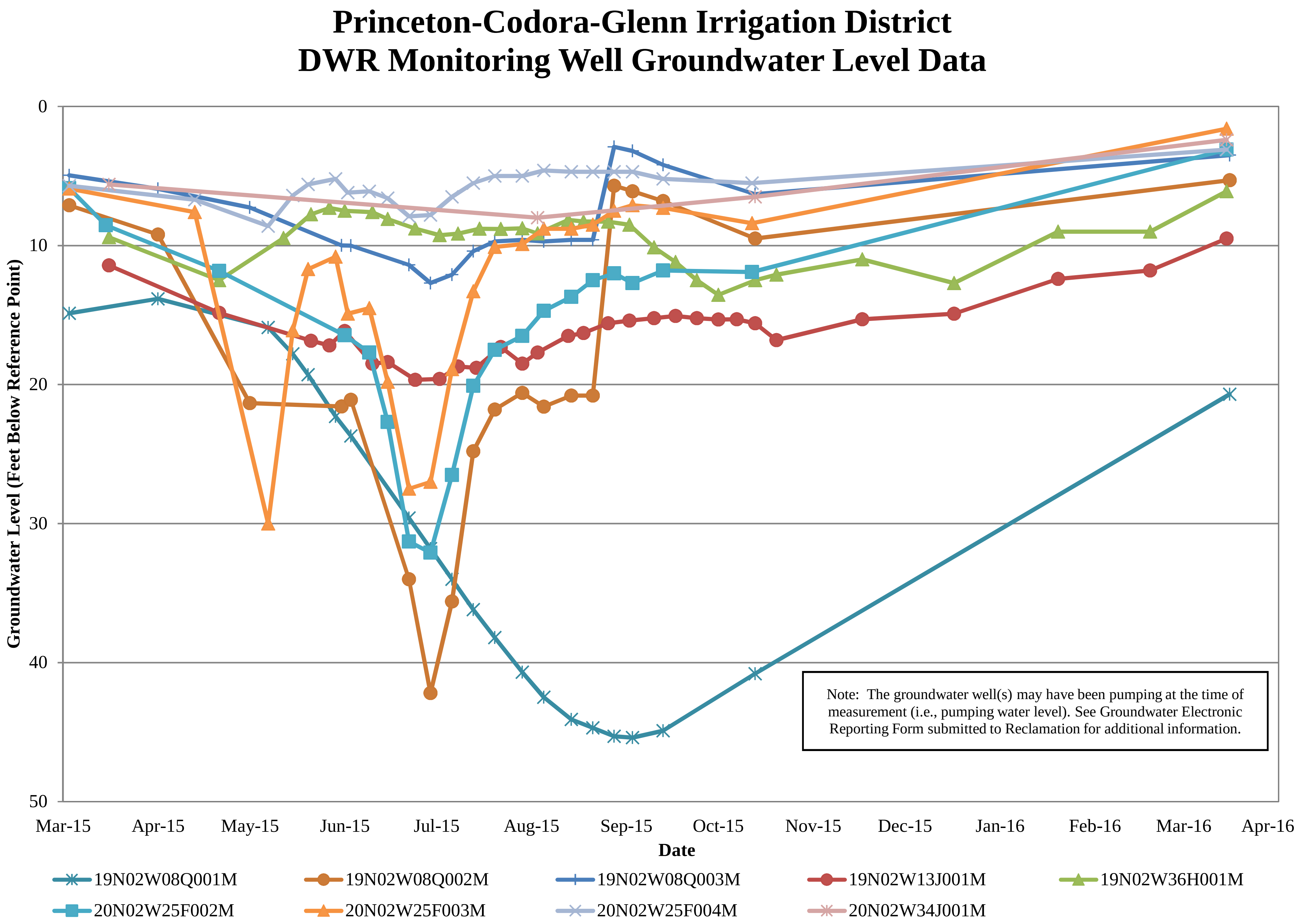

PCGID
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
Specific Conductance (µS/cm)
1,000
900
800
700
600
500
400
300
200
100
0
5/7/15
5/21/15
6/4/15
6/18/15
7/2/15
7/16/15
7/30/15
8/13/15
8/27/15
Date
D. Withrow Specific Conductance
Chrismann Specific Conductance
Specific Conductance Threshold

# Princeton-Codora-Glenn Irrigation District
# Monitoring Well Groundwater Level Data



# Princeton-Codora-Glenn Irrigation District
# Production Well Groundwater Level Data





Princeton-Codora-Glenn Irrigation District
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
10
20
30
40
50
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
19N02W08Q001M
19N02W08Q002M
19N02W08Q003M
19N02W13J001M
19N02W36H001M
20N02W25F002M
20N02W25F003M
20N02W25F004M
20N02W34J001M

# Provident Irrigation District

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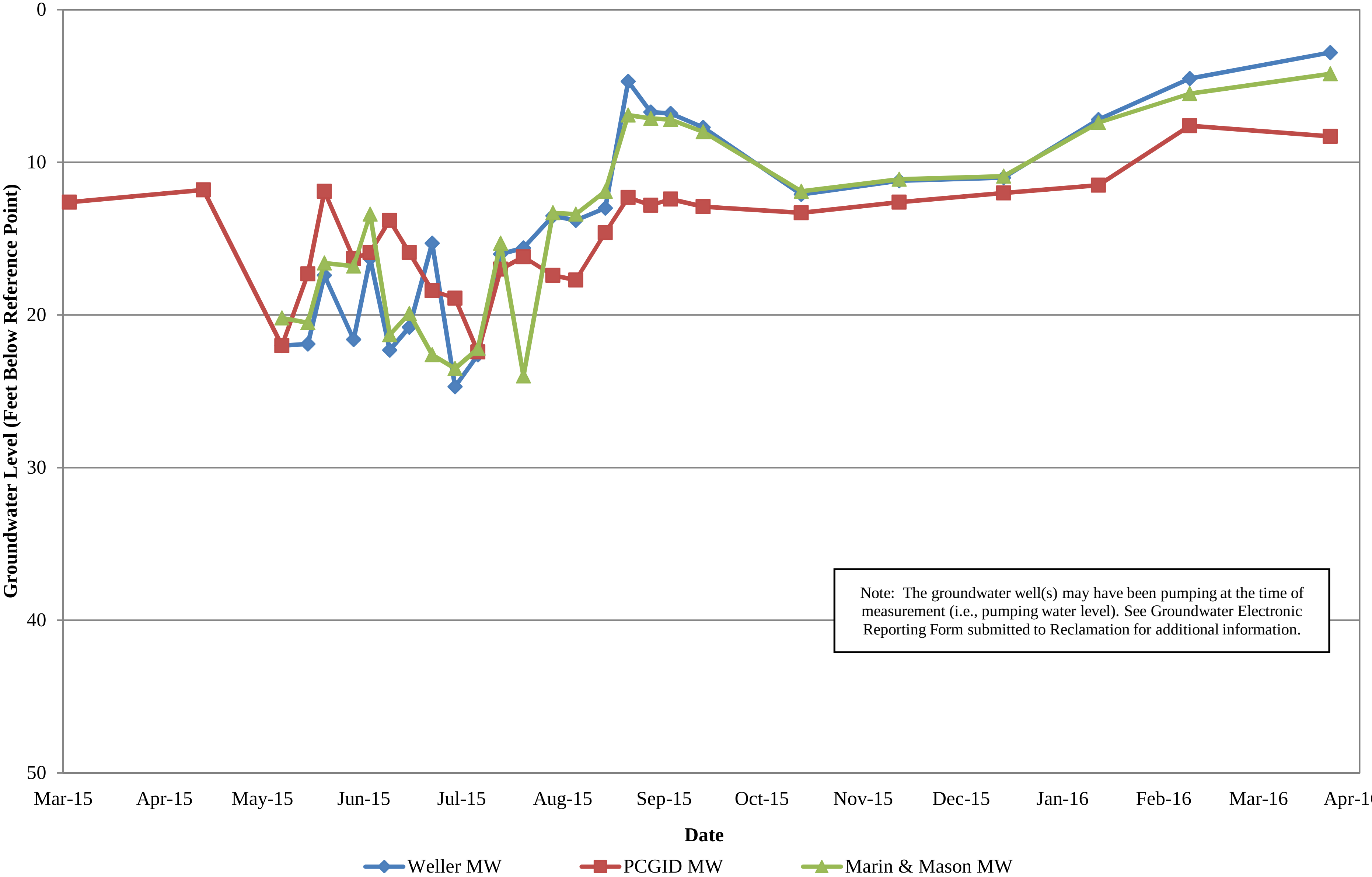
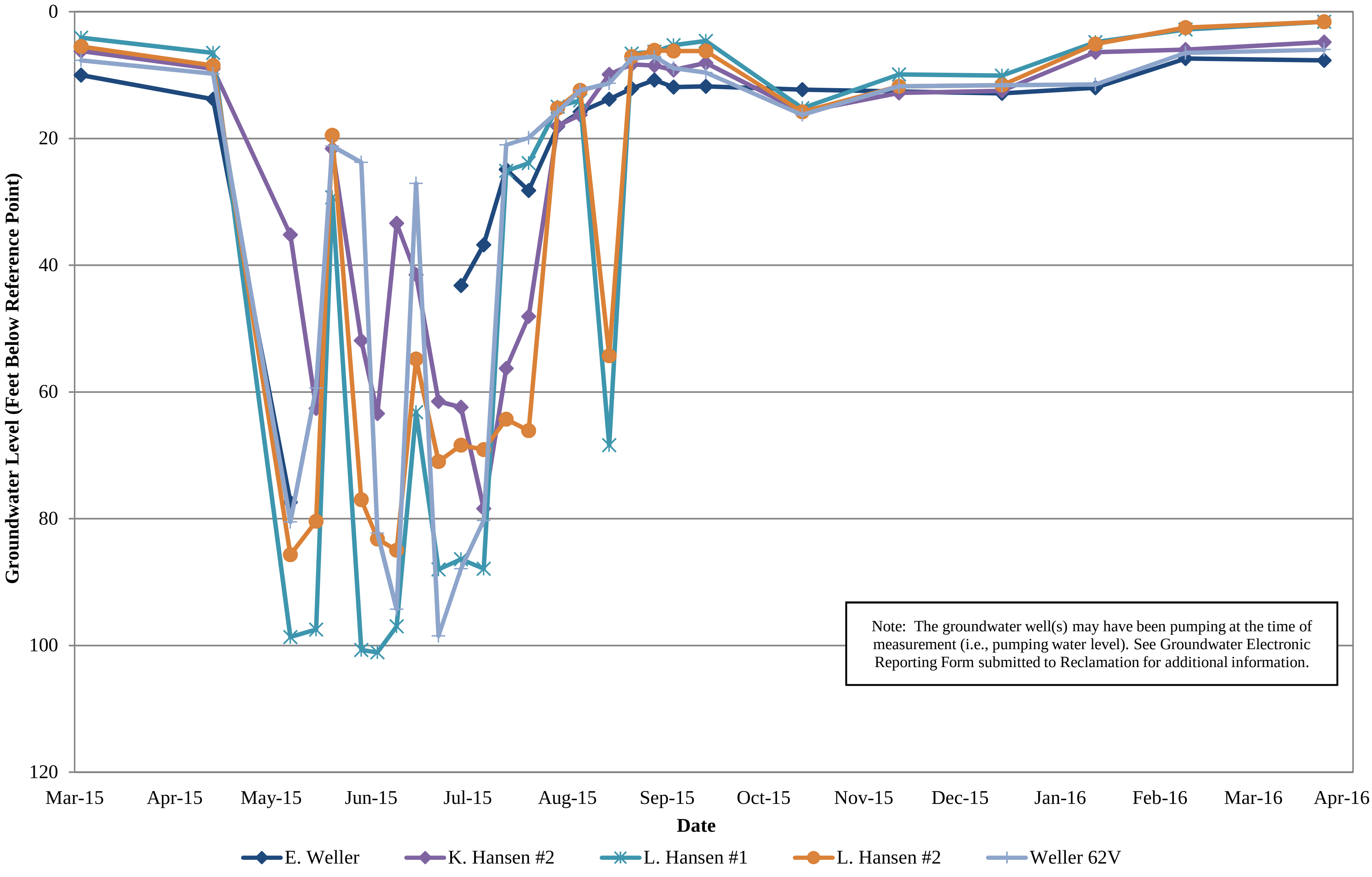
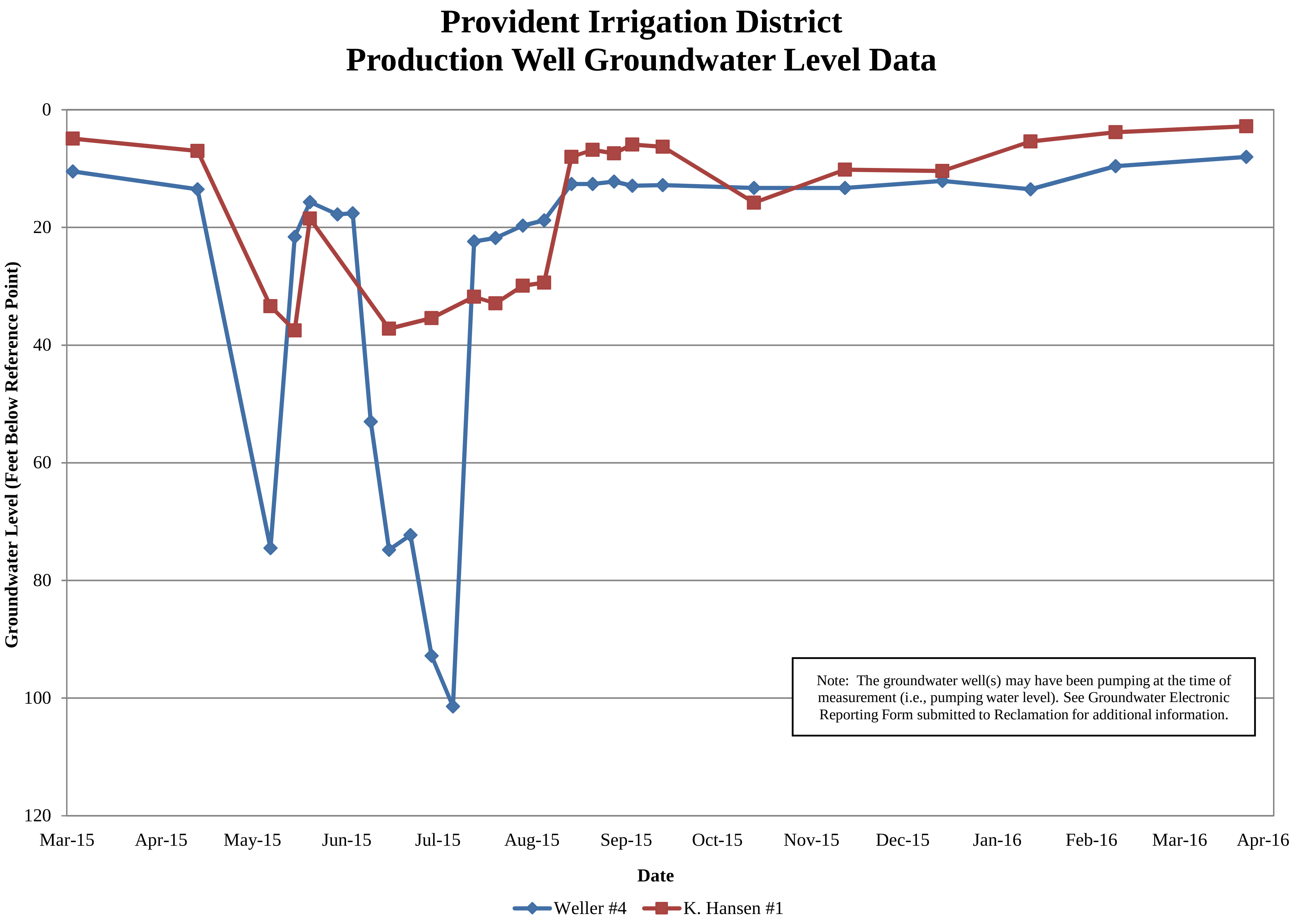
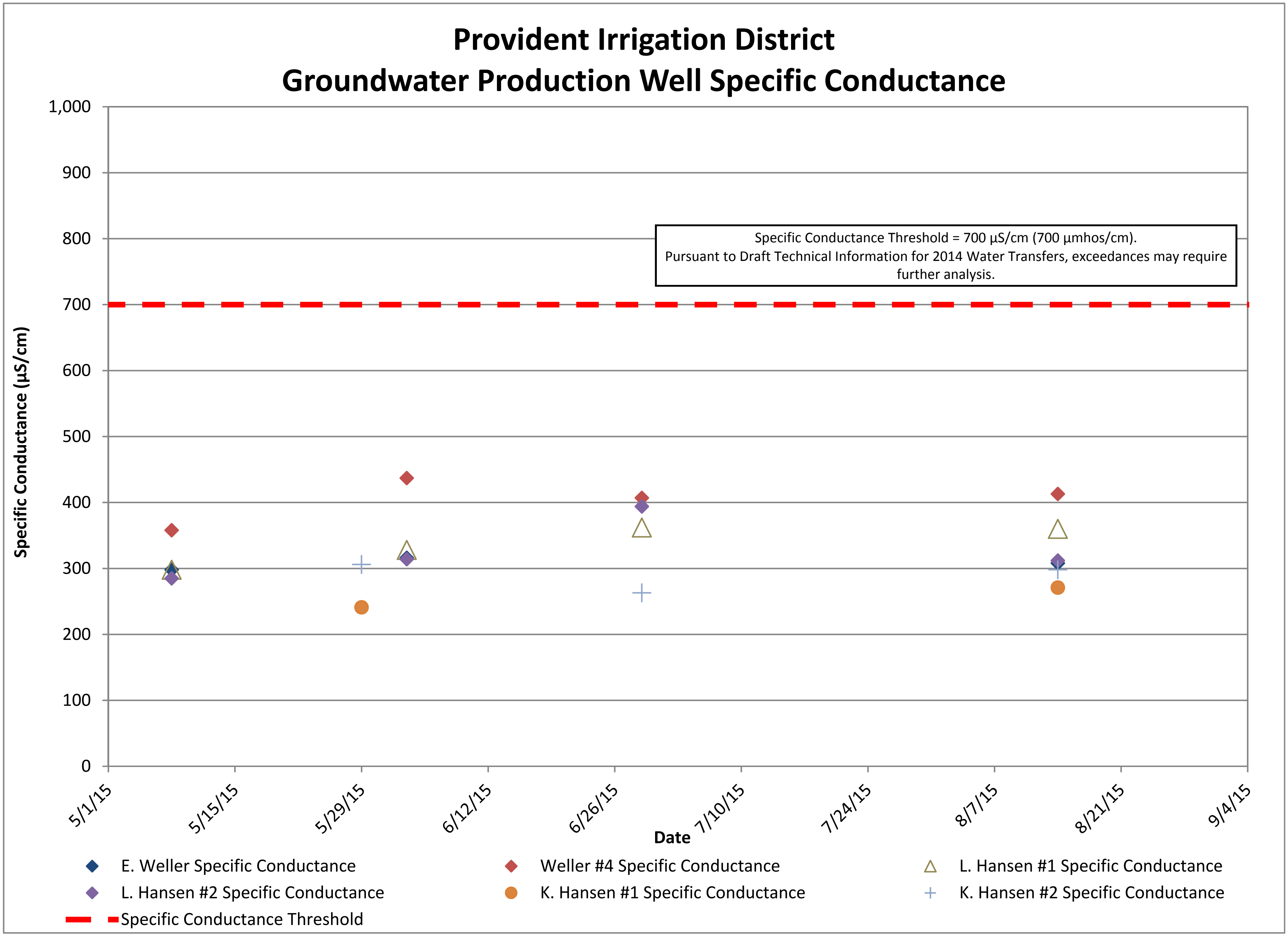
# Provident Irrigation District
# Monitoring Well Groundwater Level Data



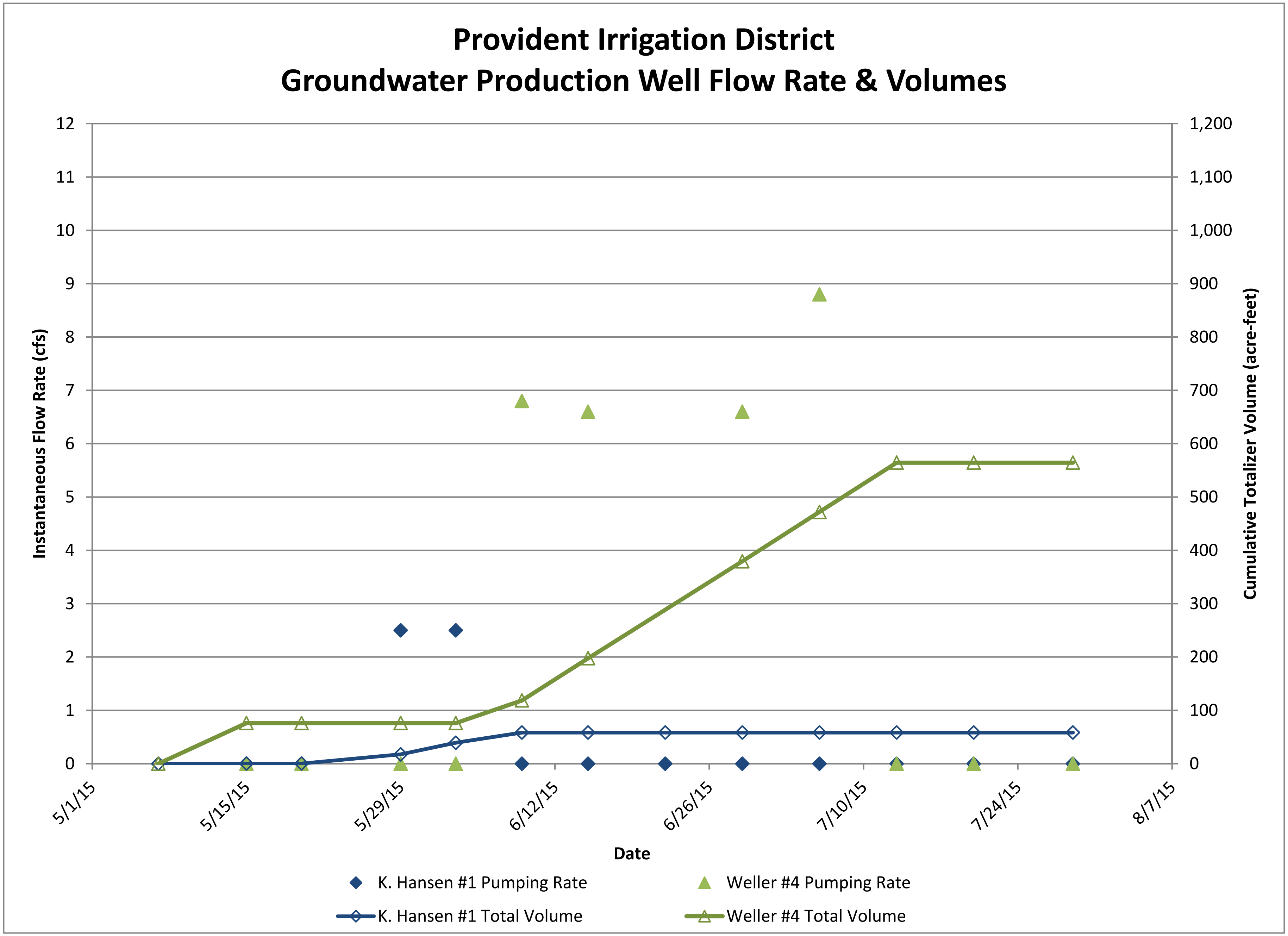
# Provident Irrigation District
# Production Well Groundwater Level Data

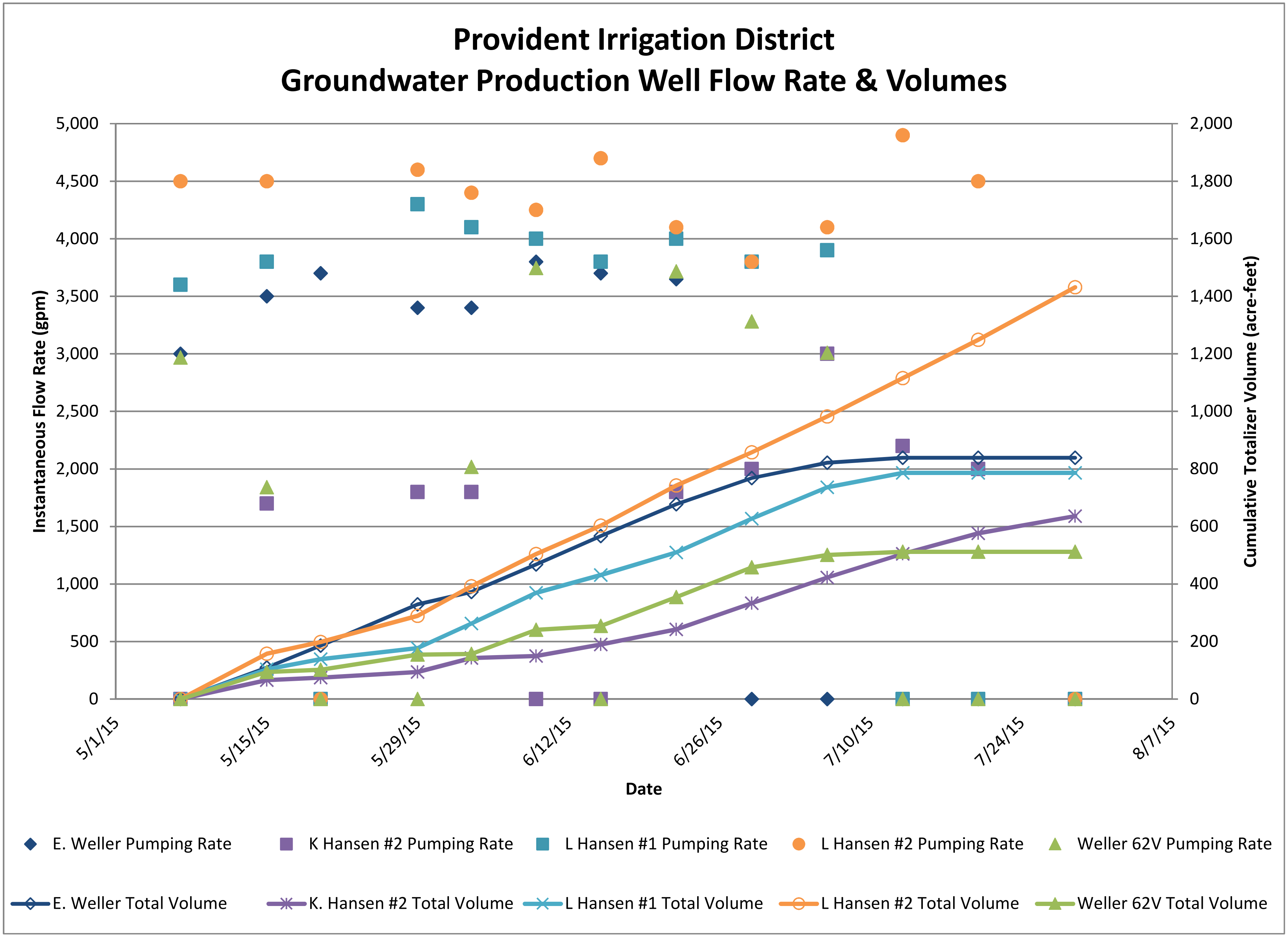



Provident Irrigation District
Production Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
20
40
60
80
100
120
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Weller #4
K. Hansen #1
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.

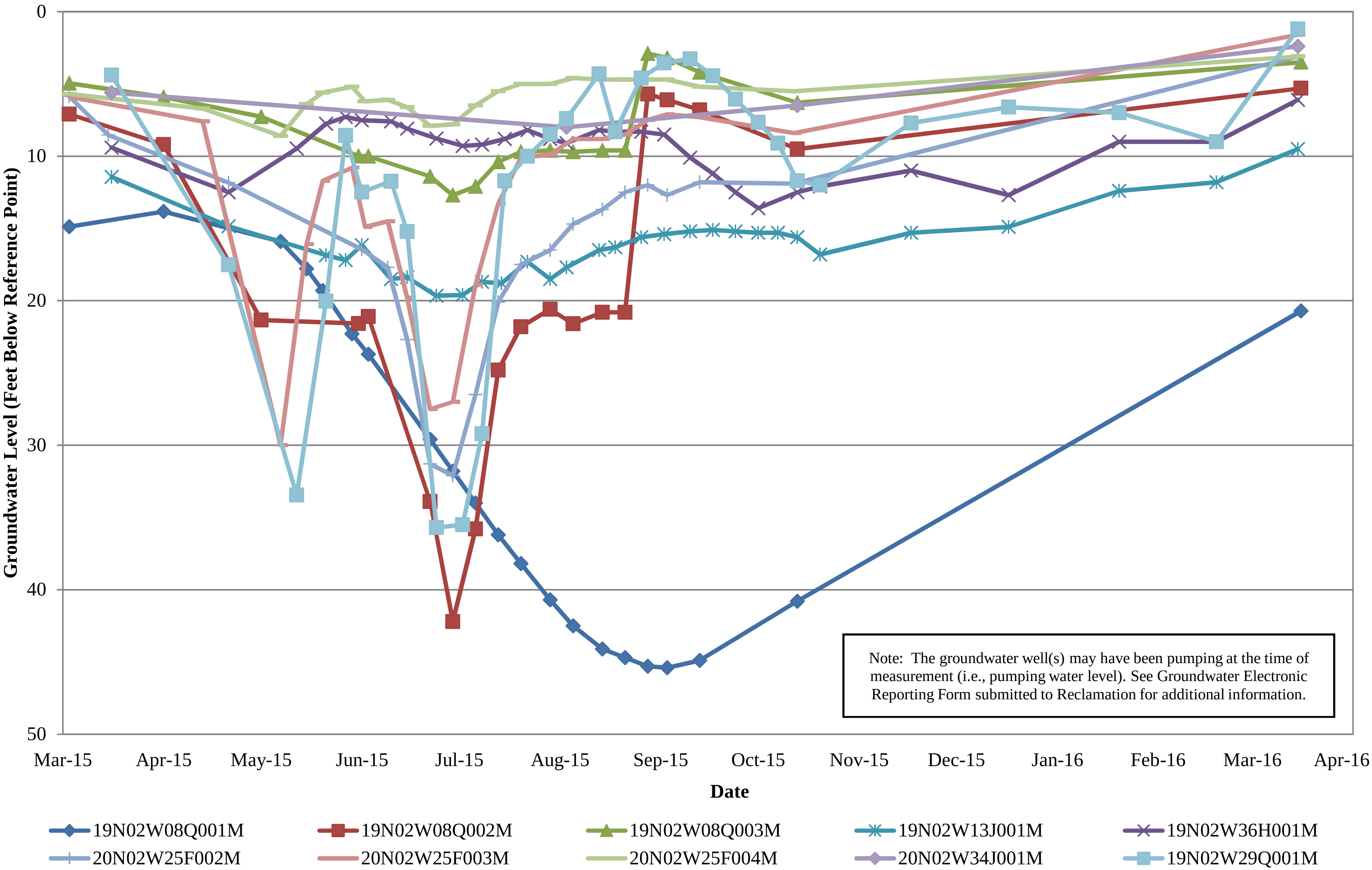


Provident Irrigation District
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
1,000
900
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2014 Water Transfers, exceedances may require further analysis.
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
8/21/15
9/4/15
Date
E. Weller Specific Conductance
Weller #4 Specific Conductance
L. Hansen #1 Specific Conductance
L. Hansen #2 Specific Conductance
K. Hansen #1 Specific Conductance
K. Hansen #2 Specific Conductance
Specific Conductance Threshold


Provident Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (cfs)
Cumulative Totalizer Volume (acre-feet)
0
1
2
3
4
5
6
7
8
9
10
11
12
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
K. Hansen #1 Pumping Rate
Weller #4 Pumping Rate
K. Hansen #1 Total Volume
Weller #4 Total Volume


Provident Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
E. Weller Pumping Rate
K Hansen #2 Pumping Rate
L Hansen #1 Pumping Rate
L Hansen #2 Pumping Rate
Weller 62V Pumping Rate
E. Weller Total Volume
K. Hansen #2 Total Volume
L Hansen #1 Total Volume
L Hansen #2 Total Volume
Weller 62V Total Volume

# Provident Irrigation District
# DWR Monitoring Well Groundwater Level Data



# Reclamation District No. 108

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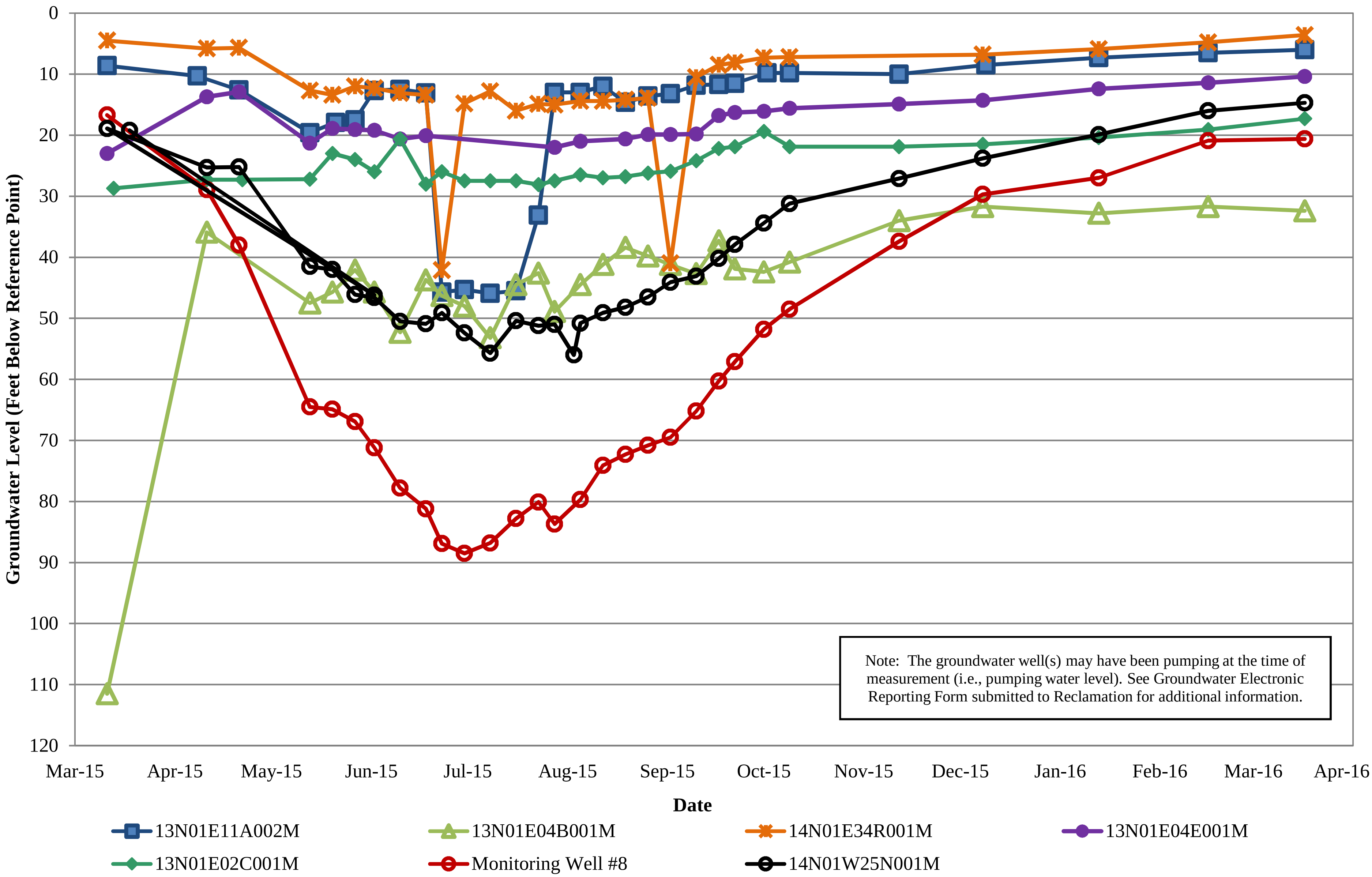
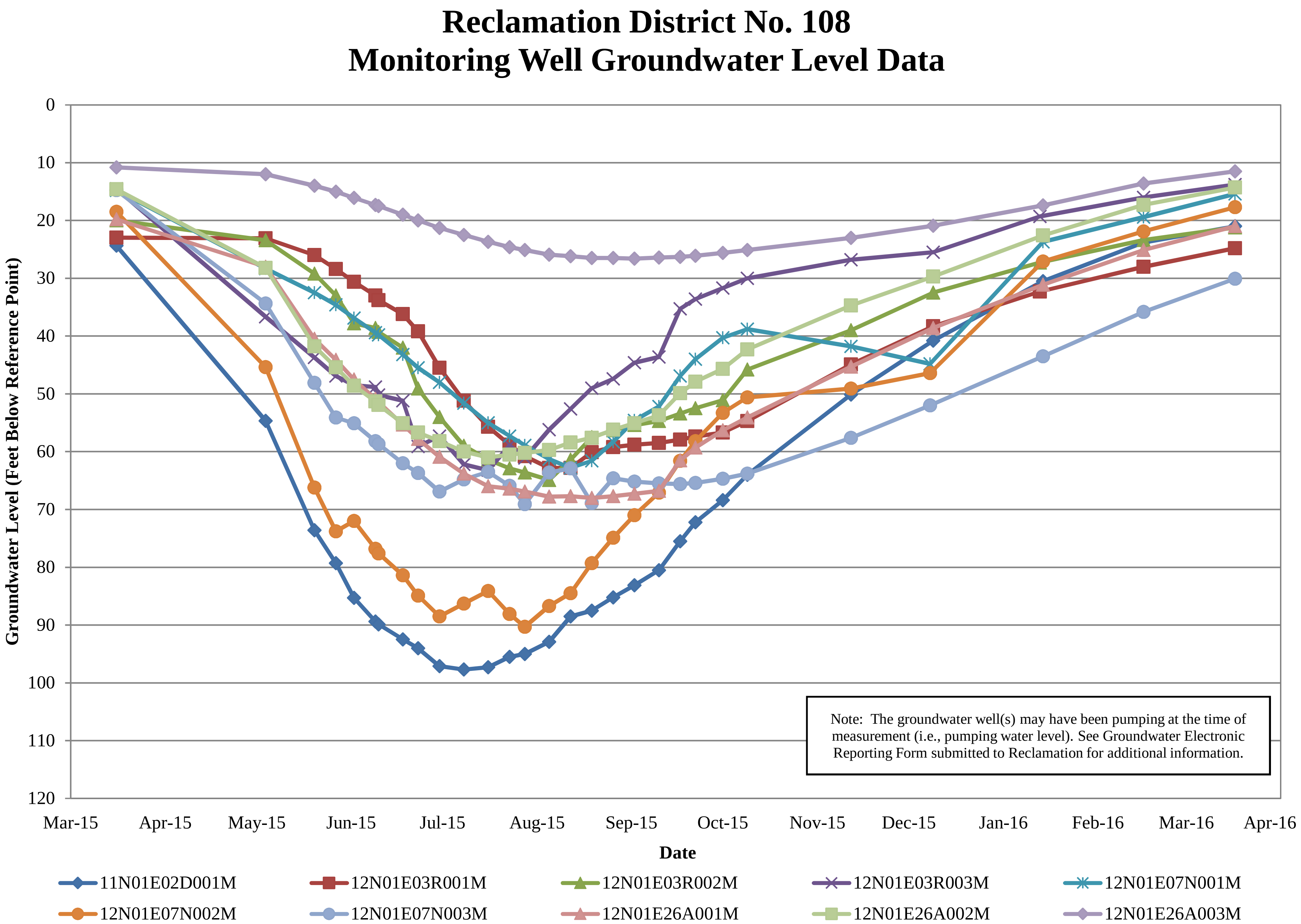
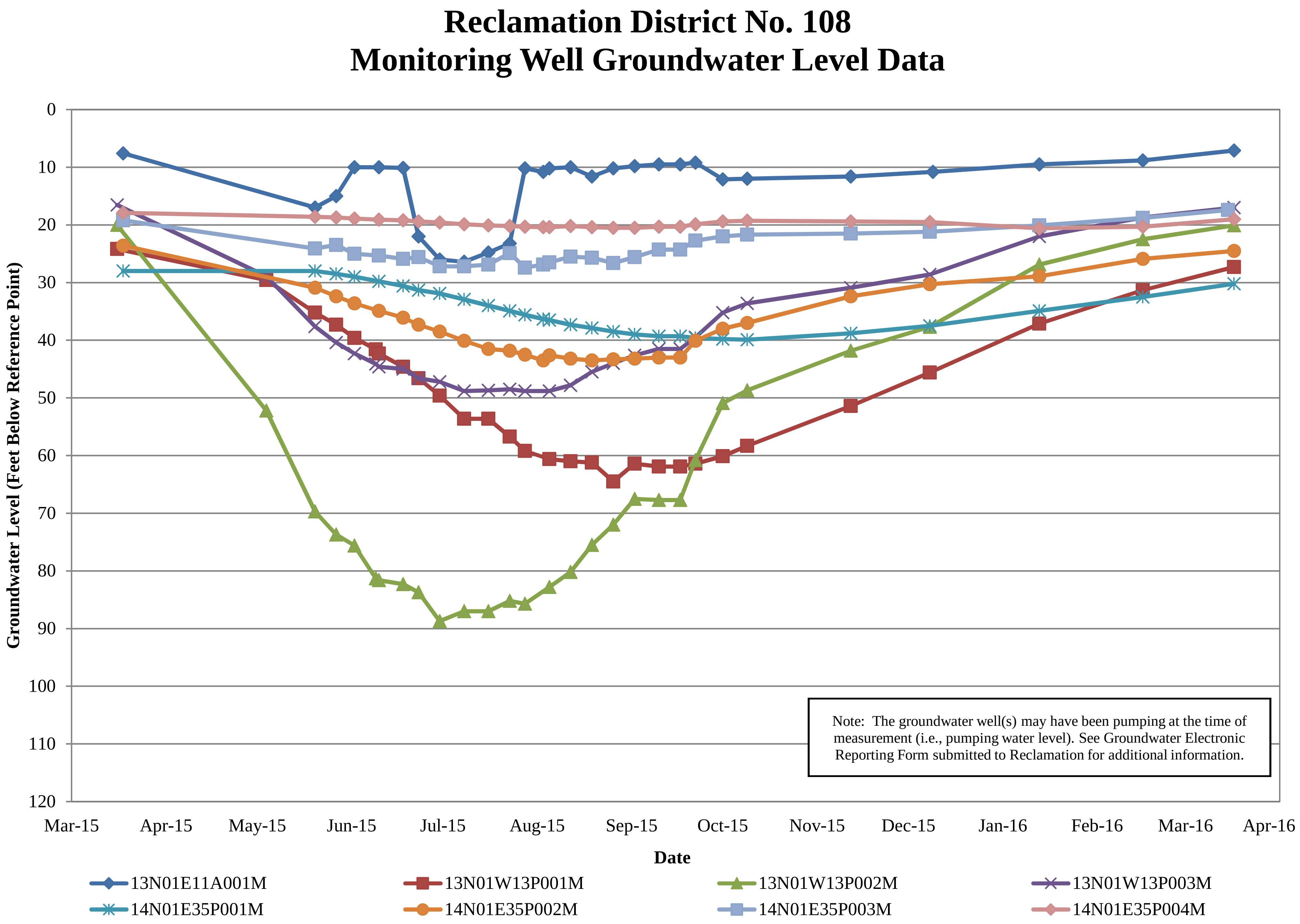
# Reclamation District No. 108
# Monitoring Well Groundwater Level Data

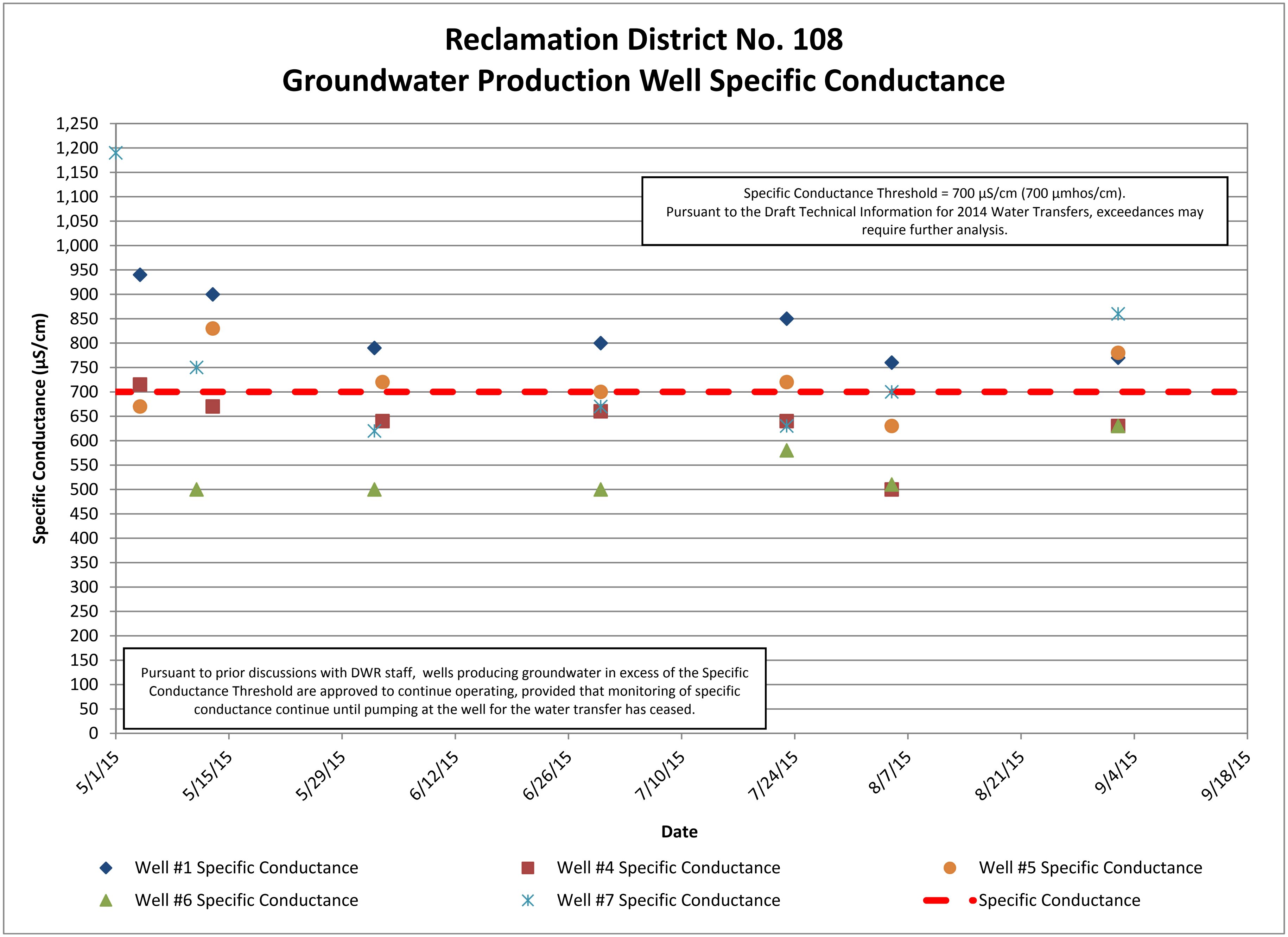




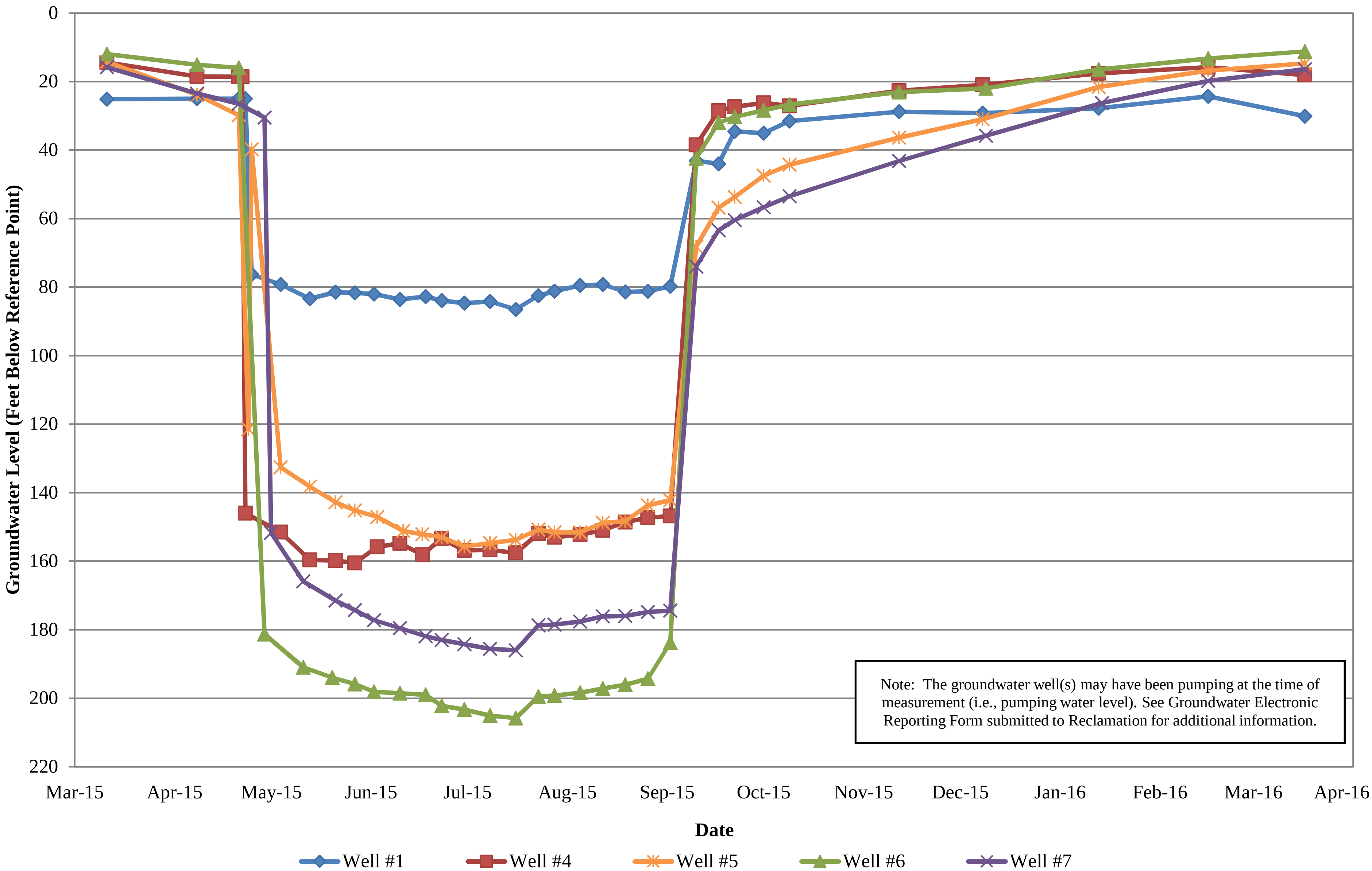
Reclamation District No. 108
Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
10
20
30
40
50
60
70
80
90
100
110
120
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
11N01E02D001M
12N01E03R001M
12N01E03R002M
12N01E03R003M
12N01E07N001M
12N01E07N002M
12N01E07N003M
12N01E26A001M
12N01E26A002M
12N01E26A003M

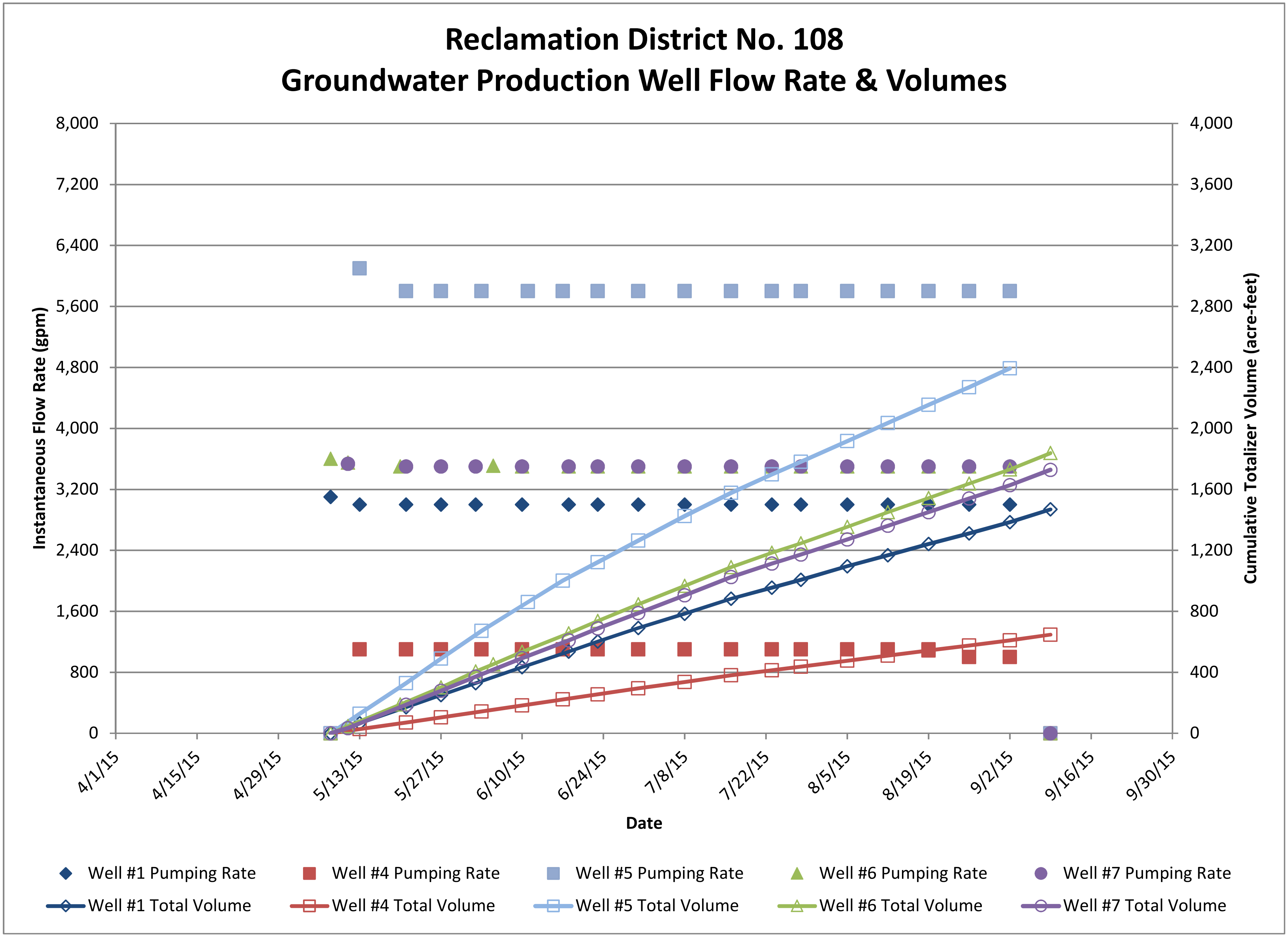


Reclamation District No. 108
Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
10
20
30
40
50
60
70
80
90
100
110
120
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
13N01E11A001M
13N01W13P001M
13N01W13P002M
13N01W13P003M
14N01E35P001M
14N01E35P002M
14N01E35P003M
14N01E35P004M


Reclamation District No. 108
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to the Draft Technical Information for 2014 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance (µS/cm)
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
8/21/15
9/4/15
9/18/15
Date
Well #1 Specific Conductance
Well #4 Specific Conductance
Well #5 Specific Conductance
Well #6 Specific Conductance
Well #7 Specific Conductance
Specific Conductance

# Reclamation District No. 108
# Production Well Groundwater Level Data





Reclamation District No. 108
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
8,000
7,200
6,400
5,600
4,800
4,000
3,200
2,400
1,600
800
0
4,000
3,600
3,200
2,800
2,400
2,000
1,600
1,200
800
400
0
4/1/15
4/15/15
4/29/15
5/13/15
5/27/15
6/10/15
6/24/15
7/8/15
7/22/15
8/5/15
8/19/15
9/2/15
9/16/15
9/30/15
Date
Well #1 Pumping Rate
Well #4 Pumping Rate
Well #5 Pumping Rate
Well #6 Pumping Rate
Well #7 Pumping Rate
Well #1 Total Volume
Well #4 Total Volume
Well #5 Total Volume
Well #6 Total Volume
Well #7 Total Volume

# River Garden Farms

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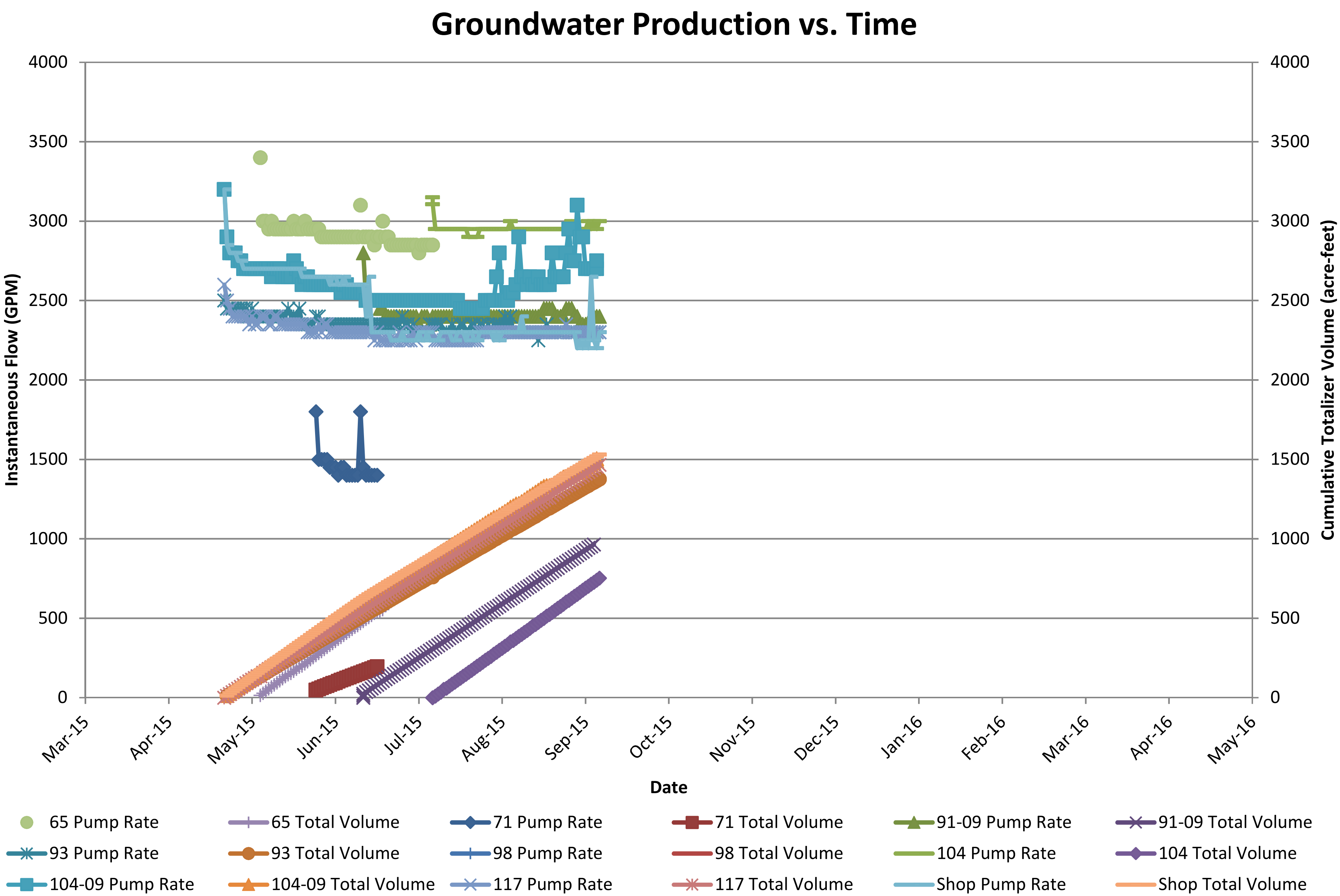
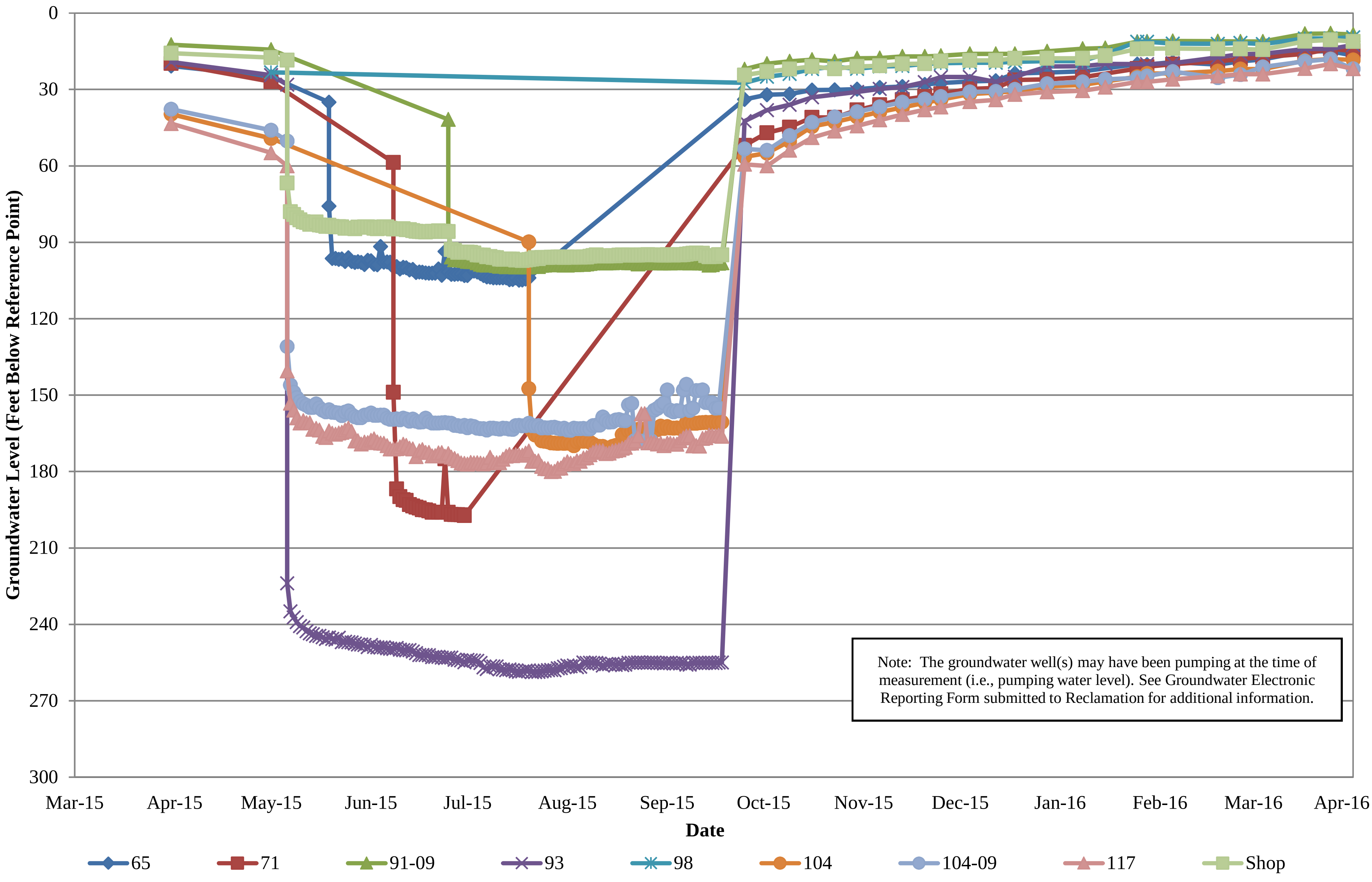
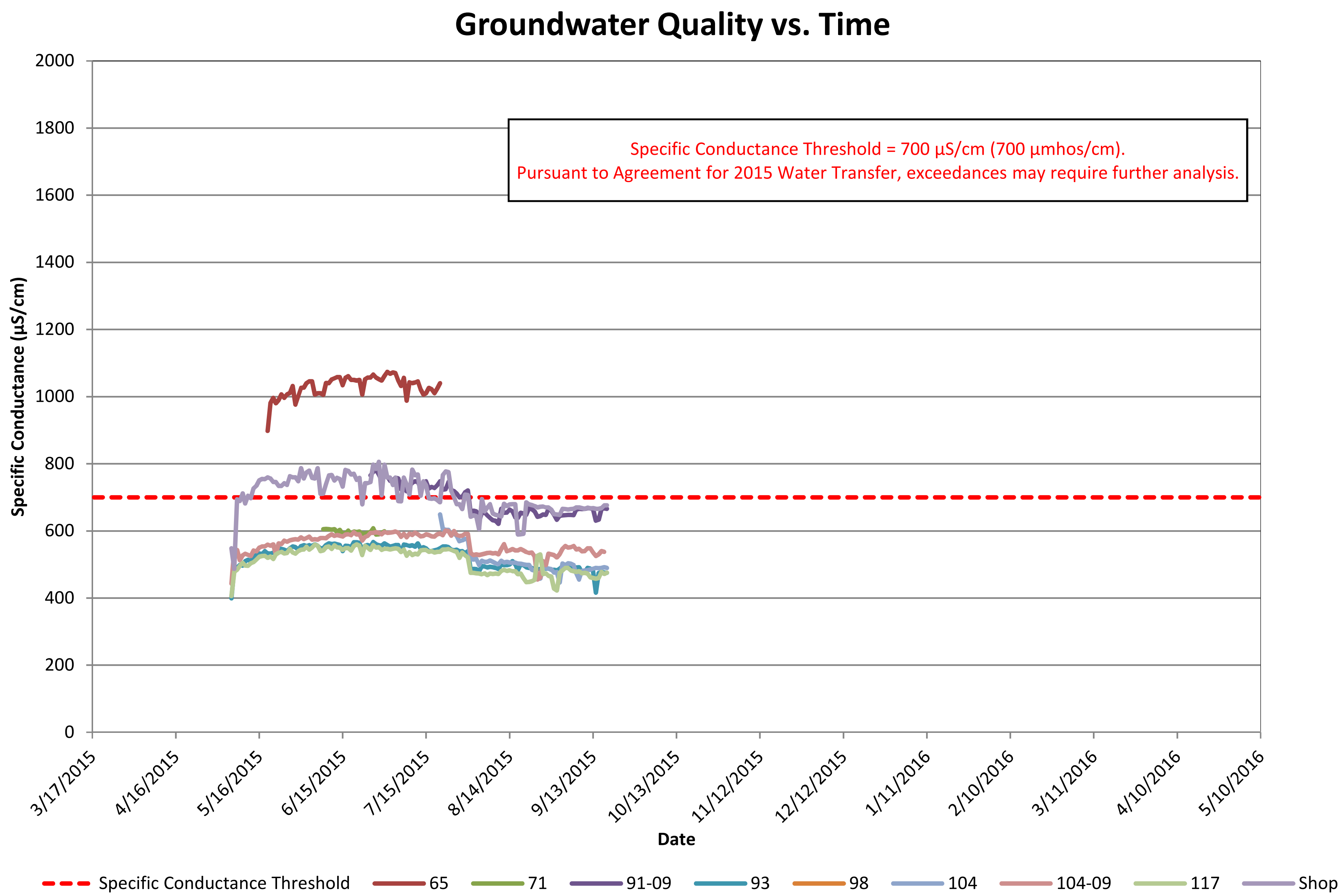





C:\Users\woodruffam\AppData\Local\Temp\Temp1_2015 WT Groundwater Data Electronic Reporting Forms 08.05.2016.zip\RGF Groundwater Data Electronic Reporting Form 08.05.2016.xlsx
Tab: Production Data

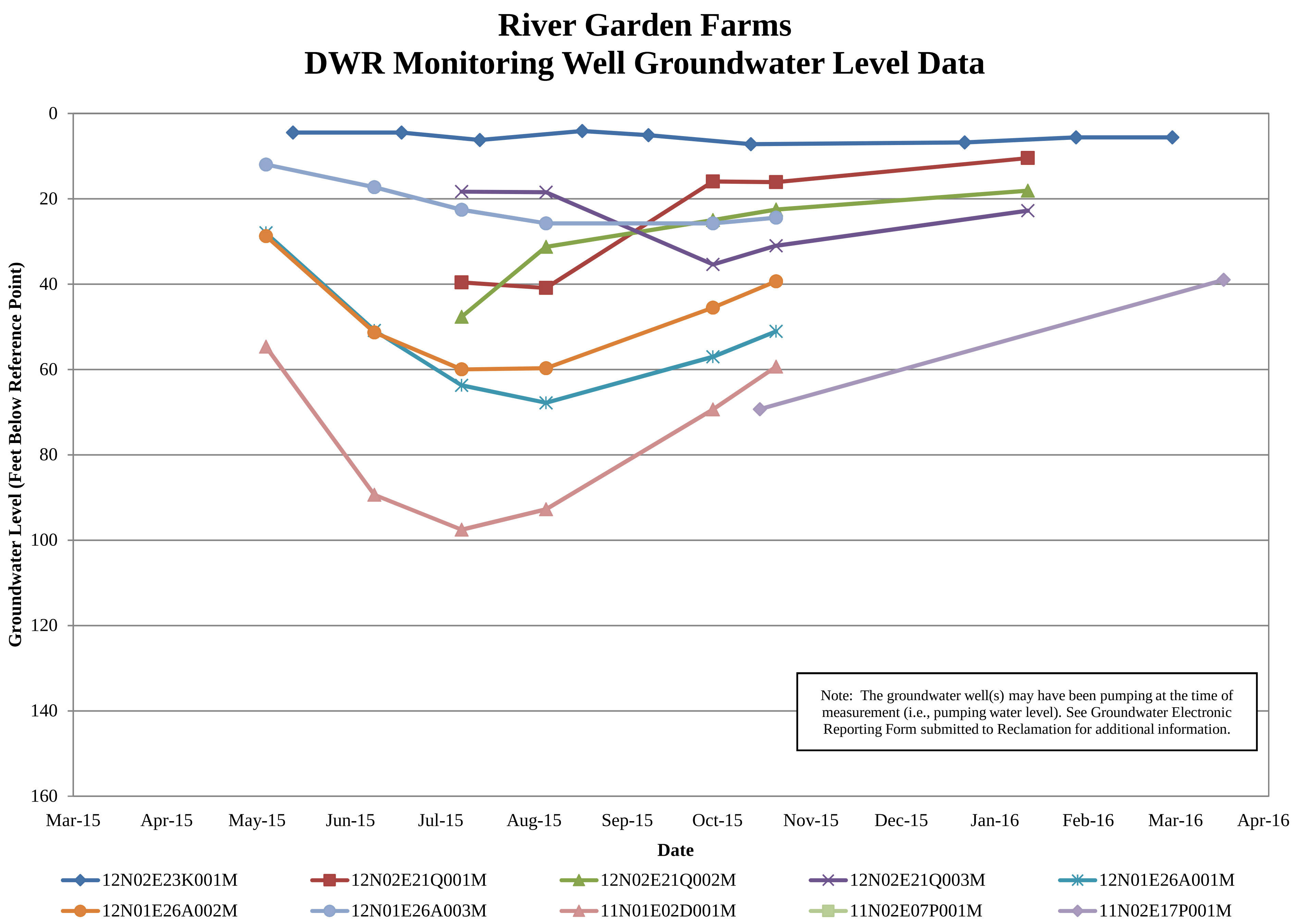
# River Garden Farms
# Production Well Groundwater Level Data



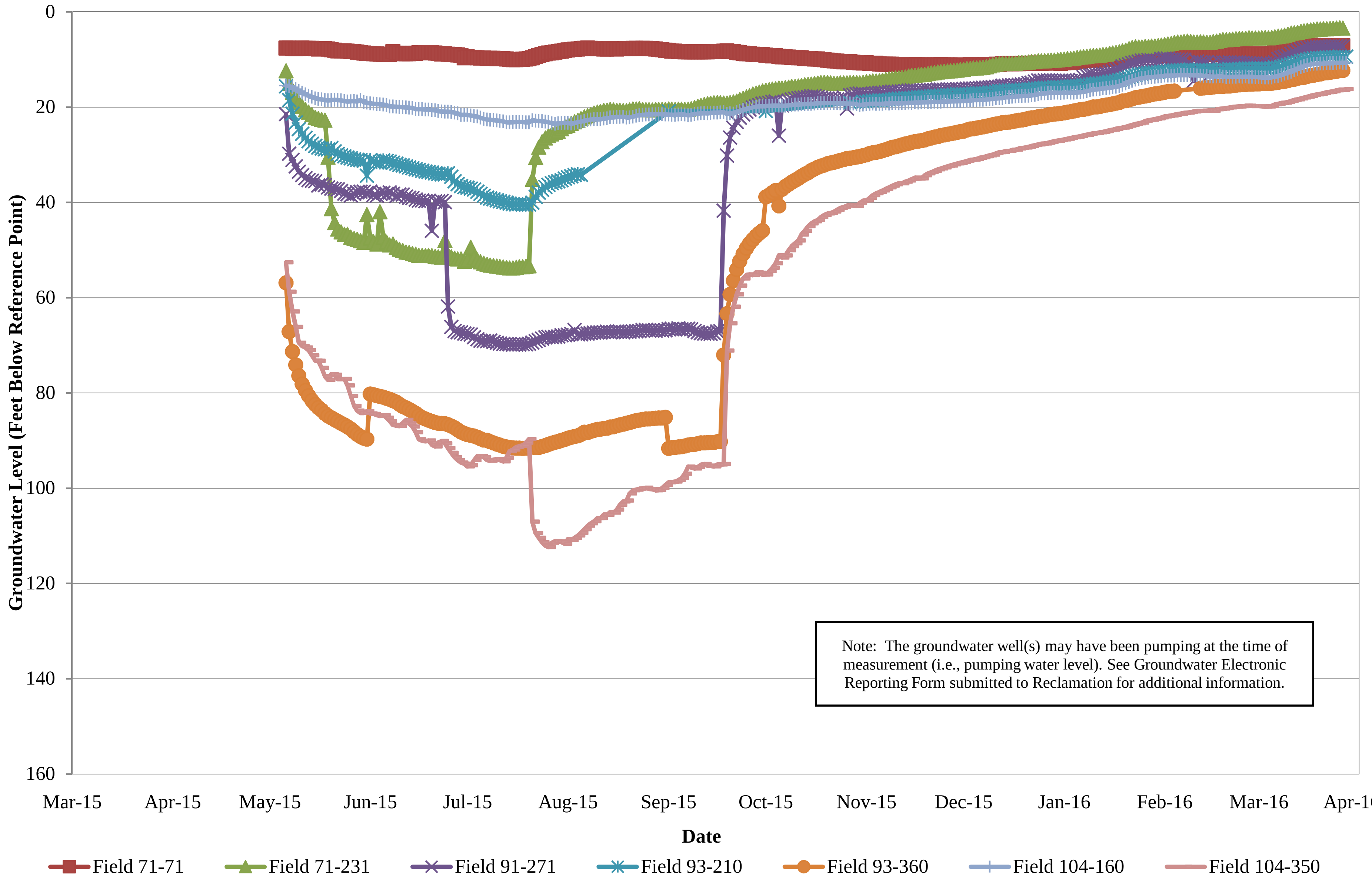



**River Garden Farms**
**Final Report of 2015 Water Transfer Monitoring**
*July 2016*

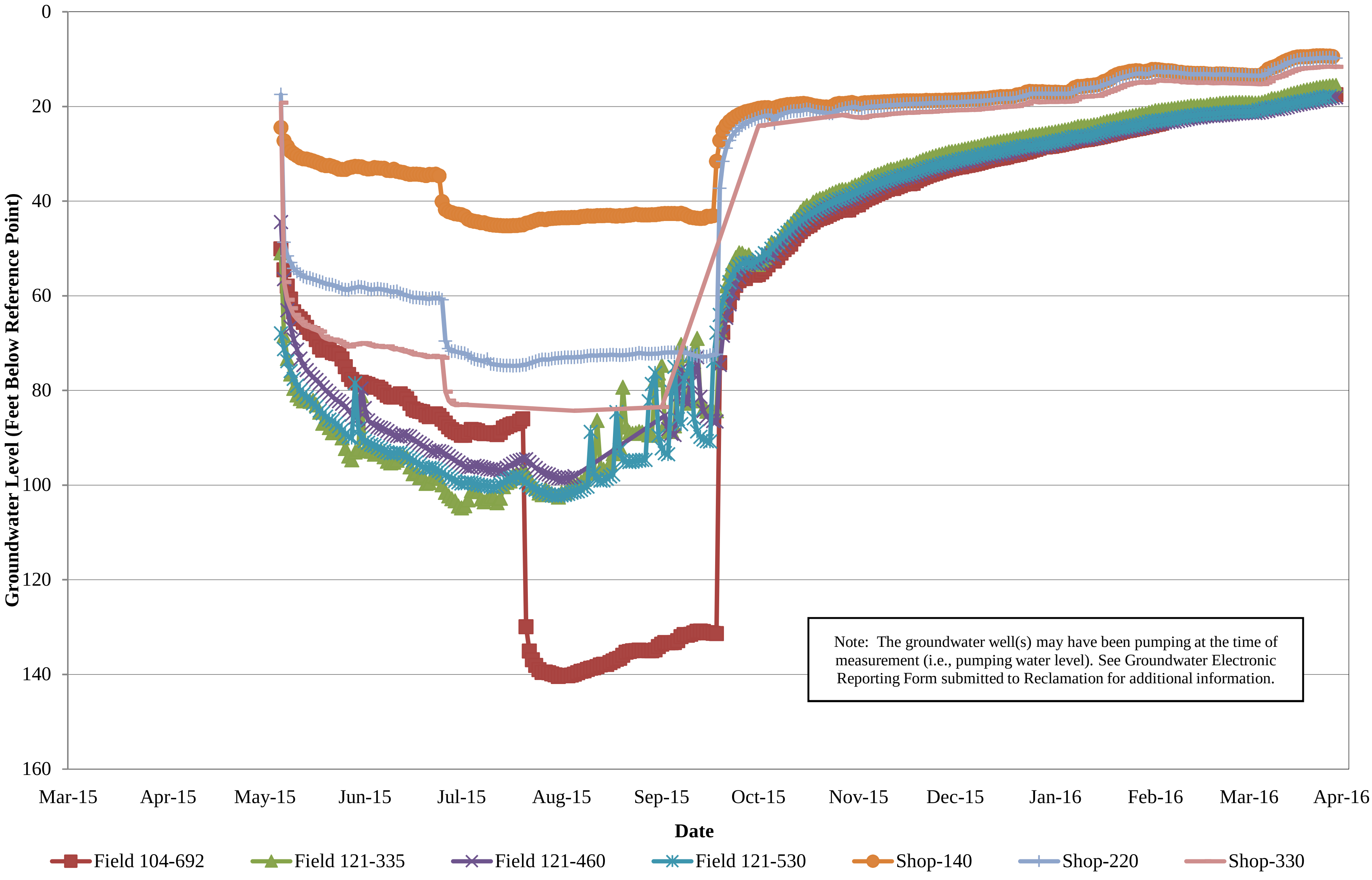
C:\Users\woodruffam\AppData\Local\Temp\Temp1_2015 WT Groundwater Data Electronic Reporting Forms 08.05.2016.zip\RGF Groundwater Data Electronic Reporting Form 08.05.2016.xlsx
Tab: Water Quality Data


River Garden Farms
DWR Monitoring Well Groundwater Level Data
0
20
40
60
80
100
120
140
160
Groundwater Level (Feet Below Reference Point)
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
12N02E23K001M
12N02E21Q001M
12N02E21Q002M
12N02E21Q003M
12N01E26A001M
12N01E26A002M
12N01E26A003M
11N01E02D001M
11N02E07P001M
11N02E17P001M

# River Garden Farms
# Monitoring Well Groundwater Level Data



# River Garden Farms
# Monitoring Well Groundwater Level Data



# T&P Farms

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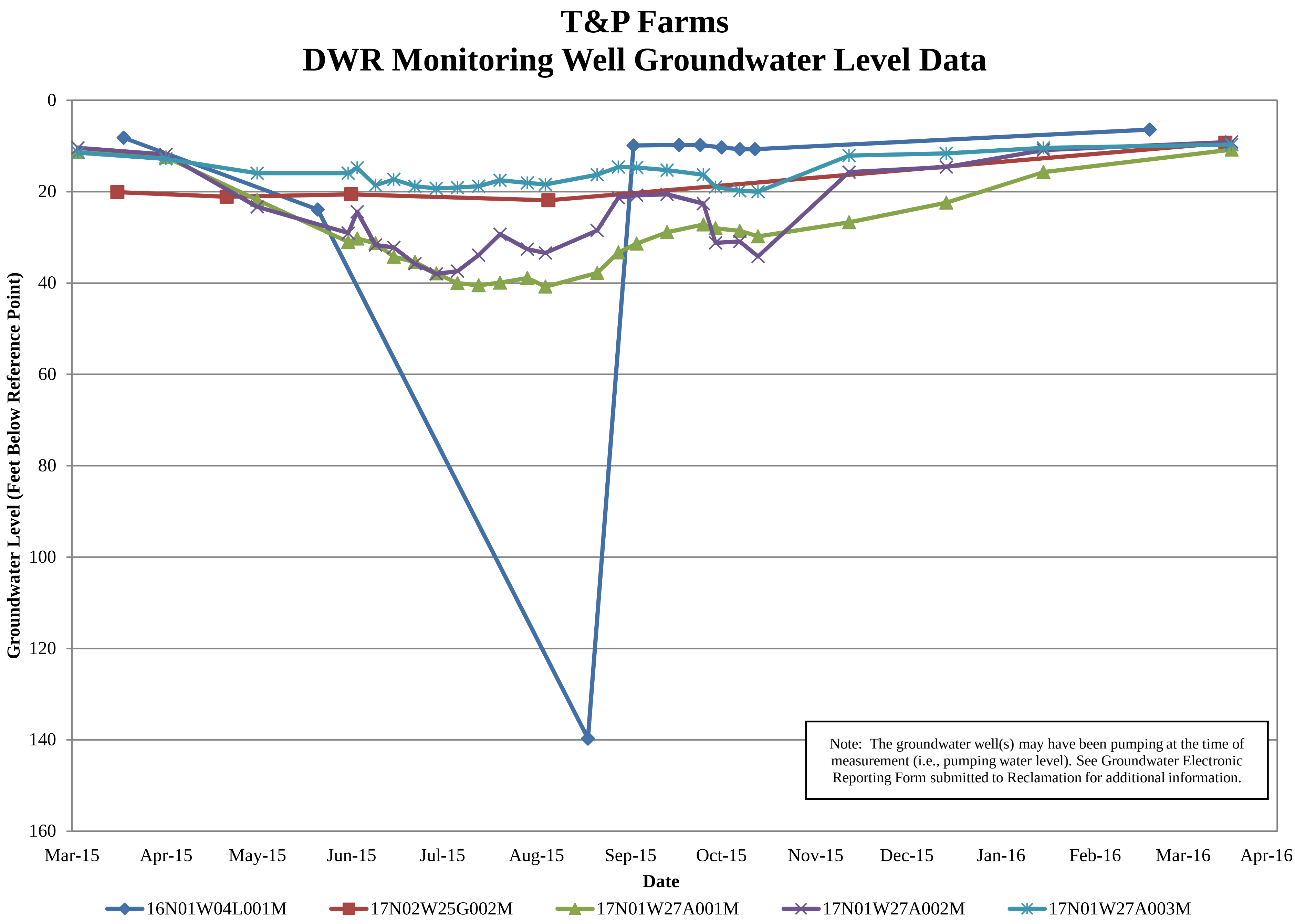
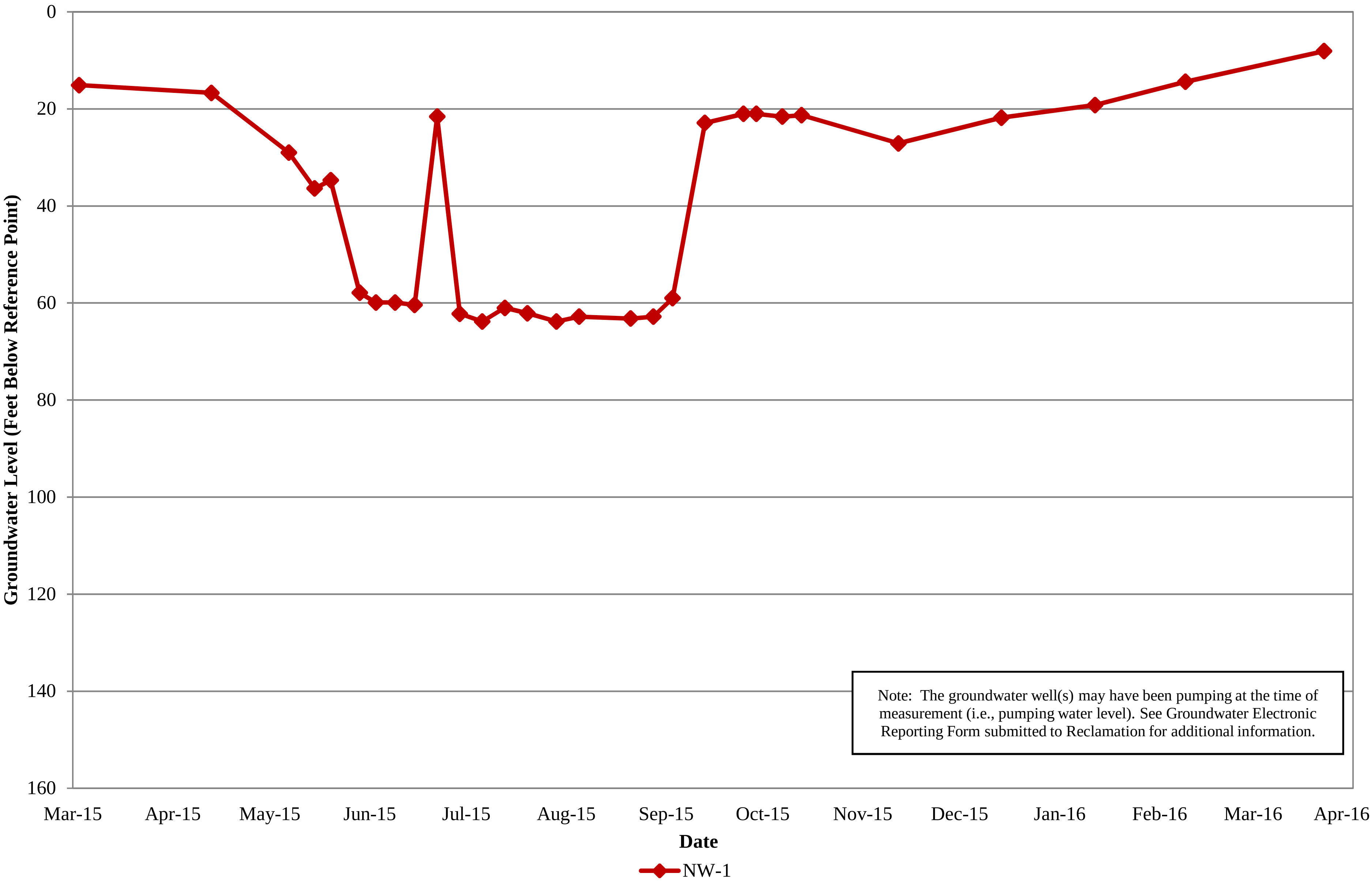
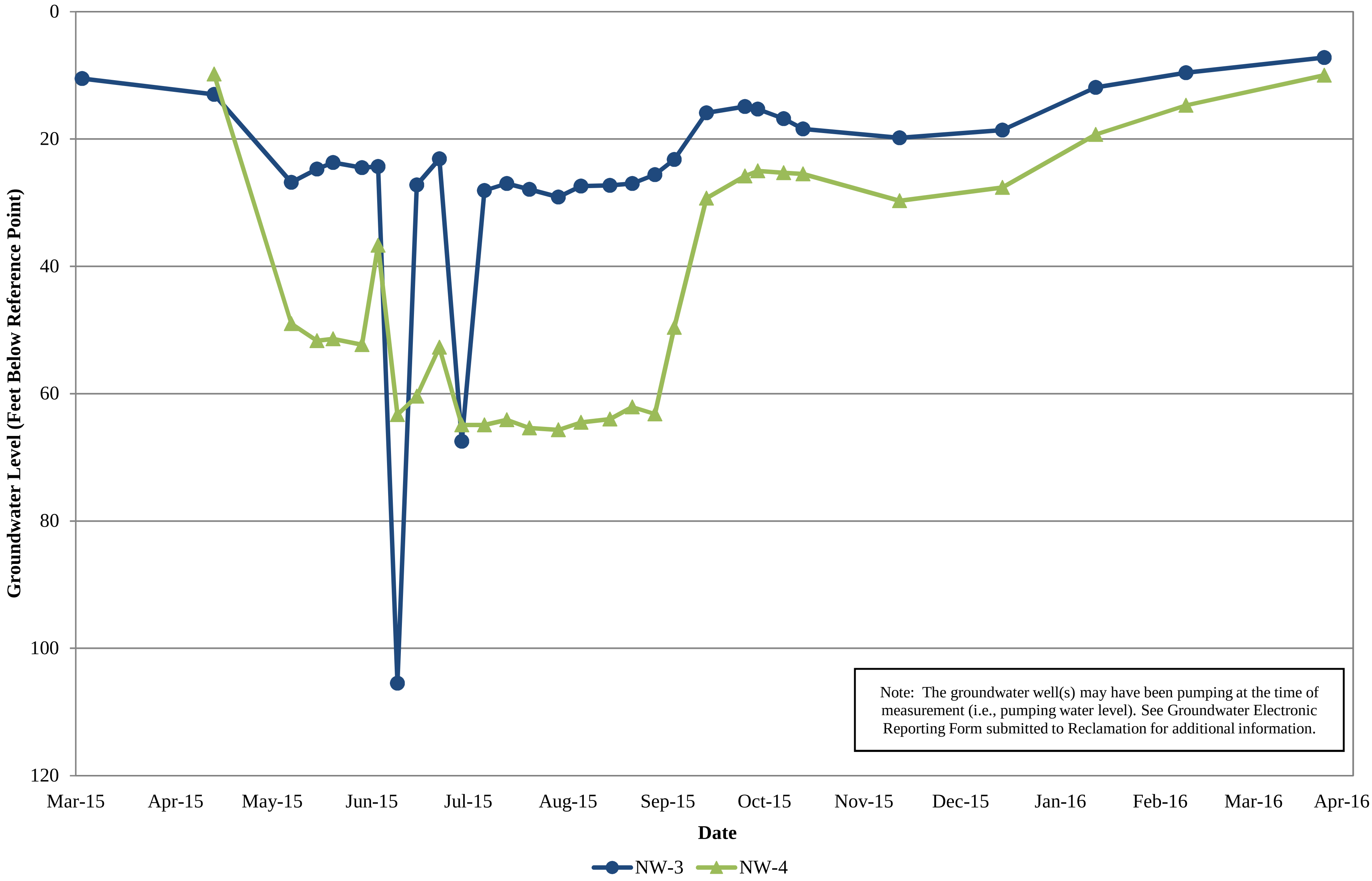
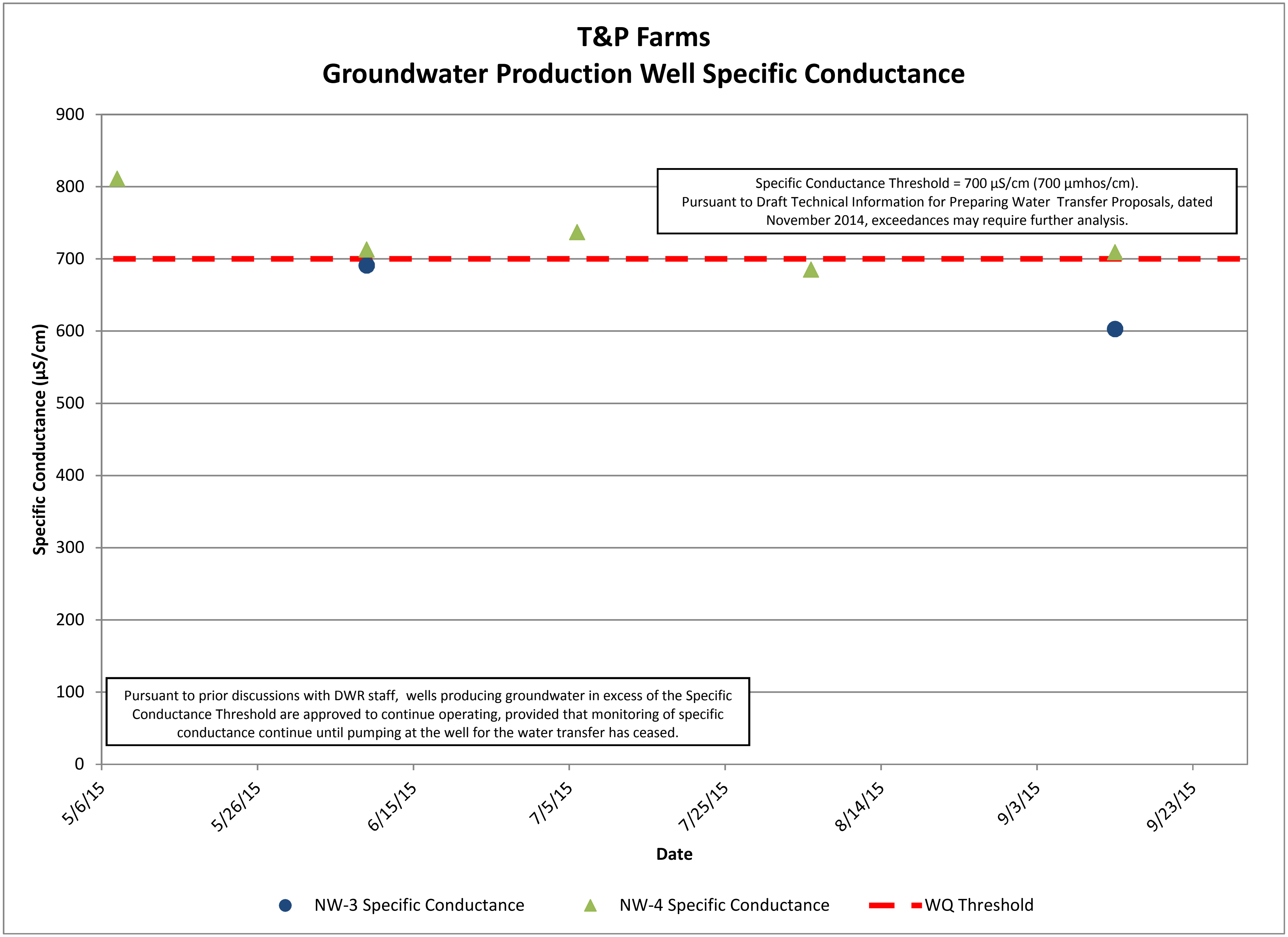

T&P Farms
DWR Monitoring Well Groundwater Level Data
Groundwater Level (Feet Below Reference Point)
0
20
40
60
80
100
120
140
160
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.
16N01W04L001M
17N02W25G002M
17N01W27A001M
17N01W27A002M
17N01W27A003M

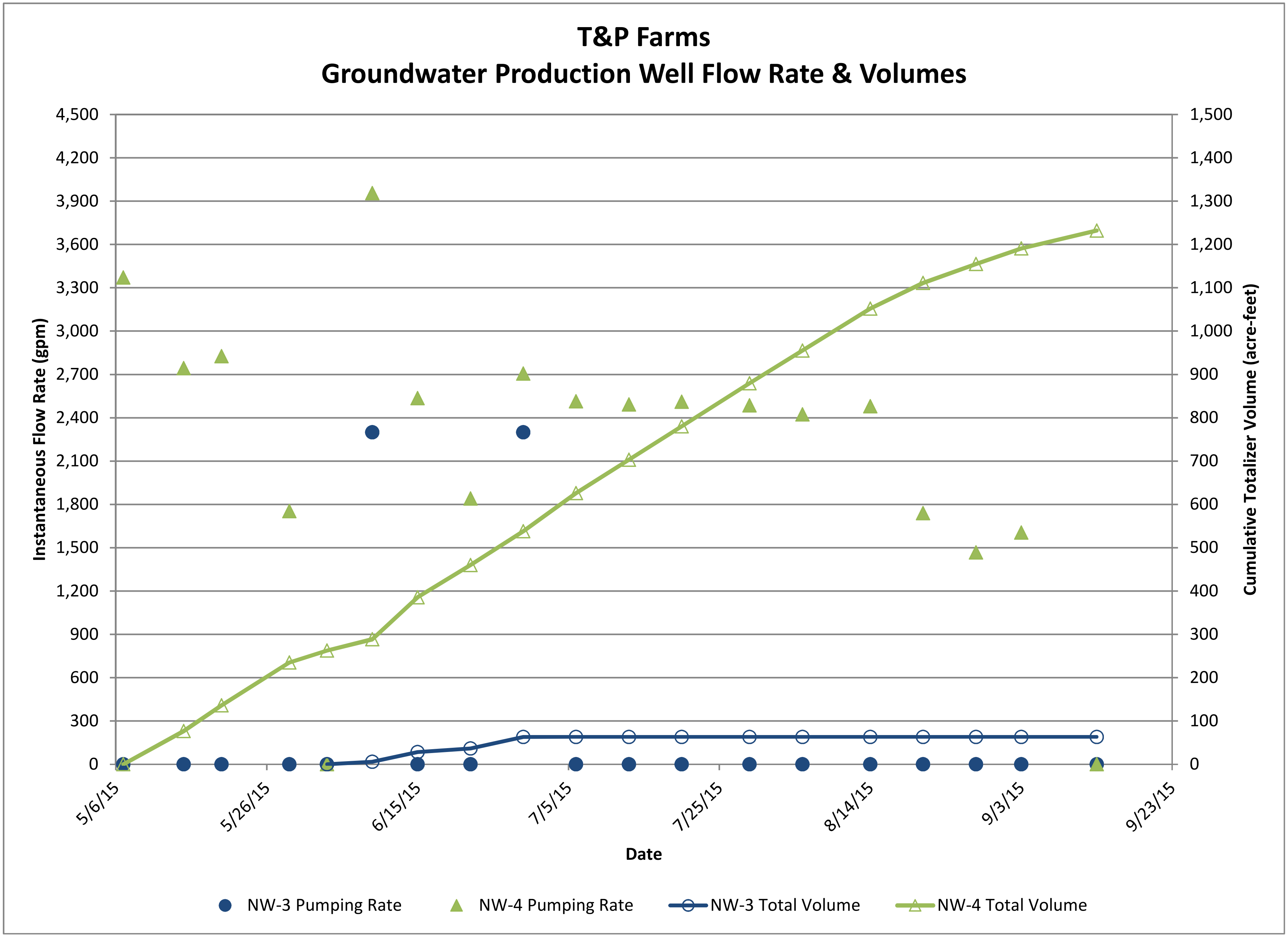
# T&P Farms
# Monitoring Well Groundwater Level Data



# T&P Farms
# Production Well Groundwater Level Data




T&P Farms
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance (µS/cm)
900
800
700
600
500
400
300
200
100
0
5/6/15
5/26/15
6/15/15
7/5/15
7/25/15
8/14/15
9/3/15
9/23/15
Date
NW-3 Specific Conductance
NW-4 Specific Conductance
WQ Threshold


T&P Farms
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
0
300
600
900
1,200
1,500
1,800
2,100
2,400
2,700
3,000
3,300
3,600
3,900
4,200
4,500
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
5/6/15
5/26/15
6/15/15
7/5/15
7/25/15
8/14/15
9/3/15
9/23/15
NW-3 Pumping Rate
NW-4 Pumping Rate
NW-3 Total Volume
NW-4 Total Volume

# Te Velde Revocable Family Trust

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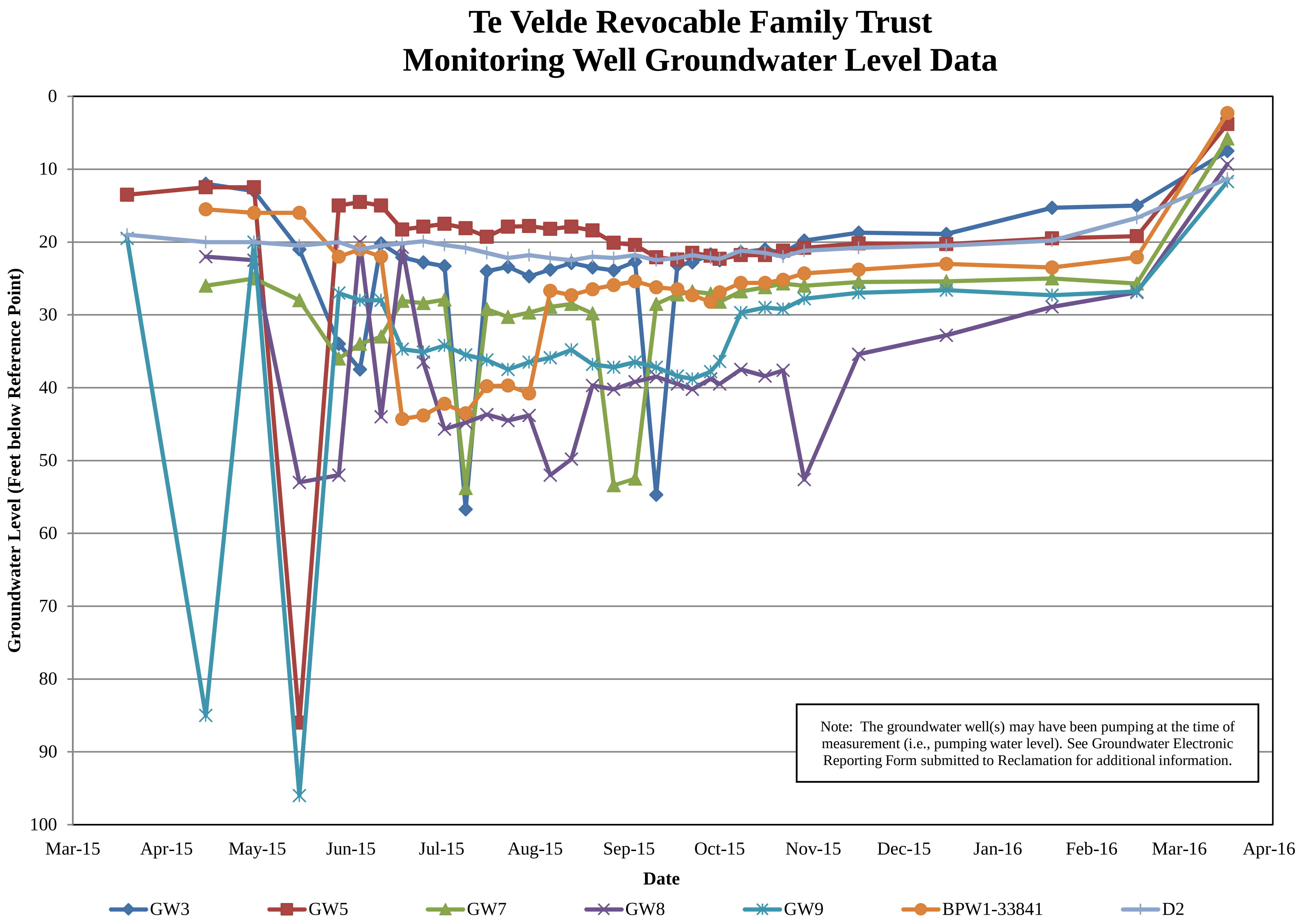
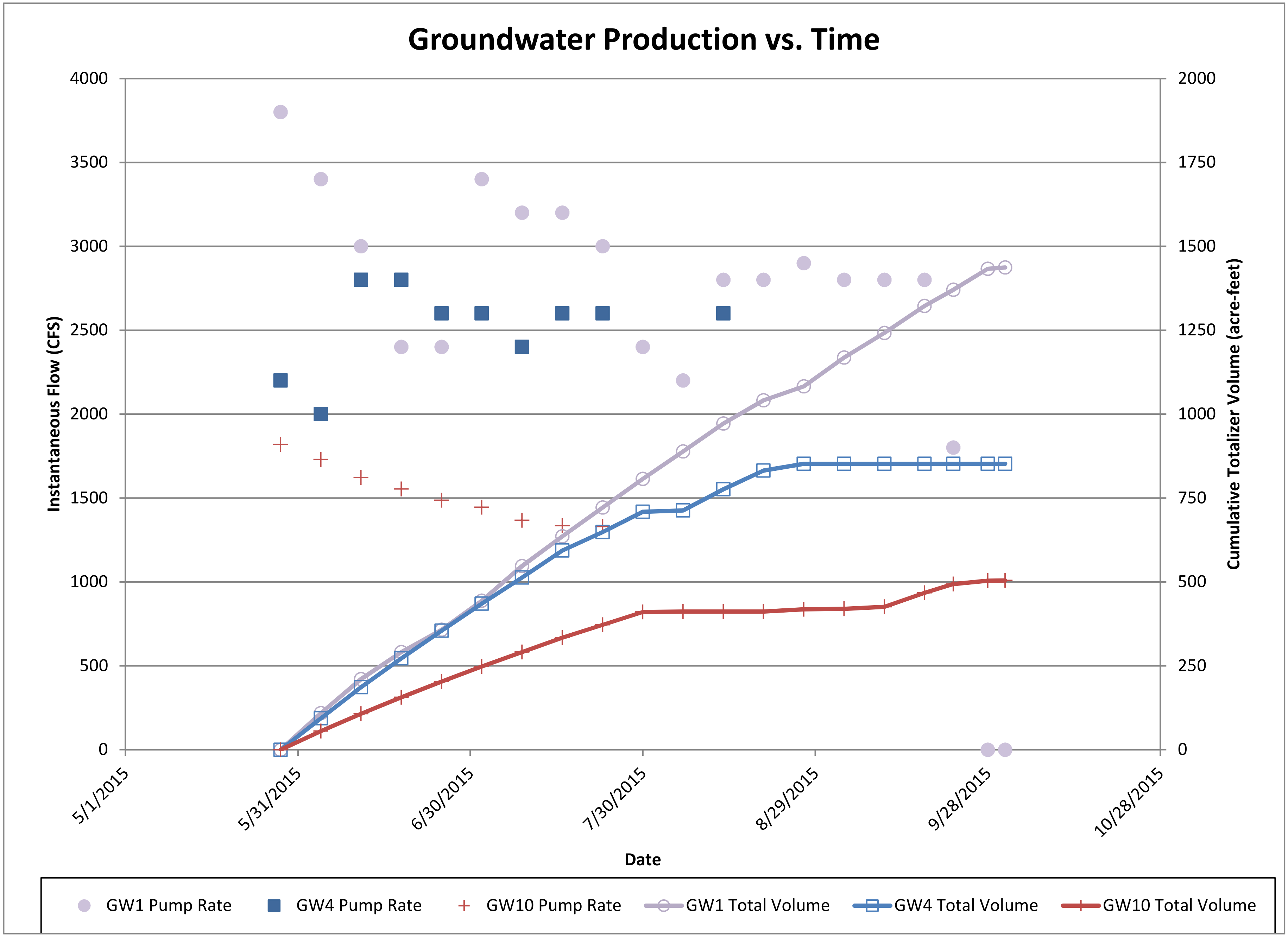
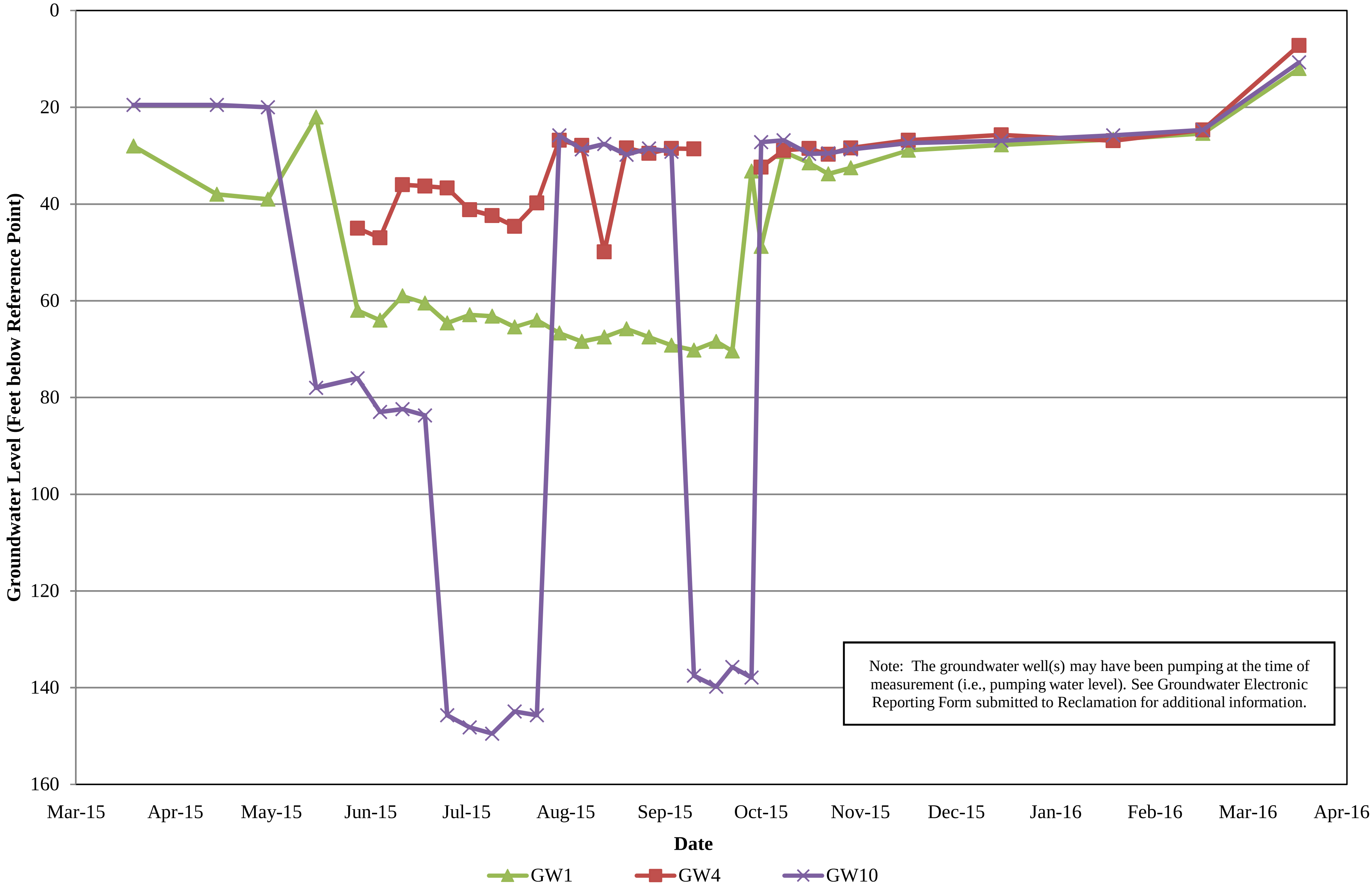

Te Velde Revocable Family Trust
Monitoring Well Groundwater Level Data
Groundwater Level (Feet below Reference Point)
0
10
20
30
40
50
60
70
80
90
100
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date
GW3
GW5
GW7
GW8
GW9
BPW1-33841
D2
Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.

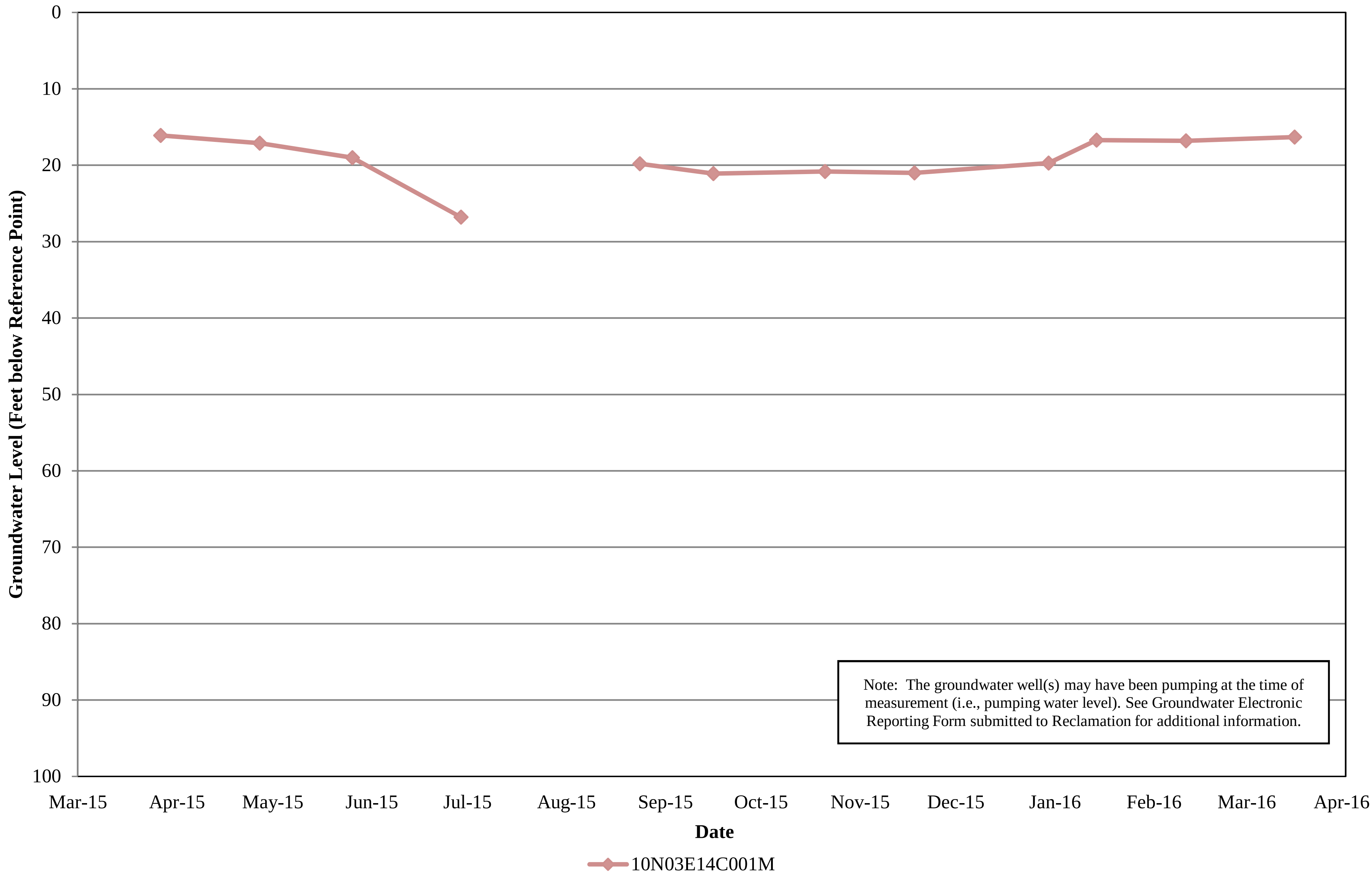


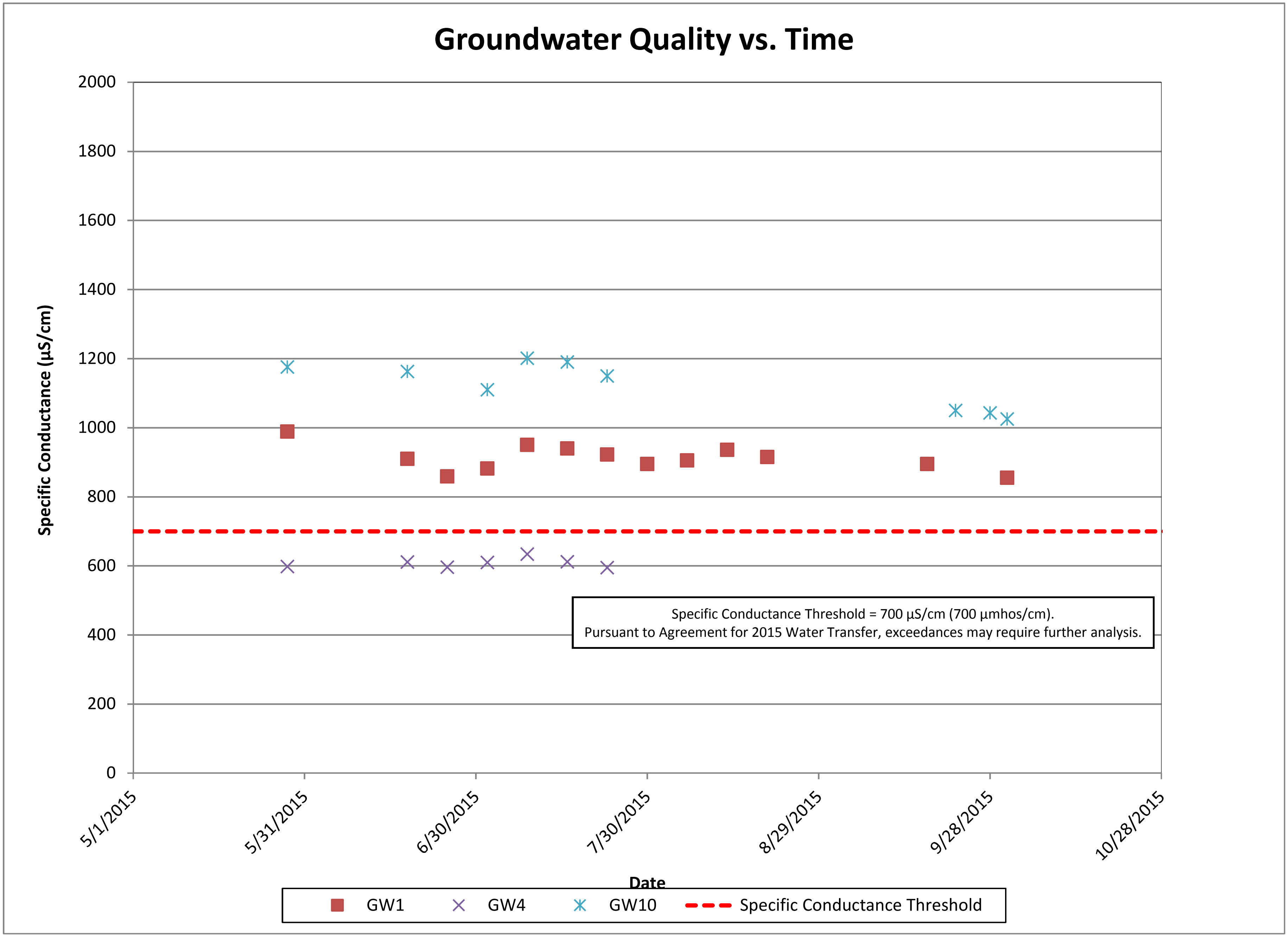
Groundwater Production vs. Time
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
Date
4000
3500
3000
2500
2000
1500
1000
500
0
2000
1750
1500
1250
1000
750
500
250
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
10/28/2015
GW1 Pump Rate
GW4 Pump Rate
GW10 Pump Rate
GW1 Total Volume
GW4 Total Volume
GW10 Total Volume

# Te Velde Revocable Family Trust
# Production Well Groundwater Level Data



# Te Velde Revocable Family Trust
# DWR Monitoring Well Groundwater Level Data




Groundwater Quality vs. Time
Specific Conductance (µS/cm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Agreement for 2015 Water Transfer, exceedances may require further analysis.
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
10/28/2015
Date
GW1
GW4
GW10
Specific Conductance Threshold

# Appendix J

# Cumulative Projects

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# Appendix J Cumulative Projects

This appendix provides an analysis of overall cumulative effects of Proposed Action taken together with other past, present, and reasonably foreseeable probable future projects (or actions) as required by NEPA implementing regulations (40 CFR, Section 1508.7) and CEQA Guidelines (14 CFR, Section 15130). The reasonably foreseeable probable future actions considered in this cumulative effects analysis are actions located within the Seller Service Area that have been identified as potentially having an effect on resources that also may be affected by the Proposed Project. This analysis follows applicable guidance provided by the CEQ in *Considering Cumulative Effects under the National Environmental Policy Act* (1997) and *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (*2005).

## J.1 Cumulative Projects

The cumulative analysis considers other potential water transfers that could occur in the 2020 transfer season, including other CVP water transfers, non-CVP water transfers, and additional water transfers. No construction projects within the Seller Service Area were analyzed. Table J-1 lists potential sellers, including those in the Proposed Action, that have indicated interest or have provided water for transfer in the past, including:

- Potential transfers from sellers in the Sacramento River, American River, Yuba River, and north-westerly Delta areas. The majority of these potential sellers, which include the sellers in the Proposed Action, were evaluated in the Long-Term Water Transfers EIS/EIR and subsequent Long-Term Water Transfers RDEIR/SDEIS prepared by SLDMWA and Reclamation that analyzed potential CVP-related transfers from 2019 to 2024. Additional sellers in the Sacramento River area not evaluated in the EIS/EIR have indicated interest in selling water in 2020 and are also included in Table J-1.
- Potential transfers from sellers in the Feather River Region from entities holding settlement agreements with DWR that could make surface water available for CVP or SWP contractors. These transfers would be approved and facilitated by DWR.

The Lower Yuba River Accord (Yuba Accord) transfers were not included in the cumulative condition analysis in Chapter 3 because transfers would be made available in a different geographical area than the Proposed Action. The Yuba Accord provides for both stored water and groundwater substitution transfers ranging from 60,000 AF per year and up to an additional 140,000 AF for state and federal contractors in drier years. From 2007 through 2014, Yuba Accord transfers averaged approximately 129,000 AF. Transfers under the Yuba Accord historically account for a large portion of the DWR approved water transfers and represented 73 percent of the DWR approved transfers in 2015 (DWR 2015a). Groundwater substitution transfers for the Yuba Accord would occur in the North Yuba and South Yuba subbasins and would not affect groundwater levels near the Proposed Action.

### J.1.1 Potential transfers analyzed in the cumulative analysis

The cumulative analysis considers other CVP and non-CVP water transfers that could occur in addition to Proposed Action. These water transfer methods could include cropland idling and groundwater substitution (the same as described for the Proposed Action). Transfer methods could also include additional methods such as conservation, where a seller takes a conservation action to reduce irrecoverable water losses, and stored reservoir water, which includes releases of water that would have remained in storage in non-CVP or SWP reservoirs.

Transfer water shown in Table J-1 could be sold to multiple agencies, including, TCCA, East Bay Municipal Utility District (MUD), SWP contractors receiving water from the North Bay Aqueduct, and south of Delta buyers, including SLDMWA and Metropolitan Water District of Southern California. Unlike transfers to TCCA and East Bay MUD that would be diverted off the Sacramento River, transfers to south of Delta buyers would be exported through the Delta via Banks or Jones Pumping Plants.

**Table J-1. Potential Cumulative Sellers (Upper Limits)**

| Water Agency | Groundwater Substitution[1] (acre-feet) | Cropland Idling/ Crop Shifting[1] (acre-feet) | Stored Reservoir Release[1] (acre-feet) | Conservation[1] (acre-feet) | Maximum Potential Transfer (acre-feet per year) |
|---|---|---|---|---|---|
| **Sacramento River Area** | | | | | |
| Anderson-Cottonwood Irrigation District | 5,225 | | | | 5,225 |
| Baber, Jack et al. | | 2,310 | | | 2,310 |
| Canal Farms | 1,000 | 635 | | | 1,635 |
| Conaway Preservation Group | 35,000 | 21,349 | | | 35,000 |
| Cranmore Farms (Pelger Road 1700 LLC) | 8,000 | 2,500 | | | 8,000 |
| Eastside Mutual Water Company | 2,230 | | | | 2,230 |
| Giusti Farms | 1,000 | | | | 1,000 |
| Glenn-Colusa Irrigation District | 25,000 | 66,000 | | | 91,000 |
| Henle Family Limited Partnership | 700 | | | | 700 |
| Maxwell Irrigation District | 3,000 | 5,000 | | | 8,000 |
| Natomas Central Mutual Water Company | 30,000 | | | | 30,000 |
| Pelger Mutual Water Company | 4,670 | 2,538 | | | 4,670 |
| Pleasant Grove-Verona Mutual Water Company | 18,000 | 9,000 | | | 18,000 |
| Princeton-Cordora-Glenn Irrigation District | 6,600 | 6,600 | | | 12,100 |
| Provident Irrigation District | 10,000 | 9,900 | | | 16,900 |
| Reclamation District 108 | 15,000 | 20,000 | | | 35,000 |
| Reclamation District 1004 | 7,175 | 12,500 | | | 19,675 |
| River Garden Farms | 10,000 | 10,000 | | | 16,000 |
| Sutter Mutual Water Company | 18,000 | 18,000 | | | 18,000 |
| Sycamore Mutual Water Company | 15,000 | 10,000 | | | 20,000 |

| Water Agency | Groundwater Substitution[1] (acre-feet) | Cropland Idling/ Crop Shifting[1] (acre-feet) | Stored Reservoir Release[1] (acre-feet) | Conservation[1] (acre-feet) | Maximum Potential Transfer (acre-feet per year) |
|---|---|---|---|---|---|
| T&P Farms | 1,200 | 890 | | | 1,200 |
| Te Velde Revocable Family Trust | 7,094 | 6,975 | | | 7,094 |
| Windswept Land & Livestock | 2,000 | | | | 2,000 |
| **American River Area** | | | | | |
| City of Sacramento | 5,000 | | | | 5,000 |
| Placer County Water Agency | | | 47,000 | | 47,000 |
| Sacramento County Water Agency | 15,000 | | | | 15,000 |
| Sacramento Suburban Water District | 30,000 | | | | 30,000 |
| **Yuba River Area** | | | | | |
| Browns Valley Irrigation District | | | 5,000 | 3,100 | 8,100 |
| Cordua Irrigation District | 12,000 | | | | 12,000 |
| **Feather River Area** | | | | | |
| Butte Water District | 5,500 | 11,500 | | | 17,000 |
| Garden Highway Mutual Water Company | 14,000 | | | | 14,000 |
| Gilsizer Slough Ranch | 3,900 | | | | 3,900 |
| Goose Club Farms and Teichert Aggregates | 10,000 | 10,000 | | | 10,000 |
| South Sutter Water District | | | 15,000 | | 15,000 |
| Tule Basin Farms | 7,320 | | | | 7,320 |
| Biggs-West Gridley Water District[2] | | 32,190 | | | 32,190 |
| Richvale Irrigation District[2] | | 22,345 | | | 22,345 |
| Plumas Mutual Water Company[2] | 5,000 | 1,750 | | | 4,550 |
| South Feather Water and Power[2] | | | 10,000 | | 10,000 |
| Sutter Extension Water District[2] | 4,000 | 11,000 | | | 15,000 |
| Western Canal Water District[2] | | 37,655 | | | 37,655 |
| Total | **337,614** | **330,637** | **77,000** | **3,100** | **661,799** |

[1] These totals cannot be added together. Agencies could make water available through groundwater substitution, cropland idling, or a combination of the two; however, they will not make the full quantity available through both methods. The last column reflects the total upper limit for each agency and will not equal the sum of all the individual transfer quantities for each agency.

[2] Entity holds Settlement Agreement with DWR.

Table J-1 lists the transfer method and associated maximum annual transfer quantity potentially available from each seller. The actual quantity of water transferred in a given year, as evidenced by past dry years, is less than the totals shown in Table J-1 and depends on a number of factors, including hydrologic conditions and available conveyance capacity. Cross Delta transfers to south-of-Delta buyers require pumping at the CVP and SWP south Delta export facilities and historically account for the majority of the transfers from sellers listed in Table J-1. Table J-2 lists the total quantities of cross Delta transfers from 2009 to 2015 that ranged from zero to 414,629 AF from 2009 through 2015, or approximately zero to 55 percent of the maximum total shown in Table J-1. In 2014, Sacramento Valley sellers transferred 35,446 AF to TCCA Member Units. In 2015, TCCA used 23,997 AF of transfer water from Settlement Contractors. TCCA did not engage in water transfers in 2016 – 2019, and cross-Delta water transfers were not implemented.

**Table J-2. Historic Cross Delta Water Transfers (2009 – 2015)**

| Year | Total Acre-Feet |
|---|---|
| 2009 | 274,551 |
| 2010 | 264,165 |
| 2011 | 0 |
| 2012 | 84,781 |
| 2013[1] | 351,515 |
| 2014[1] | 414,629 |
| 2015[1] | 262,466 |

*Source: DWR and SWRCB 2015*

*[1] Data for 2013, 2014 and 2015 are for quantities made available North of the Delta and include Streamflow Depletion losses (where applicable) but do not include carriage water losses across the Delta. Data for 2015 is preliminary as of May 2015 and may change as the year develops. Cross Delta water transfers using facilities operated by DWR in 2014 and 2015 were 305,699 AF and 104,348 AF respectively and Reclamation 73,930 AF and 157,018 AF respectively.*

Transfers originating from the Sacramento Valley represent a small portion of the Sacramento Valley's overall water supply. In addition to the transfers described in Table J-1, TCCA may also engage in "Project Water" transfers under the Central Valley Project Improvement Act section 3405(a)(1)(m). Reclamation analyzed potential impacts of these transfers in an EA in 2016, the "Accelerated Water Transfer and Exchange Program for Sacramento Valley Central Valley Project Contractors – Contract Years 2016-2020." The EA identified no effect to biological resources and potentially small, beneficial effects to other resources. Because these transfers would not have adverse effects, they are not included in the cumulative conditions analysis in Chapter 3.

### J.1.2 Voluntary Agreements

On December 12, 2018, the State Water Resources Control Board (Board) adopted Resolution 2018-0059, approving an update to the Bay-Delta Water Quality Control Plan (Bay-Delta Plan). The agreement included flow and non-flow measures to improve water quality in the Bay-Delta watershed to support viability of native fishes. On March 1, 2019, several parties, including the Sacramento River Settlement Contractors, entered into the "*Planning Agreement Proposing Project Description and Procedures for the Finalization of the Voluntary Agreements to Update and Implement the Bay-Delta Water Quality Control Plan* (Planning Agreement).

The flow measures discussed in the Planning Agreement provide instream flows above existing conditions and in a manner that: (a) does not conflict with the requirements of the Sustainable Groundwater Management Act and (b) maintains reliability of water supply for other beneficial uses, including designated wildlife refuges. These flows above existing conditions will be generated through land fallowing, reservoir reoperation and/or demand reduction, and limited use of groundwater substitution. Table J-3 shows the flow contributions from the Sacramento River watershed.

**Table J-3. Contribution of Flow to the Voluntary Agreement in the Sacramento River Watershed**

| Tributary | Season | Source | Application[2] | Flow Contributions (in TAF) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | C | D | BN | AN | W |
| Sacramento | Spring or summer[1] | Land fallowing | Block | | 100 | 100 | 100 | |
| Feather | Spring or summer [1] | Land fallowing | Block | | 50 | 50 | 50 | |
| Yuba | Assume spring likely [1] | Reservoir storage | Block | | 50 | 50 | 50 | |
| American | Spring | Groundwater substitution | Hybrid | 10 | 10 | | | |
| | | Reservoir storage | | | | 10 | 10 | |
| | | Reservoir storage and/or groundwater substitution | | | 10 | | | |
| | | Reservoir storage and/or groundwater substitution | | 20 | 20 | | | |

[1] Flow represents an instream target, Blocks can be scheduled within constraints, and Hybrid represents a combination.
[2] Subject to coordination with California Department of Fish and Wildlife (DFW) (Yuba) or fisheries agencies (Sacramento, Feather)
TAF – Thousand acre-feet

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