ATASCADERO BASIN
Groundwater
Sustainability Agency

Executive Committee Meeting Agenda

Meeting Date: Wednesday, October 2, 2019

Meeting Time: 4:30 p.m.

Meeting Location: Templeton CSD Board Meeting Room
206 5th Street
Templeton, California 93465

1. Call to Order

2. Roll Call

3. Pledge of Allegiance

4. Order of Business
Executive Committee members may request to change the order of business.

5. Introductions

6. General Public Comments
The Executive Committee invites members of the public to address the committee on any subject that is within the purview of the committee and that is not on today's agenda. Comments shall be limited to three minutes.

7. Consent Agenda
The following items are considered routine and non-controversial by staff and may be approved by one motion if no member of the Executive Committee wishes an item removed. If discussion is desired, the item may be removed from the Consent Agenda by an Executive Committee member and will be considered separately. Questions or clarification may be made by the Executive Committee members without removal from the Consent Agenda. Individual items on the Consent Agenda are approved by the same vote that approves the Consent Agenda, unless an item is pulled for separate consideration. Members of the public may comment on the Consent Agenda items.

   a. Minutes: July 10, 2019 — Pages 1 - 3

8. Old Business:

9. New Business:
   a. GSP Section 4, Basin Setting (draft) — Pages 4 - 46
   b. GSP Section 5, Groundwater Conditions (draft) — Pages 47 - 121

c. Request for Future Items
d. Next Meeting: January 8, 2020, 4:30 p.m.

10. Adjournment

ATASCADERO BASIN
Groundwater Sustainability Agency

TO: Executive Committee

FROM: GSA Staff/ John Neil, Atascadero Mutual Water Company

DATE: October 2, 2019

SUBJECT: Agenda Item 7.a, Minutes from July 10, 2019 Meeting

The Executive Committee (Committee) of the Atascadero Basin Groundwater Sustainability Agency (GSA) held a meeting on Wednesday, July 10, 2019, at 4:30 p.m. in the board meeting room of the Templeton Community Services District located at 206 5th Street, Templeton, CA.

Roll Call: Chairperson Roberta Fonzi called the meeting to order at 4:28 p.m. Present at the Committee meeting were Voting Members Fonzi, Vice-chairperson Debbie Arnold, Navid Fardanesh, John Hamon, Robert Jones, Rob Rossi, and Non-Voting Member Tom Mora. A quorum (minimum of 4 voting representatives) of the Committee was established. All Committee members were present.

Introductions: The Committee and audience attendees introduced themselves. Mike Cornelius with GEI Consultants joined the meeting from his Sacramento office via conference call.

Order of Business: The Committee Members reviewed the order of the meeting's agenda and confirmed to conduct the meeting as presented in the agenda.

General Public Comments: Chairperson Fonzi opened public comment and, seeing none, closed public comment.

Consent Agenda:

Agenda 7.a: April 3, 2019, Meeting Minutes – The Committee reviewed the minutes from the April 3, 2019, meeting. No changes were noted. Member Jones motioned to approve the minutes with a second by Member Rossi.
Voice vote of Voting Members: Ayes – All. Nays – none. Motion carried.

Old Business Agenda:

None

New Business Agenda:

Agenda 9.a: Election of Officers – Article 5 of the Memorandum of Agreement (MOA) specifies the annual election of Executive Committee officers, including Chair, Vice Chair, Secretary and Treasurer. The following election activity occurred:

- Member Hamon moved for Member Arnold to serve as Chairperson. Member Jones seconded the motion. A voice vote was unanimous for approval. Chairperson Arnold took the gavel and continued the oversite of the meeting.
- Member Rossi moved for Member Jones to serve as Vice Chairperson. Member Fonzi seconded the motion. A voice vote was unanimous for approval.
- Member Fonzi moved for Member Fardanesh to serve as Secretary. Member Rossi seconded the motion. A voice vote was unanimous for approval.
- Member Jones moved for Member Rossi to serve as Treasurer. Member Fonzi seconded the motion. A voice vote was unanimous for approval.

The meeting continued with the following officers seated to serve the Executive Committee through February 2020:

- Chairperson – Debbi Arnold
- Vice Chairperson – Robert Jones
- Secretary – Navid Fardanesh
- Treasurer – Rob Rossi

Agenda 9.b: GSP Section 3, Description of Plan Area (Draft) – John Neil, General Manager with the Atascadero Mutual Water Company, presented the draft Section 3 of the Groundwater Sustainability Plan (GSP) and advised the Committee that with today's presentation to the Committee, the plan is being released to the public for a 30-day review and comment period. Neil indicated that this is the last of the simple sections of the GSP to be prepared and issued for comment: the next sections will be technical and more complex and will be posted longer for the public's review and comment. The Committee requested adding Garden Farms to this section. The Committee noted the draft Section 3 as being received and no formal motion for action was required.

Agenda 9.c: Stakeholder Survey Results – Neil presented the initial stakeholder survey results from 47 responders to the survey mailed in April. The Committee was encouraged with the citizen's participation in the public outreach. The Committee noted the stakeholder survey results as being received and no formal motion for action was required.

Agenda 9.d: Request for Future Items – The Committee did not offer any suggestions for future agenda items, but did ask that future meetings have PowerPoint presentations.

Adjournment:

Next Meeting: The Committee noted that the next EC meeting will be held on October 2, 2019, at 4:30 p.m. in the board meeting room of the Templeton Community Services District located at 206 5th Street, Templeton, CA.

Adjournment: There being no further business to discuss, Member Hamon moved to adjourn the meeting: Chairperson Arnold closed the meeting at 4:45 p.m.

Submitted by: ______________________________
Committee Member Fardanesh, Secretary

ATASCADERO BASIN
Groundwater
Sustainability Agency

TO: Executive Committee

FROM: GSA Staff/ John Neil, Atascadero Mutual Water Company

DATE: October 2, 2019

SUBJECT: Agenda Item 9.a, GSP Section 4, Basin Setting (draft)

RECOMMENDED ACTION:

Review and comment on the draft of Section 4, Basin Settings, of the Atascadero Basin Groundwater Sustainability Plan (GSP).

DISCUSSION:

Attachment A is a draft of Section 4 of the Atascadero Basin GSP. The draft section was prepared by utilizing existing information that was readily available from the GSA participants, the Department of Water Resources, and other sources.

Much of the information presented in this section was derived from the basin boundary modification application.

There will be a 45-day comment period for Section 4. Stakeholders can review and comment on this section of the GSP using the Atascadero Basin Communication Portal or submit their comments in writing.

All comments received on Section 4 will be considered and incorporated into a fully-assembled draft of the GSP. The fully-assembled draft will be made available for final review and comment by your committee and the basin stakeholders.

FISCAL IMPACT:

Fifty percent of the cost to develop the GSP, including stakeholder engagement, will be funded through a Proposition 1 grant awarded to the GSA by the Department or Water Resources, with the remaining costs being a local match.

ATTACHMENTS:

A. Draft GSP Section 4, Basin Setting

Draft Atascadero Groundwater Sustainability Plan
Atascadero Groundwater Subbasin Section 4

DRAFT October 2019

Prepared for: Atascadero Subbasin Groundwater Sustainability Agency

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Table of Contents

Figures

Tables

4. Basin Setting

This section describes the hydrogeologic conceptual model of the Atascadero Area Groundwater Sub-basin of the Salinas Valley Basin (Basin), including the Basin boundaries, geologic formations and structures, and principal aquifer units. The section also summarizes general Basin water quality, and generalized groundwater recharge and discharge areas. This section draws upon previously published studies, primarily hydrogeologic and geologic investigations prepared by Fugro for the San Luis Obispo County Flood Control and Water Conservation District (SLOCFCWCD) in 2002 and 2005 and the Atascadero Area Subbasin Basin Boundary Modification Application report (BBMR) (Fugro, 2016). All subsequent investigations, including the BBMR, adopted the geologic interpretations of the Fugro 2002 and 2005 reports. The Hydrogeologic Conceptual Model presented in this section is not intended to be exhaustive but is a summary of the relevant and important aspects of the Basin hydrogeology that influence groundwater sustainability. More detailed information can be found in the original reports (Fugro, 2002 and 2005). This section sets the framework for subsequent sections on groundwater conditions and water budgets.

4.1 Basin Topography and Boundaries

The Basin is a narrow structural northwest-trending trough that extends from the Santa Margarita area at its southern end to the City of Paso Robles in the north. The Basin is bounded by the Santa Lucia Range on the west. The ground surface elevation of the Basin ranges from approximately 1,300 feet above mean sea level (msl) in the highlands at the northern tip of the Basin to approximately 700 feet above msl where the Salinas River exits the Basin to the north. The southern tip of the Basin is approximately 1,000 feet msl. The middle part of the Basin forms an elongate narrow valley along the Salinas River, flanked by areas of variable topographic relief. The Basin encompasses an area of approximately 19,800 acres.

Figure 4-1 shows the topography of the Basin using 100-foot contour intervals. The Basin boundary is defined in California Department of Water Resources (DWR) Bulletin 118 (DWR, 2016). It is generally bounded by geologic units with low permeability, sediments with poor groundwater quality, rock, and structural faults. Along a portion of the northeast boundary, sediments of the Basin are continuous with the adjacent Paso Robles Area Groundwater Sub-basin of the Salinas Valley Basin (Paso Robles Basin). Specific Basin lateral boundaries include the following[1]:

- The northwestern, western, and southern boundaries of the Basin are defined by the contact of Basin sediments with older, relatively impermeable geologic units, including

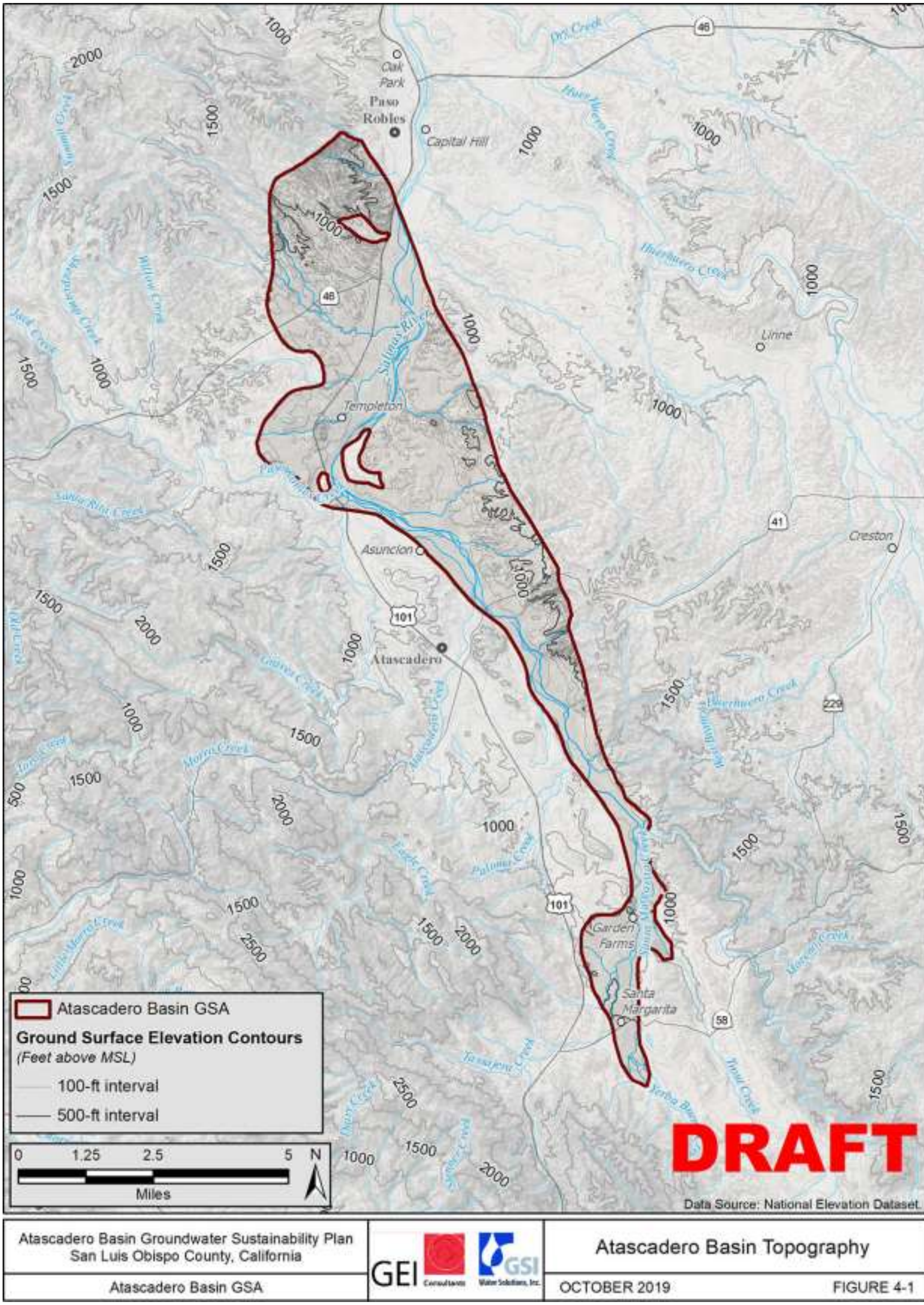
[1] Minor discrepancies between these boundary descriptions and the Bulletin 118 boundary are discussed in Section 4.3

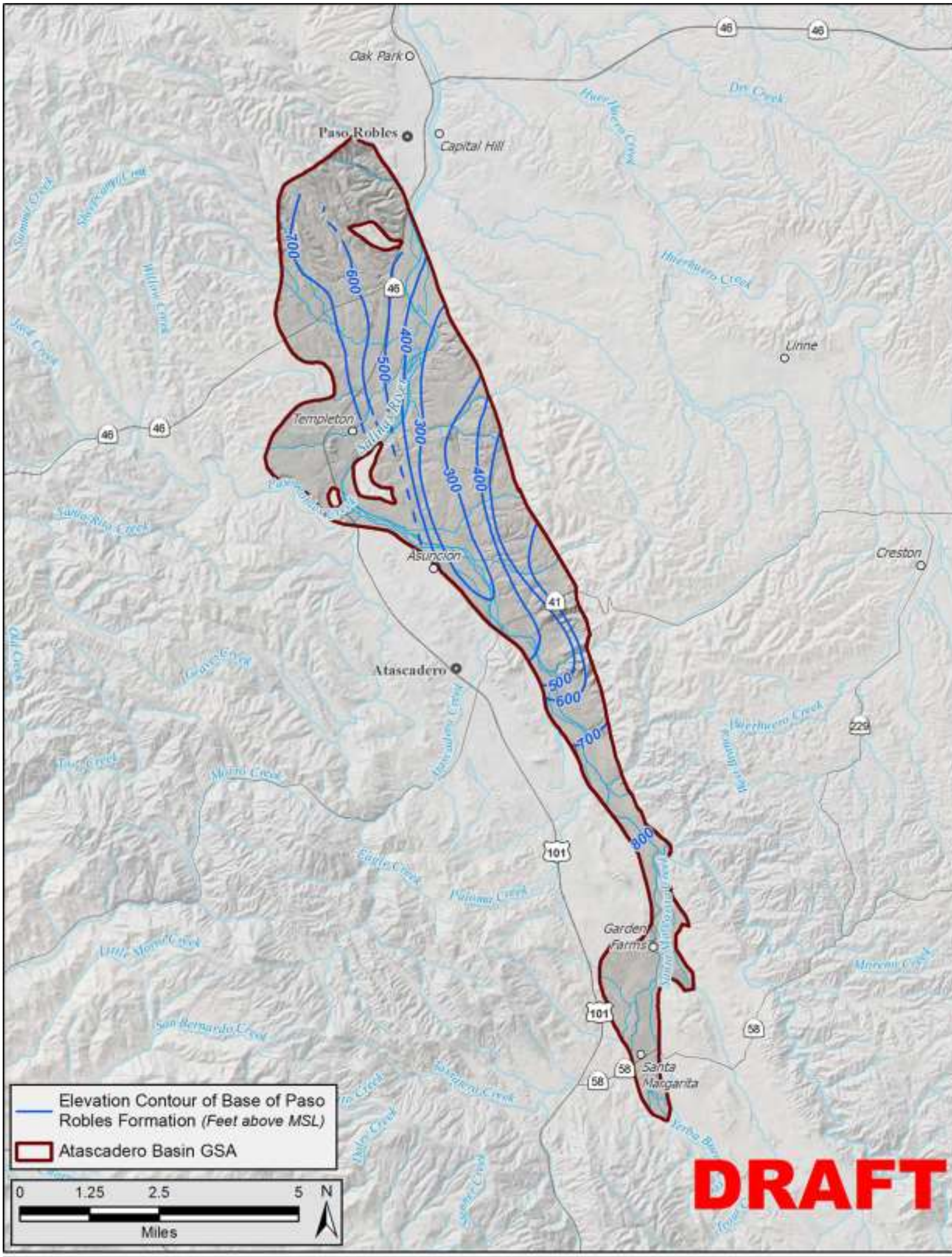
Tertiary-age consolidated sedimentary beds, Cretaceous-age metamorphic rocks, and granitic rock.

- Along the northern portion of the eastern boundary, north of Templeton, the Rinconada Fault defines the eastern boundary of the Basin and is assumed to form a leaky hydraulic barrier between the Paso Robles Basin and the Basin.

- Along the southern portion of the eastern boundary, south of Templeton, between Atascadero and Creston, the Rinconada Fault juxtaposes Monterey Formation rocks and other bedrock units with the Paso Robles Formation basin sediments.

The bottom of the Basin is generally defined as the base of the Paso Robles Formation, which is an irregular surface formed as the result of folding, faulting, and erosion (Fugro, 2002). The exception to this is the Santa Margarita area at the southern end of the Basin. In this area, the bottom of the Basin is defined as the base of the Alluvium. The Basin boundary and bottom are not considered absolute barriers to flow because some of the geologic units underlying the Paso Robles Formation produce sufficient quantities of water, but the water is generally of poor quality and it is therefore not considered part of the Basin. Figure 4-2 shows the lateral boundaries of the Basin and the approximate depth to the bottom of the Basin as defined by the base of the Paso Robles Formation.


Paso Robles
Templeton
Asuncion
Atascadero
Santa Margarita
Garden Farms
Creston
Linne
Capital Hill
Oak Park
Salinas River
Atascadero Basin GSA
Ground Surface Elevation Contours
(Feet above MSL)
100-ft interval
500-ft interval
0 1.25 2.5 5 Miles
N
DRAFT
Data Source: National Elevation Dataset
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
Atascadero Basin Topography
OCTOBER 2019
FIGURE 4-1



Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California

Atascadero Basin GSA

Base of the Basin as Defined by the Base of the Paso Robles Formation

OCTOBER 2019

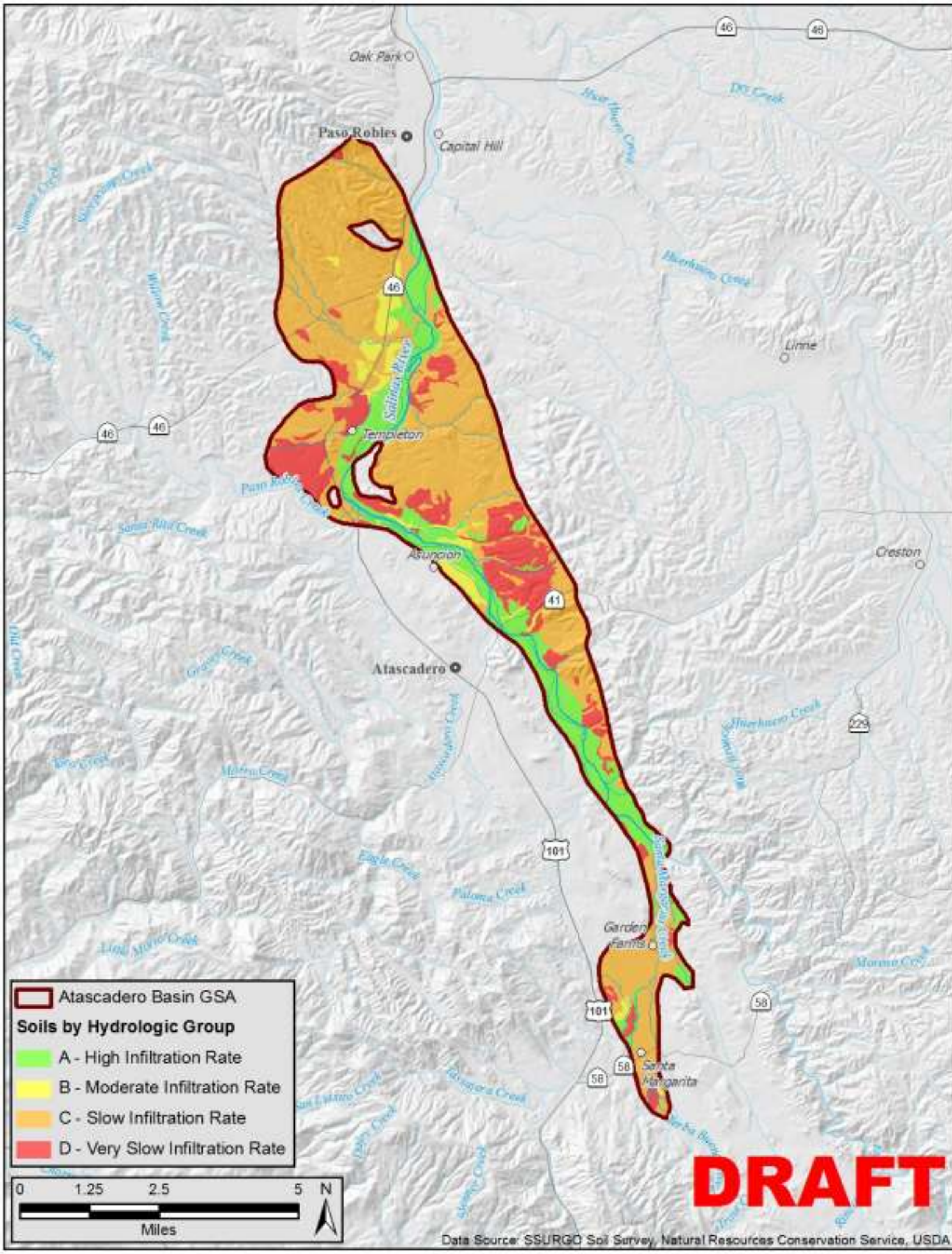
FIGURE 4-2

4.2 Soils Infiltration Potential

Saturated hydraulic conductivity of surficial soils is a good indicator of the soil's infiltration potential. Soil data from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (USDA NRCS, 2007) is shown by the four hydrologic groups on Figure 4-3. The soil hydrologic group is an assessment of soil infiltration rates that is determined by the water transmitting properties of the soil, which includes hydraulic conductivity and percentage of clays in the soil relative to sands and gravels. The groups are defined as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typically less than 10 percent clay and more than 90 percent sand or gravel
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20 percent clay and 50 to 90 percent sand
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40 percent clay and less than 50 percent sand
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soils typically have greater than 40 percent clay, less than 50 percent sand

The hydrologic group of the soil generally correlates with the hydraulic conductivity of underlying geologic units, with lower soil hydraulic conductivity zones correlating to areas underlain by clayey portions of the Paso Robles Formation. The higher soil hydraulic conductivity zones generally correspond to areas underlain by Alluvium, unsaturated Older Alluvium, or areas of coarser sediments within the Paso Robles Formation.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Atascadero Basin Soil Characteristics	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-3

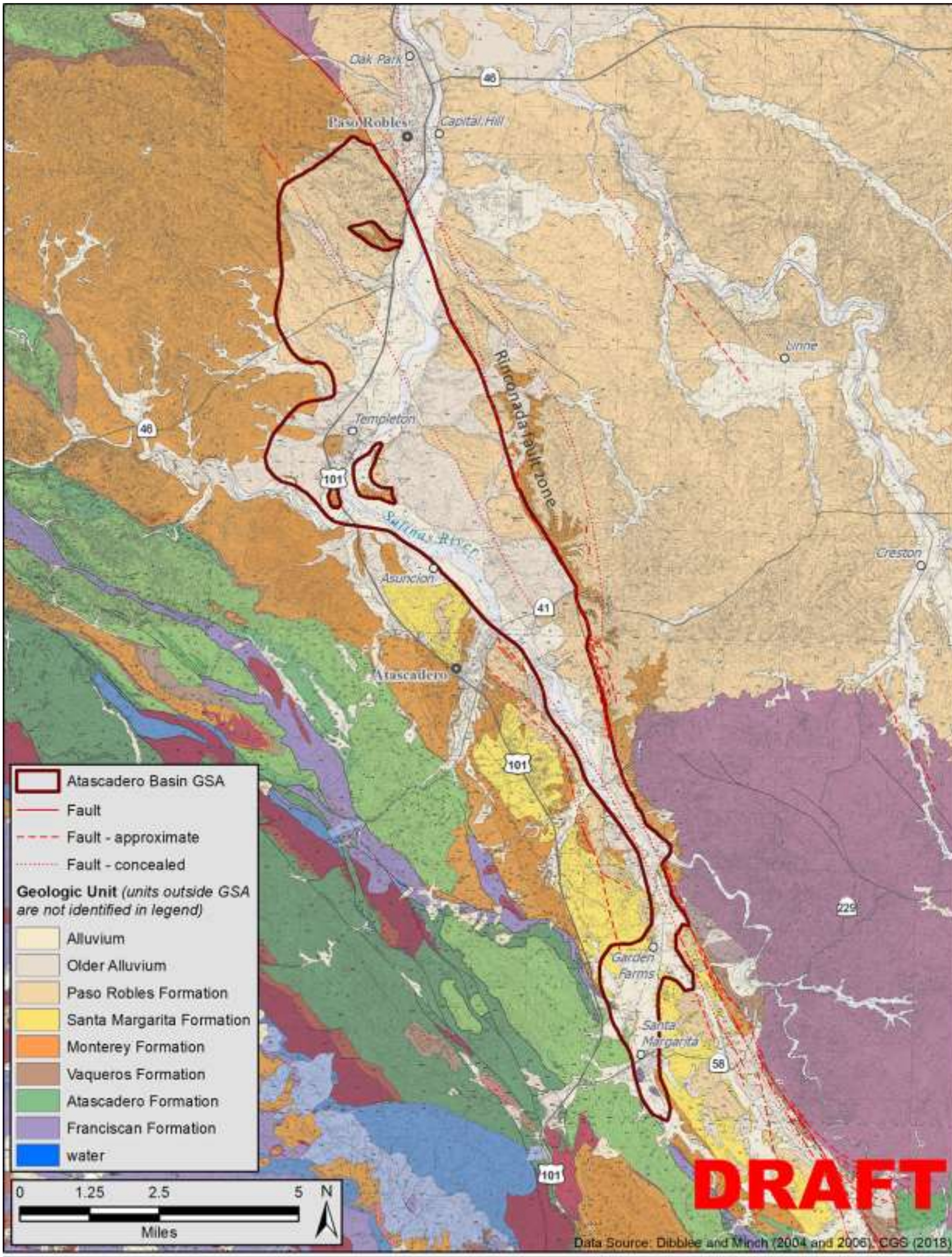
4.3 Regional Geology

This section provides a description of the geologic formations in the Basin. These descriptions are summarized from previously published reports by Fugro (2002 and 2005). Figure 4-4 shows the surficial geology and geologic structures of the Basin (Dibblee and Minch, 2004a,b,c,d,e,f,g,h and 2006a,b,c,d). Figure 4-5 provides the location of the geologic cross-sections shown on Figure 4-6 through Figure 4-10. The selected geologic cross-sections illustrate the relationship of the geologic formations that comprise the Basin and the geologic formations that underlie and bound the Basin. These cross sections shown on Figures 4-6 through 4-9 were directly adopted from the BBMR (Fugro, 2016). The cross section shown on Figure 4-10 includes a majority portion adopted from the BBMR (Fugro, 2016) with an extension of the southern end, completed for this GSP.

4.3.1 *Regional Geologic Structures*

The Basin is a narrow structural northwest-trending trough filled with sediments that have been folded and faulted by regional tectonics. The Basin is bounded on the west by the Santa Lucia Range. Water-bearing sedimentary deposits in the Basin are estimated to be up to approximately 700- to 800-feet thick. Based on inspection of well logs and the base of permeable sediments, the deepest part of the basin is the area between Templeton and the Rinconada Fault (Fugro, 2002) (Figures 4-2 and 4-10).

The northwestern, western, and southern boundaries of the Basin are defined by the contact of Paso Robles Formation sediments with older, relatively impermeable geologic units, including Tertiary-age consolidated sedimentary beds, Cretaceous-age metamorphic rocks, and granitic rock. The Rinconada Fault defines the eastern boundary of the Basin and, along the northern portion of the boundary between the Paso Robles Basin and the Basin, is assumed to form a leaky hydraulic barrier. Between Atascadero and Creston, the Rinconada Fault juxtaposes less permeable granitic and Monterey Formation rocks to the east with the Paso Robles Formation basin sediments west of the fault. Dibblee (1976) suggests that vertical displacement along the Rinconada Fault exists, but the data conflict depending on location. In the fault reach along the boundary of the Atascadero Basin, evidence exists to suggest relative uplift of the northeast block. Dibblee (1976) suggests that the earliest displacement since Miocene time was up on the northeast, then up on the southwest in the late Pleistocene. All evidence indicates that horizontal displacement on the fault is right lateral (Dibblee, 1976; Campion, et al, 1983). The Rinconada Fault is not considered active because it does not displace Holocene-age deposits, but it is considered potentially active because it displaces the Quaternary-age Paso Robles Formation.



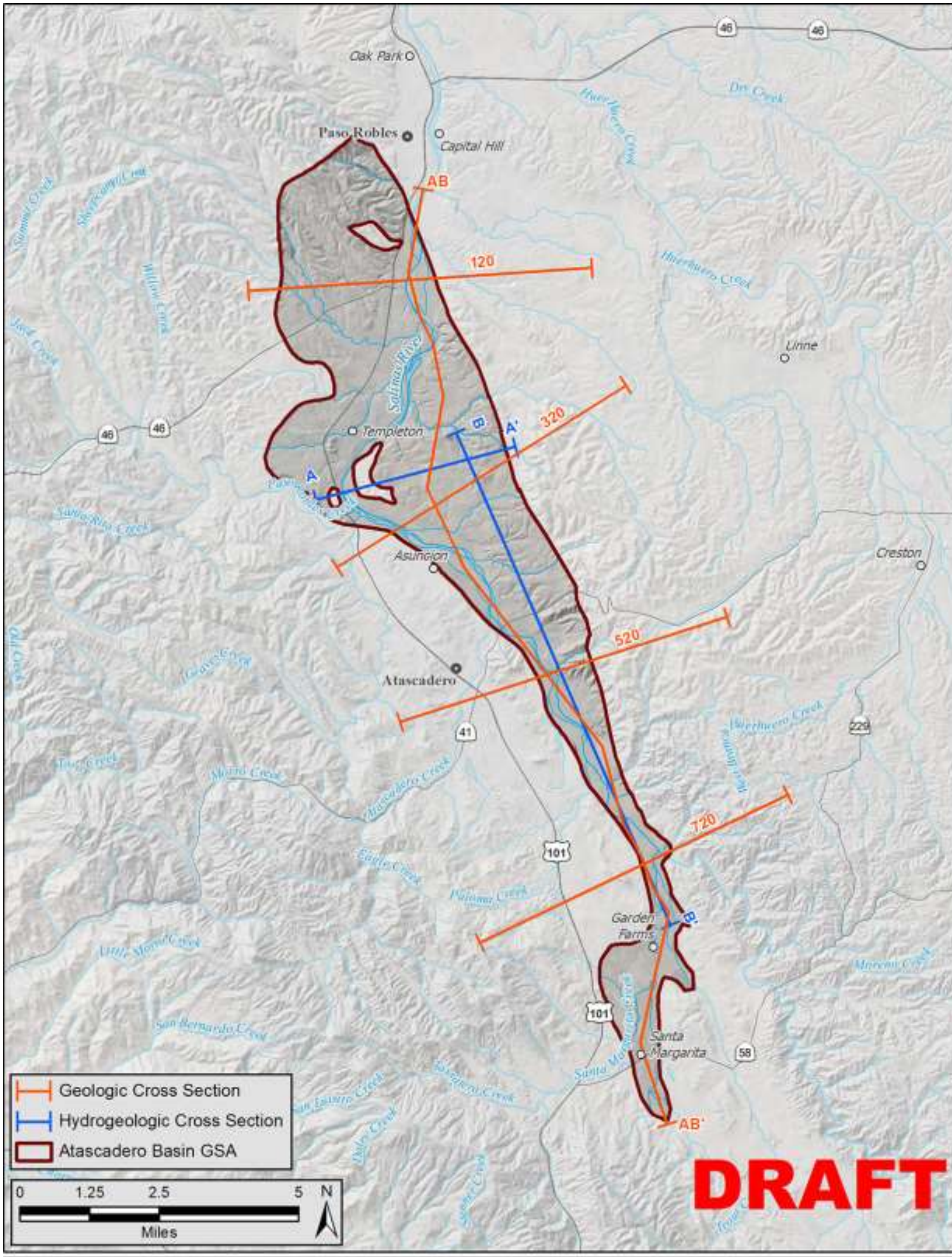
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California

Atascadero Basin GSA

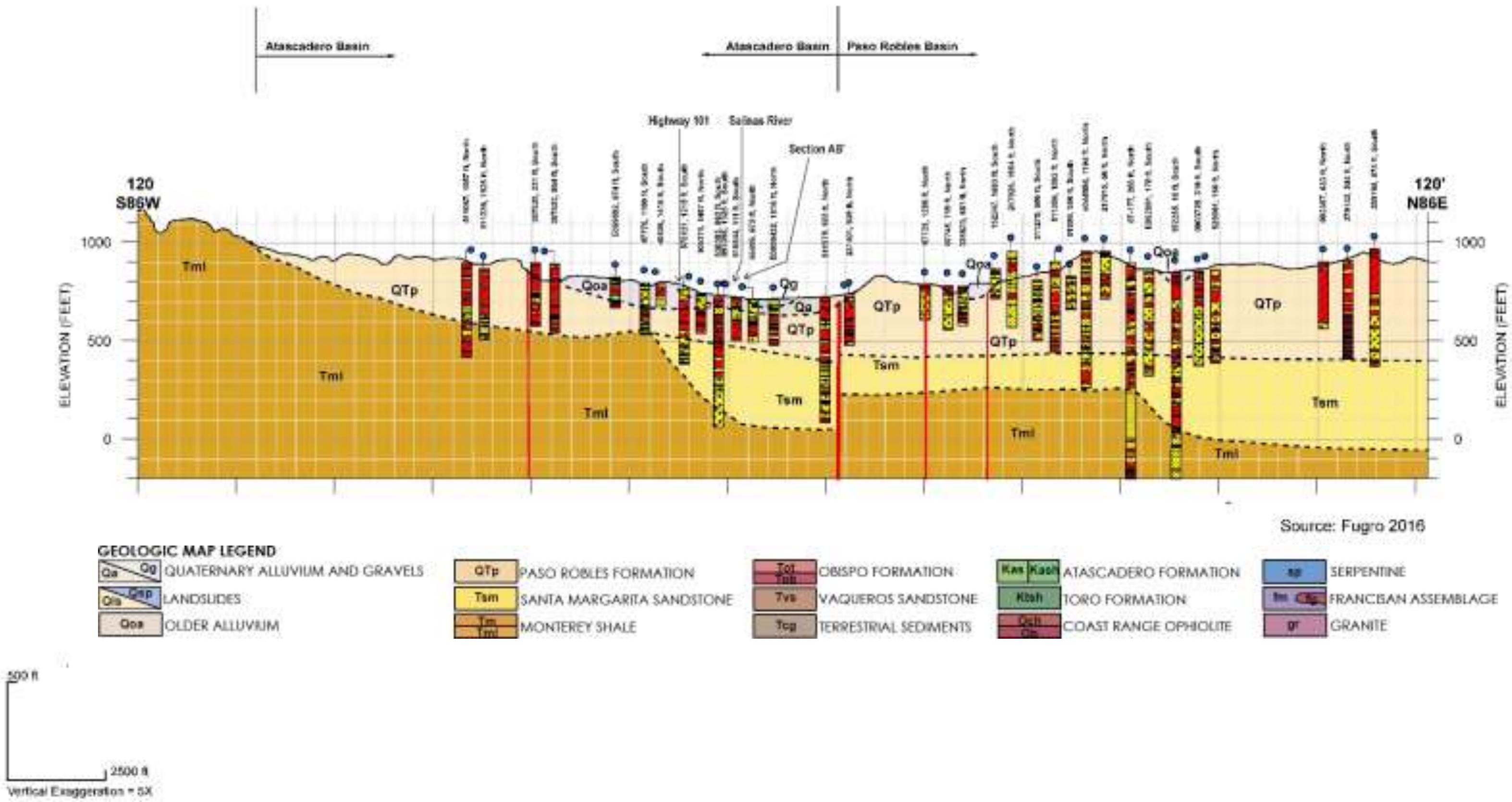
GEI Consultants | GSI Water Solutions, Inc.

Surficial Geology and Geologic Structures

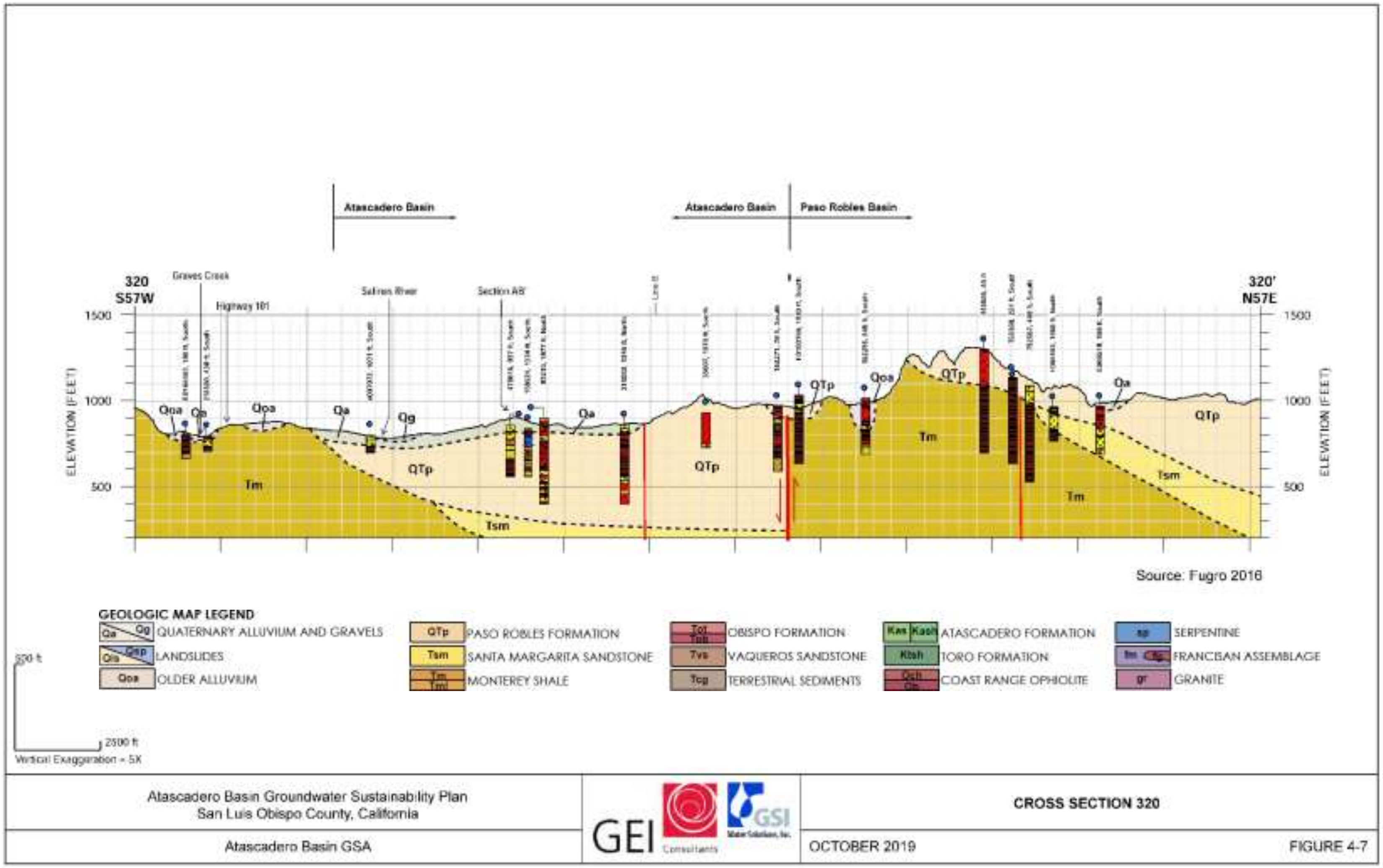
OCTOBER 2019 FIGURE 4-4

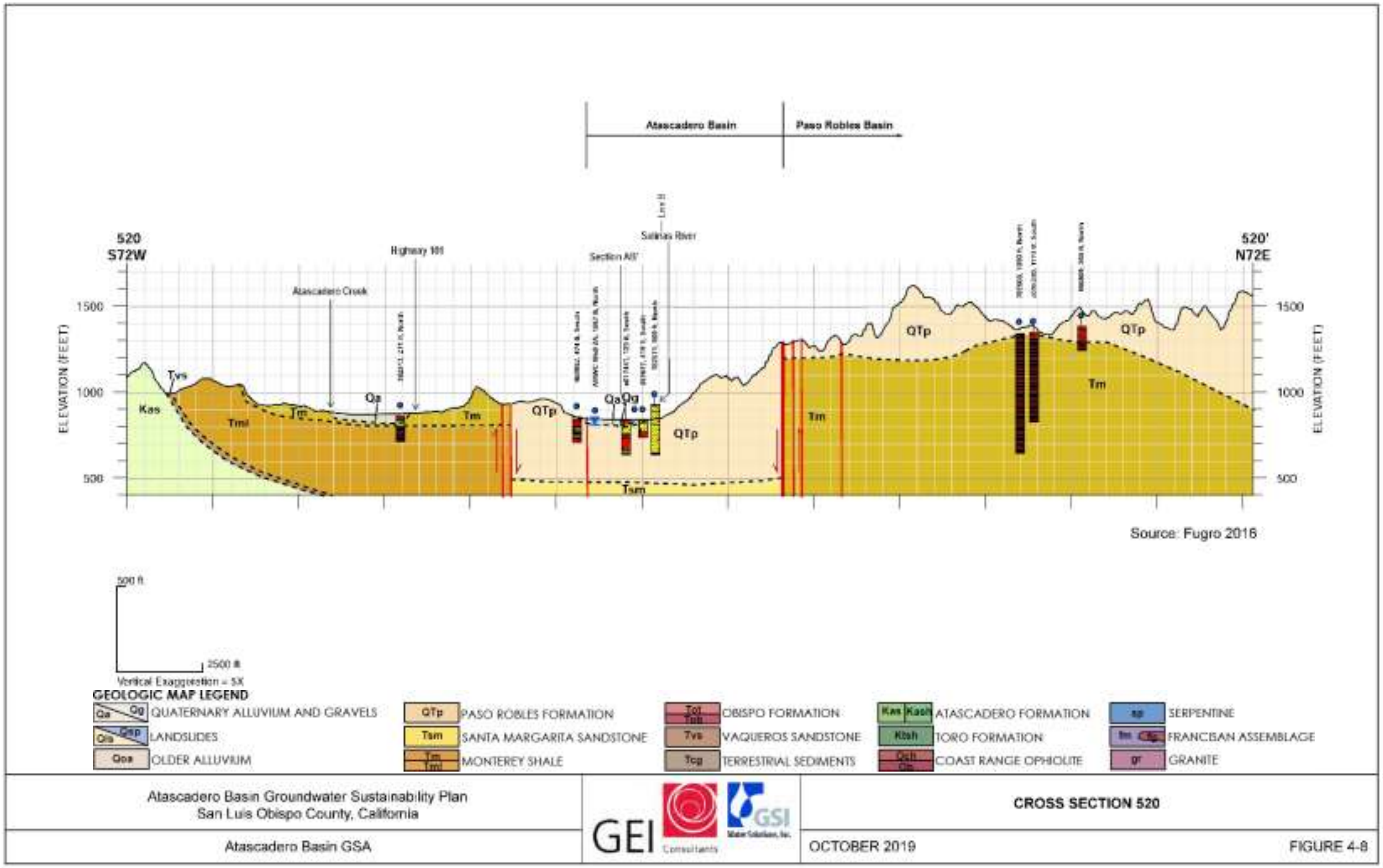


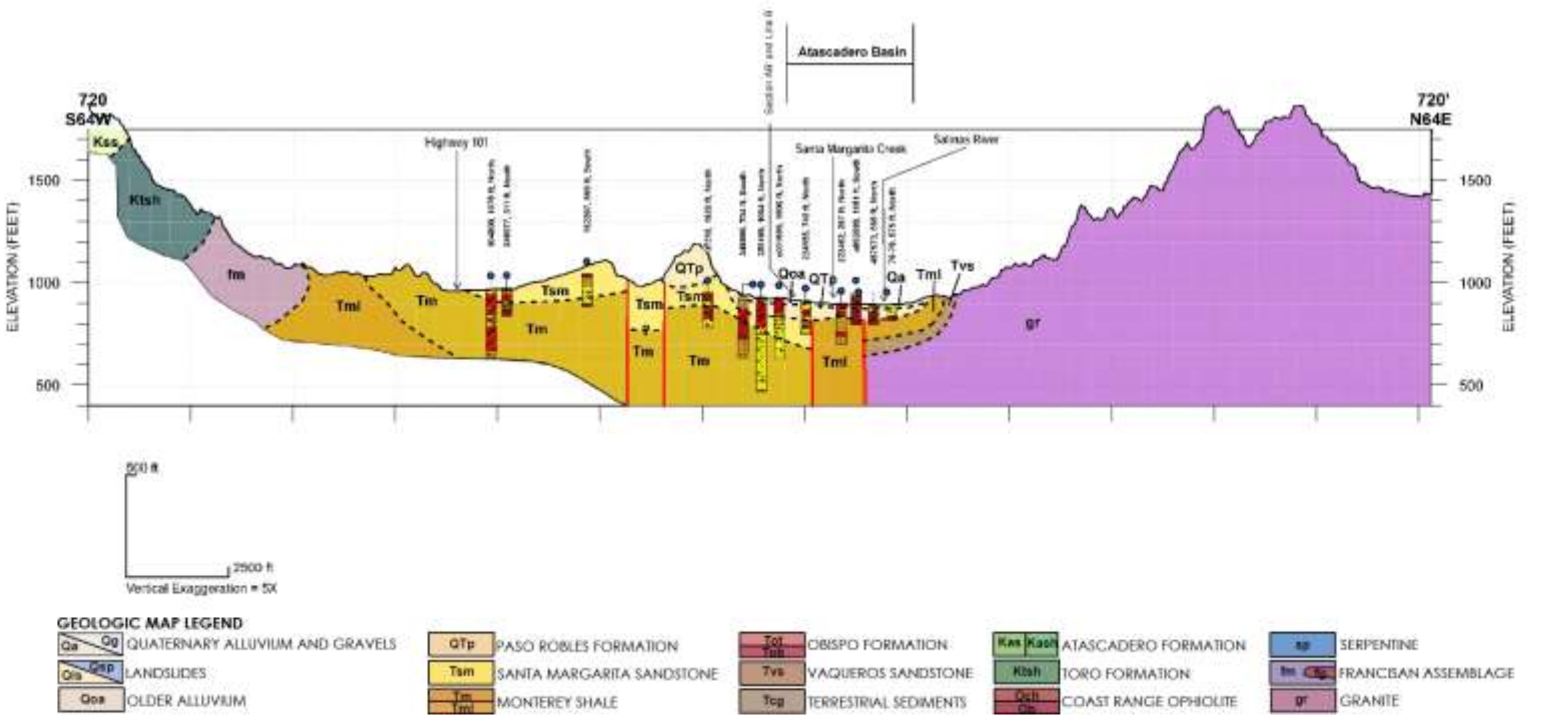
Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Cross Section Locations	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-5



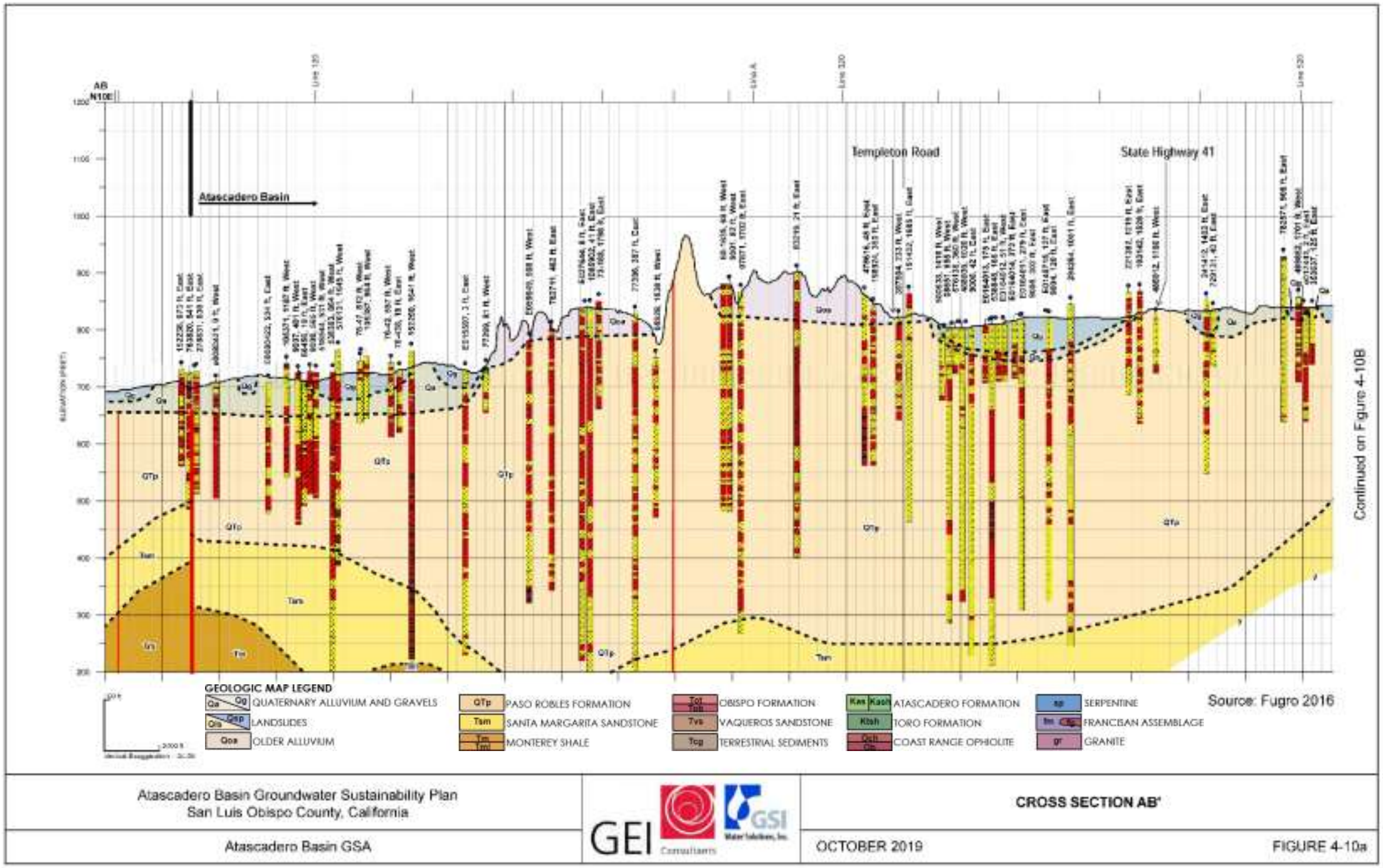
Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	CROSS SECTION 120	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-6

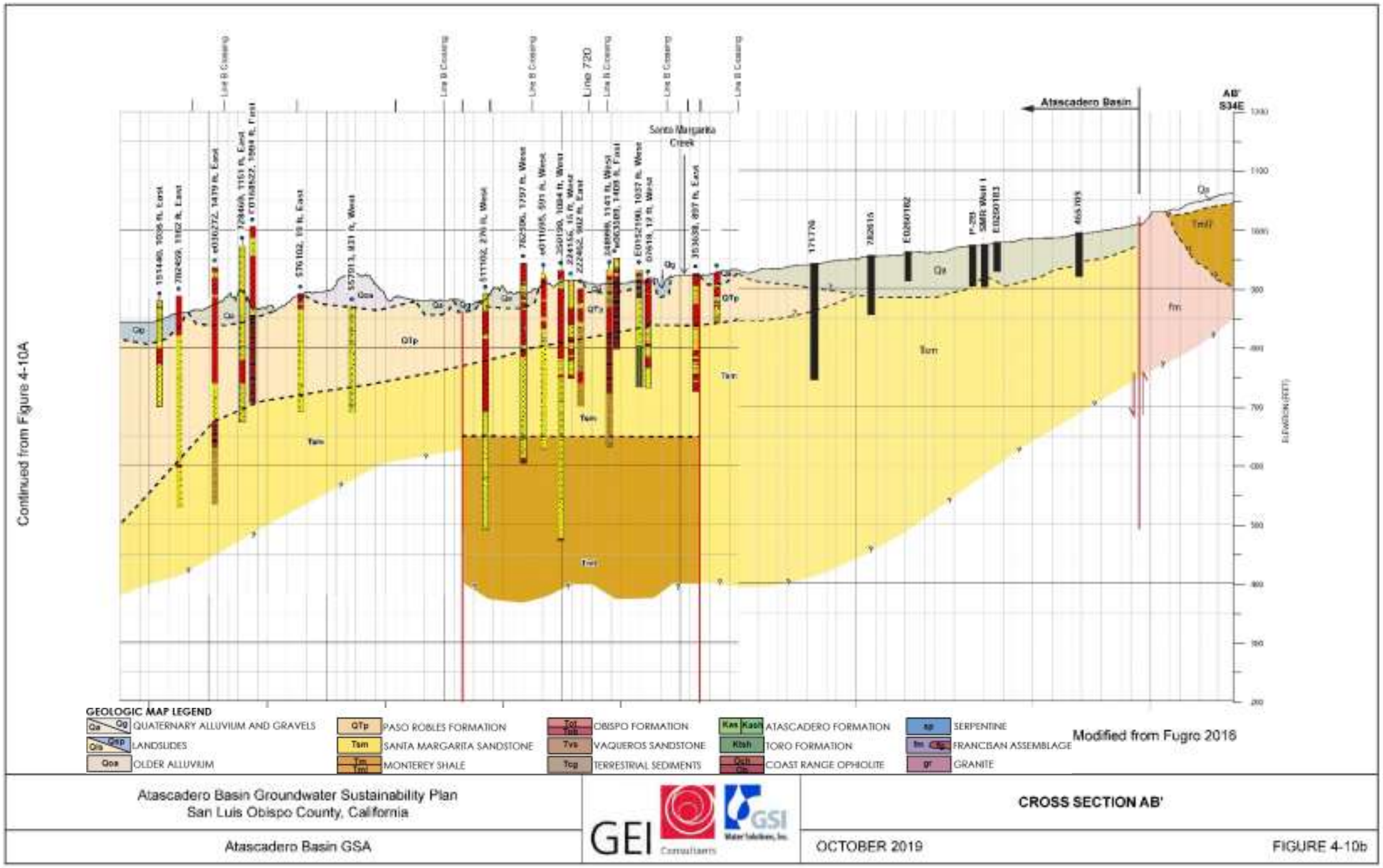

Atascadero Basin
Atascadero Basin
Paso Robles Basin
320
S57W
320'
N57E
Graves Creek
Highway 101
Salinas River
Section AB'
ELEVATION (FEET)
1500
1000
500
Qoa
Qa
Qg
QTp
Tm
Tsm
Source: Fugro 2016
GEOLOGIC MAP LEGEND
QUATERNARY ALLUVIUM AND GRAVELS
LANDSLIDES
OLDER ALLUVIUM
PASO ROBLES FORMATION
SANTA MARGARITA SANDSTONE
MONTEREY SHALE
OBISPO FORMATION
VAQUEROS SANDSTONE
TERRESTRIAL SEDIMENTS
ATASCADERO FORMATION
TORO FORMATION
COAST RANGE OPHIOLITE
SERPENTINE
FRANCISAN ASSEMBLAGE
GRANITE
500 ft
2500 ft
Vertical Exaggeration = 5X
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
GEI Consultants
GSI
CROSS SECTION 320
OCTOBER 2019
FIGURE 4-7


Atascadero Basin
Paso Robles Basin
520
S72W
520'
N72E
Highway 101
Atascadero Creek
Section AB'
Salinas River
ELEVATION (FEET)
1500
1000
500
Kas
Tvs
Tml
Tm
Qa
QTp
Qg
Tsm
Source: Fugro 2016
500 ft
2500 ft
Vertical Exaggeration = 5X
GEOLOGIC MAP LEGEND
QUATERNARY ALLUVIUM AND GRAVELS
LANDSLIDES
OLDER ALLUVIUM
PASO ROBLES FORMATION
SANTA MARGARITA SANDSTONE
MONTEREY SHALE
OBISPO FORMATION
VAQUEROS SANDSTONE
TERRESTRIAL SEDIMENTS
ATASCADERO FORMATION
TORO FORMATION
COAST RANGE OPHIOLITE
SERPENTINE
FRANCISCAN ASSEMBLAGE
GRANITE
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
GEI
GSI
OCTOBER 2019
CROSS SECTION 520
FIGURE 4-8



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	CROSS SECTION 720	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-9


Atascadero Basin
Templeton Road
State Highway 41
Continued on Figure 4-10B
GEOLOGIC MAP LEGEND
QUATERNARY ALLUVIUM AND GRAVELS
LANDSLIDES
OLDER ALLUVIUM
PASO ROBLES FORMATION
SANTA MARGARITA SANDSTONE
MONTEREY SHALE
OBISPO FORMATION
VAQUEROS SANDSTONE
TERRESTRIAL SEDIMENTS
ATASCADERO FORMATION
TORO FORMATION
COAST RANGE OPHIOLITE
SERPENTINE
FRANCISCAN ASSEMBLAGE
GRANITE
Source: Fugro 2016
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
GEI
GSI
CROSS SECTION AB'
OCTOBER 2019
FIGURE 4-10a


Continued from Figure 4-10A
Atascadero Basin
AB'
S34E
Santa Margarita Creek
Line 720
GEOLOGIC MAP LEGEND
QUATERNARY ALLUVIUM AND GRAVELS
LANDSLIDES
OLDER ALLUVIUM
PASO ROBLES FORMATION
SANTA MARGARITA SANDSTONE
MONTEREY SHALE
OBISPO FORMATION
VAQUEROS SANDSTONE
TERRESTRIAL SEDIMENTS
ATASCADERO FORMATION
TORO FORMATION
COAST RANGE OPHIOLITE
SERPENTINE
FRANCISCAN ASSEMBLAGE
GRANITE
Modified from Fugro 2016
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
GEI Consultants
GSI Water Solutions, Inc.
CROSS SECTION AB'
OCTOBER 2019
FIGURE 4-10b

4.3.2 *Geologic Formations within the Basin*

The stratigraphy in the watershed of the Basin includes the water-bearing geologic units that form the basin aquifer, and the non-water bearing geologic units that underlie and are adjacent to the basin sediments. Figure 4-4 shows the extent of the geologic formations described in the following paragraphs[2]. Descriptions of the water bearing and some of the non-water bearing geologic formations are provided below, including hydrogeologic characterizations of each formation. In addition, the critical structural features within and bounding the basins are identified.

The main criteria for defining the water bearing geologic formations in the Basin are that they exhibit both sufficient permeability and storage potential for the movement and storage of groundwater such that wells can reliably produce more than 50 gallons per minute (gpm) on a long-term basis (Fugro, 2016). Another criterion is that the groundwater produced from the geologic formation must have generally acceptable quality. DWR (1979) used groundwater conductivity of 3,000 micromhos/centimeter as the maximum limit for basin groundwater quality. Application of these two criteria limits definition of the basin sediments to Quaternary-age alluvial deposits and the Plio-Pleistocene-age Paso Robles Formation.

4.3.2.1 Alluvium

The Alluvium (Qa) consists of alluvial (river or stream-related) deposits occurring beneath the flood plains of the rivers and streams within the Basin. These deposits reach a depth of about 100 feet or less below ground surface (bgs) and are typically comprised of coarse sand and gravel. The Alluvium is generally much coarser than the Paso Robles Formation sediments, with higher permeability that results in well production capability that often exceeds 1,000 gpm. One of the principal areas of groundwater recharge to the basin occur where the shallow alluvial sand and gravel beds are in direct contact with the Paso Robles Formation.

4.3.2.2 Older Alluvium

Numerous deposits of Older Alluvium are located throughout the Basin (Figure 4-4). These deposits are terraces of dissected older alluvial sands and gravels. They are unsaturated and therefore are not considered a principal aquifer unit within the Basin.

[2] Figure 4-4 includes the Basin boundary as defined by DWR Bulletin 118 (Bulletin 118 boundary) (DWR, 2016). As shown on Figure 4-4, the Bulletin 118 boundary does not everywhere include the full lateral extent of Basin sediments (described in Section 4.3.2) and the Bulletin 118 boundary also occasionally includes older, relatively impermeable non-Basin geologic units (described in Section 4.3.3). These discrepancies between the Bulletin 118 boundary and the surficial geology presented in Figure 4-4 are generally minor and may be corrected in a future BBMR.

4.3.2.3 Paso Robles Formation

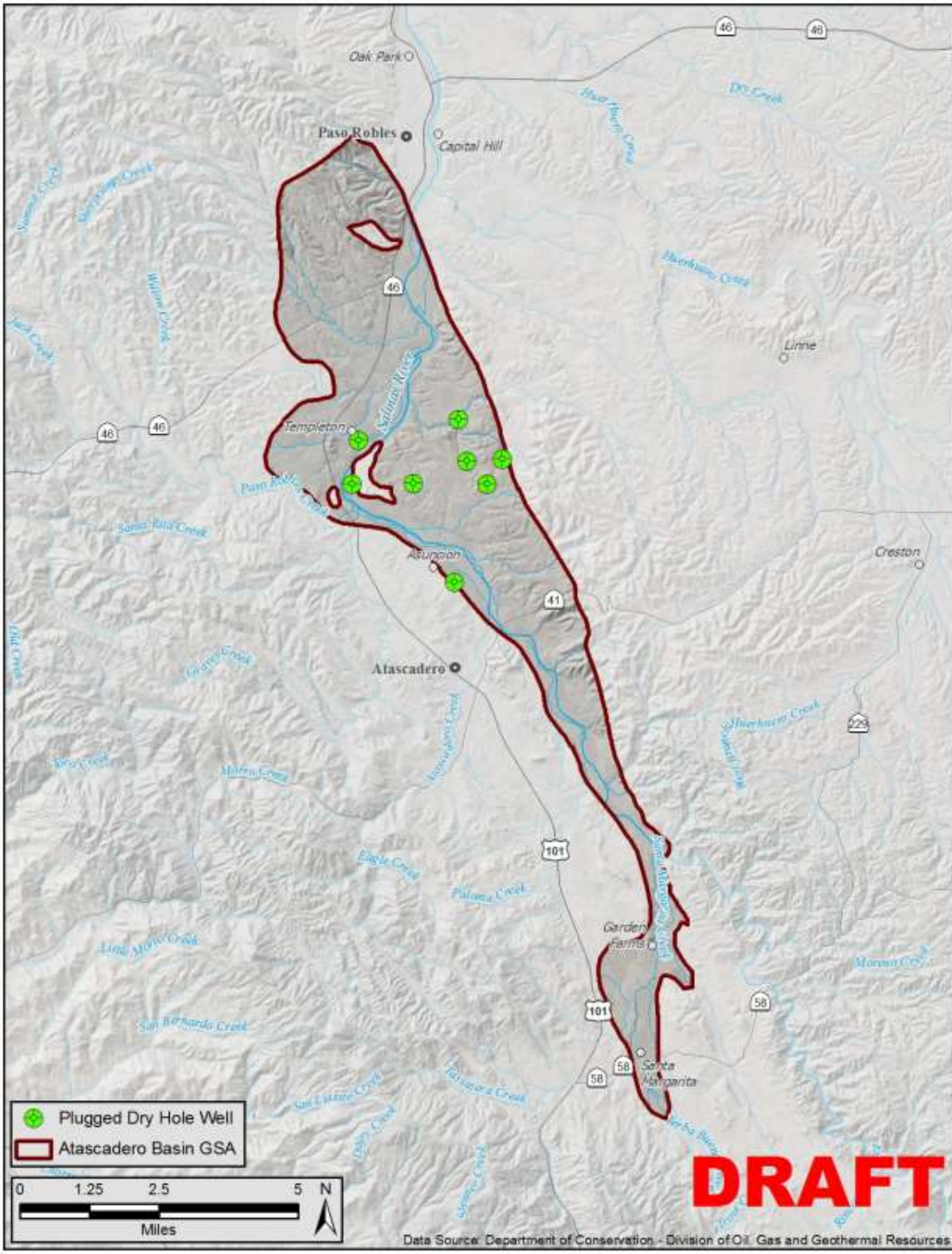
The Basin is comprised predominantly of Paso Robles Formation (QTp) sedimentary layers that extend from the ground surface, or the base of Alluvium, to approximately 700- to 800-feet thick in some areas of the Basin. The Paso Robles Formation is a Plio-Pleistocene, predominantly non-marine geologic unit comprised of relatively thin, often discontinuous sand and gravel layers interbedded with thicker layers of silt and clay. It was deposited in alluvial fan, flood plain, and lake depositional environments. Seashells are reported in some well logs near the base of the Paso Robles Formation, suggesting a near-shore marine depositional environment. The formation is unconsolidated and generally poorly sorted. It is not usually intensely deformed, except locally near fault zones. The sand and gravel beds within the unit have a high percentage of Monterey shale gravel fragments and generally have moderately lower permeability compared to the shallow, unconsolidated alluvial sand and gravel beds. The formation is typically sufficiently thick such that water wells generally produce several hundred gpm. In the area near Atascadero, the Paso Robles Formation has been folded, exposing the basal gravel beds. With the basal gravel exposed and in direct contact with the shallow alluvium, the Paso Robles Formation is recharged directly from the river alluvium (Fugro, 2016).

4.3.3 *Geologic Formations Surrounding the Basin*

Underlying the Basin sedimentary beds are older geologic formations that typically have lower permeability and/or porosity. In some cases, these older beds occasionally yield flow in excess of 50 gpm to wells, but wells drilled into these units are also often dry or produce groundwater less than 10 gpm. Generally, the water quality from the bedrock units is poor. In general, the geologic units underlying the basin include Tertiary-age consolidated sedimentary beds, Cretaceous-age metamorphic rocks, and granitic rock.

Figure 4-11 shows the location of oil and gas exploration wells drilled in the Basin. All of these oil and gas exploration wells were dry holes that were subsequently plugged. These oil and gas wells help identify the depth and extent of the geologic formations that surround and underlie the Basin.

The Tertiary-age older consolidated sedimentary formations include the Santa Margarita Formation, the Monterey Formation, and the Vaqueros Formation. These units crop out predominantly on the western edge of the Basin (Figure 4-4) and underlie the basin sediments.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Oil and Gas Wells in Atascadero Basin	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-11

4.3.3.1 Santa Margarita Formation

The Santa Margarita Formation (Tsm) is an upper Miocene-age marine deposit, consisting of a white, fine-grained sandstone and siltstone with a thickness of up to 1,400 feet regionally. The unit is found beneath most of the basin. The Santa Margarita Formation crops out in the Santa Margarita area where many domestic water wells depend on its very limited flow capabilities. It is also a host to a number of springs. South of Templeton, water produced from the Santa Margarita Formation is often of acceptable water quality. However, north of Templeton in the area south of the City of Paso Robles, the unit becomes progressively more permeable and is the main reservoir for the historical presence of geothermal water. Groundwater in the geothermal areas is often under pressure and artesian flow is a common occurrence, with flow rates at times exceeding 400 gpm. The Santa Margarita Formation aquifer is not considered part of the Basin because the produced water quality is usually very poor and because it is relatively impermeable in many areas in the vicinity of the Basin. The geothermal waters contained in the Santa Margarita Formation in this area are often highly mineralized and characterized by elevated boron concentrations that restrict agricultural uses.

4.3.3.2 Monterey Formation

The Miocene-age Monterey Formation (Tm/Tml) consists of interbedded argillaceous and siliceous shale, sandstone, siltstone, and diatomite. The unit outcrops in the highlands surrounding the Basin and generally forms the adjacent bedrock unit, stratigraphically below the Paso Robles Formation, on the western edge of the Basin. Regionally, the unit thickness is as great as 2,000 feet, and the unit is often highly deformed. Water wells completed in the Monterey Formation are occasionally productive if a sufficient thickness of highly deformed and brittle siliceous shale is encountered. More often, however, the Monterey shale produces groundwater to wells in very low quantities. Springs issue from the Monterey Formation in the Atascadero area and on Cuesta Ridge south of the Basin. North of the Basin, the Monterey Formation can also be a source for oil in the area near Hames Valley, downstream of Lake San Antonio, and in upper Indian Valley. Groundwater produced from the Monterey Formation often has high concentrations of hydrogen sulfide, total organic carbon, and manganese. In the Paso Robles area, the Monterey Formation may be a host to geothermal water that has high sulfide concentrations in addition to high boron, iron, manganese, and total dissolved solids.

4.3.3.3 Vaqueros Formation

The marine Oligocene-age Vaqueros Formation (Tv) is a highly cemented fossiliferous sandstone that reaches a thickness up to 200 feet. Springs with flows up to 25 gpm are common in canyons where the Vaqueros Formation is exposed in the Santa Lucia Range. Most water wells tapping this formation produce less than 20 gpm. Generally, the quality of water in this unit is good, though hard due to the calcareous cement within the rock.

4.3.3.4 Metamorphic and Granitic Rocks

Portions of the southern and eastern edges of the Basin are bordered by Cretaceous-age metamorphic and granitic rock. The metamorphic rock units include the Franciscan, Toro, and Atascadero formations. The Franciscan Formation (fm) consists of discontinuous outcrops of shale, chert, metavolcanics, graywacke, and blue schist, with or without serpentinite. The Franciscan Formation has an undetermined thickness and has low permeability and porosity. Limited volumes of groundwater can be produced from this geologic unit, generally only where the metavolcanics rock has been highly fractured.

The Toro Formation (Ktsh) is a highly consolidated claystone and shale that does not typically yield significant water to wells. The Atascadero Formation (Kas) is highly consolidated but does have some sandstone beds that yield limited amounts of water to wells. Both the Toro and Atascadero formations are exposed in the Santa Lucia Range west of Santa Margarita, Atascadero, and Templeton.

The granitic rock (gr) lies east of the Rinconada Fault zone, east of the City of Atascadero. The Park Hill area south of Creston and east of Atascadero is well known for the difficulty of finding sufficient groundwater to serve single residences. Where water is found, it is typically low in salinity. The granitic rocks often have a decomposed regolith up to 80 feet in thickness in the valley floor areas that may contain limited amounts of groundwater despite low sediment permeability due to the breakdown of feldspar and iron and magnesium silicates into clays and fine-grained sediment. Springs are occasionally found where the rock is fractured.

4.4 Principal Aquifers and Aquitards

Water-bearing sand and gravel beds that may be laterally and vertically discontinuous are generally grouped together into zones that are referred to as aquifers. The aquifers can be vertically separated by fine-grained zones that can impede movement of groundwater between aquifers. Two aquifers exist in the Basin:

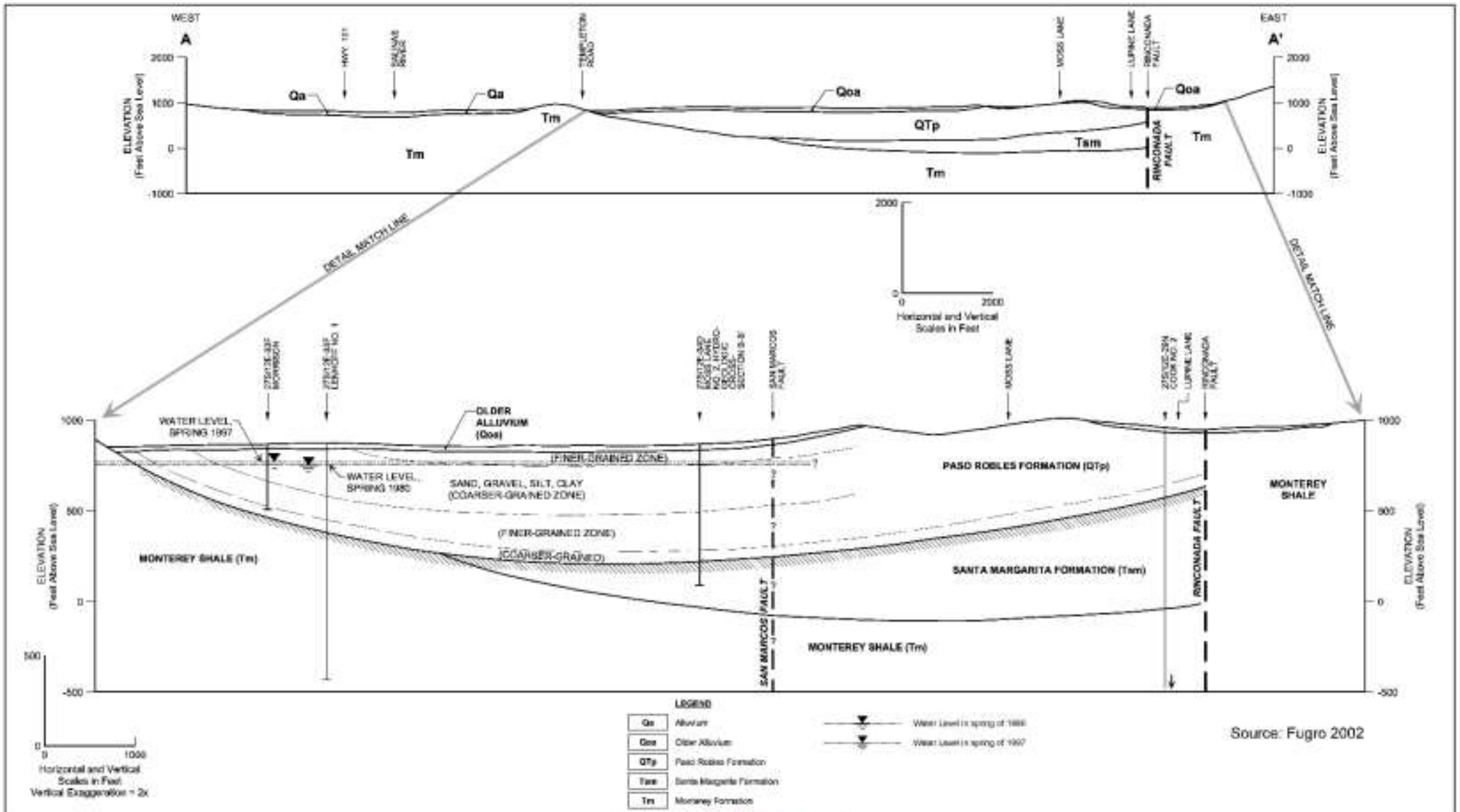
- **Alluvial Aquifer** – A relatively continuous aquifer comprising alluvial sediments that underlie the Salinas River and tributary streams;
- **Paso Robles Formation Aquifer** – An interbedded aquifer comprised of sand and gravel lenses in the Paso Robles Formation.

There are no formally defined or laterally continuous aquitards within the Basin. However, the upper portions of the Paso Robles Formation often contain thin, discontinuous clay layers interbedded with sand and “shale gravels” that can act as a leaky confining layer. These upper clay layers are generally pervasive throughout the Basin. In the Templeton area from Graves Creek to approximately Highway 46, the contact between the Alluvial Aquifer and the Paso Robles Formation Aquifer is characterized by a thick (60 feet) clay-rich aquitard that forms a hydraulic barrier to vertical groundwater flow, effectively separating the Alluvial Aquifer from the Paso Robles Formation Aquifer (Torres, 1979). Two areas where the Paso Robles Formation Aquifer is known to be in direct communication with the overlying Alluvial Aquifer, that is, there is little to no clay-rich confining layer, include:

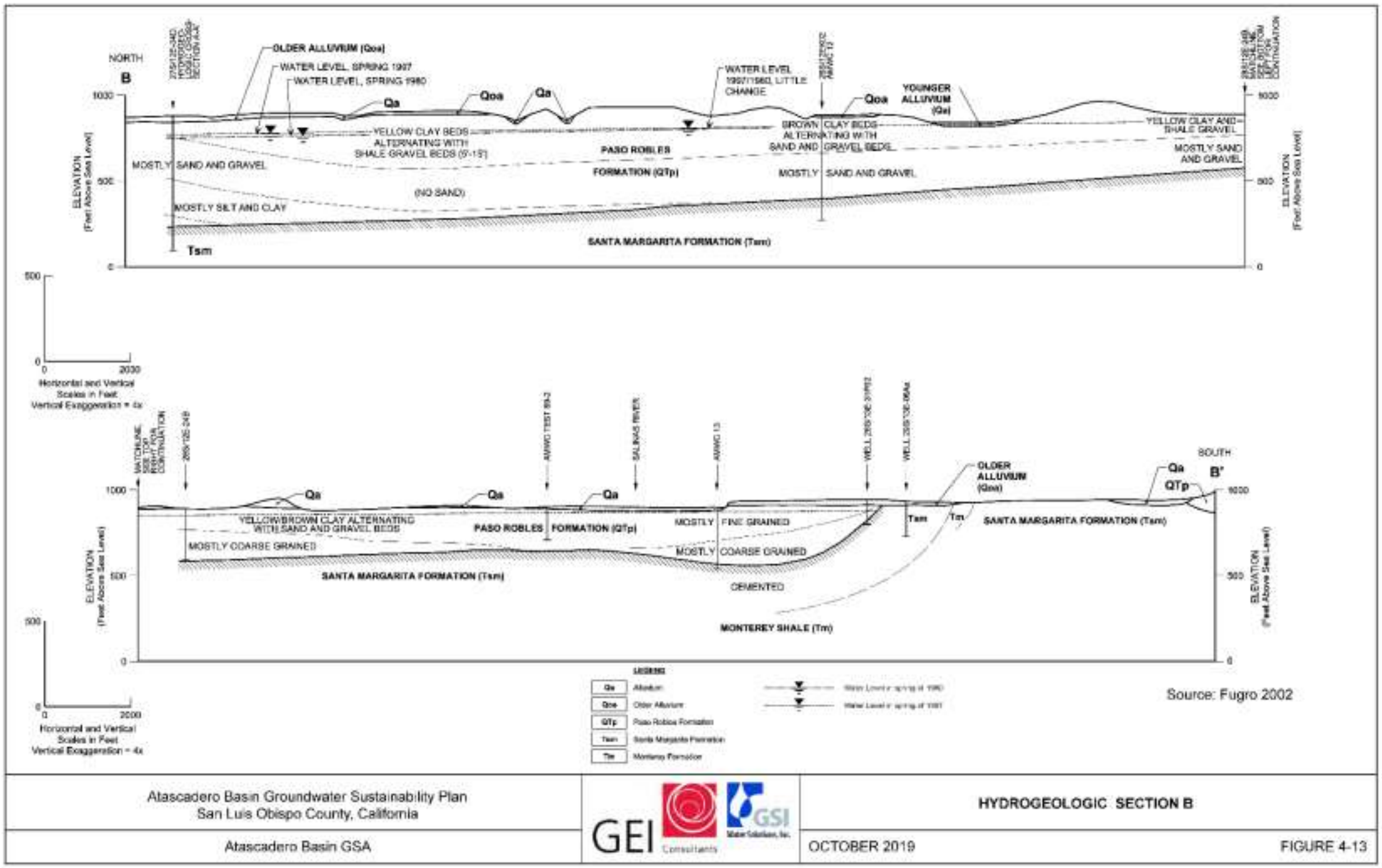
1. The Atascadero area, along the Salinas River corridor from approximately the Highway 41 crossing downstream to the confluence with Paso Robles Creek ("Jack Creek"), and

2. The area north of Templeton, along the Salinas River corridor from approximately the junction of Highway 46 and US Highway 101 north to the Rinconada Fault.

Figure 4-5 shows the location of hydrogeologic sections that were used to depict the aquifers in the subsurface. Figure 4-12 and Figure 4-13 show the aquifers in profile, which are interpreted from the geologic logs, geophysical logs, groundwater levels, and water quality (Fugro, 2002 and 2005).



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	HYDROGEOLOGIC SECTION A
Atascadero Basin GSA		OCTOBER 2019 — FIGURE 4-12


NORTH
B
OLDER ALLUVIUM (Qoa)
WATER LEVEL, SPRING 1997
WATER LEVEL, SPRING 1980
Qa
Qoa
WATER LEVEL 1997/1980, LITTLE CHANGE
YOUNGER ALLUVIUM (Qa)
YELLOW CLAY BEDS ALTERNATING WITH SHALE GRAVEL BEDS (5'-15')
PASO ROBLES FORMATION (QTp)
BROWN CLAY BEDS ALTERNATING WITH SAND AND GRAVEL BEDS
YELLOW CLAY AND SHALE GRAVEL
MOSTLY SAND AND GRAVEL
(NO SAND)
MOSTLY SILT AND CLAY
SANTA MARGARITA FORMATION (Tsm)
Tsm
ELEVATION (Feet Above Sea Level)
Horizontal and Vertical Scales in Feet
Vertical Exaggeration = 4x
YELLOW/BROWN CLAY ALTERNATING WITH SAND AND GRAVEL BEDS
PASO ROBLES FORMATION (QTp)
MOSTLY FINE GRAINED
MOSTLY COARSE GRAINED
CEMENTED
MONTEREY SHALE (Tm)
SOUTH
B'
QTp
Tm
SANTA MARGARITA FORMATION (Tsm)
LEGEND
Qa Alluvium
Qoa Older Alluvium
QTp Paso Robles Formation
Tsm Santa Margarita Formation
Tm Monterey Formation
Source: Fugro 2002
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
HYDROGEOLOGIC SECTION B
OCTOBER 2019
FIGURE 4-13

4.4.1 *Aquifer Characteristics*

Fugro (2002) reviewed the results of several pumping tests performed on wells completed in the Alluvial Aquifer and the Paso Robles Formation Aquifer throughout the Basin. The aquifer characteristics of each unit are summarized below, and presented in Table 1.

4.4.1.1 Alluvial Aquifer

Water wells penetrating and extracting groundwater from the Alluvial Aquifer are located along the Salinas River and its tributaries, including within the Santa Margarita area. The unit, consisting almost entirely of sand and gravel, is everywhere unconfined with high to very high transmissivity values. The thickness of the Alluvium ranges widely, with an estimated maximum thickness of 75 to 90 feet. Specific capacity values for wells in the Alluvium range from 20 to 60 gallons per minute per foot (gpm/ft) at production rates as high as 1,000 gpm (Fugro, 2002) (Table 1). Overall, within the Basin, the geometric mean hydraulic conductivity of the Alluvial Aquifer is estimated at 481 ft/day (Fugro, 2002).

4.4.1.2 Paso Robles Formation Aquifer

In the Atascadero area and the area north of Templeton, the Paso Robles Formation Aquifer underlies and is in direct hydraulic contact with the Alluvial Aquifer along the Salinas River channel. Wells in the Paso Robles Formation Aquifer in hydraulic communication with the overlying Alluvium tend to have higher transmissivity values than wells that penetrate the portions of the Paso Robles Formation not in contact with the Alluvium. Constant discharge aquifer pumping tests for wells in Atascadero on the west side of the Salinas River showed production rates up to 1,300 gpm, with an average specific capacity of 15 gpm/ft (Fugro, 2002) (Table 1).

Elsewhere in the Basin the upper 300 feet or so of the Paso Robles Formation is characterized by thin (5 feet to 15 feet thick) interbedded brown or yellow clays with sand and "shale gravel", as described above. The beds tend to be thicker below 300 feet, with an increasing proportion of sand and gravel. The results of several controlled aquifer pumping tests were reviewed for wells in the Paso Robles Formation Aquifer, including wells in both the Templeton and Atascadero areas. None of these wells were in direct hydraulic communication with the Alluvial Aquifer. The specific capacity in these wells ranged from 0.9 to 5.7 gpm/ft at pumping rates of 110 to 810 gpm (Table 1). Overall, within the Basin, the geometric mean hydraulic conductivity of the Paso Robles Formation Aquifer is estimated at 8.6 ft/day and the storativity ranges from 0.04 to 0.0001 (Fugro 2002).

Table 4-1. Atascadero Basin Aquifer Properties

Well Location	Test (hours)	Flow (gpm)	Well Depth (ft)	Perf. Int. (ft)	Trans. (gpd/ft)	Q/s (gpm/ft)	Hyd. Cond. (ft/day)	Storativity	Aquifer of Completion
28S/12E-5	8	90	55	30	101,106	110	450.6		Qa
27S/12E-29	24	740	60	25	650,000	105	3475.9		Qa
27S/12E-31	20	220	60	20	24,200	27.2	161.8		Qa
27S/12E-31	24	15	25	10	15,840	7.1	211.8		Qa

Well Location	Test (hours)	Flow (gpm)	Well Depth (ft)	Perf. Int. (ft)	Trans. (gpd/ft)	Q/s (gpm/ft)	Hyd. Cond. (ft/day)	Storativity	Aquifer of Completion
28S/12E-03	72	1300	425	270	45,760	17.6	22.7		QTp
28S/12E-03	72	1300 (obs)	505	332	45,760	na (obs)	18.4	0.04	QTp
28S/13E-31a	12	1000	450	300	52,800	11.5	23.5		QTp
28S/13E-31b	12	950 (obs)	450	300	36,000	na (obs)	16	0.0002	QTp
28S/13E-31c	24	1000	330	120	22,000	14.5	24.5		QTp
28S/13E-31d	24	1000 (obs)	320	87	26,400	na (obs)	40.6	0.0001	QTp
28S/13E-31e	24	1000 (obs)	310	283	--	na (obs)	146.4	0.004	QTp
28S/12E-03	24	325	370	225	5,400	3	3.2		QTp
28S/12E-11	72	810	600	300	6,198	5.7	2.8		QTp
28S/12E-11	72	810(obs)	350	200	8,250	na (obs)	5.5	0.002	QTp
27S/12E-9	72	475	605	312	6,600	2.3	2.8		QTp
27S/12E-16	24	426	640	380	2,900	2.1	1		QTp
27S/12E-16	24	441	280	115	7,300	4.6	8.5		QTp
27S/12E-20	103	110	290	120	1,700	0.9	1.9		QTp
27S/12E-20	24	150	195	87	7,275	2.8	11.2		QTp
27S/12E-17	50	200	270	170	2,122	1.8	1.7		QTp
Summary:									
Qa (average/geomean)		266	50	21	70,846	62	481		
QTp (average/geomean)		567	399	225	10,583	6	8.6	0.009	

Notes:
Qa – Alluvial Aquifer
QTp – Paso Robles Formation Aquifer
gpm – Gallons per minute
Hyd. Cond. - Hydraulic conductivity
Trans. – Transmissivity
gpd/ft - Gallons per day per foot
Perf. Int. – Perforated interval
Q/s – Specific capacity
obs – Observation well data
na - Not applicable

4.4.2 *Confining Beds and Geologic Structures*

There are no formally defined or laterally continuous aquitards within the Basin. Along the northwestern, western, and southern boundaries of the Basin sediments of the Paso Robles Formation are in contact with older, relatively impermeable geologic units, including Tertiary-age consolidated sedimentary beds, Cretaceous-age metamorphic rocks, and granitic rock.

The Rinconada Fault defines the eastern boundary of the Basin and forms a hydraulic barrier between the Paso Robles Basin and the Basin. Between Atascadero and Creston, the Rinconada Fault juxtaposes less permeable granitic and Monterey Formation rocks with the Paso Robles Formation basin sediments. Farther north, the Rinconada Fault zone was exposed in trenches on the Santa Ysabel Ranch (GeoSolutions, 2000), where the investigation concluded that the fault was a barrier to groundwater flow in the Paso Robles Formation as evidenced by differences in water levels at the Santa Ysabel warm water spring and wells drilled at the edge of the terrace above the Salinas River flood plain. South of the City of Paso Robles, the Paso Robles Formation is found on both sides of the Rinconada Fault. Based on distinctly different trends observed in Paso Robles Formation water levels on either side of the Rinconada Fault[3], it is assumed that the fault zone forms a leaky barrier that restricts flow from the Basin to the main part of the Paso Robles Basin. Groundwater flow from the Basin west of the Rinconada Fault into the Paso

[3] Groundwater levels in the western portion of the Paso Robles Basin (east of the Rinconada Fault) have generally and dramatically declined since the mid to late 1990s; whereas groundwater levels in the Atascadero Basin have remained relatively stable (Fugro, 2016).

Robles Basin is limited to underflow in the alluvial Salinas River deposits and minor subsurface groundwater flux in the Paso Robles Formation (Fugro, 2016).

4.5 Primary Users of Groundwater

The primary groundwater users in the Basin include municipal, agricultural, rural residential, small community water systems, and small commercial entities. Municipal, domestic, and agricultural demands in the Basin currently rely almost entirely on groundwater. Both the municipal sector and the agriculture sector use groundwater from the Alluvial Aquifer and the Paso Robles Aquifer.

4.6 General Water Quality

In general, the groundwater quality of the basins is relatively good, with few areas of unacceptable quality and few significant trends of deteriorating water quality. The main source of recharge to the Basin is the percolation of streamflow from the Salinas River, which drains the Cretaceous-age granitic rocks and sedimentary beds of the northwestern La Panza Range. This recharge, typically a calcium and magnesium bicarbonate water, has the greatest influence on water quality in the basin. Increasing TDS and chlorides in shallow Paso Robles Formation deposits along the Salinas River in the central portion of the basin was identified as a trend of slight water quality deterioration (Fugro, 2002). Water quality in the Basin is discussed in further detail in Section 5.

4.7 Groundwater Recharge and Discharge Areas

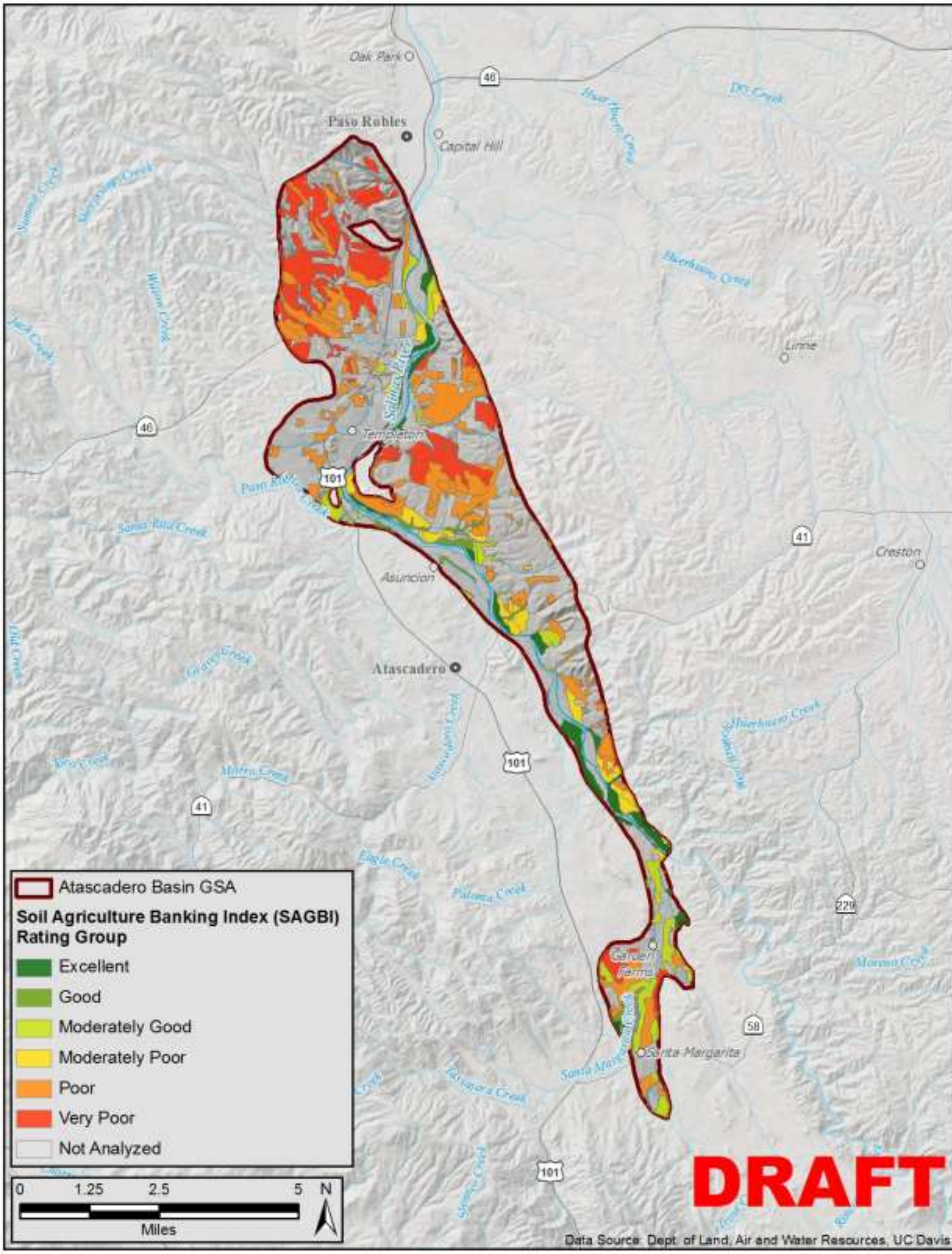
Areas of significant areal recharge and discharge within the Basin are discussed below. Quantitative information about all natural and anthropogenic recharge and discharge is provided in Section 6: Water Budgets.

4.7.1 *Groundwater Recharge Areas*

In general, natural areal recharge occurs via the following processes:

1. Distributed areal infiltration of precipitation,
2. Subsurface inflow from adjacent "non-water bearing bedrock", and
3. Infiltration of surface water from streams and creeks.

Figure 4-14 is a map that ranks soil suitability to accommodate groundwater recharge based on five major factors that affect recharge potential, including deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. The map was developed by the California Soil Resource Lab at UC Davis and the University of California Agricultural and



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Potential Recharge Areas	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-14

Natural Resources Department[4]. Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, but this map provides good guidance on where natural recharge likely occurs.

Subsurface inflow is the flow of groundwater from the surrounding "non-water bearing bedrock" into the basin sediments. Flow across the basin boundary is predominantly via highly conductive, but random and discontinuous, fractures. The rate of subsurface inflow to the Basin from the surrounding hill and mountain area varies considerably from year to year depending upon precipitation (intensity, frequency and duration, seasonal totals, etc.) and groundwater level gradients. There are no available published or unpublished inflow data for the hill and mountain areas surrounding the Basin. However, it is suspected that significant subsurface recharge comes into the Templeton area from the highland areas to the northwest.

In the area near Atascadero, the Paso Robles Formation has been folded, exposing the basal gravel beds. With the basal gravel exposed and in direct contact with the shallow alluvium, the Paso Robles Formation is recharged directly from the river alluvium (Fugro, 2002). Groundwater recharge from percolation of streamflow is known to occur near Atascadero and just south of the City of Paso Robles, with little to no recharge occurring in the Templeton area downstream of the confluence of the Salinas River with Graves and Paso Robles creeks (Fugro, 2016).

Significant anthropogenic recharge occurs via three processes, discussed further below:

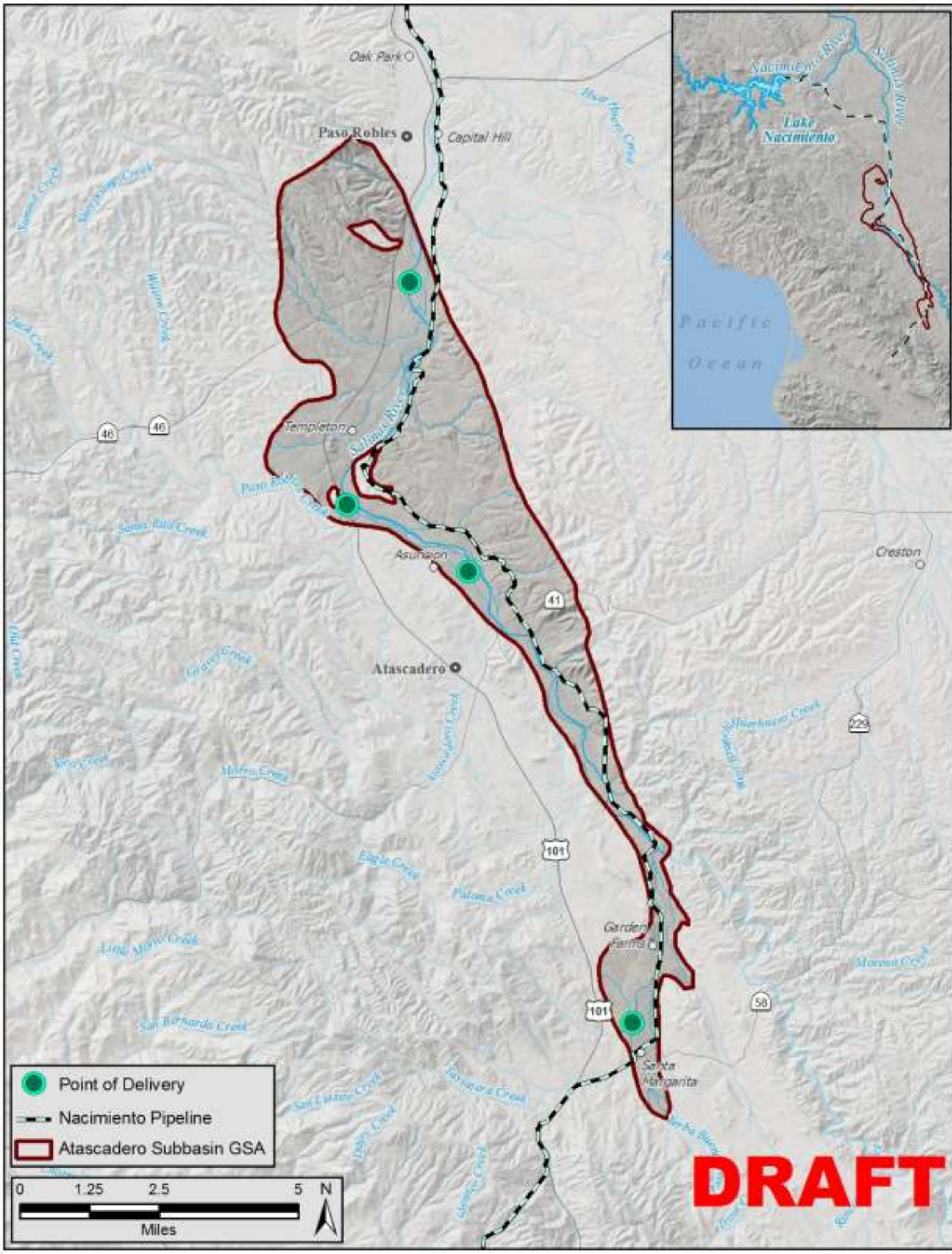
1. Percolation of wastewater treatment plant effluent,
2. Percolation of return flow from agricultural irrigation, and
3. Percolation of imported Lake Nacimiento water.

Wastewater treatment plants serving the communities of Atascadero and Templeton are operated within the Basin. Effluent from these plants is discharged to percolation ponds in the Alluvium adjacent to the Salinas River. Irrigated agriculture is prevalent in the Basin, especially in the northern portion. Return flows from irrigated agriculture occur when water is supplied to the irrigated crops in excess of the crop's water demand. This is done to avoid excess build-up of salts in the soil and is general standard practice. The percolation of the wastewater effluent and irrigation return flows are a significant anthropogenic source of recharge to the Basin.

The Nacimiento Water Project (NWP) regional raw water transmission facility delivers water from Lake Nacimiento to communities in San Luis Obispo County, including Atascadero, Templeton, the City of Paso Robles, and the Santa Margarita Ranch Mutual Water Company (SMRMWC). The NWP is designed to deliver 15,750 acre-feet of water per year (AFY). Atascadero Mutual Water Company (AMWC) has an allocation of 3,244 AFY and began taking

[4] Figure 4-14 shows the Soil Agricultural Groundwater Banking Index (SAGBI) map for the Paso Robles Subbasin. While the UC Davis database title SAGBI includes the term "banking", its use in this section is strictly as a dataset for evaluating recharge potential in the basin.

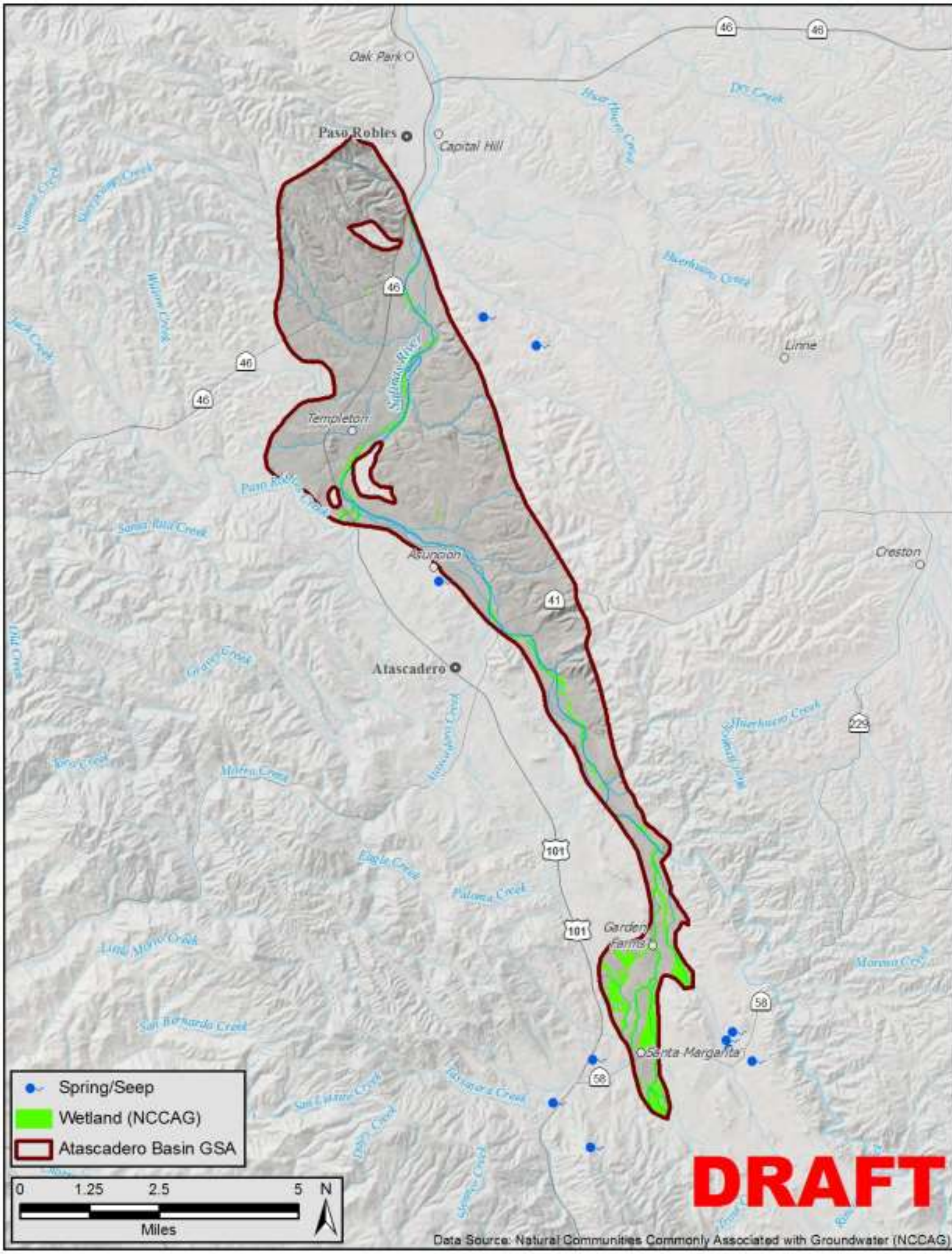
deliveries of water in the summer of 2012. Templeton Community Services District (TCSD) has an allocation of 406 AFY and began taking deliveries of water in 2012. The City of Paso Robles has an allocation of 6,488 AFY and the SMRMWC has an allocation of 80 AFY. Both AMWC and TCSD utilize their imported NWP water to recharge the Basin via percolation ponds located in the Alluvium adjacent to the Salinas River. The City of Paso Robles utilizes their NWP allocation in two ways: treatment in a package water treatment plant and applying directly to the ground surface on the alluvial gravels of the Salinas River floodplain in the north end of the Basin. SMRMWC has not yet begun receiving NWP water. The source and points of delivery for the imported NWP water with the Basin are shown on Figure 4-15.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Source and Point of Delivery for Imported Supplies	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-15

4.7.2 *Groundwater Discharge Areas*

Natural groundwater discharge occurs as discharge to springs, seeps and wetlands, subsurface outflows, and evapotranspiration (ET) by phreatophytes. Figure 4-16 shows the locations of significant active springs, seeps, and wetlands within or adjacent to the Basin. There are no mapped springs or seeps located within the Basin. Groundwater discharge to streams and potential groundwater dependent ecosystems (GDEs) are discussed in Section 5. In contrast to mapped springs and seeps, which are derived from groundwater in the Paso Robles Formation, groundwater discharge to streams is derived from the Alluvium. Subsurface outflow and ET by phreatophytes are discussed in Section 6.



Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California

Atascadero Basin GSA

Springs/Seeps and Wetlands

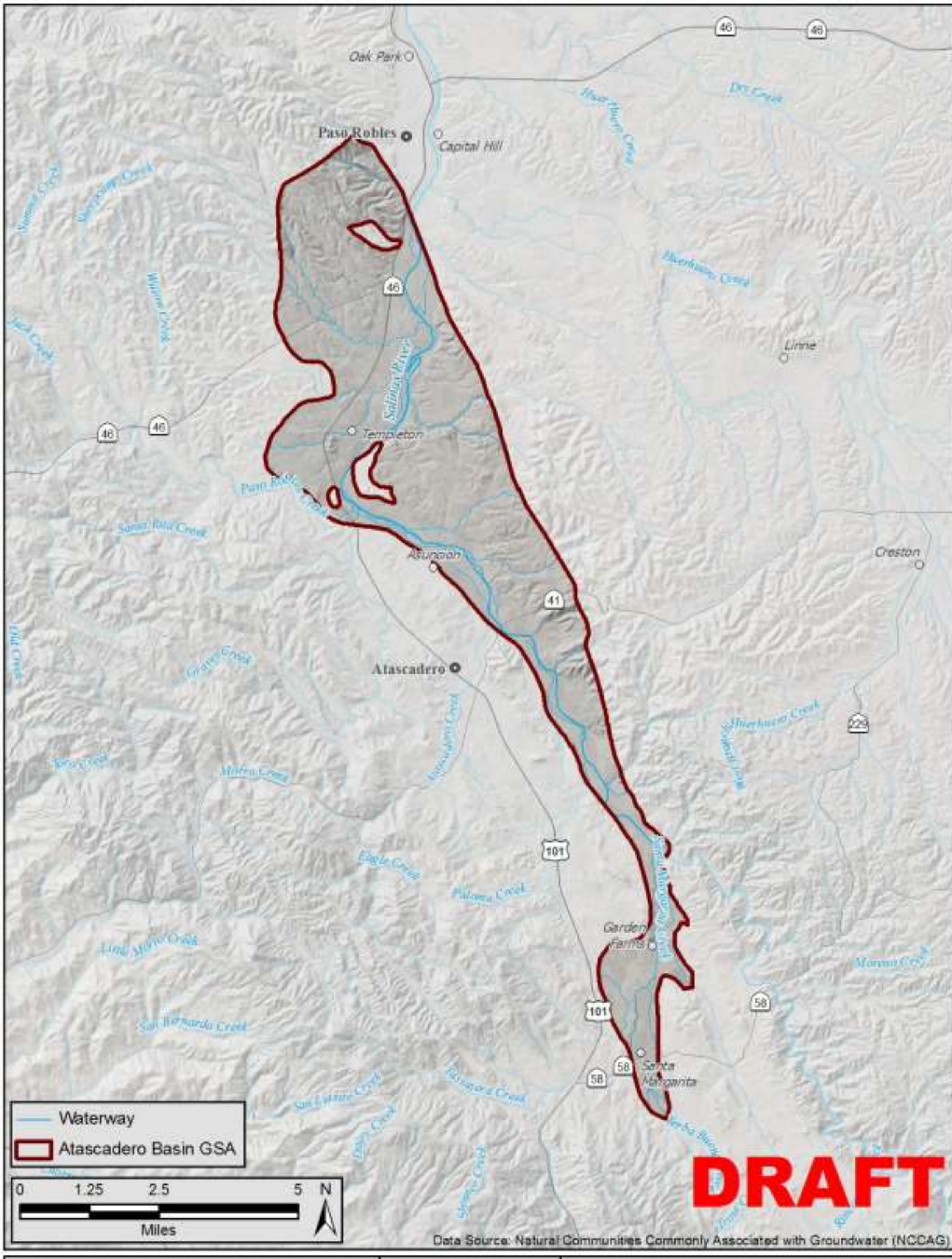
OCTOBER 2019

FIGURE 4-16

4.8 Surface Water Bodies

Figure 4-17 shows the Salinas River, which is considered significant to the management of groundwater in the Basin. The Salinas River is ephemeral, and during most of the year loses water to the shallow aquifer. A complete description and quantification of the stream/aquifer interaction is included in Sections 5 and 6. There are no natural lakes in the Basin.

There are no water supply reservoirs within the Basin; however, there is one reservoir in the watershed. The Salinas Dam south of the Basin on the Salinas River forms Santa Margarita Lake. The Salinas Dam was constructed in the early 1940s as an emergency measure to provide adequate water supplies for Camp San Luis Obispo. The military division of the United States Army Corps of Engineers (USACE) now has jurisdiction over the dam and reservoir facilities. The City of San Luis Obispo has an agreement with USACE to divert the entire yield of Santa Margarita Reservoir for water supply.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Surface Water Bodies	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 4-17

4.9 Data Gaps in the Hydrogeologic Conceptual Model

All hydrologic conceptual models contain a certain amount of uncertainty and can be improved with additional data and analysis. The hydrogeologic conceptual model of the Basin could be improved with certain additional data and analyses. Several data gaps are identified below.

4.9.1 *Groundwater Elevation Data*

Atascadero Basin has generally very good coverage in its existing groundwater monitoring network. However, the northwest end of the Basin, especially the area north of Highway 46, does not. A better understanding of water levels in the Paso Robles Formation in this area is important to the future management of the north end of the Basin. There are many existing private wells in the northwest area so there may be opportunities to bring one or more of them into the monitoring program through an outreach program.

4.9.2 *Fault Influence on Groundwater Flow*

The Rinconada Fault defines the eastern boundary of the Basin. In the area south of the City of Paso Robles, the Paso Robles Formation is found on both sides of the Rinconada Fault. Existing groundwater elevation data qualitatively show that the Rinconada Fault forms a leaky barrier to groundwater flow in this area, but no quantitative determination of the barrier's effectiveness has yet been made. A better understanding of the effectiveness of this barrier would aid in future management of the Basin. It may be possible to get a better understanding of the influence of the Rinconada Fault by performing aquifer tests across the trace of the fault.

4.9.3 *Vertical Groundwater Gradients*

There are no nested wells to demonstrate vertical hydraulic gradients. Demonstrating vertical gradients could be important to assess vertical flows between the Alluvium and the Paso Robles Aquifer as well as vertical flows within the Paso Robles Aquifer.

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References

California Department of Water Resources (DWR) (1979), Ground Water in the Paso Robles Basin: prepared by the California Department of Water Resources, Southern District, for the San Luis Obispo County Flood Control and Water Conservation District.

California Department of Water Resources (DWR) (2016), California's Groundwater: Bulletin 118 Interim Update.

Campion, L.F., Chapman, R.H., Chase, G.W., and L.G. Youngs (1983), "Resource Investigation of Low and Moderate – Temperature Geothermal Areas in Paso Robles, California"; California Division of Mines and Geology, Open File Report 83-11 SAC.

Dibblee, Jr., T.W. (1976), The Rinconada and Related Faults in the Southern Coast Ranges, California and Their Tectonic Significance, U.S. Geological Survey Professional Paper 981.

Dibblee, Jr., T.W. and Minch, J.A. (2004a), Geologic Map of the Atascadero Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-132, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2004b), Geologic Map of the Estrella & Shandon Quadrangles, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-138, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2004c), Geologic Map of the Creston & Shedd Canyon Quadrangles, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-136, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2004d), Geologic Map of the Lopez Mountain Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-130, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2004e), Geologic Map of the Paso Robles Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-137, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2004f), Geologic Map of the San Luis Obispo Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-129, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2004g), Geologic Map of the Santa Margarita Quadrangles, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-133, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2004h), Geologic Map of the Templeton Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-135, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2006a), Geologic Map of the Adelaida Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-218, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2006b), Geologic Map of the Morro Bay North Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-215, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2006c), Geologic Map of the Morro Bay South Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-214, scale 1:24,000.

Dibblee, Jr., T.W. and Minch, J.A. (2006d), Geologic Map of the York Mountain Quadrangle, San Luis Obispo County, California. Dibblee Geological Foundation Map DF-217, scale 1:24,000.

Fugro West, Inc., and Cleath and Associates (2002), Final Report, Paso Robles Groundwater Basin Study: unpublished consultant report prepared for the County of San Luis Obispo Public Works Department, August 2002.

Fugro West, Inc., ETIC Engineering, and Cleath and Associates (2005), Final Report, Paso Robles Groundwater Basin Study: Phase II Numerical Model Development, Calibration, and Application. Prepared for the County of San Luis Obispo Public Works Department, February 2005.

Fugro Consultants, Inc. (2016), Technical Report Salinas Valley – Atascadero Area Subbasin Basin Boundary Modification Application. Prepared for Department of Water Resources. March 2016.

GeoSolutions (2000), Fault Investigation Report, Santa Ysabel Ranch, Santa Ysabel Road, Paso Robles Area, County of San Luis Obispo, California: unpublished consultant report prepared for Weyrich Development, LLC, March 31, 2000.

U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (2007), Soil Survey Geographic Database (SSURGO).

ATASCADERO BASIN

Groundwater Sustainability Agency

TO: Executive Committee

FROM: GSA Staff/ John Neil, Atascadero Mutual Water Company

DATE: October 2, 2019

SUBJECT: Agenda Item 9.b, GSP Section 5, Groundwater Conditions (draft)

RECOMMENDED ACTION:

Review and comment on the draft of Section 5, Groundwater Conditions, of the Atascadero Basin Groundwater Sustainability Plan (GSP).

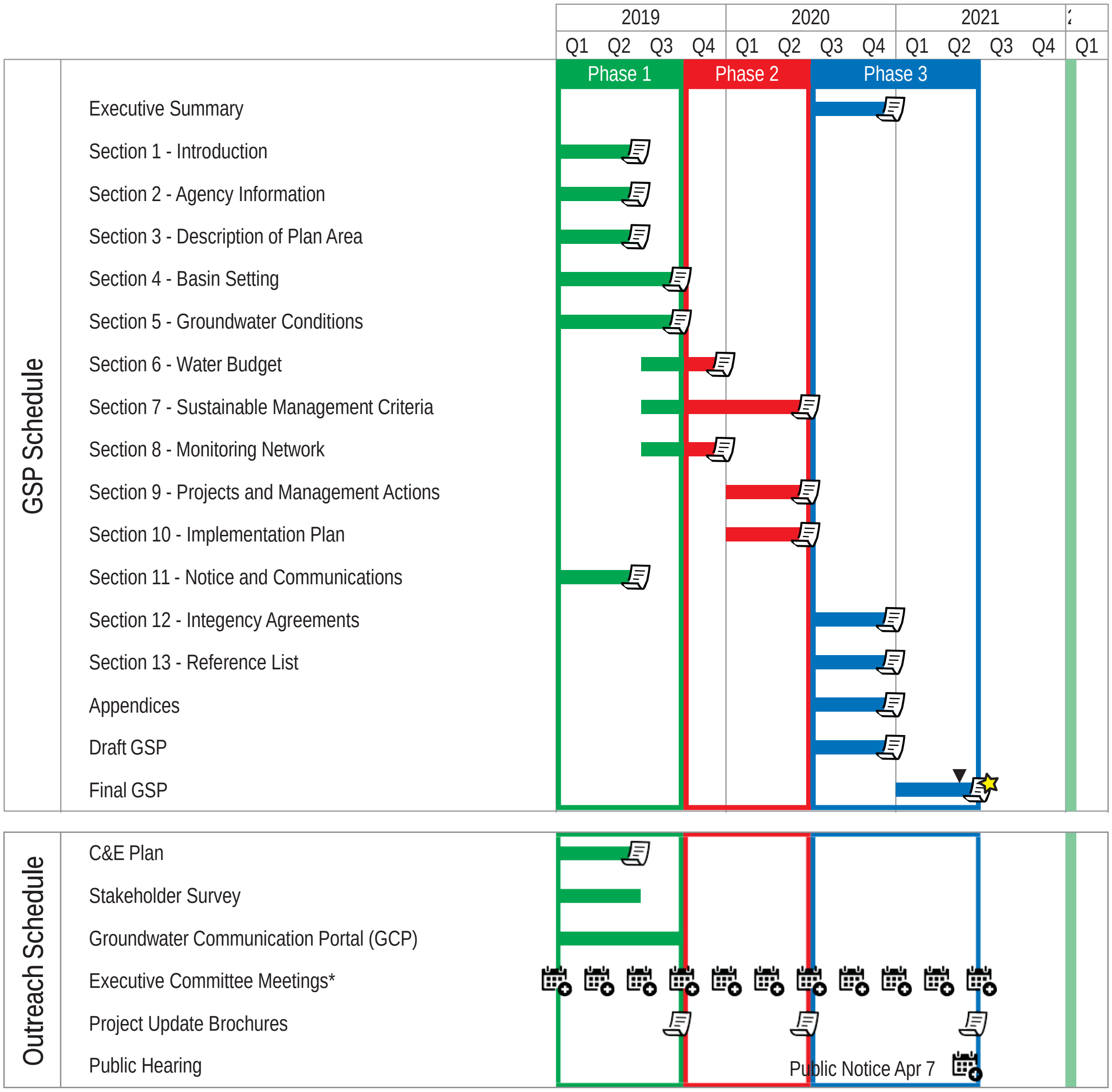
DISCUSSION:

Attachment A is a draft of Section 5 of the Atascadero Basin GSP. The draft section was prepared by utilizing existing information that was readily available from the GSA participants, the Department of Water Resources, and other sources. Many of the figures in this section are required by SGMA were specifically generated for the GSP.

There will be a 45-day comment period for Section 5. Stakeholders can review and comment on this section of the GSP using the Atascadero Basin Communication Portal or submit their comments in writing.

All comments received on Section 5 will be considered and incorporated into a fully-assembled draft of the GSP. The fully-assembled draft will be made available for final review and comment by your committee and the basin stakeholders.

Completion of Section 5 signifies the end of Phase 1 of the GSP development process. Phase 3 will occur over the next three quarters and will include sections on the water budget, sustainable management criteria, projects & management, and the implementation plan. Staff anticipates significant stakeholder input during the development of these sections.



*First Wednesday of first month of each quarter

FISCAL IMPACT:

Fifty percent of the cost to develop the GSP, including stakeholder engagement, will be funded through a Proposition 1 grant awarded to the GSA by the Department or Water Resources, with the remaining costs being a local match.

ATTACHMENTS:

A. Draft GSP Section 5, Groundwater Conditions

Draft Atascadero Groundwater Sustainability Plan

Atascadero Groundwater Subbasin Section 5

DRAFT October 2019

Prepared for: Atascadero Subbasin Groundwater Sustainability Agency

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Table of Contents

Figures

Tables

Appendices

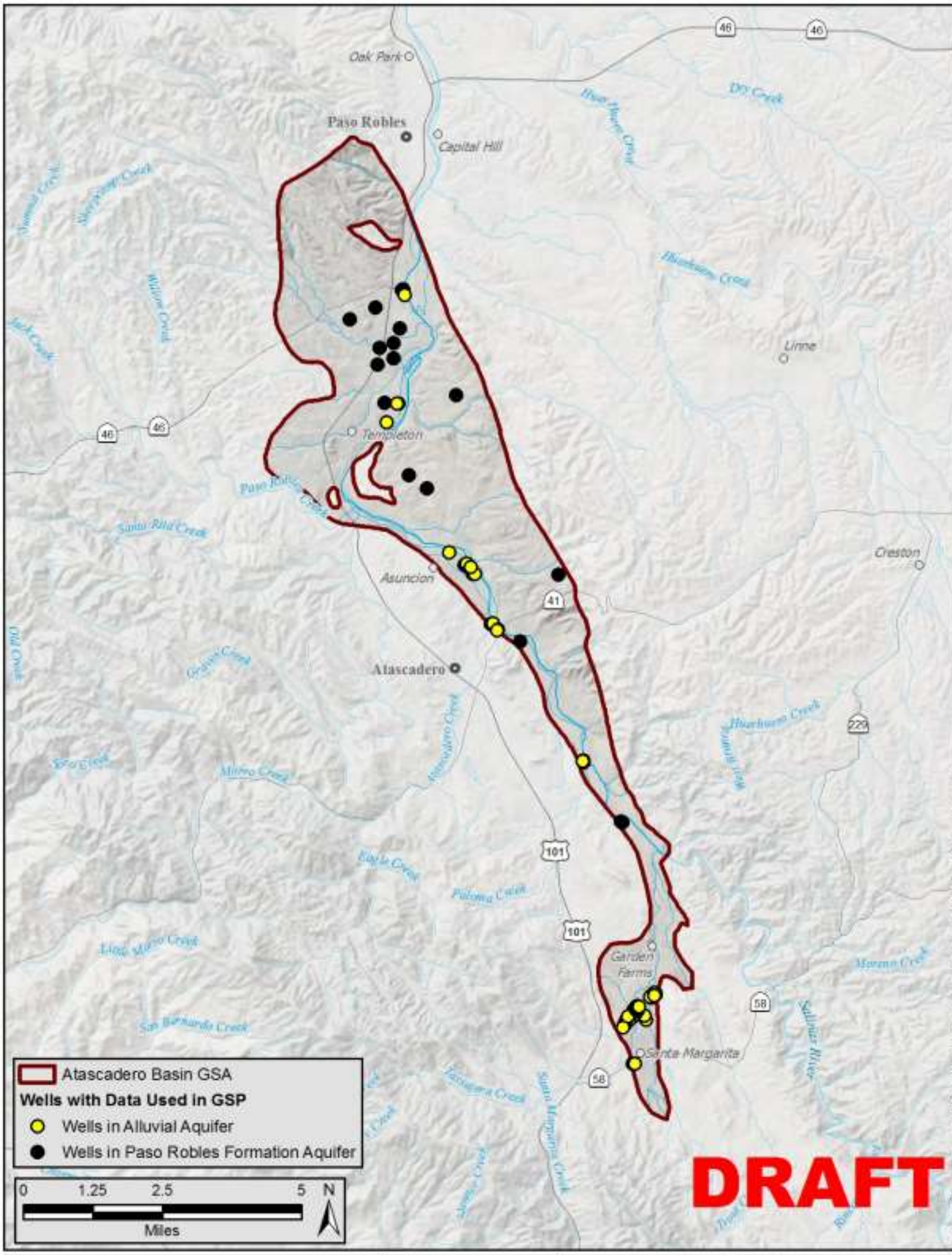
5. Groundwater Conditions

This section describes the current and historical groundwater conditions in the Alluvial Aquifer and the Paso Robles Formation Aquifer in the Atascadero Area Groundwater Sub-basin of the Salinas Valley Basin (Basin). In accordance with the SGMA emergency regulations §354.16, current conditions are any conditions occurring after January 1, 2015. By implication, historical conditions are any conditions occurring prior to January 1, 2015. This section focuses on information required by the GSP regulations and information that is important for developing an effective plan to achieve sustainability. The organization of Section 5 aligns with the six sustainability indicators specified in the GSP regulations, including:

1. Chronic lowering of groundwater elevations
2. Changes in groundwater storage
3. Seawater intrusion
4. Subsidence
5. Depletion of interconnected surface waters
6. Groundwater quality

5.1 Groundwater Elevations

The following assessment of groundwater elevation conditions is based largely on data from the San Luis Obispo County Flood Control and Water Conservation District's (SLOFCWCD) groundwater monitoring program. Groundwater levels are measured by the SLOFCWCD through a network of public and private wells in the Basin. Additional groundwater elevation data for wells were obtained from environmental investigations pertaining to the crude oil pipeline spill in the Santa Margarita area (see Section 5.6.3, below). Approximately 150 wells (depending on year) were used for the groundwater elevation assessment. Of these wells, about 100 are not subject to confidentiality agreements. The locations of these non-confidential wells used for the groundwater elevation assessment are shown on Figure 5-1. Although the groundwater elevation data from the 50 confidential wells were included in the groundwater assessment, their locations are not provided in this GSP, as consistent with their confidentiality agreements. In no cases are the well owner information provided in this GSP.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Location of Wells Used for Groundwater Elevation Assessments
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-1

The set of wells used in the groundwater elevation assessment were selected based on the following criteria:

- The wells have groundwater elevation data for 1997, and/or 2011, and/or 2015, and/or 2017
- Sufficient information exists to assign the well to either the Alluvial Aquifer or Paso Robles Formation Aquifer
- Groundwater elevation data were deemed representative of static conditions

Additional information on the monitoring network is provided in Section 8 – Monitoring Networks.

Based on available data, the following information is presented in subsequent subsections.

- Groundwater elevation contour maps for spring 1997, 2011, 2015, and 2017
- Groundwater elevation contour maps for fall 2017
- A map depicting the change in groundwater elevation between 1997 and 2011 (Paso Robles Formation Aquifer only)
- A map depicting the change in groundwater elevation between 2011 and 2015 (Paso Robles Formation Aquifer only)
- A map depicting the change in groundwater elevation between 2015 and 2017 (Paso Robles Formation Aquifer only)
- Hydrographs for select wells with publicly available data
- Assessments of horizontal and vertical groundwater gradients

5.1.1 *Alluvial Aquifer*

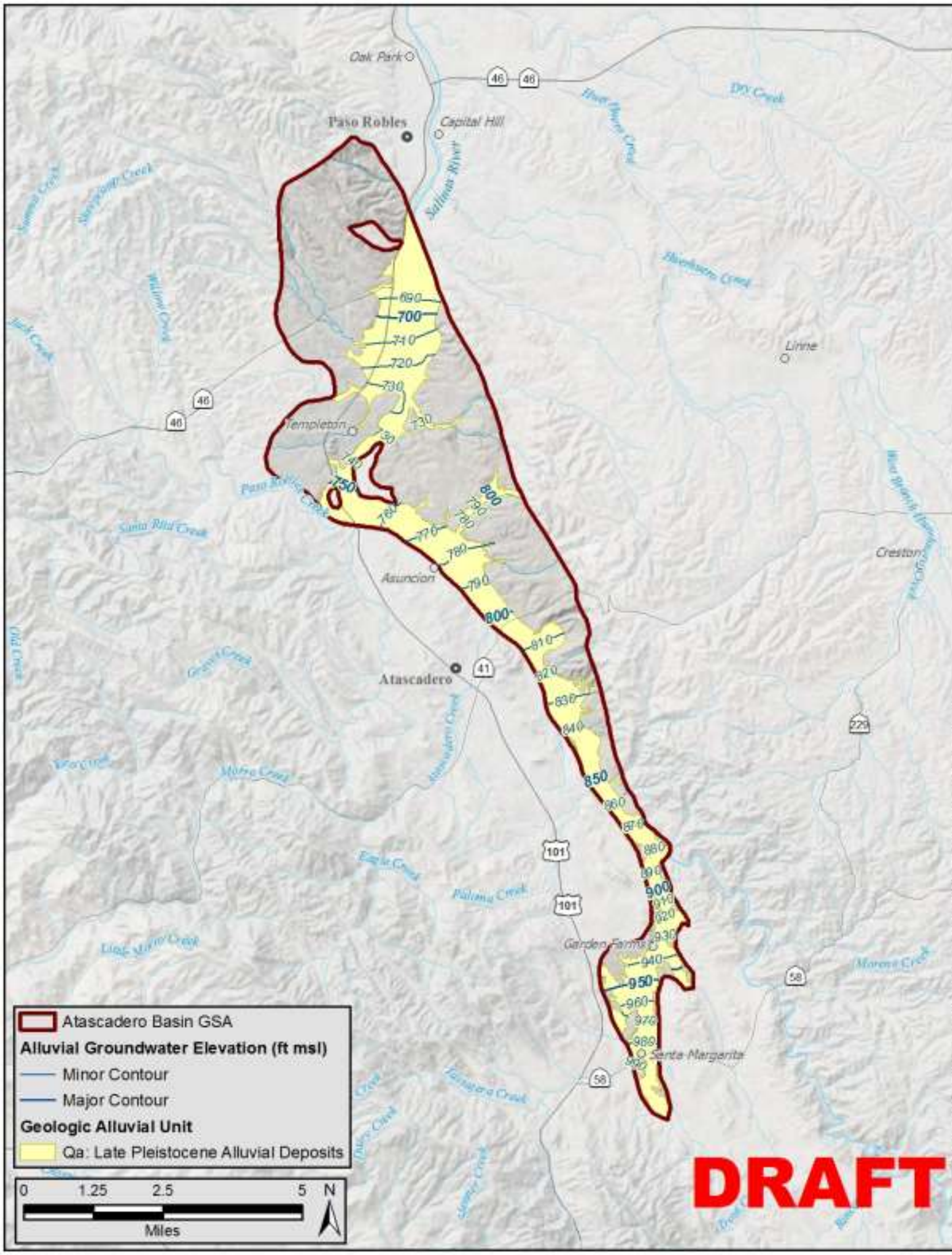
Water levels in wells in the Alluvial Aquifer are relatively stable, exhibiting little seasonal fluctuation and rapid recovery with any substantial rainfall. Because the water table is recharged rapidly immediately following any substantial stream runoff, alluvial water levels show no long-term decline. The locations of the non-confidential alluvial wells used in the groundwater elevation assessment are shown in Figure 5-1.

5.1.1.1 Alluvial Aquifer Groundwater Elevation Contours and Horizontal Groundwater Gradients

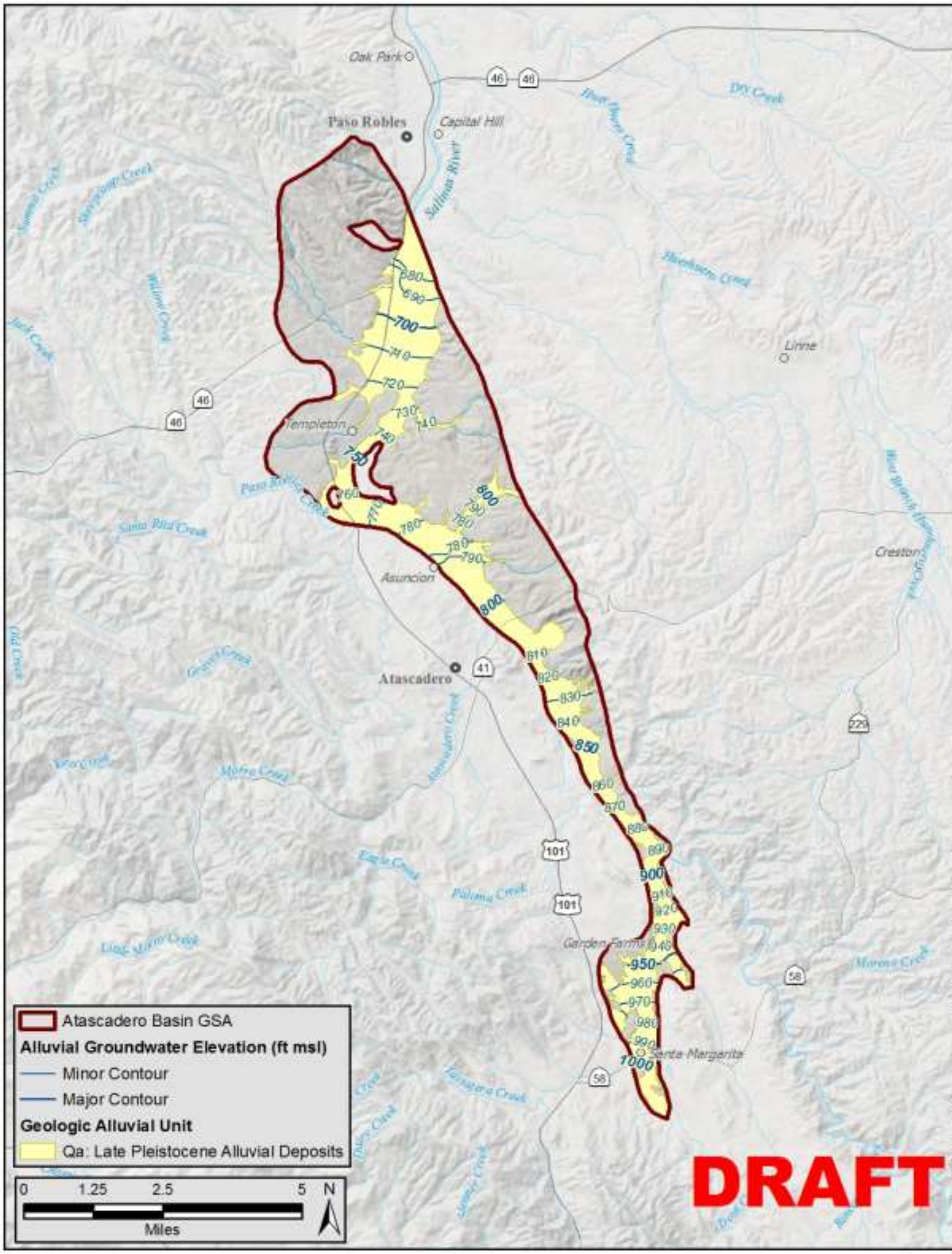
Groundwater elevation data for spring 1997, spring 2011, spring 2015, spring 2017, and fall 2017 for the Alluvial Aquifer were contoured to assess historical and current spatial variations, groundwater flow directions, and horizontal groundwater gradients. Data from public and private wells were used for contouring. The contours are based on groundwater elevation measurements from the non-confidential wells shown on Figure 5-1 and additional wells subject to confidentiality agreements not shown on the figure. Contour maps were generated using a computer-based contouring program and checked/modified by a qualified hydrogeologist. Groundwater elevation data deemed unrepresentative of static conditions or obviously erroneous were not used for contouring.

Historical groundwater elevation contours for the Alluvial Aquifer are shown on Figure 5-2 (spring 1997) and Figure 5-3 (spring 2011). Current groundwater elevation contours for the Alluvial Aquifer are shown on Figure 5-4 (spring 2015), Figure 5-5 (spring 2017), and Figure 5-6 (fall 2017). For each of the time periods depicted, alluvial groundwater elevations range from approximately 1,000 feet above mean sea level (ft msl) in the Santa Margarita area to approximately 660 ft msl in the north where the Salinas River exits the Basin. A comparison of alluvial groundwater elevations between the five time periods depicted shows that alluvial groundwater elevations were generally higher in spring 2011 than in spring 1997, were generally the lowest in spring 2015, and were approximately equal between spring 2011 and spring 2017. These observations align with the historical precipitation record (discussed further below) and demonstrate the ability of the alluvial aquifer to recharge rapidly following any substantial rainfall. Unsurprisingly, alluvial groundwater elevations were generally slightly higher in spring 2017 than in fall 2017.

Groundwater flow in the Alluvial Aquifer generally follows the alignment of the creeks and the Salinas River. Overall, groundwater in the Alluvial Aquifer flows generally to the north and northwest, parallel to flow in the Salinas River. Throughout the historical and current periods, the overall alluvial hydraulic gradient generally approximates the topographic profile of the Salinas River or its tributaries (generally between 0.002 and 0.007 ft/ft). Areas of steepened hydraulic gradient and areas of flattened hydraulic gradient are apparent due to localized pumping depressions and infiltration basin operations. These are most notable in the Atascadero and Templeton areas.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Spring 1997 Alluvial Aquifer Groundwater Elevation Contours
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-2



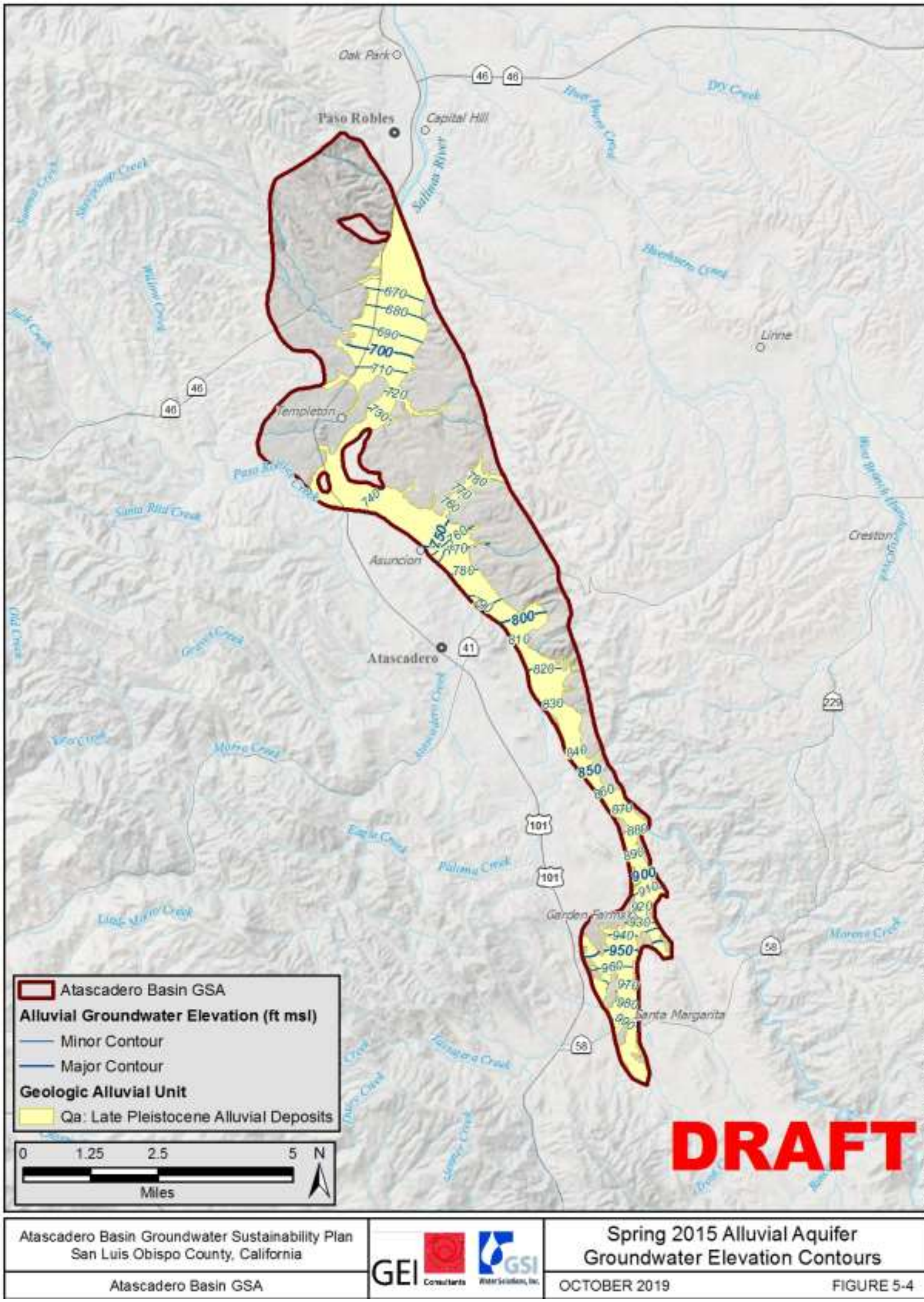
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California

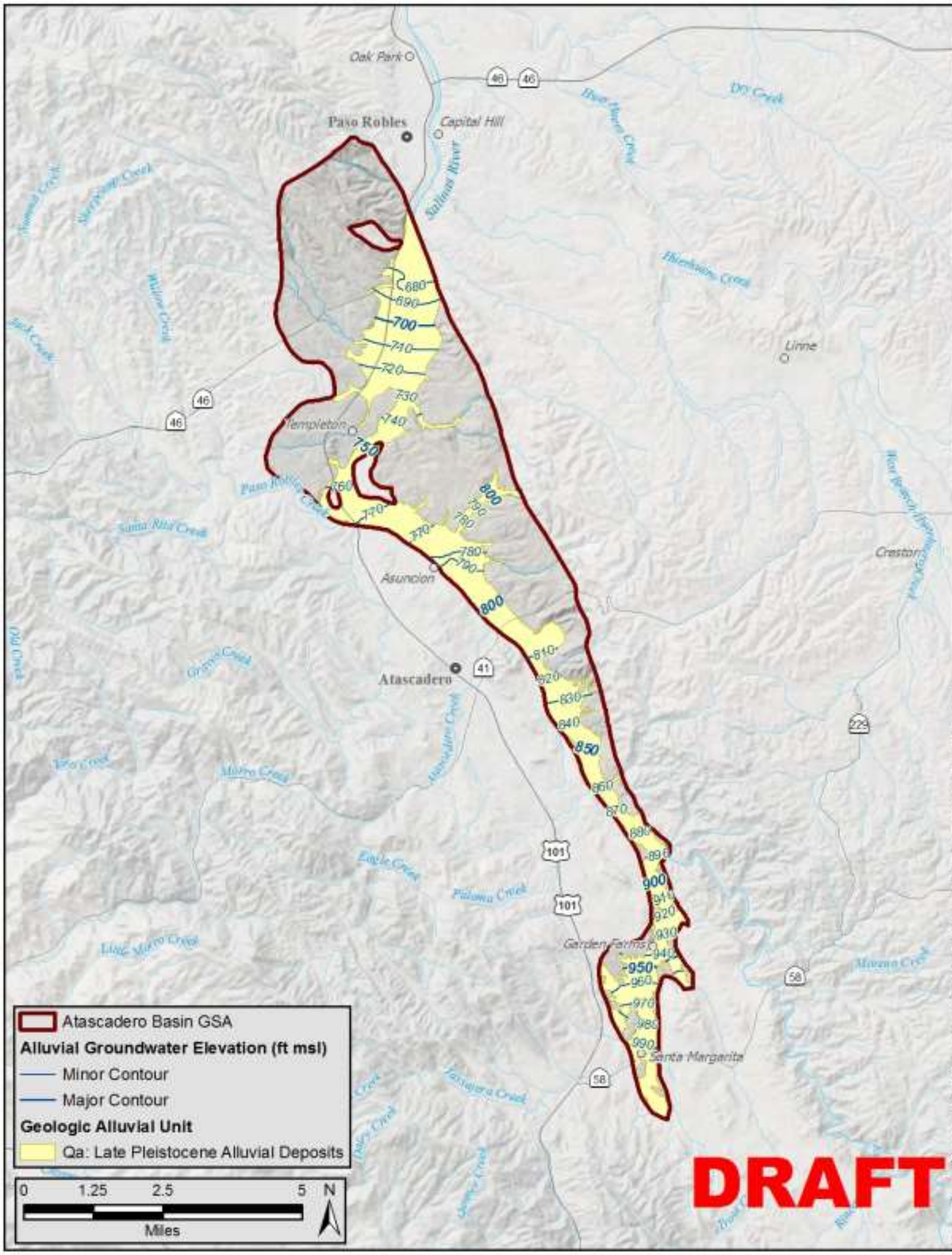
Atascadero Basin GSA

Spring 2011 Alluvial Aquifer Groundwater Elevation Contours

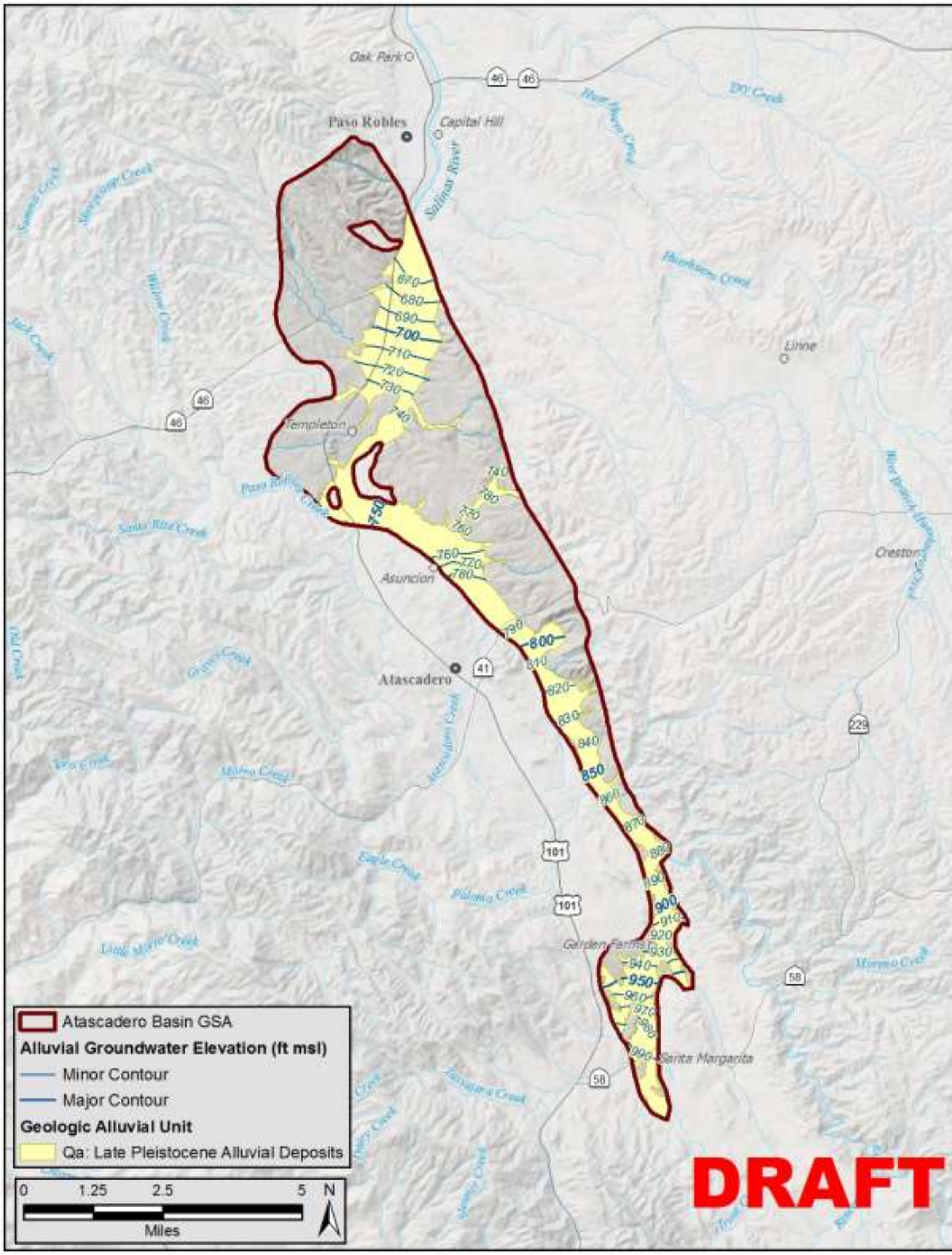
OCTOBER 2019

FIGURE 5-3


Oak Park
Paso Robles
Capital Hill
Salinas River
Dry Creek
Huerhuero Creek
Linne
Templeton
Asuncion
Atascadero
Creston
Santa Margarita
Garden Farms
DRAFT
Atascadero Basin GSA
Alluvial Groundwater Elevation (ft msl)
Minor Contour
Major Contour
Geologic Alluvial Unit
Qa: Late Pleistocene Alluvial Deposits
0
1.25
2.5
5
N
Miles
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
Spring 2015 Alluvial Aquifer
Groundwater Elevation Contours
OCTOBER 2019
FIGURE 5-4



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Spring 2017 Alluvial Aquifer Groundwater Elevation Contours	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 5-5



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Fall 2017 Alluvial Aquifer Groundwater Elevation Contours	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 5-6

5.1.1.2 Alluvial Aquifer Hydrographs

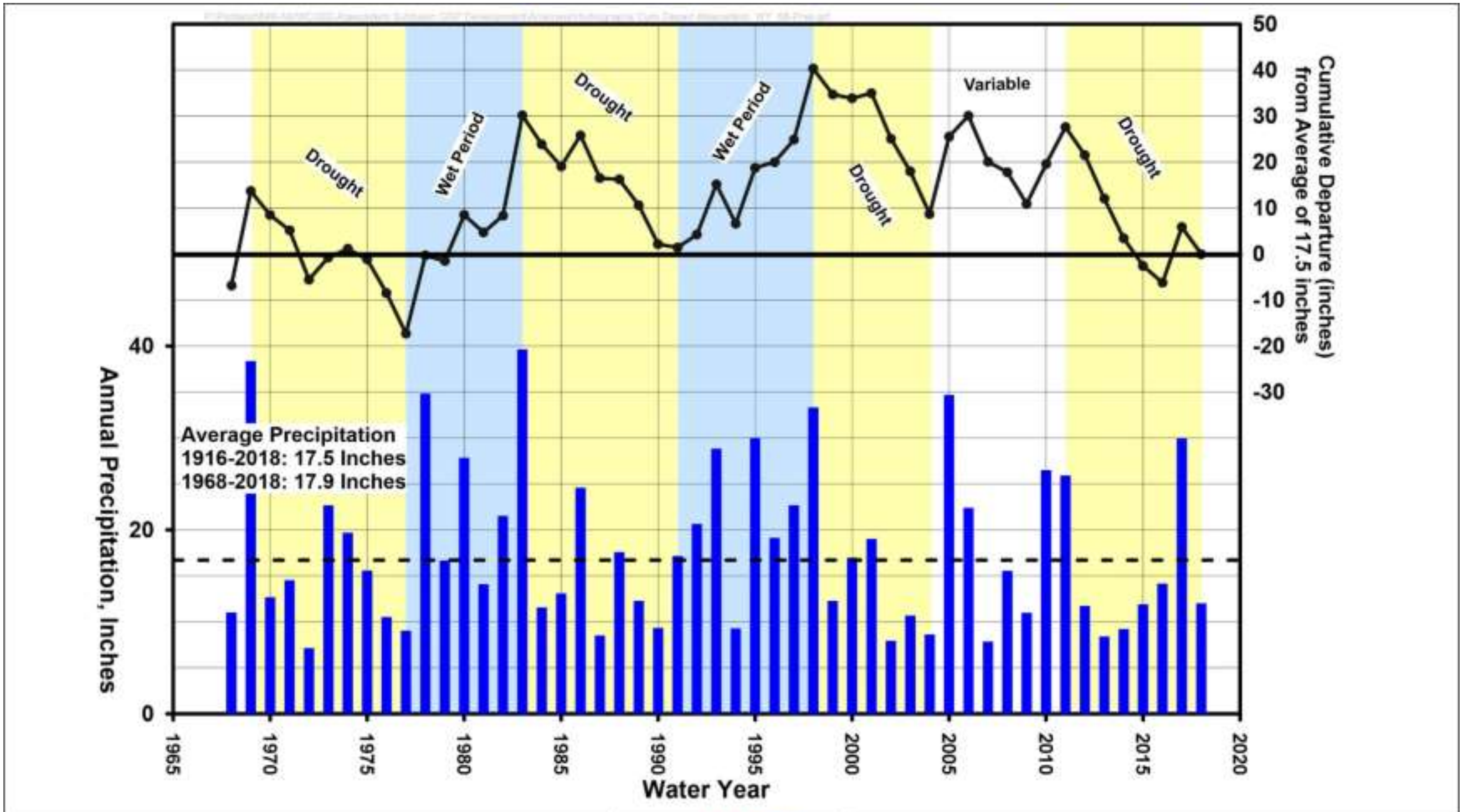
Appendix 5A includes seven hydrographs for wells in the Alluvial Aquifer. These wells were chosen because they have sufficient periods of record to identify trends and/or responses to climatic conditions, they are distributed throughout the Basin, and they have publicly available, non-confidential data.

The hydrographs show periods of climatic variations grouped by the following designations: drought, wet period, or variable. Precipitation data were reviewed and analyzed to determine the occurrence and duration of wet and dry periods for the Basin. Precipitation data from the Atascadero Mutual Water Company (AMWC) Station #34 was used for this analysis because it is representative of conditions in the Basin and has the longest period of record of any station in the Basin (1916 to present). Figure 5-7 shows total annual precipitation by water year and cumulative departure from average as recorded at AMWC Station #34 for 1968 through 2018. Mean annual precipitation is 17.5 inches for the period of record 1916 to present.

For wells that are located in close proximity to the Salinas River the hydrographs also show the elevation of the adjacent Salinas River thalweg (deepest part of the river channel, in cross section) and periods when water was present in the Salinas River (called “Live Stream” periods[1]).

The alluvial hydrographs show no discernable long-term trends. Although the hydrographs typically show declining water levels in response to drought periods, they also demonstrate the ability of the alluvial aquifer to fully recharge during wet periods. Alluvial groundwater elevations are typically higher in spring than in the fall and generally fluctuate by 30 feet or less annually.

[1] San Luis Obispo County monitors the Salinas River at seven locations to determine “Live Stream” status. The seven monitoring locations are: Highway 58 Bridge, Highway 41 Bridge, Immediately upstream of Graves Creek, Templeton Bridge, Paso Robles 13th St. Bridge, Wellsona Crossing, and the San Miguel Bridge.



Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California

Atascadero Basin GSA

CLIMATIC PERIODS IN THE ATASCADERO SUBBASIN

OCTOBER 2019

FIGURE 5-7

5.1.2 *Paso Robles Formation Aquifer*

Locations of the non-confidential Paso Robles Formation Aquifer wells used to assess the hydrogeologic conditions of the Paso Robles Formation Aquifer are shown on Figure 5-1. Groundwater occurs in the Paso Robles Formation Aquifer under unconfined, semi-confined, and confined conditions in the Basin.

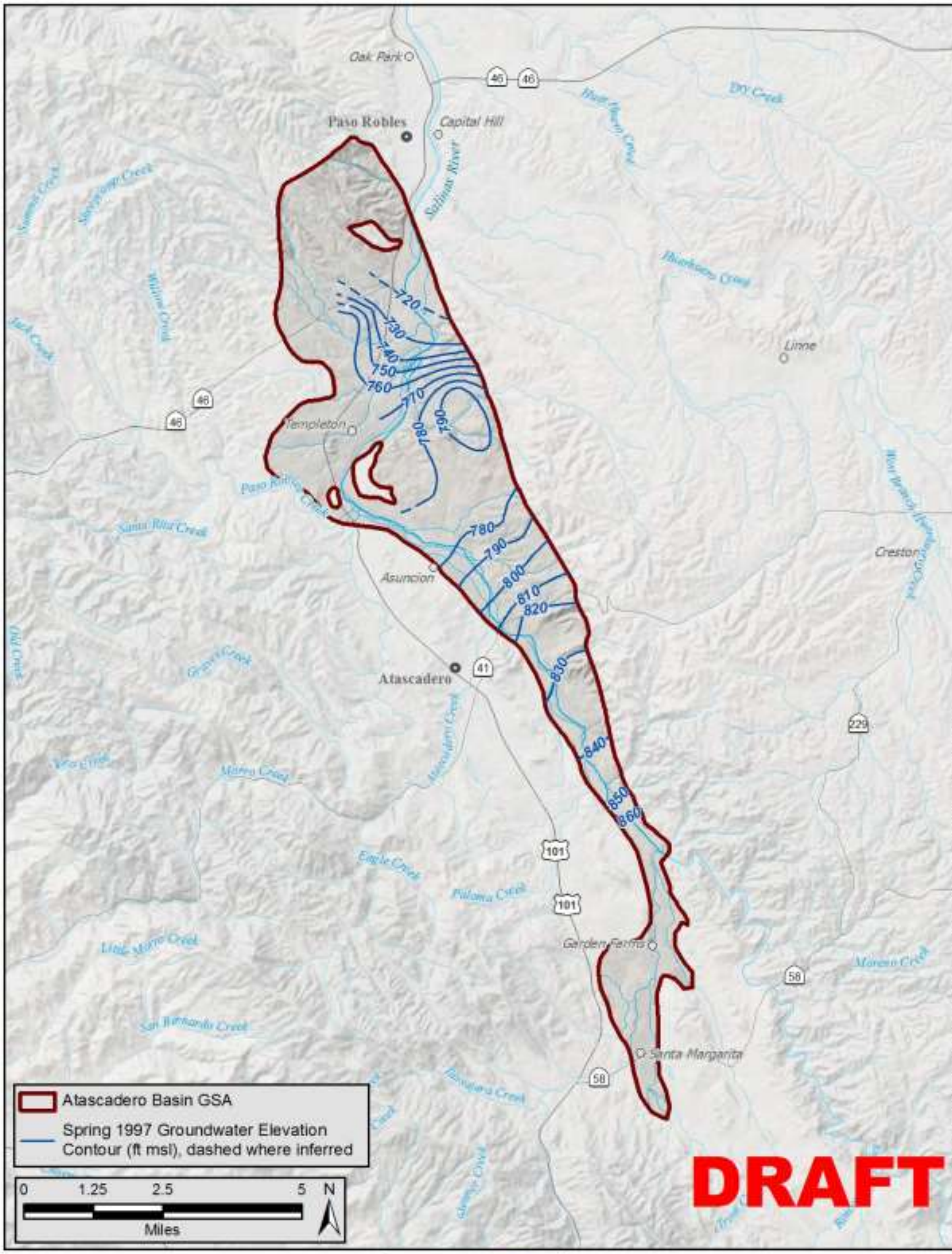
5.1.2.1 Paso Robles Formation Aquifer Groundwater Elevation Contours and Horizontal Groundwater Gradients

Groundwater elevation data for spring 1997, spring 2011, spring 2015, spring 2017, and fall 2017 for the Paso Robles Formation Aquifer were contoured to assess historical and current spatial variations, groundwater flow directions, and horizontal groundwater gradients. Data from public and private wells were used for contouring. The contours are based on groundwater elevation measurements from the non-confidential wells shown on Figure 5-1 and additional wells subject to confidentiality agreements not shown on the figure. Contour maps were generated using a computer-based contouring program and checked/modified by a qualified hydrogeologist. Groundwater elevation data deemed unrepresentative of static conditions or obviously erroneous were not used for contouring.

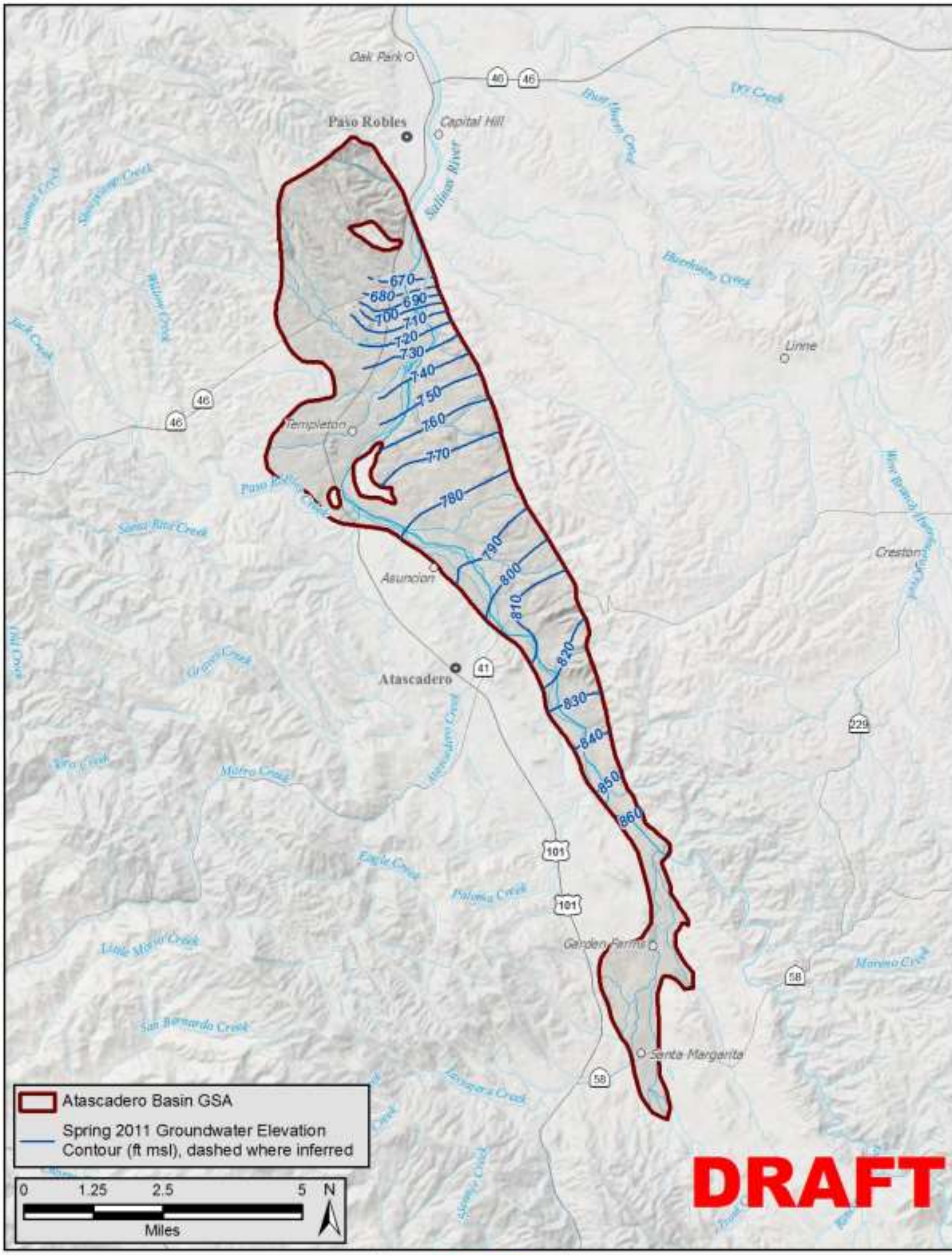
Figure 5-8 and Figure 5-9 show contours of historical groundwater elevations in the Paso Robles Formation Aquifer for spring 1997 and spring 2011, respectively. Spring 1997 groundwater elevations in the Paso Robles Formation Aquifer ranged from approximately 870 ft msl in the south to approximately 730 ft msl in the northern part of the Basin. Spring 1997 groundwater flow direction in the Paso Robles Formation Aquifer is generally to the north-northwest with hydraulic gradients ranging from approximately 0.02 to 0.001 ft/ft. A pumping trough is evident in the area northeast of Templeton as well as an area of elevated water levels in the northeastern part of the Basin.

Spring 2011 groundwater elevations in the Paso Robles Formation Aquifer ranged from approximately 870 ft msl in the south to approximately 685 ft msl in the northern part of the Basin. Spring 2011 groundwater flow direction in the Paso Robles Formation Aquifer is generally to the north-northwest with hydraulic gradients ranging from approximately 0.01 to 0.002 ft/ft. A slight pumping trough is evident in the northern part of Templeton near the junction of US HWY-101 and HWY-46 West.

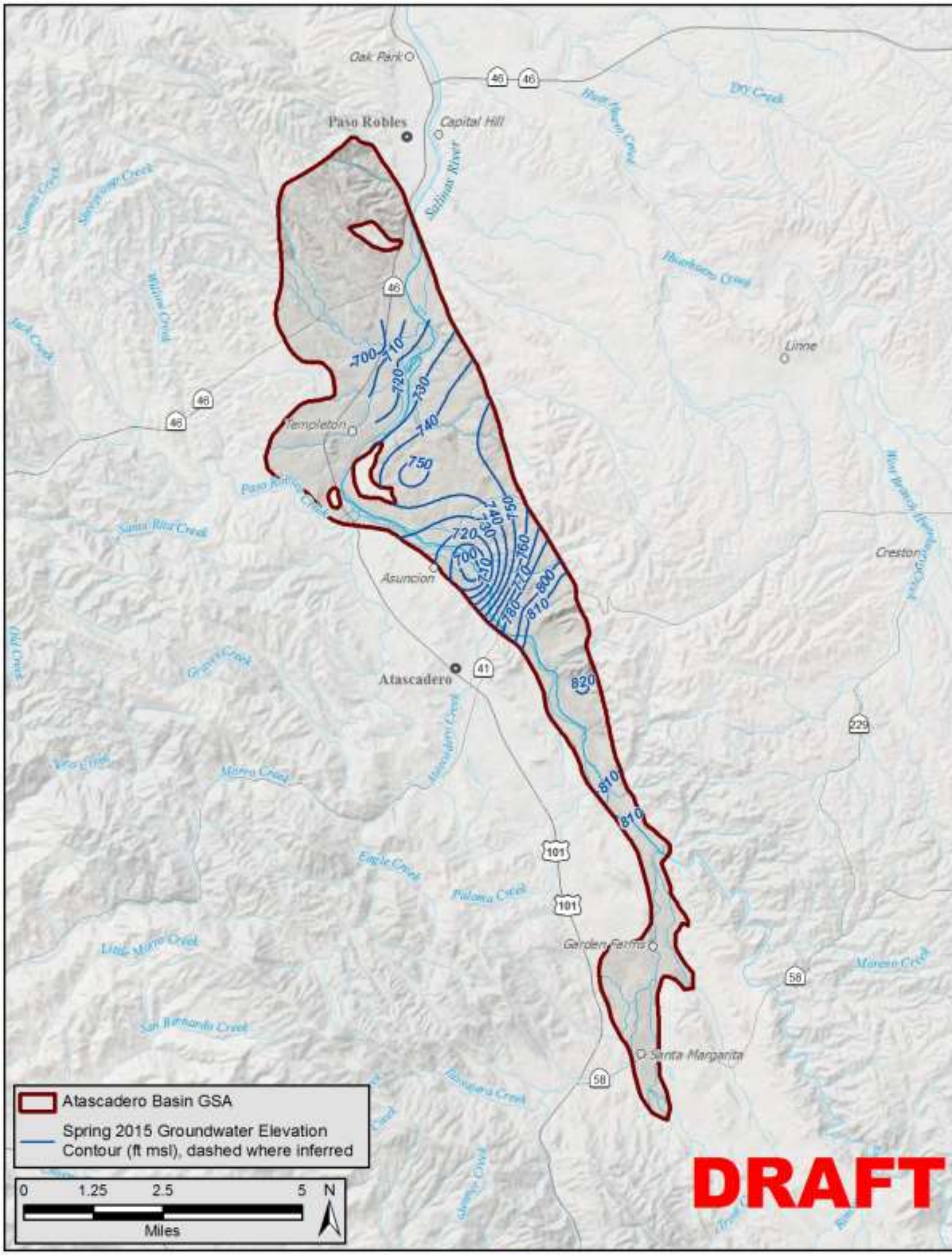
Figure 5-10, Figure 5-11, and Figure 5-12 show contours of current groundwater elevations in the Paso Robles Formation Aquifer for spring 2015, spring 2017, and fall 2017, respectively. The spring 2015 groundwater elevations in the Paso Robles Formation Aquifer ranged from approximately 821 ft msl in the south to approximately 689 ft msl in the middle of a significant pumping depression in the Atascadero area (Figure 5-10). Groundwater flow directions in the Paso Robles Formation Aquifer were generally radially inward towards the Atascadero area



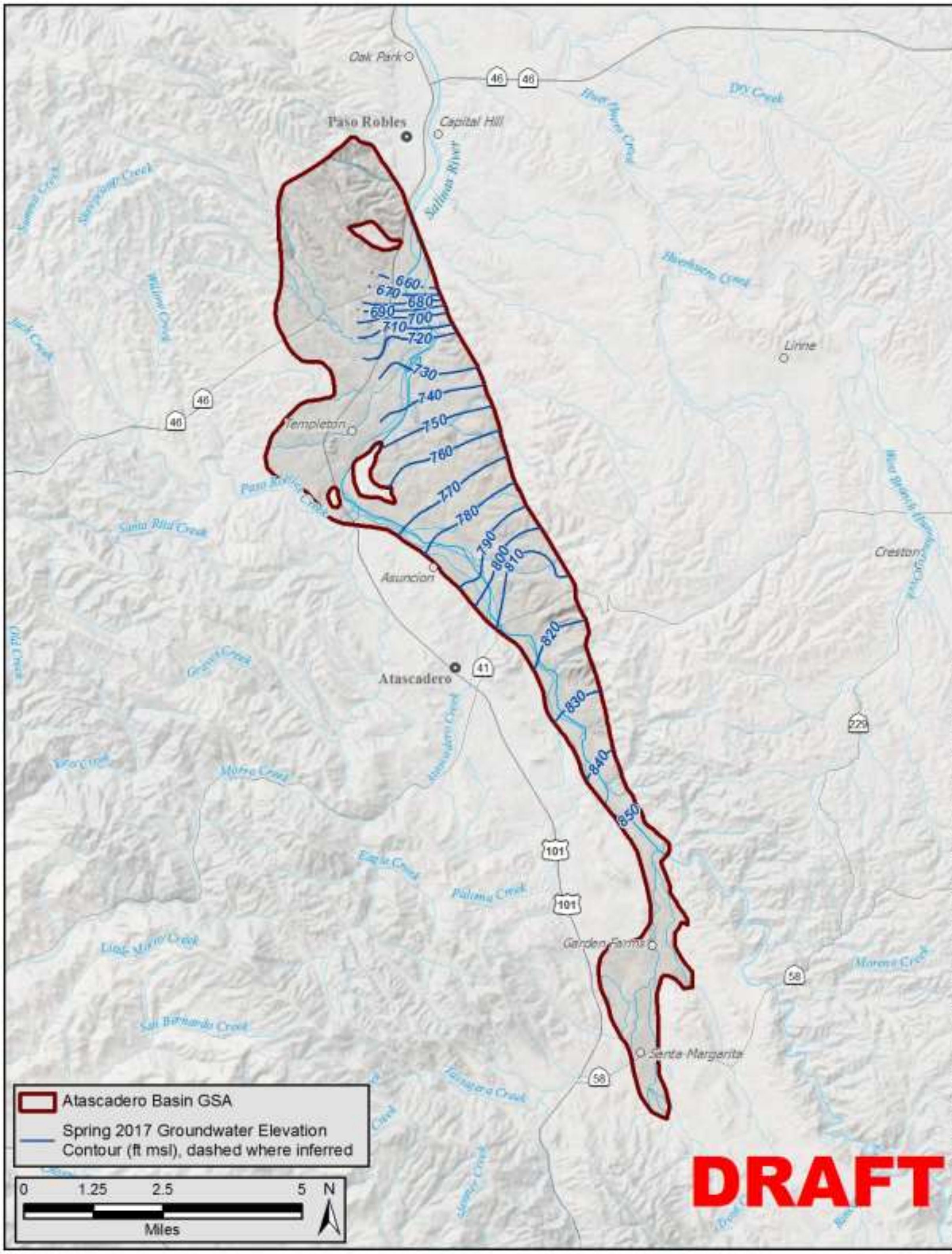
Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California		Spring 1997 Paso Robles Formation Aquifer Groundwater Elevation Contours
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-8



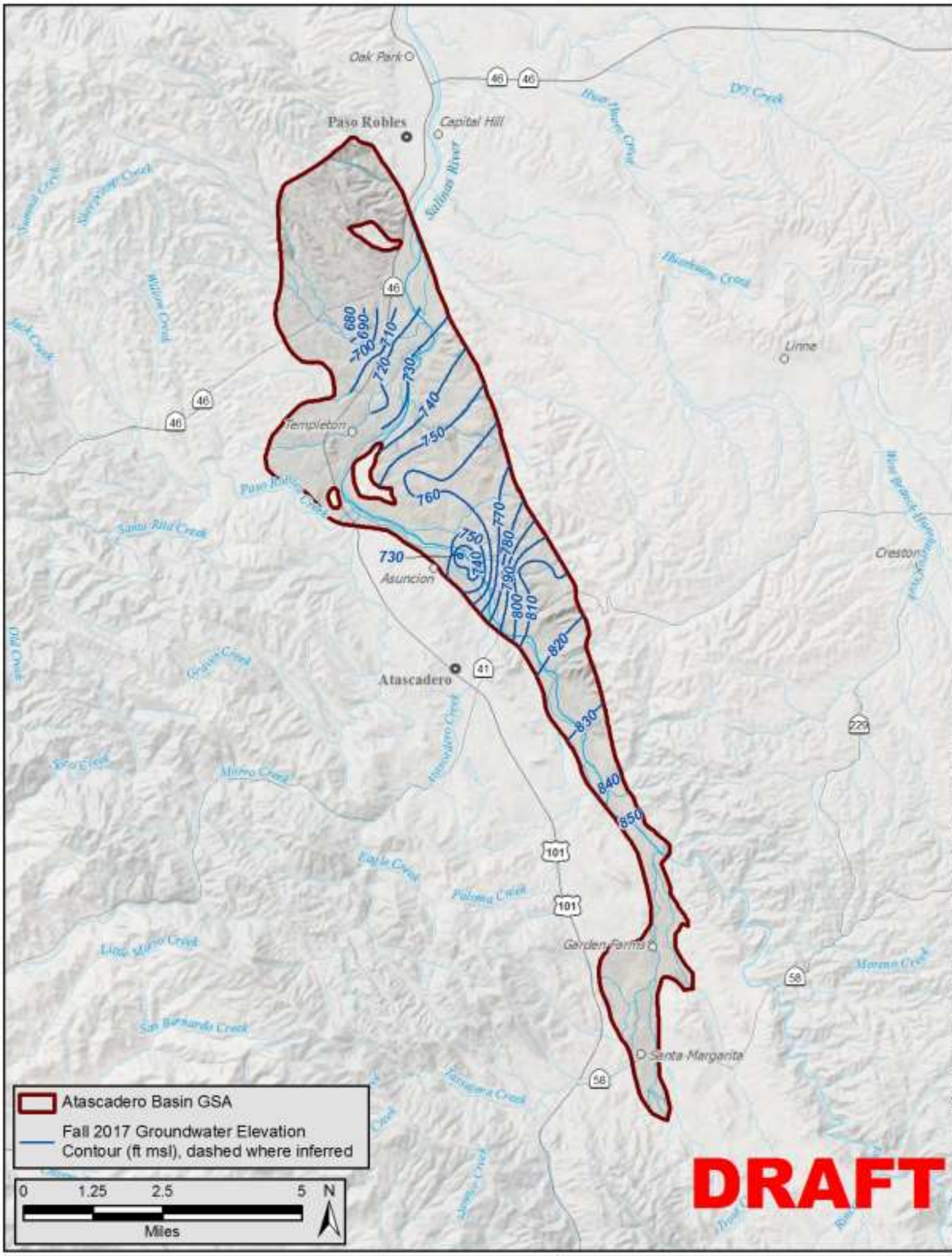
Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Spring 2011 Paso Robles Formation Aquifer Groundwater Elevation Contours
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-9



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI GSI	Spring 2015 Paso Robles Formation Aquifer Groundwater Elevation Contours
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-10



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Spring 2017 Paso Robles Formation Aquifer Groundwater Elevation Contours
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-11



Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California

Atascadero Basin GSA

Fall 2017 Paso Robles Formation Aquifer Groundwater Elevation Contours

OCTOBER 2019

FIGURE 5-12

pumping depression in spring 2015 except for in the north part of the Basin where flow direction was generally toward the northwest. Hydraulic gradients ranged from approximately 0.01, in close proximity to the pumping depression, to 0.0006 ft/ft elsewhere in the Basin. The spring 2015 contours indicate pumping influences in the Templeton area as well, although not as significant as those in the Atascadero area.

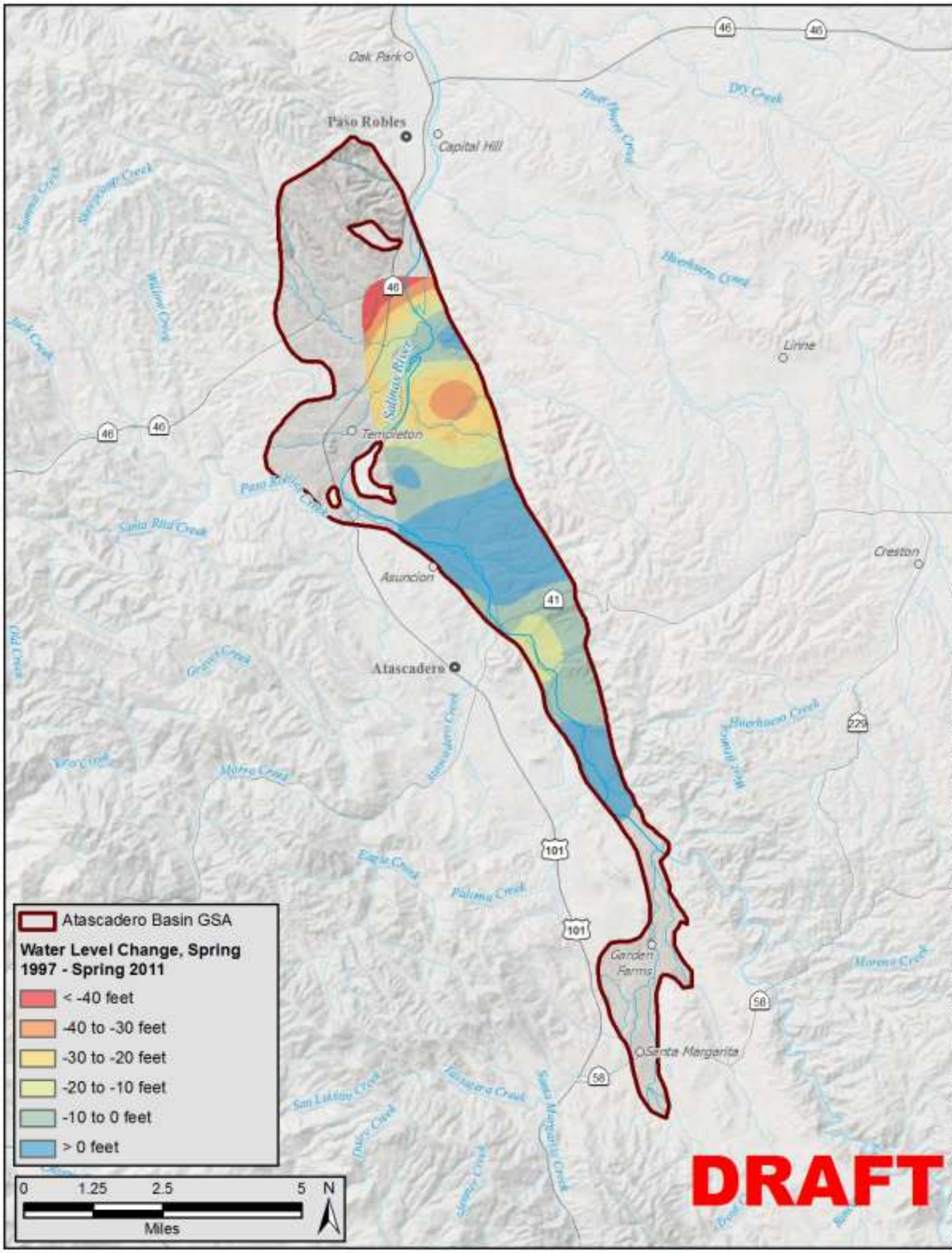
The spring 2017 groundwater elevations in the Paso Robles Formation Aquifer ranged from approximately 860 ft msl in the south to approximately 660 ft msl in the northern part of the Basin. Similar to spring 2011, the spring 2017 groundwater flow direction in the Paso Robles Formation Aquifer is generally to the north-northwest with hydraulic gradients ranging from approximately 0.02 to 0.001 ft/ft. The spring 2017 contours appear to show slight pumping influences in the Atascadero and Templeton areas.

Fall 2017 groundwater elevations in the Paso Robles Formation Aquifer ranged from approximately 860 ft msl in the south to approximately 680 ft msl in the northern part of the Basin. Fall 2017 groundwater flow direction in the Paso Robles Formation Aquifer is generally to the north-northwest with hydraulic gradients ranging from approximately 0.01 to 0.002 ft/ft. Pumping troughs are evident in the Templeton and Atascadero areas.

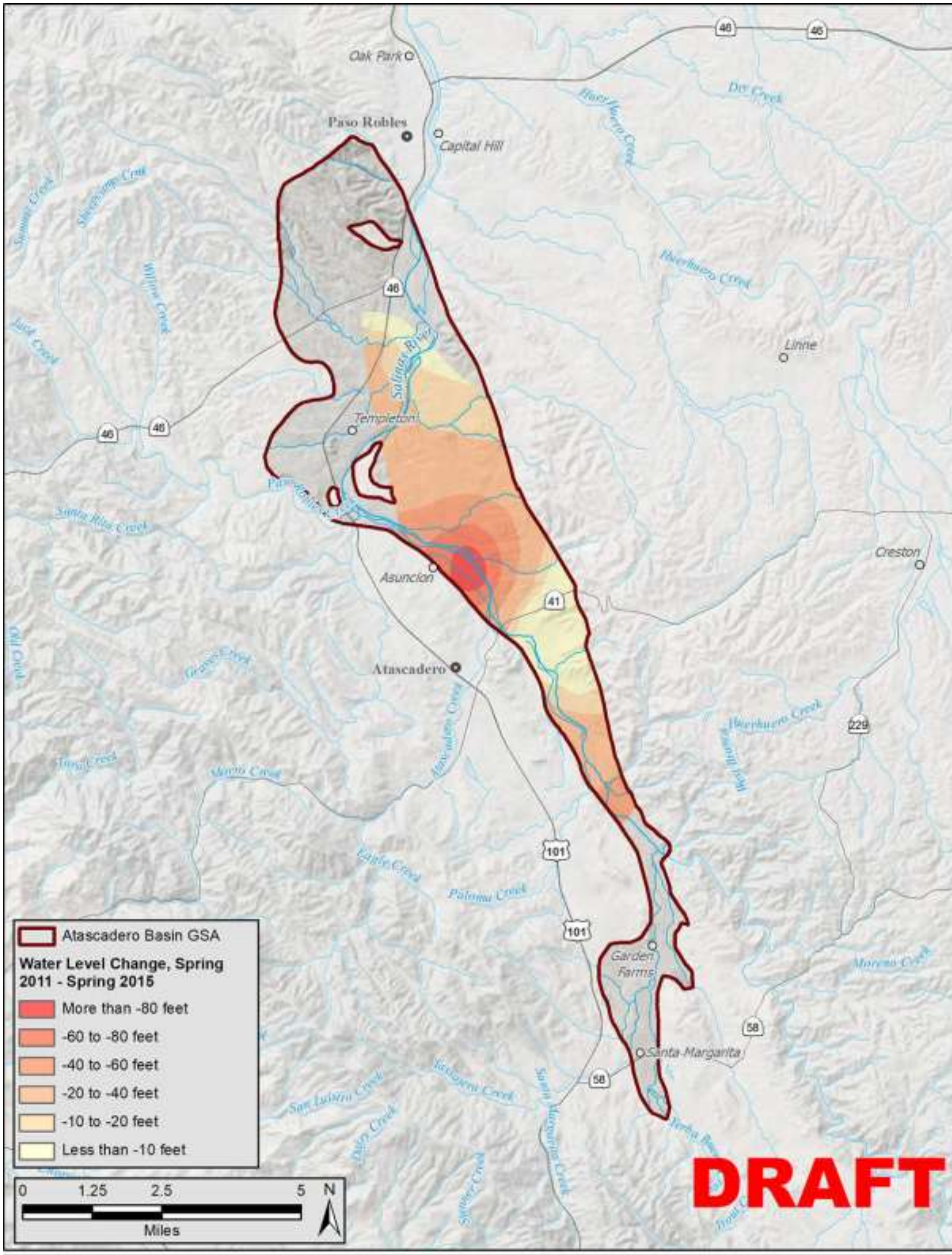
5.1.2.2 Paso Robles Formation Aquifer Changes in Groundwater Elevations

Figure 5-13 depicts the change in spring groundwater elevations in the Paso Robles Formation Aquifer between 1997 and 2011. Groundwater elevations are generally lower in 2011 than 1997 in the area east of Templeton and in the area near the intersection of HWY 101 and HWY 46 West (by as much as 45 feet). The decline in water levels in the northern part of the Basin is inferred to be related to increased agricultural pumping in the bedrock areas west of the Basin which may be resulting in decreased subsurface recharge to the Basin from the northwest. Groundwater elevations are higher in 2011 than 1997 in the Atascadero area north of the HWY 41 bridge by as much as 5 feet. The increase in water levels may be related to reductions in groundwater pumping in the area.

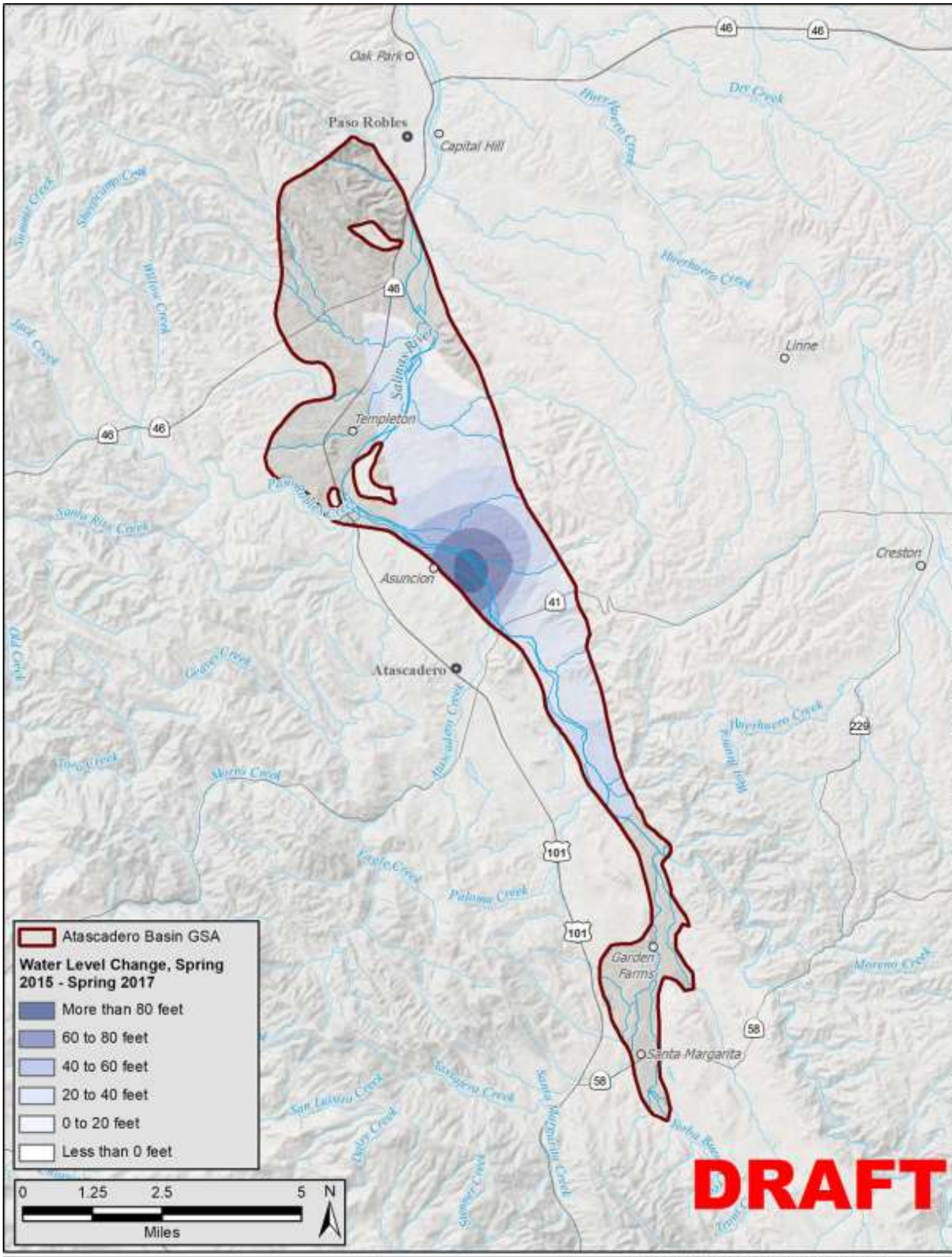
Figure 5-14 depicts the change in spring groundwater elevations in the Paso Robles Formation Aquifer between 2011 and 2015 and Figure 5-15 depicts the change in spring groundwater elevation between 2015 and 2017. Together, these effectively cover the time period of the recent drought. Groundwater elevations were significantly lower in 2015 than 2011 throughout the Basin, most notably in the Atascadero area. The relatively large decrease in water elevations in the Atascadero area are likely related to consistent groundwater production through the drought



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Paso Robles Formation Aquifer Change in Groundwater Elevation Spring 1997 to Spring 2011
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-13



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Paso Robles Formation Aquifer Change in Groundwater Elevation Spring 2011 to Spring 2015
Atascadero Basin GSA		OCTOBER 2019 — FIGURE 5-14



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Paso Robles Formation Aquifer Change in Groundwater Elevation Spring 2015 to Spring 2017
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-15

period coupled with an interruption of imported surface water delivery from the Nacimiento Water Project[2] (NWP) (John Neil, per. comm., August 23, 2019).

Groundwater elevations in the Paso Robles Formation Aquifer generally increased between spring 2015 and spring 2017, most significantly in the Atascadero area (Figure 5-15). This recovery to 2011 water levels in the Atascadero area is likely related to decreased groundwater production in 2015 and 2016, percolation of a nearly full allocation of NWP water in 2015, and above average precipitation in 2017.

The groundwater level contours and groundwater level change maps in this GSP are based on a reasonable and thorough analysis of the currently available data. The Basin has generally very good coverage in its existing groundwater monitoring network. However, the northwest end of the Basin, especially the area north of HWY-46, does not. A better understanding of water levels in the Paso Robles Formation in this area is important to the future understanding of the groundwater conditions in the north end of the Basin. Expanding the monitoring network and acquiring more groundwater elevation data will allow the GSA to refine and modify this GSP in the future based on a more complete understanding of Basin conditions. There are many existing private wells in the northwest area so there may be opportunities to bring one or more of them into the monitoring program through an outreach program. This is discussed further in Section 8.

5.1.2.3 Paso Robles Formation Aquifer Hydrographs

Appendix 5A includes ten hydrographs for wells in the Paso Roble Formation Aquifer. These wells were chosen because they have sufficient periods of record to identify trends and/or responses to climatic conditions, they are distributed throughout the Basin, and they have publicly available, non-confidential data.

Similar to the Alluvial Aquifer hydrographs, the Paso Robles Formation Aquifer hydrographs show periods of climatic variations grouped by the following designations: drought, wet period, or variable (see Figure 5-7). Generally, the hydrographs illustrate the overall stability of water levels throughout the Basin. All hydrographs but three demonstrate long-term stability of water levels, albeit with some showing seasonal fluctuations as much as 100 feet. The three exceptions include well 27S/12E-17B02 and 27S/12E-17E01, which are both located west of the intersection of HWY 101 and HWY 46 West, and well 27S/12E-22M01, which is located east of the Salinas River in the Templeton area. As discussed earlier, it is likely that the decline in water levels in the area near the intersection of HWY 101 and HWY 46 West is due to reduced subsurface inflow to the Basin as a result of increased agricultural activity in the bedrock regime to the west. Although well 27S/12E-22M01, east of Templeton, has shown a decline in water levels since the late

[2] The Nacimiento Water Project construction was completed by the San Luis Obispo County Flood Control and Water Conservation District in early 2010, and participating agencies, including City of Paso Robles, TCSD, and AMWC, have been taking deliveries of these imported surface water supplies from Nacimiento Reservoir to manage the Basin with imported water to augment the natural Basin supplies, especially during drought periods.

1990s, current water elevations are higher than water elevations prior to the 1980s, and have also shown an overall stability in the past decade.

5.1.3 *Vertical Groundwater Gradients*

Limited data exist to assess vertical groundwater gradients. Vertical groundwater gradients can be estimated from nested or clustered wells. Previous hydrologic studies of the Basin indicate that groundwater elevations are generally higher in the Alluvial Aquifer than the underlying Paso Robles Formation Aquifer, resulting in groundwater flow from the Alluvial Aquifer to the underlying Paso Robles Formation aquifer (Fugro, 2005). The lack of nested or clustered monitoring wells in the Basin is a data gap that will be addressed further in Section 8.

5.2 Change in Groundwater Storage

Changes in groundwater storage for the Alluvial Aquifer and Paso Robles Formation Aquifer are addressed in the Water Budget Section (Section 6).

5.3 Seawater Intrusion

Seawater intrusion is not an applicable sustainability indicator for the Basin. The Basin is not adjacent to the Pacific Ocean, a bay, or inlet.

5.4 Subsidence

Land subsidence is the lowering of the land surface. While several human-induced and natural causes of subsidence exist, the only process applicable to the GSP is subsidence due to lowered groundwater elevations caused by groundwater pumping.

Direct measurements of subsidence have not been made in the Basin using extensometers or repeat benchmark calibration; however, interferometric synthetic aperture radar (InSAR) has been used in the area to remotely map subsidence. This technology uses radar images taken from satellites that are used to create maps of changes in land surface elevation. One study done in the area shows that a localized area east of US HWY-101 and the Salinas River had a downward displacement of 1 to 2 inches between spring 1997 and fall 1997 (Valentine, D. W. et al., 2001). A second InSAR study completed for the time period of May 2015 to August 2016 showed 0 to 3 inches of downward displacement in the Basin (NASA JPL, 2018). It should be noted that neither study indicated that the change in ground surface elevation is attributed to extraction of groundwater.

Subsidence as a sustainability indicator will be addressed further in Section 8.

5.5 Interconnected Surface Water

The spatial extent of interconnected surface water in the Basin was evaluated using water level data from confidential and non-confidential Alluvial Aquifer and Paso Robles Formation Aquifer wells adjacent to the Salinas River[3]. In accordance with the SGMA emergency regulations §351 (o), "Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". The interconnected surface water analysis consisted of comparing average springtime water level elevations[4] in wells adjacent to the Salinas River with the elevation of the adjacent Salinas River thalweg. In cases where average springtime water levels were greater than the elevation of the adjacent Salinas River thalweg the stream reach was considered as potentially 'gaining'. In cases where average springtime water levels were below the adjacent thalweg elevation the stream reach was considered 'losing' and potentially 'disconnected'.

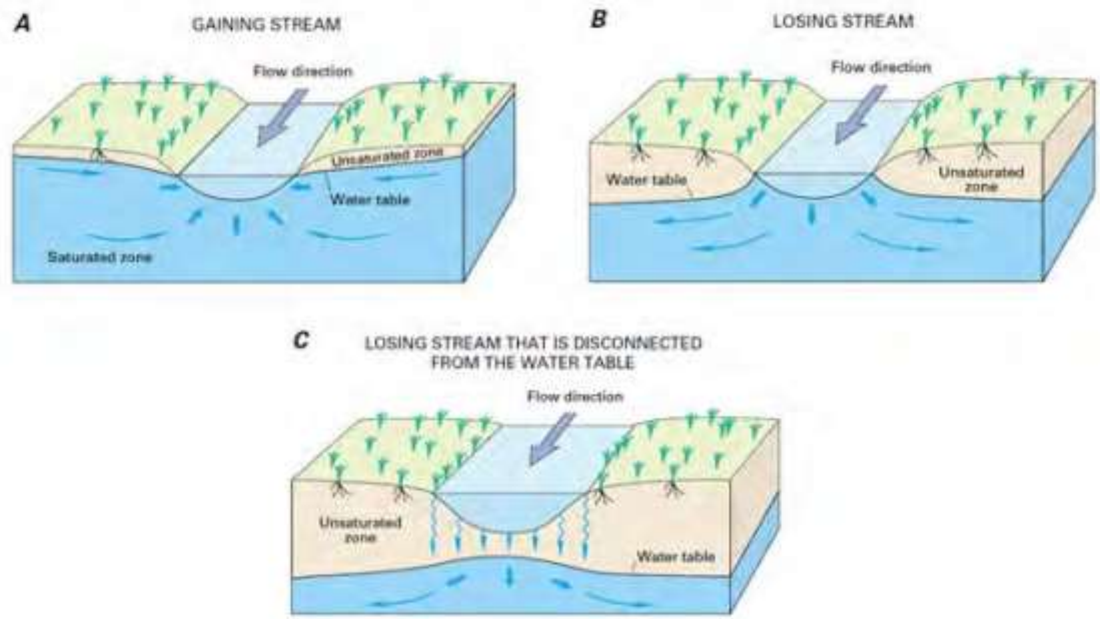
Paso Robles Formation Aquifer water levels were further evaluated based on their occurrence within confined or semi-confined zones of the aquifer or within areas known to be in direct communication with the overlying Alluvial Aquifer. Proximity to wastewater percolation and NWP infiltration basins was also considered in the analysis.

It is important to recognize that the results of these analyses reflect conditions that occur occasionally, in response to precipitation events. They are not representative of long-term average conditions. Figure 5-16 is a schematic illustrating types of interconnected and disconnected surface waters. In this figure, both diagrams A and B represent interconnected surface waters ('gaining' and 'losing', respectively) and diagram C shows disconnected 'losing' surface water.

The analysis outlined above resulted in identification of four reaches of the Salinas River that occasionally 'gain' water from the Alluvial Aquifer and four reaches that occasionally 'lose' water to the Alluvial Aquifer, one of which, located in the area just south of the City of Paso Robles, is likely also 'disconnected'. These identified reaches account for approximately 7.5 miles of the Salinas River course within the Basin, leaving approximately 8 miles of river with unknown interconnected surface water status. The results of the interconnected surface water analysis, for the Alluvial Aquifer are shown on Figure 5-17A.

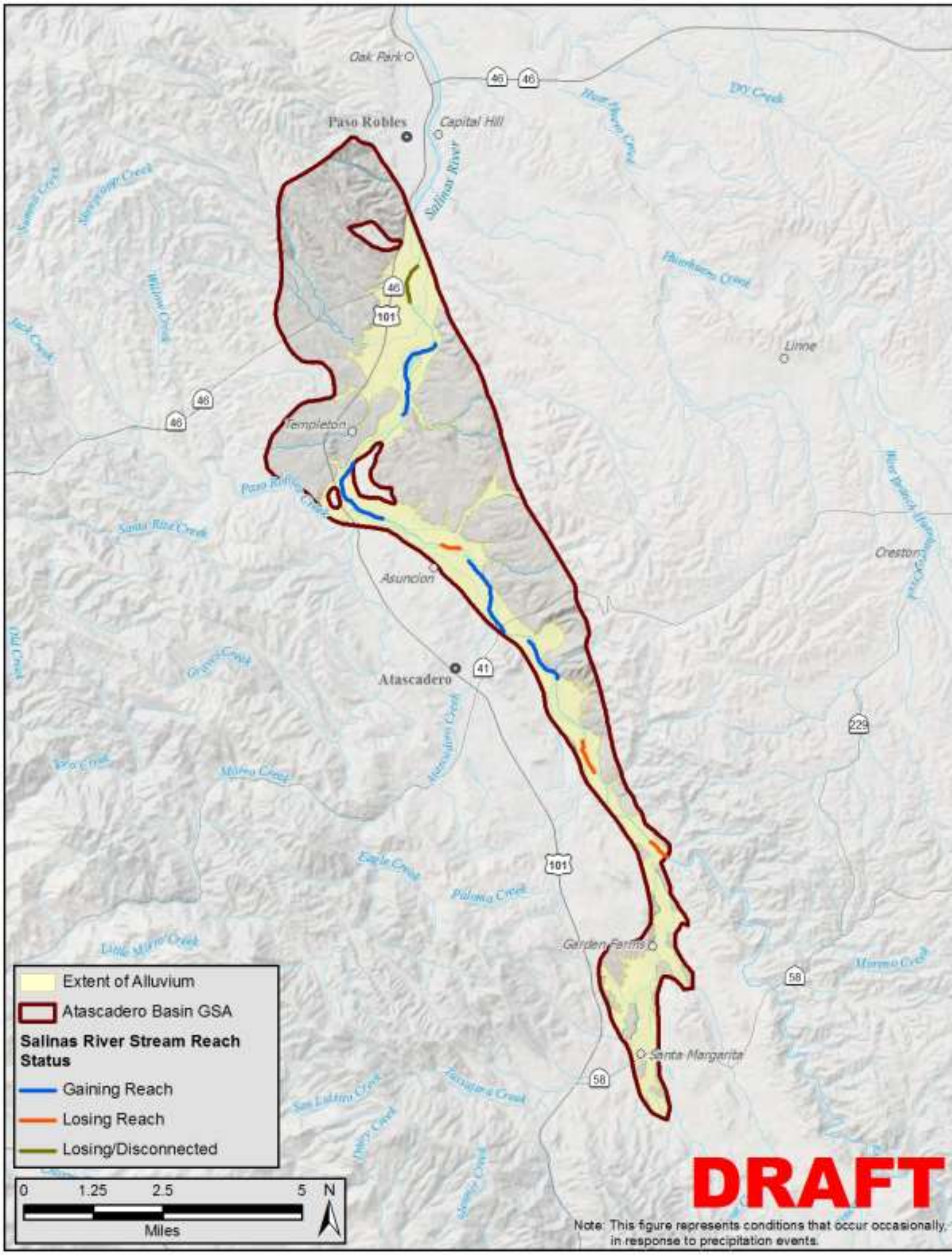
[3] The interconnected surface water analysis was restricted to the Salinas River, which is the only significant surface water body in the Subbasin.

[4] Average springtime water elevations were selected for the analysis because they represent the most commonly observed annual high water elevation over the period of record and because they generally correspond with periods of flow (or "Live Stream" events) in the Salinas River. As stated in Section 4, the Salinas River is ephemeral, and during most of the year, it either runs dry or loses water to the underlying aquifers.



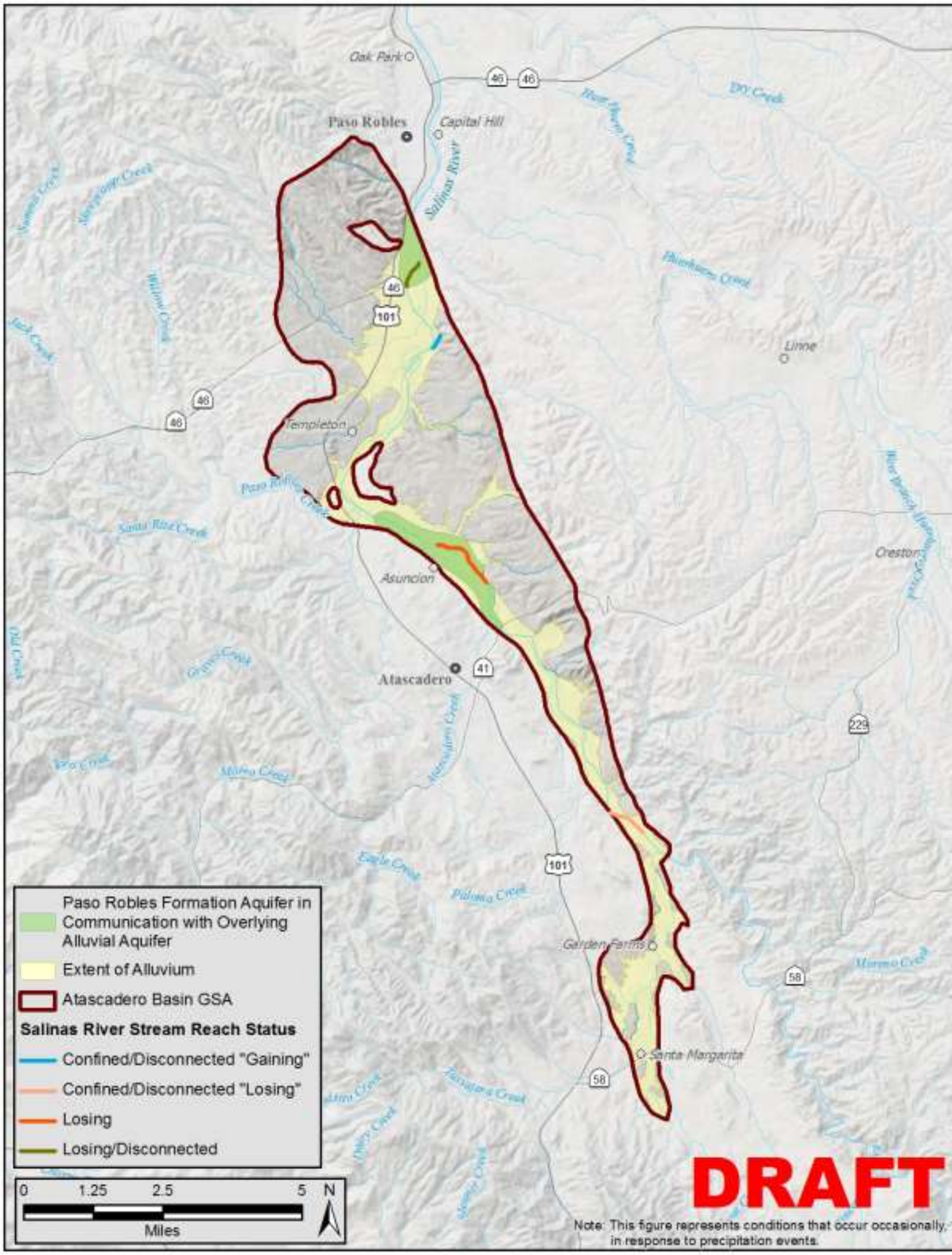
Adopted from USGS, 1999

Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	**INTERCONNECTED AND NON-INTERCONNECTED SURFACE WATERS SCHEMATIC**
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-16



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Locations of Potentially Interconnected Surface Waters - Alluvial Aquifer	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 5-17A

The Paso Robles Formation Aquifer water level analysis resulted in identification of one ‘losing’ reach of the Salinas River, located downstream of the HWY-41 bridge where the Paso Robles Formation is known to be in direct communication with the overlying Alluvial Aquifer, and one ‘losing’/’disconnected’ reach, located in the area just south of the City of Paso Robles. Water levels in the Paso Robles Formation Aquifer were also analyzed for two areas where the aquifer is confined. In one of these areas, in the Templeton area, the average springtime water levels are higher than the elevation of the adjacent Salinas River thalweg; however, this relationship is because of the presence of a documented clay aquitard in this area (Torres, 1979). Despite the elevation of the potentiometric surface in the Paso Robles Formation Aquifer at or above the thalweg, the aquifer is fully disconnected because of the documented confining clay layer. A second area analyzed within the assumed confined zone of the Paso Robles Formation Aquifer, located near the Atascadero State Hospital, shows water levels that are well below the elevation of the adjacent Salinas River thalweg. It is assumed that groundwater in the Paso Robles Formation Aquifer is disconnected from the Salinas River in this area. The results of the interconnected surface water analysis, for the Paso Robles Formation Aquifer are shown on Figure 5-17B.



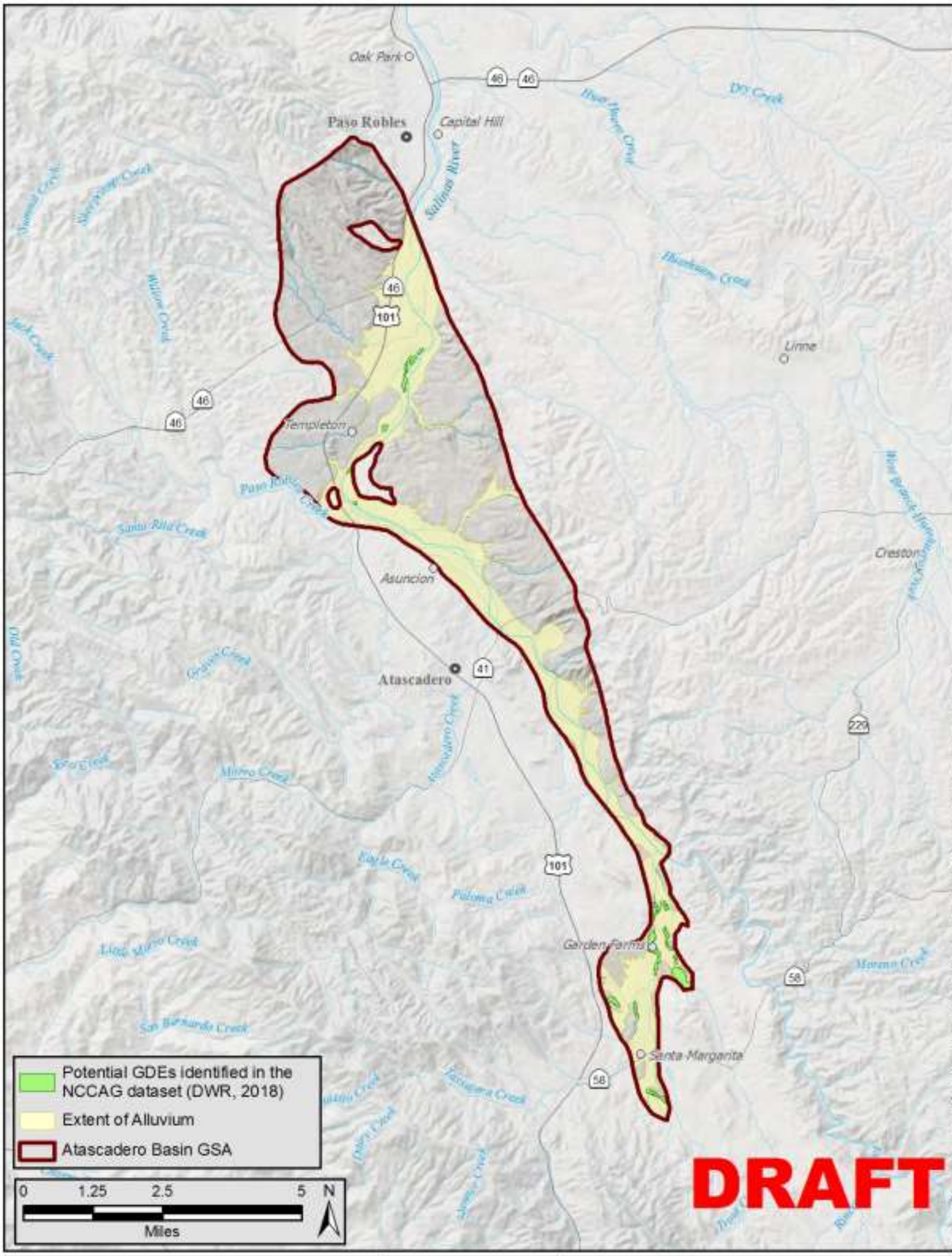
Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Locations of Potentially Interconnected Surface Waters - Paso Robles Formation	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 5-17B

5.5.1 *Depletion of Interconnected Surface Water*

Groundwater withdrawals are balanced by a combination of reductions in groundwater storage and changes in the rate of exchange across hydrologic boundaries. In the case of surface water depletion, this rate change could be due to reductions in rates of groundwater discharge to surface water, and increased rates of surface water percolation to groundwater. Variation in rates of groundwater discharge to surface water or surface water percolation to groundwater occur naturally throughout any given year, as driven by the natural hydrologic cycle, but they can also be affected by anthropogenic actions. The potential for depletion of interconnected surface waters in the Basin is discussed further in Section 6.

5.6 Potential Groundwater Dependent Ecosystems

The SGMA emergency regulations §351.16 require identification of groundwater dependent ecosystems within the Basin. The Natural Communities Commonly Associated with Groundwater (NCCAG) dataset (DWR, 2018) was utilized to identify the spatial extent of potential groundwater dependent ecosystems (GDEs) in the Basin. In accordance with the SGMA emergency regulations §351 (o), “groundwater dependent ecosystems refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface”. In areas where the water table is sufficiently high, groundwater discharge may occur as evapotranspiration (ET) from phreatophyte vegetation within these GDEs. The NCCAG dataset identifies a concentration of potential GDEs in the southern part of the Basin and several potential GDEs in the Templeton area. The overall distribution of potential GDEs within the Basin, as specified in the NCCAG dataset, is shown in Figure 5-18. There has been no verification that the locations shown on this map constitute GDEs. Additional field reconnaissance is necessary to verify the existence and extent of these potential GDEs. Appendix 5B describes methods that may be relied upon to improve the understanding of the extent and type of potential GDEs in the Basin (in progress).



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI / GSI	Potential Groundwater-Dependent Ecosystems	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 5-18

5.7 Groundwater Quality Distribution and Trends

Groundwater quality samples have been collected and analyzed throughout the Basin for various studies and programs and are collected on a regular basis for compliance with regulatory programs. A broad survey of groundwater quality sampling was conducted for the Paso Robles Groundwater Basin Study, Phase I (Fugro, 2002), and historical groundwater quality data were compiled for use in the Salt and Nutrient Management Plan (SNMP) (RMC, 2015). In addition to the cited, published studies, water quality data surveyed for this GSP were collected from:

- The California Safe Drinking Water Information System (SDWIS), a repository for public water system water quality data,
- The National Water Quality Monitoring Council water quality portal (this includes data from the recently decommissioned EPA STORET database, the USGS, and other federal and state entities [Note: in the Basin the agencies include USGS, California Environmental Data Exchange Network (CEDEN), and Central Coast Ambient Monitoring Program {CCAMP}]), and
- The California State Water Resources Control Board (SWRCB) GeoTracker GAMA database.

The main source of recharge to the Basin is the percolation of streamflow from the Salinas River, which drains the Cretaceous-age granitic rocks and Cretaceous and Tertiary-age sedimentary beds of the northwestern La Panza Range. This recharge, typically a calcium and magnesium bicarbonate water, has the greatest influence on water quality in the basin (Fugro, 2002). Significant inflow from Santa Margarita, Atascadero, and Paso Robles creeks also provides recharge to the Basin. Santa Margarita Creek (including Trout, Yerba Buena, and upper Santa Margarita creeks) water quality is typically magnesium-calcium-bicarbonate, whereas Atascadero and Paso Robles creek waters are typically calcium-bicarbonate (Fugro, 2002).

In general, the quality of groundwater in the Basin is good. Water quality trends in the Basin are dominantly stable, with some areas of improving water quality and few significant trends of ongoing deterioration of water quality. The distribution, concentrations, and trends of several major water quality constituents are presented in the following sections.

5.7.1 *Groundwater Quality Suitability for Drinking Water*

Groundwater in the Basin is generally suitable for drinking water purposes. Groundwater quality data was evaluated from the SDWIS and GeoTracker GAMA datasets. The data reviewed includes 4,500 sampling events from 149 wells in the Basin, collected between June 1953 and June 2019. Drinking water standards Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) are established by Federal and State agencies. MCLs are legally enforceable standards, while SMCLs are guidelines established for nonhazardous aesthetic considerations such as taste, odor, and color. Water quality standard exceedances in the Basin include exceedance of the MCL for nitrate, which equaled or exceeded the standard in 108 samples out of 1,959 samples (with 98 of the exceedances occurring in one well), and exceedance of the SMCL for total dissolved solids, which equaled or exceeded the standard in 24 samples from 11 wells out of 1,148 samples. Gross alpha samples from two wells exceeded the corresponding MCL in 3 out of 363 samples collected and selenium samples from two different wells exceeded the corresponding MCL in 3 out of 380 samples collected. Sulfate samples from three wells exceeded the corresponding SMCL in 4 out of 645 samples collected. The most common water quality exceedances observed in the Basin are exceedance of the MCL for arsenic, which equaled or exceeded the standard in 214 out of 983 samples (with 193 of the exceedances occurring in one well), and exceedance of the SMCL for iron, which equaled or exceeded the standard in 131 out of 1,021 samples (with 109 of the exceedances occurring in one well). In the case of public water supply systems, these water quality exceedances are effectively mitigated with seasonal well use and water blending practices to reduce the constituent concentrations to below their respective water quality standard.

5.7.2 *Groundwater Quality Suitability for Agricultural Irrigation*

Groundwater in the Basin is generally suitable for agricultural purposes, with some restrictions as described below. The primary water quality constituents of interest for evaluating agricultural irrigation uses are the sodium adsorption ratio (SAR), electrical conductivity (EC), sodium, boron, and chloride. Groundwater quality data was evaluated from the SDWIS and GeoTracker GAMA datasets. The data reviewed includes over 4,300 sampling events from 164 wells in the Basin, collected between June 1953 and June 2019. Approximately a quarter of the samples evaluated show no restriction for use in agricultural irrigation, based on evaluation of the above parameters. Electrical conductivity (EC) results from over 500 water samples taken from wells located throughout the Basin indicate that some caution should be used if irrigating salt sensitive crops. In general, seasonal monitoring of root zone soil salinity may be advisable to identify and prevent any developing soil salinity accumulation. Results of 77 water samples indicate some caution should be used if irrigating trees and vines due to potential sodium ion toxicity. Ten samples from four wells located in the northern part of the Basin indicate severe restriction for tree and vine irrigation due to potential sodium ion toxicity. Results of 284 water samples indicate some caution should be used if irrigating trees and vines due to potential chloride ion toxicity. The majority of these water samples were taken from wells located in the northern part of the Basin. None of the water samples indicate severe irrigation restrictions due to potential chloride ion toxicity. Results of 12 water samples taken from four wells located in the northern part of the Basin indicate slight to moderate restrictions for irrigation of vegetable and field crops and severe restrictions for tree and vine crops due to potential boron ion toxicity. Results of 120 water samples suggest potential soil water infiltration restrictions as indicated by a combination of SAR and EC parameters. Seventeen water samples taken from 13 wells indicate potentially severe soil water infiltration restrictions. All but one of these wells are located in the northern part of the Basin, the other is located in the Santa Margarita area.

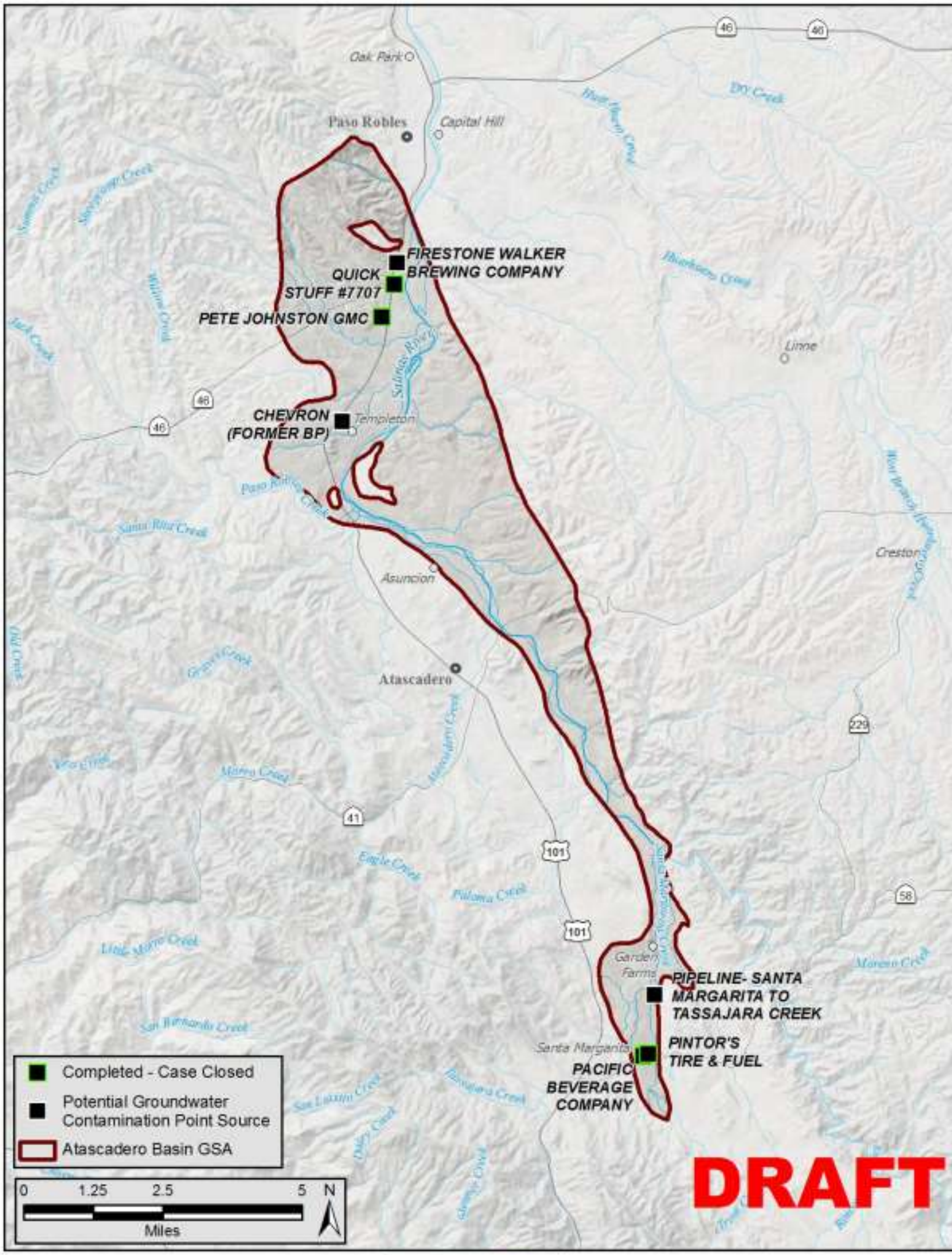
5.7.3 *Distribution and Concentrations of Point Sources of Groundwater Constituents*

Potential point sources of groundwater quality degradation were identified using the State Water Resources Control Board (SWRCB) Geotracker website. Waste Discharge permits were also reviewed from on-line regional SWRCB websites. **Table 5-*1*** summarizes information from these websites for open/active sites. Figure 5-19 shows the locations of these potential groundwater contaminant point sources and the locations of completed/case closed sites. Based on available information there are no mapped ground-water contamination plumes at these sites.

Table 5-1. Potential Point Sources of Groundwater Contamination

Site ID/ Site Name	Site Type	Constituent(s) of Concern (COCs)	Status
SL0607989492 – Pipeline-Santa Margarita to Tassajara Creek	Cleanup Program Site	Crude Oil	Open – Verification Monitoring
T0607900001 – Chevron (Former BP)	LUST Cleanup Site	Gasoline, MTBE, TBA/Other Fuel Oxygenates	Open – Eligible for Closure as of 10/26/2018
T10000009038 – Firestone Walker Brewing Company	Cleanup Program Site	PCE, TCE, Vinyl Chloride, Other Chlorinated Hydrocarbons	Open - Remediation

Notes: LUST – Leaking Underground Storage Tank, MTBE – Methyl Tertiary Butyl Ether, TBA – Tertiary Butyl Alcohol, PCE – Tetrachloroethylene, TCE – Trichloroethylene



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Location of Potential Point Sources of Groundwater Contaminants	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 5-19

5.7.4 *Distribution and Concentrations of Diffuse or Natural Groundwater Constituents*

The distribution and concentration of several constituents of concern are discussed in the following subsections. Groundwater quality data was evaluated from the SDWIS and GeoTracker GAMA datasets. The data reviewed includes 4,500 sampling events from 149 wells in the Basin, collected between June 1953 and June 2019. Each of the constituents are compared to their drinking water standard, if applicable, or their Basin Plan Median Groundwater Quality Objective (RWQCB Objective) (CCRWQCB, 2017). This GSP focuses only on constituents that might be impacted by groundwater management activities. The constituents discussed below are chosen because:

1. The constituent has either a drinking water standard or a known effect on crops.
2. Concentrations have been observed above either the drinking water standard or the level that affects crops.

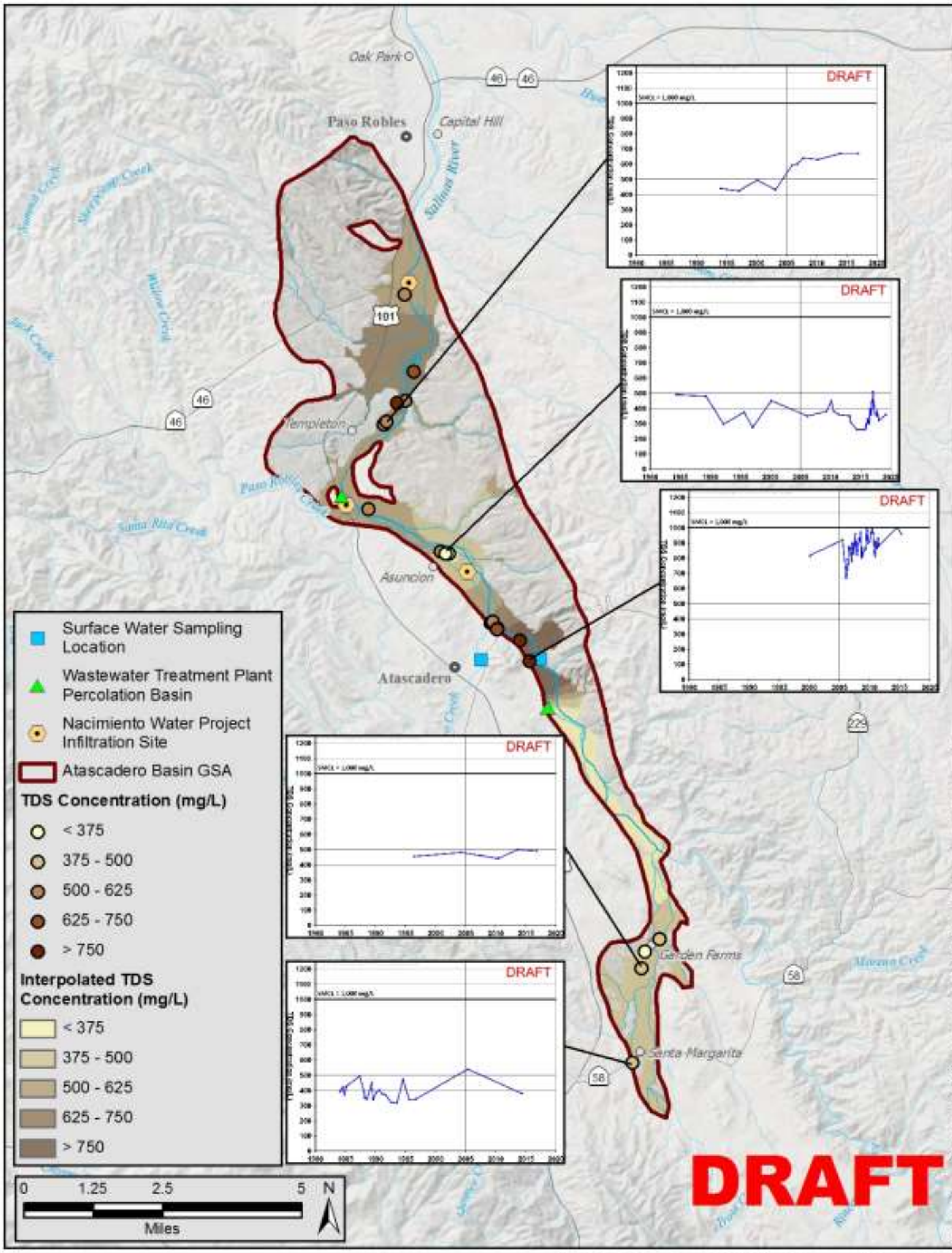
5.7.4.1 Total Dissolved Solids

TDS is defined as the total amount of mobile charged ions, including minerals, salts or metals, dissolved in a given volume of water and is commonly expressed in terms of milligrams per liter (mg/L). TDS is a constituent of concern in groundwater because it has been detected at concentrations greater than its RWQCB Objectives of 550 mg/l in the Atascadero area and 730 mg/l in the Templeton area. The TDS Secondary MCL has been established for color, odor and taste, rather than human health effects. This Secondary MCL includes a recommended standard of 500 mg/L, an upper limit of 1,000 mg/L and a short-term limit of 1,500 mg/l. TDS water quality results ranged from 187 to 1,000 mg/l with an average of 600 mg/l in the Alluvial Aquifer and ranged from 300 to 2,090 mg/l with an average of 615 mg/l in the Paso Robles Formation Aquifer.

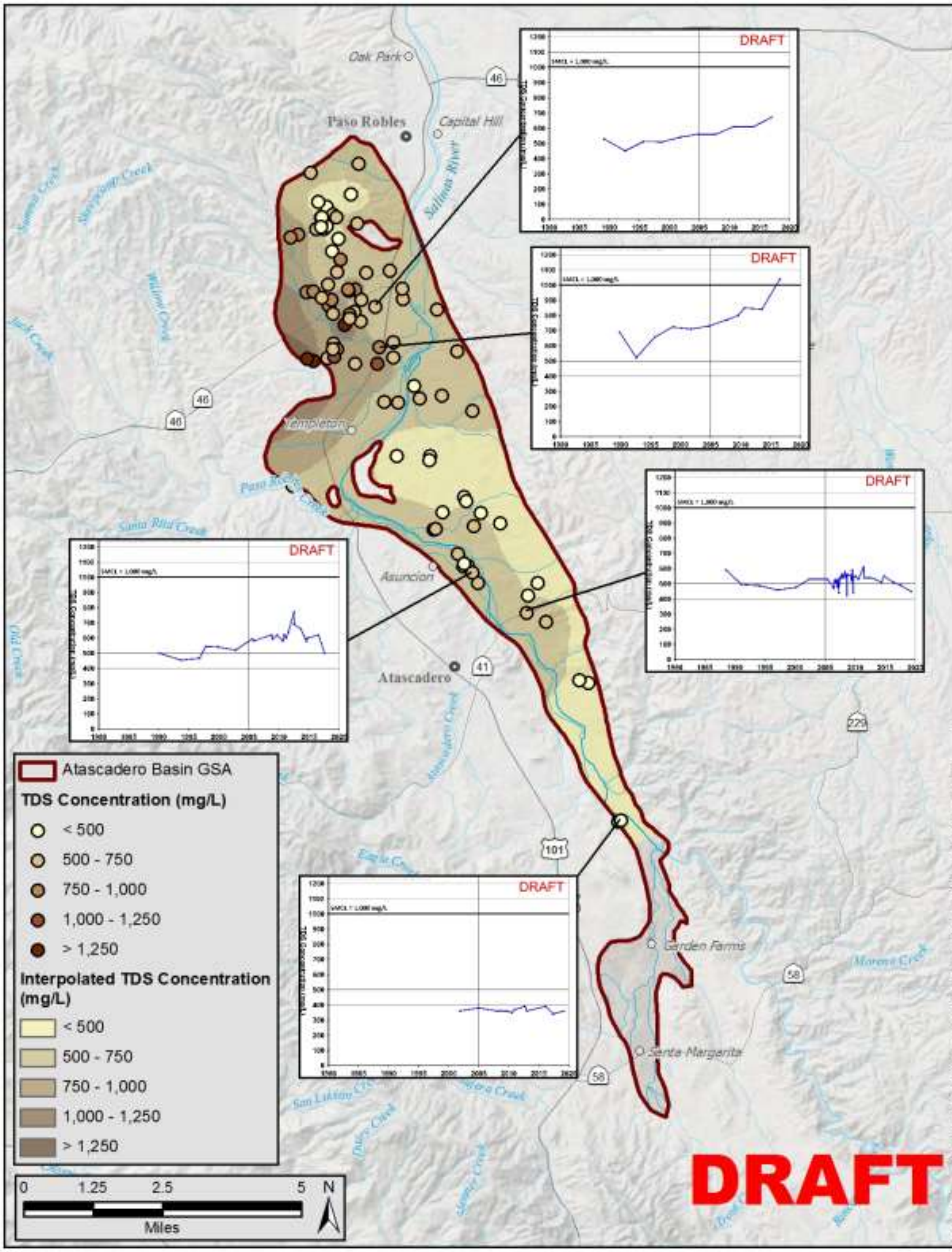
Fugro (2002) identified a slight trend of increasing TDS in alluvial and shallow Paso Robles Formation deposits along the Salinas River in the central portion of the Basin. This trend continues today, with the most visible trend of increasing TDS occurring in alluvial wells located in the Salinas River valley just downstream of both the City of Atascadero's and Templeton CSD's wastewater percolation ponds. There is also a trend of increasing TDS in Paso Robles Formation wells in the northwestern part of the Basin. This could be related to increased pumping in the northwestern highland areas within and adjacent to the Basin which may be resulting in decreased subsurface recharge to the Basin from the northwest. There are also some areas in the Basin with decreasing TDS concentrations. Several wells located in the Salinas River valley just downstream of NWP infiltration basins have shown decreasing TDS concentrations in response to introduction of NWP water.

The distribution and trends of TDS concentrations in the Alluvial Aquifer and the Paso Robles Formation Aquifer are shown on Figure 5-20 and Figures 5-21, respectively. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause TDS concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

Surface water samples have been collected from Atascadero Creek, about 1 mile upstream of its confluence with the Salinas River (located outside of the Basin), and from the Salinas River, about 1 mile upstream of the HWY-41 bridge (located within the Basin). Water samples from the Atascadero Creek site showed TDS levels ranging from 50 to 1,146 mg/l and averaging 497 mg/l, based on 120 sampling events between April 1999 and December 2012. Water samples from the Salinas River site showed TDS levels ranging from 74 to 777 mg/l and averaging 355 mg/l, based on 68 sampling events between February 1999 and June 2012. Concentrations of TDS in these surface water analyses do not show any long-term trends. The concentrations are generally higher in the summer and fall months, during times of typically lower stream flow, and lower in winter and spring months, during times of higher stream flow.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	TDS Regional Distribution and Trends Alluvial Aquifer	
Atascadero Basin GSA		OCTOBER 2019	FIGURE 5-20



Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California

Atascadero Basin GSA

TDS Regional Distribution and Trends
Paso Robles Formation Aquifer

OCTOBER 2019

FIGURE 5-21

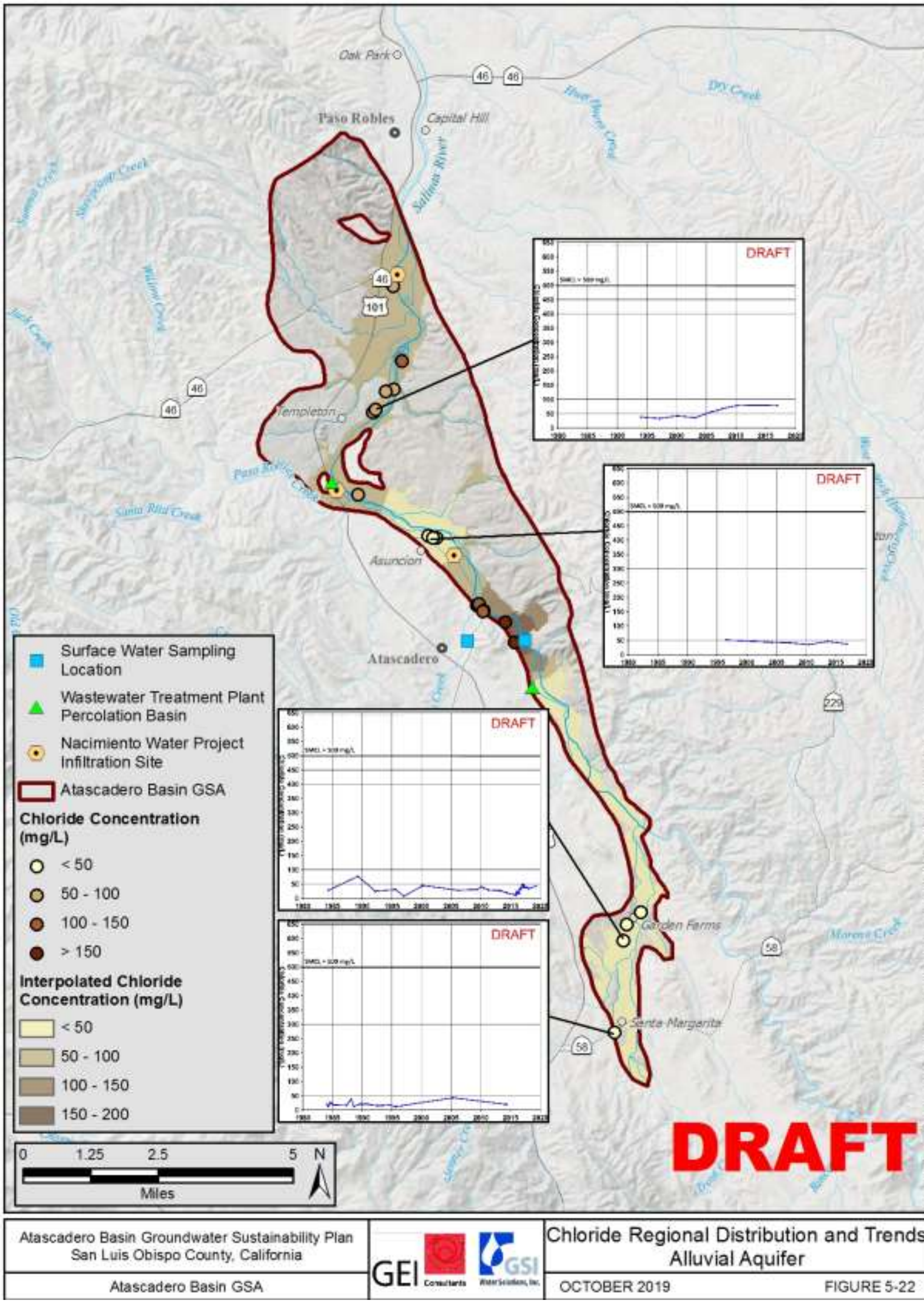
5.7.4.2 Chloride

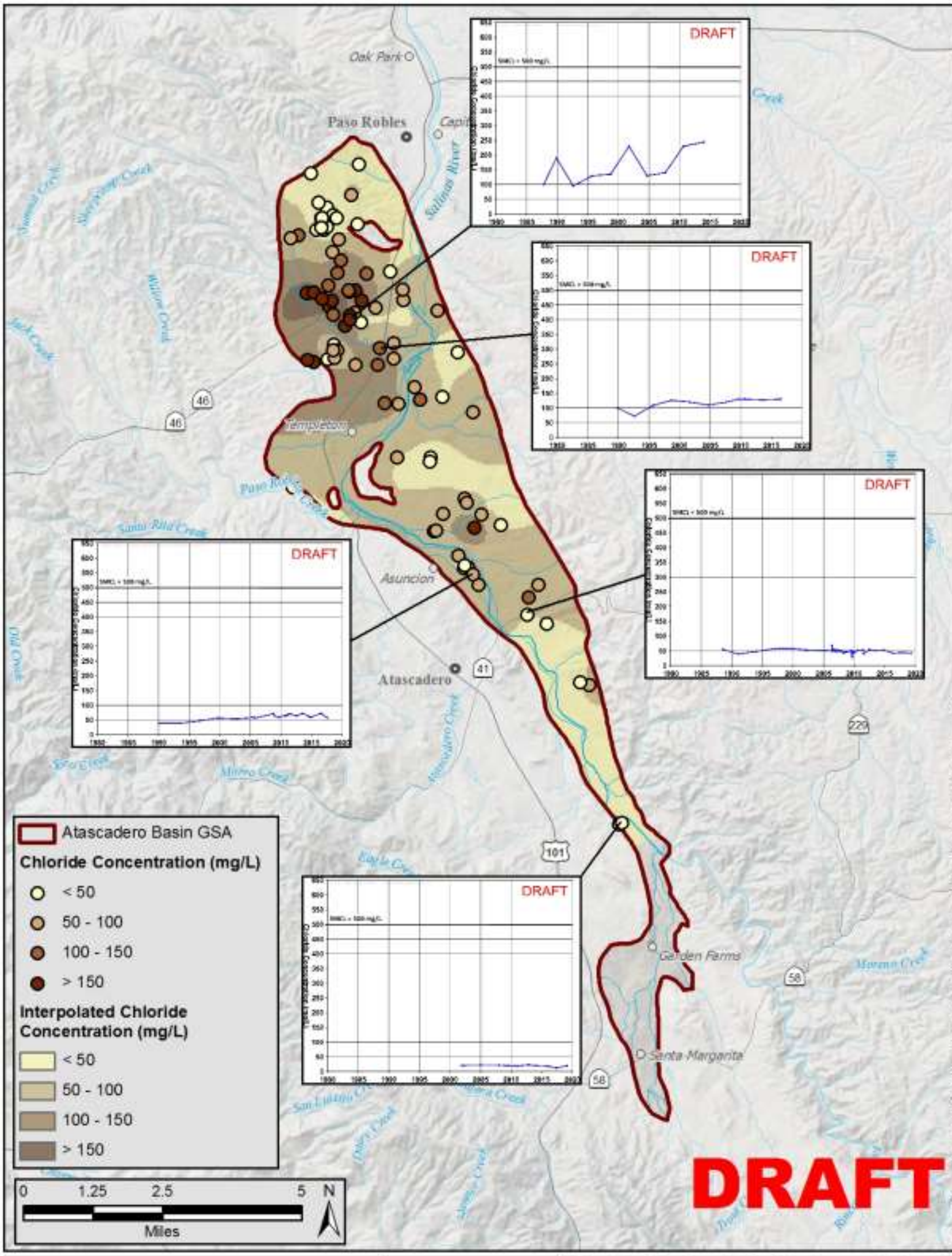
Chloride is a constituent of concern in groundwater because it has been detected at concentrations greater than its Basin Objectives of 70 mg/l in the Atascadero area and 100 mg/l in the Templeton area. The Chloride Secondary MCL has been established at 250 mg/l for taste, rather than human health effects. Chloride water quality results ranged from 4.8 to 392 mg/l with an average of 92 mg/l in the Alluvial Aquifer and ranged from 7.7 to 244 mg/l with an average of 76 mg/l in the Paso Robles Formation Aquifer.

Fugro (2002) identified a slight trend of increasing chlorides in alluvial and shallow Paso Robles Formation deposits along the Salinas River in the central portion of the Basin. This trend continues today, with the most visible trend of increasing chloride occurring in alluvial wells located in the Salinas River valley just downstream of both the City of Atascadero's and Templeton CSD's wastewater percolation ponds. There is also a slight trend of increasing chloride in Paso Robles Formation wells in the northwestern part of the Basin. Similar to TDS, this could be related to increased pumping in the northwestern highland areas within and adjacent to the Basin which may be resulting in decreased subsurface recharge to the Basin from the northwest. Elsewhere within the Basin, many wells exhibit stable or slightly decreasing chloride concentrations. Several wells located in the Salinas River valley just downstream of NWP infiltration basins have shown decreasing chloride concentrations in response to introduction of NWP water.

The distribution and trends of chloride concentrations in the Alluvial Aquifer and the Paso Robles Formation Aquifer are shown on Figure 5-22 and Figures 5-23, respectively. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause chloride concentrations in groundwater in a well that would otherwise remain below the SMCL to increase above the SMCL.

Surface water samples have been collected from Atascadero Creek, about 1 mile upstream of its confluence with the Salinas River (located outside of the Basin), and from the Salinas River, about 1 mile upstream of the HWY-41 bridge (located within the Basin). Water samples from the Atascadero Creek site showed chloride levels ranging from 13 to 97 mg/l and averaging 67 mg/l, based on 38 sampling events between April 1999 and December 2012. Water samples from the Salinas River site showed chloride levels ranging from 11 to 100 mg/l and averaging 53 mg/l, based on 23 sampling events between February 1999 and June 2012. Concentrations of chloride in these surface water analyses do not show any long-term trends. The concentrations are generally higher in the summer and fall months, during times of typically lower stream flow, and lower in winter and spring months, during times of higher stream flow.


Oak Park
Paso Robles
Capitol Hill
Salinas River
Dry Creek
Templeton
Paso Robles Creek
Santa Rita Creek
Asuncion
Atascadero
Garden Farms
Santa Margarita
DRAFT
DRAFT
DRAFT
DRAFT
DRAFT
Surface Water Sampling Location
Wastewater Treatment Plant Percolation Basin
Nacimiento Water Project Infiltration Site
Atascadero Basin GSA
Chloride Concentration (mg/L)
< 50
50 - 100
100 - 150
> 150
Interpolated Chloride Concentration (mg/L)
< 50
50 - 100
100 - 150
150 - 200
0
1.25
2.5
5
N
Miles
Atascadero Basin Groundwater Sustainability Plan
San Luis Obispo County, California
Atascadero Basin GSA
GEI Consultants
GSI Water Solutions, Inc.
Chloride Regional Distribution and Trends
Alluvial Aquifer
OCTOBER 2019
FIGURE 5-22



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Chloride Regional Distribution and Trends Paso Robles Formation Aquifer
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-23

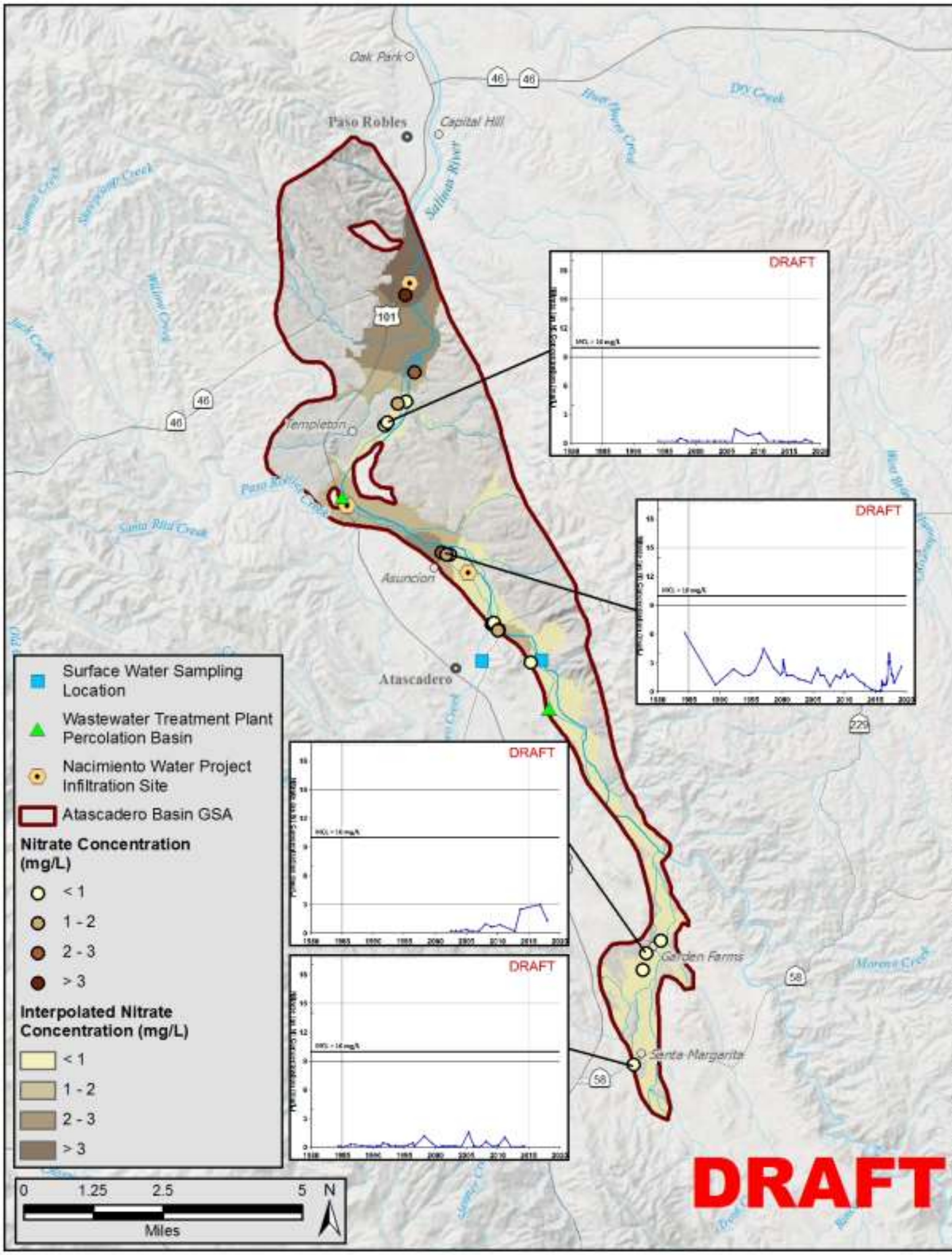
5.7.4.3 Nitrate

Nitrate is a widespread contaminant in California groundwater. High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilizers and wastewater treatment facilities. Nitrate is the primary form of nitrogen detected in groundwater. It is soluble in water and can easily pass through soil to the groundwater table. Nitrate can persist in groundwater for decades and accumulate to high levels as more nitrogen is applied to the land surface each year.

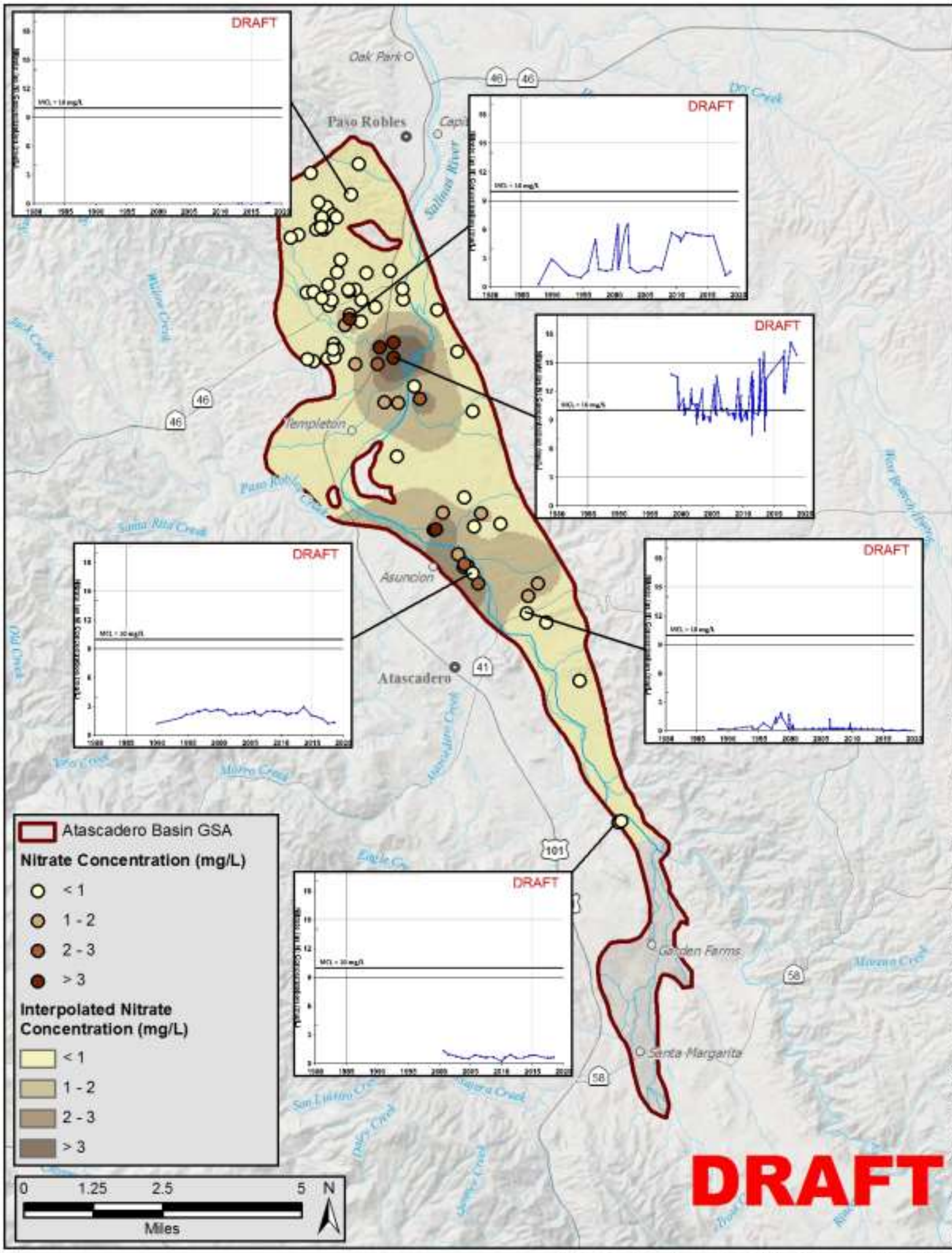
Nitrate is a constituent of concern in groundwater because it has been detected at concentrations greater than its Basin Objectives of 2.3 mg/l (as N) in the Atascadero area and 2.7 mg/l (as N) in the Templeton area. The Nitrate MCL has been established at 10 mg/l (as N). Overall, nitrate water quality results ranged from non-detect to 18 mg/l (as N) with an average of 1.3 mg/l (as N) in the Alluvial Aquifer and ranged from non-detect to 22 mg/l (as N) with an average of 4.2 mg/l (as N) in the Paso Robles Formation Aquifer.

Nitrate concentrations in the Alluvial Aquifer were relatively high in the 1990’s (2.2 mg/l [as N] on average), declined in the 2000’s (1.2 mg/l [as N] on average), continued to decline and reached a low of 0.5 mg/l (as N) on average in 2015. Nitrate concentrations in the Alluvial Aquifer have since increased and are back at levels seen in the 2000’s. Nitrate concentrations in the Paso Robles Formation Aquifer were climbing throughout the 1990’s (3.4 mg/l [as N] on average) and the 2000’s (4.9 mg/l [as N] on average), then began to decline and reached a low of 1.8 mg/l (as N) on average in 2014. Similar to the Alluvial Aquifer, nitrate concentrations in the Paso Robles Formation Aquifer have since increased and are now back at levels seen in the 1990’s. The distribution and trends of Nitrate concentrations in the Alluvial Aquifer and the Paso Robles Formation Aquifer are shown on Figure 5-24 and Figures 5-25, respectively. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause nitrate concentrations in groundwater in a well that would otherwise remain below the MCL to increase above the MCL.

Surface water samples have been collected from Atascadero Creek, about 1 mile upstream of its confluence with the Salinas River (located outside of the Basin), and from the Salinas River, about 1 mile upstream of the HWY-41 bridge (located within the Basin). Water samples from the Atascadero Creek site showed nitrate levels ranging from 0.03 to 0.4 mg/l (as N) and averaging 0.1 mg/l (as N), based on 30 sampling events between May 1999 and December 2012. Water samples from the Salinas River site showed nitrate levels ranging from 0.2 to 1 mg/l (as N) and averaging 0.6 mg/l (as N), based on 23 sampling events between February 1999 and June 2012. Concentrations of nitrate in the Salinas River show a decreasing trend over the period of record. Concentrations of nitrate in Atascadero Creek do not show any long-term trends. In general, the concentrations are higher in the summer and fall months, during times of typically lower stream flow, and lower in winter and spring months, during times of higher stream flow.



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Nitrate Regional Distribution and Trends Alluvial Aquifer
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-24



Atascadero Basin Groundwater Sustainability Plan San Luis Obispo County, California	GEI Consultants / GSI Water Solutions, Inc.	Nitrate Regional Distribution and Trends Paso Robles Formation Aquifer
Atascadero Basin GSA		OCTOBER 2019 FIGURE 5-25

5.7.4.4 Boron

Boron is an unregulated constituent and therefore does not have a regulatory standard. However, boron is a constituent of concern because elevated boron concentrations in water can damage crops and affect plant growth. Boron has been detected at concentrations greater than its Basin Objective of 300 micrograms per liter (ug/l). Boron water quality results ranged from non-detect to 520 ug/l with an average of 74 ug/l in the Alluvial Aquifer and ranged from non-detect to 1,100 ug/l with an average of 104 ug/l in the Paso Robles Formation Aquifer.

Boron concentrations in the Alluvial Aquifer have been relatively consistent throughout the period of record. Boron concentrations in the Paso Robles Formation Aquifer have generally remained steady or declined slightly over the period of record. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause boron concentrations in groundwater in a well to increase.

Surface water samples have been collected from Atascadero Creek, about 1 mile upstream of its confluence with the Salinas River (located outside of the Basin), and from the Salinas River, about 1 mile upstream of the HWY-41 bridge (located within the Basin). Water samples from the Atascadero Creek site showed boron levels ranging from 52 to 220 ug/l and averaging 97 ug/l, based on 41 sampling events between May 1999 and December 2012. Water samples from the Salinas River site showed boron levels ranging from 61 to 170 ug/l and averaging 109 ug/l, based on 20 sampling events between September 1999 and June 2012. Concentrations of boron in these surface water analyses do not show any long-term trends. The concentrations are generally higher in the summer and fall months, during times of typically lower stream flow, and lower in winter and spring months, during times of higher stream flow.

5.7.4.5 Sodium

Sodium is an unregulated constituent and therefore does not have a regulatory standard. However, sodium is a constituent of concern because elevated sodium concentrations in water can damage crops and affect plant growth. Sodium has been detected at concentrations greater than its Basin Objectives of 65 mg/l in the Atascadero area and 75 mg/l in the Templeton area. Sodium water quality results ranged from 8.5 to 130 mg/l with an average of 46 mg/l in the Alluvial Aquifer and ranged from 14 to 281 mg/l with an average of 57 mg/l in the Paso Robles Formation Aquifer.

Sodium concentrations in the Alluvial Aquifer and Paso Robles Formation Aquifer have been relatively consistent throughout the period of record. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause boron concentrations in groundwater to increase.

Surface water samples have been collected from Atascadero Creek, about 1 mile upstream of its confluence with the Salinas River (located outside of the Basin), and from the Salinas River, about 1 mile upstream of the HWY-41 bridge (located within the Basin). Water samples from the Atascadero Creek site showed sodium levels ranging from 17 to 51 mg/l and averaging 41 mg/l, based on 37 sampling events between April 1999 and December 2012. Water samples from the Salinas River site showed sodium levels ranging from 19 to 74 mg/l and averaging 48 mg/l, based on 20 sampling events between September 1999 and June 2012. Concentrations of sodium in these surface water analyses do not show any long-term trends. The concentrations are generally higher in the summer and fall months, during times of typically lower stream flow, and lower in winter and spring months, during times of higher stream flow.

5.7.4.6 Other Constituents

Other constituents found in exceedance of their respective regulatory standard include arsenic, iron, gross alpha, manganese, selenium, and sulfate. Each of these exceedances occurred in samples from a small number of wells, indicating isolated occurrences of these elevated constituent concentrations rather than widespread occurrences, affecting the entire Basin. Isolated concentrations of arsenic, iron, gross alpha, and sulfate in the Basin have been relatively consistent throughout the period of record. Selenium concentrations have generally declined since 2007. There are not enough data to determine the trend of the elevated manganese concentrations in the Basin. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause concentrations of any of these constituents in groundwater to increase.

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References

Central Coast Region State Water Resources Control Board (CCRWQCB) (2017), Water Quality Control Plan for the Central Coastal Basin. California Environmental Protection Agency, Regional Water Quality Control Board. September 2017.

California Department of Water Resources (DWR) (2018), Summary of the “Natural Communities Commonly Associated with Groundwater” Dataset and Online Web Viewer. https://gis.water.ca.gov/app/NCDatasetViewer/

Fugro West, Inc., and Cleath and Associates (2002), Final Report, Paso Robles Groundwater Basin Study: unpublished consultant report prepared for the County of San Luis Obispo Public Works Department, August 2002.

National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) (2018), Raster Geographic Information System (GIS) dataset: Vertical Displacement Total since 20150531 to 20150831. Prepared for California Department of Water Resources. July 3, 2018.

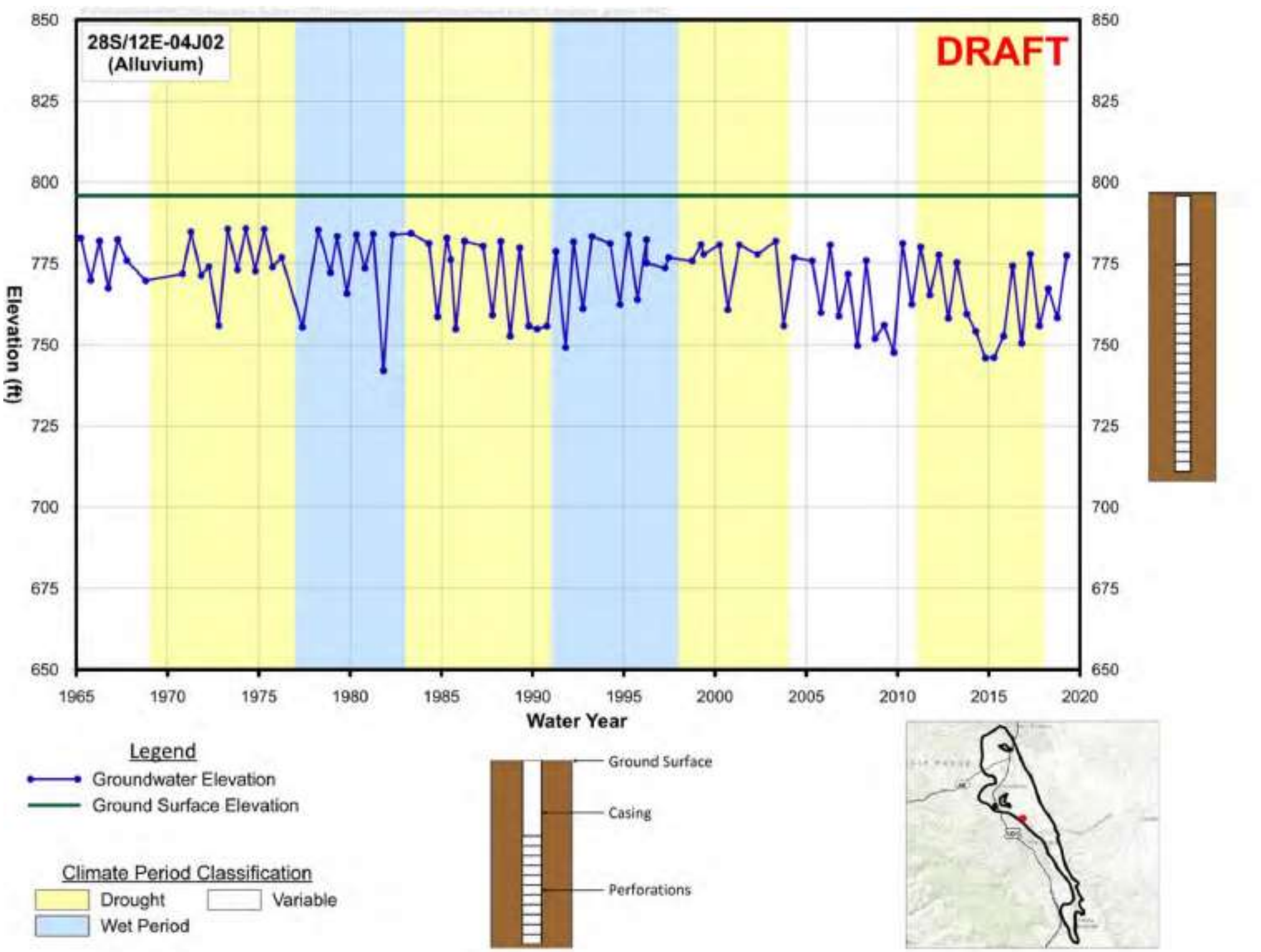
RMC Water and Environment (RMC) (2015), Salt/Nutrient Management Plan for the Paso Robles Groundwater Basin – Final Report. May 2015.

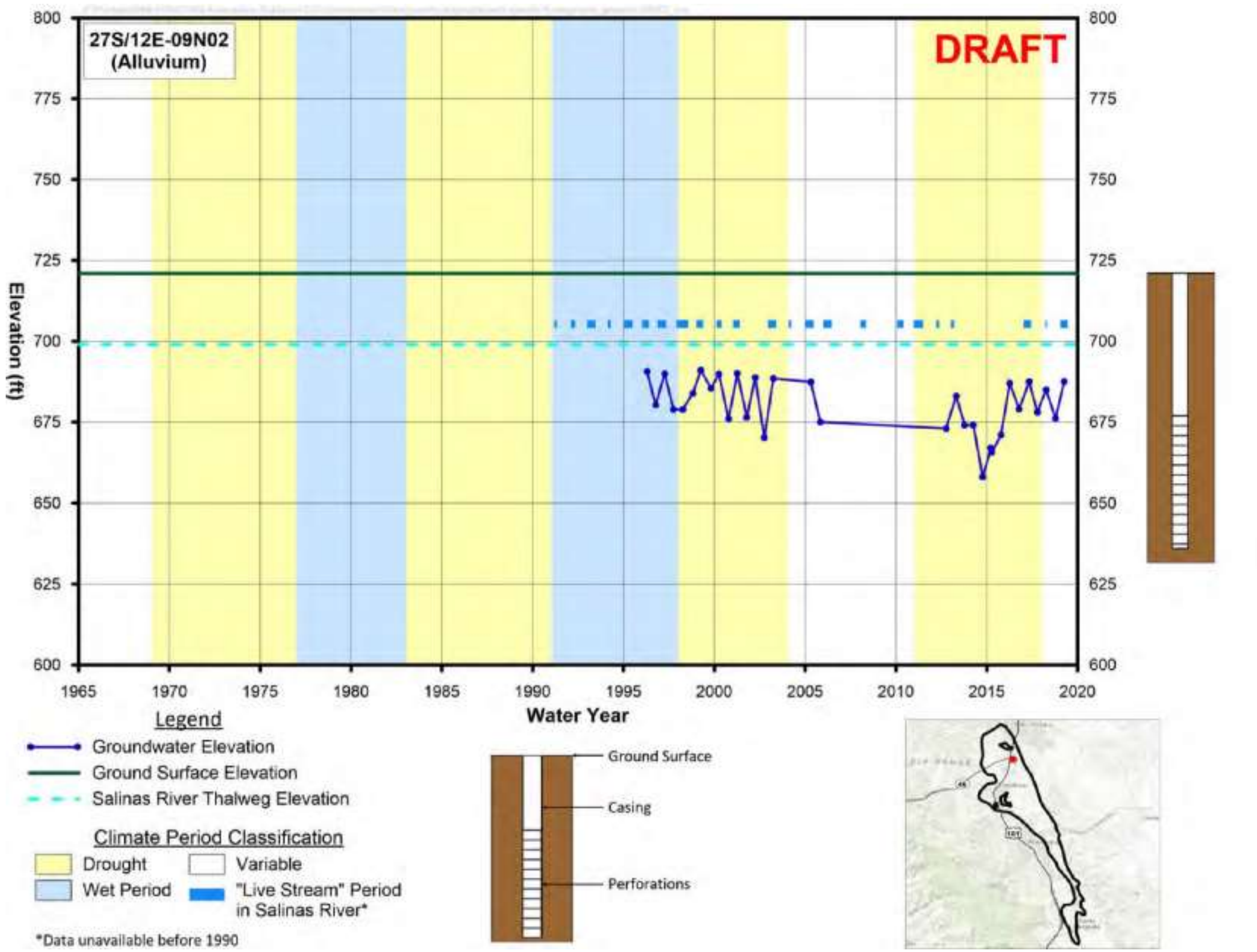
Torres, Gil (1979), Staff Report on Hydrogeologic Conditions Pertinent to Permit 5882 (Application 10216) of the City of San Luis Obispo, Diversion from Salinas River at Salinas Dam, San Luis Obispo County, in California State Water Resources Control Board, Prehearing engineering staff analysis for the protested application on tributaries to Salinas River (Salinas Dam to Nacimiento River) San Luis Obispo and Monterey Counties: typed document, Appendix B.

Valentine, D.W. et al. (2001), Use of InSAR to Identity Land Surface Displacements Caused by Aquifer System Compaction in the Paso Robles Area, San Luis Obispo County, California, March to August 1997. USGS Open File Report 00-447.

APPENDIX 5A
Hydrographs

Alluvial Aquifer Hydrographs


28S/12E-04J02
(Alluvium)
DRAFT
Elevation (ft)
850
825
800
775
750
725
700
675
650
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations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(Alluvium)
DRAFT
Elevation (ft)
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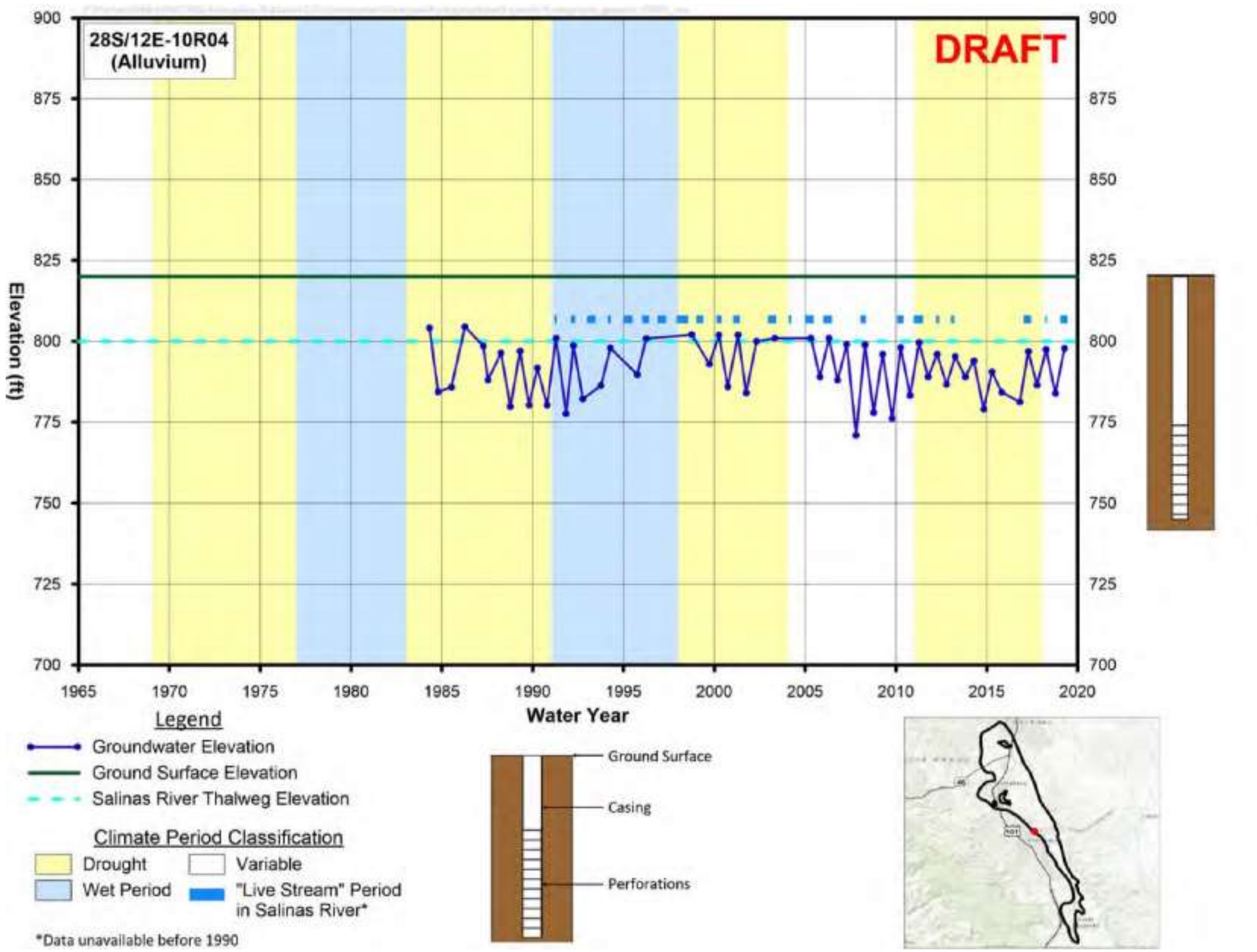
775
750
725
700
675
650
625
600
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Salinas River Thalweg Elevation
Climate Period Classification
Drought
Variable
Wet Period
"Live Stream" Period in Salinas River*
*Data unavailable before 1990
Ground Surface
Casing
Perforations


28S/12E-10R04
(Alluvium)
DRAFT
Elevation (ft)
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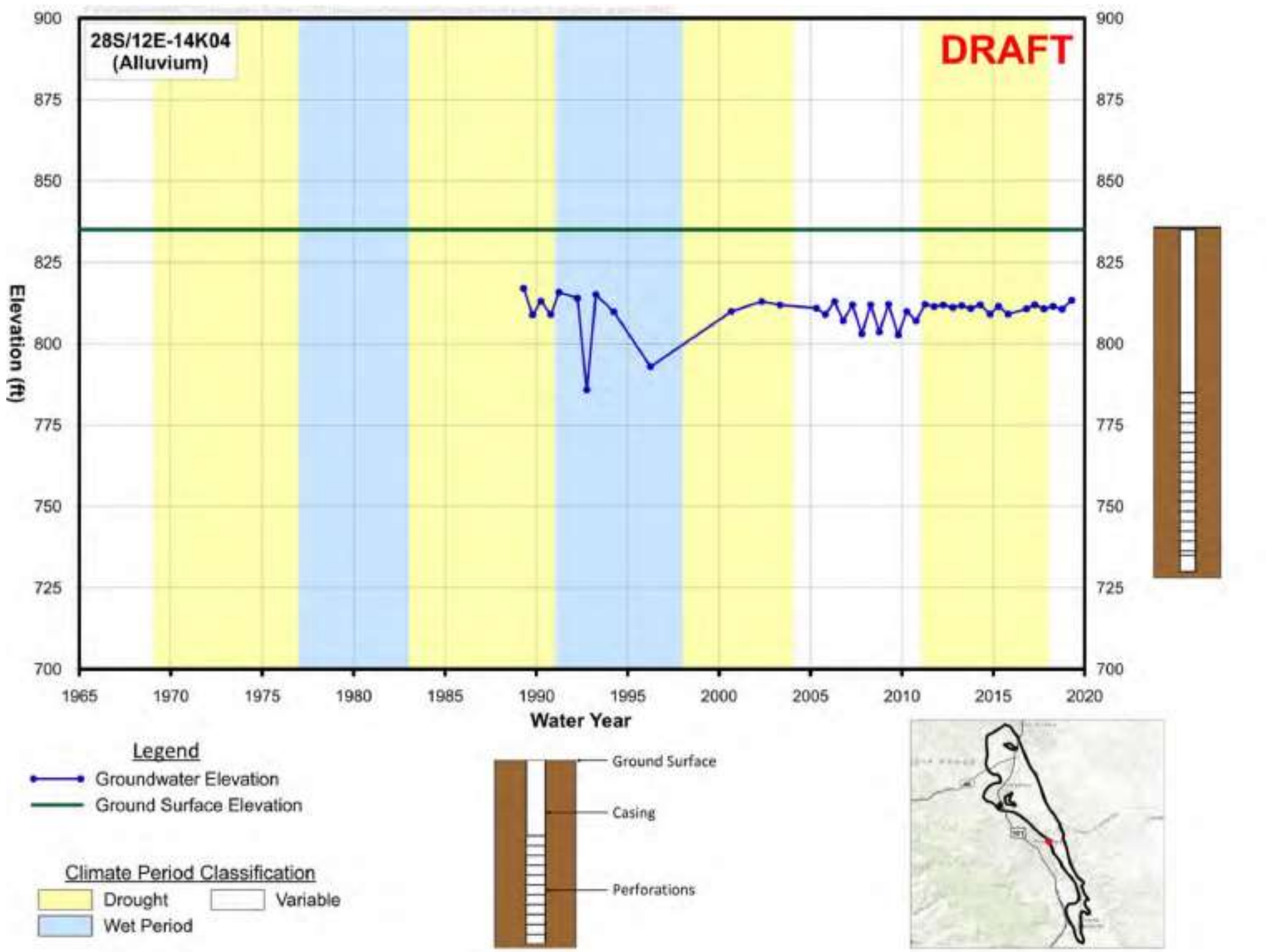
875
850
825
800
775
750
725
700
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Salinas River Thalweg Elevation
Climate Period Classification
Drought
Variable
Wet Period
"Live Stream" Period in Salinas River*
*Data unavailable before 1990
Ground Surface
Casing
Perforations


28S/12E-14K04
(Alluvium)
DRAFT
900
875
850
825
800
775
750
725
700
Elevation (ft)
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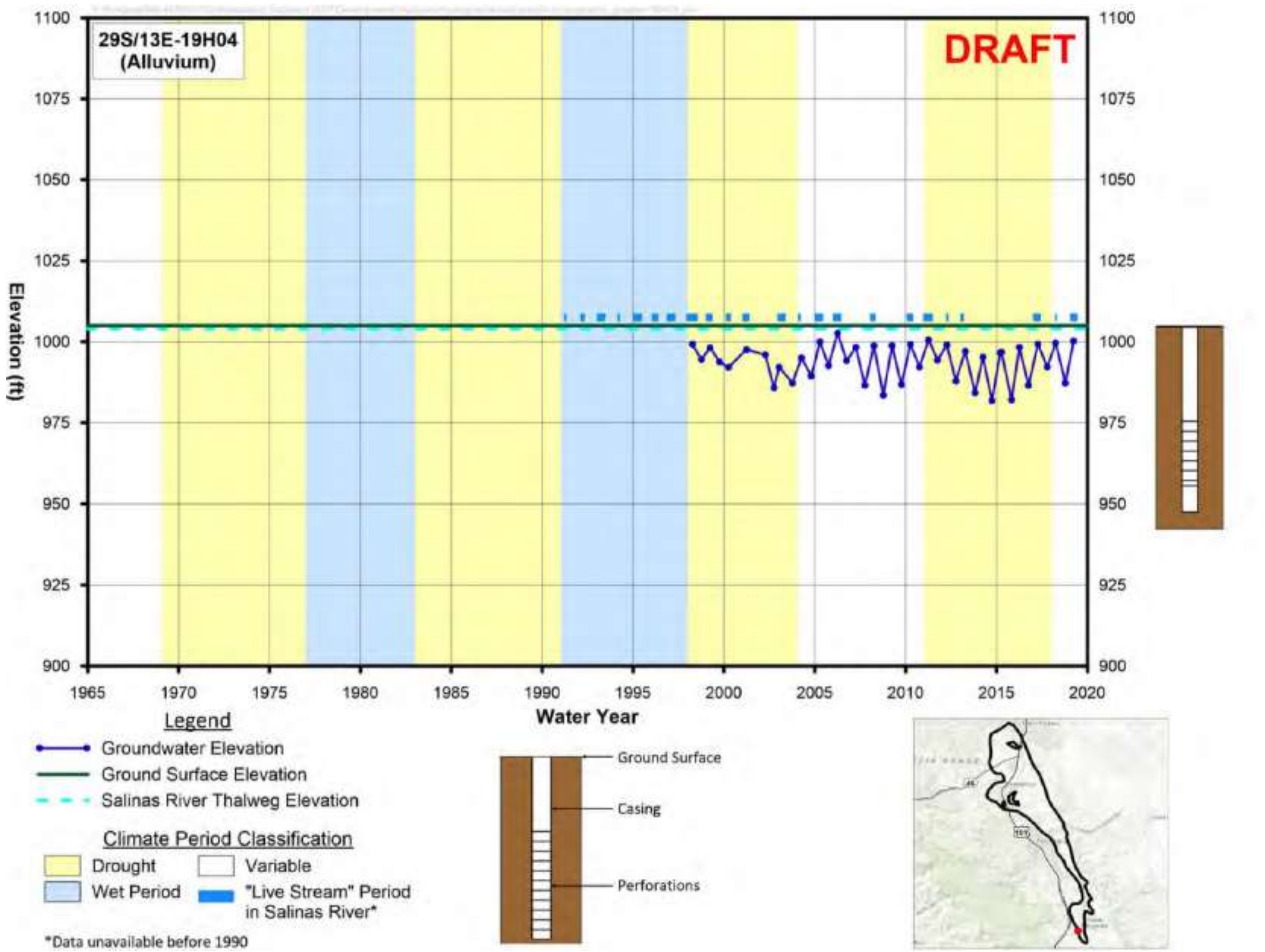
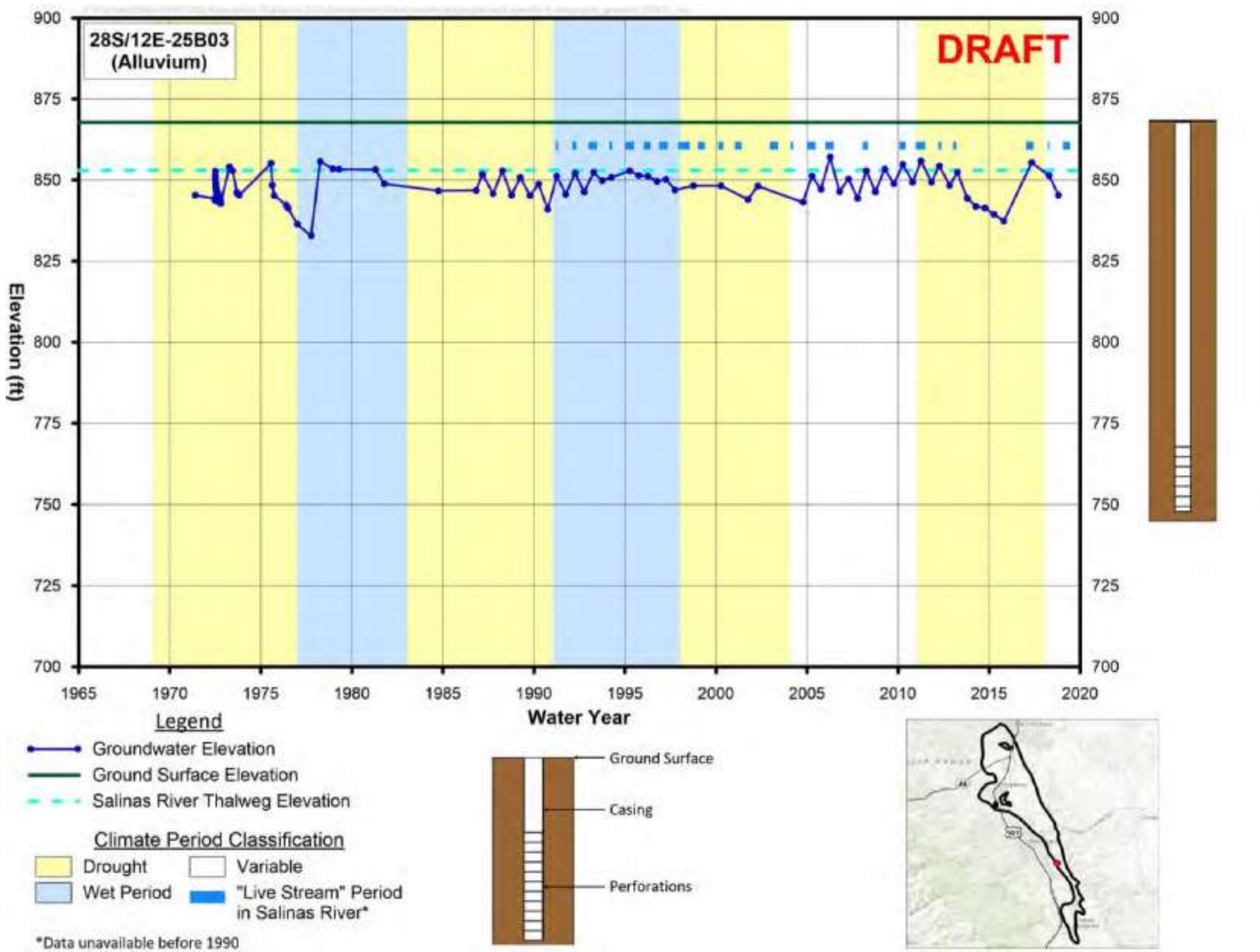
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations


29S/13E-19H04
(Alluvium)
DRAFT
1100
1075
1050
1025
1000
975
950
925
900
Elevation (ft)
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Salinas River Thalweg Elevation
Climate Period Classification
Drought
Variable
Wet Period
"Live Stream" Period in Salinas River*
*Data unavailable before 1990
Ground Surface
Casing
Perforations


28S/12E-25B03
(Alluvium)
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Elevation (ft)
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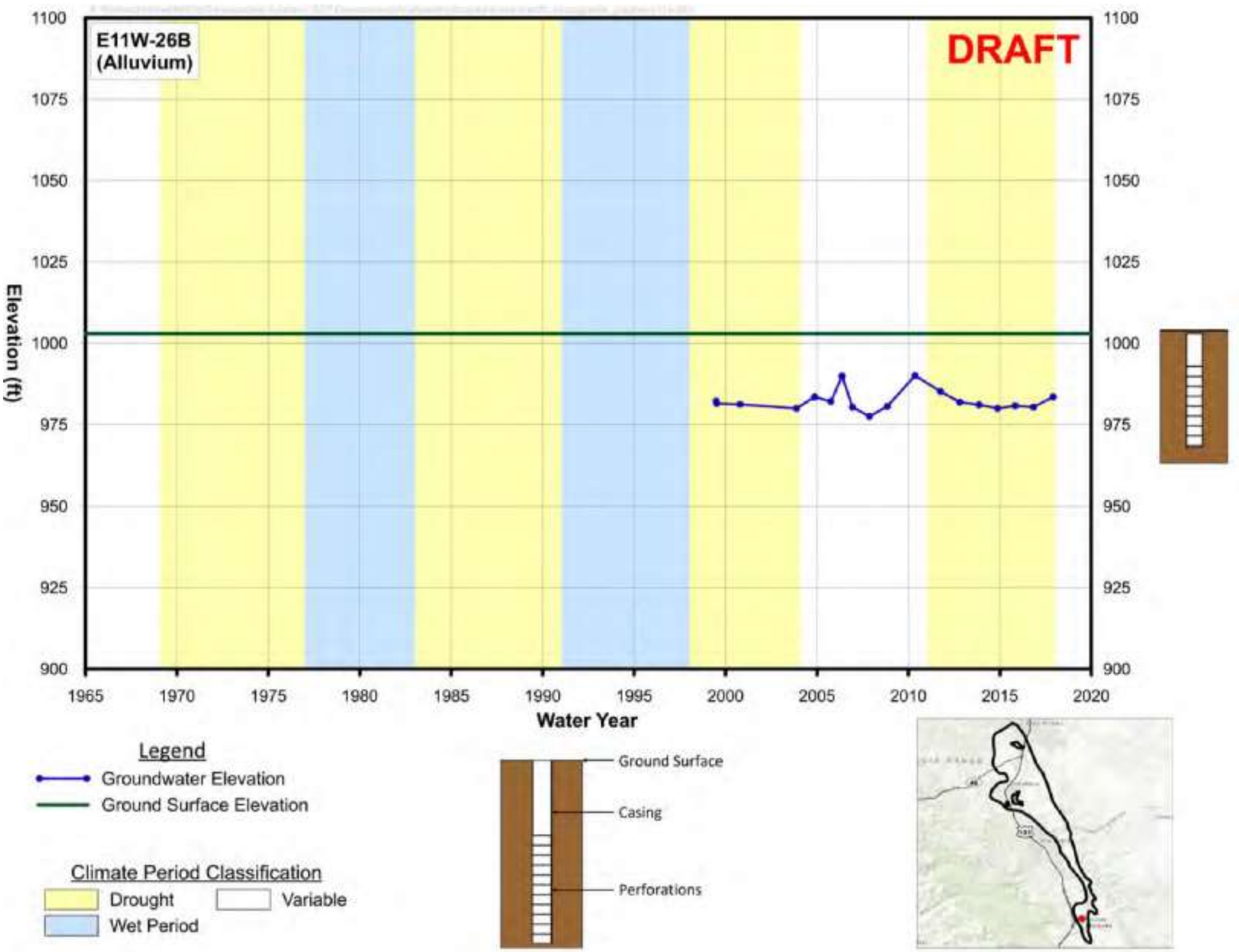
875
850
825
800
775
750
725
700
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Salinas River Thalweg Elevation
Climate Period Classification
Drought
Variable
Wet Period
"Live Stream" Period in Salinas River*
*Data unavailable before 1990
Ground Surface
Casing
Perforations


E11W-26B
(Alluvium)
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Elevation (ft)
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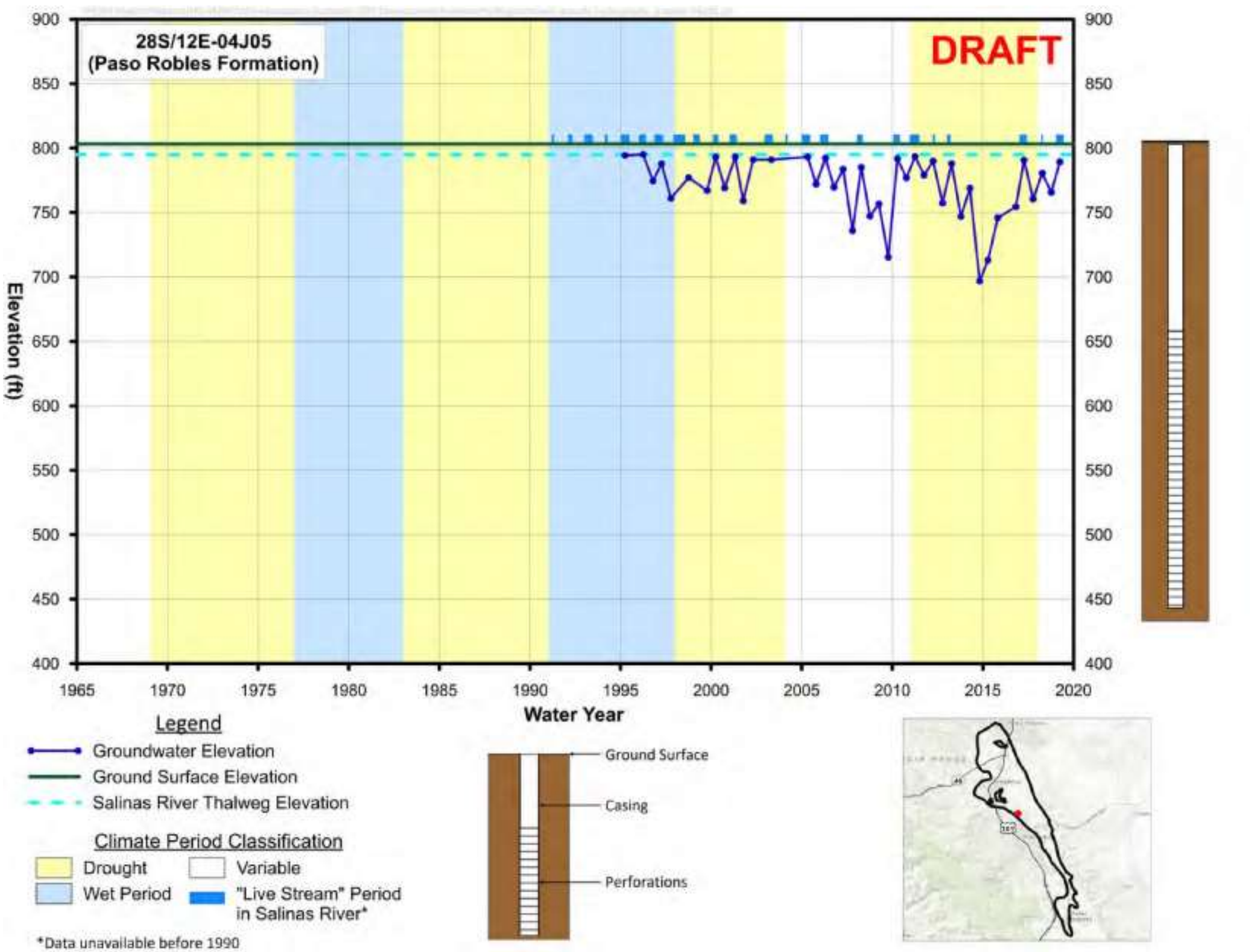
1075
1050
1025
1000
975
950
925
900
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations

Paso Robles Formation Aquifer Hydrographs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(Paso Robles Formation)
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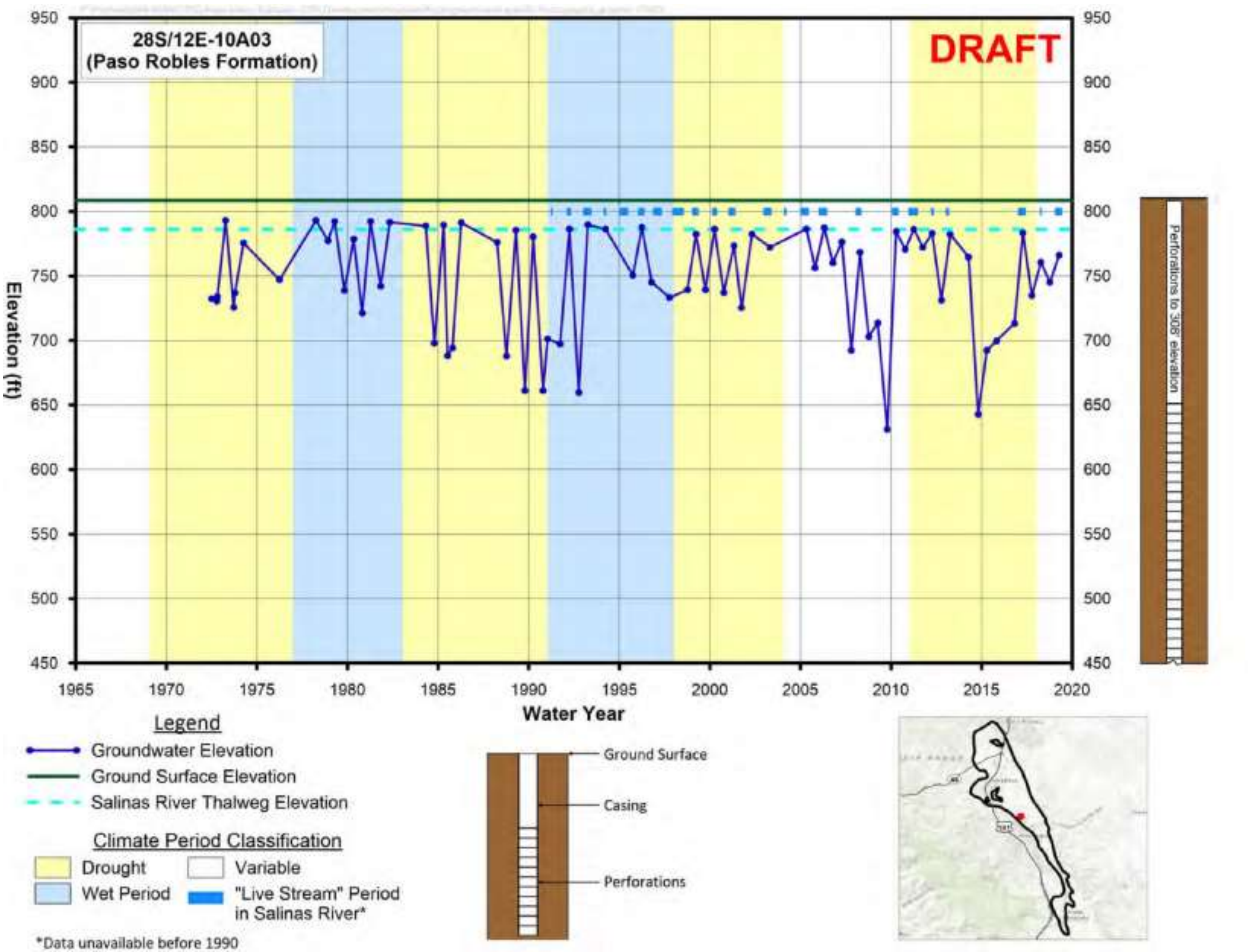
550
500
450
400
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Salinas River Thalweg Elevation
Climate Period Classification
Drought
Variable
Wet Period
"Live Stream" Period in Salinas River*
*Data unavailable before 1990
Ground Surface
Casing
Perforations


28S/12E-10A03
(Paso Robles Formation)
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Elevation (ft)
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900
850
800
750
700
650
600
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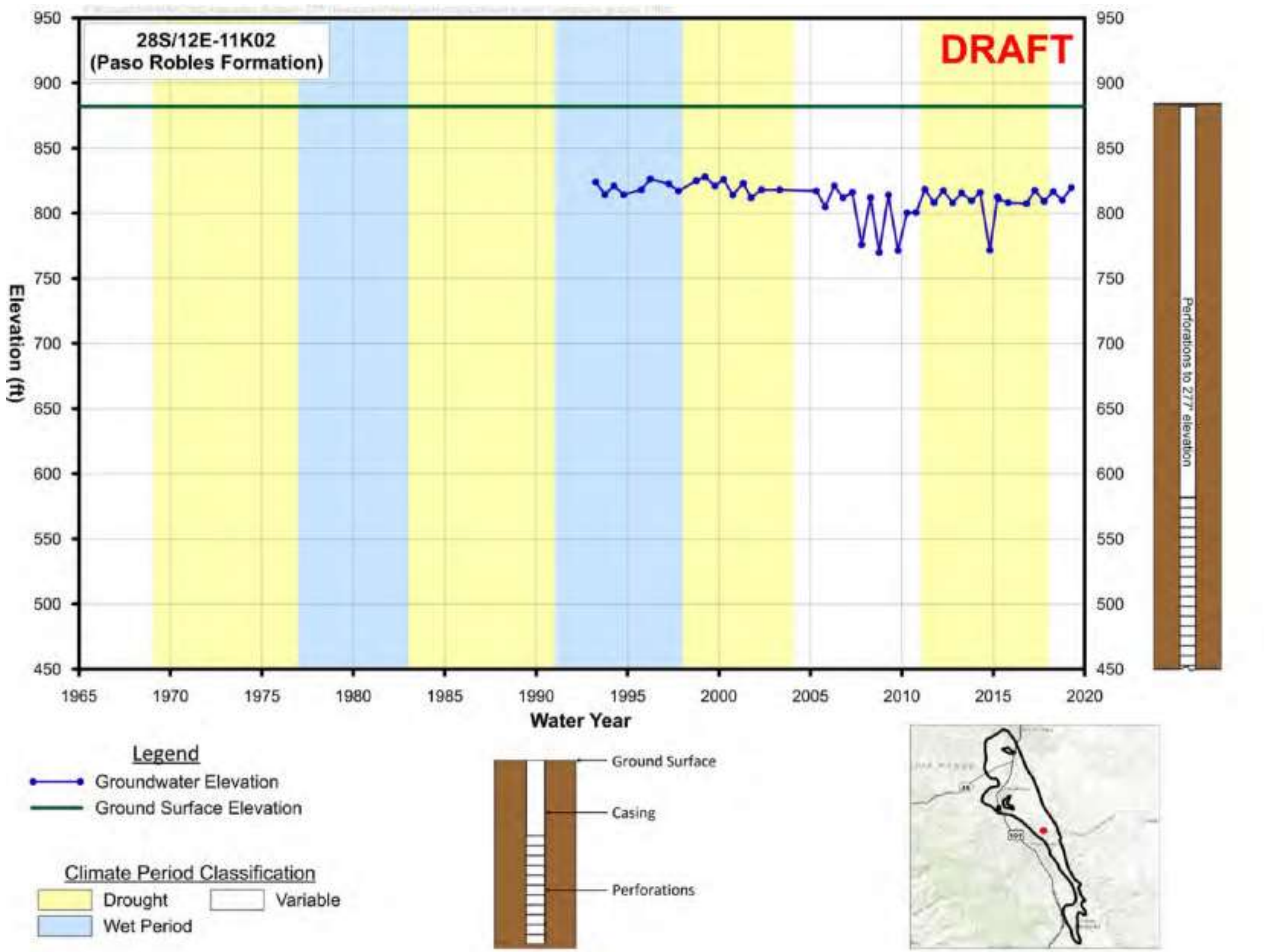
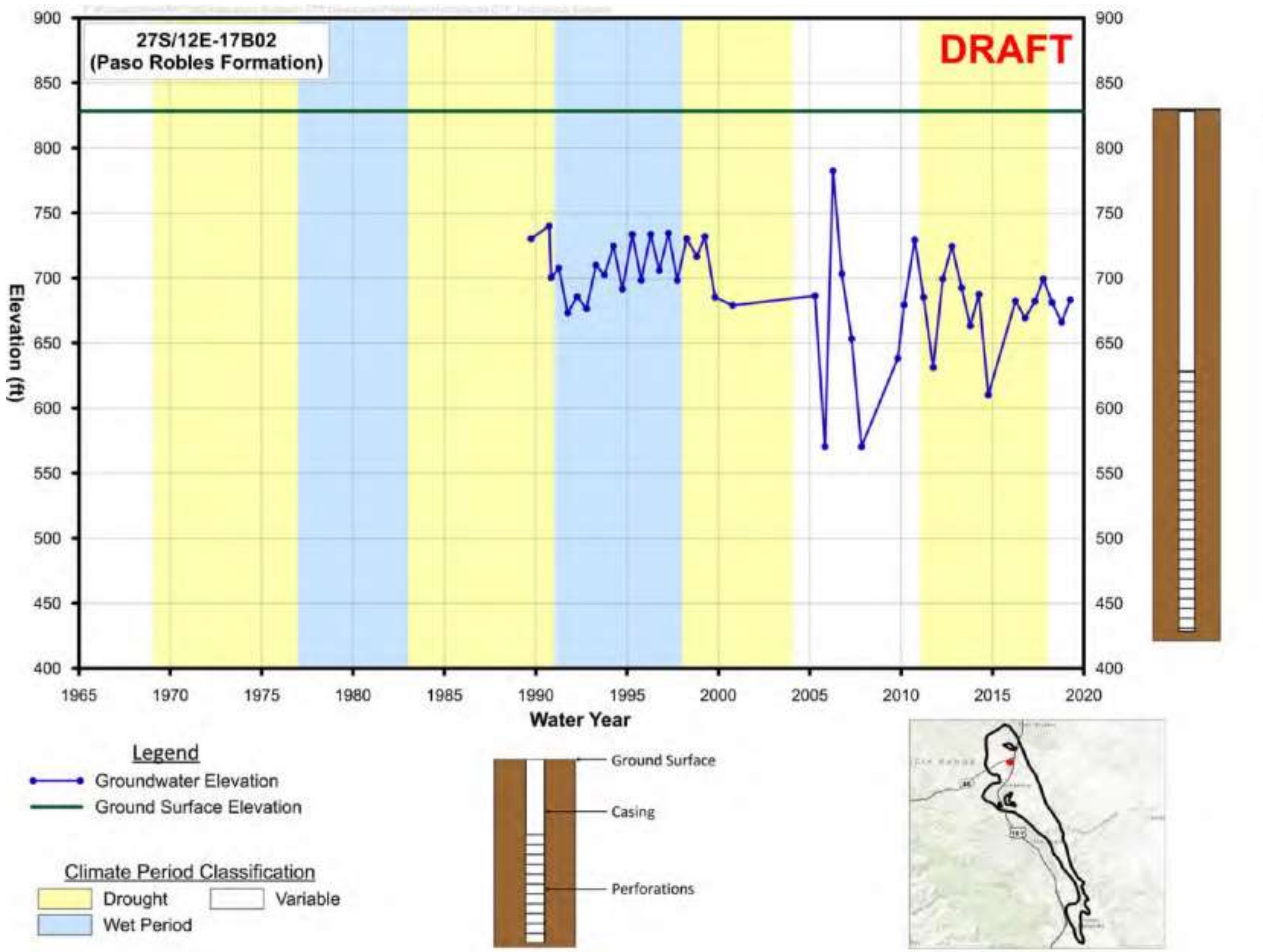
500
450
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Perforations to 308' elevation
Legend
Groundwater Elevation
Ground Surface Elevation
Salinas River Thalweg Elevation
Climate Period Classification
Drought
Variable
Wet Period
"Live Stream" Period in Salinas River*
*Data unavailable before 1990
Ground Surface
Casing
Perforations


28S/12E-11K02
(Paso Robles Formation)
DRAFT
950
900
850
800
750
700
650
600
550
500
450
Elevation (ft)
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Perforations to 277' elevation
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations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(Paso Robles Formation)
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Elevation (ft)
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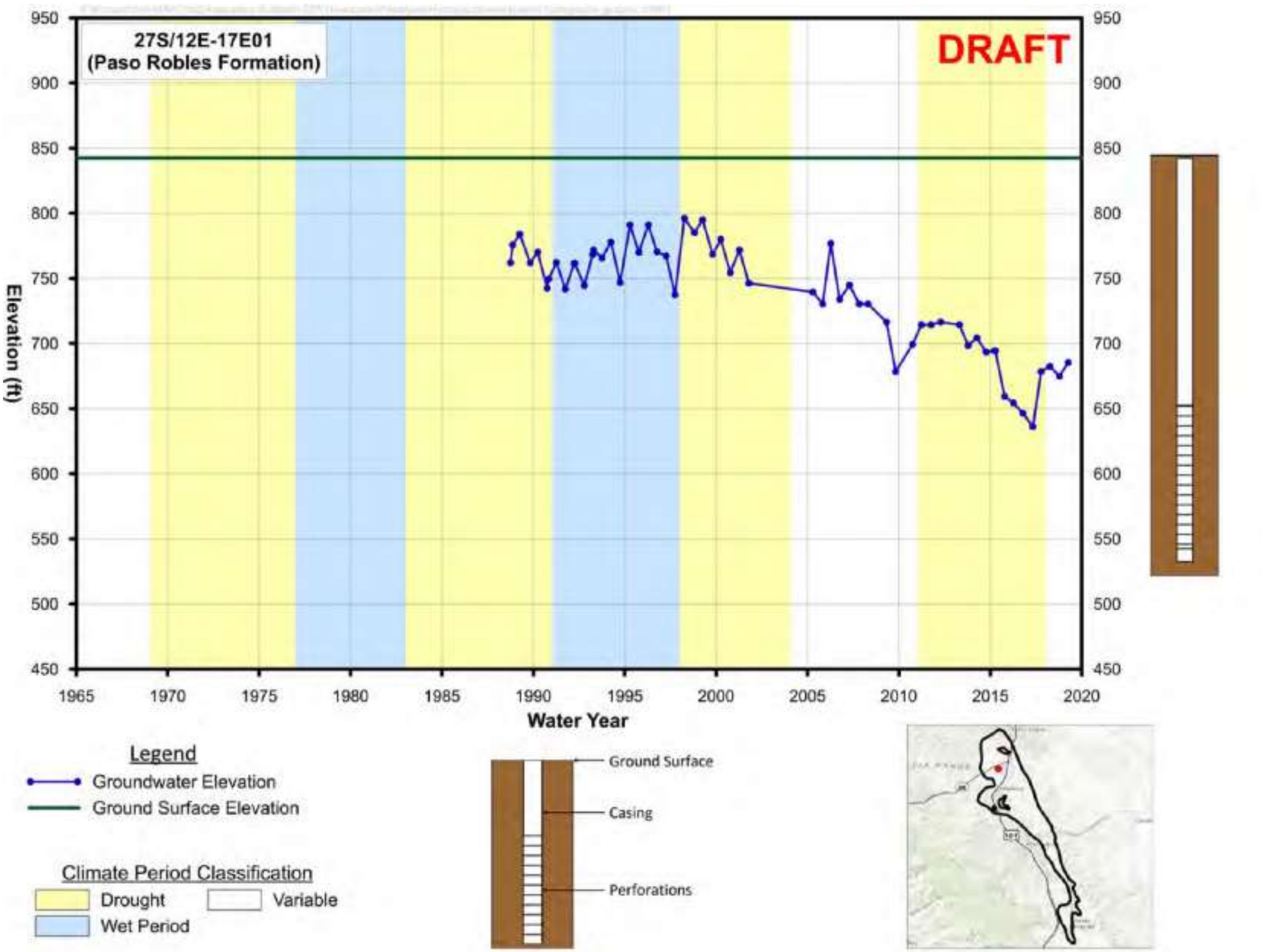
850
800
750
700
650
600
550
500
450
400
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations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Elevation (ft)
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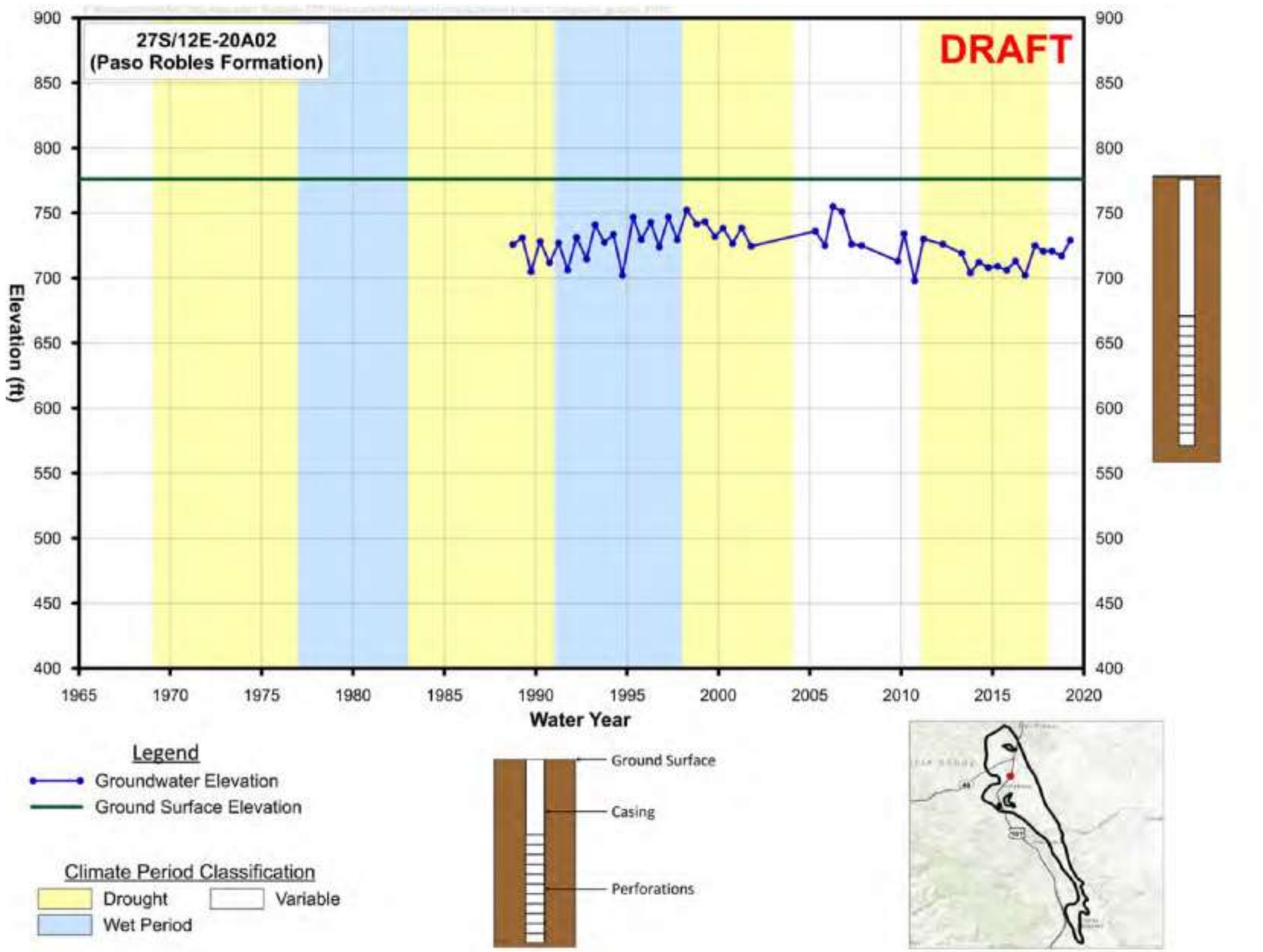
800
750
700
650
600
550
500
450
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations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(Paso Robles Formation)
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Elevation (ft)
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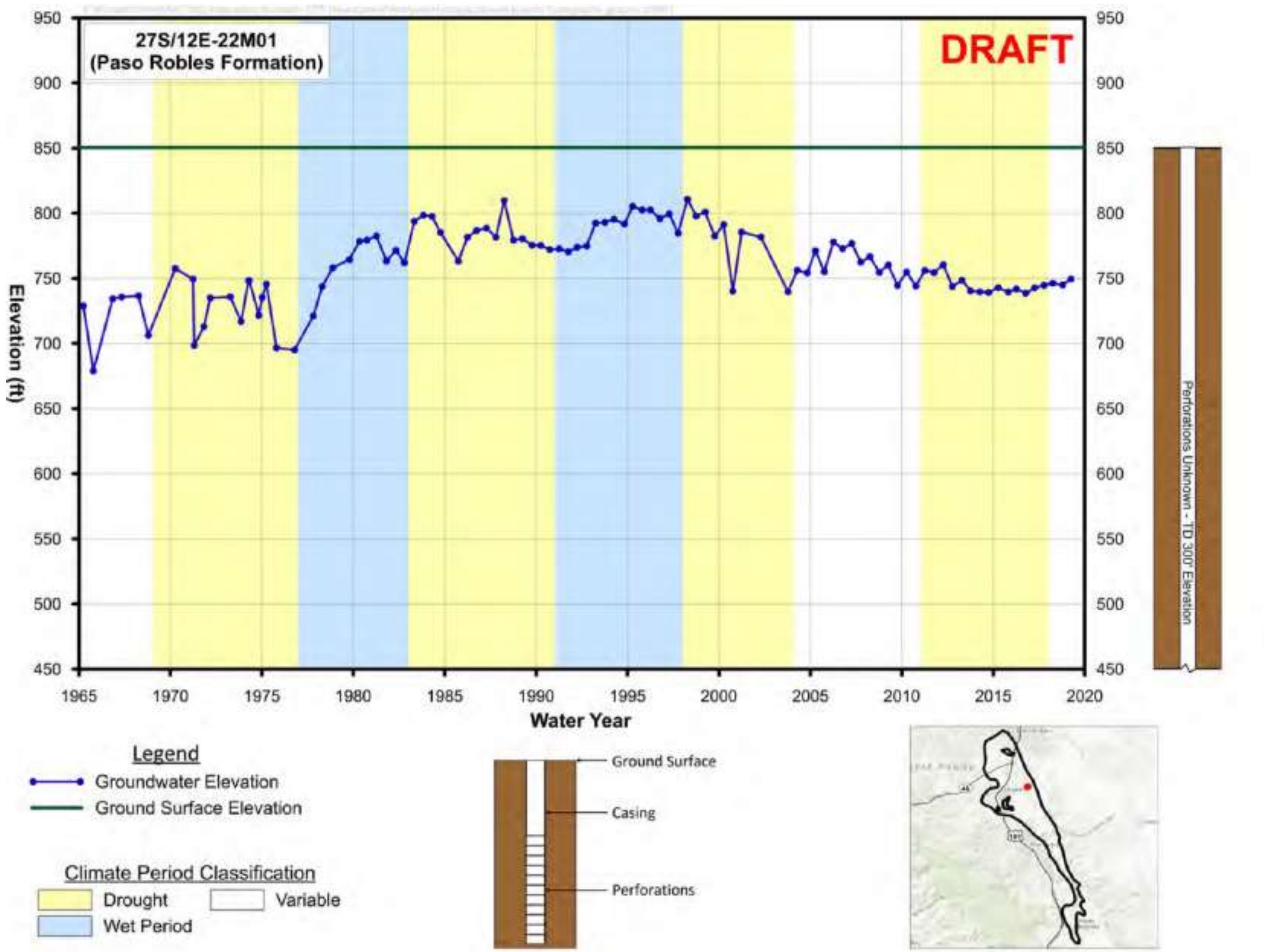
850
800
750
700
650
600
550
500
450
400
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations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(Paso Robles Formation)
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Elevation (ft)
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800
750
700
650
600
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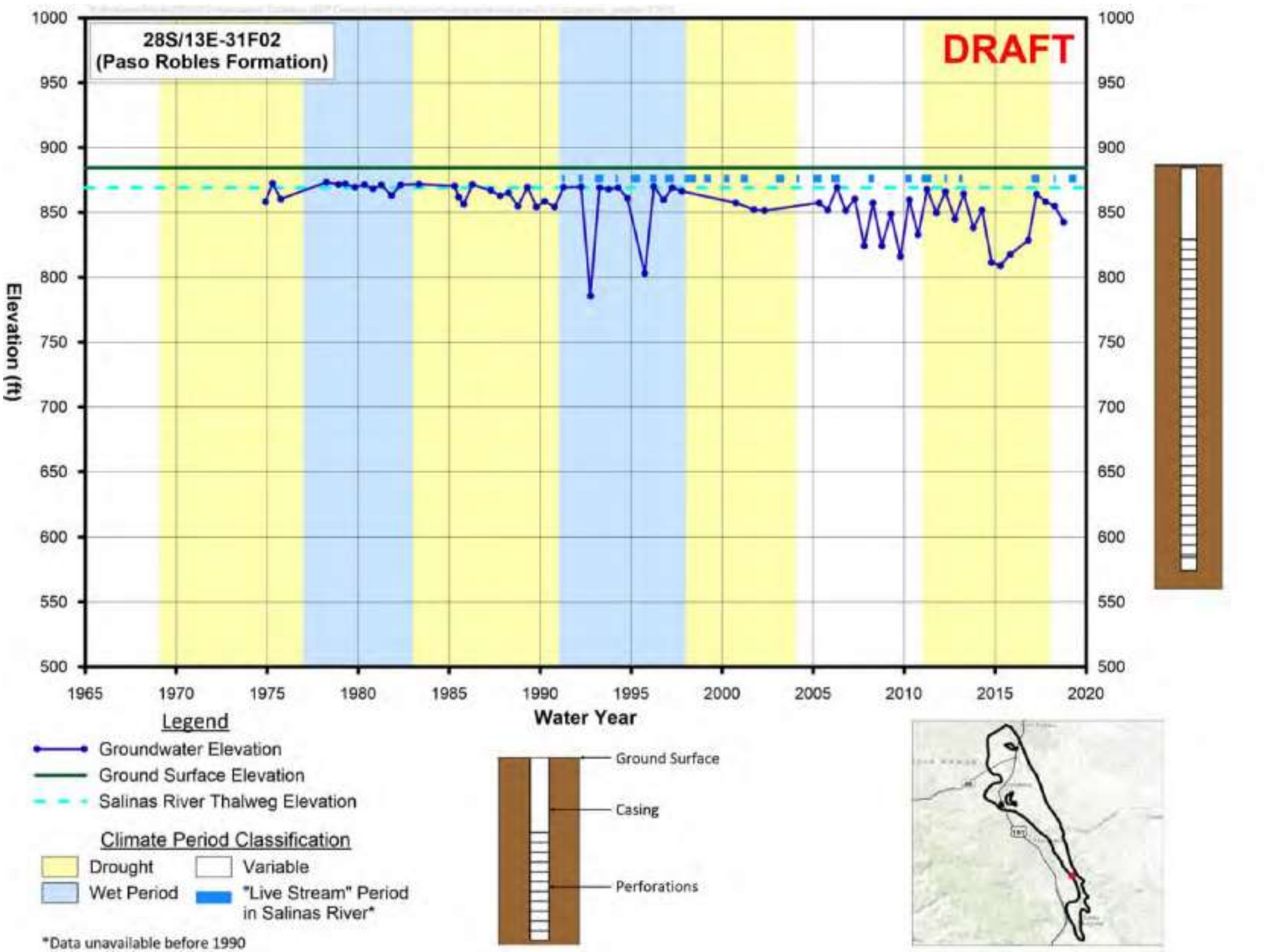
500
450
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Perforations Unknown - TD 300' Elevation
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations


28S/13E-31F02
(Paso Robles Formation)
DRAFT
Elevation (ft)
Water Year
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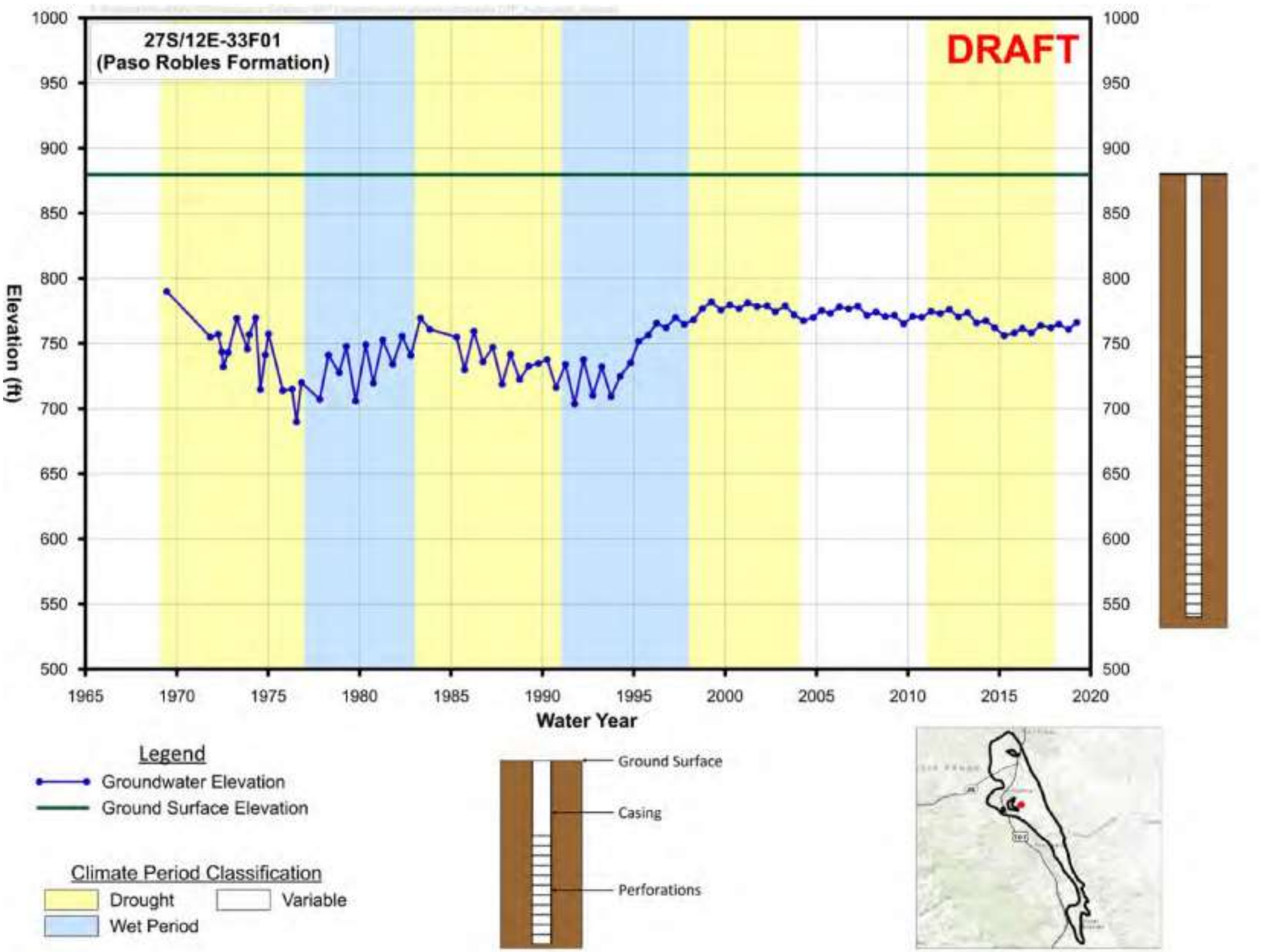
900
850
800
750
700
650
600
550
500
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Legend
Groundwater Elevation
Ground Surface Elevation
Salinas River Thalweg Elevation
Climate Period Classification
Drought
Variable
Wet Period
"Live Stream" Period in Salinas River*
*Data unavailable before 1990
Ground Surface
Casing
Perforations


27S/12E-33F01
(Paso Robles Formation)
DRAFT
Elevation (ft)
Water Year
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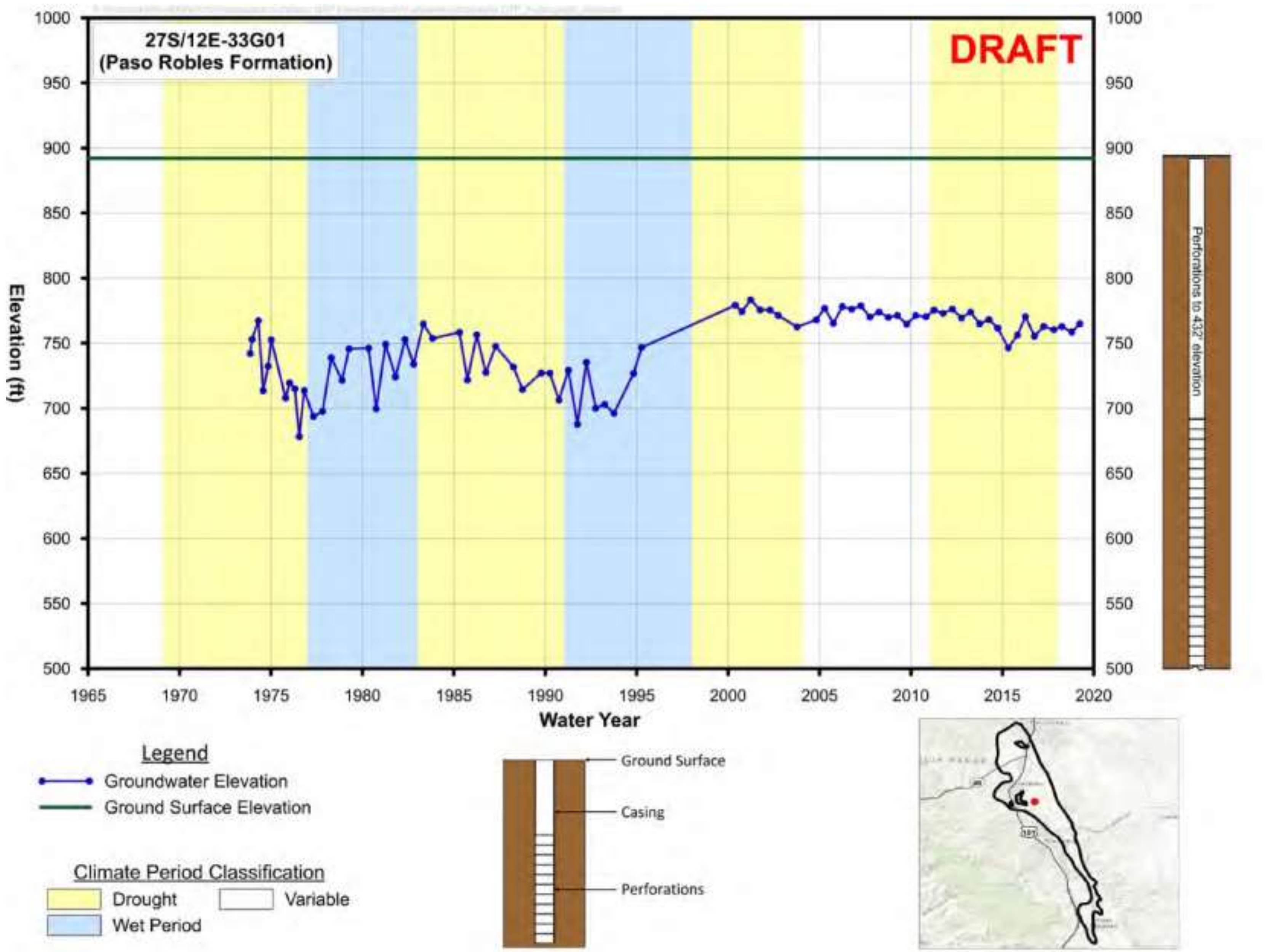
950
900
850
800
750
700
650
600
550
500
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations


27S/12E-33G01
(Paso Robles Formation)
DRAFT
Elevation (ft)
Water Year
Perforations to 432' elevation
Legend
Groundwater Elevation
Ground Surface Elevation
Climate Period Classification
Drought
Variable
Wet Period
Ground Surface
Casing
Perforations

APPENDIX 5B

Groundwater Dependent Ecosystems tech memo (in progress)