GSI Water Solutions, Inc.

August 31, 2016

Mr. Tim Godwin
Engineering Geologist
California Department of Water Resources
Division of Integrated Regional Water Management
Sustainable Groundwater Management Section
901 P Street
Sacramento, CA 95814

**Subject: Technical Report Addendum**
**Atascadero Area Subbasin**
**Basin Boundary Modification Application**

Dear Mr. Godwin,

On behalf of the Templeton Community Services District (TCSD), Atascadero Mutual Water Company (AMWC), and other stakeholders in the Atascadero Area Subbasin (Atascadero Basin), we want to thank you and the staff of the Department of Water Resources (Department) for meeting with us to review the technical background and supporting evidence related to the application to modify the boundary of the Paso Robles Area Subbasin (Paso Robles Basin) and to distinguish the Atascadero Basin as a separate basin. The technical basis for the scientific application to the Department for a basin boundary modification was initially presented in the *Technical Report, Salinas Valley – Atascadero Area Subbasin Basin Boundary Modification Application* (Fugro 2016), submitted to the Department by TCSD as part of the application packet.

Subsequent to submittal of the initial Technical Report, we met with you to discuss the application; we appreciate your willingness to meet with us and your thoughtful review and reconsideration of the application. As we discussed in our meeting on July 25, 2016, information that was not provided in the original Technical Report, but that was presented to you in the meeting, provides a compelling argument for approval of the basin boundary modification. Thus, at your request, we are pleased to document the additional information in this Addendum.

## INTRODUCTION

As a brief review of the arguments presented in the Technical Report, the proposed Atascadero Basin has long been recognized by many investigators, as well as multiple jurisdictional authorities, as distinct from the larger Paso Robles Basin. This distinction has been in the form of:

1. Scientific evidence that shows hydraulic separation from the Paso Robles Basin over most, if not all, the length of the adjoining boundary;

2. Successful groundwater management of the area by TCSD and AMWC that is manifested in maintaining groundwater in storage and stable water levels throughout the Atascadero Basin, in distinct contradiction to the serious and significant decline in groundwater in storage just across the boundary in the Paso Robles Basin, and;
3. Jurisdictional and regulatory recognition by the County of San Luis Obispo Flood Control and Water Conservation District, the County of San Luis Obispo Board of Supervisors, County of San Luis Obispo Planning Department, the San Luis Obispo County Local Agency Formation Commission, and other agencies that have consistently detached the Atascadero Basin from the Paso Robles Basin for purposes of enacting planning and growth management ordinances, proposed water districts, and groundwater management strategies.

The technical basis for the scientific application to the Department for a basin boundary modification was initially presented in the *Technical Report, Salinas Valley – Atascadero Area Subbasin Basin Boundary Modification Application* dated March 2016, submitted to the Department by TCSD as part of the application packet.

The purpose of this Addendum is to provide the Department with the additional information presented in our meeting that highlights the key technical, scientific lines of evidence that, when compiled as a single, cogent package, tells a strong and compelling reason for and justification of the formal subdivision of the Paso Robles Area Subbasin and creation of an Atascadero Area Subbasin.

We believe that there is clear and indisputable evidence that the Rinconada Fault, which forms the boundary between the Paso Robles Basin and the Atascadero Basin, creates a complete barrier to groundwater flow between the two subbasins over approximately 85% of the boundary. The remaining 15% of the boundary, located at the northern end of the Atascadero Basin where the Salinas River crosses the subbasin boundary and flows from the Atascadero Basin to the Paso Robles Basin, is the area of concern, and the area for which the Department wanted to see additional evidence that the fault creates an impediment to subsurface flow in the basin aquifer materials. These additional multiple lines of evidence include:

1. Water level contour maps (potentiometric maps)
2. Groundwater gradient difference graphics
3. Water level change maps for 1997-2013 vs. 1997-2009
4. USGS Open File Report 00-447

**ADDITIONAL EVIDENCE AND ANALYSIS**

**1. Water Level Contour Maps**

a. Figures 1 and 2 present groundwater elevation contours for Spring 2009 and Spring 2012, respectively. The groundwater elevation data were obtained from the County of San Luis Obispo Public Works Department groundwater monitoring program database. The data are from water wells that penetrate and are screened solely in the Paso Robles Formation, the deep aquifer materials comprising the percolating water aquifer. In other words, no data are shown that represents water elevations from the shallow underflow aquifer of the Salinas River gravels. The data points include both private and public wells.

b. The groundwater gradient vectors trend north-northwest, as expected, which follows the regional groundwater gradient and the regional structural trend.

c. The water level contour maps illustrate the difference in groundwater elevation throughout the length of the fault boundary between the Atascadero Basin and the Paso Robles Basin. At the north end of the Atascadero Basin, where the Paso Robles Formation is present on both sides of the fault, the difference in groundwater elevation across the fault is somewhat muted but still exhibits an elevation difference of 25 to 50 feet, particularly in the Spring 2012 data (Figure 2).

d. We believe that the groundwater elevation difference in the northern end of the Atascadero Basin, in the area where the Salinas River crosses the boundary between the two basins, is muted because of the significant volume of deep percolation of streamflow recharge from the Salinas River into the underlying percolating groundwater materials of the Paso Robles Formation. As clearly shown in the Paso Robles Basin studies (Fugro 2002, 2005) and the Paso Robles Basin Model Update study (GEOSCIENCE Support Services, 2014), streamflow percolation from the Salinas River is, along with precipitation, the primary source of basin recharge. Thus, we believe that the deep aquifer on both sides of the fault is "flooded" by river recharge that masks the actual groundwater elevation differences that would otherwise occur across the fault. As shown in the water level contour maps and even more dramatically in the groundwater elevation change maps (discussed in more detail, below), there is a significant difference in response to pumping stresses in the western portion of the Paso Robles Basin versus the Atascadero Basin. We believe that the response to those stresses are muted and masked by the significant volume of river recharge in those portions of the basins.

e. The water level contour maps show evidence for and demonstrate that the Rinconada Fault is an impediment to groundwater flow along the entire length of the boundary between the Atascadero Basin and the Paso Robles Basin.

**2. Groundwater Gradient Differences**

a. As represented in the water level contour maps on Figures 1 and 2, the groundwater gradient vectors trend north-northwest on both sides of the Rinconada Fault, representing a similar vector in the Atascadero Basin and the Paso Robles Basin. However, the groundwater gradients in the two basins are distinctly different.

b. A comparison of the groundwater gradients on each side of the Rinconada Fault are shown on Figures 3 and 4, representing groundwater elevation data from Spring 2009 and Spring 2012, respectively. The figures show significantly different groundwater gradients in the Atascadero Basin relative to the Paso Robles Basin. East of the fault, in the Paso Robles Basin, the groundwater gradient is 0.012 feet/foot (ft/ft). West of the fault, in the Atascadero Basin, the gradient is 0.003 ft/ft.

c. The differences in groundwater gradient illustrate the differences in groundwater regimes on each side of the fault and the difference in response to pumping stresses in each basin. If a hydraulic connection between the two basins in the northern end of Atascadero Basin were present, we would expect to observe a convergence of similarity in groundwater gradients between the basins, but the gradients remain quite consistent throughout the almost eight mile length of the boundary.

**3. Water Level Change Maps**

a. The San Luis Obispo County Public Works Department (County) has produced groundwater elevation change maps for the Paso Robles Basin for two different time periods, including 1997-2009 and 1997-2013 (see Figures 5 and 6, respectively). The two

maps are published by the County on the San Luis Obispo County Water Resources webpage http://slocountywater.org/site/Water%20Resources/Water%20Forum/.

b. Figures 5 and 6 show a relatively similar pattern of changes in groundwater elevation, albeit with a couple of important distinctions. Both maps show that the greatest change in groundwater elevations occurred in the Estrella subarea of the Paso Robles Basin (northeast of the Atascadero Basin), with significant areas of the basin experiencing water level declines greater than 70 feet (some wells have experienced water level declines greater than 250 feet). Within the same time periods, water level changes in wells within the Atascadero Basin remained relatively steady.

c. Figure 6 was originally presented as Figure 16 in the Technical Report submitted by TCSD in support of the basin boundary modification application, and it was noted that a small area in the northern part of the Atascadero Basin showed minor groundwater elevation declines (Figure 5 was not presented in the Technical Report). Although it was noted in the Technical Report that these declines were a result of the ongoing drought, an alternative interpretation was posited by the Department that the decline in the northern part of the basin was a result of the bleeding over of groundwater declines from the stresses observed in the Paso Robles Basin. The groundwater elevation declines observed in the northern end of the Atascadero Basin are, in our opinion, not a reflection of the stresses in the Paso Robles Basin but are, in fact, a manifestation of TCSD's response to the recent drought and a slight change in pumping patterns in their Platz well, which is the District's highest producing well.

d. The Platz well produces as much as 35% to 40% of TCSD's percolating groundwater production (that is, production from the Basin aquifer) and TCSD relies on it heavily during drought periods. The location of the Platz well is shown as Well No. 17 on Plate 17 of the Technical Report, and a hydrograph of long-term water elevations of the well was presented on Plate 18 of the Report. Typically, TCSD begins pumping heavily from their deep Basin wells (as opposed to relying on the shallow underflow wells of the Salinas River) in May and June of each year. Because the Spring water levels are measured by the County of San Luis Obispo monitoring program in the latter part of April of every year, the Spring levels typically reflect the seasonal high levels, before heavy pumping occurs.

e. The difference in the change maps (Figures 5 and 6) that shows a decline in water levels at the north end of the Basin in the 1997-2013 period is a direct reflection of the need for TCSD to slightly modify their normal pumping patterns in response to the drought. The table, below, shows the monthly pumping volumes (in acre feet) in the Platz well in 2009 in contrast to 2013. The data show that significant pumping had occurred in the Platz well in 2013 by the late April time period of the County monitoring program, which was manifested in the slightly lower groundwater elevations shown in the 1997-2013 change map (Figure 6).

**TCSD Platz Well Production (acre feet)**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 0 | 0 | 0 | 0 | 13.5 | 17.52 | 36.97 | 46.22 | 40.42 | 10.25 | 0 | 0 |
| 2013 | 0 | 1.98 | 15.59 | 30.78 | 43.23 | 38.62 | 32.0 | 25.1 | 0 | 0 | 0 | 0 |

**4. USGS Open File Report 00-447**

a. In 1999, the San Luis Obispo County Flood Control and Water Conservation District contracted with the U.S. Geological Survey to utilize Interferometric Synthetic Aperture Radar (InSAR) as a tool to aid in locating subsurface structures in groundwater basins throughout the County by determining seasonal and historical land surface changes (Valentine, David W., et al, 2001). The study was conceived in part out of a concern whether the groundwater basins in the County functioned as large individual basins or whether subsurface structures divided the basins into smaller subbasins, as suggested by observed differences in groundwater elevations.

b. InSAR has been used by the USGS to identify land surface displacements caused by compaction of the aquifer through groundwater extractions. The InSAR-derived displacement maps are used with accompanying groundwater level data to investigate differential aquifer compaction that may be related to the presence of geologic structures (faults). In cooperation with the County of San Luis Obispo, the USGS investigated the Paso Robles Basin for possible differential displacement and for evidence of subsurface barriers to groundwater flow.

c. The results of the study identified four separate "phase signatures" in the basin. Three of the signatures are located northeast of Paso Robles, and the fourth signature is in the Templeton area. According to the USGS, the investigation…

> "shows an areally small phase signature in the Atascadero area east of Highway 101 and the Salinas River. The eastern edge of the signature is bordered by the San Marcos and Rinconada faults. The phase signature appears to be controlled, in part, by the ground-water barriers formed by the faults and by the geometry of the basins adjacent to the faults."

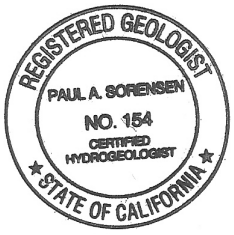
d. The results of the USGS investigation support the multiple lines of evidence that the Rinconada Fault is an impediment to groundwater flow between the Atascadero Basin and the Paso Robles Basin.

**SUMMARY**

On the basis of the evidence presented in the *Technical Report, Salinas Valley – Atascadero Area Subbasin Basin Boundary Modification Application* dated March 2016, submitted to the Department by TCSD as part of the basin boundary modification application packet and the additional information presented in this Addendum, it is our opinion that full body of scientific understanding tells a strong and compelling reason for and justification of the formal subdivision of the Paso Robles Area Subbasin and creation of an Atascadero Area Subbasin.

Again, on behalf of the stakeholders of the Atascadero Basin, we wish to thank you for your reconsideration of the evidence supporting the basin boundary modification of the Atascadero Area Subbasin. If you have any questions or wish for additional detail, please do not hesitate to call me.

Sincerely,
GSI Water Solutions, Inc.




Paul A. Sorensen, PG, CHG
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California Professional Geologist No. 5154
California Certified Hydrogeologist No. 154

Attachments

**REFERENCES CITED**

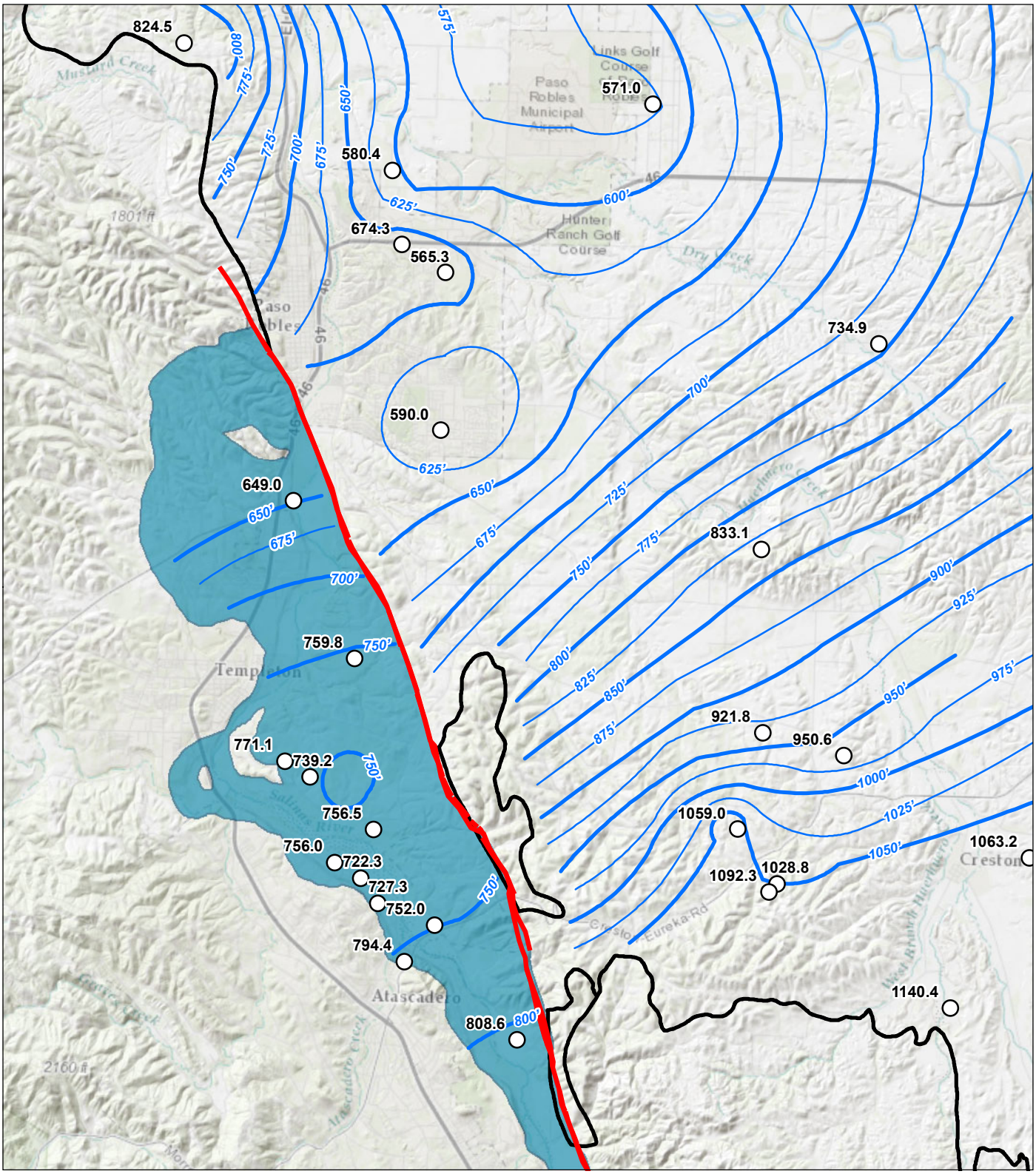
Fugro Consultants, Inc., and Cleath and Associates, 2002. Paso Robles Groundwater Basin Study (Phase I). Prepared for San Luis Obispo County Public Works Department. August 2002

Fugro Consultants, Inc., ETIC Engineers, and Cleath and Associates, 2005. Paso Robles Groundwater Basin Study, Phase II, Numerical Model Development, Calibration, and Application. Prepared for San Luis Obispo County Public Works Department. February 2005.

Fugro Consultants, Inc., Technical Report, Salinas Valley – Atascadero Area Subbasin Basin Boundary Modification Application. Prepared for Templeton Community Services District. March 2016.

GEOSCIENCE Support Services, 2014. Paso Robles Groundwater Basin Model Update. Prepared for San Luis Obispo County Flood Control and Water Conservation District. December 19, 2014.

Valentine, David W., Jill N. Densmore, Devin L. Galloway, and Falk Amelung, 2001. Use of InSAR to Identify Land Surface Displacements Caused by Aquifer-System Compaction in the Paso Robles Area, San Luis Obispo County, California, March to August 1997. U.S. Geological Survey Open-File Report 00-447.




**LEGEND**

- Groundwater Elevation Points
- Groundwater Elevation Contours (25 foot interval)
- Rinconada Fault
- Paso Robles Area Subbasin
- Atascadero Area Subbasin

N

0 2 4
Miles

Date: August 31, 2016
Data Sources: USGS, ESRI

# FIGURE 1

## Water Level Contour Map - Spring 2009

Templeton Community Services District

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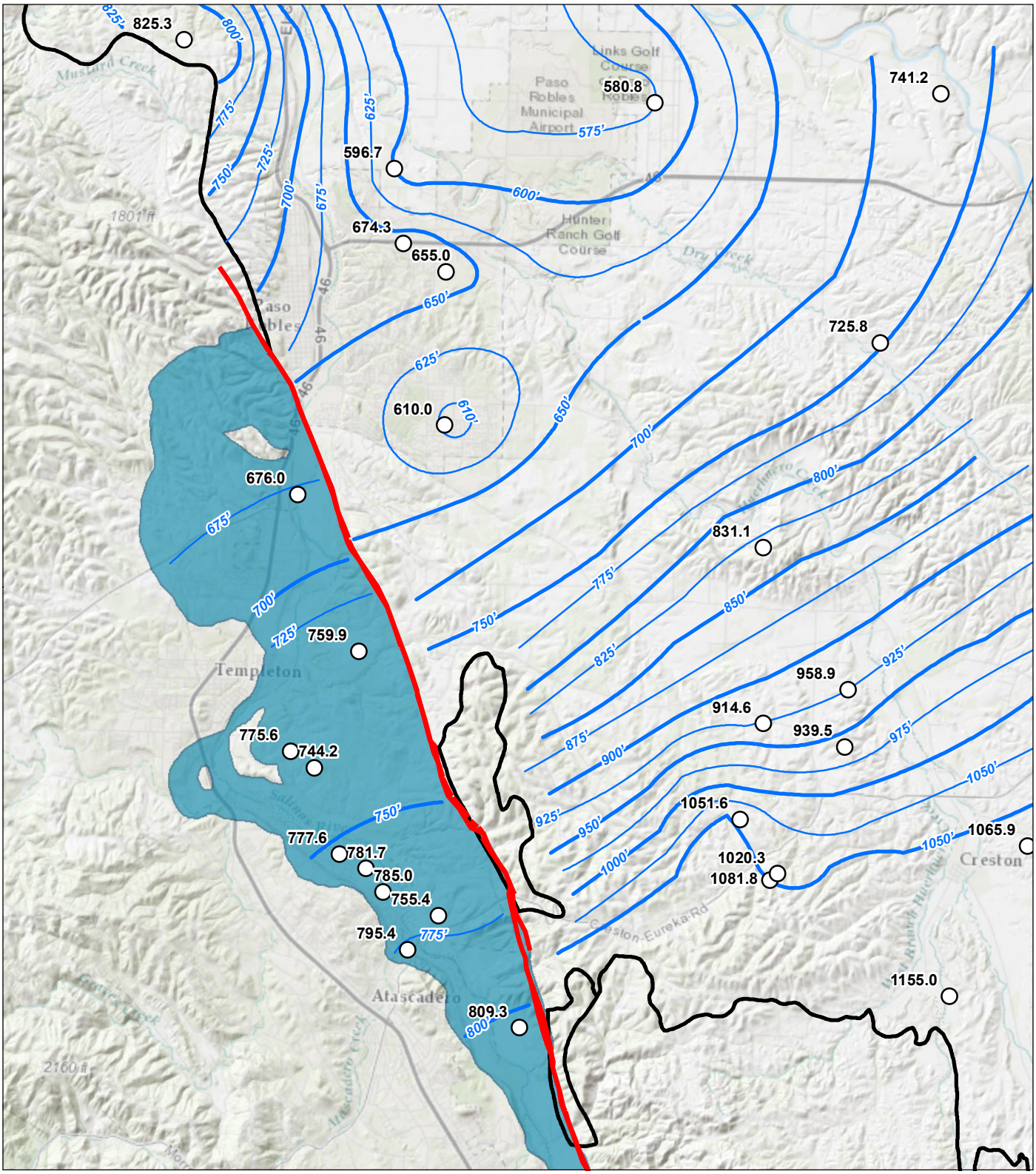



**LEGEND**

- Groundwater Elevation Points
- Groundwater Elevation Contours (25 foot interval)
- Rinconada Fault
- Paso Robles Area Subbasin
- Atascadero Area Subbasin

# FIGURE 2

## Water Level Contour Map - Spring 2012

Templeton Community Services District

N

0 2 4

Miles

Date: August 31, 2016
Data Sources: USGS, ESRI

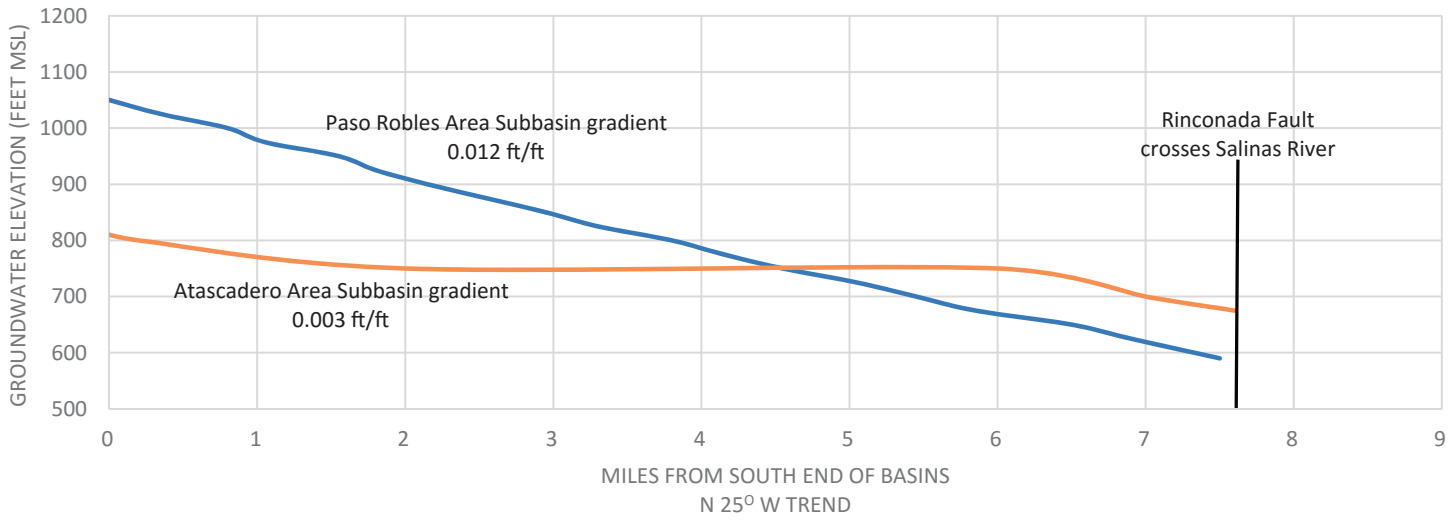
GSI Water Solutions, Inc.

Document Path: P:\Portland\652-TCSD\003-Basin Modification Comments\Project_GIS\Project_mxds\Figure2_WL_Contour_Spring2012.mxd

# FIGURE 3

**Comparison Of 2009 Groundwater Gradient Between Atascadero Area Subbasin And Paso Robles Area Subbasin**

Templeton Community Services District




**LEGEND**

- Paso Robles Area Subbasin gradient
- Atascadero Area Subbasin gradient

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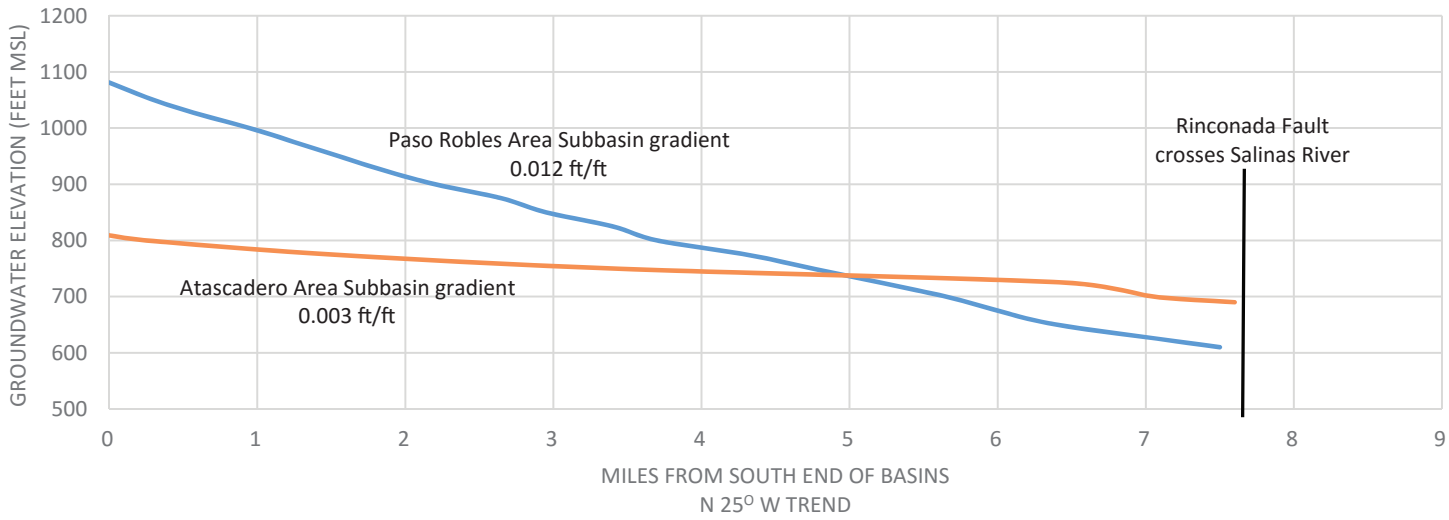
# FIGURE 4

**Comparison Of 2012 Groundwater Gradient Between Atascadero Area Subbasin And Paso Robles Area Subbasin**

Templeton Community Services District




**LEGEND**

- Paso Robles Area Subbasin gradient
- Atascadero Area Subbasin gradient

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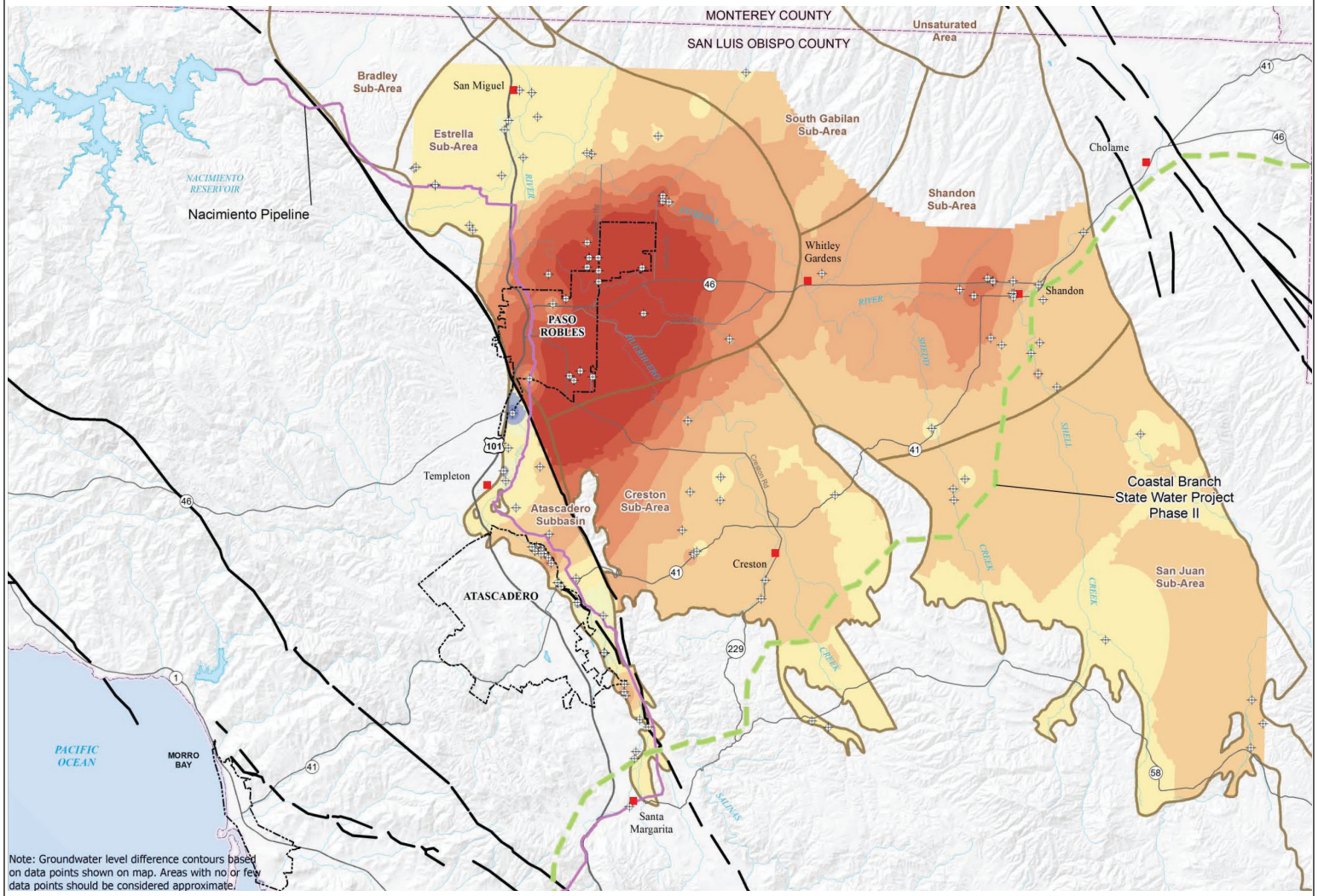
# FIGURE 5

## Difference in Spring Groundwater Elevation 1997-2009

Templeton Community Services District




**LEGEND**

- Contouring Well
- Fault

**Change in Groundwater Elevation (feet)**

- <-70
- -70 to -60
- -60 to -50
- -50 to -40
- -40 to -30
- -30 to -20
- -20 to -10
- -10 to 0
- 0 to 10
- 10 to 20
- 20 to 30
- >30

**SOURCE:**
Figure created by GEI Consultants, Figure 3-3, February 2011

N

0 2 4
Miles

GSI Water Solutions, Inc.

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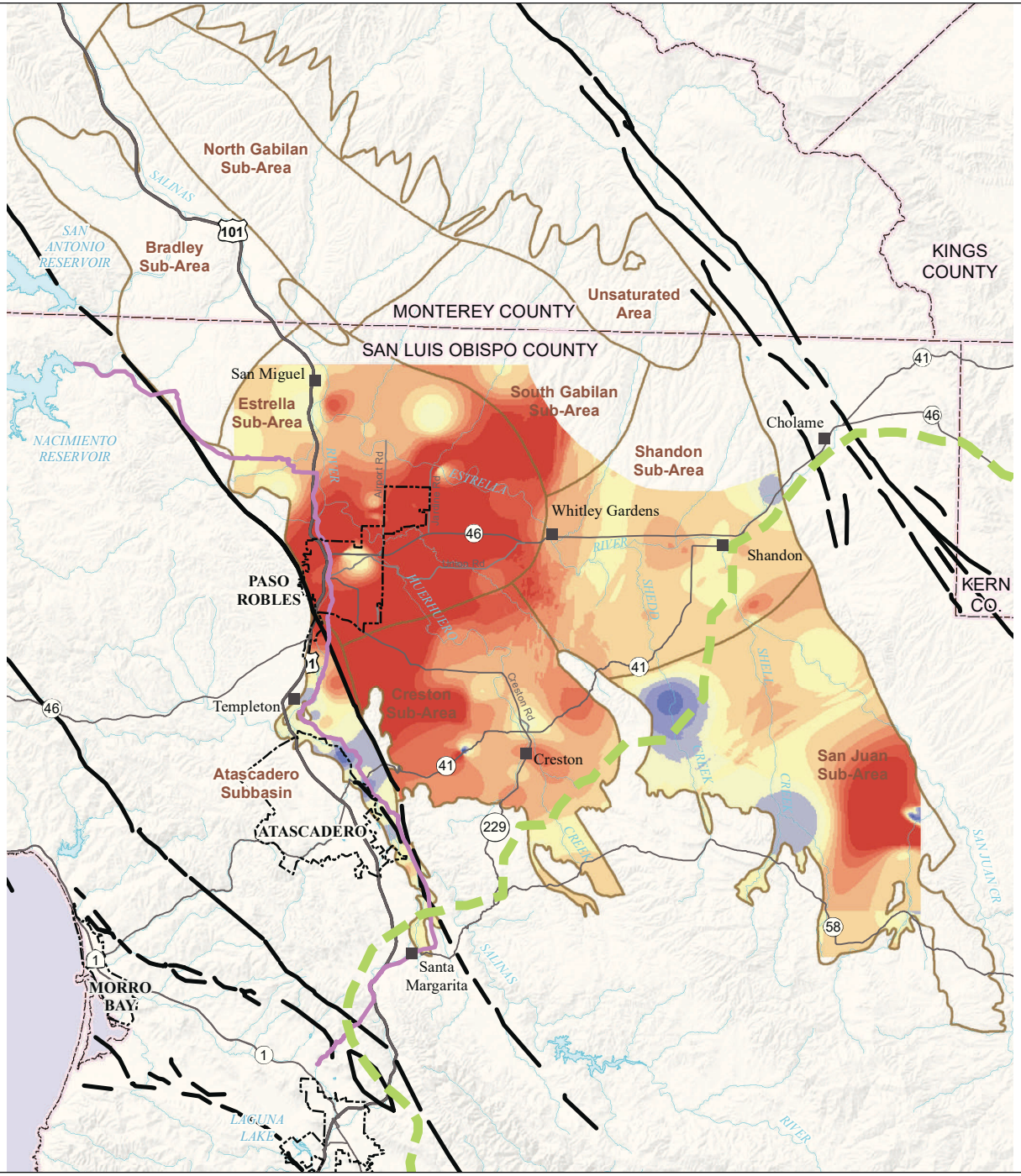


# FIGURE 6

**Difference in Spring Groundwater Elevation 1997-2013**

Templeton Community Services District

**LEGEND**

Fault

**Change in Groundwater Elevation (feet)**

- <-70
- -70 to -60
- -60 to -50
- -50 to -40
- -40 to -30
- -30 to -20
- -20 to -10
- -10 to 0
- 0 to 10
- 10 to 20
- 20 to 30
- >30

**SOURCE:**

Figure created by GEI Consultants, Figure 1, August 2013

N

0 2.5 5

Miles

GSI Water Solutions, Inc.

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