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2016 Annual Report:
Hydrologic Conditions in Baseflow Reaches Pursuant to Conditions 14 and 15, Santa Lucia Preserve, Monterey County, California

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Preface

This report presents the results of the 2016 baseflow condition surveys of the four major streams flowing through Santa Lucia Preserve– Lower Las Garzas, Potrero, San Jose, and San Clemente Creeks. This report has been prepared for the Santa Lucia Conservancy and is primarily intended for the staff of Monterey County and California Department of Fish and Wildlife, in accordance with the baseflow monitoring and reporting requirements outlined in County Conditions 14 and 15. The scope of this report is limited to the presentation and evaluation of existing baseflow conditions as required by Conditions 14 and 15.

Acknowledgments

We would like to acknowledge Chris Hauser and Christina Fischer of the Santa Lucia Conservancy and Scott Brown of Balance Hydrologics for providing logistic support and reference information. Greg James provided precipitation data for San Clemente Dam. Also, thank you to Leah MacCarter, Anna Conlen, and Magnolia Morris for their assistance in data collection.

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1 Introduction

The Santa Lucia Preserve (SLP) is a residential community established in 1994 on the 20,000 acre Rancho San Carlos property in Carmel Valley, California. The Santa Lucia Conservancy manages 18,000 acres of open space while the remaining 2,000 is occupied by the community. Before approving the final Environmental Impact Report for development, the Monterey County Planning and Building Inspection Department, the lead CEQA agency, imposed stipulations for the SLP to protect streams flowing through the property. Conditions 14 and 15 require annual baseflow monitoring on four major streams flowing through the property.

- *Condition 14*

  "Measured daily base flows in Potrero Canyon, San Clemente and Las Garzas Creeks shall be recorded at approved locations near the boundaries of Rancho San Carlos. An annual survey of pools and base flow conditions in the gaged creeks and in San Jose Creek shall be conducted in September of each year. At least every year, a base flow monitoring report for evaluating base flow conditions shall be prepared and filed with Environmental Health, Water Resource Agency, the Department of Fish and Game, and the Monterey County Planning and Building Inspection Department."

- *Condition 15*

  "If the Base Flow Monitoring Report demonstrates that the base flow in any of the four creeks has dropped below the October 1990 level as a direct result of the project, flow shall be augmented by discharging water into the creek near the upstream end of the affected Base Flow Reach. The rate of augmentation shall be of an amount sufficient to sustain pools and base flow approximately equal to conditions in October 1990; the maximum required combined augmentation for all four creeks is 30 gpm at the points where the augmented water reaches the protected base flow reaches. The proposed augmentation methods, the actual rate(s) of augmentation and the location(s) of augmentation shall be reviewed with the Water Resources Agency prior to implementation of this condition."

Baseflow conditions were surveyed from August 18, 2016 through September 2, 2016 and compared to October 1990 conditions pursuant to the requirements of Conditions 14 and 15. This report is a compilation of the findings of the 2016 baseflow conditions mapping and specific conductance profiles of the four creeks flowing through the Santa Lucia Preserve. Although the scope of this report is limited to the requirements of Conditions 14 and 15, the data collected will serve an integral part establishing a long term dataset necessary for future analyses.

2 Methods

The baseline comparison for baseflow conditions is an October 1990 study, as indicated in Condition 15. The purpose of the study was to develop a "baseline characterization of the physical influences of stream aquatic and associated riparian habitat conditions at Rancho San Carlos" (Napolitano and Hecht 1992). Balance Hydrologics conducted the annual baseflow survey prior to 2007. From 2007 to the present, the study was conducted by graduate students of CSUMB. Methods used in previous surveys have continued to be used as much as possible to maintain continuity (Woyshner et al. 2004;2005, Croyle and Smith 2007). Beginning in the 2009 report, an additional descriptor, "isolated pool", was added to provide more detail about drying channel reaches (Paddock and Smith 2009).

2.1 Baseflow Conditions Mapping

Surveys of the four major creeks in the Santa Lucia Preserve were conducted by walking the length of the creek and recording qualitative observations. Baseflow conditions were described in detail and the locations of changing conditions were recorded with a GPS unit. The results were mapped in GIS. The 1990 surveys predate the use of GPS and therefore exact locations of changing stream conditions are not known. For comparison purposes, definitions from previous surveys which describe stream conditions have been retained. Furthermore, the maps presented in this report have been formatted similar to previous surveys to maintain consistency within the dataset. The following definitions are used to describe sub-reach channel conditions (Woyshner et al. 2004;2005, Croyle 2007).

- *"Predominantly wetted channel:* Flowing segments and/or strings of isolated pools, without reference to exact location of segments. Most pools contain at least some water, however riffles may be dry. In the 1990 and 1991 memos and field notes, these segments were referred to as "continuously wetted channel[1]," but we have changed the phrase to avoid confusion with "continuously flowing" and to provide a more general definition that can be applied to all creeks. Some short sections of dry channel may be

[1] "'Wetted channel,' as used in the 1990 and 1991 reconnaissance reports, described channels with sufficient moisture to sustain riparian vegetation reliably during droughts. Generally, these were channels in which mature riparian vegetation could expect to obtain water from pools, underflow, or springs. In some cases, most notably Potrero creek, a 'wetted' channel had no expression of surface water, but we had reason to believe (often supported by digging in pools) that moist or saturated sands were within a few feet of the bed (Woyshner et al. 2005)."

included, but the reach/sub-reach was defined as having predominantly wetted conditions."

- *"Predominantly dry channel:* Stream reaches or sub-reaches with isolated pools and completely dry channel (short, predominantly-wetted channel segments separated by long dry channel segments). Some very short sections with flowing water may be included, but reach-wide conditions are predominantly dry or contain only low-volume pools. Many to most pools in these reaches are dry. The current mapping of the 1990/1991 accounts and field notes is based on reach descriptions without reference to exact locations of surface water and dry segments."

- *"Isolated Pool:* Stream reaches or sub-reaches that are intermediate in character between Predominantly Dry and Dry. There are single pools isolated by very long reaches of dry channel."

- *"Dry:* Stream reaches or sub-reaches having no surface water"

2.2 Specific Conductance Profiles

In addition to qualitative descriptions and mapping of baseflow conditions, specific conductance[2], dissolved oxygen, temperature, and pH were measured at select pools during each survey. Specific conductance is used as a proxy for "dryness" in the watershed. As the watershed begins to dry, groundwater with increasing amounts of dissolved solids feeds stream baseflow. This results in higher specific conductance. As streams begin to dry, specific conductance generally increases as demonstrated on Lower Garzas Creek by Wolshner (2003). Specific conductance is used additionally as a quantitative indicator when evaluating stream "dryness" due to changes in baseflow conditions between years.

[2] Specific conductance measures the ability of water to conduct electrical current and is a relative measure of the amount of dissolved solids in water.

3 Results

Results for the 2016 baseflow survey are summarized and compared with the 1990 reference baseflow conditions. All creeks in 2016 appear “wetter” than the reference year in 1990. Specific conductivity in all the reaches appear to be equal, if not lower, than the reference year. Precipitation was higher in 2016 (22.25 in) compared to the 1990 (13.09) reference year which could account for overall “wetter” conditions and lower specific conductivity measurements. Water year 2016 has the highest precipitation in the past four years (Figure 1). It is also the first year to have an annual precipitation above the arithmetic mean precipitation over the past few years (21.15 in).

3.1 Lower Las Garzas Creek

A baseflow survey of Lower Las Garzas Creek was conducted on August 19, 2016 (Figure 2). The survey began at the confluence of the Las Garzas Creek and Carmel River and extended upstream to Moore’s Lake at Robinson Canyon Road. In August 2016, Garzas had conditions that were slightly wetter as compared to the conditions in October 1990 (Figure 3). In 2016, the Lower and Upper SLP reaches consisted of predominately wet channel. The Pinyon Peak Reach also consisted mainly of predominantly wet channel. The Terraced Alluvial Reach had the highest variation with intermittent surface flow, dry channel, pools, and a small segment of predominantly dry channel. The upstream portion of the Alluvial Fan Reach had intermittent surface flow and the downstream portion was dry. This portion of the creek was slightly wetter than 1990, given the intermittent surface flow in the Alluvial Fan Reach where there was none in 1990. The Lower SLP reach was dry in 1990 but predominantly wet in 2016. In 1990, the majority of the “Protected Baseflow Reach” was dry or predominately wet. In 2016 the majority of the “Protected Baseflow Reach” is predominantly wet in the upper portion with intermittent flow, occasional isolated pools, and short segments of dry channel.

Specific conductivity was extremely variable in 1990. The specific conductance from 2016 appears lower than 1990 but generally follows the same spatial trend of decreasing conductivity as distance increases from the Carmel River (Figure 4).

3.2 Potrero Creek

The Potrero Creek baseflow survey was conducted on August 18, 2016. The survey extended from the SLP gatehouse to Potrero Trail Bridge crossing (Figure 5). There was continuous surface flow in the upstream and throughout the “Protected Baseflow Reach.” Downstream of the “Protected Baseflow Reach” the channel was dry. Wolshner et al. (2004) describes the “Protected Baseflow Reach” section as surveyed in 1990 as having locally discontinuous flow

(Figure 6). In 2016, Potrero Creek was similar to 1990 conditions, but may have had a longer reach of continuous flow in 2016.

Two specific conductance measurements were taken during the 1990 survey and four measurements were taken during the 1991 survey. Conditions in 1991 were wetter than 1990, but still well below average. The Potrero Creek specific conductance measurements taken in 2016 were generally equivalent to the 1991 measurements (Figure 7). Historically, Potrero Creek conductivity measurements have consistently been high relative to other creeks on the Santa Lucia Preserve.

3.3 San Jose Creek

The San Jose Creek baseflow survey was conducted on August 26, 2016. The survey began at the SLP property line and extended upstream to Stickleback Pond (Figure 8). There was continuous surface flow in the “Protected Baseflow Reach.” The reach from Van Winkley’s Creek to William’s Canyon, outside of the “Protected Baseflow Reach,” was predominately wet and maintained flow until the end of the survey when the channel became dry. The 1990 survey was discontinued above Van Winkley’s Canyon and found predominantly dry conditions for the majority of the survey (Figure 9). In 2016, San Jose Creek was “wetter” than 1990 conditions.

Specific conductance measurements from San Jose Creek were generally equivalent or lower in 2016 than highly variable measurements from 1990 (Figure 10). On the San Jose Creek, the trend for specific conductivities is from lower values to higher values with distance upstream.

3.4 San Clemente Creek

The baseflow survey for San Clemente Creek was conducted on September 2, 2016 (Figure 11). The survey began at the SLP property line (Dormody Road) and continued upstream to Robinson Canyon Road. There was continuous surface flow in the upper and lower half of the “Protected Baseflow Reach.” The middle portion of the survey was dry. During the 1990, San Clemente Creek was surveyed from the San Clemente Trail Bridge to Robinson Canyon Road (Figure 12). No 1990 reference data for conditions through the “Protected Baseflow Reach” exist. Only one short section was described as predominantly wetted, while the remainder of the creek was described as predominantly dry. More of the creek bed was assessed as predominantly wetter in the 2016 survey than the 1990 survey.

One specific conductance measurement was taken during both the 1990 and 1991 surveys. Specific conductance data from 2016 is generally lower than the base year surveys from 1990 and 1991 surveys (Figure 13). Compared with the sparse reference data that exists for 1990 conditions and the continuous surface flow in the “Protected Baseflow Reach,” San Clemente Creek specific conductance is lower than the 1990 conditions.

4 Discussion

Rainfall during the 2016 water year (22.25 inches) was greater than both the 1990 rainfall (13.1 inches) and average rainfall (21.15 inches). The reference year took place in the midst of a four-year drought. The 2016 water year is the highest precipitation since 2011. As expected, more rainfall led to overall wetter channel conditions and lower specific conductivity measurements in all creeks.

5 Conclusion

Baseflow conditions were surveyed on the four major streams that flow through the Santa Lucia Preserve – Lower Las Garzas, Potrero, San Clemente, and San Jose. The baseflow characteristics of these streams were recorded and compared with the 1990 reference conditions as stipulated in County Condition 14. All creeks appear to be locally wetter than the reference year due to higher precipitation. Specific conductivity measurements also appeared to be lower or equal to the reference year. Due to higher precipitation than previous years, no augmentation (Condition 15) is required at this time.

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Woyshner M, Brown S, Hecht B. 2005. 2005 Annual report: hydrologic conditions in baseflow reaches pursuant to conditions 14 and 15, Santa Lucia Preserve, Monterey County, California. Consulting report prepared by Balance Hydrologics for the Santa Lucia Conservancy. 29 pp.

6 Figures

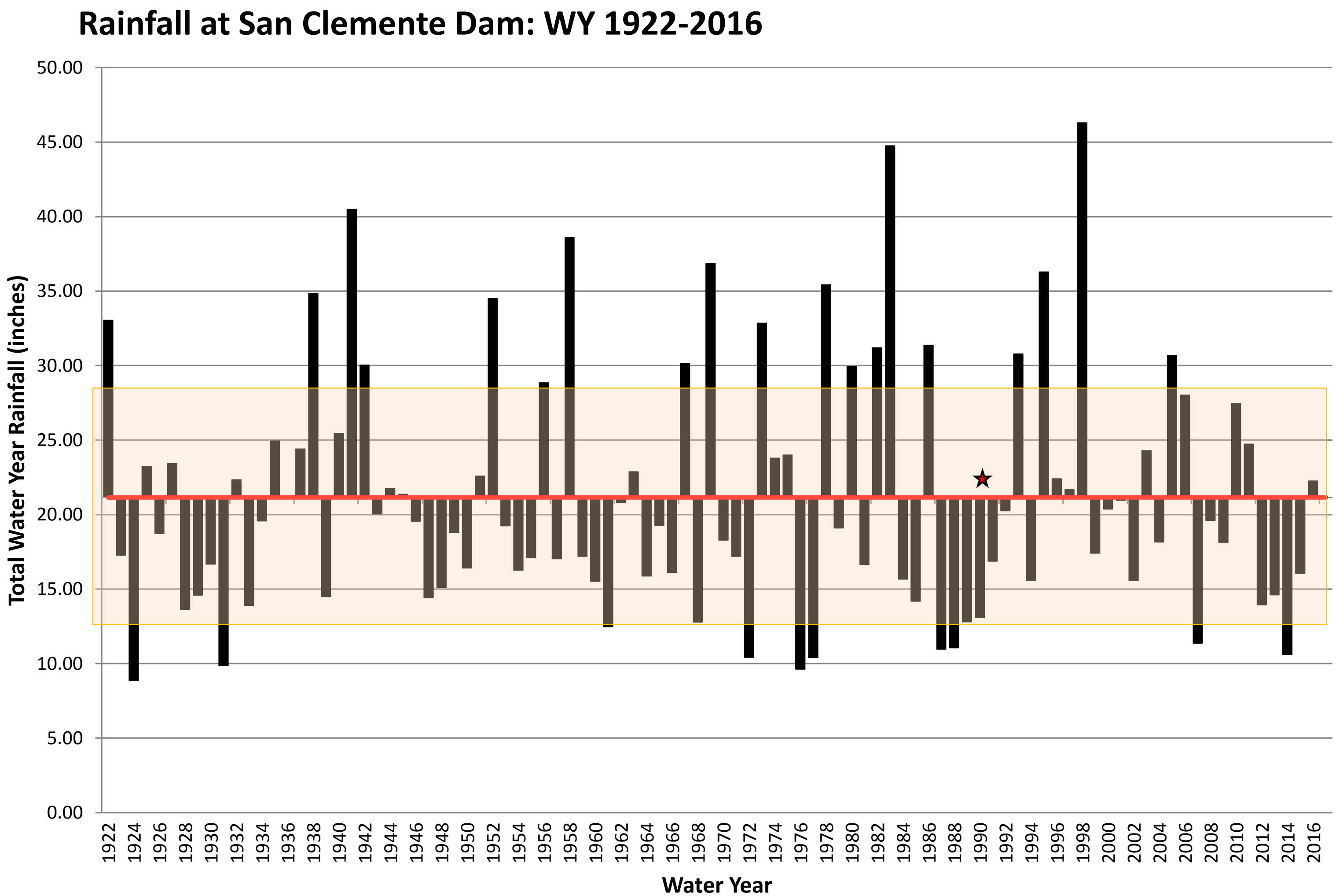

Figure 1. The average annual precipitation at San Clemente Dam for water years 1922-2016 is 21.15 inches (red line). Transparent box uncloses one standard deviation of precipitation above and below the mean. Red star is the 1990 reference year.

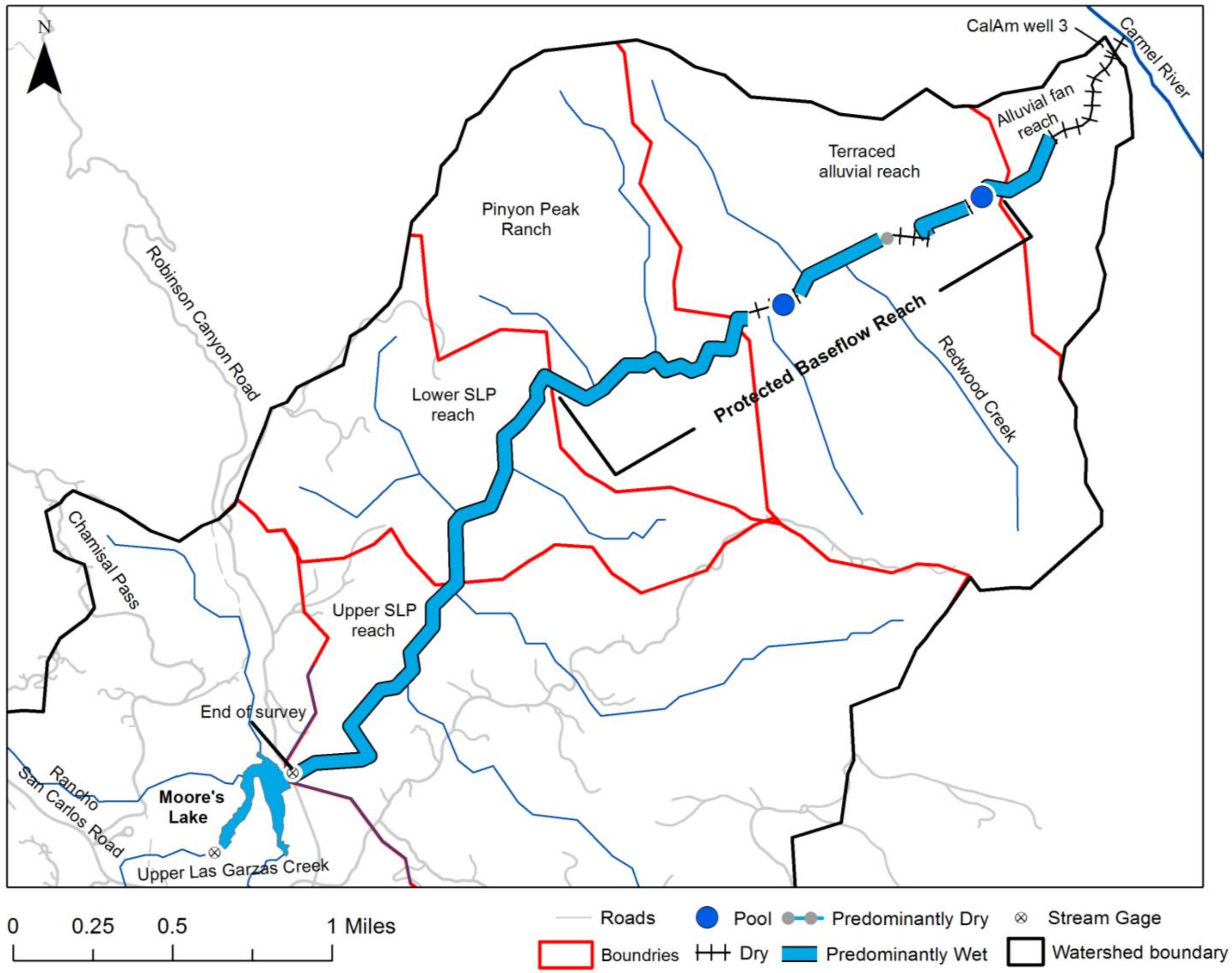

Figure 2. Map of generalized flow conditions for lower Las Garzas Creek on August 19, 2016. In 2016, the Alluvial fan reach started out dry before becoming predominantly wet. The Terraced alluvial fan reach was the most variable ranging from isolated pools, predominantly dry, and predominantly wet conditions. Pinyon Peak Ranch, Upper and Lower SLP reaches had continuous predominantly wet conditions.

October 30, 1990: Lower Las Garzas Creek Generalized Wetted and Dry Conditions

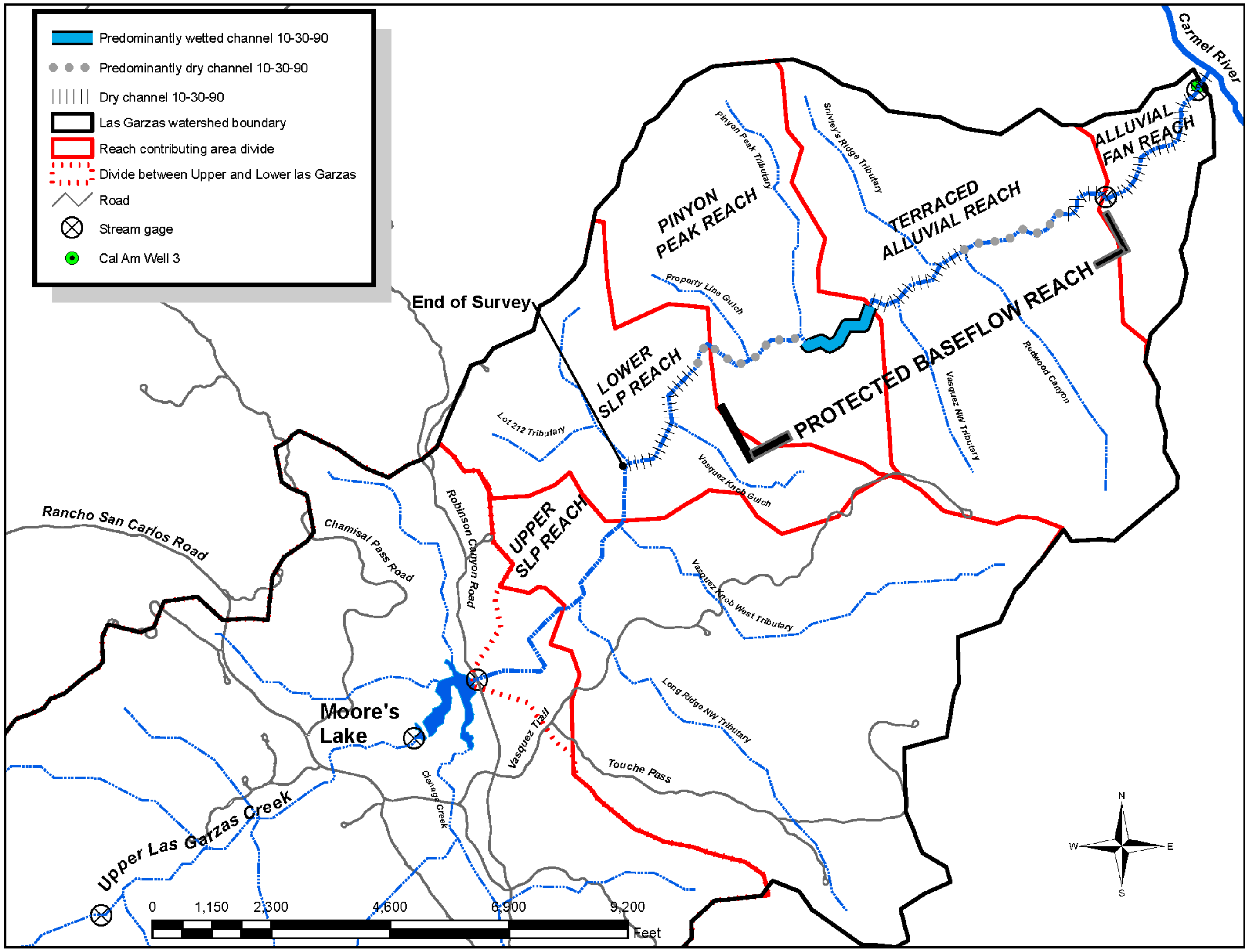

Figure 3. Generalized flow conditions on Lower Las Garzas Creek on October 30, 1990. In 1990, the upper part of Pinyon Pk. Reach consisted of isolated pools while the lower part of that reach had some continuous flow. Surface flow was not observed in the lower reaches.

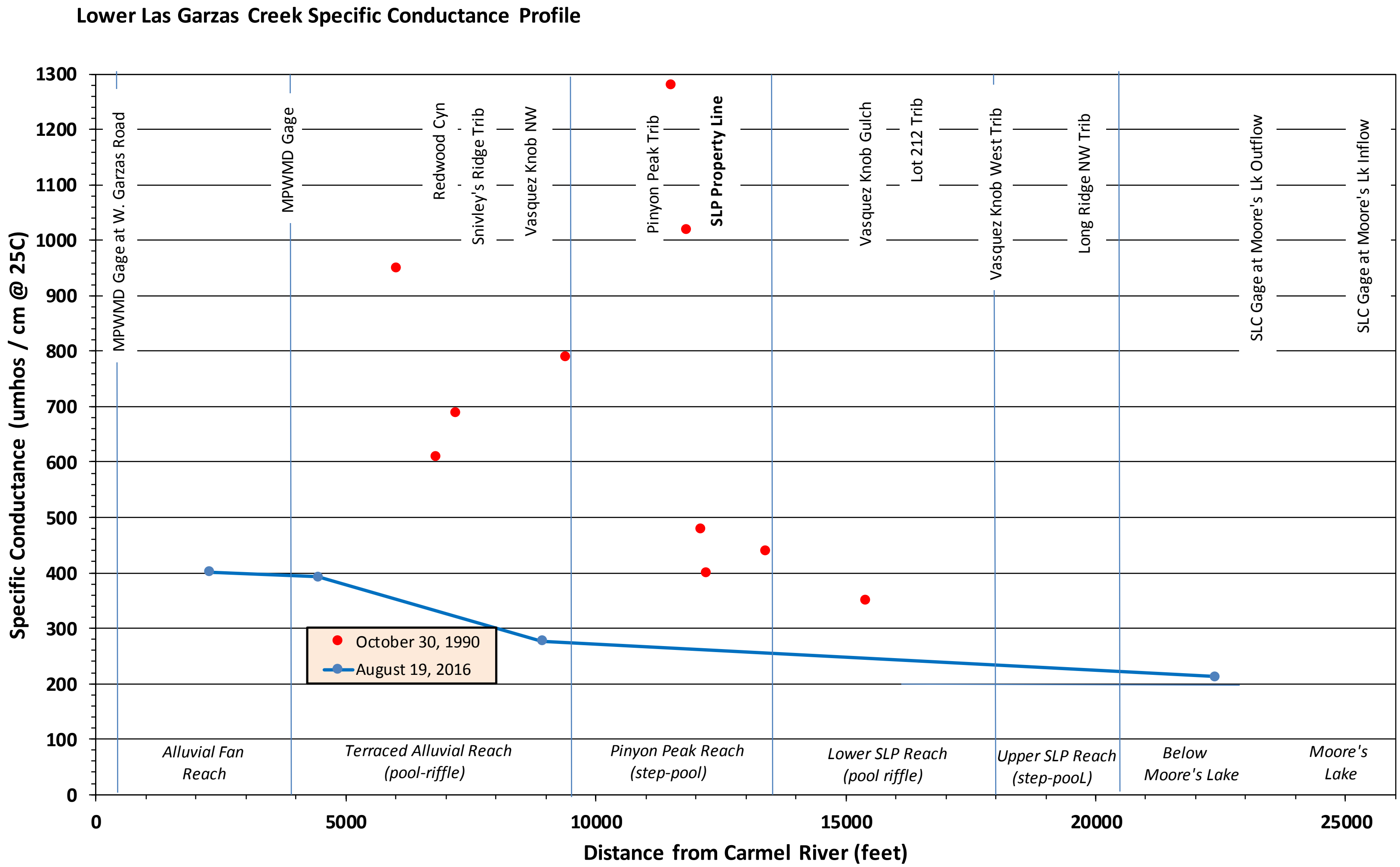

Figure 4. The comparison of Lower Las Garzas Creek specific conductance measurements from October 30, 1990 and August 19, 2016 illustrated the 2016 specific conductivity was lower than 1990 conditions. The specific conductivity data for 1990 was extremely variable, so it is very difficult to "characterize" the data for 1990 with a meaningful average.

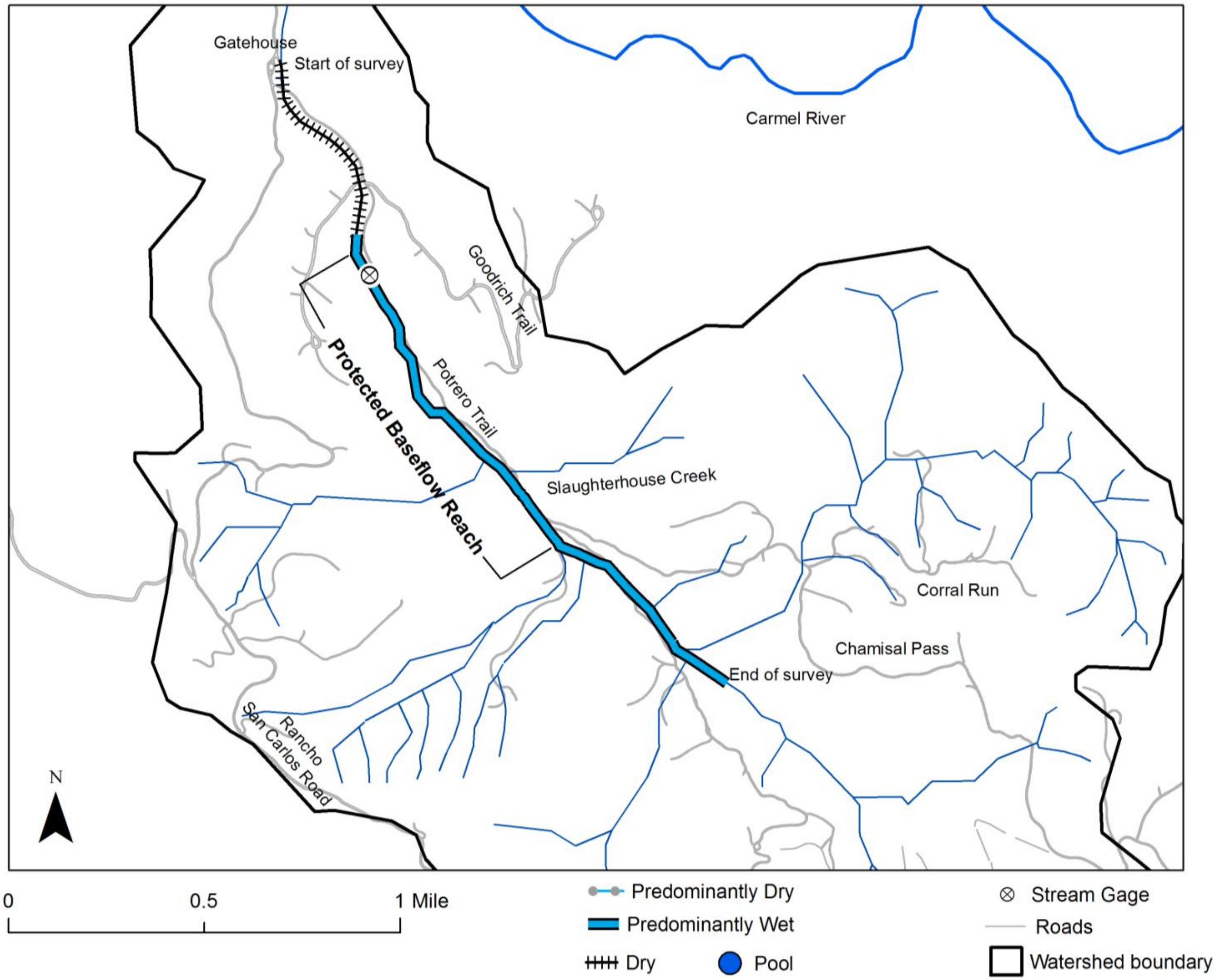

Figure 5. Map of generalized flow conditions on Potrero Creek on August 18, 2016. The upper reach was predominantly dry in 2016. From the start of the "Protected Baseflow Reach" to the end of survey, the channel was predominantly wet.

October 06, 1990: Portrero Creek Generalized Wetted and Dry Conditions

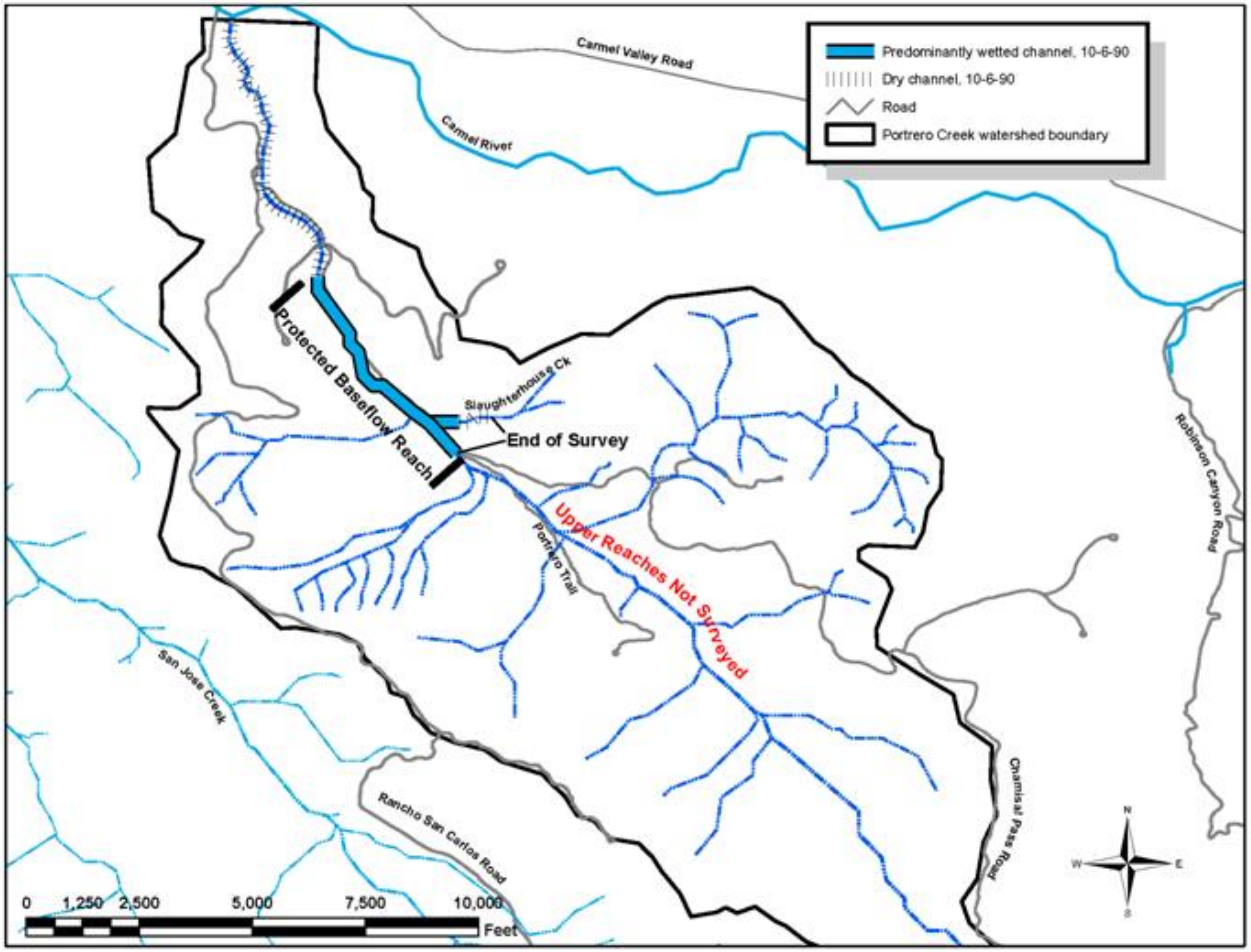

Figure 6. Generalized flow conditions on Potrero Creek on October 6, 1990.

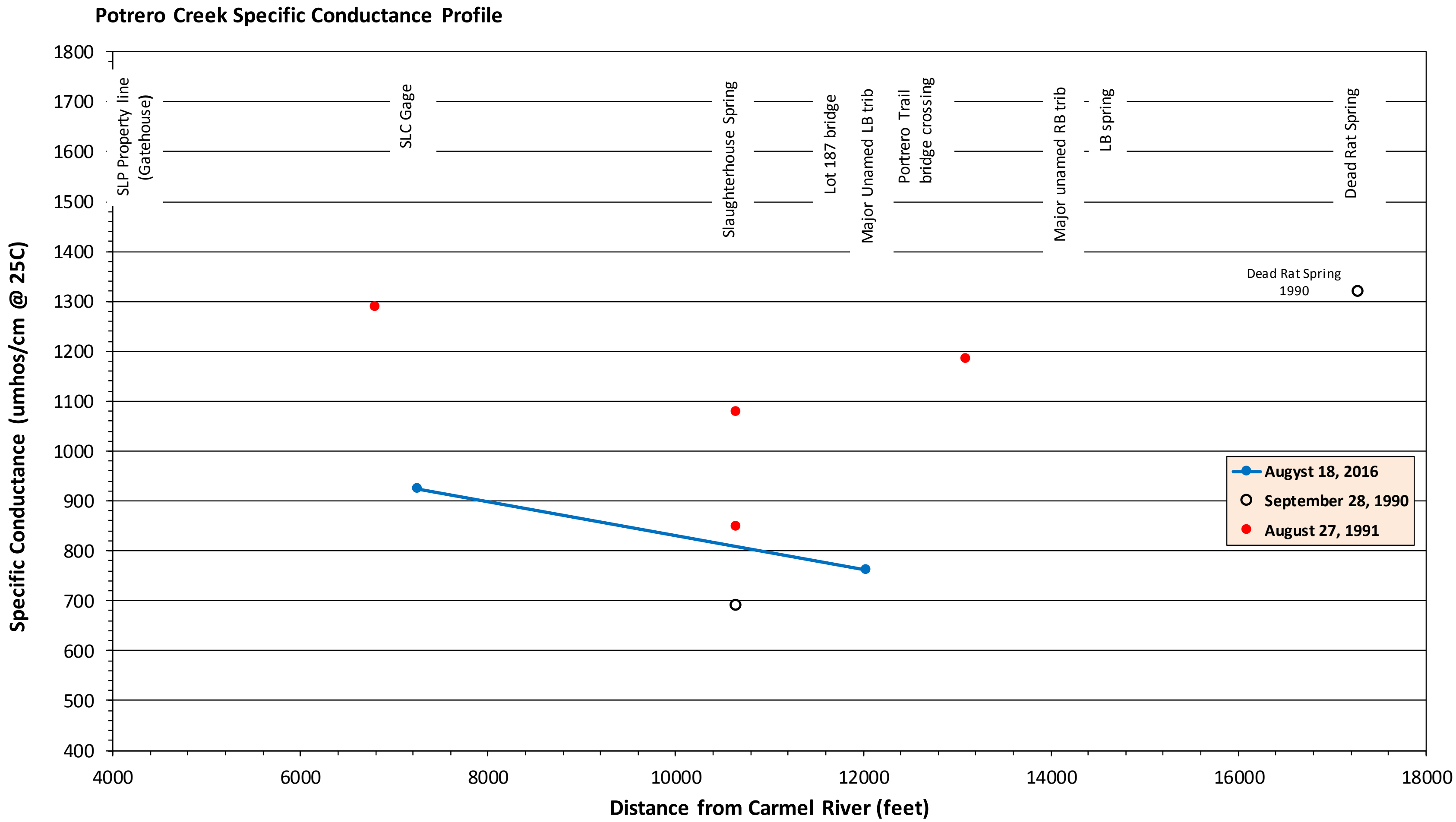

Figure 7. The comparison of Potrero Creek specific conductance measurements from September 1990, August 1991 and August 2016 illustrated the 2016 specific conductivity comparable to 1990 and 1991 conditions.

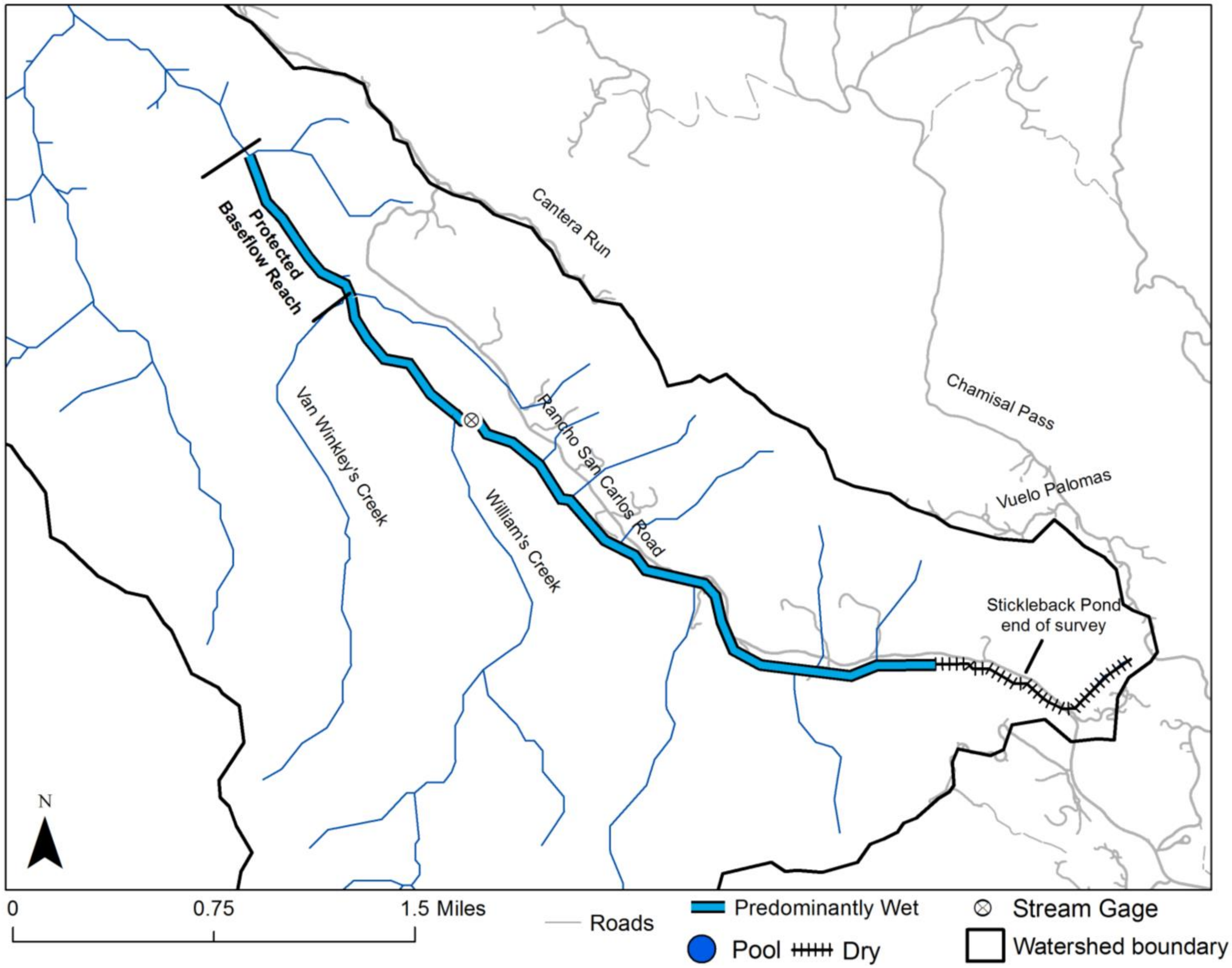

Figure 8. Map of generalized conditions on San Jose Creek on August 26, 2016. There was continuous surface flow in the "Protected Baseflow Reach" and thought most of the survey extent. Conditions became dry before reaching Stickleback Pond.

September 1990: San Jose Creek Generalized Wetted and Dry Conditions

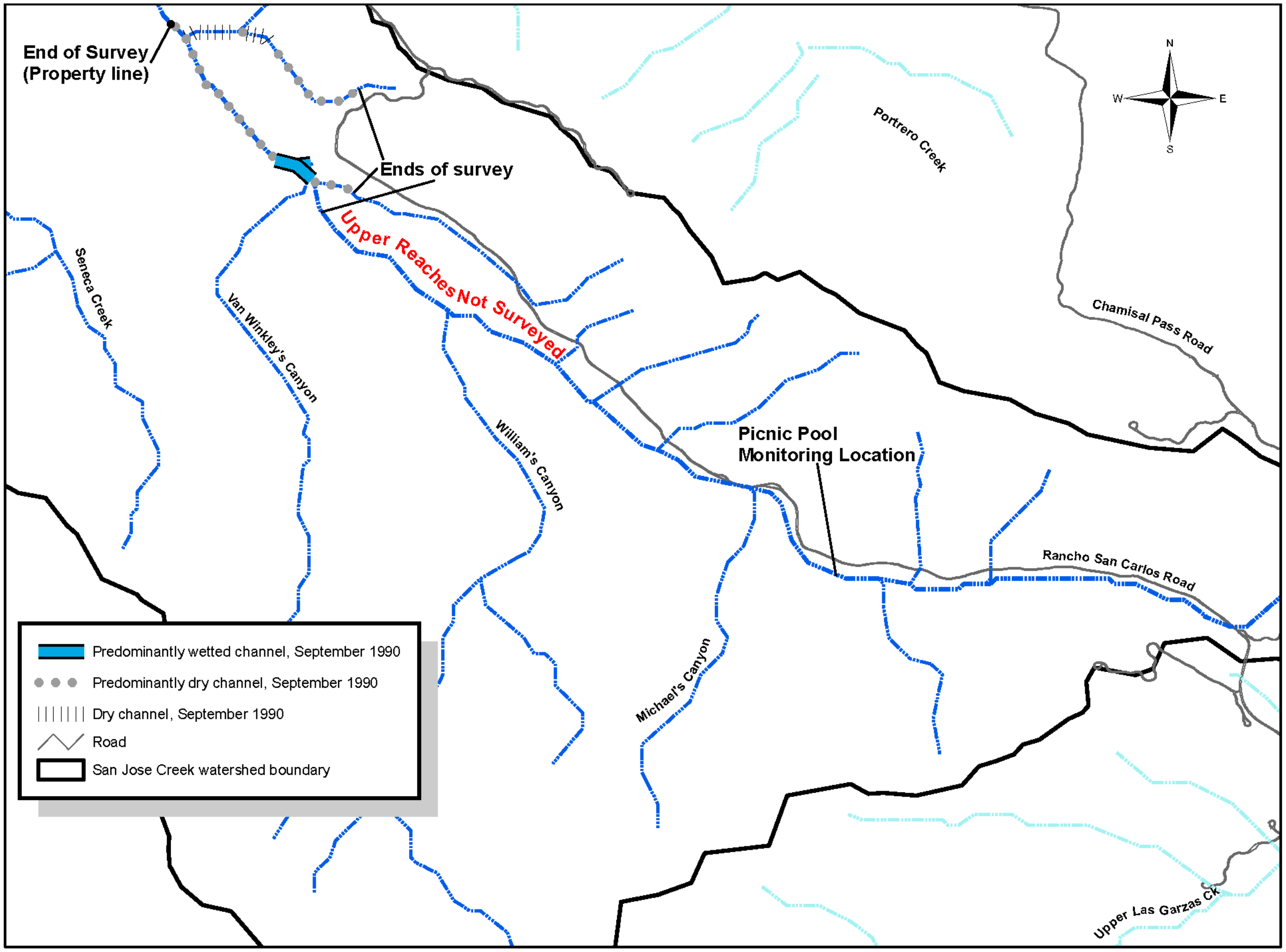

Figure 9. Generalized flow conditions on San Jose Creek in September1990.

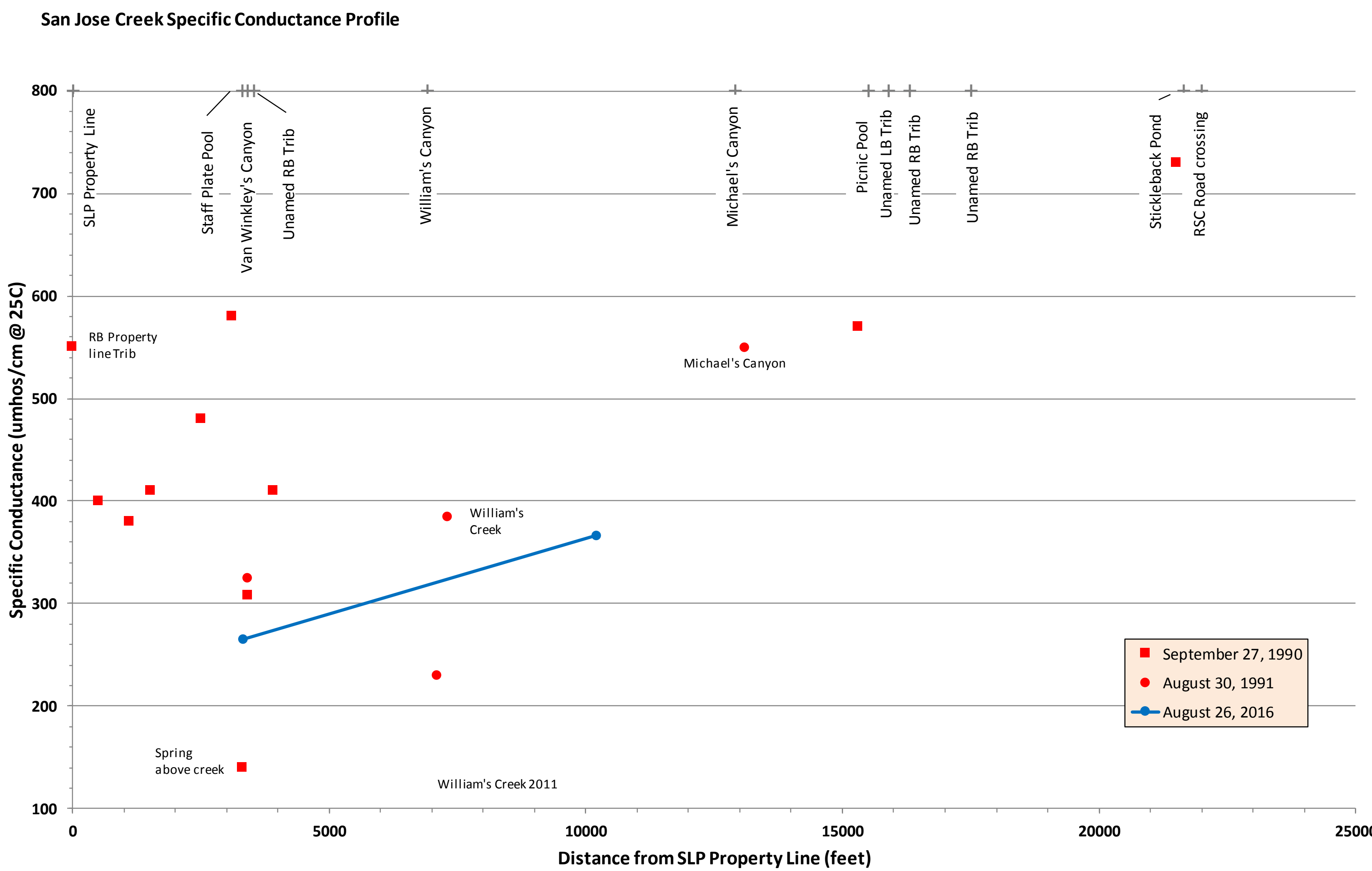

Figure 10. The comparison of San Jose Creek specific conductance measurements from September 1990, August 1991 and August 2016 illustrating the 2016 specific conductivity was generally equivalent or lower than 1990 and 1991 conditions.

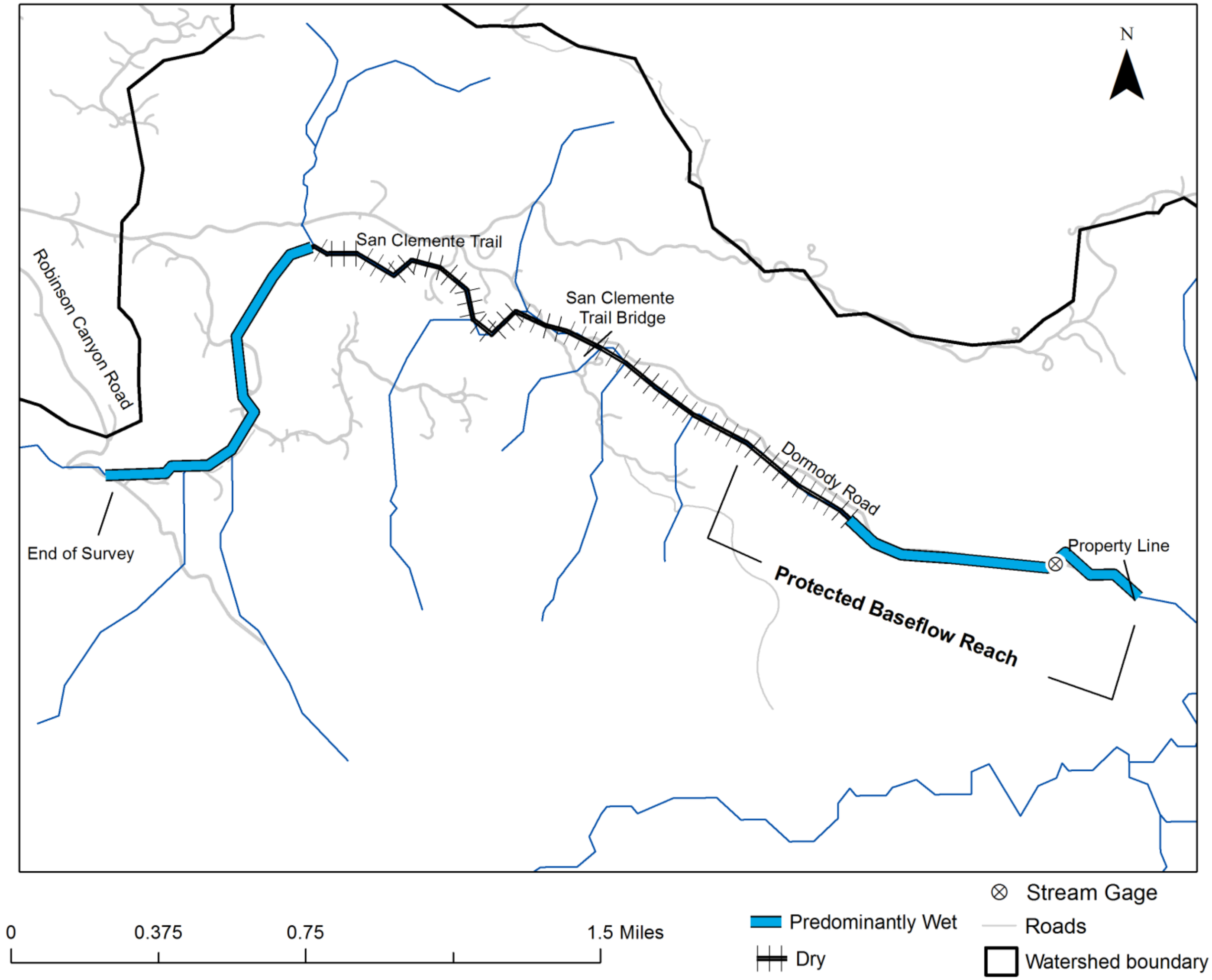

Figure 11. Map of generalized flow conditions on San Clemente Creek on September 2, 2016. There was continuous surface flow in the upper and lower portions of the survey extent, while the middle portion was dry.

September 28, 1990: San Clemente Creek Generalized Wetted and Dry Conditions

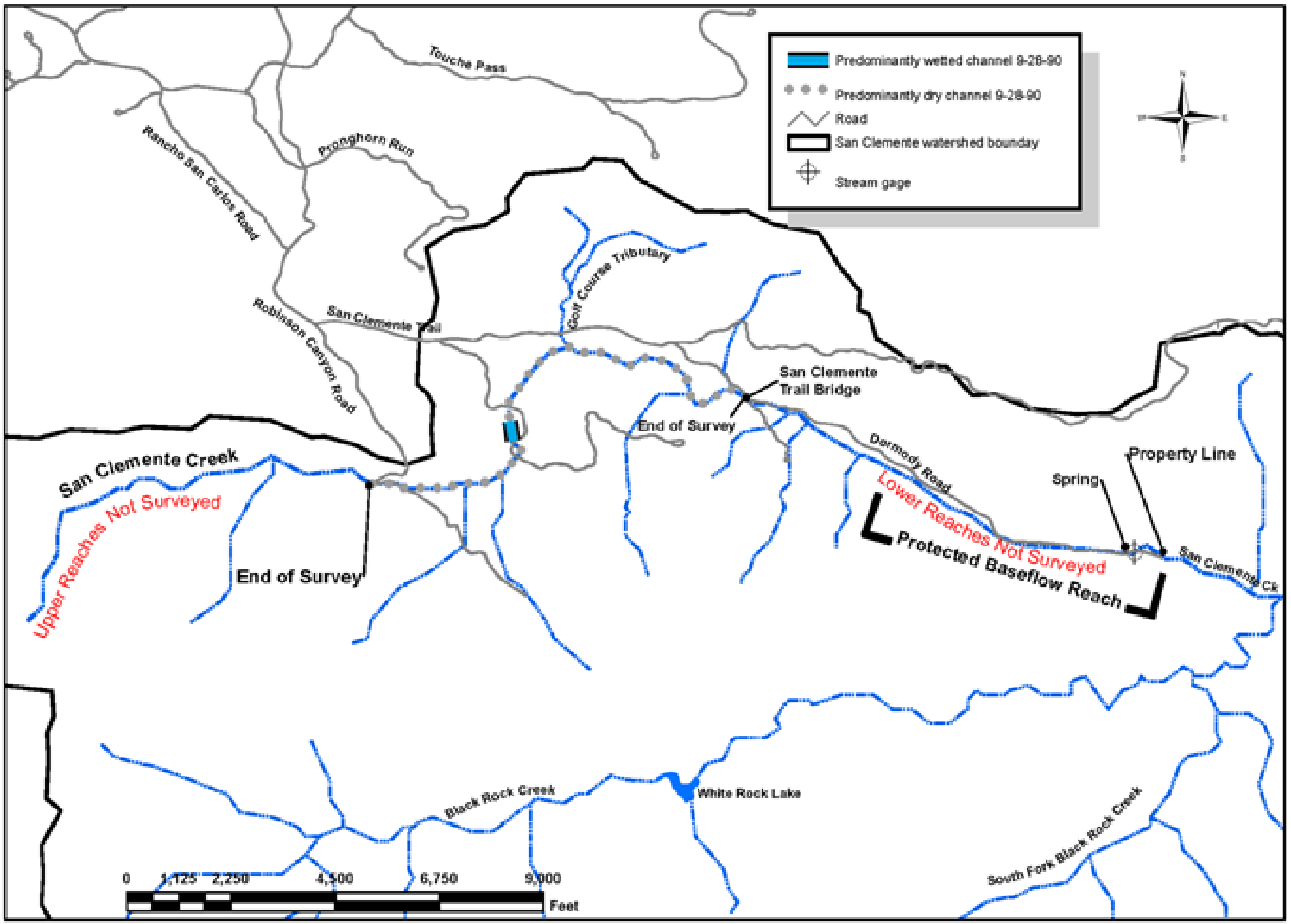

Figure 12. Generalized flow conditions on San Clemente Creek on September 28, 1990.

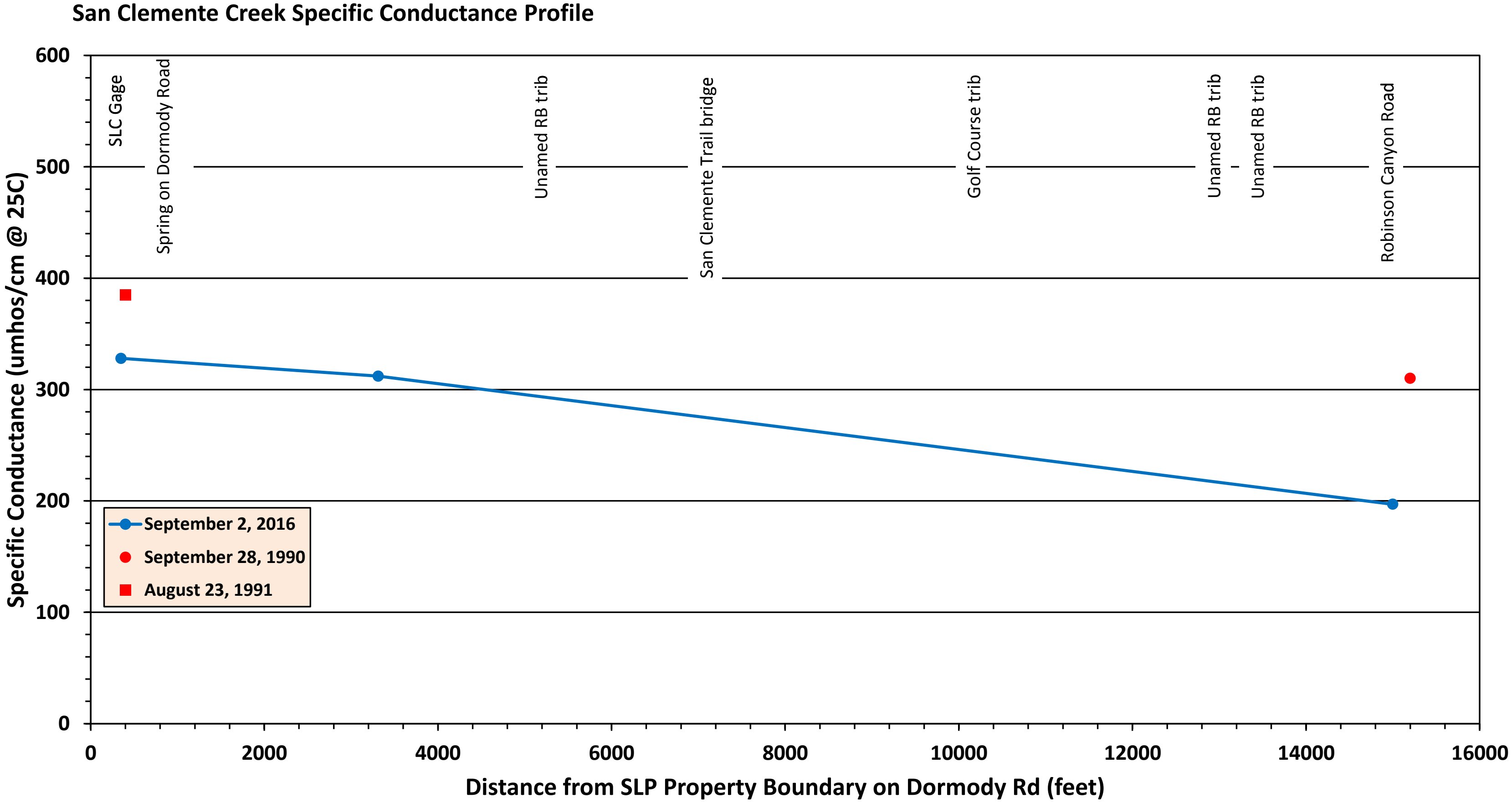

Figure 13. The comparison of San Clemente Creek specific conductance measurements from September 1990, August 1991 and September 2016 illustrates the 2016 specific conductivity was slightly lower than 1990 and 1991 conditions.