

# Riparian Health Assessment Summary

## Monitoring Year 2021-22: Near record monsoon after driest year reveals streams' responses to climate extremes

Cienega Creek is one of the few remaining perennial lowland streams in the region. Cienega Creek and Davidson Canyon are stunning examples of what many riverbeds could look like if similar preservation efforts were employed. These shallow groundwater-dependent systems and Outstanding Arizona Waters (OAW) support wildlife habitats and human activity alike. Cienega Creek and Davidson Canyon are among the priority waterbodies identified in Pima Association of Governments' Areawide Water Quality Management (208) Plan for monitoring and protection. However, despite these efforts, declining flows observed over the past two decades provide a reminder of the ecosystem's vulnerability to declining water tables, drought and climate variability.

PAG has monitored hydrologic conditions in Pima County's Cienega Creek Natural Preserve (CCNP) since 1989. The CCNP is in the lower part of the Cienega Creek Watershed. Every quarter, PAG maps baseflow in the reaches of Cienega Creek and Davidson Canyon within the CCNP and Pima County's Bar V Ranch. Baseflows are groundwater-based creek flows without the influence of recent stormwater runoff. The graphs display the time of year that is usually driest (May/June) to reflect the minimal perennial (year-round) extent of surface water. The annual maximum flow extents reflect the greater aquatic habitat present in wetter seasons.

### Pre-Monsoon Flows

In monitoring year (MY) 2021-22 (July 2021-June 2022), PAG observed higher baseflows in both Cienega Creek and Davidson Canyon than had been observed in recent years. With a June 2022 flow extent of 3.40 miles, or 37% of the Cienega Creek monitoring area, PAG observed the highest June baseflow since 2001. In June 2022, PAG observed 2.74 miles of baseflow in Davidson Canyon, the highest pre-monsoon flows recorded by PAG in this stretch.

Increased aquifer recharge also led to water resurfacing in portions of the waterways where PAG has not previously recorded flow, featured on page 4.

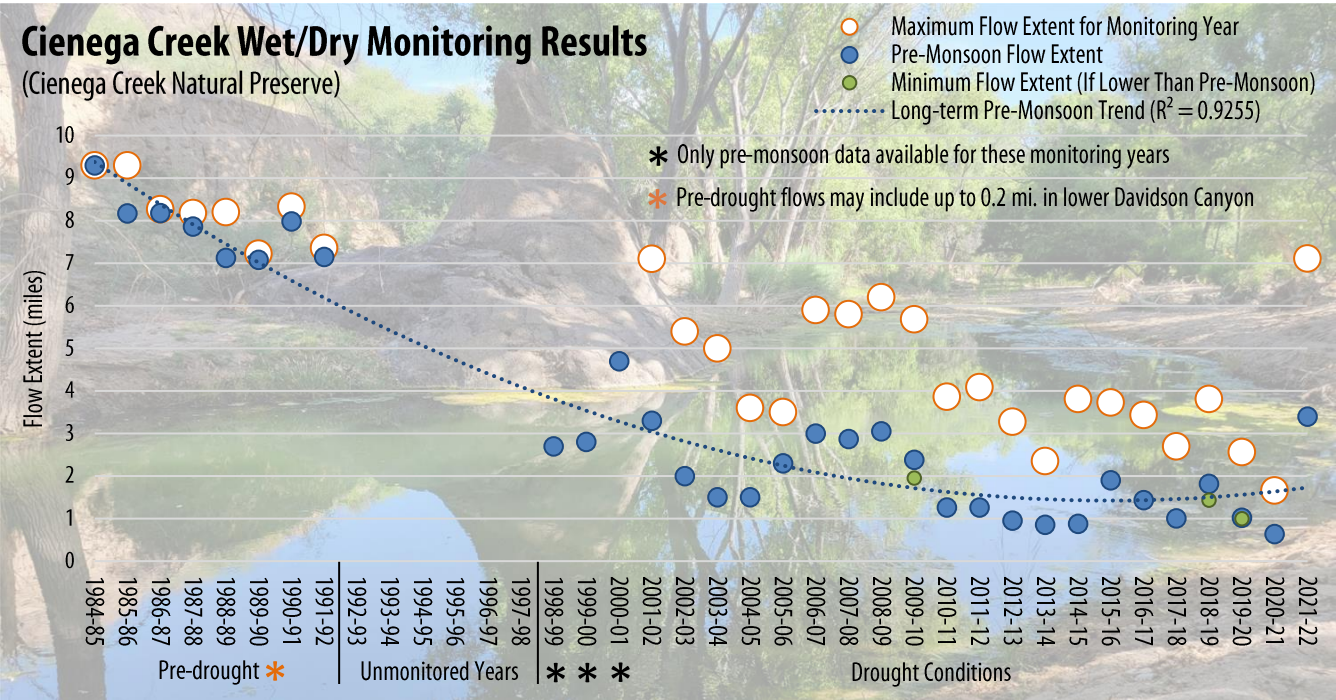
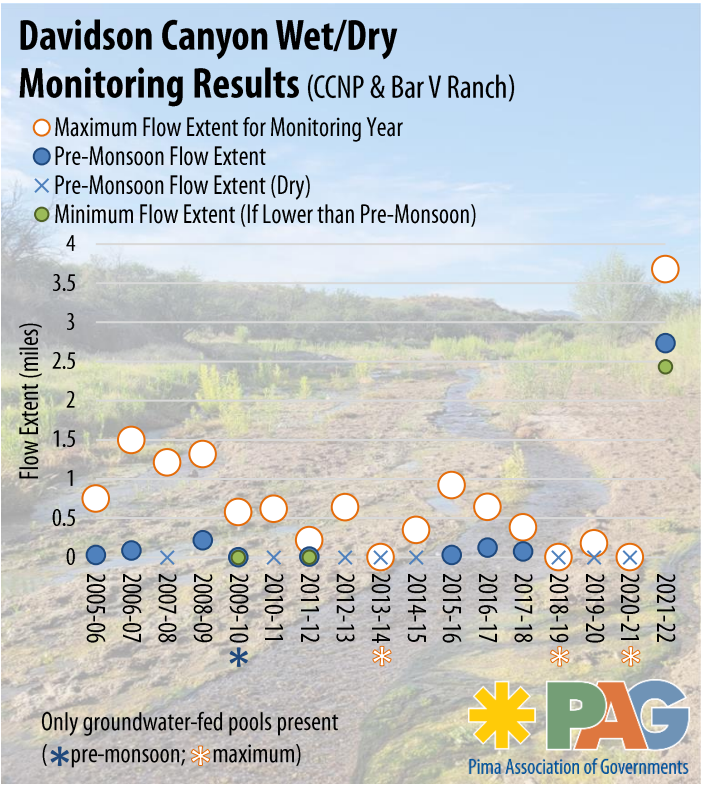


Photo near upper Davidson Canyon spring (DAV 1/3), March 2021



Photo near upper Davidson Canyon spring (DAV 1/3), March 2022





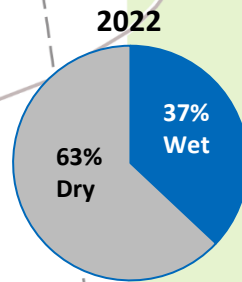
# Cienega Creek

## Pre-Monsoon Flow Extent Figure 2003 to 2022

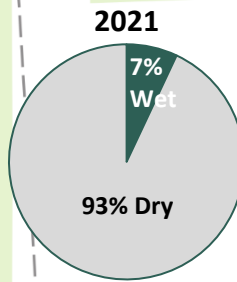
### Legend

- Pool locations (2022)
- Flowing segment (2022)
- Flowing segment (even year)
- Flowing segment (odd year)
- Dry stretch (2022)
- Dry stretch (past years)
- Cienega Creek Natural Preserve

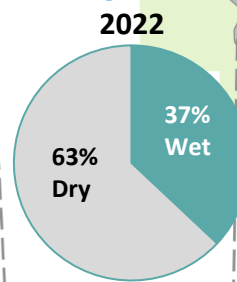
0 0.25 0.5  
Miles



Current Year



Least Flow



Most Flow



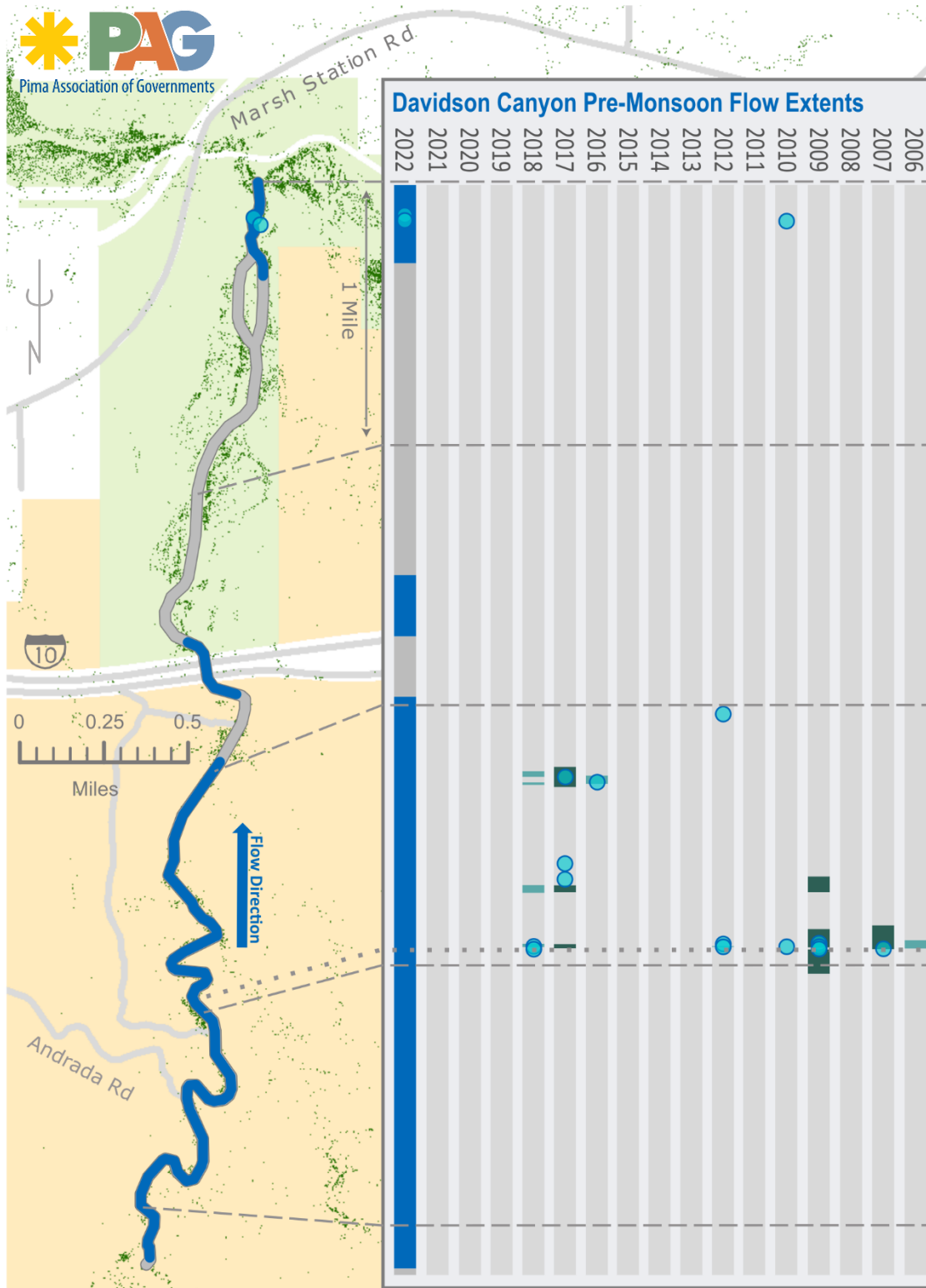
The chart below displays changes in June pre-monsoon baseflows for Cienega Creek within the CCNP since 2003. As the creek's flow extent decreases due to sedimentation, drought and/or groundwater pumping, the increasingly segmented flows are limited to reaches where shallow confining geologic layers keep the water table close to the surface. Wetter years elevate the water table, allowing segments to connect and flow to a greater extent.

Results from 2022 are shown on the map. The map displays eight of the 9.3 miles of Cienega Creek that are monitored quarterly. PAG does not monitor the upper 1.3 miles of Cienega Creek, as this area has been presumed dry since PAG resumed monitoring in 1999. The bar chart shows conditions from previous years, translated to-scale into linear bars, allowing easy comparison of flow length and location from year to year. Colors alternate for visual aid. The pie charts were generated based on pre-monsoon flow extents within the full 9.3-mile monitoring area. See page 3 for Davidson Canyon results.

PAG's consistent and long-term monitoring is necessary to provide reliable trend analysis. Results are reported to the Arizona Department of Water Resources for compilation into state records for natural areas and to the Arizona Department of Environmental Quality to support flow regime data.

PAG's reports and resources are available here:  
<https://maps.PAGregion.com/PAGLibrary/>





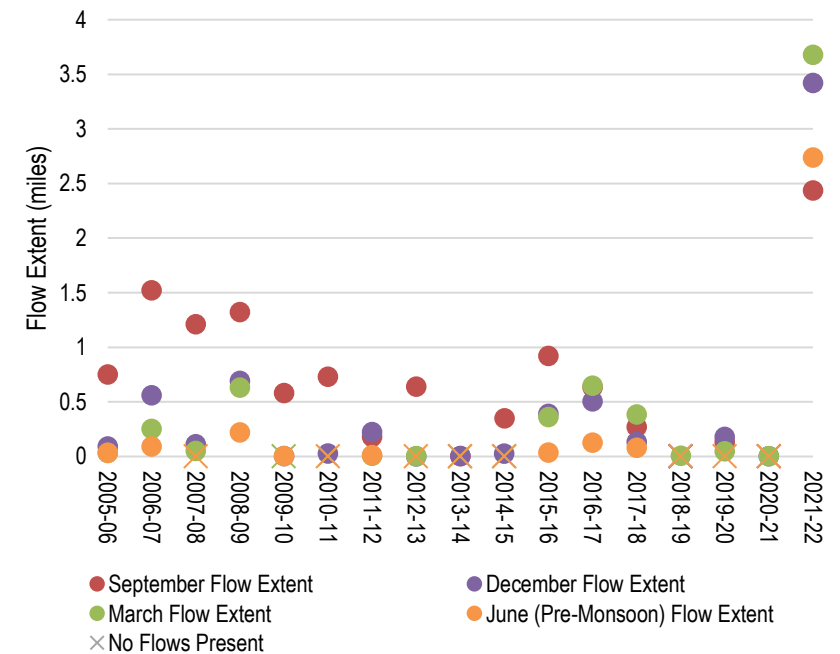
# Davidson Canyon

## Flow Extent Figures, 2005 to 2022

The chart at left displays changes in perennial baseflows for Davidson Canyon within the CCNP since 2006. Results from 2022 are shown on the map. The map displays over four miles of Davidson Canyon, which PAG has monitored quarterly since 2006 and includes the OAW reaches. Cienega Creek flow data is not pictured on this map. Tree canopy data and riparian health assessment data show that riparian vegetation in the canyon has persisted over time, supported by shallow groundwater.

The graph below shows quarterly flow observations. Within this stretch of Davidson Canyon, the total length of flow includes isolated pools that are not adjacent to flow.

### Davidson Canyon Quarterly Flow Extents (CCNP & Bar V Ranch)



## From Driest to Wettest: Two Dynamic Years in the Life of a Groundwater-Dependent Stream System

The 2021 monsoon season was the third wettest on record, leading to a drastic recovery in baseflows, breaking perennial baseflow records from the past two decades of drought. This followed a year with the lowest baseflows on record. The charts on the right show a linear comparison of quarterly baseflows observed during MY 2020-21 and MY 2021-22, not including pools. These observations highlight the impacts of climate extremes on shallow groundwater-dependent streams and the riparian areas that they sustain.

In 2020, monsoon rainfall (June 15-Sept. 30) ranged from 1.18 inches to 6.54 inches among numerous gauges distributed throughout the Cienega watershed. As a result of this poor monsoon in MY 2020-21, PAG observed record low flows in all four quarters. During this time, baseflows in Cienega Creek ranged from 0.64 miles to 1.66 miles within the CCNP. Davidson Canyon was even drier, with only one small groundwater-fed pool observed in both Dec. 2020 and March 2021, maintaining only 2 feet to 2.5 feet, respectively.

In 2021, monsoon rainfall was on an order of magnitude greater than the previous monsoon season, ranging from 10.39 inches to 20.51 inches within the Cienega watershed. In MY 2021-22, Cienega exhibited the highest baseflows in two decades, ranging from 3.40 miles to 7.11 miles throughout the year. Sept. 2021 baseflows in Cienega Creek were the highest observed by PAG for any quarter since PAG resumed wet/dry mapping in 1999. In June 2022, PAG observed the highest pre-monsoon baseflows since June 2001.

Davidson Canyon experienced record high baseflows in all four quarters of MY 2021-22, with baseflows ranging from 2.43 miles to 3.68 miles within the CCNP and a portion of Pima County's Bar V Ranch. Previously, the highest baseflow observed by PAG within this stretch of Davidson Canyon was 1.5 miles in Sept. 2006.

These numbers do not include the additional baseflow observed by PAG outside of PAG's previously established monitoring area, illustrated as the area beyond the dotted lines in the figure. In MY 2021-22, this furthered flow by 0.04 miles to 0.58 miles in Cienega Creek below the Pantano Dam and by 0.51 miles to 1.44 miles in Davidson Canyon upstream of Andrada Rd. to Empire View Rd. These areas were not monitored by PAG in MY 2020-21 but were presumed to be dry.

