Cochise Conservation & Recharge Network

# Lessons Learned 2025

**Palominas Flood Control and Stormwater Recharge Project**

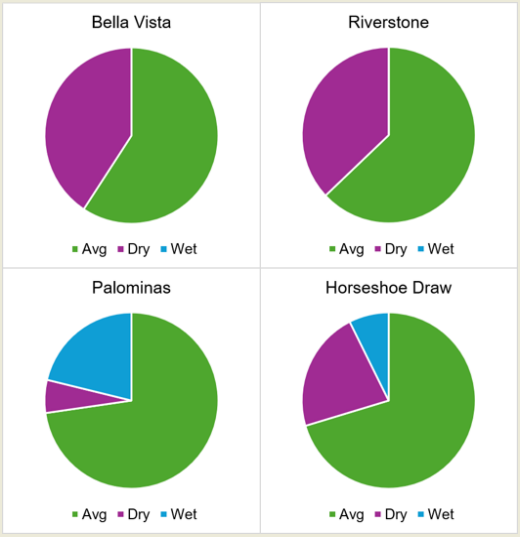
## Climate Considerations

- **Less runoff has been available** at CCRN sites for recharge than previously projected by traditional surface water models. The reasons for this are likely several, but how much rain falls, where, and when, is difficult to predict, and drier soils and rising temperatures both likely play an important role in creating a soil moisture deficit over time.
- **Precipitation patterns are highly variable.** Areas in the southern portion of the Sierra Vista Subwatershed have experienced more rainfall than in the northern portions since 2015. The further north the project is located, the more likely it is to be classified as a dry precipitation year compared to historical averages.

## Where does our rainfall go?

- **Evaporation rates are exceedingly high** when it does rain- 98% of the rain that falls in Arizona is lost to evaporation and use by plants, leaving only 2% statewide for groundwater recharge.
- **Evaporation losses also occur at recharge projects**, from both surface water and from wet bare soil, which is why it is so important to increase infiltration rates as much as possible, before evaporation can occur. At the Palominas Recharge project, the evaporative losses were calculated to be 15%, which is a significant reduction compared to typical evaporation rates across the watershed (98%).
- Bare soil was found to evaporate more than twice as much as ponded water at the Palominas Recharge project.

**The Horseshoe Draw Project** shown above is monitored to estimate recharge both within the constructed basin, and downstream of it- this quantifies the additional recharge that occurred downstream, due to the basin.




**Variability of precipitation** among CCRN project sites is shown above as the percentage of years classified as average, dry, or wet.

## Effective Monitoring Strategies for Recharge Projects

- **Baseline streamflow monitoring** at future stormwater recharge sites helps refine model estimates of runoff before project construction, informs the design of the facility, and more accurately quantifies project benefits after construction.
- **Watershed-scale precipitation monitoring** captures spatial variability in intensity, duration, and distribution of rainfall within a given watershed, which may be great, even at short distances.
- **Average precipitation rates** for any given location can be quantified by long-term monitoring to capture wet, average, and dry years, and the associated variability in precipitation.
- **Monitoring in flood prone settings** requires redundancy in equipment to minimize data loss, and/or where vandalism is likely. Continual maintenance and placement of redundant sensors are needed to minimize individual sensor failure or loss that can result from large, episodic stormwater flows in ephemeral channels. In highly mobile sandy stream beds, secure stilling wells below the streambed mobilization zone, is critical which may be of considerable depth.

# Infrastructure Planning, Design, and Maintenance

## PLANNING CONSIDERATIONS:

- **Recharge feature selection** for future projects should be based on site specific characteristics, such as depth and thickness of restrictive soil layers, water ponding depths and durations, sediment load, and regulatory requirements (i.e. permitting).

- **Stormwater runoff volumes** were typically less than 1.0% of the precipitation volume within each contributing watershed being monitored for CCRN project sites, except for Horseshoe Draw, where runoff/precipitation ratios ranged from 4.2% to 5.7%. Possible factors include historic and current land management practices, distance from higher elevation mountain front runoff zones, and channel bed characteristics. These factors should be considered for location of future stormwater recharge projects.

- **Rainfall-runoff relationships** can also be highly variable over short distances given not only the variability of precipitation, but also the amount of impervious surfaces (urbanization) and/or channelization of the floodplain, vegetation characteristics and orographic effects.

## DESIGN CONSIDERATIONS:

- **Both dry wells and infiltration trenches** can help water bypass restrictive surface soil layers, increasing capture capacity, and minimizing evaporative losses.
- **Dry wells** should be designed with elevated inlets for use in channels with moderate-high sediment transport and bedload. Therefore, they do not perform well during smaller discharge events, since they require significant ponding depths to allow flows to enter the elevated inlets. Dry wells are well suited to urban settings where sedimentation rates are typically low.

- **Infiltration trenches** have the capacity to recharge more water than dry wells when constructed in ephemeral channels since they have a larger surface area for recharging water rapidly, and do not require an elevated inlet that only functions with elevated ponding depth. They are also less expensive to construct than dry wells.

**MAINTENANCE CONSIDERATIONS:**

- **Maintenance of infiltration trenches or dry wells** located in natural channels will be likely periodically due to siltation and sediment deposition. Maintenance should be budgeted for when the facilities are constructed. At the Palominas Stormwater Recharge Project, the infiltration rates of infiltration trenches had decreased by 81-87% over eight years (2014-2022). Infiltration rates of dry wells also declined by 33-77% during that same time period.

- **Periodic replacement** is also an option if extensive sediment clogging has occurred, especially for infiltration trenches that are relatively inexpensive to construct.

## Nature-based Solutions

- **Significant increases in groundwater elevations** have been observed near the San Pedro River during/after monsoonal flood events. Natural floodplain processes increase recharge during flood flows, and recharge can continue after floods are over (as shown above), as water continues to infiltrate in ponded areas within the floodplain. As a result, groundwater storage can be enhanced for many months after floods have passed through.

- **Natural ephemeral channels** can be very effective at recharge, and they may have rapid infiltration rates due to coarse soils. At Horseshoe Draw the presence of the detention basin provided 40% more time for infiltration of flood waters downstream of the basin in the channel, than if the basin was not there. More recharge occurred in the channel downstream of the basin than within the basin itself due to this project.

**Visit the CCRN website at:**

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