Arizona Tri-University Recharge and Water Reliability Project Flood Control Districts Workshop

March 19, 2024, via Zoom

This is not a verbatim summary of comments made at the meeting, and we have not verified any of them. We have simply recorded highlights of what we heard. If you would like to make any corrections or suggestions to make this more readable, please feel free to send them to Neha Gupta at nehagupta@arizona.edu

The Arizona Tri-University Recharge and Water Reliability Project (ATUR-WRP) held a workshop with representatives from Arizona's Flood Control Districts to explore how recharge objectives could integrate with flood control. Twenty-seven flood control practitioners attended the three-hour workshop and engaged in discussions around optimizing recharge in the context of flood control. A recording of the workshop can be made available upon request.

Workshop Goals

The ATUR-WRP's Technical Advisory Committee includes several members whose work involves flood control, and team member Dr. Holly Richter has worked extensively in the recharge/flood control space. Through conversations with them, we identified working in partnership with flood control activities as a way to enhance water supply availability through capture and recharge of water or flood water produced by new urbanization that may not be subject to downstream water rights. By rapidly recharging flood waters, projects may be able to reduce flooding while simultaneously enhancing water supplies.

The guiding questions for this workshop were: 1) What opportunities exist to intersect flood control with capture and enhanced recharge? 2) Are there opportunities to enhance water supplies involving rural flood control and landscape management? These two questions were selected to explore the range of possible intersections between flood control and recharge depending on the characteristics of a flood control district. Urban districts may be more focused on enhanced urban runoff due to impervious surfaces, while the rural districts may consider landscape management projects, for example, post-fire flooding mitigation structures that produce incidental recharge.

Introductions and Presentations

The workshop began with a presentation from the ATUR-WRP team detailing project goals and methods. The research areas of focus identified through previous stakeholder meetings that relate to flood control include:

- Floodplain management/work with multiple Arizona county flood control districts to optimize recharge from flood events
- Opportunities to capture 'nuisance water' and recharge it instead of letting it evaporate

- Enhanced urban runoff associated with developed and developing areas
- A focus on watersheds with enhanced precipitation due to orographic effects
- Harvesting extreme events and/or capture during average rainfall conditions, depending on the basin and potential for direct use of captured flood waters in lieu of groundwater.

The ATUR-WRP presentation reviewed both Managed Aquifer Recharge (MAR) and Enhanced Natural/Incidental Recharge (ENR) as alternative approaches to increasing recharge. MAR projects prioritize recharge for recovery, physical construction of recharge facilities such as spreading basins or injection wells, and quantifying recharge on a defined project site. Generally, such facilities are subject to government regulations. In contrast, ENR often facilitates incidental recharge across the landscape through projects such as forest restoration and/or flood and sediment mitigation projects. Structures that fall under the ENR category include leaky weirs, sandbag dams, wood log jams, and gabions. Both MAR and ENR projects may intersect with flood control and were identified as topics to discuss with Flood Control District representatives.

The ATUR-WRP project presented the work of its Urban Environments subteam, which focuses on urban enhanced runoff produced by the expansion of impervious surfaces in developed and developing areas. The subteam is investigating Green Stormwater Infrastructure (GSI), such as retention basins, drywells, permeable pavements, and infiltration trenches constructed to recharge stormwater in urban environments. The subteam is conducting empirical analyses of runoff across scales, comparing developed and undeveloped areas, and incorporating variables such as vegetation and percent imperviousness into its models. The purpose of presenting these components of the ATUR-WRP project to workshop participants was to encourage consideration of how recharge and flood control could intersect, and to develop potential discussion ideas for later sections of the workshop.

The ATUR-WRP presentation was followed by two presentations given by practitioners: Nicholas Balik, Water Resources and Conservation Planner for Maricopa County Flood Control District, and Dr. Holly Richter, Principal for Resilient Rivers LLC. Nicholas presented an overview of floodwater recharge in an urban context, focused on approaches taken by the district and other entities in the Southwest. Dr. Richter presented primarily rural recharge projects designed and implemented by the Cochise Conservation and Recharge Network within a flood control framework. Both speakers presented approaches to integrating recharge and flood control to encourage productive discussions later in the workshop.

Group Discussion

The next section of the workshop featured a group discussion centered on three questions asked to all attendants in the “waterfall” response format:

1.) What flood control issues can be addressed through innovations in capture and recharge?
2.) What are other Districts already doing that supports recharge and water supply reliability?
3.) Are there barriers to including recharge in flood control?

Attendees were asked to type their answers into the Zoom chat and then asked to submit them at the same time in order to gather initial answers unprompted by each other’s responses. The questions seeded breakout group discussions later in the workshop.

A summary of responses to the questions includes:

What flood control issues can be addressed through innovations in capture and recharge?

- Co-benefits with recharge and flood control: Designing for multiple benefits increases funding options, may reduce peak flows through capture and recharge, may reduce flooding hazards, and has potential for community involvement in projects.

- Habitat health: Creating new habitat or restoring damaged habitat with recharged water, increasing baseflow into perennial streams, controlling invasive species that contribute to evapotranspiration losses in riparian areas, addressing issues with vector-born illnesses, and increasing urban tree canopy.

- Water quality improvements: Reduced sediment and contaminant transport in waterways, erosion control, and post-fire mitigation.

What are districts doing that supports recharge and water supply reliability?

- Exploring partnerships between water utilities and flood control districts, wastewater reuse

- Promoting increased recharge to support groundwater-dependent ecosystems

- Developing urban detention parks, and

- Limiting development through conservation easements in important recharge areas.

What are barriers to including recharge in flood control design?

- Land access: Lack of access to usable land, easement acquisition on private properties, determining rights of way, issues with land development for residential and commercial use

- Regulations: environmental controls, actual and perceived lack of authority, flood control versus storage regulations, potential to interfere with surface water rights, compliance with federal and state dam safety regulations, and a requirement to perform stormwater recharge is outside of flood control purview

- Safety concerns: Potential for back-to-back flood events and a lack of storage capacity, prioritizing flood control projects with high potential for damage, facilities designed for temporary storage and not longer-term water retention

- Institutional barriers: siloing between agencies and departments, lack of funding

- Lack of public support for combining flood control and recharge.

Breakout Groups

After reviewing the responses to the questions posed by the whole group above, workshop participants were divided randomly into small groups to support more in-depth discussions and encourage engagement by all participants. Each group had 4-5 flood control professionals, one facilitator and one notetaker who were both members of the ATUR-WRP research team. The facilitators were given a series of questions for the discussions but were also free to pose additional questions.

- Flood control district advice to ATUR project team
- How can we overcome barriers to including recharge in flood control designs?
- What data and resources are needed to move these ideas forward?
- How might data generated by the ATUR project be useful to Districts?
- Are there data and tools already available within Districts that could be useful to ATUR?

Topics in subgroup discussions:

1.) Barriers to including recharge in flood control:

- Land access: multiple subgroups reiterated that land access was a key issue for including recharge in flood control. Land located in the most beneficial places for recharge may be privately owned or require Flood Control Districts to obtain easements.

- Funding: Multiple participants expressed a lack of funding is a barrier to implementing projects that co-benefit recharge and flood control. Frustration was expressed that funding often goes to water conservation projects such as turf removal, but there is a dearth of funding for recharge projects. It was also suggested that municipalities could help pay for capital projects that enhance recharge. In more rural contexts, there is no funding in flood control for forest thinning or stream restoration projects that could enhance recharge and reduce downstream flooding. Smaller districts must distribute funding across projects and types. This can lead to uneven resource distribution across communities, generating a funding divide between urban and rural projects, for example, in updating flood maps.

- Staffing: Limited staffing can prevent flood control districts from pursuing new projects that could enhance recharge while controlling flooding.

- Water rights uncertainty: District personnel expressed concern that litigation could ensue if flood control activities enhancing recharge affect downstream surface water rights or are perceived to do so. A lack of current regulatory and legal clarity regarding the extent of allowable recharge activities by districts could prevent districts from pursuing projects that explicitly enhance recharge. Projects within stream channels may reduce flooding and enhance recharge but also face legal scrutiny from claimants of downstream water rights.

- Existing policies: Flood control is focused on managing peak flow and not on retention of water for recharge. In addition, water must drain from detention ponds within 24 to 72 hours to comply with regulations. In some cases, runoff captured from impervious surfaces must be

disposed of within five days. It may take as many as seven years to break ground on some construction projects.

- Credit system: There is currently no state program in place to allow agencies to acquire storage credits for recharging storm or flood waters.

2.) Intersecting flood control and recharge: Making a liability an asset

- Legal leeway: Arizona Revised Statutes have policy for flood control entities to engage in recharge. Understanding what Flood Control Districts are allowed to do that facilitates recharge would allow districts to explore dual purpose recharge-flood control projects. By designing flood control projects to detain water to reduce peak flows, districts can also enhance recharge to increase groundwater storage for human water supplies and/or restore natural flow regimes through riparian areas, providing ecological benefits.

- Watershed groups: Collaboration across organizations is required to encourage recharge within the flood control framework. Organizations focused on watershed health, particularly of perennial streams, could pursue projects like those managed by the Cochise Conservation and Recharge Network (https://ccrnsanpedro.org/), which support ecosystem health within a flood control framework. Watershed councils provide the opportunity to work across organizations. Conservation partners like The Nature Conservancy can help acquire vacant lands for projects that support environmental health.

- Agriculture: For rural flood control districts in largely agricultural counties, there is an interface between flood control and farmers. Farmers often construct flood control features on their property and may use flood water to irrigate. However, constructed features may not be engineered or sustainable, and may have impacts on downstream properties. Districts are often only involved in the event of a problem. A co-benefit could exist between projects that keep flood waters out of irrigation canals – that water can be captured for recharge instead. Tribal agencies also manage significant agricultural lands and are concerned about groundwater depletion; thus, engaging tribal communities in recharge efforts will also be important.

- Unconventional project partners: The Arizona Department of Transportation is conducting stormwater recharge activities from a flood control standpoint. The U.S. Department of Defense is another potential partner, which is already supporting recharge projects along the San Pedro River. Wastewater departments and municipal water providers could be partners in developing recharge flood control projects. In urban environments, unexpected partners may be community groups, such as churches or large parcel owners. The Arizona Department of Water Resources' Dam Safety Program could also become more involved in recharge, in terms of increased recognition of the potential benefits of stormwater recharge from dams, as well as the problems related to increased fissures and subsidence resulting from groundwater withdrawals that also relate to dam safety. In addition, many dams designed for 100-year storm events also require rehabilitation to address increased risk of severity of storms/extreme storm events due to climate change. There is a general need for better calculation of rainfall/runoff relationships in a changing world using more recent empirical data.

- Existing recharge/flood control projects: Data from existing projects would help guide the development of further projects and give examples of how they can be implemented.

- Importance of project siting for recharge: In order for water to not only infiltrate into the subsurface (i.e., the vadose zone), but also reach the aquifer, flood control and recharge projects must be carefully sited. Underlying geology must allow water to percolate to the aquifer. For example, recharge is hindered in areas where subsurface contains extensive clay layers. Recharging through the natural system, such as a channel bed, may be an efficient method for rapidly recharging flood waters, depending on a site's hydrogeologic characteristics. Detailed information on subsurface hydrogeologic conditions would support project siting and prioritization to enhance recharge potential of stormwater management projects.

- Urban features: Pocket parks facilitate recharge but the scale of recharge is small.

- Invasive species: Removal of tamarisk and other invasives along riparian corridors could reduce evapotranspiration losses and increase groundwater storage in floodplains. Improving natural function in watersheds could enhance natural recharge, including up- or downstream of urban areas. The U.S. Army Corps of Engineers recently released a new nationwide permit to assist with mitigation of invasive species.
https://www.usace.army.mil/Missions/Environmental/Invasive-Species-Management/

- Climate change: Climate change is generally not included in current flood control planning. Some districts have started discussing its inclusion in project design, particularly the evaluation of potential increases in rainfall intensity, duration, and frequency. Structures are currently designed for the 100-year flood event, but more projects are incorporating the 500-year flood event during the design process in response to climate change uncertainty. Information on changes in relation between rainfall and runoff over time would assist with project design.

- Sedimentation: Sedimentation in streams and floodplains has increased flood risk in some reaches. Clean Water Act Section 404 permits are required for any construction that affects waters of the US (WOTUS).

- Real-time data: Increasing rural precipitation monitoring networks and making data from the districts' flood hazard notification ALERT system data more accessible to download would be beneficial to the districts. Currently, the system only allows for the download of a single year of data at a time. Districts require higher resolution geospatial data that are more up to date, and for longer periods of record.

3.) <u>Research areas for ATUR-WRP to consider that would support recharge and flood control</u>:

- Climate change: Information on changing relations between rainfall, runoff, and recharge would aid with planning. The relationship between rainfall and runoff in rural, grassland, and undeveloped watersheds is related to vegetation health and/or watershed condition. Multispectral imagery can characterize rainfall/runoff/recharge potential in these environments.

- Future development scenarios: Changes in runoff and recharge due to increases in impervious surfaces, commercial farm development and soil compaction.

- Urban enhanced runoff: By comparing runoff from currently developed areas with impervious surfaces to similar undisturbed natural areas, can the amount of additional runoff available for managed aquifer recharge be estimated? How big is the difference between developed areas versus natural areas? Districts could benefit from an overview of potential stormwater capture strategies and general estimates of volumes of capture across the state.
- Developer detention requirements: Developers in some urban counties must detain and manage the first 0.5 inches of precipitation during a storm event on-site. However, the infrastructure that performs this function may not be maintained long-term. Data on urban runoff could help conversations around increasing the amount of water detained on-site to 1 inch for future developments. To do this effectively, developers would need an incentive to implement more extensive stormwater management infrastructure.

- Post-fire flooding: Mapping areas of increased wildfire risk and post-wildfire flooding would assist with flood control mitigation and recharge downstream of burn scars in rural counties where risks related to wildfire is a key management concern.

- Geospatial data: Map of favorable recharge locations is foundational. Additional useful layers are the hydrogeologic setting, land ownership, land use, land cover, DEM files and the extent of impervious surfaces. Geospatial data would help determine the appropriate scales for projects.

- Subsidence: Subsidence could be considered in terms of potential for recharge. Are areas of subsidence viable areas for recharge? Could recharge occur rapidly through earth fissures, although there may be a risk of causing erosion and downcutting? Note: Maps of earth fissures are produced by the Arizona Geological Survey.

- Floodplain recharge: Do dams that spread out flow increase or reduce recharge relative to more channelized flow? If diversion or inflatable dams were opened during large flow events, would this enhance recharge?

- Dam safety: Information supporting the analysis of how recharge may support dam safety could encourage managers to consider potential co-benefits of recharge.

- Agriculture: Monitoring and/or modeling of groundwater conditions under agricultural fields could aid with understanding recharge related to on-farm flood control measures.

4.) <u>Data/Reports useful to ATUR-WRP</u>

- Pima County Flood Control District:
    - Pima County Comprehensive Plan

  - Delta Dashboard – a good example of how impervious surfaces affect runoff relative to natural conditions, includes spatial depictions of the greatest changes in runoff between impervious and pervious surfaces. The dashboard is located here: https://pimamaps.maps.arcgis.com/apps/dashboards/e431d23fbbf040a58627c933c8e5a220

  - Pima County has both a public and internal GIS system with substantial data at small scales.

- The Kyl Center for Water Policy at Arizona State University's Morrison Institute provides access to water data across the state https://azwaterblueprint.asu.edu/

- Maricopa County Flood Control District:
  - A database like Pima County's Delta Dashboard is under development by an external consulting firm. It will be updated continuously over time.

  - 2018 stormwater collection study. Rio Verde Area Alternative Stormwater Management, Water Conservation, Green Infrastructure/Low Impact Development Analysis Tools and Development Summary Report. https://apps.fcd.maricopa.gov/library/docs/scanfcdlibrary/A681_903RioVerdeAreaAlternativeStormwaterManagement_WaterConservation_GreenInfrastructureLowImpactDevelopmentAnalysisToolsandDevelopmentSummaryReport.pdf

  - Currently evaluating structures for 10 different integrated strategies, incorporating results into future planning studies.

  - Area drainage master studies https://apps.fcd.maricopa.gov/fcdprojects

  - Loma Vista Study in Tempe modeled urban stormwater capture

- Montgomery and Associates: Map layers on recharge projects

- ADWR: 2021 report on potential for Arizona State Trust Land to be used for underground storage. The study included soil data and other criteria and identified high potential areas throughout the state.

Attendees

- ATUR: Neha Gupta, Kristin Pearthree, Holly Richter, Kathy Jacobs, Yoga Korgaonkar, Xin Su, Tianfang Xu

- Maricopa County: Eric Cook, Lee Jiminez, Logan Brown, Obenia Kingsby, Ryan Hummell, Nicholas Balik, Elizabeth Rockwell, Mel Bunkers, Suparna Dasgupta
- Yavapai County: Lynn Whitman, Ben Serpa
- Coconino County: Joe Loverich (JE Fuller), Katie Geyer (JE Fuller), Karlie Kessel (JE Fuller)
- Yuma County: David Ruvalcaba
- Cochise County: Sean Brady, Jackie Watkins, Mark Apel, Joaquin Solis
- Pima County: Carrie Olson, Jacob Prietto, Justin Warlick, Michael LeBlanc
- Pinal County: Joshua Plumb
- Graham County: Michael Bryce
- City of Tucson: Chad Lapora, Stu Williams
- Additional: Alex Wood (Natural Channel Design), Harry Cooper (AMWUA)

ATUR-WRP Flood Control Districts Workshop Agenda

Time	Topic
9:00 am - 9:30 am	**Welcome, ATUR-WRP Project Overview, Introductions**
	Guiding Questions: What opportunities exist to intersect flood control with capture and enhanced urban recharge? Opportunities involving rural flood control and landscape management?
	Areas of Focus related to Flood Control: • Enhanced urban runoff: GSI, MAR, sewer redesign • Floodplain management: capture nuisance water, managed recharge in rivers downstream of flood control structures • Extreme events harvesting
9:30 am - 10:00 am	**Presentations**
	• Maricopa Flood Control District: 15 minutes • Holly Richter: 15 minutes
10:00 - 10:30	**Group Discussion**
	• What flood control issues can be addressed through innovations in capture and recharge? • What are other Districts already doing that supports recharge and water supply reliability?
10:30 am - 10:40 am	**Break**
10:40 am - 11:20 am	**Breakout Groups: Integrating Opportunities and Challenges**
	• FCD Advice to ATUR project team • How can we overcome barriers to including recharge in flood control designs? • What data and resources are needed to move these ideas forward? • How might data generated by the ATUR project be useful to Districts? • Are there data and tools already available within Districts that could be useful to ATUR?
11:20 am - 11:45 am	**Breakout Group Report-Outs**
	Each group's spokesperson will summarize the key insights and ideas discussed.
11:45 am - 12:00 pm	**Workshop Summary & Next Steps**