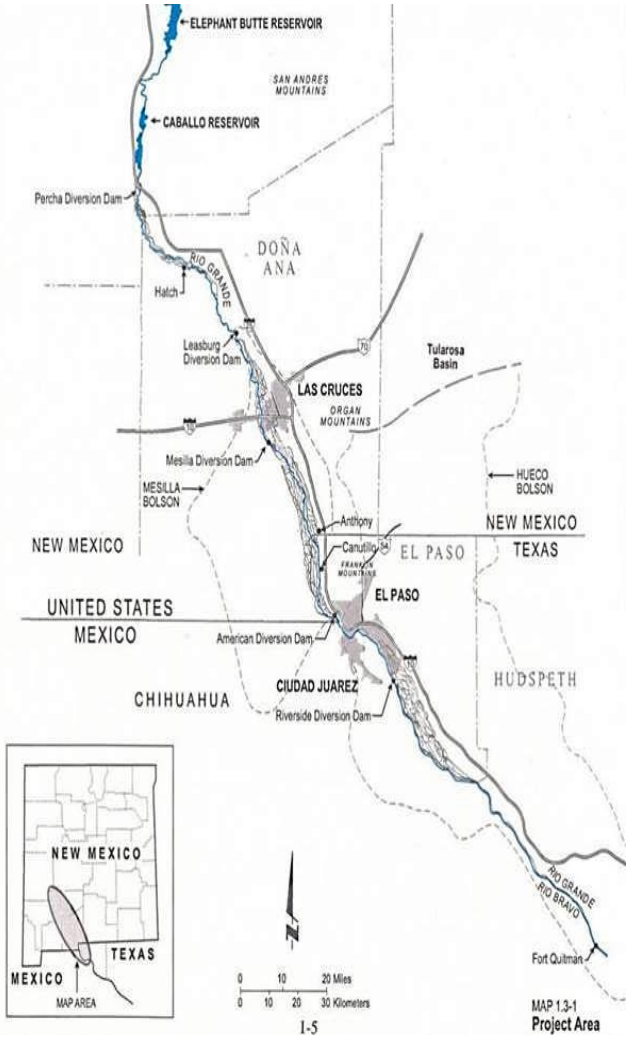
Case Study: Adapting to Drought and Climate Change: Storm Water Capture in Elephant Butte Irrigation District



Setting: Elephant Butte Irrigation District (EBID) is the New Mexico portion of the Rio Grande Project (RGP) in southern New Mexico and far west Texas, providing for international treaty delivery by the United States to Mexico. This region of the Chihuahuan Desert has great potential for agricultural production dating back to pre-Columbian times, but this productivity has been tempered by periodic severe and sustained droughts. The major concern now is that the drought we are facing may be more than just a drought. It is likely a harbinger of a permanent shift to a more arid climate in EBID.

EBID delivers water to 90,640 acres through an extensive network of miles of canal system. Drought has become one of the greatest water issues facing the West; the District and its members have countered with innovative, creative and conservative practices to deal with this crisis.

Summer monsoon over the Mesilla Valley (photo N. Khandan)

Need: The profound drought that the RGP has experienced in the past 16 years has led to dramatically reduced spring snowmelt runoff from southern Colorado and northern New Mexico. Historically, snowmelt runoff has been the controlled and regulated source of supply for the RGP. For most of the last 16 years snowmelt runoff has been far below the historical average. Local monsoonal rainfall and resulting intense and violent runoff was more of a hazard than a viable water source. Very basic flood control infrastructure in the form of earthen dams and conveyance channels to the Rio Grande, EBID drains and canals was developed from the 1950s to the 1970s, with the objective of evacuating storm water from the watersheds and irrigation system as quickly as possible to avoid structural or property damage from the intense flood waters of the monsoon.

Flooding arroyo flowing into the Rio Grande

Arroyos washing out county roads

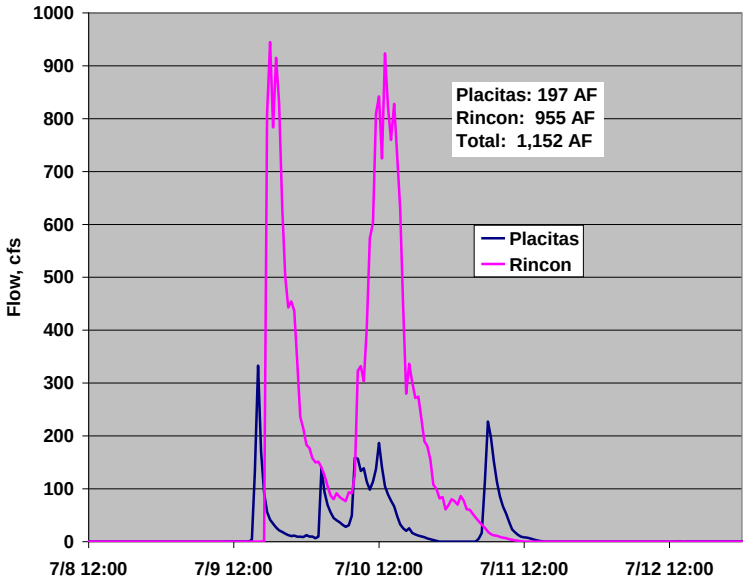
Selden Drain capturing storm water and metering the flow

EBID responded to the drought that began in the early 2000s by viewing storm water not as a threat but as a valuable resource. They began placing sensors equipped with telemetry on most of the main arroyo systems in the district to collect rainfall runoff data. One of the challenges of storm water management within the district is that there are at least 20 major watersheds and hundreds of small watersheds within

the whole system. However, the US Bureau of Land Management (BLM) owns most of the land where the sensors need to be placed. While EBID has achieved some access and cooperation with the BLM, much more collaboration is needed.

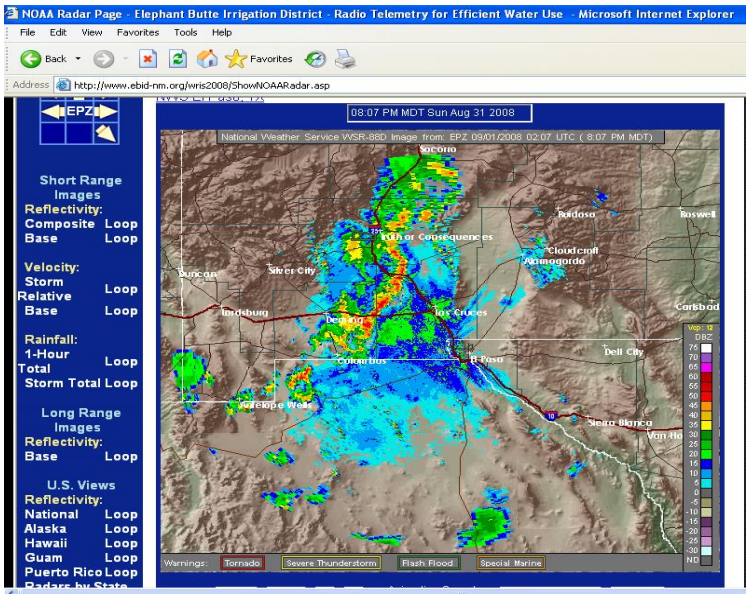
Approach: Drought and the prospect of an increasingly arid climate have motivated EBID to rethink the management of storm water, essentially to grab the bull by the horns. They began to look at storm water flows as a viable source of water. In the absence of resources to build large new flood control infrastructure, EBID has relied on state-of-the-art information infrastructure with strategic improvements to existing facilities that are deficient and degraded to more effectively capture and beneficially use the previously unusable and hazardous monsoonal flows coming into the District below the major Project storage facilities at Elephant Butte and Caballo reservoirs.

Storm Water Capture in the district involves high intensity, generally monsoonal events downstream of Caballo Dam. The historical strategy was to evacuate water downstream as quickly as possible. Now the goal is to capture water in flood control dams, agricultural canals and drains. The direct use of storm water allows EBID to meet downstream demand as well as providing opportunity for infiltration into the aquifer. In 2013-14 several thousand acre feet were captured in canals, drains and in the bed of the Rio Grande after reservoir releases had ceased for the year. Additional benefits include improved downstream flood protection, enhanced riparian habitat and improved water quality.



Arroyo hydrographs from EBID's telemetry system in 2008

Strategic Time Frame: Preparation is the key to managing storm water, and EBID's staff track storm formation from satellite imagery while it is still days away, off the Pacific coast, in the Gulf of Mexico, or streaming off the tops of the Sierra Madres in Mexico. As storm systems approach and their structure becomes clearer, Doppler Radar from the National Weather Service's National Mosaic and the EPZ station in Sunland Park, New Mexico provide information on the tack of specific cells that may produce runoff within a timeframe of several hours.



Storm Event on National Weather Service Radar

Tactical Time Frame: As storms hit the area, it is critical to know how intense a precipitation event will be so that the appropriate action can be taken. Decisions on where to capture storm water and where to avoid it must be based on reliable information. While Doppler radar gives a general idea of storm intensity, actual rainfall hitting the ground is the key process, indicating runoff events with lead times of two hours to several minutes. Using telemetry data gathered remotely out in the field, EBID quickly analyzes where a storm is likely to hit, where it actually does, and then how much storm water is generated and fed into the system. With enough rain gauges in place the data generated can greatly increase public safety in the event of a major storm event.

Upper Watershed Weather station

James Narvaez with eco friendly portable rain gauge system for sensitive lands

Sequence of events in storm water capture. Upper: 150 cfs storm water diverted at Leasburg Dam. Middle: Leasburg water diverted into the Selden Drain, which is modified for storm water capture. Lower: Groundwater response adjacent to Selden Drain showing storm water successfully recharging the aquifer.

Rainfall Monitoring: EBID is developing a network of rainfall gauges in the upper reaches of the key watersheds that drain into the Rio Grande, often through EBID facilities. These gauges continuously report data through a radio telemetry system that includes alarms sent to key personnel cellphones when precipitation events occur. The district is working to get a rain gauge in each one of the contributing watersheds. The continued expansion of the data coverage area will provide a more complete picture, resulting in better water resource management. Further collaboration and support from the BLM is critical.

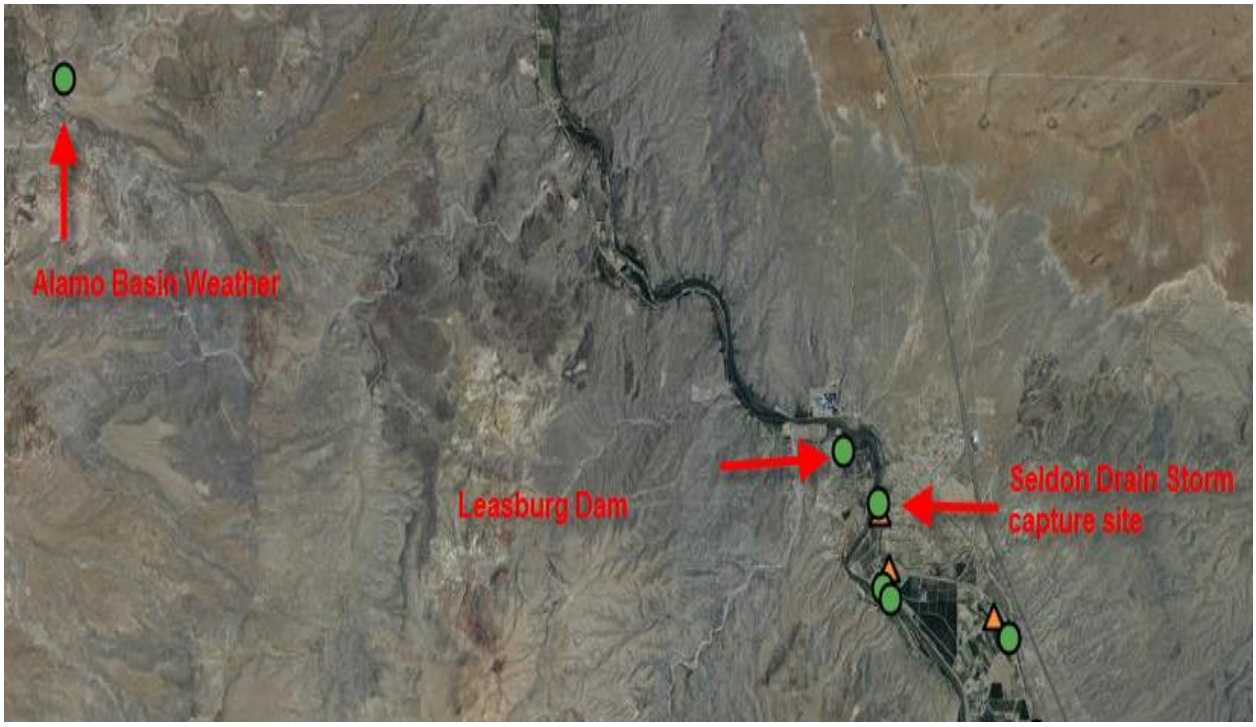
The knowledge of where precipitation is falling and at what intensity allows EBID personnel to fine-tune their response and capture the runoff where it is feasible and safe. The district has developed a compact rainfall gauge with radio telemetry that can be backpacked into critical watersheds in wilderness areas and national monuments where motorized vehicles are prohibited.

Arroyo Flow Gauging: As rainfall runoff collects and concentrates in arroyos, both the opportunity and danger of capturing storm water become clear. EBID refines its response as instrumented gauges in major arroyos report flow rates in real time through the district's radio telemetry system. Very large events may require avoidance at the local level, but may be captured once they flow down the river and peak flow rates are attenuated. Smaller events can be captured directly and managed within EBID's conveyance and drainage system. EBID has modified drains, originally designed for the low flows associated with water table control to allow impoundment and regulation of significant arroyo flows.

As arroyo flows reach the Rio Grande, focus switches to EBID's river gauging stations. EBID maintains six river gauges that are used by the district and other local agencies to monitor the status of reservoir releases as well as floodwater in the main stem of the river.

Diversion of Storm Water: Diversions are done primarily at Leasburg and Mesilla Dams. Timing of the diversions is critical because the leading edge of a storm surge can have very high debris content. It is key to let the first surge of debris pass by before capturing for farm use or aquifer recharge. Captured storm water could potentially be several hundred acre feet or more per event.

Storm water diverted into the Leasburg Canal after reservoir releases had ended for the year.



Weather station locations in the upper tributary watersheds. The rain gauge at Alamo Basin triggers in a storm event and EBID technicians are alerted and can then prepare to divert the runoff at Leasburg Dam and capture it at Selden Drain for infiltration into the aquifer.

Conclusion

While EBID's primary goal in storm water capture is to either use the water directly for irrigation or infiltrate it as aquifer recharge, the district's efforts have many benefits. First, the storm water capture helps ensure the safety of persons and property downstream. Secondly, storm water capture sites such as Selden Drain provide riparian habitat for many bird and wildlife species. Finally, detention allows die-off time for potentially harmful microorganisms associated with storm water runoff, improving water quality. This multi-benefit approach is truly a bright spot in an otherwise bleak drought.