Lower Santa Cruz River Basin Study
System Reliability Metrics
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DRAFT

1.0 Introduction

For over sixty years, the Lower Santa Cruz River (LSCR) Basin, including the Tucson, Arizona metropolitan area, relied on groundwater to meet water supply needs with pumping greatly exceeding replenishment. In 1993, the Bureau of Reclamation's Central Arizona Project (CAP) began delivering Colorado River water to the Basin. Since then, LSCR Basin water users have directly used or recharged their CAP and recycled water supplies; portions of recharged CAP and recycled water are recovered on an annual basis. Consequently, groundwater levels have rebounded in many areas. Yet, there are still significant spatial imbalances between supply and demand within the Basin. Reasons include a lack of transmission infrastructure, insufficient recharge and recovery capacity, a lack of recharge and recovery facilities in up gradient parts of the basin, and the cost of constructing new facilities.

Uncertainty about the future compounds these issues. The Central Arizona Project (CAP) has junior priority rights on the Colorado River; thus, CAP subcontractors will bear the brunt of imminent shortages. Agricultural users will be the first affected under the CAP's priority system, but if the shortages are severe enough, reductions to municipal users will take place.

In addition, Southern Arizona, which naturally experiences episodic droughts, has been in an extended drought for the last fifteen years. Water providers without physical access to renewable supplies are already experiencing falling groundwater levels. Climate change poses additional threats to the Basin, such as increased water demand, increased temperatures, and possible decreases in precipitation—which would exacerbate the impacts of future droughts.

The LSCR Basin Study's objectives are to:

- Identify water supply and demand imbalances due to climate and other factors
- Evaluate risks to infrastructure and other systems
- Formulate and assess adaptation strategies to address water supply vulnerabilities
- Perform a trade-off analysis of adaptation strategies

> System reliability: the risk or vulnerability of infrastructure and other systems to meet water supply and demand imbalances
>
> Adaptation: strategies that address vulnerabilities

Reliability for the Lower Santa Cruz Basin (Tucson Active Management Area)

System reliability assesses the capability of existing and near term water supply infrastructure to meet current and projected water demand under each scenario. Reliability is a measure of how

well water demands are met for a give set of conditions. A previous paper, *Defining Water Supply Reliability for the Lower Santa Cruz River Basin Study*, discussed reliability considerations.

For the Lower Santa Cruz River Basin, the Project Team agreed that system reliability entails three elements:

1) Long-term physical water supply availability for delivery to water users (municipal, industrial, agricultural), which in the TAMA may actually be translated to sufficient groundwater supplies to meet demands over a period of time,

2) Reliability for the purposes of sustaining and potentially enhancing environmental quality and biodiversity, and

3) Reliability for the purposes of sustaining or creating cultural and recreational features that are important to the broader Tucson community.

2.0 Approach for Reliability Metric Development

Metrics are measurements of conditions, such as rates of streamflow, temperatures or volumes of groundwater recharge affected by water supply and demand imbalances. Metrics were developed using a collaborative process with the Basin Study's project team involving Reclamation and the local study partners. The following categories and metrics were identified to reflect system vulnerabilities for the LSCR Basin Study area:

<u>Water Supply Resources</u>

- Increased municipal water demand due to higher temperatures
- Increased agricultural water demand due to higher evapotranspiration
- Water scarcity where there is no water service available from a municipal water provider

<u>Groundwater Supply Resources</u>

- Declining levels for non-municipal well owners
    - Increased pumping costs
    - Decrease in well productivity
    - Loss of water supply in certain locations
- Shallow groundwater areas
- Locations where distance below land surface, distance below phreatic zone and saturated thickness exceed a threshold areas e
- Locations exceeding a four-foot per year rate of decline preventing recovery of stored water
- Hydrogeology of dewatered areas and impacts to subsidence potential
- Target saturated aquifer thickness
- Recommendation to develop a groundwater index

<u>Groundwater Quality</u>

- Mobilization of existing contaminated plumes
- Threat to current and future water supply availability

Ecosystem Resources

- Maintain biodiversity
- Maintain phreatic vegetation supported by shallow groundwater
- Preserve and maintain soil integrity
- Increase ET
- Economic impact – loss of ecotourism
- Loss of shallow groundwater-dependent riparian areas

Cultural and Recreational Resources

- Impact to ecotourism, such as bird-watching
- Economic impacts

Agricultural Resources

- Increased water demand due to evapotranspiration and increased temperature

Health and Safety

- Increased incidence of dust storms
- Water scarcity in rural areas

Flood Management

- Changes in flood risk
- Increase in extreme flood events

Next steps:

Attributes
Location of interest
Metric type: Qualitative or quantitative?
Methods for qualifying risks
Identify reference value