Review of Recommendations and Discussion Points

Project Team Meeting May 20, 2016, Lower Santa Cruz Basin Study

For clarification and confirmation at 9/27/16 Project Team webinar.

1. ***Does the Project Team want to evaluate a high greenhouse gas emissions, "worst-case" scenario?***

   Discussion:

   - To date, most water supply planning in Arizona has assumed a climate future that is much like the past. Water providers generally feel they are well prepared for "business as usual". Recent analyses show that the climate may change substantially, with rising temperatures and a potential for less precipitation.

   - In order to manage risk, water managers need to be prepared for the "worst case" scenario – so that they can provide their customers want a reliable, long-term water supply, even if an extreme level of change takes place.

   - Other Reclamation Basin Studies have typically used 3 to 5 climate scenarios (warm/dry; warm/wet; hot/dry; hot/wet; and central tendency).

   - One view was that if this study is going to be used primarily as a risk-management tool, there seems to be little point of evaluating "middle of the road"/central tendency scenarios. Therefore the "warm/dry and warm/wet" conditions are not as useful for this study as the "hot/dry" one.

   - *Recommendation*: Project Team members appeared to support the inclusion of a high greenhouse gas emissions, "worst-case" scenario in the Basin Study.

2. ***Does the Project Team want to include projections from dynamically downscaled climate model in its selection of climate scenarios?***

   Background:

   - Global climate models generate projections of temperature and precipitation at a scale of $1^o – 2^o$ (latitude and longitude). The size of these grid cells is too large for hydrologic modeling at a basin scale. To develop projections at a scale suitable for hydrologic modeling (around 10 km^2), global climate projections must be "downscaled".

- To date, Reclamation Basin Studies have used projections from "statistically downscaled" models. Statistical downscaling uses relationships derived from past climate information to generate higher resolution (more detailed) projections consistent with observed patterns. Until recently, statistical downscaled projections were considered the best information available.

- Researchers from the UA Atmospheric Science department presented information on newly available "dynamically downscaled" climate projections. In this process, the output of a global climate model becomes the input to a finer scale (smaller grid size) model that simulates atmospheric processes at a regional scale. Results have shown that dynamically downscaled projections do a better job of simulating certain features of the Southwest climate, particularly the monsoons, than statistically downscaled projections.

- Results from dynamically downscaled projections suggest that long-term Colorado River Basin runoff could be approximately 10% less than estimated in Reclamation's Colorado River Basin Study.

- There are a limited number of dynamically downscaled projections available because they are computationally intensive.

- *Recommendation*: The Project Team appeared to support including results from dynamically downscaled climate projections in the Basin Study, although time ran short on the discussion.

3. Does the Project Team want to evaluate climate impacts at a Colorado River Basin scale, a local scale, or both?

Discussion:

- Because the Tucson area is reliant on both the Central Arizona Project and local groundwater supplies, it is important to understand the impact of climate changes on both sources. Impacts in the Upper Colorado Basin (where the majority of the flows of Colorado River flows originate) may be quite different than on the Lower Santa Cruz River Basin (Tucson Active Management Area).

- If the Project Team chose to look at a worst-case scenario, this approach would be carried through at both levels of analysis.

- *Recommendation*: The group agreed to analyze water resource implications at both a local and a Colorado River Basin scale.

4. How will impacts to water demands (municipal, agricultural, evapotranspiration) be adjusted to account for climate change?

Background:

- In addition to affecting water supplies, climate change will also affect water demand. However, these effects will be overlaid on other trends, such as increasing water use efficiency, changes in population growth, etc. How should climate change be factored into demand scenarios?

Discussion:

- There is flexibility as to which demand assumptions are utilized by the Project Team. The working groups can discuss what assumptions should be used, including whether to use the assumptions made by ADWR in the 4th management plan. However, the supply and demand assumptions for a specific climate scenario should be based on assumptions that are consistent.

- We could conduct a sensitivity analysis to examine which parts of the Tucson Active Management Area water budget are most affected by climate change. This would provide a basis to determine which whether or how it is useful to adjust demand values to account for climate change.

- Recommendation: The Project Team appeared to be open to this suggestion, but deferred additional discussion until demand scenarios were further developed.

5) ***What is the appropriate number of climate scenarios to evaluate? Fewer scenarios make the analysis simpler, but a greater number of scenarios provide a wider range of future conditions.***

Discussion:

- The greater the number of scenarios, the more complex the decisions will be throughout the Basin Study process.

- Focusing on fewer scenarios would make the overall project simpler and more focused, but would not encompass the full range of possible futures.

- With respect to environmental or agricultural considerations, it may be beneficial to focus on different climate scenarios to account for seasonality (different seasonal futures, for example the possibility of a wetter summer even if there is overall a reduction in precipitation).

- If water supply during monsoon season is a concern, dynamical downscaling may be the best method of regional modeling. Statistical downscaling is not capable of taking into account the physical processes that generate thunderstorms.

- Recommendation: Further development of supply and demand scenarios will help to clarify what the critical issues that the group wants to focus on and will help to determine the appropriate number of scenarios for the study.

Summary: After discussion, the Project Team recommended the following:

1. Explicitly focus on a worst-case climate scenario, e.g. a high level of greenhouse gas emissions, rather than a full range of possible futures. This approach includes looking at the potential for extreme conditions rather than "median" climate conditions. Note that this differs in approach from other Reclamation Basin Studies that have focused on a wide range of climate scenarios.

2. Explore the feasibility and implications of using dynamical downscaling to model regional climate change impacts, recognizing that the outcomes will differ from those in the Reclamation's Colorado River Basin Study. Recent dynamical downscaling results indicate that the shortages on the Colorado that are projected in the Colorado River Basin Study may be underestimated.

3. Evaluate climate change impacts on both Colorado River Basin and local water supplies as a result of the "worst case" scenario.

In addition, the Project Team will return to the questions of how to adjust demand scenarios for climate change and the appropriate number of scenarios when the supply and demand scenarios are better defined.