Option Submittal Form
Colorado River Basin Water Supply and Demand Study
Date Option Submitted: January 31, 2012

Option Name: Reverse Migration

Description of Option: Loss of jobs, rising utility costs, and diminishing quality of life throughout the rapidly warming Southwest, including most of Arizona, southern Nevada, and California's Inland Empire and Coachella Valley, upend demographic projections and lead to much lower population increases in these areas by 2025, and subsequent minor population decreases thereafter. Total populations in these areas will still be two million more than projected in 2015, but much less than projected by the Lower Basin states.

Temperature alone will not drive this option: large numbers of people already live in Phoenix, Yuma, El Centro, and other cities where summertime temperatures regularly exceed 110° F. Indirect impacts, however, may be significant. For example, in the face of rising summertime peak temperatures, the power grid increasingly will be unable to satisfy electrical demand. On August 3, 2011, in the grips of record temperatures, the grid operator in Houston imposed power cuts on industry in an effort to avoid rolling blackouts in the city. As the grid is unable to meet rising demand, rolling blackouts will discourage businesses and households from locating in these areas, and may encourage existing businesses and industries to move toward more areas with a reliable power supply. Less dramatically, the average household electricity bill in Phoenix currently is about $1,500 year; in the summertime, monthly household electric bills can exceed $500 for some customers. As utilities build new peaking-power generating stations to meet rising demand, at some point their rising costs and subsequent rising utility bills could discourage businesses from locating in these areas. Instead of moving to Las Vegas, Phoenix, or Yuma, will businesses and individuals instead choose to move to rust-belt cities with large existing capacity on the grid, ample water supplies, and under-utilized infrastructure generally?

Public perception will play a role here as well. One or more rolling summertime blackouts, where night-time temperatures – exacerbated by the urban heat island effect – do not fall below 110° F and people die, coupled with chronic water shortages and the loss of jobs, could create a general public perception that Southwestern cities are unlivable.

To date, the U.S. Census and state demographers have not incorporated climate change impacts into their population projections. Nonetheless, it is plausible that Southwestern cities will become less desirable places to live in the medium-term future.

If this is the case, the federal government could determine that it is more cost-effective and in the best overall interests of the country as a whole to incentivize business and industry to locate where water and energy supplies are less strained, than to subsidize water and energy augmentation schemes that will continually fail to meet rising demands in a hotter, drier Southwest.

Local rust-belt governments, chambers of commerce, and booster organizations also might provide incentives or campaigns to encourage people to move from the Southwest to their communities.

Location: *Describe location(s) where option could be implemented and other areas that the option would affect, if applicable. Attach a map, if applicable.*

This option projects that most of Arizona, southern Nevada, and California's Inland Empire and Coachella Valley will experience a population increase that peaks in 2025, followed by a 0.1% annual population decline through 2060. Under this projection, total lower basin population in 2060 will still be some 2,000,000 greater than projected in 2015, but almost 13,000,000 lower than the states' own projections. Upper Basin cities and adjacent areas, such as the Wasatch Front and the Front Range, will absorb some of this population; these increases are already reflected in these states' population projections.

Quantity and Timing: *Roughly quantify the range of the potential amount of water that the option could provide over the next 50 years and in what timeframe that amount could be available. If option could be implemented in phases, include quantity estimates associated with each phase. If known, specify any important seasonal (e.g,. more water could be available in winter) and/or frequency (e.g., more water could likely be available during above-average hydrologic years) considerations. If known, describe any key assumptions made in order to quantify the potential amount.*

This option projects that the basin and adjacent area populations of the Lower Basin states peak in 2025 and then decline by 0.1% thereafter. For modeling purposes, assume that the 2025 populations for Arizona, California, and Nevada are 8.59 million, 21.88 million and 2.28 million, respectively, and decline by 0.1% annually thereafter. This option also projects that 'self-served industrial' demands peak in 2025, and decline by 0.1% per year thereafter.

Quantity of water conserved depends on the assumed per capita rate. Assuming that M&I per capita rates decline at 1% annually (from the 2015 projection) reduces total water demand in 2060 by more than 2,000,000 acre-feet relative to 2015 demand, not including the reduction in self-served industrial demand.

Technical Feasibility: *Describe the maturity and feasibility of the concept/technology being proposed, and what research and/or technological development might first be needed*.

No technical feasibility required. Internal migration is older than the nation.

Costs: *Provide cost and funding information, if available, including capital, operations, maintenance, repair, replacement, and any other costs and sources of funds (e.g., public, private, or both public and private). Identify what is and is not included in the provided cost numbers and provide references used for cost justification. Methodologies for calculating unit costs (e.g., $/acre-foot or $/million gallons) vary widely; therefore, do not provide unit costs without also providing the assumed capital and annual costs for the option, and the methodology used to calculate unit costs*.

Federal costs could include new tax incentives or other support for businesses and industries that locate in Detroit and other cities with surplus capacity. These costs have not been determined. Local governments, chambers of commerce, and boosters may also incur costs in the form of incentives and public campaigns.

Permitting: *List the permits and/or approvals required and status of any permits and/or approvals received*.

None.

Legal / Public Policy Considerations: *Describe legal/public policy considerations associated with the option. Describe any agreements necessary for implementation and any potential water rights issues, if known*.

May be challenged by some parochial interests.

Implementation Risk / Uncertainty: *Describe any aspects of the option that involves risk or uncertainty related to implementing the option*.

Actual demographic shifts attributable to climate change are uncertain. This option merely posits one possible future.

Reliability: *Describe the anticipated reliability of the option and any known risks to supply or demand, such as: drought risk, water contamination risk, risk of infrastructure failure, etc*.

By projecting a relative (though not absolute) population decline, this option reduces pressure on limited water supplies.

Water Quality: *Identify key water quality implications (salinity and other constituents) associated with the option in all of the locations the option may affect*.

Not applicable.

Energy Needs: *Describe, and quantify if known, the energy needs associated with the option. Include any energy required to obtain, treat, and deliver the water to the defined location at the defined quality*.

Reduces future energy demands.

Hydroelectric Energy Generation: *Describe, and quantify if known, any anticipated increases or decreases in hydroelectric energy generation as a result of the option*.

Reduces future energy demands.

Recreation: *Describe any anticipated positive or negative effects on recreation*.

No direct impacts.

Environment: *Describe any anticipated positive or negative effects on ecosystems within or outside of the Colorado River Basin*.

Reduces impacts from additional demands. Reduced populations will diminish pollutant loadings relative to what they would be under the state projections.

Socioeconomics: *Describe anticipated positive or negative socioeconomic (social and economic factors) effects*.

For basin state communities dependent on growth, this option will generate negative socio-economic impacts after 2025. These impacts presumably will be offset in other parts of the country.

Potential losses to tax base offset by improvements to quality of life, such as reduced traffic, improved air quality, shorter lines at the airport, and improved dependability of water and energy utilities.

Other Information: *Provide other information as appropriate, including potential secondary benefits or considerations. Attach supporting documentation or references, if applicable*.

Barnett, J, and M Webber. 2010. Accommodating migration to promote adaptation to climate change. *World Bank Policy Research Working Paper 5270*. 62 pp.

The Detroit Works Project. See http://detroitworksproject.com/2011/03/07/young-people-to-revive-detroit/

Klinenberg, E. 2002. *Heat Wave: A Social Autopsy of Disaster in Chicago*. Chicago: University of Chicago Press, 320 pp.

McCarthy, MP, MJ Best, and RA Betts. 2010. Climate change in cities due to global warming and urban effects. *Geophys. Res. Lett.* 37: L09705. doi:10.1029/2010GL042845.