

**Appendix C14**  
**Water Demand Scenario Storylines**

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# Appendix C14 – Water Demand Scenario Storylines

The scenario narratives, or storylines, are described in this appendix, and are organized by the general driving force categories (Demographics and Land Use, Technology and Economics, and Social and Governance) and by specific parameters. The characteristics of each parameter are briefly described. During quantification, these descriptions were refined to maintain consistency and provide coherent descriptions of each scenario.

## 1.0 Storyline for the Current Projected (A) Scenario

### 1.1 Demographics and Land Use

**Population**<sup>1</sup> – Populations in the Colorado River Basin (Basin), the adjacent areas, and the southwestern United States grow at rates commensurate with the “best estimate” demographic projections. Population growth generally occurs centered in existing urban areas.

**Agricultural Land Use** – There are decreases in irrigated agricultural lands due to conversion of agricultural land use to urban land use and lower-economic value crops being phased out in some areas. Agricultural land use reductions vary by location, with some increases in acreage due to build-out of currently planned agricultural water supply projects.

### 1.2 Technological and Economics

**Agricultural Water Use Efficiency** – Current trends in agricultural water use efficiency continue making modest improvements to on-farm and system efficiency through projects such as those supported under the Salinity Control Program. These improvements result in minimal change to Basin consumptive use. No radical changes in technology are anticipated. Agricultural uses are generally consistent with today’s practices (for example, no major changes in techniques, crops, or practices).

**Municipal and Industrial (M&I) Water Use Efficiency** – Water use efficiency increases according to current Basin water provider policies (for example, Southern Nevada Water Authority’s [SNWA’s] current gallons per capita per day [gpcd] planning goals) and technology. External factors beyond the control of Basin water providers that limit the water use of fixtures and appliances (for example, federal statutes) continue, resulting in “natural” increases in in-home efficiency. Water use efficiency changes vary by location according to local goals and mix of water use categories. No radical changes in technology are anticipated.

**Water Needs for Energy** – Water needs for energy expand relative to population growth and current regulations, policies, and planning for the energy industry. Current requirements for renewables are met according to current schedules. Fossil fuel development, and in particular, oil shale development, occurs according to current plans. No dramatic changes to global economies

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<sup>1</sup> Population estimates for each state correspond with different reference points based on state, local information, and planning, and consider long-term trends to represent “best estimate” projections.

or energy demand that would spur additional consideration occur (for example, increased fossil fuel prices).

### 1.3 Social and Governance

**Institutional and Regulatory** – Federal and state laws and regulations affecting the Basin continue in a similar manner as today. Despite the potential for sunseting of future regulations and agreements, the operations of the Colorado River are relatively unchanged.

**Flow-dependent Endangered Species Act (ESA) Needs** – There is no expansion of the federal endangered species program, change to the needs of currently listed ESA species, or updates of existing Biological Opinions. Operations for ESA needs continue according to recent practices, agreements, and regulations.

**Flow-dependent non-ESA Needs** – No change is anticipated in currently realized ecosystem needs or operational practices to meet needs. Operations to meet ecosystem needs continue according to recent practices.

**Social Values** – Social values that affect water use in all categories remain consistent with the recent past. These values include continued support for ongoing, planned M&I and agricultural conservation efforts as well as support for the ESA and its implementation.

**Tribal Use** – Tribal use develops according to quantified rights and current use patterns.

## 2.0 Storyline for the Slow Growth (B) Scenario

### 2.1 Demographics and Land Use

**Population** – Populations continue to grow primarily in urban centers, but at slower rates than the current projected scenario. Population growth is consistent with moderate to low economic growth, followed by economic and subsequent population growth that is less robust than that of the recent past.

**Agricultural Land Use** – There are decreases in irrigated agricultural lands due to conversion of agricultural land use to urban land use and lower-economic value crops being phased out in some areas. Agricultural land use reductions vary by location, with some increases in acreage due to build-out of currently planned agricultural water supply projects.

### 2.2 Technological and Economics

**Agricultural Water Use Efficiency** – Lack of economic growth results in decreased revenues and reduced capital investment for routine and long-term maintenance. Reduced maintenance results in an overall decline in on-farm and delivery efficiency. These efficiency reductions require greater diversions to meet consumptive use requirements. However, Basin consumption changes little as additional losses are returned to the Colorado River system.

**M&I Water Use Efficiency** – Water use efficiency increases according to current policies (for example, SNWA’s current gpcd planning goals) and technology. External factors that limit the water use of fixtures and appliances (for example, federal statutes) continue, resulting in “natural” increases in in-home efficiency. Water use efficiency changes vary by location according to local goals and mix of water use categories. No radical changes in technology are

anticipated. Aging infrastructure and lack of capital investment due to slow growth result in some acute water loss events. However, these events are generally absorbed by the long-term natural trends toward greater efficiency.

**Water Needs for Energy** – Water needs for energy expand relative to population growth and current regulations, policies, and planning for the energy industry. Current requirements for renewables are met according to current schedules. Despite the regional slow growth, global energy demand, and in particular, fossil fuel development (including oil shale development), occurs according to current plans. No dramatic changes to global economies or energy demand that would spur additional consideration occur (for example, increased fossil fuel prices).

### 2.3 Social and Governance

**Institutional and Regulatory** – Slow growth and focus on economic efficiency lead to no significant change in institutional and regulatory requirements. Existing federal and state laws and regulations affecting the Basin continue.

**Flow-dependent ESA Needs** – No change is anticipated in currently realized ecosystem needs or operational practices to meet needs. Operations to meet ecosystem needs continue according to recent practices.

**Flow-dependent non-ESA Needs** – No change is anticipated in currently realized ecosystem needs or operational practices to meet needs. Operations for ecosystem needs continue according to recent practices.

**Social Values** – Economic efficiency is the overwhelming driver affecting social values. Social values that affect water use in all categories trend toward preferences for human water use and systems over other concerns. This focus is driven largely by a lack of funds for capital outlay and a lack of societal willingness to take on new programs.

**Tribal Use** – Tribal use continues to develop, but at slower than planned rates.

## 3.0 Storyline for the Rapid Growth (C1 and C2) Scenarios

This storyline includes two branches: (C1) slower technology adoption, and (C2) rapid technology adoption and slight increase in social values.

### 3.1 Demographics and Land Use

**Population** – Rapid population growth, focused around urban centers with sprawl to outlying areas, is driven by prolonged growth following patterns of recent history. This population growth is similar to typical “high” demographic projections for the Southwest.

**Agricultural Land Use** – Agricultural land use decreases at a slightly faster rate than the Current Projected (A) scenario, primarily because of economic growth resulting in an increased rate of urbanization. Agricultural land use reductions vary by location, with some increases due to development of currently planned projects.

### 3.2 Technological and Economics

**Agricultural Water Use Efficiency** – (C1) Lack of economic growth in the agricultural sector results in decreased revenues and reduced capital investment for routine and long-term maintenance. Reduced maintenance results in an overall decline in on-farm and delivery efficiency. These efficiency reductions require greater diversions to meet consumptive use requirements. However, Basin consumption changes little as additional losses are returned to the Colorado River system.

(C2) Economic conditions result in investment and rapid adoption of new technologies, resulting in significant increases in agricultural water use efficiency. These technologies result in denser cropping patterns and higher yields, with subsequent greater overall consumptive use demand. Irrigation techniques and delivery system water control are significantly improved over those in the Current Projected (A) scenario. Gains in distribution efficiency partially offset the increased consumptive use.

**M&I Water Use Efficiency** – (C1) Water use efficiency increases according to current policies (for example, SNWA’s current gpcd planning goals) and technology. External factors that limit the water use of fixtures and appliances (for example, federal statutes) continue, resulting in “natural” increases in in-home efficiency. Water use efficiency changes vary by location according to local goals and mix of water use categories. No radical changes in technology are anticipated.

(C2) Increased federal investment in water-saving technology and conservation programs results in a substantive increase in water-saving technology (for example, WaterSmart, EnergyStar, and landscape technology). These technologies are applied Basin-wide, resulting in reduced demand and consumptive use.

**Water Needs for Energy** – (C1) Water needs for energy expand relative to population growth and current regulations, policies, and planning for the energy industry. Current requirements for renewables are met according to schedules. Fossil fuel development, and in particular, oil shale development, occurs at a faster rate due to economic drivers spurring growth in energy production.

(C2) Water needs for energy expand relative to population growth and current regulations, policies, and planning for the energy industry. However, investment in technology results in adoption of water-saving techniques (for example, dry cooling). Renewable energy requirements continue, with an emphasis on dry cooling due to an increase in social considerations related to carbon production. Economic conditions do not favor new fossil fuel development in the Southwest.

### 3.3 Social and Governance

**Institutional and Regulatory** – (C1) Federal and state laws and regulations affecting the Basin continue in a similar manner as today. Despite the potential for sunseting of future regulations and agreements, the operations of the Colorado River are relatively unchanged.

(C2) Changing social values lead to increased governmental regulation, including the enactment of climate change and greenhouse gas mitigation measures. These measures primarily manifest themselves in more-integrated management of water and energy (water use efficiency).

**Flow-dependent ESA Needs** – No change is anticipated in currently realized ecosystem needs or operational practices to meet needs. Operations to meet ecosystem needs continue according to recent practices.

**Flow-dependent non-ESA Needs** – No change is anticipated in currently realized ecosystem needs or operational practices to meet needs. Operations for ecosystem needs continue according to recent practices.

**Social Values** – (C1) Social values that affect water use in all categories remain consistent with the recent past. These values include continued support for ongoing planned M&I and agricultural conservation efforts as well as support for the ESA and its implementation.

(C2) A slight increase in social values and subsequent pressure focused on conservation efforts results in management of the Basin, with increased flexibility for multiple water uses (for example, recreational). Trends continue toward M&I conservation adoption.

**Tribal Use** – Tribal use and development occur faster than currently planned. In addition, new tribal claims and settlements are realized.

## 4.0 Storyline for the Enhanced Environment Scenarios (D1 and D2)

This storyline includes two branches: (D1) current projected growth, and (D2) rapid growth and technology.

### 4.1 Demographics and Land Use

**Population** – (D1) Populations in the Basin, the adjacent water-dependent basins, and the southwestern United States grow at rates commensurate with the best estimate demographic projections. Population growth generally occurs centered in existing urban areas.

(D2) Rapid population growth focused around urban centers is driven by prolonged economic growth following patterns of recent history. This population growth is similar to typical “high” demographic projections for the Southwest.

**Agricultural Land Use** – There are nominal increases in irrigated agricultural lands, primarily due to the build-out of currently planned agricultural water supply projects. Agricultural land use growth varies by location, with some conversion of agricultural land to urban land and lower-economic value crops being phased out in some areas.

### 4.2 Technological and Economics

**Agricultural Water Use Efficiency** – (D1) Current trends in agricultural water use efficiency continue making modest improvements to on-farm and system efficiency through projects such as those supported under the Salinity Control Program. These improvements result in little change to Basin consumptive use. No radical changes in technology are anticipated. Agricultural uses are generally consistent with today’s practices (for example, no major changes in techniques, crops, or practices).

(D2) Economic conditions result in investment and rapid adoption of new technologies, resulting in significant increases in agricultural water use efficiency. These technologies result in denser

cropping patterns and higher yields with subsequent greater overall consumptive use demand. Irrigation techniques and delivery system water control are significantly improved over those in the Current Projected (A) scenario. Gains in distribution efficiency partially offset the increased consumptive use.

**M&I Water Use Efficiency** – Increased federal investment in water-saving technology and conservation programs results in a substantive increase in water-saving technology (for example, WaterSmart, EnergyStar, and landscape technology). These technologies are applied Basin-wide, resulting in reduced demand and consumptive use.

**Water Needs for Energy** – Water needs for energy expand relative to population growth and current regulations, policies, and planning for the energy industry. However, investment in technology results in adoption of water-saving techniques (for example, dry cooling). Renewable energy requirements continue, with an emphasis on dry cooling due to an increase in social considerations related to carbon production. Economic conditions do not favor new fossil fuel development in the Southwest.

### **4.3 Social and Governance**

**Institutional and Regulatory** – Changing social values lead to increased governmental regulation, including the enactment of climate change and greenhouse gas mitigation measures. These measures primarily manifest themselves in more-integrated management of water and energy (water use efficiency).

**Flow-dependent ESA Needs** – ESA flow targets for existing listed species are met and recovery of the species is maintained.

**Flow-dependent non-ESA Needs** – Increased social values lead to institutional agreements for ecological flows sufficient to support a healthy river system (in timing, amount, and location).

**Social Values** – Increase in social values and subsequent pressure focused on conservation efforts results in management of the Basin with increased flexibility for multiple water uses (for example, recreational). Trends continue toward M&I conservation adoption and public demand for in-stream flows (for example, tourism and Wild and Scenic Rivers).

**Tribal Use** – (D1) Tribal use develops according to quantified rights and current use patterns.

(D2) Tribal use and development occur faster than currently planned. In addition, new tribal claims and settlements are realized.