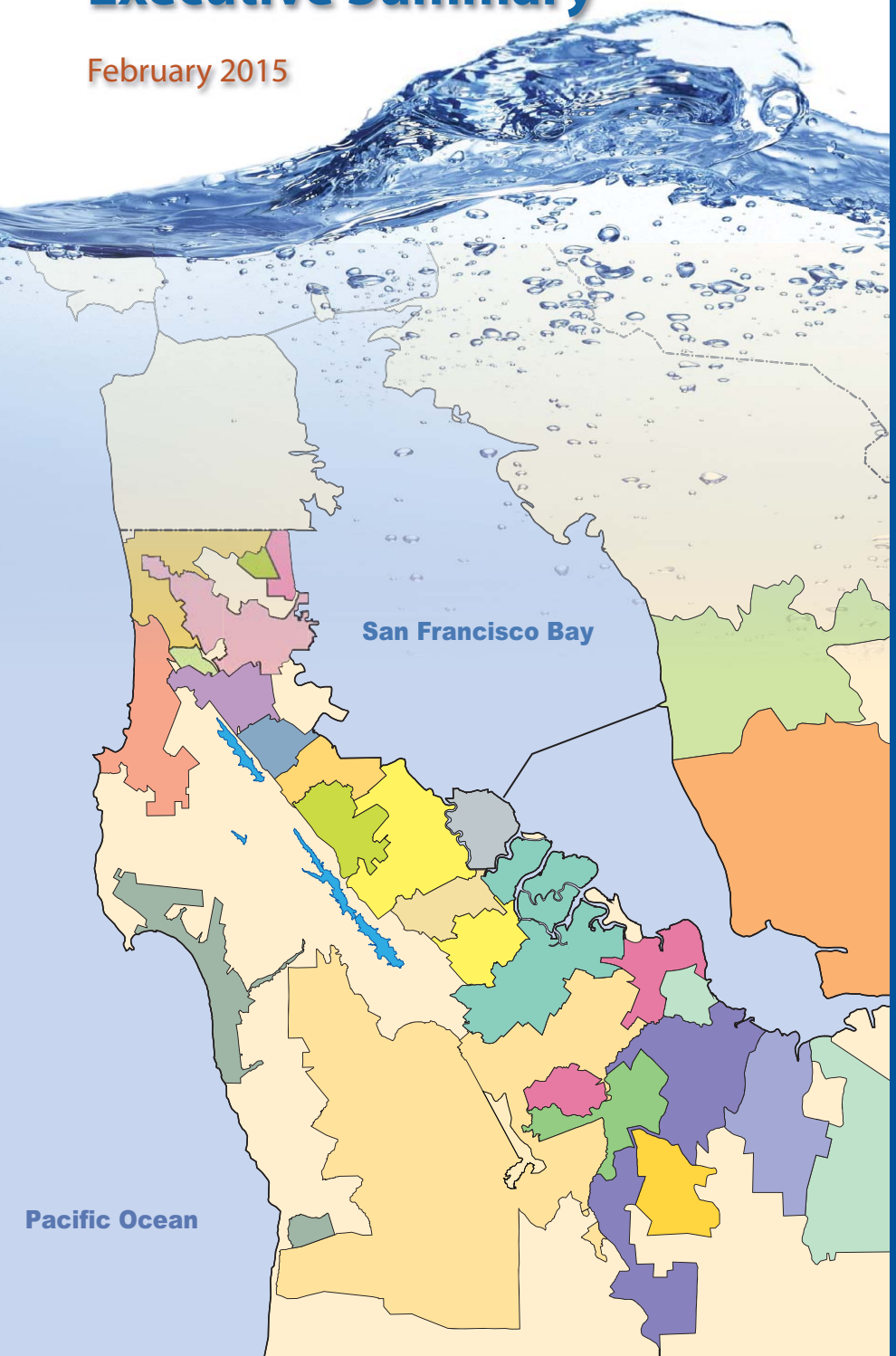
BAWSCA
Bay Area Water Supply & Conservation Agency

Long-Term Reliable Water Supply Strategy

Strategy Phase II Final Report Executive Summary

February 2015



CDM Smith

Bay Area Water Supply and Conservation Agency

Goals

BAWSCA's goals are to ensure:

- A reliable water supply
- High-quality water
- A fair price

Authorities

BAWSCA has the authority to coordinate water conservation, supply and recycling activities for its agencies; acquire water and make it available to other agencies on a wholesale basis; finance projects, including improvements to the regional water system; and build facilities jointly with other local public agencies or on its own to carry out the agency's purposes.

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Long-Term Reliable Water Supply Strategy Phase II Final Report: Executive Summary

The Bay Area Water Supply and Conservation Agency's (BAWSCA's) water management objective is to ensure that a reliable, high-quality supply of water is available where and when people within the BAWSCA member agency service area need it. The purpose of the Long-Term Reliable Water Supply Strategy (Strategy) is to quantify the water supply reliability needs of the BAWSCA member agencies through 2040, identify the water supply management projects and/or programs (projects) that could be developed to meet those regional water reliability needs, and develop an implementation plan for the Strategy. Successful implementation of the Strategy is essential to ensuring that there will be reliable water supplies for the BAWSCA member agencies and their customers in the future. The Strategy findings and five recommended actions are presented in this Executive Summary and the report.

In this Executive Summary:

ES.1 Strategy Initiated to Address Key Water Reliability Issues

BAWSCA initiated work on the Strategy in 2009 in response to the following:

1. Demand forecasts by the BAWSCA member agencies, as part of their 2005 Urban Water Management Plans (UWMPs) and other planning documents, suggested that additional water management actions (i.e., increased supplies and/or reduced demands) would be needed to meet then-projected normal and drought year demands.

2. In October 2008, the San Francisco Public Utilities Commission (SFPUC) made the unilateral decision to establish a 184 million gallon per day (mgd) limitation on what the BAWSCA member agencies could purchase collectively from the San Francisco Regional Water System (SF RWS) through at least 2018.

3. In October 2008, SFPUC adopted an 80 percent level of service (LOS) goal for the SF RWS. Based on the rules for drought allocation between SFPUC and the Wholesale Customers, this results in up to a 26 percent cutback, in aggregate, to the BAWSCA member agencies during droughts. This could reduce annual business sales in the BAWSCA and SFPUC service areas by $2.0 billion (B) per year of drought.

4. The reliability of the SFPUC supply could also be adversely affected by climate change and future regulatory actions or policy changes. As such, the BAWSCA member agencies expressed an interest in developing a source of supply that was independent of the SFPUC.

Throughout development of the Strategy, the BAWSCA Board of Directors (Board) has provided direction on scope and policy issues as shown in Figure ES-1.

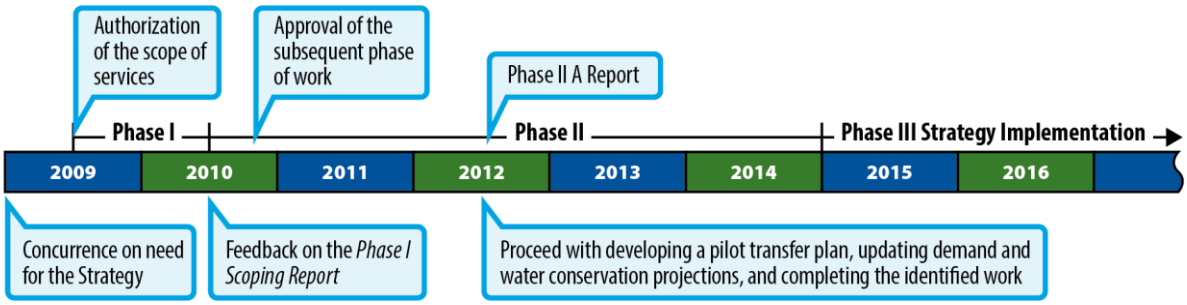

Figure ES-1
Strategy Development Informed by Board Direction

ES.2 While Normal Year Supply is Adequate to 2040, Drought Year Shortfalls are Significant

The demand analysis resulted in the following key findings:

- There is no longer a normal year supply shortfall.
- There is a drought year supply shortfall of up to 43 mgd.

The 2014 *Regional Demand and Conservation Projections Project*, undertaken based on recommendations in the *Phase II A Report*, identified changed water demands and has shaped the Strategy analysis. The analysis showed that the projected reliability need of the BAWSCA member agencies through 2040 will be negligible after accounting for passive and active conservation (as shown in Figure ES-2). In addition, with projected purchases from the SFPUC of 153 mgd in 2018 and 168 mgd in 2040, the short-term adverse impacts of the SFPUC-imposed Interim Supply Limitation of 184 mgd are no longer an immediate concern in normal years due to decreases in demand and increased development of other available supplies.

However, during the same planning period, reliability shortfalls on the SF RWS of up to 43 mgd (approximately 48,000 acre-feet per year [AFY]) are forecast in dry years, resulting in system-wide SFPUC cutbacks of to 20 percent (as shown in Figure ES-3). The reliability need is spread throughout the BAWSCA service area, with individual member agency shortfalls ranging from 0.1 to 10.7 mgd. Any reliability shortfall would need to be met by some combination of additional supplies and/or additional conservation. The Strategy does not assume that the BAWSCA member agencies will commit to filling the entire supply shortfall, but focuses on identifying (1) options for filling all or portions of the shortfall and (2) additional actions to further investigate or implement the projects identified.

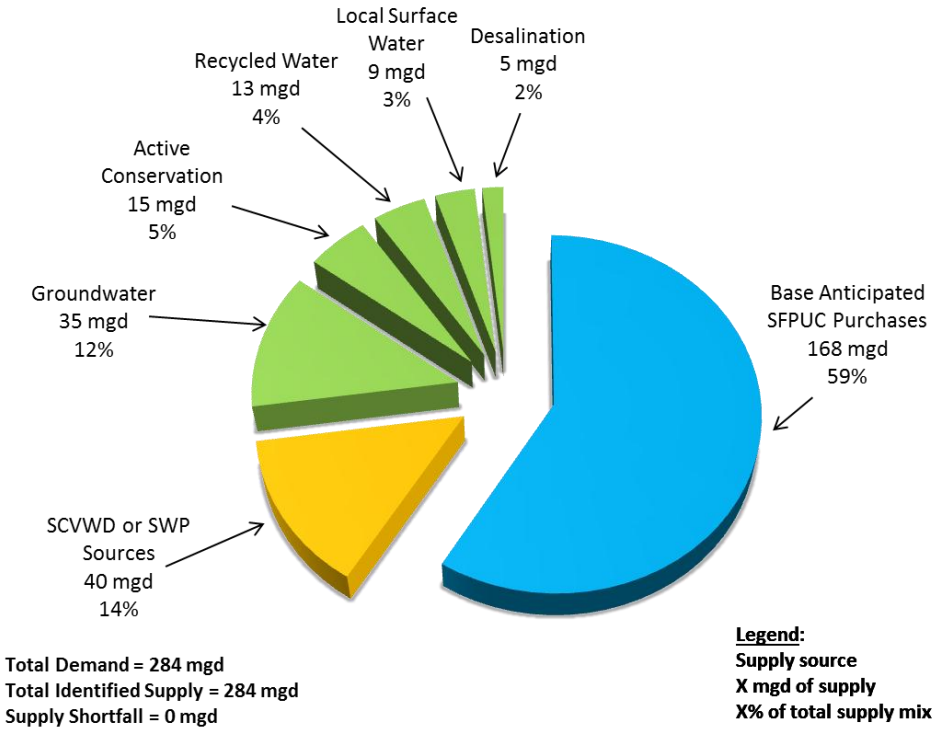

Figure ES-2
Normal Year Water Supply is Sufficient through 2040

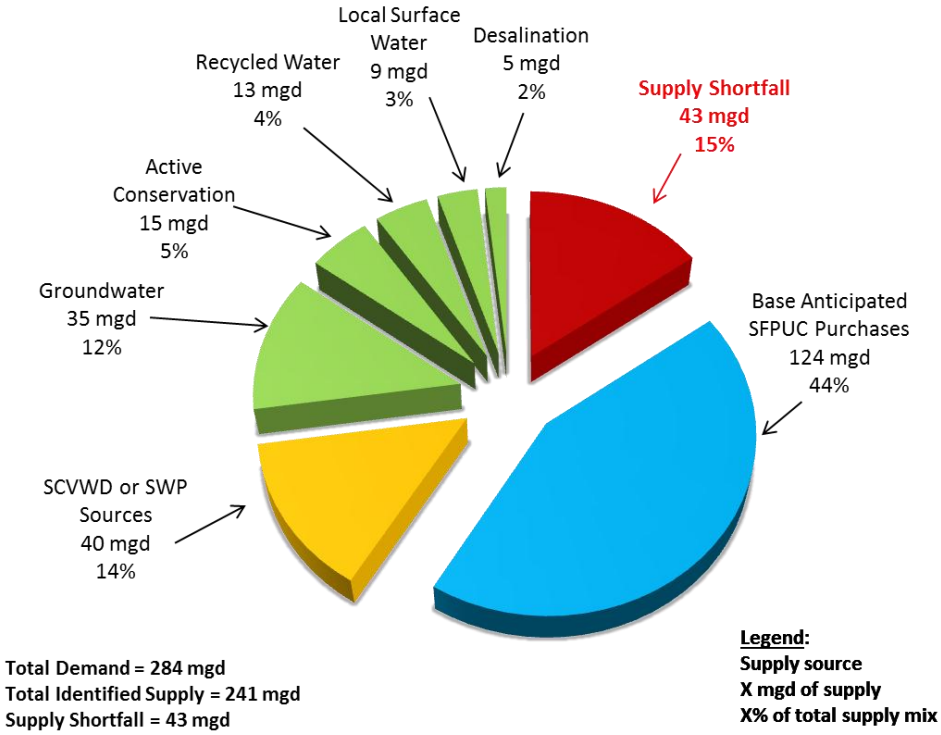

Figure ES-3
Reliability Need Identified for Drought Years (2040)

Based on the 2040 demand assumptions and using 91 years of historical hydrologic data and the SFPUC's Hetch Hetchy/Local Simulation Model, drought year shortages of 10 percent to 20 percent on the SF RWS are estimated to occur up to 8 times during the 91-year historical hydrologic sequence (i.e., 1920 through 2011) that the SFPUC uses for water supply planning purposes. This is the equivalent of a shortage event on t20849he SF RWS approximately every 11 years. The estimated frequency of shortage is conceptually illustrated in Figure ES-4.

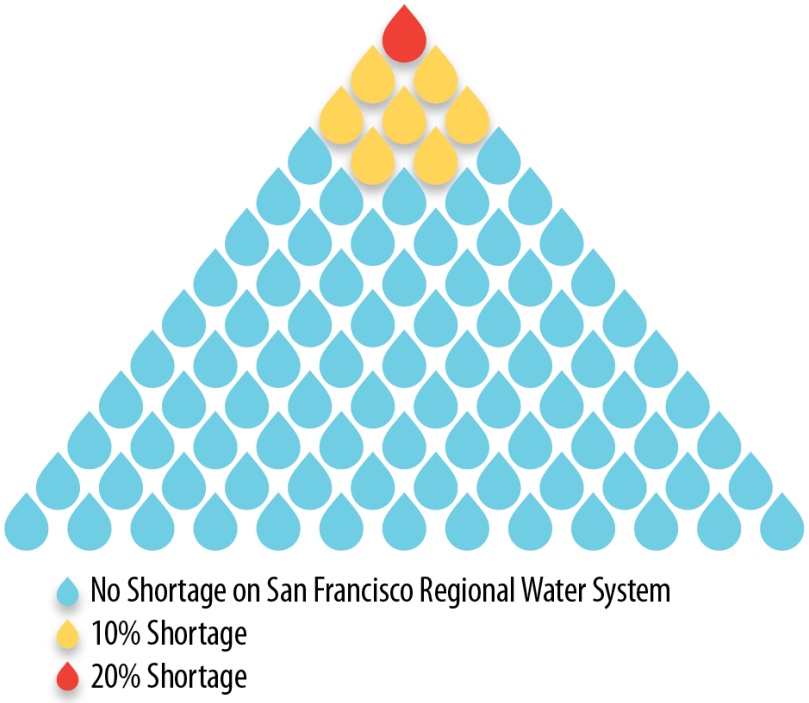

Figure ES-4
Projected Frequency of Shortage on San Francisco RWS in 2040 Based on the 91-Year Historical Hydrologic Record and Estimated Demands

Based on the existing agreements that allocate drought year water supplies between San Francisco and the Wholesale Customers (i.e., the Tier 1 Plan), a drought event that creates a 10 percent system-wide shortfall corresponds to an average 15 percent cutback to the Wholesale Customers, while a 20 percent system-wide shortfall corresponds to an average 26 percent cutback to the Wholesale Customers. In addition, the allocation varies for each BAWSCA member agency (i.e., under a 20 percent system-wide shortfall scenario, some agencies could receive a cutback of up to 40 percent to their SFPUC supply, while some receive less than a 26 percent cutback).

The drought year need may be somewhat greater than estimated above for the following reasons:

- Drought frequency over the historical record may increase when including hydrology through 2014;
- Climate change could impact SFPUC supply reliability; and
- Shortfalls to other imported and local supplies during drought years were not considered when determining drought year need. The shortfalls identified in this report were based solely on the SF RWS historical reliability.

- There could be shortfalls to other imported and local supplies during drought years that were not accounted for when determining drought year need based solely on the SF RWS historical reliability.

Further study of all these areas is suggested as part of the recommended actions.

ES.3 SFPUC Supply Shortfalls Can Have Significant Economic Impacts to the BAWSCA Member Agencies and Region

SFPUC commissioned an economic impact analysis to estimate the economic effect to the region from potential future droughts through 2035. In the SFPUC study it was estimated that a 10 percent system-wide supply shortfall would reduce annual business sales in the BAWSCA and City and County of San Francisco service areas by as much $0.4B in Fiscal Year 2010-11, and by as much as $2.0B for a 20 percent supply shortfall, based on the 91-year historical record. These impacts could be compounded in the case of multi-year droughts and because per capita demand in the BAWSCA member agency service area is already low compared to other portions of the Bay Area and the State of California.

Drought Impacts:

- Droughts occur 1 in every 11 years on the SF RWS.
- Some BAWSCA agencies could receive cutbacks of up to 40%.
- Regional business sales impacts up to $2.0B annually.

The potential impacts to the BAWSCA member agencies are regional and not just limited to the individual cities or water districts. For example, the severity of the potential drought's impact to commercial and industrial sectors could cause relocation of businesses for which a reliable water supply is critical. The loss of this commercial and industrial base would undoubtedly weaken the regional economy. Furthermore, the residents and voters in one community often work or own businesses in another community within the BAWSCA member agency service area or neighboring communities. Therefore, a drought year reliability shortfall in one BAWSCA member agency that results in loss of jobs or other impacts could have a detrimental effect on the customers of another BAWSCA member agency, even if that agency itself is not facing a supply shortfall.

ES.4 Several Viable Projects Have Been Identified That Together Can Reduce the Drought Year Shortfall

Over 65 individual water supply management projects were evaluated that could be developed by BAWSCA and the BAWSCA member agencies to meet identified drought year reliability needs through 2040. Projects were not retained as part of the Strategy for any of the following reasons:

1. An agency chose to independently implement a project;
2. An agency was not interested in being a proponent of the project as a part of the Strategy;
3. The project did not provide additional supply;
4. Regulatory restrictions impeded implementation;
5. No regional benefit was found;

6. The project implementation schedule did not fit within the timeline of the Strategy; and
7. The project was deemed infeasible due to water quality issues.

Eleven specific projects were evaluated in greater detail encompassing five project types (i.e., recycled water, groundwater, local capture and reuse, desalination, and water transfer projects), and nine are evaluated and scored in this report. Two projects were not scored given limited data on key criteria.

The projects offer a wide range of potential dry year yield, from small projects that can be implemented individually by member agencies, to large yield projects that would require direct involvement by BAWSCA. These projects, and a summary of their characteristics, are presented below in Table ES-1. Two items are particularly important to note:

1. If all these projects were implemented, and achieved the average anticipated project yield, they would almost meet the 43 mgd (48,000 AFY) dry year supply need.
2. The combined average anticipated yields of two projects - water transfers and desalination - account for meeting over 80 percent of the average projected dry year need.

Even though all projects may be needed to meet BAWSCA's dry year needs, an evaluation of projects was conducted to gain insights on how the projects perform against the Strategy objectives, highlight key tradeoffs between the projects, and identify where more information is needed. This information can then be used to prioritize recommended actions and inform their sequencing.

Table ES-1. Summary of Strategy Projects

Strategy Project Type	Strategy Project	Yield (AFY)	Range of Unit Cost ($/AF)	Schedule
Agency Identified Projects – Recycled Water (RW)	City of Daly City- Colma Expansion Project	1,060	$3,310	3-4 years
	City of Mountain View- Increase Recycled Water Supply from Palo Alto Regional Water Quality Control Plant	429	$1,950-$2,450	3-4 years
	City of Palo Alto- Recycled Water Project to Serve Stanford Research Park	900	$2,830	3-4 years
	City of Redwood City- Regional Recycled Water Supply[1]	Up to 3,200	Not determined	3-4 years
Agency Identified Projects – Groundwater (GW)	City of Sunnyvale Groundwater Project	1,880-2,350	$1,230-$1,350	4 years
Regional Projects – Local Capture and Reuse	Rainwater Harvesting	210-680	$2,900- $4,700	On-going
	Greywater Reuse	1,240-3,000	$550-$4,530	On-going
	Stormwater Capture[1]	Not determined	Not determined	Not determined
Regional Projects – Desalination	Open Bay Intake Desalination	16,800	$2,100-$4,950	5-12 years
	Brackish Well Desalination	780-7,280	$1,400-$7,090	5-12 years
Regional Projects – Transfers	Water Transfers	10,000-31,800	$950-$1,750	2-5 years

[1] The Redwood City Regional Recycled Water Supply project and stormwater capture were dropped from further consideration due to limited information currently available on key criteria of cost and potential demand.

ES.5 Analysis of Individual Projects and Portfolios Converge on Identical Priorities

An analysis was performed to identify those projects and combination of projects, or portfolios, which emphasized significant objectives of the Strategy.

For the project analysis, detailed scoring for each project was created on a normalized scale where the highest possible score was 100 points. The evaluation criteria and metrics were developed with input from the Board and the BAWSCA member agencies. The project scores and weightings were developed using the Strategy objectives and findings.

To reflect that not all objectives and criterion are of equal importance, a sensitivity analysis was conducted with different sets of weighting factors on the various objectives and criteria to evaluate project performance. Figure ES-4 presents the results of the project analysis when emphasizing drought supply, cost, regulatory vulnerability, local control, and institutional complexity evaluation criteria. The bar representing each project combines the individual criterion scores for that project to provide a comparison of the relative contribution of each criterion score across the Strategy projects. The total length of the bar represents the overall performance of the project.

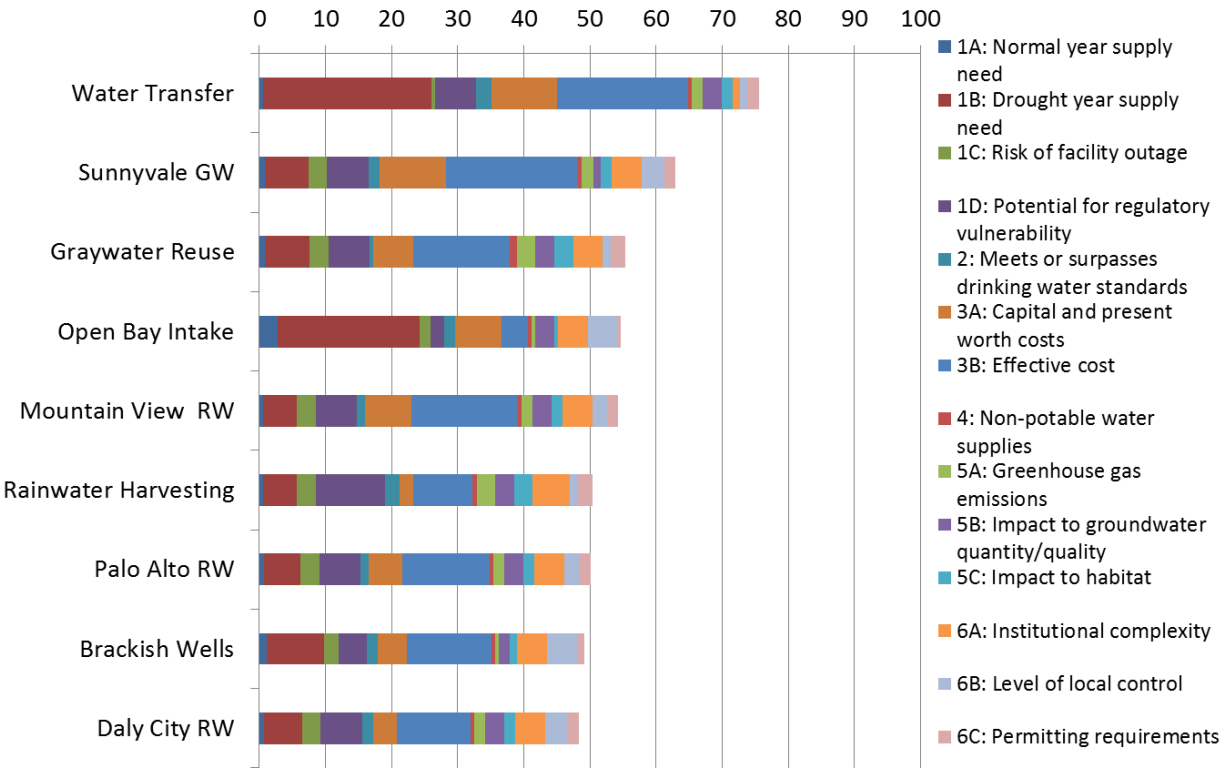

Figure ES-4
Cumulative Score for the Strategy Projects under Sensitivity Emphasizing Drought Supply, Costs, Regulatory Vulnerability, Local Control, and Institutional Complexity

The key findings of the project evaluation analysis were:

1. Water transfers score consistently high across the various performance measures and within various portfolio constructs and thus represent a high priority element of the Strategy.

2. Desalination also potentially provides substantial yield, but its high effective costs and intensive permitting requirements make it a less attractive drought year supply alternative. However, given the limited options for generating significant yield for the region, desalination warrants further investment in information as a hedge against the loss of local or other imported supplies.

3. The other potential regional projects provide tangible, though limited benefit in reducing dry year shortfalls given the small average yields in drought years.

For the portfolio analysis, the individual projects were combined into several different portfolios reflecting different priorities and also analyzed using the same sensitivity weightings. The performance of projects through the sensitivity analysis described above was used to help determine which projects comprised each portfolio. The following observations can be made based on the portfolios analysis:

- Water transfers are a component of all top scoring portfolios.
- The greatest certainty for dry year yield would be the Local Control portfolio, which contains desalination. It represents the highest cost and previous desalination projects have encountered delays in their implementation.
- The Least Stranded Costs portfolio was the highest scoring portfolio. This portfolio consists only of water transfers, which provide a very high dry year yield for no capital costs and a low cost per acre-foot.
- The Local Control and Least Environmental Impact portfolios have the highest number of projects, but are the lowest scoring portfolios on average and do not score as well on yield and cost criteria.
- The Least Cost and Fastest Implementation portfolios contain the same projects.
- Each portfolio provides an average dry year yield of over 20,000 AFY, which is almost half of the 2040 dry year need of 48,000 AFY (assuming a 100 percent LOS). Or, put another way, each of the portfolios would reduce rationing significantly. While no formal decision was made by BAWSCA regarding a preferred LOS, it is recognized that achieving 100 percent LOS was not required.

ES.6 Evaluation Results Identify the Need to Balance Risks and Invest in Further Information

As discussed above, the demand analysis done during Phase II of the Strategy resulted in the following key findings:

- There is no longer a normal year supply shortfall.
- There is a drought year supply shortfall of up to 43 mgd.

In addition, the project evaluation analysis done during Phase II of the Strategy resulted in the following key findings:

- Water transfers score consistently high across the various performance measures and within various portfolio constructs and thus represent a high priority element of the Strategy.
- Desalination also potentially provides substantial yield, but its high effective costs and intensive permitting requirements make it a less attractive drought year supply alternative. However, given the limited options for generating significant yield for the region, desalination warrants further investment in information as a hedge against the loss of local or other imported supplies.
- The other potential regional projects provide tangible, though limited, benefit in reducing dry year shortfalls given the small average yields in drought years[1].

Given that the total average water supply yield of the identified Strategy water management projects is approximately equivalent to the dry year need and the uncertainty around the potential yield and ability to implement the Strategy projects, actions should be taken to implement each of the identified projects. The evaluation of the Strategy projects against the water management objectives has provided information that will be used to prioritize and define sequencing of implementation actions. As evidenced above, water transfers consistently perform higher on most of the objectives than any other project.

The evaluation has also indicated the need to further examine potential risks and tolerance to risk. There are still unknowns surrounding the projects. For example, water transfers may not be able to be secured due to a number of factors, and the brackish desalination project yield could vary up to an order of magnitude due to uncertain geological conditions.

The Strategy, therefore, must proceed on all fronts, pursuing actions on each project, to balance different risks so as to maximize the likelihood that BAWSCA can provide the water when and where it is needed.

The recommended actions have been broadly classified into two categories, depending on the stage of development of the project, degree of risk, level of uncertainty, and level of financial investment required for the action. Figure ES-5 provides a conceptual overview of these two types of actions. These actions are conceptually defined as:

[1] While specific projects were not developed or evaluated for the Strategy, regional discussions on indirect/direct potable reuse have accelerated dramatically in the last year, making this a water supply management project BAWSCA will be tracking closely.

- *Core Actions*: Low-cost, low-risk actions pursued in an early phase of project development that can provide critical information, identify partnerships, and reduce uncertainty for pursuing full-scale investments in water supply projects.
- *Implementation Actions*: Higher-cost and higher-risk actions pursued in later phases of water supply projects that more directly lead to development of new supplies.

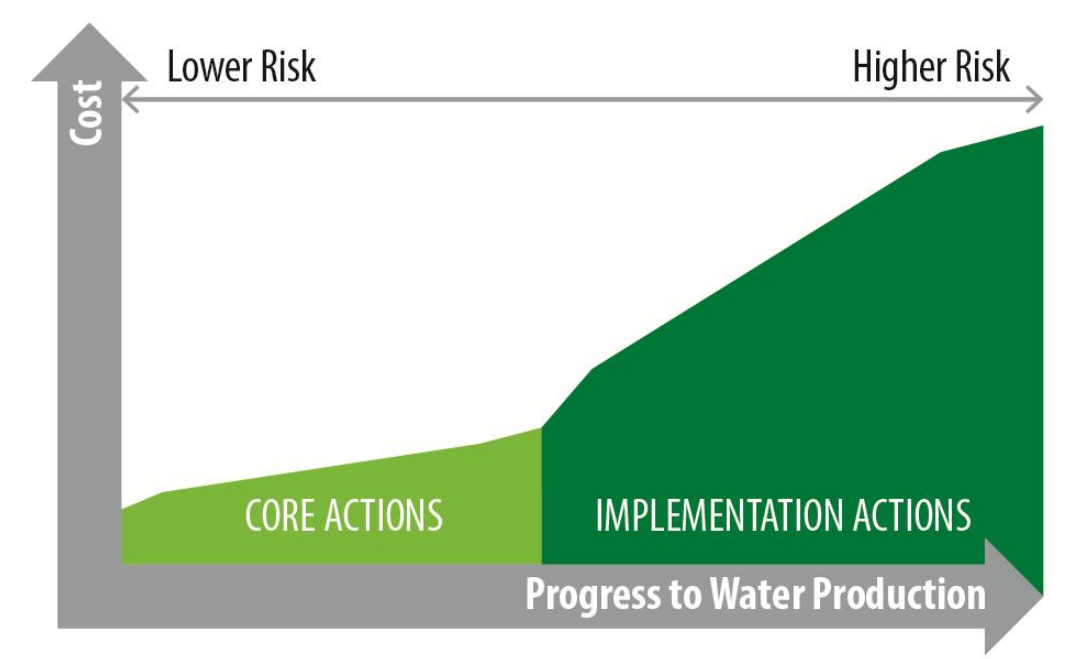

Figure ES-5
Defining Core and Implementation Actions

Figure ES-5 illustrates that Core Actions occur when there is much progress needed before water supply is produced, and Implementation Actions occur closer to the realization of a new water supply. Also, as illustrated in Figure ES-5, Core Actions have lower costs and risks, while Implementation Actions have higher costs and risks, comparatively.

ES.7 Recommendations

Details on the recommended Core Actions and Implementation Actions are presented in Table ES-2 and can be summarized as the following five recommended actions:

1. Lead water transfer development and implementation including identifying and evaluating water storage options;
2. Facilitate desalination partnerships and pursue outside funding for related studies;
3. Support agency-identified projects (i.e., recycled water and groundwater) and local capture and reuse;

4. Participate in regional planning studies in cooperation with others; and

5. Continue monitoring regional water supply investments and policies.

The actions arise from on-going work by BAWSCA and also represent new work for BAWSCA. Of these recommended actions, executing the East Bay Municipal Utility District (EBMUD) Pilot Transfer will have the most immediate financial impact. In addition, some new work has been identified as a priority. For example, identification of potential water storage options could reduce the risks of the water transfers, the highest performing project. Acquiring and storing these surplus supplies during non-drought periods for withdrawal and delivery during drought years would strengthen water transfers as a viable water management action.

Table ES-2. Range of Recommended Actions

Action	Core	Implementation
On-going	**Santa Clara Valley Water District (SCVWD)** Pilot Transfer Plan: complete plan to evaluate potential transfer options	**EBMUD Pilot Transfer**: execute a pilot water transfer
	Recycled Water: facilitate partnerships and grant funding	**Local Capture and Reuse:** implement rain barrel program; pursue funding
	Groundwater: facilitate partnerships and grant funding	
	Planning Studies: examine impacts of non-SFPUC shortfalls; evaluate hydrology under the current drought and climate change; participate in the Bay Area Regional Reliability process	
New	**Water Storage Options:** identify and evaluate storage options	**SCVWD Pilot Transfer**: execute a pilot water transfer[1]
	Recycled Water: monitor indirect/direct potable reuse policy development; facilitate discussions; pursue funding	**Water Storage:** develop agreements[1]
	Local Capture and Reuse: evaluate new programs; pursue funding	**Brackish Desalination:** conduct aquifer testing[1]
	Desalination Projects: facilitate partnerships; pursue funding	
	Planning Studies: review lessons learned from prior droughts; consider development pattern impacts on water demands	

[1] Contingent on findings from earlier activities

Some of the recommended actions reflect that the Strategy is not static and needs to be informed by changes in planning assumptions, impacts, and actions of others. This includes refining estimates of supply need that reflect updated hydrology, shifts in demands associated with development and climate change, and mining insights from other agencies that have made significant investments against future extended droughts. Other recommended actions will either be addressed under proposed work plan activities or will be contingent on findings from proposed work plan activities.

For example, desalination project development actions will be contingent on both identifying partners and obtaining funding through existing and new outside funding channels (e.g., California Proposition 84, the California Water Bond, and Federal funding).

Finally, continued monitoring of other agencies' policy decisions and supply investments is important for the Strategy as changing policy or supply conditions could alter activities related to Strategy implementation and its fundamental objective of assuring reliability for BAWSCA. A summary of the major policy decisions and supply investments that should be monitored as part of the Strategy is presented in Table ES-3.

Table ES-3. Policy Decisions and Supply Investment Activities to Monitor

Element	Entity	Activities to Monitor
Policy	State and Federal	Federal and State decisions that may (1) further limit supply availability from the exiting supplies (e.g., Tuolumne River) and (2) facilitate the development of new supplies (e.g., direct/indirect potable reuse).
	SFPUC	Decision on 2018 interim supply limitation which will impact supply availability from the SF RWS. Determination on role as regional provider.
Supply Investments	BAWSCA Member Agencies	Progress on implementing planned projects will impact supply need. 2015 UWMPs will reflect changes in near-term projections.
	SFPUC	Performance of projects in construction and projects under consideration may impact the magnitude of the supply need.
	SCVWD and Regional Wastewater Agencies	Development of various potable reuse projects, which may indirectly or directly create additional water supply.

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