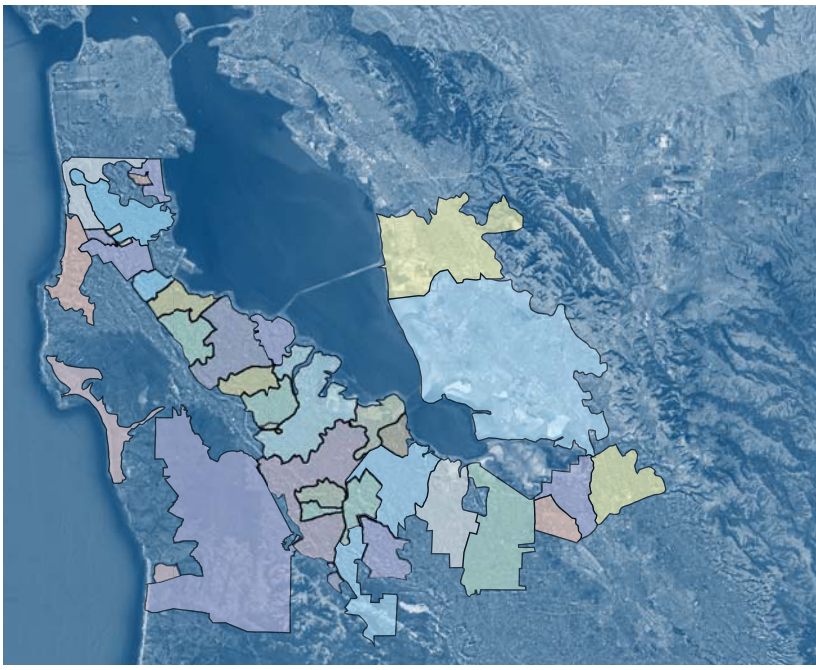
BAWSCA
Bay Area Water Supply & Conservation Agency

Long-Term Reliable Water Supply Strategy

Volume I
Phase II A Final Report







CDM Smith

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Acronyms

$/AF	dollars per acre-foot
$M	million dollars
AF	acre-feet, acre-foot
AF/year	acre-feet per year
BAAQMD	Bay Area Air Quality Management District
BARDP	Bay Area Regional Desalination Project
BAWSCA	Bay Area Water Supply and Conservation Agency
Cal Water	California Water Service Company
CCWD	Contra Costa Water District
CEQA	California Environmental Quality Act
Colma	Town of Colma
CVP	Central Valley Project
Delta	Sacramento-San Joaquin Delta
DRIP	Drought Implementation Plan
DWR	Department of Water Resources
EBMUD	East Bay Municipal Utility District
EIR	Environmental Impact Report
FERC	Federal Energy Regulatory Commission
FY	fiscal year
gpd	gallons per day
GW	groundwater
HDDW	horizontally directionally drilled well
HH/LSM	Hetch Hetchy/Local Simulation Model
ISG	Individual Supply Guarantee
LID	Low-impact development
mgd	million gallons per day
mg/L	milligrams per liter
NCCWD	North Coast County Water District
NRDC	Natural Resources Defense Council
O&M	operations and maintenance
project	water supply management project
RWQCP	Regional Water Quality Control Plant
SB	Senate Bill
SBSA	South Bayside System Authority
SCVWD	Santa Clara Valley Water District
SF RWS	San Francisco Regional Water System
SFPUC	San Francisco Public Utilities Commission
State Board	State Water Resources Control Board
Strategy	Long-Term Reliable Water Supply Strategy
SWP	State Water Project
TBD	to be determined
TDS	total dissolved solids
UWMP	Urban Water Management Plan
WQCP	water quality control plant
WSA	Water Supply Agreement
WWTP	wastewater treatment plant
Zone 7	Alameda County Flood Control & Water Conservation District Zone 7

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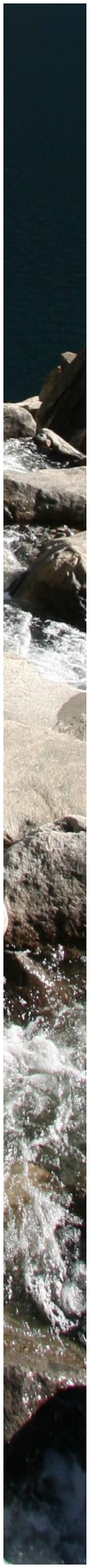


Long-Term Reliable Water Supply Strategy - Phase II A: Executive Summary

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 Long-Term Reliable Water Supply Strategy (Strategy) will quantify the water supply need of the BAWSCA member agencies through 2035, identify the water supply management projects (projects) that could be developed to meet that need, and prepare the implementation plan for the Strategy. Successful implementation of the Strategy is critical to ensuring that there will be sufficient and reliable water supplies for the BAWSCA member agencies and their customers in the future.

In this Executive Summary:

ES.1 Strategy Initiated to Address Key Water Supply Issues

At the request of the BAWSCA Board of Directors (Board) and its member agencies, BAWSCA initiated work on the Strategy in 2009 in response to the following circumstances:

1. Demand forecasts by the BAWSCA member agencies as part of their 2005 Urban Water Management Plans (UWMPs) suggested that additional supply would be needed to meet projected normal and drought year demands, even after accounting for aggressive conservation.
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% level of service goal for the SF RWS. Based on the rules for drought allocation between SFPUC and the Wholesale

Customers that are documented in the 2009 Water Supply Agreement (WSA), this results in up to a 29% cutback to the BAWSCA member agencies during droughts. This has an estimated economic impact of up to $7.7 billion per year in the BAWSCA member service area.

4. The reliability of the SFPUC supply could also be impacted 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.

ES.2 Strategy Development Adapted to Changed Conditions to Use Resources Efficiently

The Strategy is being developed in phases to provide BAWSCA and the BAWSCA Board the opportunity to confirm the direction of the Strategy at key decision points, and redirect (reprogram) these efforts as appropriate to ensure that the goals of the Strategy are met. Figure ES-1 presents the general phasing of the Strategy development and implementation.

Phase I of the Strategy was completed in May 2010. The *Phase I Scoping Report* identified the range of anticipated demands and supply needs for the BAWSCA member agencies, described over 65 different projects that could potentially be developed in some combination to meet the identified needs, and provided the framework to evaluate those projects as part of the Strategy.

Phase II A of the Strategy is now complete and the results are documented in this report. These technical results and recommendations will be presented to the BAWSCA Board in July 2012. The associated policy decisions will be brought to the BAWSCA Board in September 2012 for anticipated action.

The Final Strategy Report is planned for completion by December 2014. This report will incorporate the results of additional work and present the recommended Strategy and the associated Strategy implementation plan (i.e., who will do what by when).

Figure ES-1
Strategy Development Phased to Ensure that the Desired Results will be Achieved

ES.3 More Water Supply is Needed in Normal and Drought Years

Phase II A of the Strategy updated the water demand and conservation projections and supply needs for the BAWSCA member agencies based primarily on information developed as part of the agencies' 2010 UWMPs. After accounting for the impacts of passive and active conservation, the resulting projected water supply needs of 4 mgd to 13 mgd in normal years and 58 mgd to 62 mgd in drought years are shown in Figure ES-2.

The ranges in the projected needs reflect the current temporary and interruptible status of Santa Clara and San Jose (i.e., the higher end of the need range assumes that San Francisco will decide not to provide permanent supply to those cities in the future). Further, while the WSA allows for the permanent transfer of Individual Supply Guarantees (ISGs) between BAWSCA member agencies, as well as shorter-term transfers of drought allocations, no such transfers have occurred to date and the Strategy does not make any assumptions regarding these transfers occurring in the future.

The 2035 normal year need is potentially as little as 4 mgd and is localized to seven of the 26 BAWSCA member agencies. In contrast, the drought year need of up to 62 mgd is significant and is spread throughout the BAWSCA member agency service area as indicated in Figure ES-3. It is anticipated that future Strategy efforts will be most effectively focused on meeting the drought year need (rather than both normal and drought year needs) due to the magnitude of the economic and other impacts of drought to all of the BAWSCA member agencies.

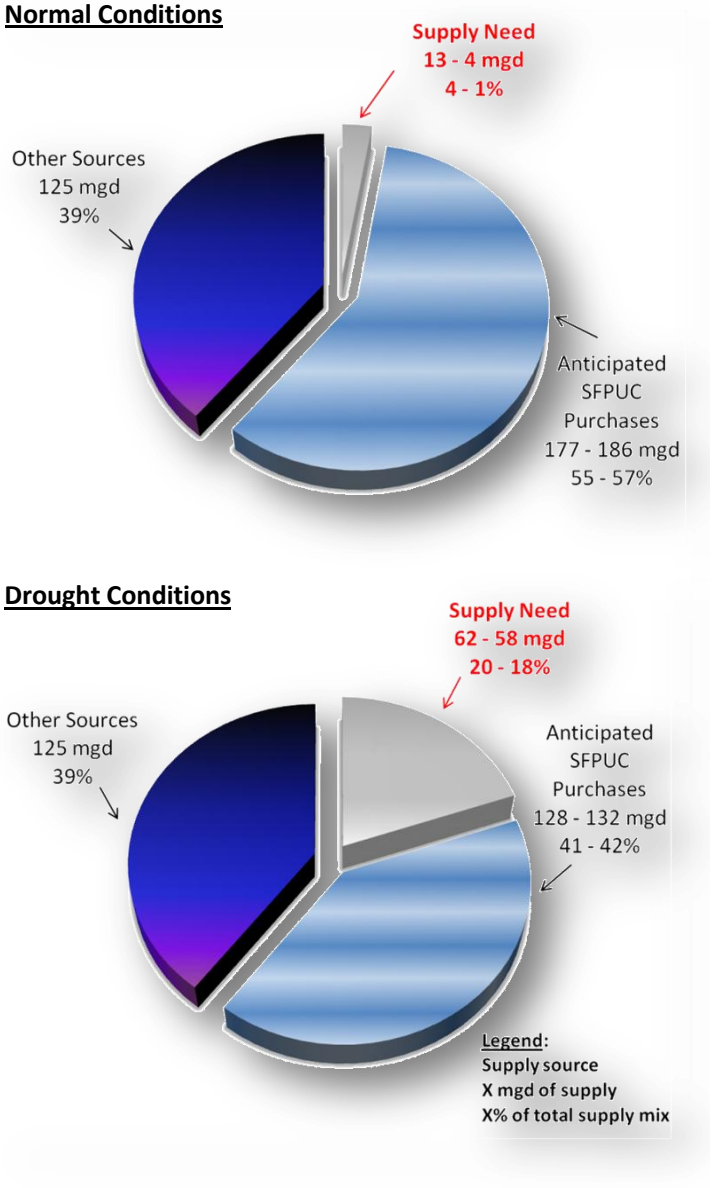


Figure ES-2
More Water Supply is Needed in Normal and Drought Years (2035

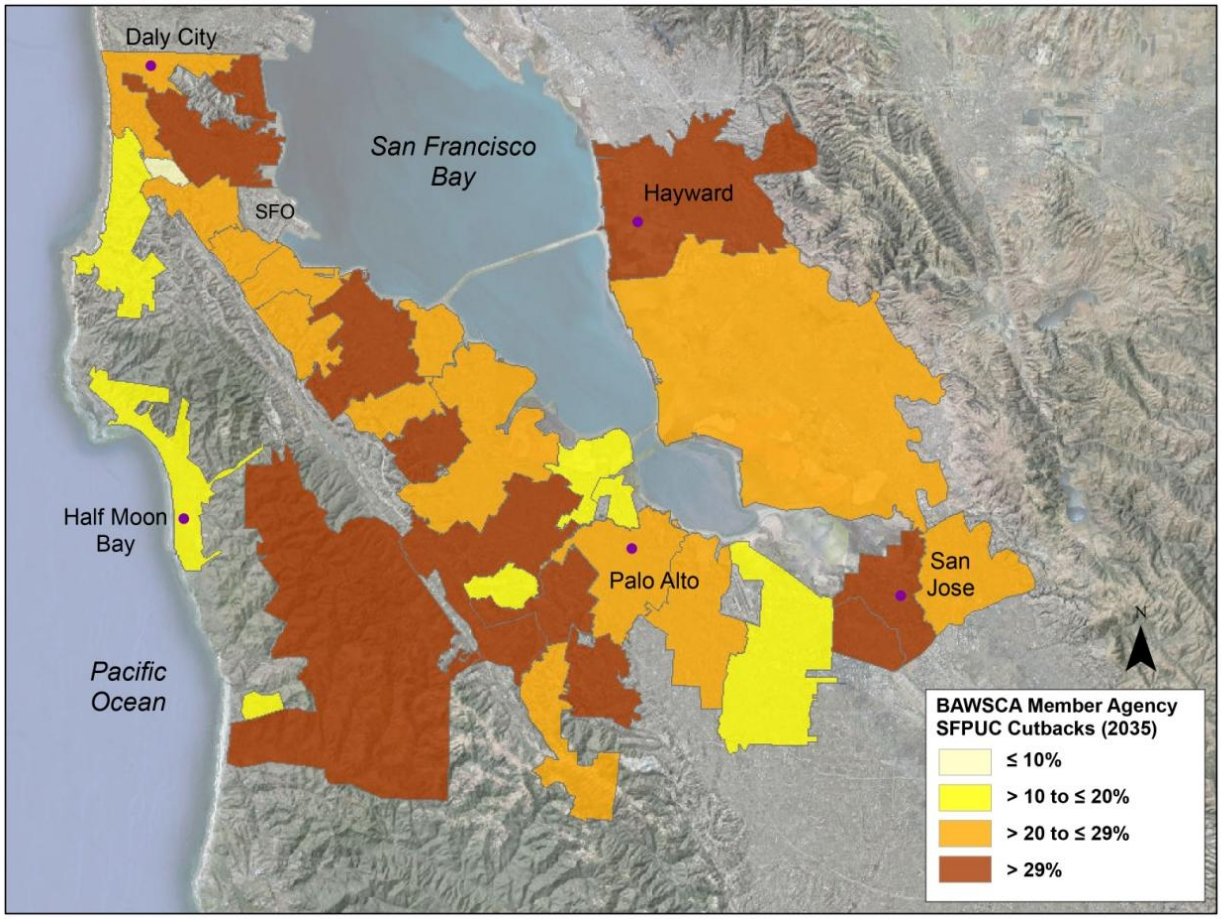


Figure ES-3
20% Supply Shortfalls on the SF RWS Result in an Average Cutback of 29% to the BAWSCA Member Agencies (2035)

ES.4 The Frequency and Magnitude of SFPUC Supply Shortfalls Have Significant Impacts to the BAWSCA Member Agencies

Based on the 2035 demand assumptions and using the SFPUC hydraulic system model, drought shortages of 10% to 20% on the SF RWS are estimated to occur up to 8 times during the 82-year historical hydrologic sequence (i.e., 1920 through 2002) that the SFPUC uses for water supply planning purposes. This is the equivalent of a drought event on the SF RWS every ten years, as shown in Figure ES-4.

If the 82-year hydrologic sequence is extended to include the recent droughts experienced by the SF RWS between 2002 and 2011, the frequency of shortages on the SF RWS appears to increase to 11 years over the last 92 years, with separate drought events occurring every eight years, on average. Two multiple dry year events, including the drought of record, occurred during the last 25 years.

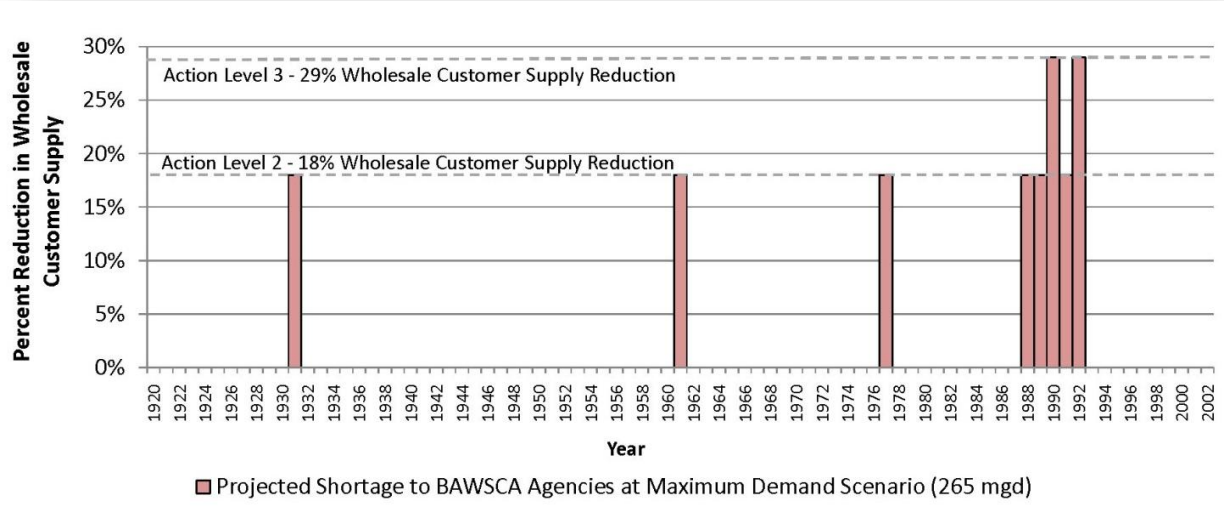


Figure ES-4
Drought Events that Create System-wide Supply Shortfalls of 10% to 20% Are Projected to Occur on Average Every Ten Years on the SF RWS

Based on the formula used in the 2009 WSA to allocate dry year water supplies between San Francisco and the Wholesale Customers (i.e., the Tier 1 Plan), a drought event that creates a 10% system-wide shortfall corresponds to an average 18% cutback to the Wholesale Customers, in aggregate, while a 20% system-wide shortfall corresponds to an average 29% cutback to the Wholesale Customers. The Tier 2 Plan, adopted by all 26 BAWSCA member agencies in March 2011, allocates the collective Wholesale Customer share among the BAWSCA member agencies. Under the rules of the Tier 2 Plan, the cutbacks vary for each BAWSCA member agency (i.e., under a 20% system-wide shortfall scenario, some agencies receive a cutback of up to 40% to their SFPUC supply, while some receive less than a 29% cutback).

Studies have estimated regional economic losses in the BAWSCA member agency service area of up to $7.7 billion per year during a 20% system-wide shortfall on the SF RWS. Supply cutbacks of this magnitude can also result in voluntary or mandatory restrictions for outdoor water uses and increased water rates and excess use charges. These impacts are anticipated to be compounded in the future 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.

Drought Impacts:

- Droughts occur 1 in every 10 years on the San Francisco Regional Water System
- Some BAWSCA agencies receive cutbacks of up to 40%
- Regional economic impacts up to $7.7B 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

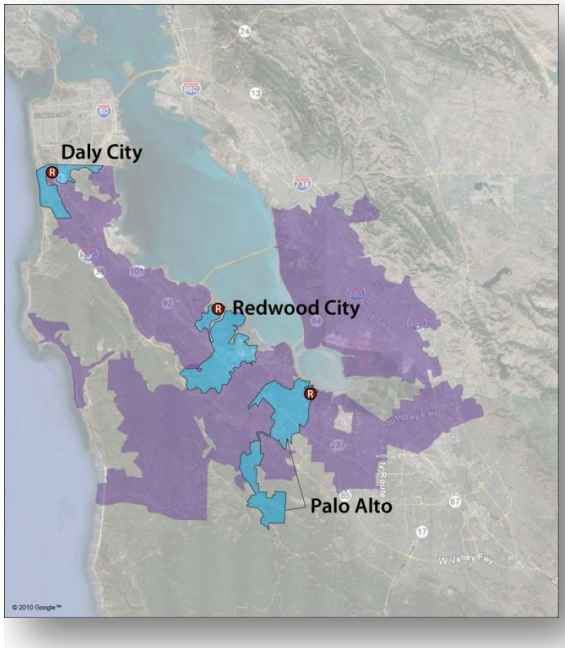
another community within the BAWSCA member agency service area or neighboring communities. Therefore, a future drought year water supply shortfall in one BAWSCA member agency that results in loss of jobs or other impacts can have a detrimental effect on the customers of another BAWSCA member agency, even if that agency itself is not facing a supply shortfall.

As a regional agency, it will be important for BAWSCA to have the necessary information (e.g., the cost of alternative water supplies and the economic impact of supply reductions) to consider the impacts of drought regionally when weighing the costs and benefits of investing in additional drought reliability.

ES.5 A Refined List of Water Supply Management Projects Was Preliminarily Evaluated

Over 65 projects were evaluated that could potentially be developed by BAWSCA and the BAWSCA member agencies to meet the identified supply needs through 2035. The project information developed to date has focused on preliminary estimates of the yield, cost, reliability, and implementation schedule. The objective has been to develop the information to a common level to the extent possible so that BAWSCA could begin to assess which individual project or combination of projects could best meet the supply need. Four types of projects have emerged with the most promise for addressing the supply need (i.e., recycled water, local capture and reuse, desalination, and water transfer projects). These projects, and a preliminary summary of their characteristics, are presented below and on the following page.

Recycled Water Projects



- Three (3) Projects: Daly City, Redwood City, Palo Alto
- Yield ~ 1,000 acre-feet per year (AF/Year)
- Schedule ~ 6 to 8 years

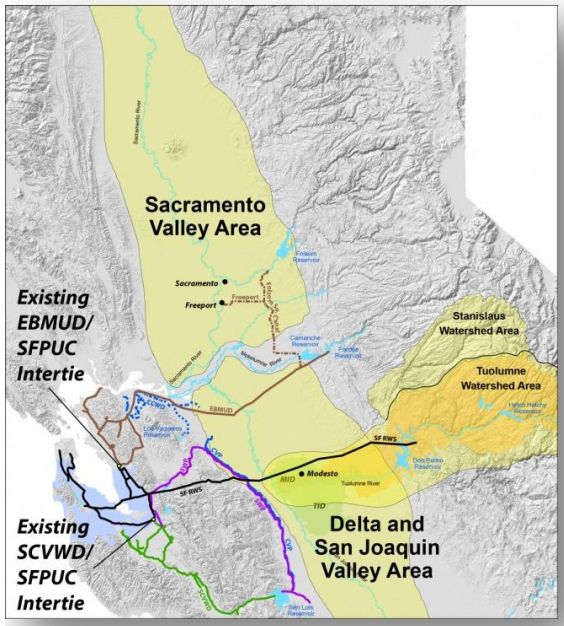
Local Capture & Reuse Projects

- Three (3) Projects: Rainwater, Stormwater, Greywater
- Yield ~ 200 to 700 AF/Year

Desalination Projects

- Nine (9) Projects: Coastal, Brackish Groundwater, Bay Water, Bay Area Regional Desalination Project (BARDP)
- Yield ~ 1,000 to 22,400 AF/Year
- Schedule ~ 6 to 15 years

Water Transfer Projects



- Two (2) Project Source Areas: Sacramento Valley, and Delta and San Joaquin Valley Areas
- Yield ~ 1,000 to more than 5,000 AF/Year
- Schedule ~ 2 to 5 years

ES.6 Criteria Have Been Developed to Evaluate the Projects

Both quantitative and qualitative criteria and metrics will be used to distinguish projects and portfolios and facilitate comparisons. The criteria objectives that have been developed are:

- Increase Supply Reliability;
- Provide High Level of Water Quality;
- Minimize Cost of New Water Supplies;
- Reduce Potable Water Demand;
- Minimize Environmental Impacts of New Water Supplies; and
- Increase Implementation Potential of New Water Supplies.

Once the project information has been sufficiently developed, the evaluation criteria would be used to compare projects and groups of projects (i.e., portfolios), in the ranking and evaluation step of the Strategy project evaluation and decision process.

ES.7 Critical Work is On-Going That Will Inform Final Strategy Recommendations

There is additional work currently being performed by other agencies. BAWSCA is coordinating closely with these agencies, as the results their efforts are expected to impact the the final Strategy recommendations and implementation plan. This work includes:

- East Bay Municipal Utility District (EBMUD) Conveyance Capacity Study;
- BAWSCA member agency project development studies;
- The Bay Area Regional Desalination Project (BARDP) studies;
- SFPUC/Modesto Irrigation District water transfer agreement(s);
- SFPUC system hydraulic modeling that incoporates 2002 through 2011 hydrology; and
- SFPUC Economic Analysis to support the Federal Energy Regulatory Commission (FERC) re-liscensing of New Don Pedro.

BAWSCA will continue to track and monitor these efforts and to work with the SFPUC and others to ensure that the full extent of potential impacts to the BAWSCA member agencies are identified. Results and findings from these efforts will be incorporated into the Final Strategy Report as appropriate.

ES.8 Recommendations for Board Action in September 2012

Three recommendations for the BAWSCA-led work efforts on the Strategy between now and December 2014 will be brought for action to the BAWSCA Board in September 2012:

Summary of Recommendations:

1. Complete the Reprogrammed Phase II A Work and Other Identified Work to Complete the Strategy
2. Develop a Plan for a Pilot Water Transfer with EBMUD and/or SCVWD
3. Update the Demand and Water Conservation Projections for BAWSCA Member Agencies Using a Common Methodology

Recommendation #1: Complete the Reprogrammed Phase II A Work and Other Identified Work to Complete the Strategy

To incorporate changed conditions (e.g., reduced demand and number of projects) and to present relevant solutions, the schedule, scope and focus of Phase II A were modified. To complete the Strategy, it is necessary to the complete the following tasks:

- Further refine project descriptions to: (1) incorporate the additional project information that is being developed by BAWSCA and others, and (2) include all of the information needed to compare the projects against the project evaluation criteria;
- Complete analysis of the economic impacts of drought;
- Compare the benefits of alternative projects and cost allocations;
- Compare alternative costs of increased drought reliability to avoided economic impact and determine level of service goal;

- Evaluate and rank the projects, or groups of projects, against the project evaluation criteria;
- Prepare the implementation plan for developing the recommended project, or groups of projects, to achieve the Strategy results; and
- Prepare Final Strategy Report by December 2014.

During the development of Phase II A, several outstanding issues were identified associated with many of the Strategy elements (e.g., the demand projections, project information, etc.) that are not otherwise captured in the reprogrammed Phase II A work. The key recommended actions that should be taken by BAWSCA to resolve these outstanding issues include:

- Monitor changes in water demand in service area, including the implementation of water conservation measures;
- Work with BAWSCA member agencies to identify level of service goals; and
- Track and monitor existing local capture and reuse projects to evaluate potential benefits and support for these projects.

The completion of both the reprogrammed Phase II A work and the recommended BAWSCA actions by December 2014 is critical to the development the Final Strategy Report and implementation plan.

Recommendation #2: Develop a Plan for a Pilot Water Transfer with EBMUD and/or SCVWD

Water transfers appear to be a promising option to address the identified drought year needs of the BAWSCA member agencies. However, there are a limited number of facilities that could be used to convey water to the BAWSCA member agencies from sources originating outside the Bay Area. Further, use of these facilities would require the resolution of several technical, legal and institutional issues. An efficient means to address these outstanding issues would be to conduct a pilot transfer of real water into the BAWSCA member agency service area. Additional reasons why the development of a Pilot Water Transfer Plan is recommended now are presented below:

- EBMUD and Santa Clara Valley Water District (SCVWD) have expressed an interest in potentially partnering with BAWSCA to enact a water transfer. Additional work would need to be done with these agencies to better assess the costs and feasibility of such transfers, including questions regarding water quality, system conveyance capacity constraints, and regulatory and permitting requirements.
- BAWSCA is in competition with other agencies for use of the available capacity in these other water systems. There may be a need for BAWSCA to act to secure (at a minimum) transfer capacity in a conveyance system, or risk losing that opportunity for good. Developing a Pilot Water Transfer Plan now would place BAWSCA in the best possible position to enact a water transfer as early as Fall 2013, and to make more informed decisions regarding water transfer options and conveyance capacity rights in the future.

Recommendation #3: Update the Demand and Water Conservation Projections for BAWSCA Member Agencies Using a Common Methodology

BAWSCA worked closely with its member agencies during Phase II A to combine the individual agency 2010 UWMP water demand and conservation projections for use at the regional level. However, given the inconsistencies in water demand and conservation projection methodologies, this

process may not be sufficient for regional planning purposes (i.e., as the basis for environmental documentation) or fully representative of the regional needs (i.e., may result in double-counting or exclusion of potential demands). Updating the water demand and conservation projections for the BAWSCA member agencies using a common methodology is recommended because:

- A more robust and consistent water demand and conservation projection methodology for the BAWSCA member agencies as a whole is necessary for effective planning at the regional level to support future local and regional investment decisions.
- Preparing updated water demand and conservation projections in advance of December 2014 will enable the agencies to use these demand estimates for their 2015 UWMPs and 20 by 2020 assessments. This will increase the level of consistency in regional planning among the BAWSCA member agencies and streamline their 2015 UWMP development process.

The adopted Fiscal Year (FY) 2012-13 BAWSCA Work Plan includes the selection of a water demand and conservation projection methodology and the development of a scope of work and budget to complete updated projections for all of the BAWSCA member agencies. It is anticipated that BAWSCA would present this information to the BAWSCA Board in Spring 2013, possibly as part of the FY 2013-14 budget process, and recommended that the Board act to fund the development of water demand and conservation projections for the BAWSCA member agencies using a common methodology.

ES.9 Potential Longer-Term Actions

Depending on the results of the work completed between now and 2014, additional recommendations for action may be presented to the Board. These recommendations for action could potentially include:

- ***Implement the pilot water transfer plan***. In order to fully test BAWSCA's ability (both physically and institutionally) to import water to serve the member agencies during a drought, BAWSCA would need to, at a minimum, enact a pilot water transfer. Such a transfer would be based on the Pilot Water Transfer Plan and could occur as early as Fall 2013.
- ***Pursue long-term water transfer supplies and/or conveyance agreement***. The Strategy analysis to date indicates that water transfers could be a viable option for meeting the long-term dry year water supply needs of the BAWSCA member agencies. Based on the information learned from the execution of a pilot water transfer, BAWSCA may recommend that the BAWSCA Board act to secure transfer capacity and/or transfer water.
- ***Conduct project-specific field investigations.*** While review of the available data and analytical and numerical modeling can provide some level of certainty regarding a project's characteristics, field investigations and testing are likely to be necessary to confirm key project elements. For example, in the case of the desalination projects, additional field investigations would be needed to verify subsurface yields, water

Potential Long-Term Actions:

1. Implement the pilot water transfer plan
2. Pursue long-term water transfer supplies and/or conveyance agreement
3. Conduct project-specific field investigations

quality, potential impacts on other groundwater users, and project costs. If there is strong interest expressed by the BAWCSA Board or the member agencies to pursue development one of the identified projects, BAWSCA may recommend that the BAWSCA Board act to authorize additional, project-specific investigations.

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Section 1
Introduction

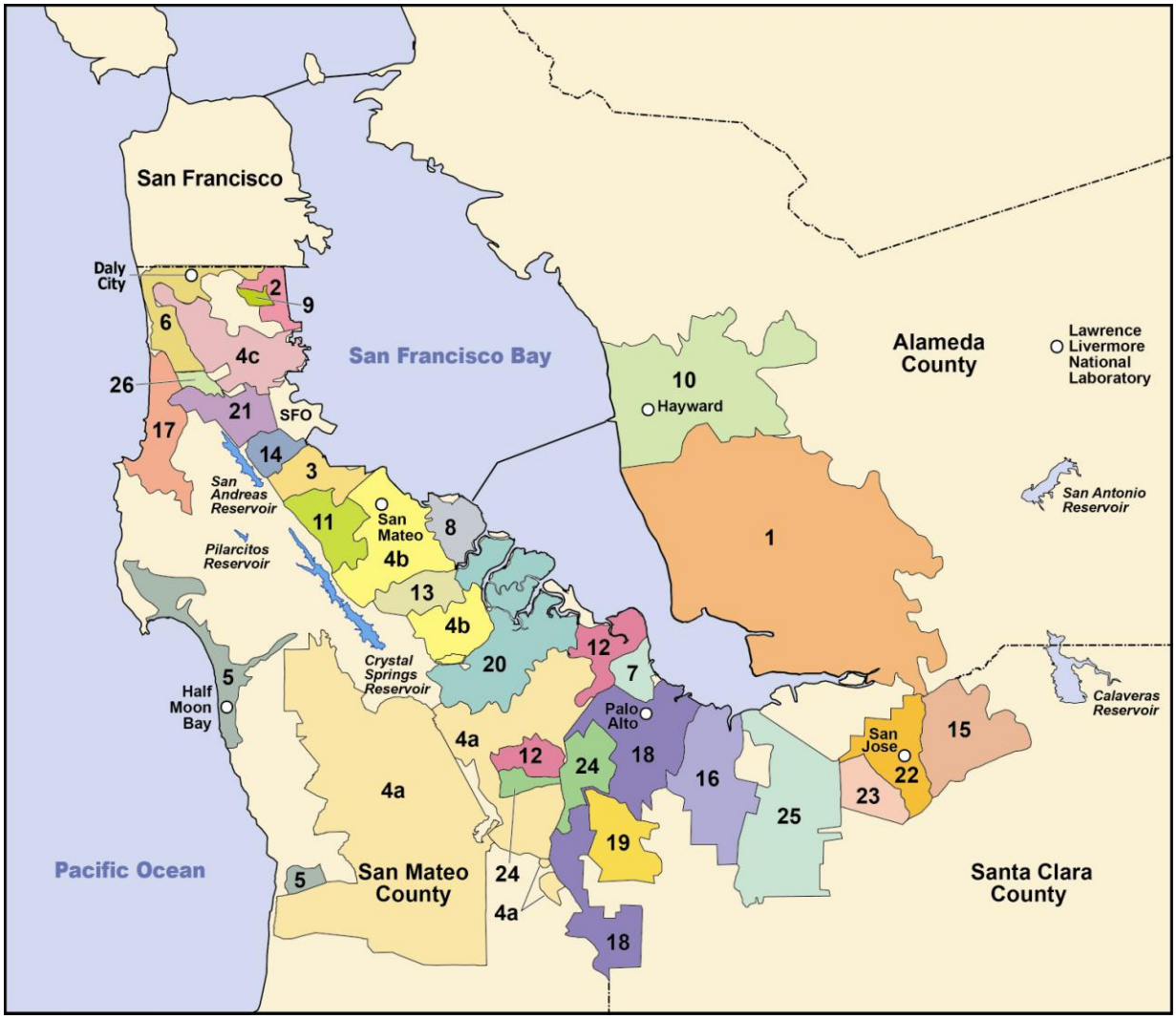
1.1 Strategy Overview

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 service area need it. The purpose of BAWSCA's Long-Term Reliable Water Supply Strategy (Strategy) is to quantify the water supply need of the BAWSCA member agencies through 2035, identify the water supply management projects (projects) that could be developed to meet that need, and prepare the implementation plan for the Strategy. Successful implementation of the Strategy is critical to ensuring that there will be sufficient and reliable water supplies for the BAWSCA member agencies and their customers in the future. Figure 1-1 indicates the service areas for the 26 BAWSCA member agencies.

1.2 Strategy Initiated to Address Key Water Supply Issues

At the request of the BAWSCA Board of Direectors (Board) and its member agencies, BAWSCA initiated work on the Strategy in 2009 in response to the following circumstances:

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 supply would be needed to meet projected normal and drought year demands, even after accounting for aggressive conservation.
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% level of service goal for the SF RWS. Based on the rules for drought allocation between SFPUC and the Wholesale Customers that are documented in the 2009 Water Supply Agreement (WSA), this results in up to a 29% cutback to the BAWSCA member agencies during droughts. This has an estimated economic impact of up to $7.7 billion per year in the BAWSCA member service area.
4. The reliability of the SFPUC supply could also be impacted 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.



Sources: BAWSCA, San Mateo County General Plan

Legend

1 Alameda County Water District	**13** Mid-Peninsula Water District
2 City of Brisbane	**14** City of Millbrae
3 City of Burlingame	**15** City of Milpitas
4a CWS – Bear Gulch	**16** City of Mountain View
4b CWS – Mid-Peninsula	**17** North Coast County Water District
4c CWS – South San Francisco	**18** City of Palo Alto
5 Coastside County Water District	**19** Purissima Hills Water District
6 City of Daly City	**20** City of Redwood City
7 City of East Palo Alto	**21** City of San Bruno
8 Estero Municipal Improvement District	**22** San Jose Municipal Water System
9 Guadalupe Valley MID	**23** City of Santa Clara
10 City of Hayward	**24** Stanford University
11 Town of Hillsborough	**25** City of Sunnyvale
12 City of Menlo Park	**26** Westborough Water District

Figure 1-1
BAWSCA Member Agency Service Area Map

1.3 Strategy Developed Based on Guiding Principles

Based on discussions with the BAWSCA Board and the member agency representatives, five principles were identified that inform the development of the Strategy:

1. The Strategy must add value to BAWSCA member agency customers.
2. The Strategy must provide certainty for future planning and development.
3. The Strategy must not result in the uncompensated or involuntary reallocation of BAWSCA member agency assets.
4. The Strategy must be consistent with the water transfer provisions of the 2009 WSA between the City and County of San Francisco and the Wholesale Customers.
5. The projects that are developed as part of the Strategy will be paid for based upon cost allocation methods that will be agreed upon by the BAWSCA Board.

At each stage of the Strategy development, and as part of each decision making process, the efforts and results are tested against the above principles to ensure that the Strategy is developed and implemented in a manner that is consistent with these principles.

1.4 Strategy Developed in Phases

The Strategy is being developed in phases to provide BAWSCA and the BAWSCA Board the opportunity to confirm the direction of the Strategy at key decision points, and redirect (reprogram) these efforts as appropriate to ensure that the goals of the Strategy are met. Figure 1-2 presents the general phasing of the Strategy development and implementation.

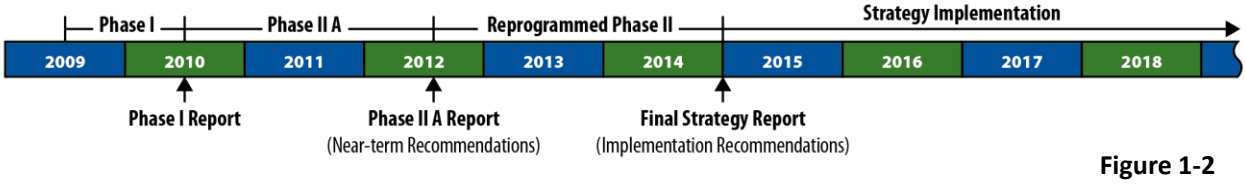


Figure 1-2
The Strategy Development is Phased to Ensure that the Desired Results will be Achieved

Phase I of the Strategy was completed in May 2010. The *Phase I Scoping Report* identified the range of anticipated demands and supply needs for the BAWSCA member agencies, described over 65 different projects that could potentially be developed in some combination to meet the identified needs, and provided the framework to evaluate those projects in Phase II A (i.e., the current phase) of the Strategy.

Phase II A of the Strategy is now complete and the results of this effort are documented herein. This Phase II A Report presents updated water demands and supply needs, provides detailed information on the refined list of projects that could potentially be developed to address those needs, and presents recommendations for key future efforts, including the proposed scope and schedule to complete the Strategy by late 2014. The recommendations for key future Strategy efforts will be presented to the BAWSCA Board in July 2012 and the recommended actions reviewed with the BAWSCA Board in September 2012 for anticipated action.

The Final Strategy Report is scheduled for completion by December 2014. This report will incorporate the results of the additional work performed and present the recommended Strategy and associated Strategy implementation plan (i.e., who will do what by when).

1.5 Development Managed to Adapt to Changed Conditions and Use Resources Efficiently

The Strategy is not being developed in a vacuum, but rather in the context of changing circumstances, many of which have impacts on the Strategy's results and recommendations. For example, as the Phase II A work progressed, significant changes in the projected demand, normal and drought year supply need, and number and types of projects were identified. To incorporate these changed conditions, and to provide solutions that remain relevant and cost effective, the schedule, scope, and focus of the Strategy was modified to efficiently use the available resources to the maximum benefit of the BAWSCA member agencies. These Strategy modifications were communicated to the BAWSCA Board and the member agencies over the course of Phase II A of the Strategy. The scope and content of the Phase II A Report reflects the adaptive nature of the Strategy, as do the resultant recommendations for specific future work associated with completing the Strategy.

1.6 Report Structure

This report presents a summary of the technical information that was developed during Phase II A of the Strategy, as well as specific recommendations for future BAWSCA actions to address the outstanding issues. The information contained in this report relies heavily on the work performed as part of Phase II A and documented in the Phase II A technical memoranda (*Attachments 1 through 5* to this report). These technical memoranda should be referenced for more detailed information related to each section of this report.

The remainder of this Phase II A Report consists of the following:

- *Section 2 – Water Supply and Demand Projections* presents the updated demands and the timing and magnitude of the projected water supply needs within the BAWSCA member agency service area.
- *Section 3 – Estimated Impacts of Supply Shortfalls* summarizes the information available on economic impacts of supply shortfalls within the BAWSCA service area and the frequency and magnitude of the projected shortfalls.
- *Section 4 – Agency-Identified Water Supply Management Projects* summarizes the agency-identified projects screened from the initial list presented in the *Phase I Scoping Report* and the information developed for the evaluation of these projects.
- *Section 5 – Regional Water Supply Management Projects* summarizes the regional projects identified in the *Phase I Scoping Report* and the information developed for the evaluation of these projects.
- *Section 6 – Overview of Project Evaluation Criteria* summarizes the proposed evaluation criteria and metrics that will be used in the evaluation and ranking of these projects.
- *Section 7 – Summary of Phase II A Results* summarizes the 2035 water supply need, the water supply management projects being evaluated as part of the Strategy, and the critical work being

performed by other agencies that impact the Strategy, and presents a discussion of the specific actions taken by BAWSCA to adaptively manage the development of the Strategy.

- *Section 8 – Recommendations* presents the recommended near-term actions, including the development of a consistent demand projection methodology, the development of Pilot Water Management Agreements/Water Transfer Plans with other water agencies, and the completion of select activities necessary to complete the Strategy by late 2014.
- *Section 9 – References* presents documents referenced in this *Phase II A Final Report* and *Attachments.*
- *Attachment 1 – Updated Water Demand and Supply Need Projections for the Long-Term Reliable Water Supply Strategy; Phase II A Task 1 Technical Memorandum.*
- *Attachment 2 – Updated Agency-Identified Water Supply Management Project Information for the Long-Term Reliable Water Supply Strategy; Phase II A Task 2 Technical Memorandum*.
- *Attachment 3 – Updated Regional Water Supply Management Project Information for the Long-Term Reliable Water Supply Strategy; Phase II A Task 3 Technical Memorandum*.
- *Attachment 4 – Summary of SFPUC HH/LSM Modeling to Assess Magnitude and Timing of Drought on the SF RWS (Task 6-B Memo)*
- *Attachment 5 – Status of Phase II A Scope Elements and Recommended Additional Work.*

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Section 2
Water Supply and Demand Projections

A key objective of the Strategy is to update the water supply need of the BAWSCA member agencies through 2035 for normal and drought years. The supply need estimates are based on the differences between the projected water demands of the BAWSCA member agencies and their anticipated use of available water supplies. The information presented in this section is based on new data collected in 2011 from the BAWSCA member agencies, and addresses the future planning years of 2015, 2018, 2020, 2025, 2030, and 2035. The analysis shows that, even after accounting for the savings associated with the existing and planned water conservation activities, water demands within the BAWSCA service area are projected to exceed available supplies in future normal and drought years. Key results presented in this section are:

- Since the BAWSCA member agencies are only projecting to purchase 171.8 mgd from the SF RWS in 2018, the immediate concern of San Francisco imposing a supply limitation on the BAWSCA member agencies in 2018 has been eliminated;
- The projected water supply need in 2035 in normal years is small (i.e., 4 mgd to 13 mgd) and localized to a small number of BAWSCA member agencies; and
- The projected drought water supply need remains significant (i.e., up to 62 mgd) and regional, with impacts to all of the BAWSCA member agencies.

Additional detailed information on the demand projections and drought allocation calculations is provided in *Attachment 1*.

2.1 Continued Population Growth is Projected for the BAWSCA Service Area

The total population of the BAWSCA member agency service areas increased by 24% (from 1.4 million people to 1.7 million people) between 1985 and 2010. This equates to an average increase of 1% (13,000 people) per year. As shown in Figure 2-1, based on the information presented in the agencies' 2010 UWMPs, the total population of the BAWSCA member agency service areas is projected to increase to 1.8 million people by 2015 and 2.1 million people by 2035, an increase of 24% over 25 years, or also about 1% per year. As the population increases, the associated employment, and water demands are expected to increase as well.

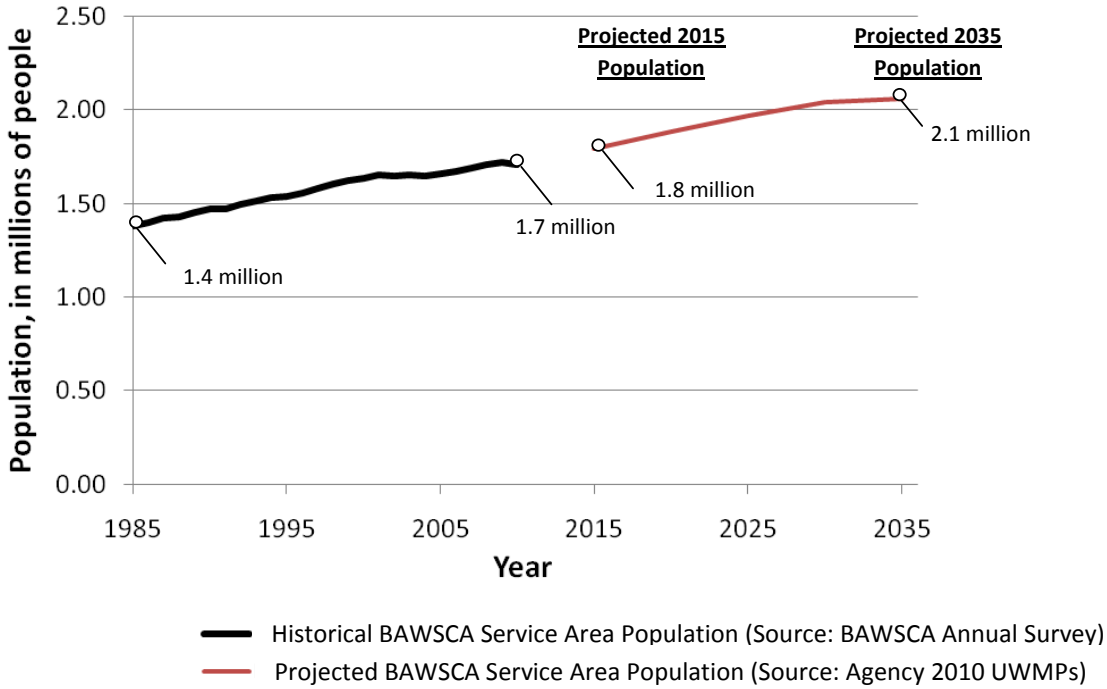


Figure 2-1
Population in the BAWSCA Service Area is Projected to Increase by an Average of 1% per Year From 2010 to 2035

2.2 Continued Investment in Water Conservation Needed to Achieve the Projected 2035 Savings

Water conservation remains a priority for BAWSCA and its member agencies. Successful implementation of water conservation measures provides reductions in water demand in both normal and drought years. The potential savings from conservation will vary by measure and member agency, as well as factors such as population growth and customer participation rate. Several efforts have been initiated in recent years to estimate the potential water conservation savings throughout the BAWSCA service area and to develop aggressive water conservation plans. These include:

- Program Environmental Impact Report (PEIR) for the San Francisco Public Utilities Commission's Water System Improvement Program (WSIP);
- BAWSCA's Water Conservation Implementation Plan (WCIP); and
- BAWSCA member agencies' 2010 UWMPs and 20 by 2020 assessments[1].

[1] Pursuant to Senate Bill (SB) SB 7X-7, the State will have to reduce per capita water use by at least 10% no later than December 31, 2015, and by 20% by no later than December 31, 2020. These water use reductions will be compared against a 10- to 15-year baseline period that ends between 2004 and 2010. The legislation will not require individual urban water suppliers to reduce per capita water usage by more than 20%; however, each supplier will have to reduce per capita daily water use by at least 5%, unless their water use is less than 100 gallons per capita per day (gpcd). Urban water suppliers will have to meet their own, specified water use targets, which can be established on an individual or regional basis, using one of four methods. The quantification of what conservation savings agencies need to achieve to comply with SB 7X-7 is presented in individual agency 2010 UWMPs.

The projected water conservation savings between now and 2035 are comprised of the following:

- Plumbing code savings (denoted as "passive conservation"). Per the WCIP (Maddaus 2009), passive conservation is expected to result in as much as 32 mgd in water savings by 2035; and
- Savings based on the continuous implementation of water conservation measures within the member agency service areas (denoted as "active conservation"). Based on the WCIP (2009) and the member agency UWMPs, active conservation is expected to result in between 16 mgd and 24 mgd of water savings by 2035. Achieving these estimated savings requires a continued level of funding and implementation by the agencies each year through 2035.

For the purposes of this assessment, passive conservation has been subtracted from the future demand projections, while active conservation is considered to be a source of supply.

2.3 Water Demands in the BAWSCA Service Area are Projected to Increase

Coincident with the agencies' preparations of their respective 2010 UWMPs, BAWSCA worked with its member agencies to update their projected future water demands. As can be seen in Figure 2-2, after accounting for passive conservation, the BAWSCA agencies are projecting to use 272 mgd in 2018 and 315 mgd in 2035 to meet customer water demands. This projected future demand is significantly lower than the demands that were projected in the agencies' 2005 UWMPs and in the *Phase I Scoping Report,* and reflects historic low water use throughout the service area in the last several years and the most recent forecasts for population growth and economic recovery in the Bay Area.

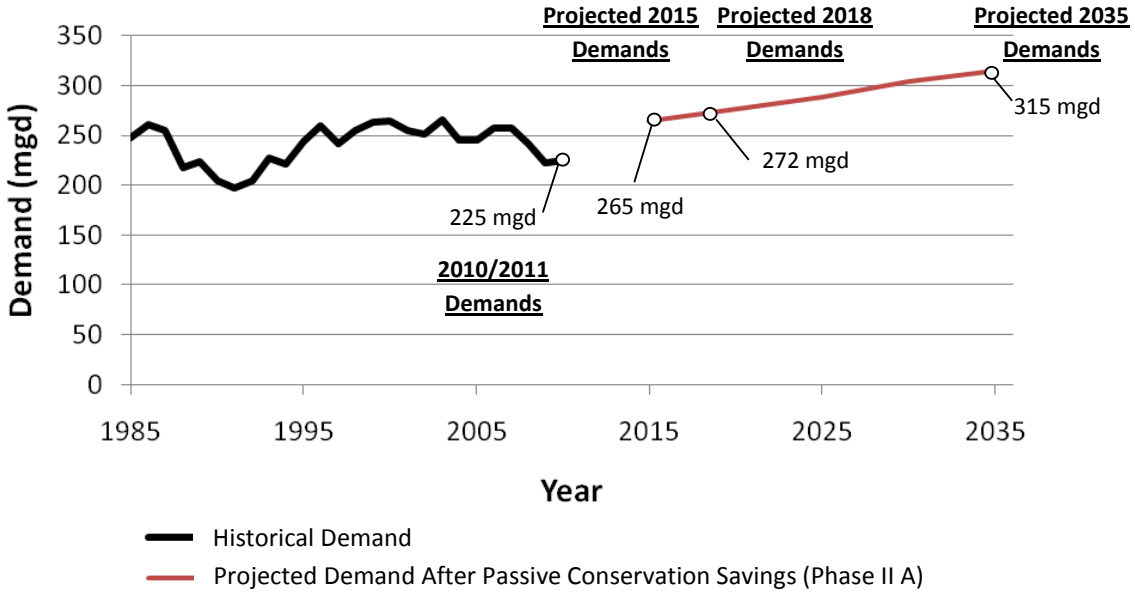


Figure 2-2
Planned Population and Economic Growth Results in Water Demand Increases in the BAWSCA Service Area

2.4 Greater Supply Diversity is Projected for the BAWSCA Service Area in Future Normal Years

The anticipated BAWSCA service area supply mix for 2035 under normal year conditions is presented in Figure 2-3. Anticipated SFPUC purchases range from 177 mgd to 186 mgd, or 55% to 57% of the total anticipated supply mix. This represents a reduction from the historical percentage of SFPUC supply in the overall supply portfolio of the BAWSCA member agencies, with a greater percentage of future water supply needs anticipated to be met with non-SFPUC supplies. The lower end of the range of projected purchases from SFPUC is associated with a potential future decision by San Francisco to not provide 9 mgd of permanent supply to the Cities of Santa Clara and San Jose, whose contracts with the City and County of San Francisco are temporary and interruptible. Additional sources of supply used by the BAWSCA member agencies include groundwater, desalination water, local surface water, recycled water, State Water Project (SWP) water, and supply purchased from the Santa Clara Valley Water District (SCVWD). In addition, 16 mgd of water savings achieved through active conservation is considered to be a source of supply for the purposes of this report. In total, these non-SFPUC supplies account for about 40% of the total anticipated supply mix.

Included in Figure 2-3 is the "Not Yet Determined" category that represents the difference between the total individual agency demands and their projected use of available supplies. The upper end of the "Not Yet Determined" range is associated with a potential future decision by San Francisco to not provide 9 mgd of permanent supply to the Cities of Santa Clara and San Jose.

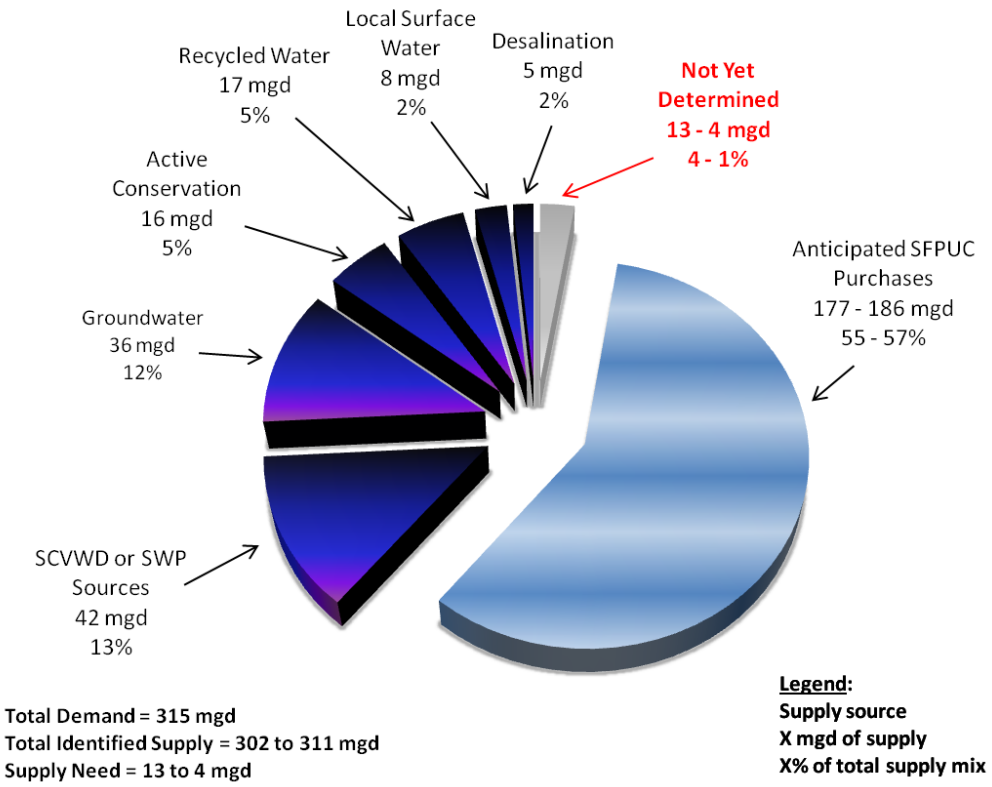


Figure 2-3
More Water Supply is Needed Even in Normal Years Despite BAWSCA Agencies Continued Investment in Alternative Supplies (2035)

Table 2-1 presents the anticipated use of available supplies by the BAWSCA member agencies for 2015 through 2035, under normal year conditions. The "Anticipated SFPUC Purchases" were estimated by each BAWSCA member agency in accordance with the WSA and based on assumptions regarding the availability of other supplies. Specifically, each agency's Anticipated SFPUC Purchases were limited to no more than that agency's Individual Supply Guarantee (ISG), which is each agency's share of the 184 mgd perpetual Supply Assurance from San Francisco. While the WSA allows for the permanent transfer of ISGs between BAWSCA member agencies, no such transfers have occurred to date and the Strategy does not make any assumptions regarding these transfers occurring in the future. As such, while the lower end of the total Anticipated SFPUC Purchases (177.1 mgd in 2035) is projected to be below the collective 184 mgd Supply Assurance, some individual BAWSCA member agencies have a demand exceeding their individual ISGs (and other available supplies). Therefore, these agencies are assumed to have a need for a "Not Yet Determined" source of supply.

Table 2-1 – Aggregate BAWSCA Member Agency Anticipated Use of Available Supplies Under Normal Conditions Show Increased Investments in Non-SFPUC Supplies (mgd)

	2015	2018	2020	2025	2030	2035
Anticipated SFPUC Purchases[1]	170.9	171.8	161.8 - 170.8	166.6 - 175.6	172.7 - 181.7	177.1 - 186.1
Groundwater	24.4	26.0	26.9	29.9	33.7	36.4
Surface Water	7.6	7.6	7.7	7.7	7.8	7.9
Recycled Water	12.9	13.8	14.8	15.8	16.5	17.1
Desalination	5.0	5.0	5.0	5.0	5.0	5.0
SCVWD or SWP Sources	34.5	35.0	35.5	37.6	40.4	42.2
Active Conservation[2]	7.5	11.2	14.1	15.1	15.8	16.2
Not Yet Determined[3]	*2.0*	*1.9*	*2.0 - 11.0*	*2.4 - 11.4*	*2.9 - 11.9*	*4.3 - 13.3*
Total Anticipated Supply Use[4]	**264.8**	**272.3**	**276.7**	**289.0**	**303.8**	**315.2**

Source Data: Agency Demand & Supply Worksheets, 2011

[1] The lower end of the range in Anticipated SFPUC Purchases is associated with a potential future decision by San Francisco to not provide 9 mgd of permanent supply to the Cities of Santa Clara and San Jose, whose contracts with the City and County of San Francisco are temporary and interruptible. For conservative planning purposes the Strategy assumes that San Francisco could make this decision as early as 2018.

[2] "Active Conservation" represents the savings associated with active conservation measures that a member agency plans on implementing and is considered herein to be a supply source. Some agencies took a different approach in their 2010 UWMPs and counted both passive and active conservation as demand reductions. Active Conservation includes the conservation that agencies plan to implement to meet their SB 7X-7 targets.

[3] "Not Yet Determined" is the category of supply that represents the total of individual agency demands that exceed their projected use of SFPUC and other supplies. This value assumes no permanent inter-agency transfers of ISGs or use of SFPUC supply in excess of an agency's ISG.

[4] "Total Anticipated Supply Use" is the sum of all anticipated use of supplies, including the "Not Yet Determined" supply.

Based on the BAWSCA member agency projections, the use of some supplies, such as local surface water and desalination, is anticipated to remain constant or increase only slightly by 2035. In contrast, by 2035 the uses of groundwater and SCVWD/SWP sources are projected to increase by as much as 12 mgd and 8 mgd, respectively, and savings from active conservation is expected to double. The amount of supply from a source "Not Yet Determined" that is needed to meet the projected demands is projected to increase from 2 mgd in 2015 to between 4 mgd and 13 mgd in 2035.

2.5 The SFPUC Supply Reliability Remains Uncertain

The water supplies currently available to the BAWSCA member agencies are limited and their reliability is affected by several factors including policy decisions, hydrologic conditions, regulatory actions, and climate change. Although the above issues may affect many of their current supply sources, and may increase the total regional supply need during future normal and drought years, the Strategy focuses only on the impacts of these issues to the SFPUC supply reliability. At this time, based on conversations with member agencies and the SCVWD, it is assumed that any reductions in non-SFPUC supplies will be addressed by the individual BAWSCA member agencies, or the other regional water suppliers (e.g., SCVWD).

Issues that may affect the quantity and reliability of SFPUC supplies include, but are not limited to, the following:

- **SFPUC Policy Decisions** - As part of the Phased Water Supply Improvement Program Variant, SFPUC made the unilateral decision to limit the water supply available from the SF RWS to the BAWSCA member agencies to 184 mgd until at least 2018. By 2018, the SFPUC will re-evaluate water demands in the service area through 2030 and assess whether or not to increase deliveries from the SF RWS after 2018. The SFPUC may also make a decision at that time regarding the status of the Santa Clara and San Jose contracts. For the purposes of the Strategy, BAWSCA has assumed that deliveries from the SF RWS to the BAWSCA member agencies will continue to be limited to the 184 mgd Supply Assurance in the future and that the SFPUC may decide to not make San Jose and Santa Clara permanent customers (i.e., to not meet their 9 mgd purchase projections).

- **Hydrologic Conditions** - The WSA commits the SFPUC to meeting a Level of Service Goal for drought reliability of no more than a 20% system-wide reduction in any given year and presents the Wholesale Customer share of the SFPUC supply under different drought conditions. Future climate changes may further impact the available SF RWS water supply, and the supply available to the BAWSCA member agencies, by increasing the frequency and/or magnitude of droughts.

- **Regulatory Actions** - The Federal Energy Regulatory Commission (FERC) is in the process of evaluating the relicensing of Don Pedro Reservoir. The result of this process could include additional instream flow requirements for fishery restoration purposes, and a potential reduction to SFPUC supplies, particularly during droughts. For example, based on SFPUC's current drought supply forecasting protocols, the 2009 proposed instream flow requirements could require a reduction in SF RWS drought year deliveries by as much as 53% (Federal Energy and Regulatory Commission 2009).

  In addition, increased flow releases below Calaveras Dam and Crystal Springs Dam to benefit downstream fishery resources are being required by the resource agencies. SFPUC has identified an impact on the dry year yield of the SF RWS which has not yet been resolved.

  Changes to the California State Water Resources Control Board (State Board) plan for the Sacramento-San Joaquin Delta (Delta), which increases unimpaired flows from the Tuolumne watershed, and the State Board development of flow criteria for the Delta ecosystem as part of the Sacramento-San Joaquin Delta Reform Act of 2009 could also affect the yield of the SF RWS.

Potential impacts of these issues on SFPUC supply reliability are difficult to assess because, in most cases, studies are ongoing and there is still much uncertainty. For example, scientists researching climate change are nearing a general consensus on long-term forecasts of regional temperature rise and rainfall changes, but more research is needed to estimate the ultimate impact on local water supplies due to potential adaptations in water system operations and management. It remains essential to continue to track these issues and to include the necessary uncertainty considerations in long-term water supply planning.

2.6 Supply Diversity Also Benefits the BAWSCA Service Area in Future Drought Years

Consistent with the current SF RWS level of service goals, the SFPUC supply available to the BAWSCA member agencies during a drought was estimated for both a 10% and 20% system-wide water supply shortfall. The Strategy does not address future drought year supply shortfalls for the non-SFPUC supplies on which the member agencies rely, such as groundwater, local sources, or imported surface water. As such, the use of these non-SFPUC supplies is assumed to remain constant regardless of year type. As stated above, it is assumed that any reductions in the non-SFPUC supplies will be addressed by the individual BAWSCA member agencies or the other regional supply agencies (e.g., SCVWD).

The 2009 WSA between San Francisco and its Wholesale Customers includes a Water Shortage Allocation Plan to allocate water from the SF RWS to the retail and Wholesale Customers during system-wide shortages of 20% or less (the Tier 1 Plan). Under the rules of the Tier 1 Plan, a 10% system-wide reduction in 2035 results in an 18% average reduction to the BAWSCA agencies and a 20% system-wide reduction results in a 29% average reduction to the BAWSCA agencies. The provisions of the Tier 1 Plan allow the Wholesale Customers to "bank" drought allocations and to voluntarily transfer the allocations to each other and San Francisco. The Tier 1 Plan also presents an updated schedule for actions preceding and during a drought.

The Tier 2 Drought Implementation Plan (Tier 2 Plan or "DRIP"), which was adopted by all 26 BAWSCA member agencies in March 2011, allocates the collective Wholesale Customer share among each of the 26 BAWSCA member agencies. Under the rules of the Tier 2 Plan, the range of cutback varies for each BAWSCA member agency (i.e., some agencies receive greater than a 29% cutback to their SFPUC supplies in 2035, while some receive less than a 29% cutback). The current Tier 2 Plan has a sunset date of 2018, but is assumed to extend through 2035 for the purposes of this assessment. The Tier 1 and Tier 2 Plans apply only during times of drought shortages.

Table 2-2 presents the data for the aggregated use of available supplies by the BAWSCA member agencies for 2015 through 2035 assuming a 10% system-wide shortfall on the SF RWS. Figure 2-4 presents the projected 2035 supply mix assuming a 10% system-wide supply reduction in the SF RWS as a pie chart. Table 2-3 presents similar data for the period 2015 through 2035 assuming a 20% system-wide shortfall on the SF RWS with Figure 2-5 providing a graphical representation of the projected supply mix during a 20% system-wide reduction in 2035. The difference between Figures 2-4 and 2-5 is a 20 mgd reduction in the anticipated purchases from SFPUC, based on the reduced supply availability under a 20% system-wide shortfall scenario. Under both the 10% and 20% system-wide reduction in SF RWS supply, the data indicates a significant need for additional water supplies during a drought to meet customer needs reliably. In Tables 2-2 and 2-3, each agency's Anticipated SFPUC Purchases were limited to no greater than that agency's drought allocation. While the WSA allows for the transfer of drought allocations between BAWSCA member agencies, no such transfers

have occurred to date and the Strategy does not make any assumptions regarding these transfers occurring in the future.

Table 2-2 – A Diverse Water Supply Portfolio Will Benefit the BAWSCA Member Agencies During a 10% Supply Shortfall on the SF RWS, but Will Not Meet all of the Identified Need (mgd)

Supply Type	2015	2018	2020	2025	2030	2035
Anticipated SFPUC Purchases[1]	143.7	143.7	137.4 - 142.6	139.9 - 145.0	143.9 - 149.1	147.4 - 152.5
Groundwater	24.4	26.0	26.9	29.9	33.7	36.4
Surface Water	7.6	7.6	7.7	7.7	7.8	7.9
Recycled Water	12.9	13.8	14.8	15.8	16.5	17.1
Desalination	5.0	5.0	5.0	5.0	5.0	5.0
SCVWD or SWP Sources	34.5	35.0	35.5	37.6	40.4	42.2
Active Conservation[2]	7.5	11.2	14.1	15.1	15.8	16.2
Not Yet Determined[3]	*29.2*	*29.9*	*30.3 - 35.4*	*32.9 - 38.1*	*35.5 - 40.7*	*37.8 - 43.0*
Total Anticipated Supply Use[4]	**264.8**	**272.3**	**276.7**	**289.0**	**303.8**	**315.2**

Source Data: Agency Submitted Demand & Supply Worksheets, 2011

[1] The lower end of the range in Anticipated SFPUC Purchases is associated with a potential future decision by San Francisco to not provide 9 mgd of permanent supply to the Cities of Santa Clara and San Jose, whose contracts with the City and County of San Francisco are temporary and interruptible. For conservative planning purposes the Strategy assumes that San Francisco could make this decision as early as 2018.

[2] "Active Conservation" represents the savings associated with active conservation measures that a member agency plans on implementing and is considered herein to be a supply source. Some agencies took a different approach in their 2010 UWMPs and counted both passive and active conservation as demand reductions. Active Conservation includes the conservation that agencies plan to implement to meet their SB 7X-7 targets.

[3] "Not Yet Determined" is the category of supply that represents the total of individual agency demands that exceed their projected use of SFPUC and other supplies. This value assumes no permanent inter-agency transfers of ISGs or use of SFPUC supply in excess of an agency's ISG.

[4] "Total Anticipated Supply Use" is the sum of all anticipated use of supplies, including the "Not Yet Determined" supply category.

Table 2-3 – A Diverse Water Supply Portfolio Will Benefit the BAWSCA Member Agencies During a 20% Supply Shortfall on the SF RWS, but Will Not Meet all of the Identified Need (mgd)

Supply Type	2015	2018	2020	2025	2030	2035
Anticipated SFPUC Purchases[1]	124.8	124.7	119.2 - 123.7	121.4 - 125.9	124.9 - 129.4	127.9 - 132.4
Groundwater	24.4	26.0	26.9	29.9	33.7	36.4
Surface Water	7.6	7.6	7.7	7.7	7.8	7.9
Recycled Water	12.9	13.8	14.8	15.8	16.5	17.1
Desalination	5.0	5.0	5.0	5.0	5.0	5.0
SCVWD or SWP Sources	34.5	35.0	35.5	37.6	40.4	42.2
Active Conservation[2]	7.5	11.2	14.1	15.1	15.8	16.2
Not Yet Determined[3]	*48.2*	*48.9*	*49.1 - 53.6*	*52.1 - 56.6*	*55.2 - 59.7*	*58.0 - 62.5*
Total Anticipated Supply Use[4]	**264.8**	**272.3**	**276.7**	**289.0**	**303.8**	**315.2**

Source Data: Agency Submitted Demand & Supply Worksheets, 2011

[1] The lower end of the range in Anticipated SFPUC Purchases is associated with a potential future decision by San Francisco to not provide 9 mgd of permanent supply to the Cities of Santa Clara and San Jose, whose contracts with the City and County of San Francisco are temporary and interruptible. For conservative planning purposes the Strategy assumes that San Francisco could make this decision as early as 2018.

[2] "Active Conservation" represents the savings associated with active conservation measures that a member agency plans on implementing and is considered herein to be a supply source. Some agencies took a different approach in their 2010 UWMPs and counted both passive and active conservation as demand reductions. Active Conservation includes the conservation that agencies plan to implement to meet their SB 7X-7 targets.

[3] "Not Yet Determined" is the category of supply that represents the total of individual agency demands that exceed their projected use of SFPUC and other supplies. This value assumes no permanent inter-agency transfers of ISGs or use of SFPUC supply in excess of an agency's ISG.

[4] "Total Anticipated Supply Use" is the sum of all anticipated use of supplies, including the "Not Yet Determined" supply category.

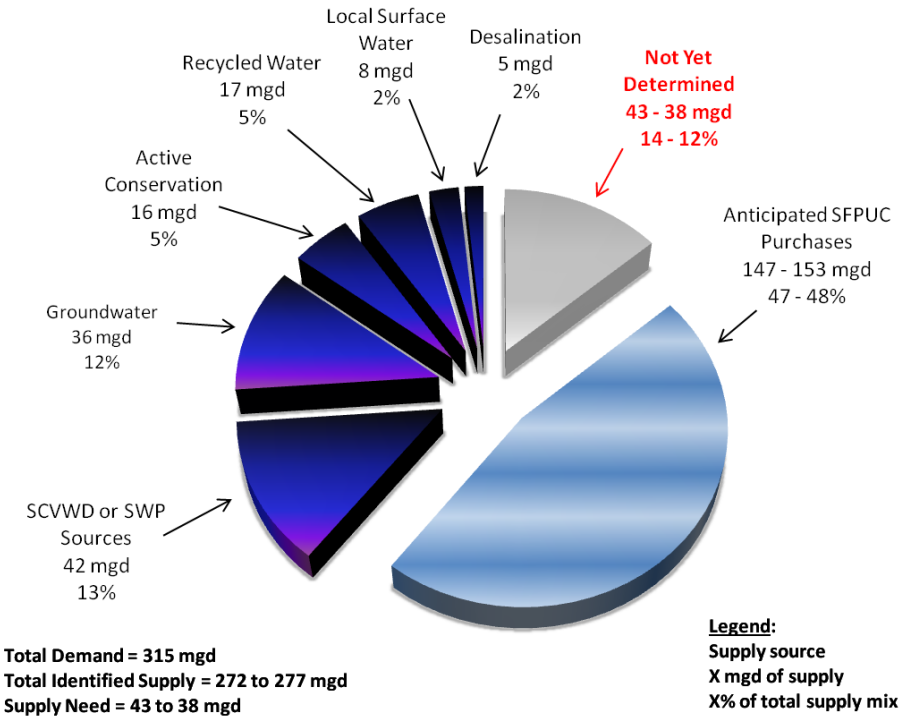


Figure 2-4
A Diverse Water Supply Portfolio Will Benefit the BAWSCA Member Agencies During a 10% Supply Shortfall on the SF RWS, but Will Not Meet all of the Identified Need (2035)

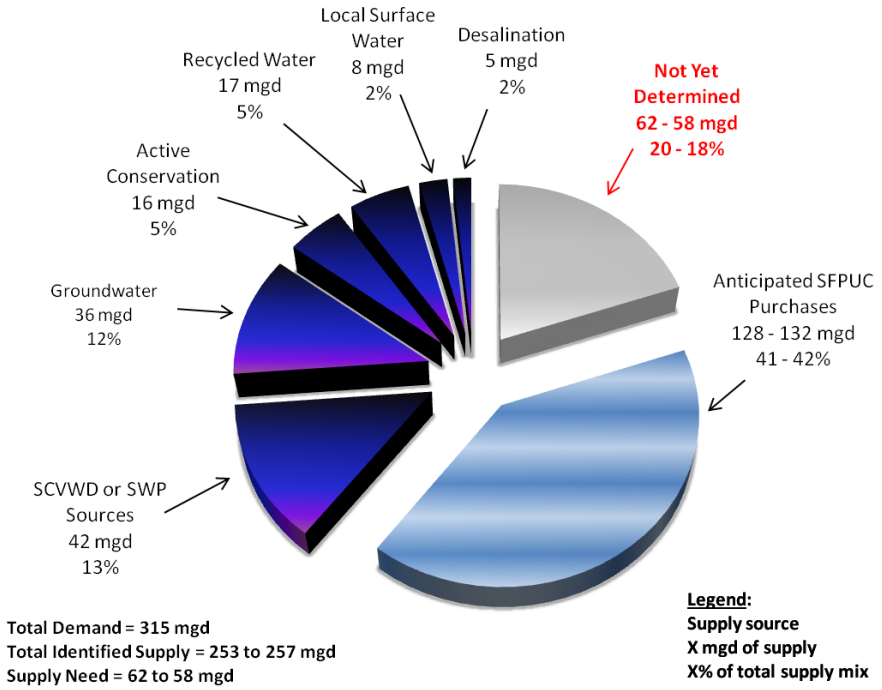


Figure 2-5
A Diverse Water Supply Portfolio Will Benefit the BAWSCA Member Agencies During a 20% Supply Shortfall on the SF RWS, but Will Not Meet all of the Identified Need (2035)

It should be noted that in normal conditions a 9 mgd range in the "Anticipated SFPUC Purchases" is shown associated with the current temporary and interruptible status of Santa Clara and San Jose. During a drought, application of the existing Tier 1 and Tier 2 Plans narrows that range to 4 mgd to 5 mgd. Further, it should be noted that the current volume of "Not Yet Determined" supply assumes the desire to meet a 100% level of demand. This assumption of 100% level of service (i.e., no rationing) is unlikely to be the final recommendation coming out of the Strategy and this issue will be further discussed with the BAWSCA member agencies and the BAWSCA Board.

As discussed further in Section 3 and in *Attachment 4*, the potential impacts of drought to the BAWSCA member agencies are significant and regional (i.e., not limited to the individual cities or water districts within the service area). Figures 2-6 and 2-7 illustrate the potential distribution of reduction of SFPUC supply in 2035 during a 20% supply shortage on the SF RWS in terms of reduction in mgd and percent of supply, respectively, consistent with the Tier 2 Plan. Under a 20% system-wide cutback from the SF RWS, seven of the 26 BAWSCA member agencies are expected to experience a cutback to their SFPUC supplies of greater than the average BAWSCA agency member cutback of 29%.

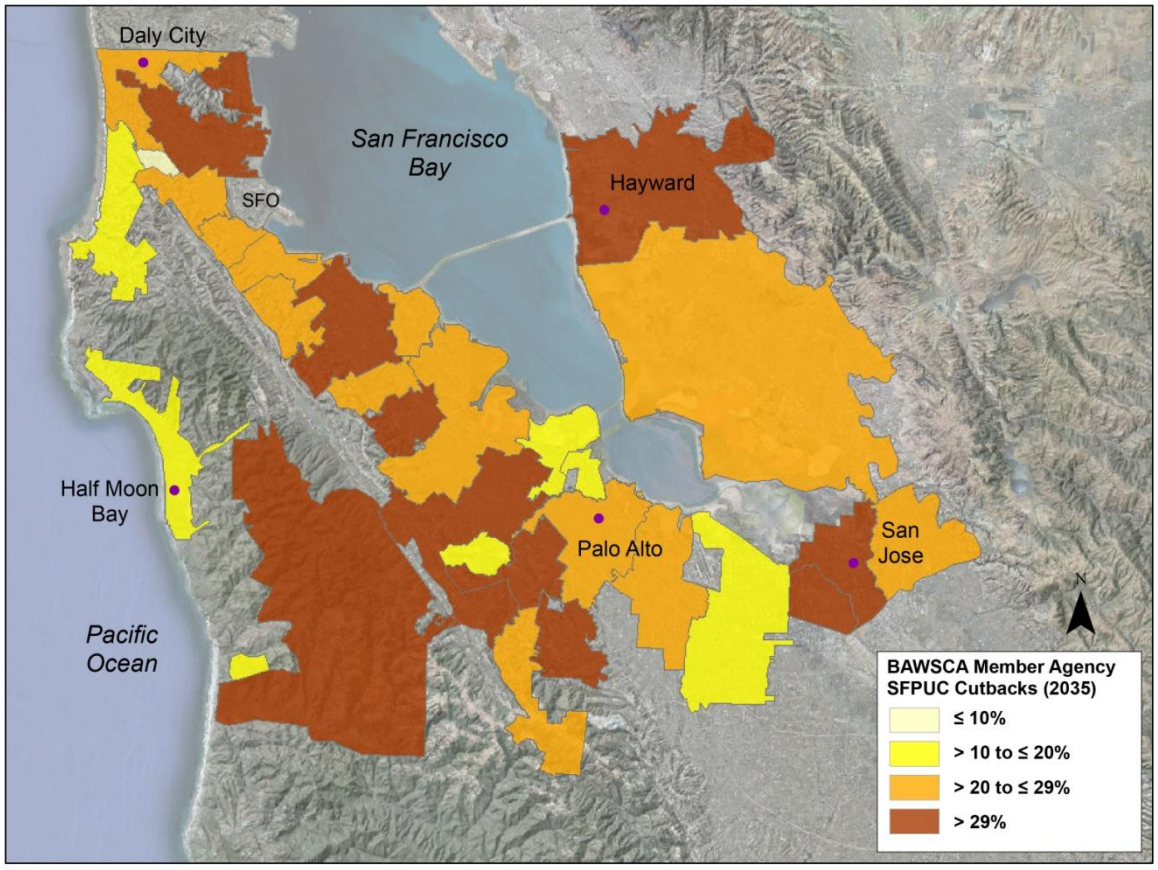


Figure 2-6
20% Supply Shortfalls on the SF RWS Result in an Average Cutback of 29% to the BAWSCA Member Agencies (2035)

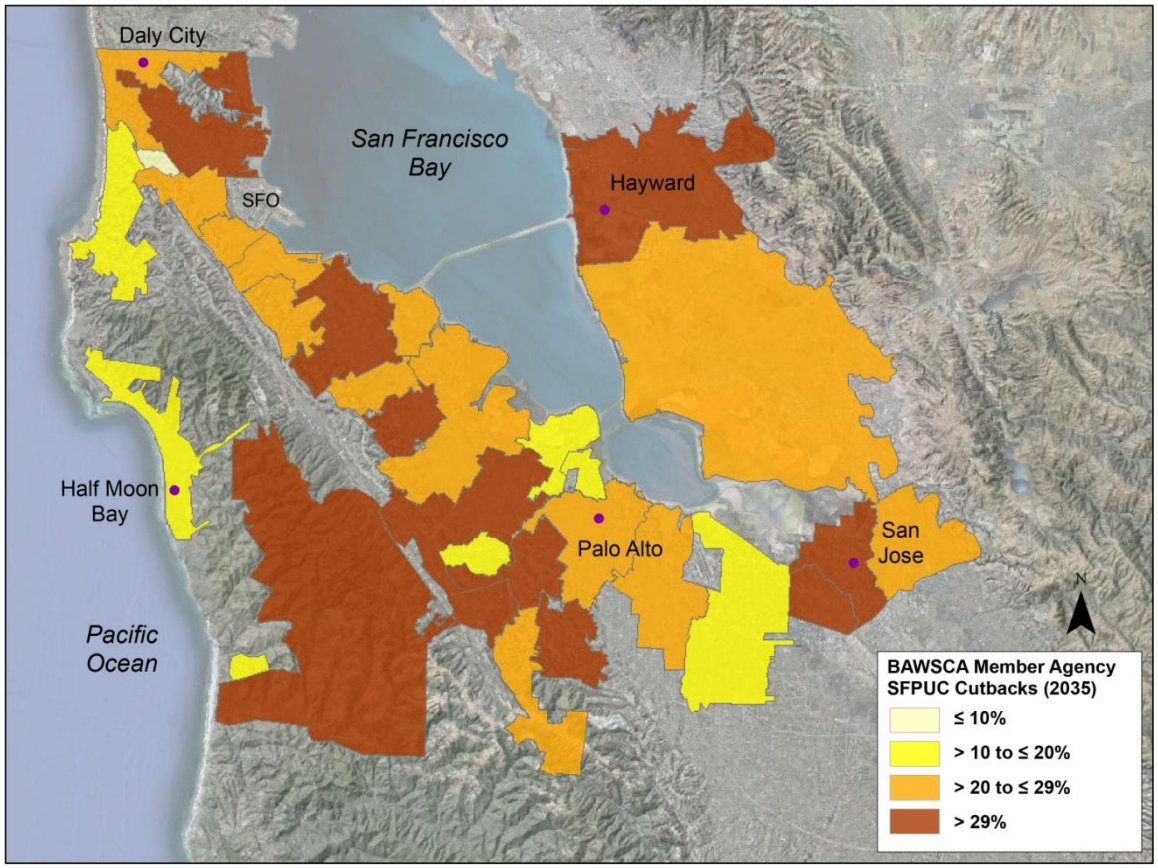


Figure 2-7
Range in Percentage Cutbacks to BAWSCA Agencies Resulting from a 20% Supply Shortfall on the SF RWS (2035)

2.7 More Water Supply is Needed in Normal and Drought Years Despite Investments in Supply Diversity

This subsection compares the projected future BAWSCA member agency demands to their available water supplies and identifies the timing and magnitude of future water supply shortfalls from the SF RWS. Table 2-4 summarizes the projected BAWSCA member agencies' need for water in 2035 under normal and drought year conditions, after accounting for water conservation.

Figure 2-3 presented the projected BAWSCA service area water supply need in 2035 in a normal hydrologic year, which ranges from 4 mgd to 13 mgd. The "Not Yet Determined" category represents the upper bound of the anticipated "Supply Need" because this value does not include consideration of permanent ISG transfers between the BAWSCA member agencies or the potential use of the SFPUC supply in excess of contractual allocations. If these options are implemented by individual BAWSCA member agencies, the Supply Need could be reduced relative to the "Not Yet Determined" value. Again, the upper end of the need range (13.3 mgd) is associated with a potential future decision by San Francisco to not provide 9 mgd of permanent supply to Santa Clara and San Jose.

Table 2-4 – More Water Supply is Needed in Normal and Drought Years Despite Investments in Other Supplies (2035, mgd)

Hydrologic Condition	Anticipated SFPUC Purchases[1]	Anticipated Use of Available Local & Other Supplies	Total Anticipated SFPUC, Local, and Other Supply Use	Projected Demand After Passive Conservation[2]	Anticipated Need for Water[3]
Normal	177.1 - 186.1	124.8	301.9 - 310.9	315.2	4.3 - 13.3
10% SFPUC Drought Reduction	147.4 - 152.5	124.8	272.1 - 277.3	315.2	37.8 - 43.0
20% SFPUC Drought Reduction	127.9 - 132.4	124.8	252.7 - 257.2	315.2	58.0 - 62.5

Source Data: Agency Submitted Demand & Supply Worksheets, 2011

[1] The lower end of the range in "Anticipated SFPUC Purchases" is associated with a potential future decision by San Francisco to not provide 9 mgd of permanent supply to the Cities of Santa Clara and San Jose, whose contracts with the City and County of San Francisco are temporary and interruptible. For conservative planning purposes the Strategy assumes that San Francisco could make this decision as early as 2018.

[2] "Projected Demand After Passive Conservation" represents the demand that member agencies estimate will occur after projected passive conservation is considered, but does not include the water savings anticipated from active conservation measures. As many member agencies consider active conservation to be a demand reduction method rather than a supply, demand after passive conservation may not be consistent with the projected water demands included in agencies' 2010 UWMPs.

[3] "Anticipated Need for Water" is the difference between the "Projected Demand After Passive Conservation" and the Total Anticipated Supply Use. In drought conditions, the current analysis assumes an Anticipated Need for Water to provide 100% level of service.

Figures 2-4 and 2-5 presented the projected BAWSCA service area water supply need in 2035. The need ranges from 38 mgd to 43 mgd during 10% system-wide shortfall on the SF RWS, to 58 mgd to 62 mgd during a 20% system-wide shortfall. The "Not Yet Determined" category represents the upper bound of the anticipated water supply need, assuming a 100% level of service and no execution of drought allocation transfers.

2.8 The Supply Need Has Decreased Since Phase I of the Strategy

Determining the 2035 water supply need for the BAWSCA member agencies is predicated on the projections of demand and the assumptions regarding the availability of existing supplies under different hydrologic conditions. The member agencies' projections of demand and their anticipated use of supplies have changed since these elements were first assessed in Phase I of the Strategy (see Figures 2-8, 2-9, and 2-10). Specifically, the Phase II A projection of the BAWSCA member agencies' 2035 demand is 8% lower than the demand projection presented in the *Phase I Scoping Report*. Much of this change is based on the dramatic declines in water use by the BAWSCA member agencies in recent years (i.e., approximately 12% decline in total BAWSCA member agency demand between Fiscal Year (FY) 2006-07 and FY 2010-11, as shown in Figure 2-8). While the exact reasons for these changes are not yet fully understood, this decline is generally assumed to be associated with a combination of a poor economy, cool weather, and increased conservation as a result of recent drought conditions. Each BAWSCA member agency addressed the observed water use decline and the potential timing and magnitude of the rebound in demand differently as part of their 2010 UWMPs.

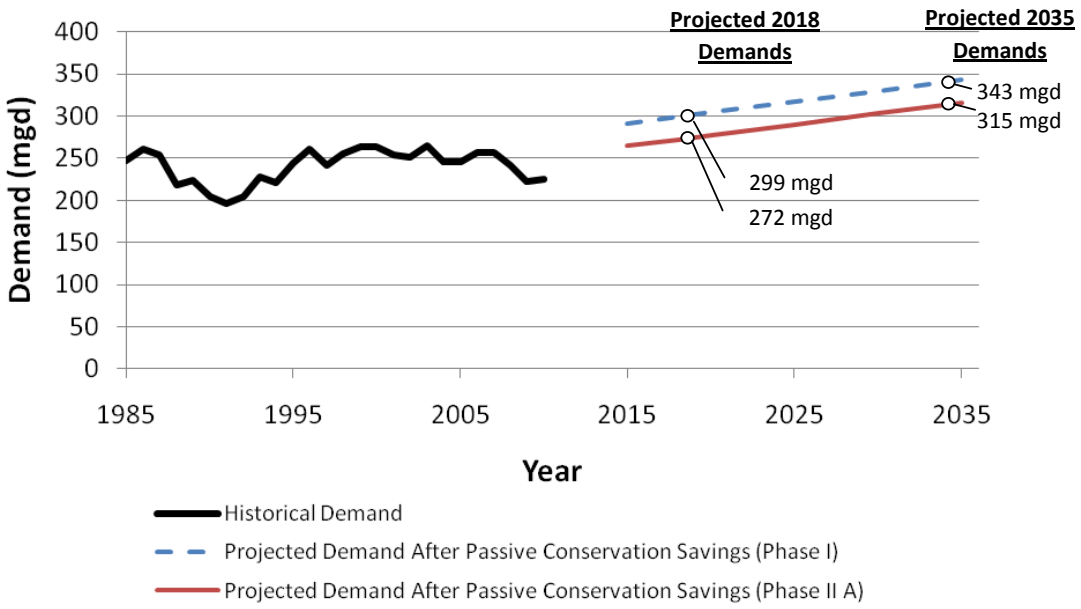


Figure 2-8
Projected 2035 Demands Reduced Eight Percent Between Phase I and Phase II A

The Strategy addresses water supply need related to future normal year conditions and to drought conditions when the SFPUC supplies will be curtailed. The updated normal year water supply need in 2035 is anticipated to be 4 mgd to 13 mgd (see Figure 2-9), as compared to the prior Phase I estimates of 14 mgd to 23 mgd.

The updated drought year water supply need in 2035 with 20% system-wide rationing conditions is anticipated to be 58 mgd to 62 mgd (see Figure 2-10), as compared to the prior Phase I estimate of up to 77 mgd.

As a result of the reduction in anticipated normal year water supply need in 2035, the focus of the Strategy is now more targeted towards meeting the dry year needs of the BAWSCA member agencies. Based on the updated demand projections, the total projected SFPUC purchases by the BAWSCA member agencies in 2018 is estimated at 171.8 mgd, which should not trigger the Interim Supply Limitations. As such, the immediate concern of an imposed supply restriction by the SFPUC in 2018 has been eliminated.

BAWSCA will continue to monitor future changes in water demands and assess supply needs in both normal and drought periods. In addition, BAWSCA will revisit the desired level of service for the individual BAWSCA member agencies to develop final recommendations for what portion of the drought year need should be met with the Strategy. Of particular interest is whether the demands will continue along the path of the current projections, or rebound more quickly, resulting in higher demands and supply needs during both future normal years and droughts.

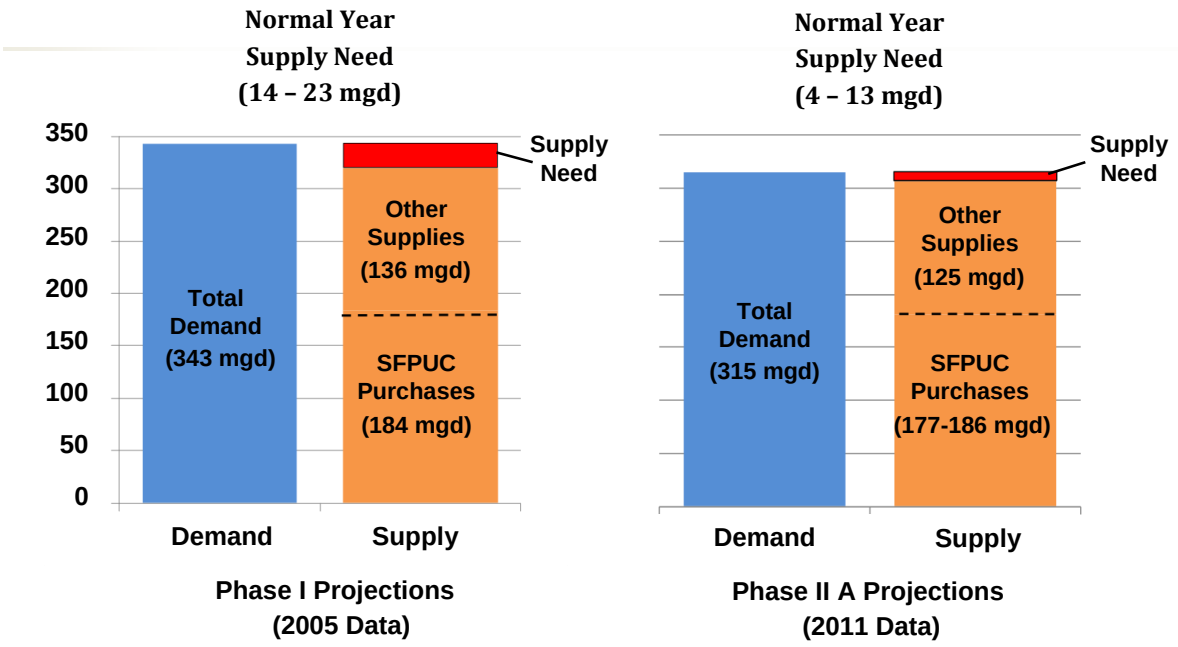
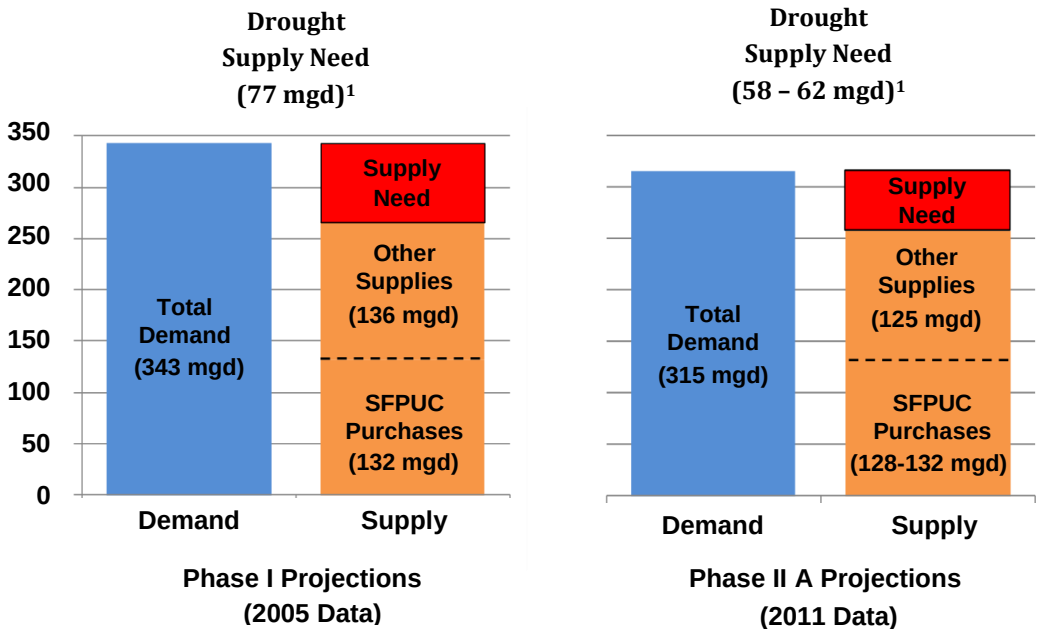


Figure 2-9
Normal Year Supply Need Significantly Reduced Between Phase I and Phase II A (2035)



[1]Assumes 100% Level of Service and no transfers of drought allocation

Figure 2-10
Drought Supply Need Remains Large Under a 20% Shortfall on the SF RWS (2035)

2.9 Approach to Addressing Outstanding Issues For Water Supply and Demand Projections

As described below, there are outstanding issues associated with BAWSCA member agency demand projections and estimates of supply need. Specific actions are described that could be taken to address these issues:

- **Demand and Water Conservation Projections:** The demand and water conservation projections presented herein are based largely on the 2010 UWMPs prepared by the BAWSCA member agencies for the California Department of Water Resources (DWR). The DWR recognizes that there are many acceptable methods for projecting water demands and does not specify that a particular methodology must be used. As a result, the BAWSCA member agencies used several different projection methodologies to estimate their future demands. BAWSCA worked closely with its member agencies to combine the individual agency demand and water conservation projections for use at the regional level. However, given the differences in methodology, this process may not be sufficient for regional planning purposes (i.e., as the basis for environmental documentation) or fully representative of the regional needs (i.e., may result in double-counting or exclusion of potential demands).
  - ***Develop New Demand and Updated Water Conservation Projections for Member Agencies Using Consistent Methodology***. For effective planning at the regional level, a more robust and consistent demand and water conservation projection process for the BAWSCA member agencies as a whole is necessary to support future local and regional investment decisions. As part of its adopted FY 2012-13 Work Plan, BAWSCA will: (1) work with the member agencies to identify a common and consistent demand and water conservation projection methodology that is robust, transparent, and flexible; and (2) select a consultant to develop updated projections in FY 2013-14 using the selected methodology. These data can then be used to support the Strategy and the agencies' 2015 UWMPs.
  - ***Monitor Changes in Water Demand in Service Area.*** BAWSCA should continue to monitor the water demands of the BAWSCA member agencies and assess the potential impacts of changes in demand to the projected water supply needs in both normal and drought years.
  - ***Monitor Implementation of Water Conservation Programs***. The ability of the agencies to fully implement the conservation measures identified in the WSIP PEIR, the 2009 WCIP, and in the 2010 UWMPs is not known and will have an impact on demand. BAWSCA should continue to track the success of the water conservation programs within the BAWSCA service area, and modify or augment the programs as needed to meet customer needs and achieve the desired water savings.
- **Supply Need Estimates:** The current analysis of supply need during drought conditions assumes the provision of a 100% level of service (i.e., no rationing). If a BAWSCA member agency with an identified supply need reduced its level of service goal, the supply need would be reduced as well. Information from the SFPUC on the expected timing and magnitude of future droughts will influence this assessment.
  - ***Confirm Frequency, Magnitude, and Economic Impacts of SFPUC Supply Shortfalls***. BAWSCA should continue to work with the SFPUC to develop more information on the expected timing and magnitude of future drought shortages, and the potential economic

impacts of those shortages. The SFPUC has indicated that they will provide additional information to BAWSCA regarding these issues by Fall 2012 after they have made updates to the current SF RWS operational model and their econometric model.

- ***Confirm BAWSCA Member Agency Level of Service Goals***. BAWSCA should work with the each member agency to establish an acceptable level of service goal to be used moving forward in the Strategy. BAWSCA will also consider the need for a regional level of service goal (i.e., for the entire BAWSCA service area) to offset the economic and other impacts of SFPUC supply shortfalls. This evaluation will take place as part of the Final Strategy work when the project data and the updated impact economic impact analysis work is complete. This information would be presented to the BAWSCA Board as part of its deliberation on establishing a regional level of service goal.

These actions indicated above form the basis for several of the recommendations presented in Section 8, which support the completion of the Strategy and the Final Strategy Report by December 2014.

Section 3
Estimated Impacts of Supply Shortfalls During Droughts

Another key objective of the Strategy is to quantify the potential impacts of water supply shortages during droughts to the BAWSCA member agencies. This section presents the results of studies completed to date on the economic and social impacts of drought on the BAWSCA member agencies and the current estimates of the frequency and magnitude of drought cutbacks from the SF RWS. As discussed in Section 2, the level of service goal for the SF RWS is no more than a 20% system-wide shortfall during a drought. Based on the current 2035 SFPUC purchase projections, and application of the Tier 1 Plan, a 20% shortfall on the SF RWS results in a 29% cutback to the Wholesale Customers in aggregate. This section summarizes the impacts to people and businesses in the BAWSCA service area associated with that 20% system-wide shortfall and presents the following key results:

- It is currently estimated that historical droughts on the SF RWS occur roughly once every ten years. The SF RWS model is being updated to incorporate the latest ten years of hydrologic data, which may increase the estimated frequency of droughts to once every eight years;
- It is currently estimated that a 20% system-wide shortfall on the SF RWS will create a $7.7 billion impact to business and industry in the BAWSCA service area. The economic impacts of drought to the BAWSCA service area are being updated as part of a joint effort with the SFPUC. The update will also address impacts to residential customers; and
- Given the interconnected nature of the economy within the BAWSCA service area, drought impacts are a regional issue that will impact all communities.

3.1 The Impacts of Drought are Estimated to be Significant and Regional

It is well documented that water supply shortages during droughts can have significant economic and other impacts to residents and businesses. Several studies have been prepared by the DWR and others that have documented these impacts for the 1987 through 1992 drought and for other significant California droughts (DWR 2000; DWR 2008; Moore et. al. 1993; California Natural Resources Agency 2009; US Climate Change Science Program 2008; PPI 2012). If the water supplies that are available to the BAWSCA member agencies are unreliable and subject to drought shortages, existing and future customers will be increasingly affected. In a broad sense, without sufficient additional water supplies to meet projected future drought year demands, residential and economic development could be curtailed within the BAWSCA service area and potentially relocated to other parts of the State or elsewhere. This could result in loss of new housing, jobs, manufacturing, and community services.

3.1.1 Impacts of Drought to the Commercial and Industrial Sector

In 2005, work was done by the resource economist William Wade, Ph.D., to assess the economic impact to the BAWSCA member agencies of a SFPUC supply shortfall during a drought (Wade 2005). Wade found, among other things, that the subset of industrial sectors that are particularly sensitive to

curtailments in water supply (e.g., computer and electronic manufacturers, food and beverage manufacturers, and biotechnology) would be significantly affected by drought and that these issues would be compounded if the drought shortage conditions lasted multiple years. Specifically, Wade estimated that a 20% supply shortfall would reduce the economic output from these types of industries in the BAWSCA service area by nearly $7.7 billion in each year that a drought of that magnitude persisted. Knowing this information, BAWSCA strongly advocated that the SFPUC adopt a level of service goal of no more than 10% rationing in order to reduce the economic impact in the BAWSCA service area. While unsuccessful in convincing the SFPUC to modify its drought level of service goal, BAWSCA has continued to pursue increasing drought supply reliability in the service area through the development of this Strategy.

The SFPUC is currently developing an updated economic impact analysis of supply reductions to the City and County of San Francisco and the BAWSCA member agencies as part of the FERC relicensing process for the New Don Pedro Dam. Preliminary results from this analysis are anticipated by Fall 2012. BAWSCA is prepared to perform additional analysis beyond what the SFPUC will make available by Fall 2012 if necessary for its own purposes. Once completed, the updated economic impacts analysis will be presented to the BAWSCA Board to support deliberations regarding investment in additional dry year reliability (i.e., as part of the overall understanding of the benefits of increased water supply reliability to the communities within the BAWSCA service area).

3.1.2 Impacts of Drought to the Residential Sector

Drought impacts on the residential sector can include: voluntary or mandatory restrictions for lawn watering, washing cars, driveways and sidewalks, or filling swimming pools; mandatory water use cutbacks; and increasing water rates and excess use charges. Under extreme drought conditions, all outside water use may be prohibited in the residential sector.

Drought impacts for the residential sector are expected to be compounded in the future as a result of demand hardening (i.e., as conservation measures are increasingly implemented and per capita water use declines, it becomes more difficult to save the next increment of water without applying more drastic measures, such as eliminating landscape irrigation). This is particularly an issue in the BAWSCA service area where residential per capita demand is already low as compared to other portions of the Bay Area and the State.

As part of the economic analysis of supply reductions currently being performed by the SFPUC to support the FERC process, an analysis of the estimated impact of drought on residential customers within the BAWSCA service area will be performed, along with an analysis of the impact of demand hardening on this customer sector. Preliminary results from this analysis are anticipated by Fall 2012.

3.1.3 Regional Nature of Drought Impacts

It is important to recognize that the potential impacts of drought to the BAWSCA member agencies are regional and not just limited to individual cities or water districts. For example, the severity of the potential drought impact to the 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 service area or neighboring communities. Using socioeconomic development data provided by the Association of Bay Area Governments and a transportation model

of the Bay Area, the Metropolitan Transportation Commission has estimated residential commutes between Bay Area Counties from 2010 to 2035. Although a large portion of jobs within the Alameda, San Mateo, and Santa Clara Counties were staffed by employees who reside within the same county (68%, 53%, and 83% in 2010, respectively), a significant number of jobs were staffed by employees who reside in other counties and specifically the other counties that include BAWSCA member agencies. This trend is expected to continue out to, and beyond, the 2035 planning horizon of the Strategy. Therefore, a future drought year water supply shortfall in one BAWSCA agency that results in loss of jobs or other impacts can have a detrimental effect on the customers of another BAWSCA agency, even if that agency itself is not facing a supply shortfall. As such, it is important to consider the impacts of drought regionally when weighing the costs and benefits of investing in additional drought reliability.

3.2 Current Estimates of the Frequency and Magnitude of SFPUC Supply Shortfalls

System-wide supply shortages are imposed within the SF RWS operations in a step wise manner. Each step (or "Action Level") is triggered by thresholds based on total system storage on July 1 of each year. Action Level 1 does not impose a reduction in water supply deliveries, but does impose a change in system operation, including the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. Action Levels 2 and 3 result in 10% and 20% system-wide supply reductions, respectively. As discussed in Section 2, the existing WSA includes a Tier 1 Plan which allocates the available SF RWS water supply during a drought between San Francisco and the Wholesale Customers. With the application of the Tier 1 Plan on projected 2035 SF RWS purchases, a 10% system-wide shortfall in 2035 corresponds to an 18% cutback to the Wholesale Customers and a 20% system-wide shortfall in 2035 corresponds to a 29% cutback to the Wholesale Customers. These Action Levels and their corresponding cutbacks (assuming 2035 conditions) are summarized in Table 3-1.

Table 3-1 – SFPUC Drought Action Levels and Projected 2035 Supply Cutbacks

Action Level	Supplemental Water Supply Action	System-Wide Supply Shortfall	Wholesale Customers Supply Cutback
1	Westside Basin Groundwater Program; Water transfer	None	None
2	Westside Basin Groundwater Program; Water transfer	10%	18%[1]
3	Westside Basin Groundwater Program; Water transfer	20%	29%[2]

[1] This percentage is associated with the higher end of the SFPUC purchase projection in 2035. At the lower end of the SFPUC purchase projection in 2035, this value is 17%.

[2] This percentage is associated with the higher end of the SFPUC purchase projection in 2035. At the lower end of the SFPUC purchase projection in 2035, this value is 28%.

3.2.1 SFPUC System Model Used to Determine Frequency and Magnitude of Supply Shortfalls

Currently the SFPUC models the frequency and magnitude of supply shortfalls on the SF RWS using its Hetch Hetchy/Local Simulation Model (HH/LSM). The HH/LSM simulates SF RWS operations over an 82-year sequence that represents historical hydrological conditions between 1920 and 2002 and over an 8.5-year Design Drought planning sequence.

The Design Drought planning sequence replicates the hydrologic conditions associated with the 1987 through 1992 drought, followed by the hydrologic conditions associated with the 1976 through1977 drought. The basis for the design of this sequence is that by adding the worst hydrologic years of record to the end of the most severe drought of record, the SFPUC can attempt to mimic the situation a water system manager faces when deciding how much water can be provided to residents and businesses during a drought, when there is no certainty as to when that drought may actually end.

The HH/LSM incorporates information about key aspects of the SF RWS such as reservoir and conveyance attributes, stream runoff, and water demands. By iteratively running the model for the Design Drought and other key periods of the historical record, operating procedures and "rules" have been developed that provide for a viable system operation for all tested hydrologic sequences. One of the procedures developed from this modeling is the protocol for triggering a reduction to SF RWS deliveries (i.e., the Action Levels) during a drought so as to not run out of water before the drought ends.

At BAWSCA's request, the SFPUC analyzed the frequency and magnitude of the potential water supply shortfalls under various demand scenarios using HH/LSM. Three demand scenarios were considered wherein the average purchase levels for the BAWSCA member agencies varied from a minimum of 148.6 mgd, which was the total SFPUC purchases by the BAWSCA member agencies in FY 2009-10, to a maximum of 186.1 mgd, which is the projected BAWSCA member agency purchases in 2035, including San Jose and Santa Clara. The SFPUC retail purchases from the SF RWS are projected to range from 75.5 mgd to 78.7 mgd in these scenarios. The demand scenarios evaluated in this analysis are summarized in Table 3-2.

Table 3-2 – Three Different Demand Scenarios Used to Examine Frequency and Magnitude of SFPUC Supply Shortfalls Using SFPUC Hydrologic Model

Scenario Name	Total System Demand (mgd)	Purchases by the BAWSCA Agencies (mgd)	SFPUC Retail Demand (mgd)
Minimum Demand (FY 2009-10)	224.1	148.6	75.5
Intermediate Demand (Projected 2025)	251.8	175.6	76.2
Maximum Demand (Projected 2035)	264.8	186.1[1]	78.7

[1] Total anticipated SFPUC purchases for the BAWSCA member agencies is projected to be 186.1 mgd in 2035, including delivery of 9 mgd to the Cities of San Jose and Santa Clara.

All demand scenarios were assessed under hydrologic conditions represented by the hydrologic years 1920 through 2002 (i.e., equivalent to assuming that the historical hydrology will be replicated in the future). Scenarios were also assessed under the SFPUC's Design Drought conditions. Updates to HH/LSM were made by the SFPUC to simulate the impact on the SF RWS from the increased requirements for instream flows below Calaveras and Crystal Springs Dams. However, historical hydrologic conditions were not modified to reflect the potential future impacts of climate change, nor was the model updated to incorporate hydrological data for 2002 through 2012.

3.2.2 SFPUC Supply Reductions Estimated to Occur Every Ten Years Assuming Historical Hydrologic Conditions

Under historical hydrologic conditions, the Minimum Demand scenario results in no water supply shortfalls. The Intermediate and Maximum Demand scenarios result in supply shortfalls in eight years during the 82-year simulation: 1931; 1961; 1977; and 1988-92. Table 3-3 summarizes the projected supply cutbacks to the BAWSCA member agencies and the years in which they occur. Figure 3-1 presents the supply cutbacks for the Maximum Demand scenario.

Table 3-3 – Projected Frequency of SFPUC Supply Reduction to the Wholesale Customers Assuming Historical Hydrologic Conditions

Demand Scenario	Number of Years of Projected Supply Cutbacks to the Wholesale Customers Over 82-year History	
	18% Avg. Wholesale Customer Supply Cutback (10% System-Wide Shortfall)	29% Avg. Wholesale Customer Supply Cutback (20% System-Wide Shortfall)
Minimum Demand Scenario (224 mgd)[1]	0	0
Intermediate Demand Scenario (252 mgd)[1]	7	1
Maximum Demand Scenario (265 mgd)[1]	6	2

[1] Total demand including San Francisco Retail and Wholesale Customers

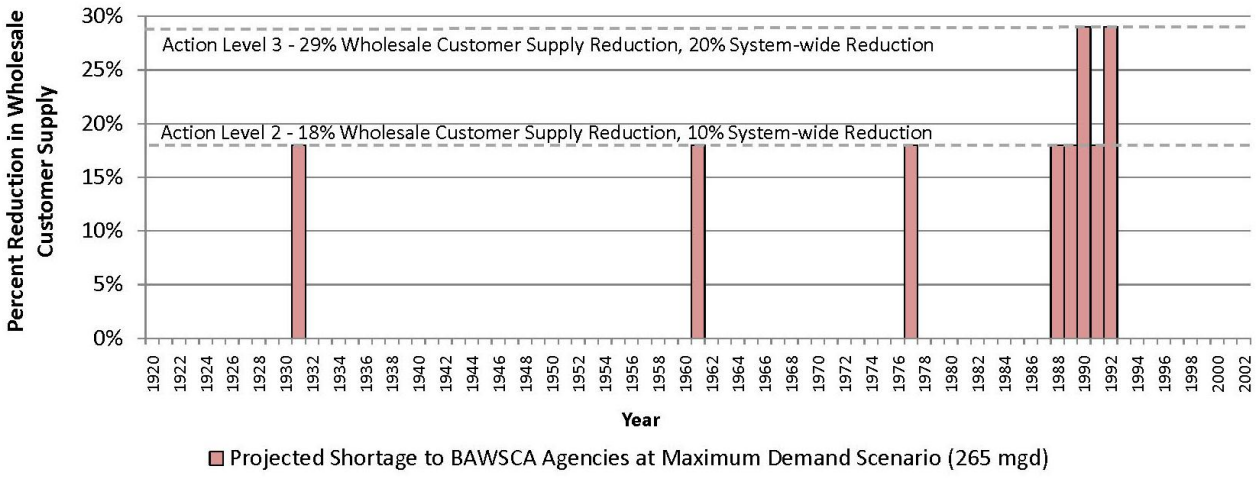


Figure 3-1
Drought Events that Create System-wide Supply Shortfalls of 10% to 20% Are Projected to Occur on Average Every Ten Years on the SF RWS

3.2.3 SFPUC Supply Reductions Under the Design Drought Evaluation

Under the Design Drought evaluation, the hydrology for the years leading up to the Design Drought itself (i.e., 1920 through 1987) is the same as those in the historical hydrologic conditions analysis. However, the Design Drought extends the 1987 through 1992 drought period for two additional years (i.e., through 1994). The two additional years of drought produce a shortage Action Level of 3 in the Maximum Demand scenario.

Under historical hydrologic conditions, the Minimum Demand scenario results in no water supply shortfalls, even during the Design Drought. The Intermediate and Maximum Demand scenarios result in drought shortages in 10 years during the 82-year simulation (including the design drought years): 1931; 1961; 1977; and 1988-1994. Table 3-4 summarizes the projected supply reduction to the BAWSCA member agencies and the years in which they occur, and also shows the years with a supply shortfall under all demand scenarios for the Design Drought evaluation. Figure 3-2 shows shortages under the Design Drought evaluation for the Maximum Demand scenario, with the two additional years of drought identified by cross hatching.

Table 3-4 – Projected Frequency of SFPUC Supply Reduction to the Wholesale Customers Assuming Design Drought Hydrologic Conditions

Demand Scenario	Number of Years of Projected Supply Cutbacks to the Wholesale Customers Over 82-year History	
	18% Avg. Wholesale Customer Supply Cutback (10% System-Wide Shortfall)	29% Avg. Wholesale Customer Supply Cutback (20% System-Wide Shortfall)
Minimum Demand Scenario (224 mgd)[1]	0	0
Intermediate Demand Scenario (252 mgd)[1]	7	3
Maximum Demand Scenario (265 mgd)[1]	6	4

[1] Total demand including San Francisco Retail and Wholesale Customers

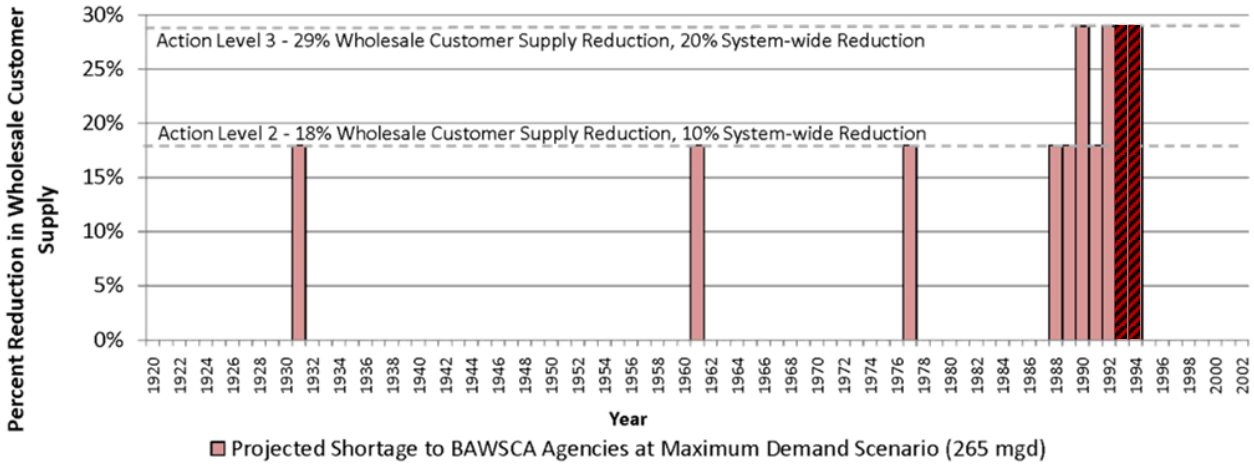


Figure 3-2
SFPUC Supply Cutbacks to the Wholesale Customers
(Assuming Maximum Demand and the Design Drought Sequence)

While any single year of Action Level 2 or 3 shortages would be expected to have some economic impact on the BAWSCA member agencies, the three consecutive years of Action Level 3 shortages that are associated with the Design Drought could have detrimental economic impacts, especially for those BAWSCA member agencies that receive cutbacks greater than 29% under the Tier 2 Plan. As discussed in Section 3.1.1, Wade estimated that a 20% supply shortfall could reduce the economic output in the BAWSCA service area by nearly $7.7 billion in each year that a drought of that magnitude persisted. This work suggests that three consecutive years of Action Level 3 shortages could result in at least a $23 billion economic impact to the BAWSCA member agencies.

3.3 Issues that May Impact the Current Drought Estimates

While the SFPUC's HH/LSM provides the best information to date on the frequency and magnitude of the anticipated supply shortfalls on the SF RWS for different projected future demand scenarios, these estimates may not provide the complete picture of the reliability of the SFPUC supply.

For example, the SFPUC modeling is based on the historical hydrologic sequence from 1920 through 2002. While this 82-year record does include a number of significant dry periods, it does not capture the recent droughts experienced on the SF RWS between 2002 and 2012. Specifically, the calls for 10% voluntary rationing in 2007 and 2008 (i.e., Action Level 2 shortages) are not accounted for, nor is the very dry year of 2011 represented. If these shortages are factored in, the frequency of cutbacks appears to increase to eleven Action Level 2 or 3 years over the 92-year analysis period. Two multiple dry year events, including the drought of record, have occurred over the last 25 years.

By comparison, the recent water system modeling done by East Bay Municipal Utility District (EBMUD) that extends through 2011 does include these more recent drought conditions. As illustrated in Figure 3-3, SFPUC's projected Action Levels appear to roughly correlate with the years that EBMUD has identified as "Dry" and "Critical Dry". As such, it would be expected that if the SFPUC modeling did extend through 2011, additional dry years would be identified on the SF RWS, and these results may change the current estimates of drought frequency. The SFPUC has indicated that it is extending the HH/LSM simulation period through 2011, and the updated model should be available by Fall 2012.

As discussed in Section 2, there are a number of other issues that may affect the quantity and reliability of SFPUC supplies including SFPUC policy decisions, climate change, and regulatory actions. Potential impacts of these issues on supply reliability are difficult to assess because, in most cases, studies are ongoing and there is still much uncertainty. For example, the ongoing FERC relicensing process, changes to the State Board plan for the Delta which increases unimpaired flows from the Tuolumne watershed, and the State Board development of flow criteria for the Delta ecosystem as part of the Sacramento-San Joaquin Delta Reform Act of 2009 may reduce the volume of supply that is available in the SF RWS during normal and drought conditions. In addition, climate change may continue to have impacts on supply reliability. Continuation of on-going work is needed to assess the impacts of these issues on the SF RWS long-term reliability.

Further, the economic landscape has changed dramatically in the seven years since Wade completed an assessment of the economic impacts of drought in the BAWSCA service area. The SFPUC's analysis that is being performed as part of the New Don Pedro FERC relicensing will refine the economic impact assessment of an extended drought to both residential and non-residential customers in the BAWSCA service area, as well as examine the issue of demand hardening. This information will help

inform decisions by the BAWSCA Board and the member agencies regarding the level of drought supply that should be developed as part of the Strategy.

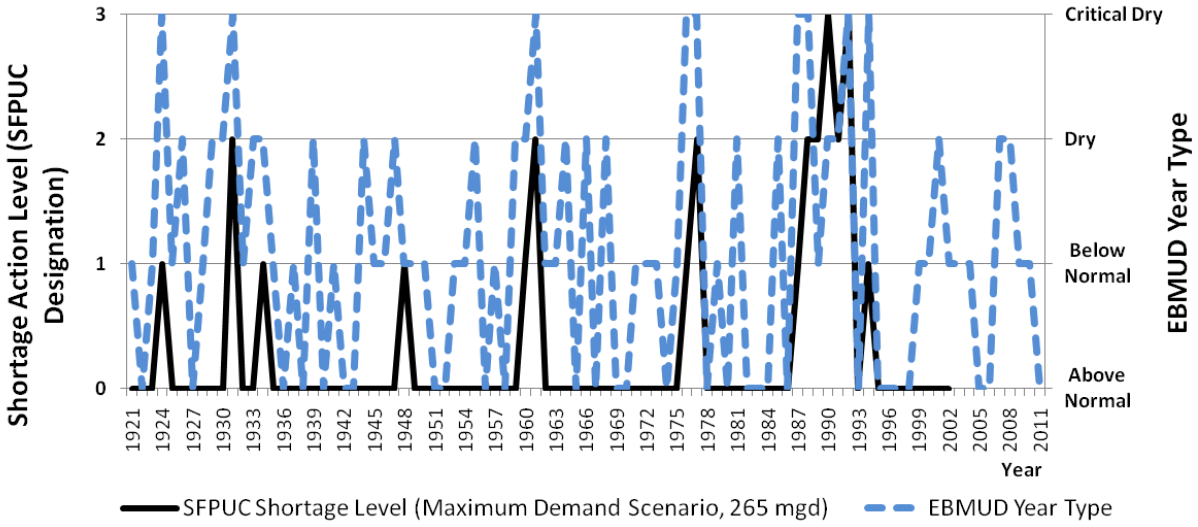


Figure 3-3
Comparison of SFPUC and EBMUD Water System Hydrology – Water Year Type Classification Indicates Potential Increased Frequency of SFPUC Supply Shortfall in Recent Years

3.4 Approaches to Addressing Outstanding Issues Related to Estimating Impacts of Supply Shortfalls During Drought

As identified above, there are outstanding issues associated with the assessments of the frequency and magnitude of potential drought events in the SF RWS and the impacts that drought has on the economy of the BAWSCA member agencies. BAWSCA is working closely with the SFPUC to understand the current estimates of drought frequency and to perform an updated analysis of the economic impact of drought shortages as part of the FERC relicensing effort. Specific future actions that BAWSCA should take to continue to monitor these issues are described below.

- **Review Updated HH/LSM Results**. BAWSCA has requested that the SFPUC extend the HH/LSM modeling analysis through 2011 to identify potential supply shortfalls associated with recent hydrologic conditions (i.e., 2007, 2008, and 2011). The SFPUC has indicated that the extension of the model analysis period will be complete by Fall 2012. When that effort is complete, BAWSCA should review the results and the implications for the BAWSCA member agencies and the Strategy.

- **Review/Update Economic Impact Analysis**. BAWSCA should continue to work with the SFPUC to confirm that the impacts of supply shortfalls to the BAWSCA member agencies are adequately included in the FERC analysis. After reviewing the final results, BAWSCA should identify whether supplemental analysis of economic impacts is necessary.

- **Monitor Issues That May Impact Future SF RWS Supply Reliability**. BAWSCA should continue to track the assessments of issues like climate change to include the necessary

uncertainty considerations in long-term water supply planning. BAWSCA should continue to work with SFPUC to ensure that the climate change and other issues are incorporated into their analyses of SF RWS reliability.

The above actions form the basis for several of the recommendations presented in Section 8, which will more fully inform the BAWSCA Board of the regional economic impact of a supply shortfall, the expected frequency of such shortages, and support the BAWSCA Board's consideration of what level of increased drought supply reliability is appropriate for the region. The results of these analyses and Board deliberations will support the completion of the Strategy and the Final Strategy Report by December 2014.

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Section 4

Agency-Identified Water Supply Management Projects

A key objective of the Strategy is to identify and evaluate those projects that potentially could be developed to meet the future normal and/or drought year water needs of the BAWSCA member agencies through 2035. Three general types of projects have been evaluated to date as part of the Strategy: (1) agency-identified water supply management projects (e.g. local projects identified by the BAWSCA member agencies during the Strategy scoping process); (2) local capture and reuse projects (i.e., rainwater harvesting, stormwater capture, and greywater reuse); and (3) regional projects identified by the Strategy Team (i.e., BAWSCA staff and the consultant team). This section and *Attachment 2* describe the "agency-identified" and local capture and reuse projects. The key results presented in this section are:

- After project screening was conducted on the 65 agency projects identified in Phase I, ten agency-identified projects were retained for further evaluation in the Strategy, four of which are evaluated herein, and six of which were retained for potential evaluation in later phases of the Strategy;
- The four retained agency projects included three recycled water projects with yields ranging from 900 acre-feet per year (AF/year) to 2,060 AF/year, and one desalination project with a potential yield of up to 6,700 AF/year; and
- Three types of local capture and reuse projects were evaluated herein (i.e., rainwater harvesting, stormwater capture, and greywater reuse). The yield of these projects is estimated to range from 190 AF/year to 2,700 AF/year.

4.1 The Number of Agency-Identified Projects Included in the Strategy Was Refined From Sixty-five to Ten

The *Phase I Scoping Report* classified 65 agency-identified projects as existing, planned, or potential opportunities that could be included in the Strategy. As part of Phase II A of the Strategy, the BAWSCA member agencies and the Strategy Team participated in a project refinement and screening process which included multiple meetings and information exchanges between the Strategy Team and the BAWSCA member agencies. The project refinement process is summarized in Figure 4-1 and in *Attachment 2*.

Based on the results of this effort, ten agency-identified projects were retained for further evaluation in the Strategy: four for evaluation in Phase II A of the Strategy; and six for potential evaluation in later phases of the Strategy. The rest of the agency-identified projects are not being evaluated further as part of the Strategy based on the screening criteria agreed upon and applied by the Strategy Team and the BAWSCA member agencies.

The four agency-identified projects retained for development and evaluation in Phase II A of the Strategy are:

- Daly City – Daly City recycled water expansion (DC-4);
- Palo Alto – City of Palo Alto recycled water project to serve Stanford Research Park (PA-2);
- Redwood City – Redwood City recycled water treatment plant expansion (RC-4); and
- Representative coastal desalination project (*formerly the North Coast County Water District [NCCWD] – Desalination Plant [NC-4]*).

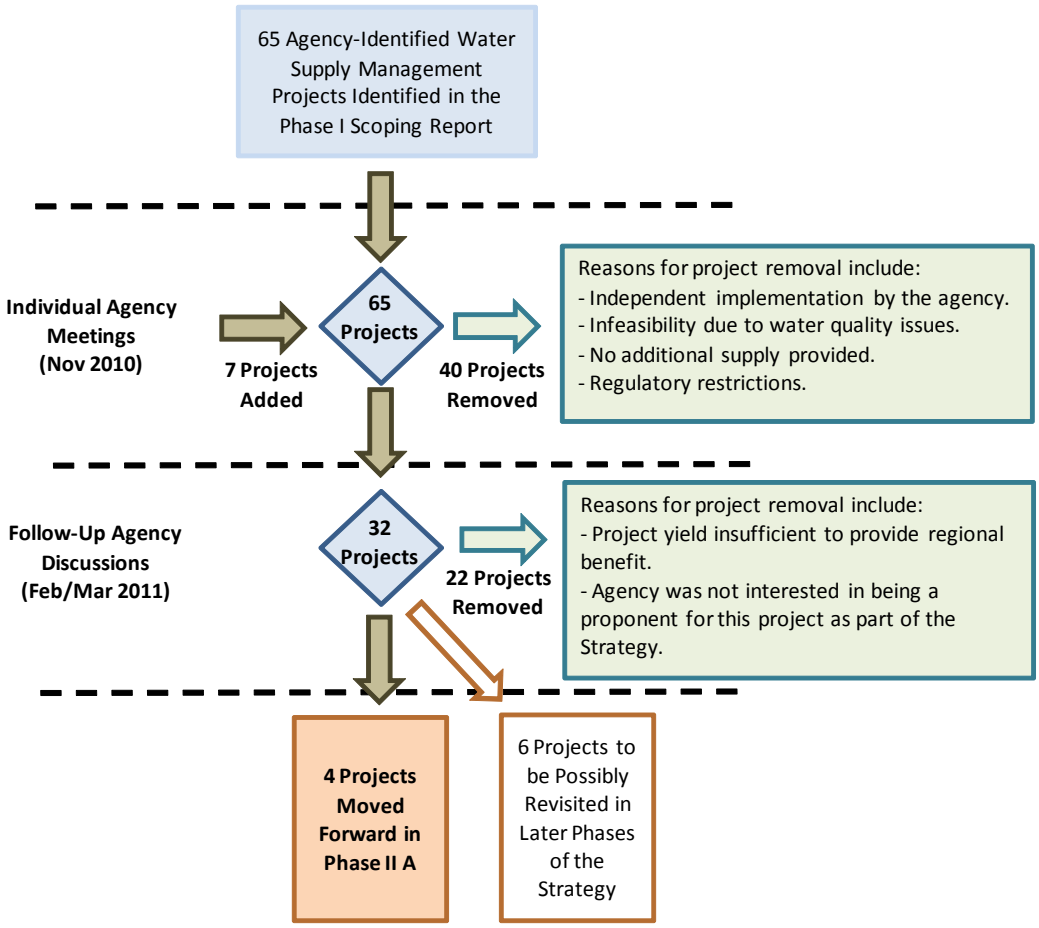

Figure 4-1
Agency-Identified Projects Refined From Sixty-five to Ten During Phase II A

The six agency-identified projects that have been retained for potential evaluation in later phases of the Strategy include:

- California Water Service Company (Cal Water) - Water desalination project (CW-6);
- City of Mountain View - Recycled water intertie with Sunnyvale (MV-2);
- City of Mountain View - Increase recycled water supply from Palo Alto Regional Water Quality Control Plant (RWQCP) (MV-3);
- City of San Jose - Intertie connection with SCVWD (SJ-4);
- City of Sunnyvale - Increase recycled water output from Wastewater Treatment Plant (WWTP) (SV-2); and
- City of Sunnyvale - Expand use of new or converted wells to normal year supply (SV-4).

4.2 Local Capture and Reuse Project Development Process

During interviews with the BAWSCA member agencies in November 2010, the Strategy Team assessed each agency's interest in pursuing local capture and reuse projects: rainwater harvesting, stormwater capture, and greywater reuse. While some agencies expressed little interest in these alternatives, several agencies did express an interest in supporting these types of local water capture and reuse projects, and other agencies are already supporting their implementation. As such, rainwater harvesting, stormwater capture, and greywater reuse projects are included herein. Along with the agency interviews, a literature review was completed to better understand the regulations governing the development of local capture and reuse projects, and what other agencies in California and outside of California were doing to develop these types of projects.

As a group, the information on yield, cost and schedule is limited for these projects because of the relatively small number of successfully implemented projects in the region. For rainwater harvesting and greywater reuse projects, the yield estimates described assume these projects are implemented throughout the BAWSCA service area. These projects are described in more detail in Section 4.3.3.

4.3 Overview of Agency-Identified Projects

In order to allow comparison between the projects retained for evaluation within the Strategy, key project information was developed by the BAWSCA member agencies and the Strategy Team. The following sections and Table 4-1 summarize the information developed to date for the costs, facilities, supply reliability, and implementation schedule for the agency-identified projects, the representative coastal desalination project, and the local capture and reuse projects. For each of these potential projects, while the development would occur locally, the potential exists for local and/or regional benefits. The location of these projects is shown in Figure 4-2. Additional detailed information is presented in *Attachment 2*.

Table 4-1 – Summary of Project Yields, Costs and Implementation Schedules for Agency-Identified, Representative Coastal Desalination, and Local Capture and Reuse Projects

Item	Daly City Recycled Water Expansion Project[1]	City of Palo Alto Recycled Water Project to Serve Stanford Research Park	Redwood City Recycled Water Treatment Plant Expansion Project	Representative Coastal Desalination Project	Rainwater Harvesting Projects	Stormwater Capture Projects	Greywater Reuse Projects
Yield							
Assumed Treatment Production Capacity (mgd)	2.89	2.0	NA[2]	7.5	NA	NA	NA
Estimated Annual Production – Yield (AF/year)	1,060	900	NA[2]	6,700 [3]	190 – 610	NA	1,120 – 2,700
Capital Cost							
Capital Cost ($ millions [M])[4]	$50.1	NA[5]	NA[2]	$214.7 [6]	$13.3 – $26.6	NA	$13.3 – $26.6
Present Worth Costs [7]							
Total Production – 30 years (AF)	31,800	NA[5]	NA[2]	201,600	5,700 – 18,300	NA	33,600 – 81,000
Total Present Worth Cost ($M)	$65.0[8,9]	NA[5]	NA[2]	$448[6,10]	NA	NA	NA
Present Worth Unit Cost ($/AF)[7]	$2,100[8,9,11,12]	NA[5]	NA[2]	$2,200[6,10,12]	$2,900 - $4,700[12,13,14]	NA	$660 - $790[11]
Implementation Schedule							
Implementation Schedule (years)	6	NA[5]	NA[2]	6 to 8	NA	NA	NA

[1] Based on data provided by Daly City.
[2] Data currently not available and are being developed by Redwood City.
[3] Assumes annual operation at 80% of capacity.
[4] Costs adjusted to August 2011.
[5] Data currently not available and are being developed by Palo Alto.
[6] Does not include land and conveyance costs.
[7] Annualized cost based on 30-year return with 3% discount rate.
[8] Data developed by Strategy Team.
[9] Does not include operations and maintenance (O&M) costs for distribution system.
[10] Does not include potential costs for conveyance through SF RWS.
[11] Greywater reuse estimate includes range of yields and costs: $26.6 million/ 2,700 AF/year / 15 years life expectancy = $658/AF. $13.3 million / 1,120 AF/year / 15 years life expectancy = $792/AF
[12] Costs rounded to nearest $100/AF
[13] Rainwater harvesting estimate includes range of yields and costs: $26.6 million / 610 AF/year / 15 years life expectancy = $2,914/AF. $13.3 million / 190 AF/year / 15 years life expectancy = $4,667/AF.
[14] Costs are only for purchase of basic tank and fittings and do not include maintenance or replacement with 15 year life expectancy.

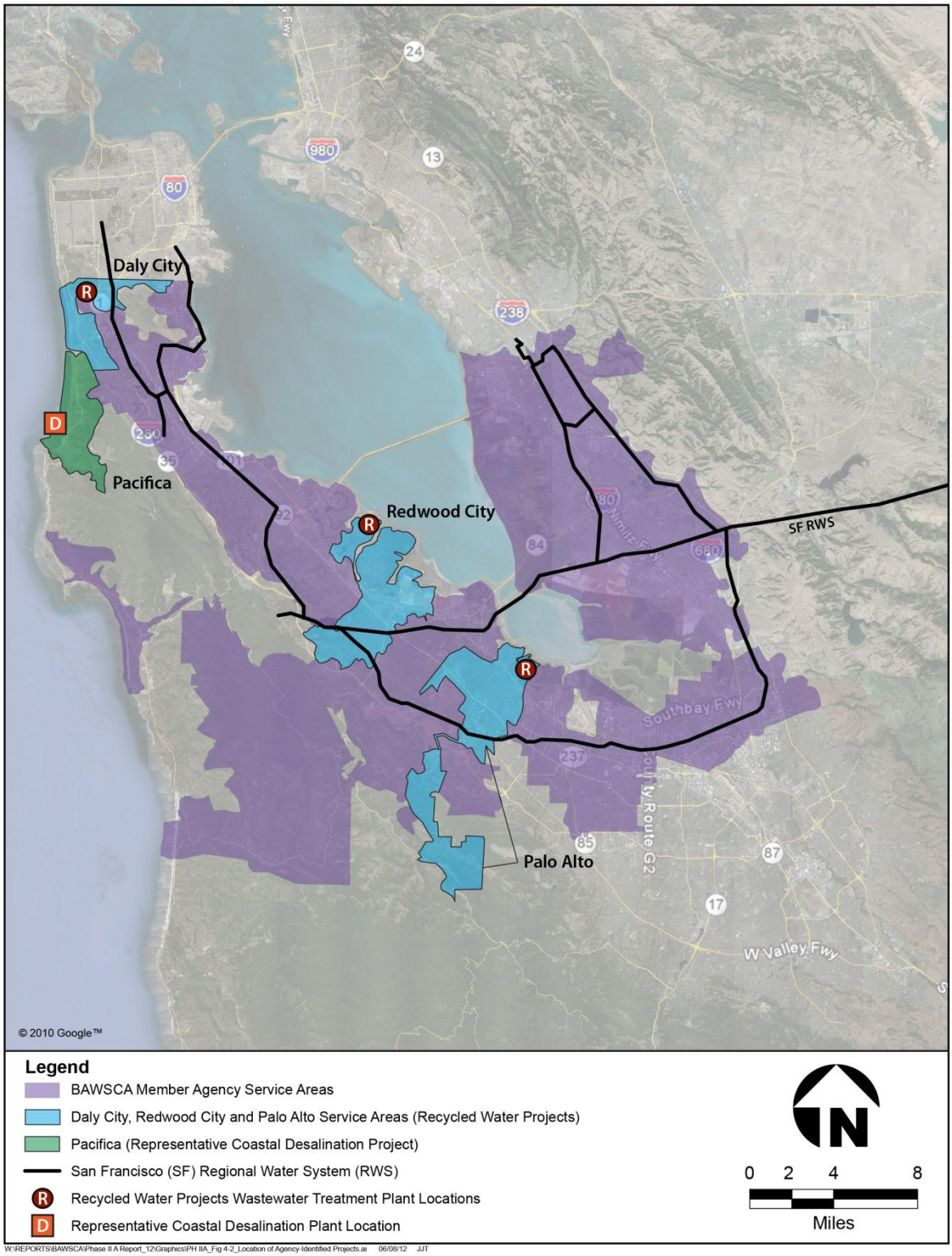

Figure 4-2
Location of the Agency-Identified Projects and the Representative Coastal Desalination Project

4.3.1 Recycled Water Projects

The agency-identified recycled water projects described in this section include:

- Daly City recycled water expansion project;
- City of Palo Alto recycled water project to serve Stanford Research Park; and
- Redwood City recycled water treatment plant expansion project.

4.3.1.1 Daly City Recycled Water Expansion Project

The Daly City recycled water expansion project is summarized in the text below. Additional information is provided in *Attachment 2.*

Description

The Daly City recycled water expansion project includes a 2.89 mgd expansion of the existing Daly City recycled water treatment, transmission, and distribution system to serve irrigation customers within the Town of Colma, including cemeteries, city parks, schools, and a golf course.[1] These irrigation customers currently use private groundwater wells that extract groundwater from the Westside Groundwater Basin, or potable water served by Cal Water's South San Francisco System, to irrigate turf and other landscaping. Converting these irrigation customers to recycled water would free up these supplies for other uses. Figure 4-3 indicates the location of the WWTP and the potential recycled water transmission pipeline from Daly City to Colma.

Yield

The 2.89 mgd Daly City recycled water expansion project is designed to meet the estimated combined annual demand of the Colma irrigation customers of 1,060 AF/year. The estimated project yield is lower than the maximum potential yield available from the 2.89 mgd expansion due to the timing and duration of the irrigation demand.

Cost

The present worth cost for the Daly City recycled water expansion project is about $2,100/AF, excluding costs for O&M. The O&M costs have not been developed at this time for the recycled distribution system. Inclusion of those O&M costs will increase the present worth cost for the project.

Project Implementation Schedule

A specific implementation schedule has not been developed for this project. However, based on similar types of projects, it is anticipated that implementation, including planning and environmental review, preliminary design, final design and construction, will take about six years after a decision has been made to move forward with the project.

[1] An initial evaluation of this project concept was done as part of a joint study by Daly City and the SFPUC to evaluate the feasibility and cost of expanding the existing Daly City Recycled Water Plant by 3.4 mgd to serve both Colma and areas within the City and County of San Francisco. The Daly City recycled water expansion project being evaluated as part of the Strategy does not include the 0.4 mgd of expansion and service to the City and County of San Francisco.

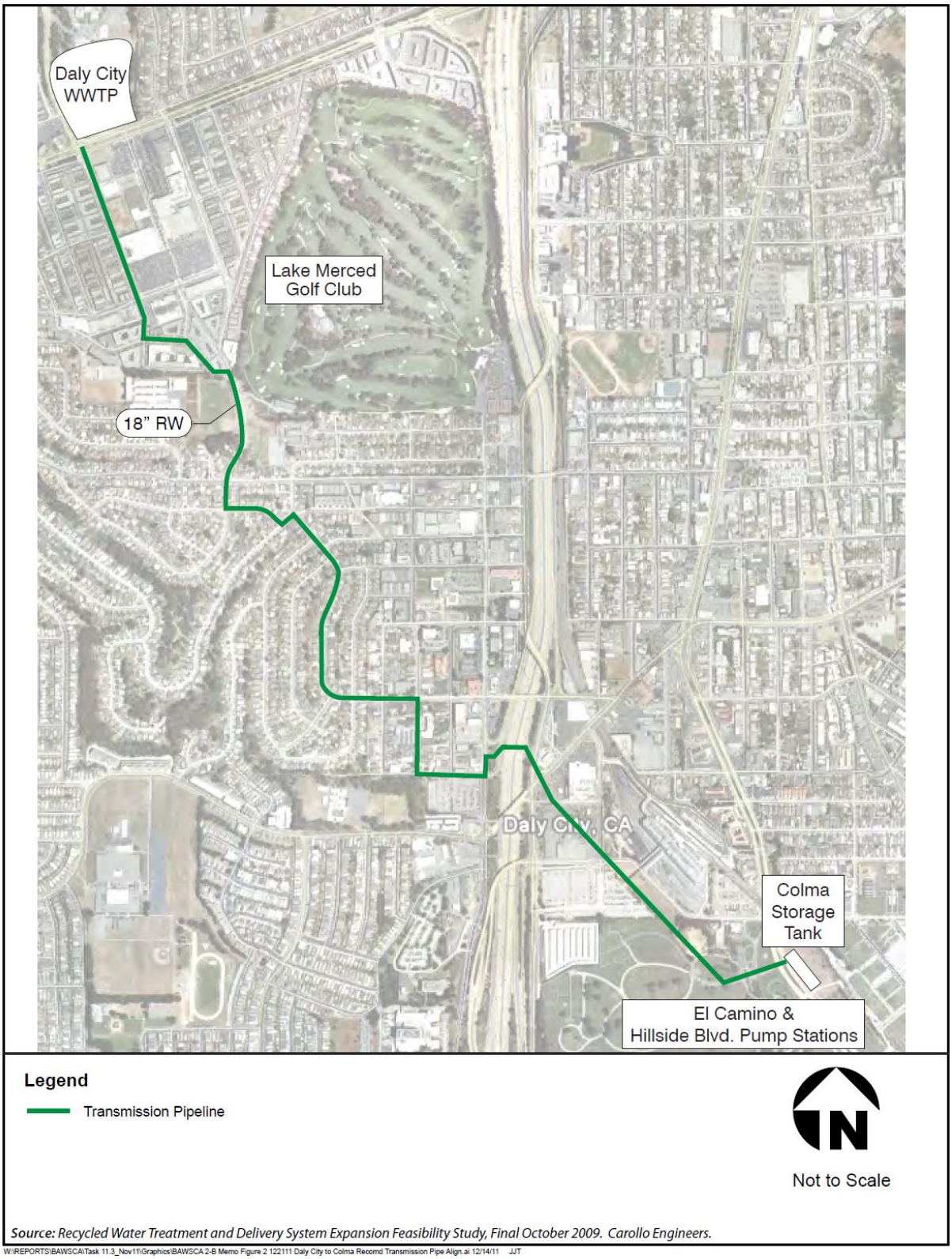

Figure 4-3
Potential Recycled Water Transmission Pipeline Alignment - Daly City to Colma

4.3.1.2 City of Palo Alto Recycled Water Project to Serve Stanford Research Park

The project under consideration by the City of Palo Alto is an extension of recycled water service to serve approximately 900 AF/year to the Stanford Research Park. This project would use existing capacity within the Palo Alto RWQCP, but would require construction of a new pipeline to serve Stanford Research Park and the associated pumping and storage requirements at the RWQCP. It is anticipated that the yield, cost, implementation schedule and other information will be available from Palo Alto later this year as part of the project environmental impact report (EIR). The project information that is available to date is included below and in *Attachment 2*.

Description

Palo Alto owns and operates the RWQCP which treats wastewater for six communities and districts including Los Altos, Los Altos Hills, Mountain View, Palo Alto, Stanford University and the East Palo Alto Sanitary District. The extension of the recycled water service by constructing a new pipeline to Stanford Research Park would provide average annual and peak demands estimated to be 0.8 mgd and 2.0 mgd, respectively with an estimated annual yield of 900 AF/year. Capacity constraints at the RWQCP as well as water quality issues may limit how much recycled water Palo Alto can reliably deliver to the Stanford Research Park. Also, additional clarification is needed to regarding whether Palo Alto or the City of Mountain View has priority access to the current unused recycled water capacity at the RWQCP. Resolution of this issue may affect the Palo Alto project, as well as the City of Mountain View *Recycled Water Intertie with Sunnyvale (Project MV-2),* or *Increase Recycled Water Supply from Palo Alto RWQCP (Project MV-3).* The recycled water quality, specifically the total dissolved solids (TDS), needs to meet the irrigation criteria that were specified by Stanford Real Estate during discussions with Palo Alto.

Yield

The planned yield is 900 AF/year. The potential recycled water customers, their demands, projections of delivered water quantity, and annual yield may be updated based on the EIR currently being prepared by Palo Alto.

Cost

The costs for this project are currently being developed by Palo Alto.

Project Implementation Schedule

A conceptual project schedule is currently being updated as part of the EIR preparation.

4.3.1.3 Redwood City Recycled Water Treatment Plant Expansion Project

The Redwood City recycled water treatment plant expansion project is currently being evaluated by Redwood City and only limited information is available at this time. It is anticipated that the yield, cost, implementation, schedule, and other information for this project will be available from Redwood City as part of their Update to the Phase II Recycled Water Feasibility Study that is planned to be available by Fall 2012. The project information that is available to date is included below and in *Attachment 2*.

Description

The existing Redwood City recycled water system includes tertiary treatment facilities, two 2.2 million gallon (MG) storage tanks, a distribution system pump station (all located at the South Bayside System Authority [SBSA] WWTP), and recycled water distribution facilities throughout Redwood City.

The Redwood City recycled water treatment plant expansion project includes the expansion of the existing Redwood City/SBSA recycled water treatment facility from 2.8 mgd to 8.0 mgd. Additional transmission and distribution facilities will be required. Depending on the location and demands of potential customers, booster pump stations and storage may also be required.

Yield

The location and demand of potential customers (i.e., the project yield), is currently being developed by Redwood City and is expected to be available in late 2012.

Cost

The costs for this project are currently being developed by Redwood City and are expected to be available in late 2012.

Project Implementation Schedule

The implementation schedule is currently being developed by Redwood City and is expected to be available in late 2012.

4.3.2 Representative Coastal Desalination Project

The representative coastal desalination project is a project that was originally identified by NCCWD during the *Phase I Scoping Report* (*NCCWD – Desalination Plant (NC-4)*). In subsequent discussions conducted with the Strategy Team as part of the project refinement process described in Section 2, NCCWD indicated that they would not be pursuing the development of this project independently. However, because of the potential benefits to the region, a similar project concept has been carried forward for evaluation by BAWSCA. This representative coastal desalination project is summarized below. Additional information is presented in *Attachment 2.*

Description

The representative coastal desalination project would treat sea water from a subsurface intake structure developed on the coast near the City of Pacifica. The water would be treated through a reverse osmosis (RO) desalination process and delivered to a connection with the SF RWS on the upper San Francisco Peninsula.

This project has an estimated maximum treated water capacity of 7.5 mgd based on estimated facility capacity limitations. This treated water capacity is specifically limited due to space constraints at the proposed desalination treatment plant site (assumed to be the former Sharp Park WWTP site), and the potential capacity of the subsurface intake structures (i.e., assumed to be Ranney Collector Wells located in the Pacifica State Beach area). The potential subsurface intake capacity is based on the identified beach area and conservative estimates of spacing for multiple Ranney Collector Wells. However, specific information is not known about thickness of the beach sands or the off-shore geologic formations that could affect this capacity. Figure 4-4 identifies the general location for these facilities.

Yield

Annual production estimates depend on whether the project would be developed for normal and/or drought year supply. For the purposes of this analysis, the annual production is assumed to be 80% of the estimated maximum potential treated water capacity of 7.5 mgd, or up to 6,700 AF/year.

Figure 4-4
Representative Coastal Desalination Project - Potential Facility Locations

Cost

The present worth cost for this project is about $2,200/AF, excluding costs for land acquisition for the Ranney Collector Wells, the treatment plant site, and the reservoir storage site, and conveyance through the SF RWS. Inclusion of those costs, once developed, could substantially increase the present worth cost for the project.

Project Implementation Schedule

A preliminary implementation schedule has been developed for this project, based on similar types of desalination projects. It is anticipated that project implementation, including planning and environmental review, preliminary design, final design, and construction, would take at least six to eight years after a decision had been made to move forward with the project.

4.3.3 Local Capture and Reuse Projects

The local capture and reuse projects described in this section include:

- Rainwater harvesting;
- Stormwater capture; and
- Greywater reuse.

Additional detailed information is presented in *Attachment 2*.

4.3.3.1 Rainwater Harvesting Projects

Implementation of rainwater harvesting projects throughout the BAWSCA service area would require the support of BAWSCA member agencies and participation from member agency customers. As part of the project development process described in Section 2, several BAWSCA agencies stated that their customers have expressed interest in rainwater harvesting. The following BAWSCA agencies currently have rainwater harvesting support and/or implementation plans:

- The City of Millbrae offers a Rainwater Harvesting and Greywater Reuse Workshop annually and is starting a rain barrel rebate program;
- The City of Palo Alto offers rebates of $50 per rain barrel. Cistern rebates are $0.15 per gallon with a maximum residential rebate of $1,000 and a maximum commercial rebate of $10,000. Palo Alto also hosts rainwater harvesting education events to educate its customers on the benefits and opportunities for rainwater harvesting;
- The City of Brisbane has a Rain Barrel Guidance manual;
- Stanford's Graduate School of Business is considering the installation of a 75,000-gallon rainwater harvesting system; and
- Westborough Water District is considering the development of a rainwater harvesting project to serve the decorative fountain at its office.

Description

Rainwater harvesting includes the collection of rainwater runoff from roof surfaces by gutters and downspouts and storage of that water for use during a subsequent dry day. Using the stored water for landscape irrigation and non-potable indoor uses reduces potable water demands. In the most straightforward single-family residential applications, rainwater is collected from a roof in a rain barrel and used to irrigate a yard or garden. This simple application requires only the purchase of a rain barrel and the appropriate hoses and fittings to convey the stored rainwater to the irrigated area.

For larger scale roof rainwater collection and storage, such as for commercial developments and multi-family housing, greater quantities may be captured, provided that large cisterns are constructed in basements or if underground or surface level storage tanks are present at the site. The stored rainwater is then pumped from storage and used for non-potable purposes such as irrigation, car washing, clothes washing machines, toilet flushing, swimming pools, and process water for commercial and industrial uses. Many of these applications, including toilet flushing, swimming pools and process water, require treatment and separate piping systems.

Yield

A preliminary estimate of the potential yield for rainwater harvesting in 2035 in the BAWSCA service areas ranges from 190 AF/year to 610 AF/year. This calculation is based on the projected number of single family residential units within the BAWSCA service area in 2035, average monthly rainfall, average roof size, the percentage of roof area captured by the rainwater harvesting system, and the assumed percentage of total homes that install a rainwater harvesting system. The range in yield was determined by varying the percent of roof runoff that is captured by the rainwater harvesting system (25 and 50%) and the San Francisco customer participation rate (10 and 20%). The yield of rainwater harvesting projects is also largely dependent on the magnitude and timing of rainfall and the seasonality of demands that would utilize the stored rainwater (e.g. outdoor irrigation).

Cost

The estimated cost of this supply ranges from about $13.3 to $26.6 million based on the following assumptions:

- Household system costs: $300 (estimate for one rain barrel and associated fittings, per unit);
- Estimated equipment life: 15 years; and
- Number of households participating: 44,400 (10% participation rate) and 88,800 (20% participation rate).

Based on this range of capital costs and potential yields (190 AF/year to 610 AF/year) the present worth costs are anticipated to range from roughly $2,900/AF to $4,700/AF.

Project Implementation Schedule

Rainwater harvesting projects, depending on ownership and size, will vary in the time required to implement them on an individual basis and within an agency service area. Part of the implementation on the agency level could be the development of the types of rebates or other incentives that an agency may provide to encourage the installation and use of rainwater harvesting systems.

4.3.3.2 Stormwater Capture Projects

Implementation of stormwater capture projects throughout the BAWSCA member service area would require the support of BAWSCA member agencies and participation from member agency customers. As part of the project development process described *Attachment 2*, several BAWSCA agencies stated that their customers have expressed interest in stormwater capture.

The following stormwater capture projects that are currently planned, or are being implemented, in the BAWSCA service area could provide insight on the potential yields and costs of stormwater capture projects. Additional information is presented in *Attachment 2*.

- Alameda County Water District (ACWD) captures rainfall runoff from the Alameda Creek Watershed for use as groundwater recharge. Captured water is diverted to several hundred acres of ponds (former gravel quarries) where water percolates to recharge the underlying Niles Cone Groundwater Basin. Although this project is much larger in scale than the single property-sized stormwater capture projects being considered in Phase II A of the Strategy, it can provide insight into representative potential yields and costs.

- The City of East Palo Alto included stormwater capture in its October 2010 Water System Master Plan, noting "Stormwater capture and reuse has the potential to become a valuable method of supplementing an area's water supply" (East Palo Alto 2010). The Master Plan identified multiple sites within East Palo Alto where a stormwater reuse/recycling project could be utilized including Martin Luther King Park and Jack Farell Park. The Master Plan identified a cost of $450,000 for the potential Martin Luther King Park stormwater capture project including stormwater collection, 90,000 gallons storage tank, irrigation pump, and a tertiary treatment system to serve the 5.4-acre park.

- Ken Coverdell, a BAWSCA Board member from the Coastside County Water District won the Silicon Valley Water Conservation Award in 2010 for a rainwater harvesting/stormwater capture project at Sally Coverdell's Half Moon Bay Blue Sky Farms Café and Native Plant Nursery. As a demonstration project, the Coverdells installed a 30,000-gallon cistern to store and reuse rainwater and stormwater runoff from their parking and hardscape areas through pervious concrete. Data from a sophisticated satellite weather service activates the nursery's drip-irrigation system that is fed from a 110-foot long cistern buried under the parking lot. Two years after installation, the now primarily California native landscape no longer requires irrigation. Altering their landscape and changing to California native plants and drip irrigation with rain sensors helped the Coverdells conserve water at their 2.5 acre nursery and home as well. In fact, these practices reduced the nursery's potable water use by 750,000 gallons the first year.

Description

The stormwater capture projects addressed in Phase II A of the Strategy are primarily projects that could be developed by property owners on individual parcels of land (i.e., single or multi-family residential, commercial or industrial) that involve the capture and storage of stormwater runoff that can then be used for a variety of purposes, including increasing the groundwater supply through recharge and reducing potable water use for outdoor irrigation. These stormwater capture projects would focus on the potential potable water demand reductions within the BAWSCA service area, and area-wide implementation of low-impact development (LID) projects.

Yield

Reliable information on the potential yield of BAWSCA service area wide implementation of stormwater capture projects is not currently available due to the lack of projects in the region.[2] Existing stormwater capture and groundwater recharge projects like those implemented by ACWD could provide some guidance on estimating yields, but are much larger than the single property-sized projects being considered in Phase II A of the Strategy. Yield of individual projects will be determined largely by the magnitude and timing of rainfall runoff as well as the size of land available to capture the stormwater runoff, the method of retention (i.e., capture and storage for reuse or infiltration into the groundwater aquifers), and the amount of demand that could be met through the reuse of the stormwater stored aboveground.

Cost

Reliable cost information is not currently available for implementation of stormwater capture and reuse or LID projects on a regional or local scale. As such, neither capital nor present worth costs are included at this time.

Project Implementation Schedule

Implementation of stormwater capture projects is dependent on the individual project developer and the permitting process for planning and approval as part of new developments, or retrofits of existing properties. Financial or other incentives may be necessary to make these projects feasible for developers, and a number of site-specific issues would need to be well understood including the presence or absence of a groundwater basin, whether the local geology is suitable for recharge, and potential water quality impacts.

4.3.3.3 Greywater Reuse Projects

Implementation of greywater reuse projects throughout the BAWSCA service area would require the support of BAWSCA member agencies and participation from member agency customers. Based on the results of agency interviews as a part of Phase II A of the Strategy, many BAWSCA agencies are interested in promoting greywater in response to public interest, but some concerns exist regarding sewer system backflow and conflicts with recycled water programs. There is also concern that a reduction in wastewater flows due to the implementation of greywater reuse projects may affect solids movement in wastewater lines. There are currently no documented greywater projects being implemented by BAWSCA member agencies though they do exist in other areas in the Bay Area and the State.

[2] A study by the Natural Resources Defense Council (NRDC) found that LID has a substantial potential to save both water and energy in the San Francisco Bay Area. NRDC estimated that LID projects implemented throughout a 3,850-square mile study area including San Francisco, Marin, Contra Costa, Alameda, Santa Clara, and San Mateo Counties could provide 34,500 AF/year to 63,000 AF/year by 2030 (or 9.0 AF/year to 16.4 AF/year of water per square mile) (NRDC 2009). Using this example, the 460-square mile BAWSCA service area would potentially capture 4,100 AF/year to 7,500 AF/year through service area-wide implementation of LID projects. Because this study includes both roof-top capture stormwater as well as use of stormwater to recharge groundwater, with no breakdown between the two, this potential yield estimate is not used to avoid double-counting with the water savings estimate of the rainwater harvesting projects. In addition, the yield estimate assumes part of the yield is in groundwater recharge which is very limited in many portions of the BAWSCA service area.

Description

Greywater (also spelled graywater, grey water, and gray water) is the untreated household wastewater from bathtubs, showers, bathroom sinks, and washing machines. Wastewater from toilets, referred to as "black water", is not included. In California, wastewater from kitchen sinks or dishwashers is also not an acceptable source of greywater.

Unlike rainwater harvesting and stormwater capture, greywater production capacity does not vary seasonally. However, the potential yield from greywater reuse projects is dependent on the timing and magnitude of the demand, especially to the extent that the water is used for irrigation. During the winter months, when irrigation demands are lower, there could be a surplus of greywater supply which would have to be discharged to the sewer or septic system. Greywater can also be used to flush toilets, which provide year-round demands, but this would require the construction of a more complex and permitted system that would provide treatment to California Code of Regulations Title 22 standards.

Yield

A preliminary estimate of potential greywater yield in 2035 for the BAWSCA member agencies' service areas ranges from about 1,120 AF/year to 2,700 AF/year for simple systems used for irrigation. This estimate is based on a calculation using the number of single family residential units within the BAWSCA service area, assumed participation rate, and an average volume of greywater generated per household. The yield range is based on assumed greywater production per household (a range of 41 gallons per day [gpd] to 108 gpd) and participation rate (10 and 20%). The seasonal nature of irrigation demands is also considered in the yield estimate.

Cost

The estimated cost of this supply ranges from about $13.3 to $26.6 million based on the following assumptions:

- Household system costs: $300 (estimate for one rain barrel, and associated fittings per unit);
- Estimated equipment life: 15 years; and
- Number of households participating: 44,400 (10% participation rate) and 88,800 (20% participation rate).

Based on this range of capital costs and potential yields (1,120 AF/year to 2,700 AF/year) the present worth costs are anticipated to range roughly from $660/AF/year to $790/AF/year.

Project Implementation Schedule

Greywater reuse projects, depending on ownership and size, will vary in the implementation time on an individual basis and within the service areas. Part of the implementation on the agency level could be the development of the types of rebates or other incentives that an agency may provide to encourage the installation and use of greywater reuse systems. In addition, regulations which currently limit the use of greywater also will affect the implementation of these projects.

4.4 Approach to Addressing Outstanding Issues Related to Agency-Identified, Representative Coastal Desalination, and Local Capture and Reuse Projects

There are outstanding issues associated with the agency-identified projects, the representative coastal desalination project, and the local capture and reuse projects that may affect the yield, cost, implementation, water quality, and other aspects of project viability. The following presents a general description of each issue, as well as a list of the specific actions that would need to be performed by the implementing agency and/or BAWSCA to address the stated issues. Table 4-2, located at the end of this section, provides a more detailed description of the issues critical to each of these agency-identified projects.

4.4.1 Yield

A project's yield is dependent on: (1) the level of water demand that could potentially be served by the project; and (2) the physical capacity of the infrastructure to deliver this supply. For example, a WWTP may be capable of producing significant quantities of recycled water, but the customer demand and quality requirements may limit the use of the water and therefore the overall yield.

In order to confirm the yield for a number of the agency-identified and other projects, the potential customer market and demands to be served by the project must be confirmed, as well as the customers' long-term commitment to use of the new supply. In addition, the physical capacity of several of the projects to produce water needs to be confirmed.

- Ongoing work by Daly City, Redwood City, and Palo Alto is necessary to confirm the potential market for their recycled water (demand) and to secure commitments by potential customers for long-term use of the recycled water supply, including addressing potential water quality issues.
- The lead agency for the representative coastal desalination project should assess the potential yield of the proposed Ranney Collector Wells along the Pacifica shoreline, including limitations due to the potential impacts on water quality or yield for other groundwater pumpers in the area. The lead agency would also need to confirm whether there is sufficient land to construct the proposed desalination treatment plant and treated water storage tank.
- The long-term yield of the rainwater harvesting, stormwater capture, and greywater reuse projects is dependent on the number and storage capacity of units installed, whether they are maintained, and on-going customer participation. At this time, local agencies have not established anything to require and enforce maintenance of these systems. In addition, the yield of rainwater harvesting and stormwater capture projects is dependent on the availability and timing of rainfall and the type of demands that they would serve, e.g. outdoor irrigation. BAWSCA, and/or the individual member agencies, could better understand the typical level of participation and yield achieved with these types of projects by tracking successful projects in the area, like the Half Moon Bay Blue Sky Farm's stormwater capture and reuse system or potential projects like East Palo Alto's Martin Luther King Park stormwater capture system.

4.4.2 Cost

In many cases, project costs are incomplete (e.g., they do not include some facilities, land purchase, conveyance, wheeling through the SF RWS, or other critical information). Additional information will be needed to determine total project cost and to compare project costs.

- The Daly City recycled water distribution system O&M costs estimates should continue to be developed by Daly City. Redwood City and Palo Alto should develop capital, O&M, and present worth costs for their recycled water projects. The purchase price for water, whether subsidized or not, also should be developed. Ongoing work by these agencies is expected to complete these cost estimates.
- The lead agency for the representative coastal desalination project should confirm the availability and cost for use of the suggested facility sites for the representative coastal desalination project (i.e., wells, pipelines, treatment plant, and storage).
- Rainwater harvesting, stormwater capture, and greywater reuse systems can be expensive to retrofit because of the storage and plumbing required. Larger stormwater projects would require pressure pumps and controls, increasing maintenance costs of these systems. More information could be developed on the actual costs of successfully implemented rainwater harvesting, stormwater capture, and greywater reuse systems. BAWSCA, and/or individual member agencies, could also track projects to better understand the total lifecycle costs of these projects.

4.4.3 Implementation

All of the projects listed herein are complex and would require the agreement of multiple parties, as well as the construction of facilities, environmental review, and other elements (e.g., land purchase, wheeling agreements, permitting, rights-of-way).

- Daly City, Redwood City, and Palo Alto should continue to confirm potential partners for project development and the customers for their respective recycled water projects.
- The lead agency for the representative coastal desalination project should identify ownership and operation of the treatment, pumping, and brine disposal facilities.
- Implementation of rainwater harvesting, stormwater capture, and greywater reuse projects will require consideration of storage needs, permitting, and maintenance of systems. Also, because these projects require individual customer implementation, a sponsoring agency may not have total control over how the systems are installed and maintained. BAWSCA, and/or individual member agencies, could better understand the implementation requirements for these projects by tracking successful projects in the area.
- Implementing rainwater harvesting, stormwater capture, and/or greywater reuse projects that include storage may require approval by local county agencies that regulate mosquito control for onsite storage. This could be the responsibility of the individuals planning to install these types of projects. However, the BAWSCA member agencies could also provide support for implementation through development of guidelines.

4.4.4 Water Quality

Water quality can have a significant impact on treatment costs, conveyance ability, and beneficial use of the water. The water quality for these projects is not fully known and will need to be confirmed.

- The potential environmental impact and public acceptance of the treated water quality associated with recycled water projects should be assessed for all projects and their specific customer groups. In addition, the source water quality (e.g., salinity, iron, manganese, etc.) of the recycled water projects is currently not described and may affect the treatment process, treatment cost, and the brine discharge requirements and cost. Ongoing work by Daly City, Redwood City, and Palo Alto is expected to address these issues.
- Member agencies considering implementation of rainwater harvesting, stormwater capture, and greywater reuse projects within their service areas should consider possible permitting and regulatory limitations on the use of these supplies due to public health cross-connection and backflow concerns. Also, uncertainty about water quality impacts to groundwater from the reuse of both stormwater and greywater could restrict its application in sensitive groundwater areas. BAWSCA and/or individual member agencies could estimate the potential impact on groundwater recharge of these projects due to possible presence of contaminants in the captured water, and the ability of the proposed recharge areas to recharge the groundwater aquifers.

4.4.5 General

There are two general actions that should be considered in addressing the outstanding issues, including:

- BAWSCA should continue to update the project information included in Phase II A of the Strategy to include additional data developed by Daly City, Redwood City, and Palo Alto as part of their respective ongoing project studies and environmental documentation; and
- A lead agency should be identified for the representative coastal desalination project.

These actions indicated above form the basis for several of the recommendations presented in Section 8, which supports the completion of the Strategy and the Final Strategy Report by December 2014.

Table 4-2 – Key Project Issues Identified for Agency-Identified, Representative Coastal Desalination, and Local Capture and Reuse Projects (Page 1 of 2)

Issue Type	Daly City Recycled Water Expansion Project	Palo Alto Recycled Water Project to Serve Stanford Research Park	Redwood City Recycled Water Treatment Plant Expansion Project	Representative Coastal Desalination Project	Rainwater Harvesting Projects	Stormwater Capture Projects	Greywater Reuse Projects
Yield	▪ Yield is dependent on customers' long-term commitment to use. ▪ Treated water quality may affect which customers can use this supply and affect demand and yield.	▪ Yield is dependent on customers' long-term commitment to use. ▪ Capacity constraints at the RWQCP as well as water quality issues may limit how much recycled water Palo Alto can reliably deliver to the Stanford Research Park. ▪ Additional clarification is needed regarding whether Palo Alto or the City of Mountain View has priority access to the current unused recycled water capacity at the RWQCP. Resolution of this issue may affect the Palo Alto Project, as well as the City of Mountain View Recycled Water Intertie with Sunnyvale (MV-2), or Increased Recycled Water Supply from Palo Alto RWQCP (MV-3). ▪ Treated water quality may affect which customers can use this supply and affect demand and yield.	▪ Yield is dependent on customers' long-term commitment to use. ▪ Treated water quality may affect which customers can use this supply and affect demand and yield.	▪ Hydrogeologic information is not available for the proposed intake area. ▪ Mitigation of the potential impacts on water quality or yield for other groundwater pumpers in the area may impact pumping capacity and long-term yield.	▪ Frequency and amount of rainwater may not coincide with when demands occur (i.e., summer months). ▪ Storage capacity limits rainwater harvesting during wet periods. ▪ If storage exceeds 360 gallons local plumbing codes will require a permit. ▪ Long-term yield is dependent on number of units installed, whether they are maintained and on-going customer participation.	▪ Frequency and amount of stormwater may not coincide with when demands occur (i.e., summer months). ▪ Yield is dependent on rainfall occurrence, storage capacity and available uses of water captured. ▪ Long-term yield is dependent on number of projects developed, whether they are maintained and on-going customer participation. ▪ Yield through groundwater recharge is dependent on the geology of the aquifers to allow recharge and storage, and potential limitations due to the presence of contaminants in the surface or groundwater.	▪ Long-term yield is dependent on number of units installed, timing of demand, and whether they are maintained and on-going customer participation. ▪ If storage exceeds 360 gallons local plumbing codes will require a permit.
Cost	▪ Funding sources are unknown. ▪ Distribution system O&M costs estimates have not been developed for the project. ▪ Purchase price for water, whether subsidized or not, needs to be developed.	▪ Funding sources are unknown. ▪ Capital, O&M, and present worth (life-cycle) costs need to be developed to determine project viability. ▪ Purchase price for water, whether subsidized or not, needs to be developed.	▪ Funding sources are unknown. ▪ Capital, O&M, and present worth (life-cycle) costs need to be developed to determine project viability. ▪ Purchase price for water, whether subsidized or not, needs to be developed.	▪ Funding sources are unknown. ▪ The availability and the potential use of land for the Ranney Collector Wells (Pacifica Beach Area), desalination treatment plant (old Sharp Park WWTP), and tank site (Milagra Ridge Park) need to be confirmed. If these sites are not available the cost of the project will be greater than currently estimated. ▪ If the proposed alignment changes for the raw water, treated water, and brine pipelines, the pipeline costs could be greater than currently estimated.	▪ Required replacement of storage and other equipment will affect costs.	▪ Most systems will require pressure pumps and controls compared to using municipal system water pressure, increasing maintenance costs. ▪ Required replacement of storage and other equipment will affect costs.	▪ Retrofitting existing facilities can be expensive as dual plumbing (wastewater and greywater) will be required. ▪ Required replacement of storage and other equipment will affect costs.

Table 4-2 – Key Project Issues Identified for Agency-Identified, Representative Coastal Desalination, and Local Capture and Reuse Projects (Page 2 of 2)

Issue Type	Daly City Recycled Water Expansion Project	Palo Alto Recycled Water Project to Serve Stanford Research Park	Redwood City Recycled Water Treatment Plant Expansion Project	Representative Coastal Desalination Project	Rainwater Harvesting Projects	Stormwater Capture Projects	Greywater Reuse Projects
Implementation	▪ Both Daly City and the City and County of San Francisco are potentially planning service to Colma. Who will serve Colma needs to be resolved. ▪ The potential recycled water customers identified by Daly City (i.e., the cemeteries in Colma) need to commit to long-term use and purchase of the recycled water. ▪ Potential funding partners for the project and the retail unit price for the recycled water need to be determined. ▪ Interagency agreements will require long-term purchase commitments along with recycled water supply sales agreement.	▪ Potential partners for project development need to be identified. ▪ Potential customers need to be confirmed. ▪ Interagency agreements will require long-term purchase commitments along with recycled water supply sales agreement.	▪ Potential partners for project development need to be identified. ▪ Potential customers need to be confirmed. ▪ Interagency agreements will require long-term purchase commitments along with recycled water supply sales agreement.	▪ Potential partners for project development need to be identified. ▪ Potential customers need to be determined. ▪ Ownership and operation of the treatment, pumping and brine disposal facilities needs to be determined. ▪ Local public support and/or opposition will affect project implementation. ▪ Availability and the potential use of land for the Ranney Collector Wells (Pacifica Beach Area), desalination treatment plant (old Sharp Park WWTP), and tank site (Milagra Ridge Park) need to be confirmed. If these sites are not available the feasibility of the project will be affected. ▪ Availability of proposed alignment for raw water, treated water, and brine pipelines need to be confirmed and potential mitigation and permitting issues determined.	▪ Deed restrictions in some developments may limit a homeowner's ability to add an outdoor storage tank (rain barrel). ▪ Requires individual property owner implementation. ▪ Projects requiring on-site storage may require vector (primarily mosquito) control.	▪ Stormwater capture for groundwater recharge using discharge to streams requires National Pollutant Discharge Elimination System (NPDES) permits. ▪ Requires individual property owner implementation. ▪ Projects requiring on-site storage may require vector (primarily mosquito) control.	▪ Can be difficult and costly to obtain a permit for greywater reuse systems. ▪ Reduced sewer flows from greywater systems have led to increases in sewer blockages and increases in odor complaints in some areas. ▪ The State of California has several codes (i.e., Plumbing and Health and Safety Code) regulating the use of greywater systems water quality that may limit number of units installed. ▪ Requires individual property owner implementation. ▪ Projects requiring on-site storage may require vector (primarily mosquito) control.
Water Quality	▪ The public and potential customers may not find the use of recycled water at the cemeteries to be acceptable.	▪ Project may be subject to a potential limitation on recycled water applications due to salt impacts to sensitive plants. ▪ Public acceptance of the use of recycled water may be an issue.	▪ Project may be subject to a potential limitation on recycled water applications due to salt impacts to sensitive plants. ▪ Public acceptance of the use of recycled water may be an issue.	▪ Source water quality (e.g., salinity, iron, manganese, etc.) is currently unknown and may affect the treatment process, treatment cost, and the brine discharge requirements and cost.	▪ Developments that utilize larger roof areas for collection of rainwater can increase the contamination risks from bird or animal droppings. ▪ Local agencies may not be willing to accept the burden of regulatory requirements required to meet public health cross-connection and backflow requirements.	▪ Permits for urban stormwater runoff stored and reused for irrigation may require review by the Department of Public Health to ensure the necessary water quality is maintained.	▪ Greywater can contain soaps and other chemicals that can kill plants and antimicrobial products that can reduce beneficial soil microbes. ▪ Greywater supply cannot be used to irrigate most food plants. ▪ Local agencies may not be willing to accept the burden of regulatory requirements required to meet public health cross-connection and backflow requirements. ▪ Uncertainty about water quality impacts to groundwater from the use of greywater could restrict its application in sensitive groundwater areas.

Section 5
Regional Water Supply Management Projects

As described in Section 4, a key objective of the Strategy is to identify and evaluate those projects that potentially could be developed to meet the future water needs of the BAWSCA member agencies through 2035. This section and *Attachment 3* describe the regional water projects that have been evaluated to date as part of Phase II A of the Strategy. The key results presented in this section are:

- No groundwater projects that rely on only conventional treatment processes are included for further evaluation. The groundwater supply retained for further evaluation requires desalination and alternative intake structures to increase yield potential;
- Multiple locations have been identified where a desalination plant could be located within the BAWSCA service area to produce a supply for the BAWSCA region or a member agency that could be independent of the SF RWS; and
- Water transfers that take advantage of existing interconnections with other regional water systems (e.g., the EBMUD system) offer a unique opportunity for BAWSCA.

5.1 Regional Water Supply Management Project Refinement

The *Phase I Scoping Report* identified potential regional projects, in addition to the agency-identified projects. As part of Phase II A of the Strategy, the Strategy Team refined the number and type of regional projects based on review of existing data, discussions with potential partners, and interest by the BAWSCA member agencies. The original group of regional projects included:

- Groundwater projects;
- BAWSCA representative desalination projects;
- The Bay Area Regional Desalination Project (BARDP);
- Water transfers; and
- Reservoir storage.

The only group that was removed from further consideration in Phase II A of the Strategy was reservoir storage, which only included one project: Enlargement of the Calaveras Reservoir.

As part of the WSIP process, the SFPUC decided to construct a new Calaveras Reservoir dam, but not to increase the storage capacity of the reservoir. Future enlargement of the reservoir would likely result in significant costs, environmental and regulatory requirements, and an implementation timeframe that would extend beyond the Strategy planning horizon of 2035. For these reasons, this project was removed from further consideration as part of the Strategy.

The other four groups of regional projects continued in Phase II A of the Strategy and are discussed in the following subsections.

5.2 Overview of Regional Water Supply Management Projects

The following sections summarize key information regarding the description of the regional projects, and Table 5-1 summarizes their estimated yields, capital and present worth costs, and implementation schedules.

5.2.1 Groundwater Projects

Several relatively large and high-yield groundwater (GW) aquifers are located within the BAWSCA service area (e.g., the Westside Groundwater Basin, the Santa Clara Groundwater Basin, and the Niles Cone Groundwater Basin). However, these aquifers are already heavily utilized by BAWSCA member agencies and others for water supply and conjunctive use operations. Further, some smaller scale groundwater projects are already being pursued by individual BAWSCA agencies to locally increase their supplies (see *Attachments 2* and *3* for additional information on the groundwater projects originally identified in Phase I of the Strategy). Based on work completed by others to date, there appears to be limited potential to develop a "new" high-quality (freshwater) groundwater supply to support a regional project within the BAWSCA service area. As such, no such freshwater groundwater projects have been included as part of the Strategy.

However, work completed to date throughout the BAWSCA service area does indicate that brackish groundwater aquifers exist along the western portion of the San Francisco Bay that, with the exception of ACWD, are not currently utilized by any of the BAWSCA member agencies or others. The possible development of these brackish groundwater sources has been included as part of the Strategy and is described in more detail in Section 5.2.2 and in *Attachment 3.*

5.2.2 BAWSCA Representative Desalination Projects

The BAWSCA representative desalination projects are summarized below. Additional information is presented in *Attachment 3.*

Description

Seven representative desalination projects have been conceptualized based on the different types of intakes and source water quality. The projects include desalination of brackish groundwater and Bay water. For preliminary evaluation purposes, three general areas along the Bay side of the San Francisco Peninsula were identified. These general areas include: Dumbarton Bridge Area; San Mateo Bridge Area; and South San Francisco Area, which are shown in Figure 5-1. These areas were selected because: they are sites with potentially favorable groundwater characteristics; they include undeveloped area that would provide sufficient space for the construction of intake and treatment facilities; there is the potential for co-location for brine disposal with existing WWTPs and outfalls; and there are nearby connection points to either local agency water systems or the SF RWS.

The three types of intakes evaluated include vertical groundwater wells, Horizontally Directionally Drilled Wells (HDDW, which would extend under the Bay), and open water intakes. The quality of the source water varies depending on the intake type. For example, the brackish groundwater accessed by vertical wells is assumed to have a salinity ranging from about 1,000 milligrams per liter (mg/L) to 10,000 mg/L of TDS. In contrast, the Bay water, which would be accessed via HDDW or open water intakes, is assumed to have a TDS level of about 25,000 mg/L. Table 5-2 summarizes this project information.

Table 5-1 - Summary of Project Sizing, Cost, and Implementation Schedule for Desalination Projects and Water Transfers

Item	BAWSCA Representative Desalination Projects														The Bay Area Regional Desalination Project[1]			Water Transfers
	Dumbarton Bridge Area			San Mateo Bridge Area						South San Francisco Area								
	1 mgd Brackish GW Wells	2 mgd Brackish GW Wells	5 mgd Brackish GW Wells	1 mgd Brackish GW Wells	2 mgd Brackish GW Wells	5 mgd Brackish GW Wells	5 mgd Bay Water HDDW[2] Wells	10 mgd Bay Water HDDW[2] Wells	10 mgd Bay Water Open Intake	1 mgd Brackish GW Wells	2 mgd Brackish GW Wells	5 mgd Bay Water HDDW[2] Wells	10 mgd Bay Water HDDW[2] Wells	20 mgd Bay Water Open Intake	Scenario 1	Scenario 2	Scenario 3	
Yield																		
Assumed Treated Water Production Capacity [3] (mgd)	1	2	5	1	2	5	5	10	10	1	2	5	10	20	20	20	20	-
Assumed Annual Production (AF/year) [3,4]	900	1,800	4,500	900	1,800	4,500	4,500	9,000	9,000	900	1,800	4,500	9,000	17,900	22,400	7,600	22,400	1,000 - > 5,000
Capital Cost																		
Capital Cost ($M) [5,6]	$30.6	$43.0	$64.4	$35.8	$47.3	$72.1	$126.5	$201.8	$274.7	$31.1	$42.7	$120.5	$194.3	$364.6	$159.4	$159.4	$171.7	-
Present Worth Costs																		
Total Production – 30 years (AF) [3,4]	27,000	54,000	135,000	7,000	54,000	135,000	135,000	270,000	270,000	27,000	54,000	135,000	270,000	537,000	680,000	227,000	680,000	> 150,000
Total Present Worth Cost ($M) [5,6,7]	$52.9	$76.2	$129.4	$58.5	$82.9	$137.4	$229.1	$395.3	$516.6	$53.0	$74.2	$223.5	$388.4	$829.7	$374.2	$242.2	$386.3	-
Present Worth Unit Cost ($/AF) [5,6,7,8]	$2,000	$1,400	$1,000	$2,200	$1,500	$1,000	$1,700	$1,500	$1,900	$1,900	$1,400	$1,700	$1,400	$1,500	$550	$1,069	$566	$200 - $900[9]
Implementation Schedules																		
Implementation (years)	6-8	6-8	6-8	6-8	6-8	6-8	10-12	10-12	10-15	6-8	6-8	10-12	10-12	10-15	6-7	6-7	6-7	2 - 5

[1] BARDP project description and data are presented in *Attachment 3*. Unit Present worth costs presented in this table have been adjusted to August 2011 dollars.
[2] HDDW – Horizontally Directionally Drilled Wells.
[3] Capacity is treated water production from desalination plant.
[4] Assumes annual operation at 80% of capacity for representative desalination projects (100% for BARDP scenarios 1 and 3, 33% on average for BARDP scenario 2).
[5] Costs adjusted to August 2011. Annual O&M costs for BARDP Scenario 2 are based on dry-year operation (which is assumed to occur once every three years).
[6] Costs do not include property acquisition, cost for use of WWTP outfall capacity, conveyance costs by others, purchase price of water, conveyance to BAWSCA member agencies through the SF RWS, or storage.
[7] Present Worth estimates include a 3% escalation and a 3% discount rate. The same escalation rate is used for electricity, materials, labor, and capital costs.
[8] Costs are rounded to the nearest $100/AF (except for BARDP).
[9] Cost only for purchase of supply, does not include costs for treatment, conveyance to BAWSCA member agency service areas, or infrastructure requirements.

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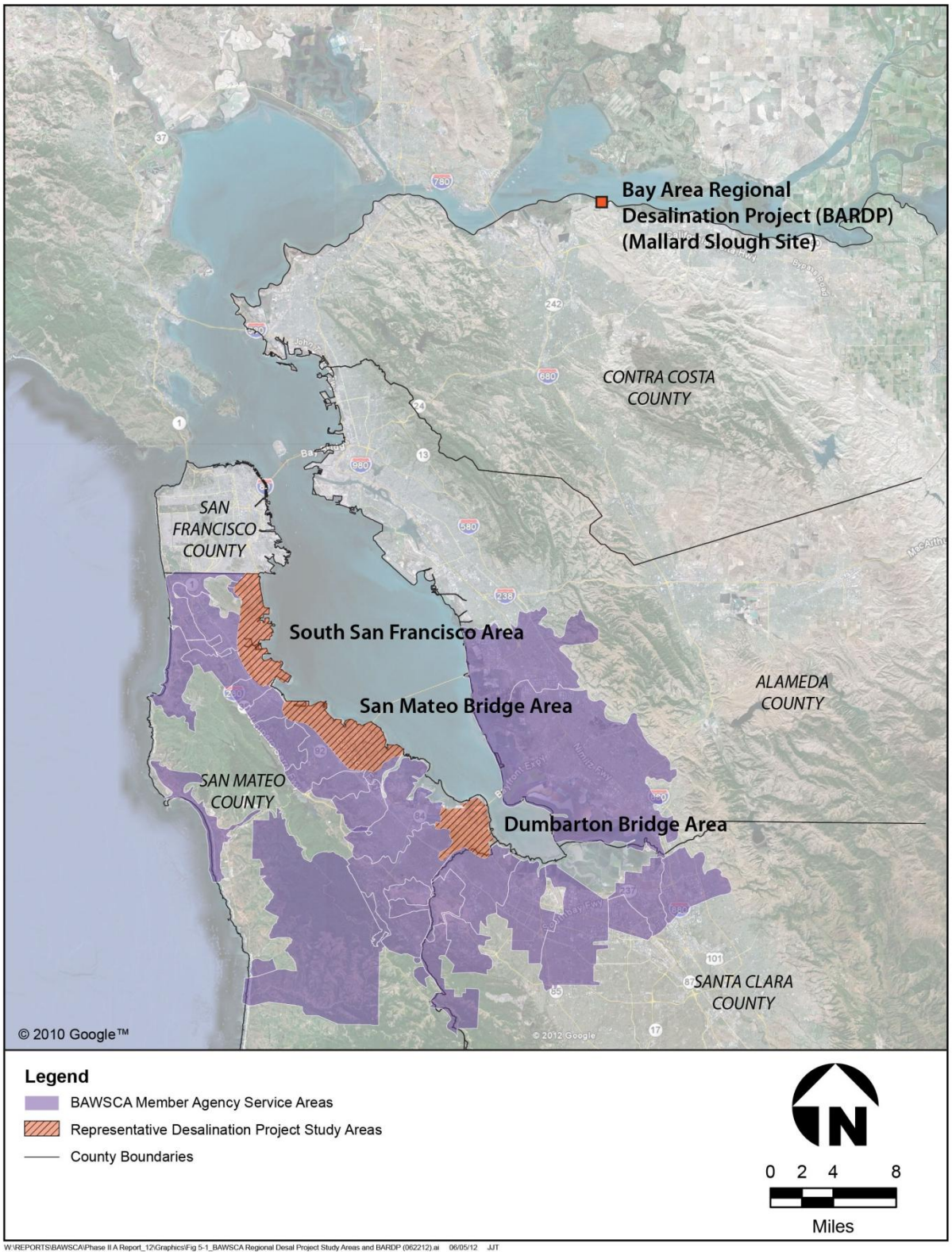

Figure 5-1
BAWSCA Representative Desalination Project Study Areas and BARDP

Table 5-2 – The BAWSCA Representative Desalination Projects Characteristics

Select Project Elements	Dumbarton Bridge Area	San Mateo Bridge Area	South San Francisco Area
Brackish Groundwater Well Capacity (mgd)	1 – 5	1 – 5	1 – 2
HDDW Capacity (mgd)	–	5 – 10	5 – 10
Open Water Intake Capacity (mgd)	–	10	20
Assumed Water Quality (mg/L) TDS	1,000 – 10,000	1,000 – 25,000	1,000 – 25,000
Potential Brine Disposal Option	Palo Alto RWQCP	San Mateo WWTP	South San Francisco/San Bruno Water Quality Control Plant (WQCP)
Range in Cost ($/AF)	$1,000 – $2,000	$1,000 – $2,200	$1,400 – $1,900
Implementation Duration (years)	6 to 8	6 to 15	10 to 15

Yield

The potential yield of the brackish groundwater supply developed through vertical wells is limited by the local hydrogeology and available recharge. Based on the available information, treated water capacities of 1 mgd, 2 mgd, and 5 mgd were assumed for the brackish vertical wells, with the larger capacities including multiple well locations. Capacities of 5 mgd and 10 mgd were assumed for the HDDW projects and capacities of up to 20 mgd were assumed for the open water intake projects. Annual yields for these projects assume operation at 80% of the design capacity with resulting annual yields of 900 AF to 4,500 AF for the vertical wells, 4,500 AF to 9,000 AF for HDDW, and up to 17,900 AF for open water intakes. In all cases, additional work would need to be done to confirm the yields.

Cost

To develop costs for the BAWSCA representative desalination projects, specific intake locations, desalination treatment plant sites, nearby WWTP facilities for potential co-use of the existing outfalls for brine disposal, and pipeline alignments were identified. These facility locations for the Dumbarton Bridge Area, San Mateo Bridge Area, and South San Francisco Area are shown in Figures 5-2, 5-3, and 5-4, respectively.

The present worth costs for the BAWSCA representative desalination projects, excluding site acquisition and brine discharge, range from $2,200/AF for the 1 mgd brackish groundwater projects to $1,000/AF for the 5 mgd brackish groundwater projects. The costs for the HDDW projects range from $1,700/AF to $1,400/AF for the 5 mgd and 10 mgd projects respectively. The 10 and 20 mgd open water intake projects have an estimated present worth cost of $1,900/AF and $1,500/AF, respectively. Inclusion of the site acquisition and brine disposal costs are expected to significantly increase the present worth costs of these representative projects.

Project Implementation Schedule

In general, the desalination projects that utilize brackish groundwater pumped from vertical wells will have the shortest implementation time (e.g., 6 to 8 years). The implementation time for the HDDW projects is expected be longer (e.g., 10 to 12 years), and the open water intake projects are expected to require the longest time (e.g., 10 to 15 years). These implementation schedules are based on estimated time durations after a decision has been made to proceed with a specific project or projects and reflect the different complexities associated with the permitting, environmental, and other issues associated with desalination projects.

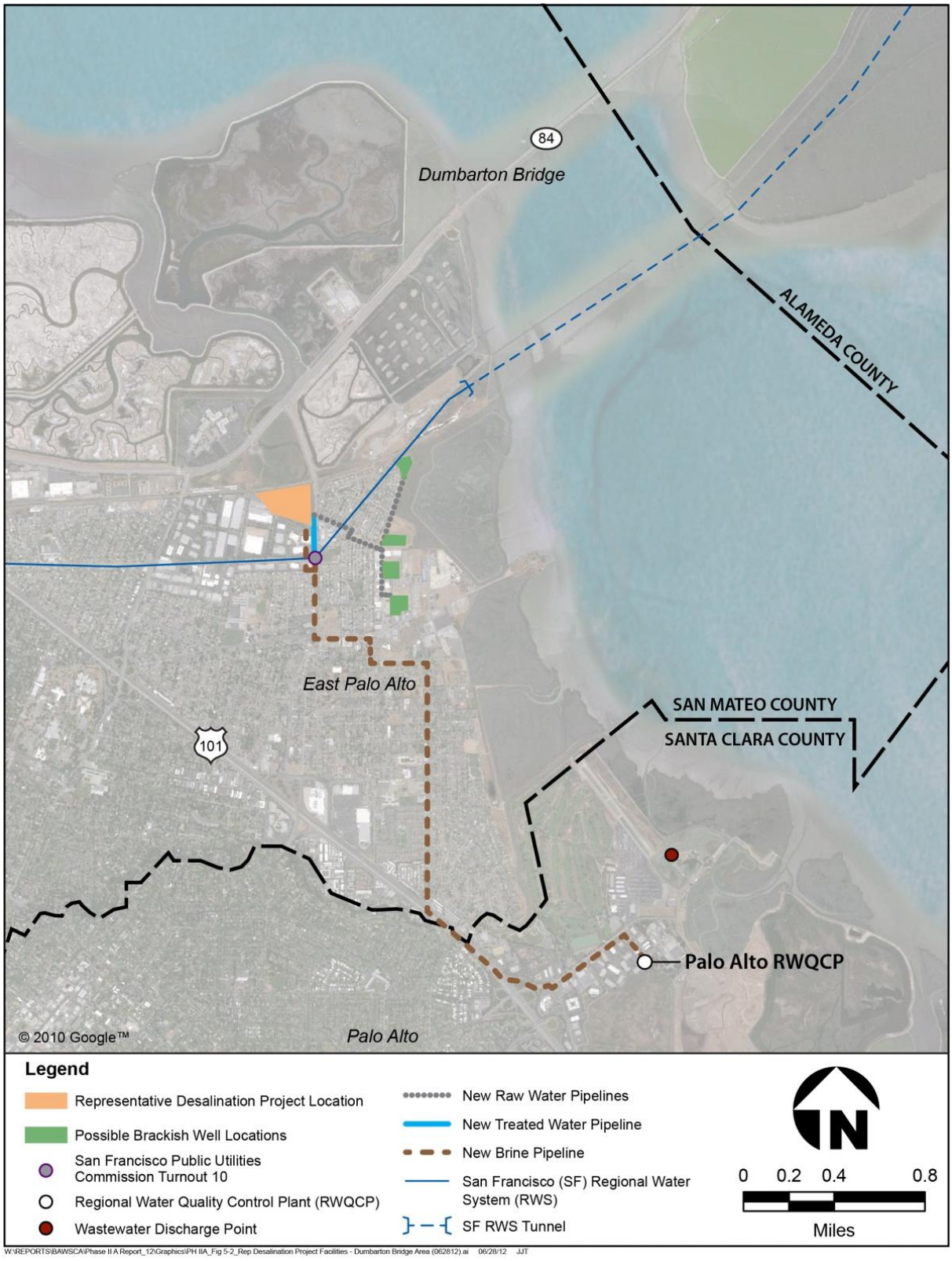

Figure 5-2
Representative Desalination Project Facilities – Dumbarton Bridge Area

Figure 5-3
Representative Desalination Project Facilities – San Mateo Bridge Area

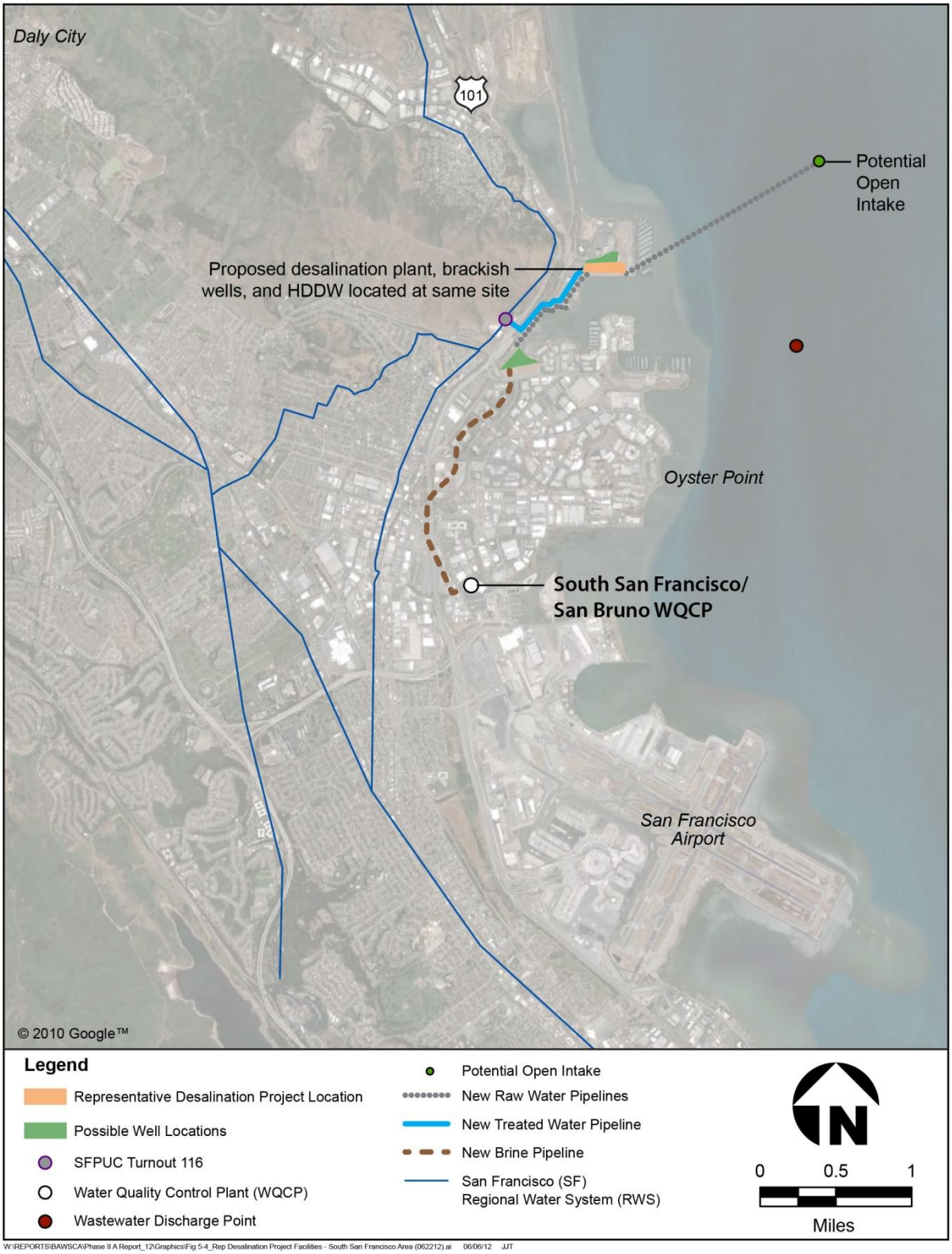

Figure 5-4
Representative Desalination Project Facilities – South San Francisco Area

5.2.3 The Bay Area Regional Desalination Project

The BARDP information is summarized below. Additional information is also presented in *Attachment 3*.

Description

The BARDP is being evaluated by five Bay Area regional water agencies (EBMUD; SCVWD; SFPUC; Contra Costa Water District [CCWD]; and the Alameda County Flood Control and Water Conservation District, Zone 7 [Zone 7]) for potential normal and dry year supply. To date, BAWSCA's interests in the BARDP have been represented by SFPUC (i.e., BAWSCA has paid for two-thirds of SFPUC's share of the BARDP development costs, which total about $283,000 to date). The BARDP has been included for evaluation in the Strategy for two reasons: (1) to serve as a benchmark for Sacramento River desalination project costs; and (2) to assess if BAWSCA wants to pursue participation in the BARDP independent of SFPUC.

Figure 5-1 indicates the location of the currently proposed BARDP site, which is assumed to be at CCWD's Mallard Slough Pump Station Site on the Sacramento River. Three different 20 mgd BARDP pumping and treatment scenarios have been evaluated to date by the five agencies. Scenarios 1 and 2 assume intake and treatment at the Mallard Slough location, but at different operational levels (i.e., Scenario 1 assumes operation in both normal and dry years, while Scenario 2 assumes only dry-year operation). Scenario 3 assumes intake, treatment, and brine disposal at some as-of-yet undefined locations. Operation for Scenario 3 occurs in both normal and dry years.

Evaluations of conveyance of the treated water to the participating agencies, or into the BAWSCA service area, have not been completed to date. CCWD has initiated an evaluation of the potential use of Los Vaqueros Reservoir for storage of the desalinated water. EBMUD is currently evaluating the potential hydraulic capacity and treatment and conveyance requirements to convey water from either the BARDP plant site or the CCWD reservoir to other potential users in the Bay Area (i.e., SCVWD, SFPUC, Zone 7, and BAWSCA). These studies are anticipated to be completed in spring/summer 2013. Table 5-3 summarizes information available at this time.

Table 5-3 – The Bay Area Regional Desalination Project Characteristics

Select Project Elements	Scenario 1	Scenario 2	Scenario 3
Source	Sacramento River Mallard Slough	Sacramento River Mallard Slough	Sacramento River
Capacity (mgd)	20	20	20
Source Water Quality (TDS)	Freshwater to brackish	Freshwater to brackish	Freshwater to brackish
Annual Yield (AF/year)	22,400 [1]	7,600 [2]	22,400 [1]
Potential Brine Disposal Option	TBD [3]	TBD	TBD
Range in Cost ($/AF)[4]	$550	$1,069	$566
Implementation Duration (years)	6-7	6-7	6-7

[1] Operation at 100% capacity every year.
[2] Operation at 100% capacity, but only in dry years.
[3] To be determined
[4] Cost at the desalination plant

Yield

The BARDP is sized to produce 20 mgd when the facilities are operated at full capacity in both normal and dry years. However, the amount of BARDP water that might be available to BAWSCA and its agencies is currently unknown and will depend on, among other things, the needs of the other participating agencies and the available conveyance capacity. The annual yield for the BARDP projects range from 7,600 AF to 22,400 AF with the lower yield based on operation only during dry years. The higher yields are based on assumed operation at 100% of capacity during all years.

Cost

The present worth costs for BARDP range from $550/AF to $566/AF for Scenarios 1 and 3 respectively, and up to $1,069/AF for Scenario 2, at the desalination plant. The Scenario 2 present worth costs are higher because the project is assumed to only operate during dry years. None of these scenarios include site property costs, brine disposal, any potential storage at Los Vaqueros, or conveyance from the BARDP site to the SF RWS or through the SF RWS to the BAWSCA member agencies. Inclusion of these costs is expected to significantly increase the present worth cost of this project.

Project Implementation Schedule

After completion of the EBMUD and CCWD conveyance and storage studies, the participating agencies are expected to make a decision as to which agencies will continue to fund BARDP and on what schedule it will be implemented. Based on the earlier BARDP studies, it was estimated that it will take approximately 6 to 7 years to complete the environmental documentation, design, construction, and startup once the agencies agree to implement the BARDP.

5.2.4 Water Transfer Projects

The BAWSCA water transfer projects are summarized below. Additional information is presented in *Attachment 3*.

Description

A water transfer must include a willing seller and buyer, and a means to convey that water from the buyer to the seller. As part of the Strategy, BAWSCA has evaluated several combinations of options for the source of supply and conveyance to the BAWSCA member agencies. BAWSCA is primarily evaluating options for dry-year transfers.

As can be seen on Figure 5-5, there are a number of options for the source of the supply for water transfer projects, including: (1) transfers from the SWP and Central Valley Project (CVP) systems; (2) transfers from Sacramento Valley, Delta, San Joaquin Valley, and private owners; and (3) transfers from the Tuolumne River Watershed or the Stanislaus Watershed.

A critical component of any transfer is the ability to physically move the water from the seller to the buyer. For supplies originating outside of the Bay Area, there are a limited number of existing conveyance facilities that could be used to wheel water to the BAWSCA member agencies. The potential options evaluated are shown on Figure 5-5 and include: SWP and CVP facilities; SCVWD/SFPUC emergency intertie and SCVWD facilities; EBMUD/SFPUC emergency intertie and EBMUD facilities; and the SF RWS.

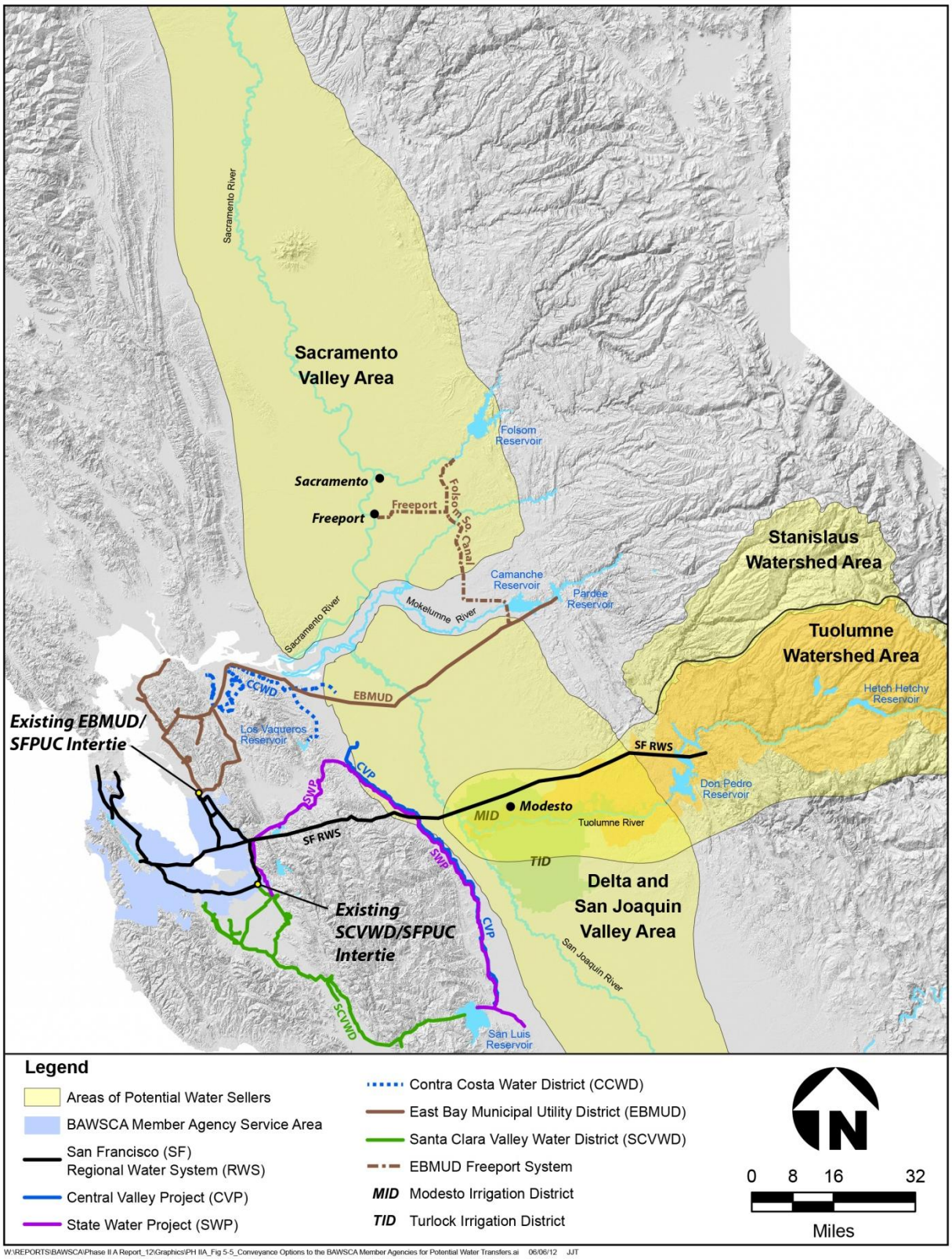

Figure 5-5
Conveyance Options to the BAWSCA Member Agencies for Potential Water Transfers

Based on the initial evaluation of water transfer options as documented in *Attachment 3*, a potentially promising option for BAWSCA is purchase of a supply that can be accessed north of the Delta (e.g., at the EBMUD's Freeport Project) and wheeled through existing infrastructure (e.g., the EBMUD and/or CCWD systems) to the SF RWS for delivery to the BAWSCA agencies. BAWSCA is also discussing the potential for water transfers in the form of water management agreements through the SCVWD system to the SCVWD/SFPUC emergency intertie. The most likely potential source of supply for such a water management agreement with SCVWD is unknown at this time but could include supplies from both north and south of the Delta given SCVWD's infrastructure.

BAWSCA is closely monitoring the progress of the potential SFPUC water transfer with the Modesto Irrigation District (MID) from the Tuolumne River Watershed. The SFPUC and MID are currently developing agreements for a 2 mgd transfer, and will be investigating the potential for larger transfers in the future. The results of that effort (i.e., costs, timing, supply benefits to the BAWSCA agencies, etc.) will be incorporated into the Strategy assessment as the information becomes available.

Table 5-4 summarizes the known information for the water transfer projects.

Table 5-4 – Water Transfer Projects Characteristics

Source of Supply	Yield (AF/year)	Purchase Cost $/AF[1]	Conveyance Option[2]				
			SF RWS	SWP/ SBA	CVP/San Felipe Project	EBMUD/ SFPUC Intertie	SCVWD/ SFPUC Intertie
Sacramento Valley Area	1,000 – >5,000	$200-$900	-	X	X	X	X
Delta and San Joaquin Valley Areas	1,000 – 5,000	$200-$900	-	X	X	X	X
SWP	NA	-	-	X	-	-	X
CVP	NA	-	-	-	X	-	X
Tuolumne/Stanislaus Rivers	TBD	TBD	X	-	-	-	-

[1] Does not include cost for conveyance from point of origin.
[2] X – included as part of conveyance option.

Yield

Yields for water transfer projects may vary depending on the supply source and owner. The majority of sellers identified to date by BAWSCA have available supply in the range of 1,000 AF/year to 5,000 AF/year. However, the amount of transfer water that might be available to BAWSCA and its agencies is currently unknown and will depend on, among other things, the available conveyance capacity. Based on initial discussions with potential conveyance partners, the maximum transfer capacity is anticipated to be about 20 mgd (about 22,000 AF/year) during specific time windows with a lesser capacity available in other parts of the year.

Cost

The location and reliability of the supply will significantly affect the total cost, as will the treatment and conveyance options. In addition, the cost structure of the water purchase will impact the price (i.e., does the water need to be paid for in all years, even though it is only used in dry years). Based on recent water transfers enacted within California, the cost of the water may range from $200/AF to $900/AF at the point of origin. Conveyance costs to move the water from the seller to the buyer are a major factor, as is the availability of seasonal or annual storage associated with the supply. For

example, EBMUD has indicated that preliminary estimates of cost to convey water through their system could be about $1,200/AF to $1,600/AF. Costs to purchase transfer water and convey transfer water through EBMUD's system are currently being refined as part of ongoing discussions with EBMUD and work related to BARDP.

Project Implementation Schedule

The implementation schedule for water transfers is dependent on many factors including: water source location and type; need for construction of additional infrastructure for conveyance and/or storage; negotiations and agreements with sellers and potential conveying agencies; and completion of environmental documentation and permitting. Because of the complexity associated with each of the above issues, it is estimated that a water transfer project would take a minimum of two to five years to implement, depending on the yield, complexity, and number of partners.

5.3 Approach to Addressing Outstanding Issues Related to Regional Water Supply Management Projects

There are outstanding issues associated with the regional projects that may affect the yield, cost, implementation, water quality, and other aspects of these projects. The following presents a general description of each issue, as well as a list of specific actions that would need to be performed by the implementing agency and/or BAWSCA to address the stated issues. Table 5-5, located at the end of this section, and *Attachment 3 Section 1.3,* provide more detailed description of the issues critical to the viability of each of these regional projects.

5.3.1 Yield

The yield of regional projects is dependent on: (1) potential yield of the supply source; and (2) physical capacity limitations to treat and convey the source water. For example, brackish groundwater well yields may be limited by the storage capacity of the aquifer, the hydraulic capacity of the geologic formations, or potential impacts on other groundwater pumpers. Further, constraints on the available area for siting wells or the treatment facilities may limit the extraction and treatment capacity, and the available capacity in the WWTP outfalls could limit brine disposal capacity. Similarly, for water transfers, the yield may be limited both by the timing and volume of the available supply and by constraints on the conveyance of the water into the BAWSCA service area.

- BAWSCA should develop a regional groundwater model to provide an initial assessment of the yields of subsurface brackish water intakes along the Bay within San Mateo County.
- BAWSCA, and/or member agencies, should consider constructing pilot (or demonstration) pumping and monitoring wells and conduct hydraulic testing to confirm estimated groundwater yields.
- BAWSCA should confirm the other physical constraints on desalination project capacity, including land availability to construct the facilities and brine disposal capacity through the WWTP outfalls.
- BAWSCA should continue to track the progress of BARDP to assess how much capacity might be available to BAWSCA, independent of the SFPUC.
- BAWSCA should continue to engage EBMUD, SCVWD, SFPUC, Hayward, and others to assess the potential available capacity for water transfers through the SCVWD, CCWD, EBMUD, and SF RWS systems and associated interties.

5.3.2 Cost

In many cases, project costs are incomplete (e.g., they do not include some facilities, conveyance, or other critical information) and additional information will be needed to determine total project cost and to compare costs between projects.

- BAWSCA should update the BARDP project information included in the Strategy with the revised cost estimates for the brackish water desalination along the Sacramento River, and the capacity and costs to transfer that water to the existing EBMUD/SFPUC emergency intertie that are being updated for BARDP in 2013.
- BAWSCA should update the costs for the BAWSCA representative desalination projects to include, among other things: whether it is feasible to operate these projects will be operated in all years or in drought years only; property costs; refined pipeline alignments; and brine disposal.
- BAWSCA should update the costs for the water transfer projects to include information on the transfer capacity and transfer costs through the CCWD and EBMUD systems, or the SCVWD system.
- BAWSCA should engage SFPUC in discussions on costs associated with water transfers through the existing EBMUD/SFPUC and SCVWD/SFPUC emergency interties.
- BAWSCA should engage SFPUC in discussions associated with wheeling water through the SF RWS as there is currently no agreement on the allocation of costs associated with wheeling water though the SF RWS.

5.3.3 Implementation

All of the projects listed in this report are complex and would require the agreement of multiple parties, environmental review, and other elements (e.g., land purchase, wheeling agreements, permitting, rights-of-way, etc.). The desalination projects also require construction of facilities, environmental review, and other elements (e.g., land purchase, wheeling agreements, permitting, rights-of-way, etc.).

- BAWSCA should confirm if the regional wastewater agencies are willing and able to provide brine disposal capacity through long-term agreements; if use of regional wastewater agency capacity for brine disposal is not feasible, BAWSCA should develop planning level alternatives for new outfalls.
- BAWSCA should implement a pilot water transfer with EBMUD, and potentially CCWD, to demonstrate the ability to transfer water through the EBMUD and CCWD systems, and potentially store water in the CCWD Los Vaqueros Reservoir.
- BAWSCA should continue to engage SCVWD in discussions about potential water management agreements/water transfer options and considerations, including the potential for a pilot water transfer, or another type of water management project.
- BAWSCA should engage SFPUC and others in discussions on the potential to modify the use of the existing EBMUD/SFPUC and SCVWD/SFPUC emergency interties for non-emergency operation.
- BAWSCA should engage SFPUC regarding wheeling water through the SF RWS.

5.3.4 Water Quality

Water quality can have a significant impact on treatment costs, conveyance options, and beneficial use of the water. The source water quality for the projects is not fully known. Conservative estimates of salinity levels for the brackish and Bay water projects have been assumed for costing purposes with treated water quality similar to the existing SF RWS supply.

- BAWSCA should review with the member agencies any potential water quality compatibility issues, within their own systems or associated with individual customers, that may result from blending treated brackish or Bay water, or from water transfers through the existing EBMUD/SFPUC and SCVWD/SFPUC emergency interties.
- BAWSCA should review with the wastewater agencies blending brine into their wastewater discharge to confirm whether the anticipated brine concentrations can be blended and discharged within the current discharge permit requirements, or whether additional studies may be required.

5.3.5 General

There are three general actions that BAWSCA should consider in addressing the outstanding issues, including:

- BAWSCA should continue its efforts to partner with EBMUD, SCVWD, and potentially others to develop a pilot water transfer plan;
- BAWSCA should decide whether further effort is warranted to better define the feasibility, yield, and cost for the BAWSCA representative desalination projects; and
- BAWSCA should decide whether to participate in BARDP, and/or the development of water transfers.

These actions indicated above form the basis for several of the recommendations presented in Section 7, which supports the completion of the Strategy and the Final Strategy Report by December 2014.

Table 5-5 – Key Project Issues for the Regional Water Supply Management Projects (Page 1 of 2)

Issue Type	BAWSCA Representative Desalination Projects			The Bay Area Regional Desalination Project	Water Transfers
	Dumbarton Bridge Area	San Mateo Bridge Area	South San Francisco Area		
Yield	▪ Limited hydrogeologic information is available for the brackish groundwater aquifers. As such the location and potential yield of these aquifers needs to be confirmed. ▪ The recharge, long term yield, and potential impact on other groundwater users may affect the assumed capacities and yields. ▪ WWTP outfall capacity and agency concerns may limit co-use for brine disposal. ▪ Open intake yields may be limited by regulatory requirements.	▪ Very limited hydrogeologic information is available for the brackish aquifers. As such the location and potential yield of these aquifers needs to be confirmed. ▪ The recharge, long term yield, and potential impact on other groundwater users may affect the assumed capacities and yields. ▪ WWTP outfall capacity and agency concerns may limit co-use for brine disposal. ▪ Open intake yields may be limited by regulatory requirements.	▪ Very limited hydrogeologic information is available for the brackish aquifers. As such the location and potential yield of these aquifers needs to be confirmed. ▪ The recharge, long term yield, and potential impact on other groundwater users may affect the assumed capacities and yields. ▪ WWTP outfall capacity and agency concerns may limit co-use for brine disposal. ▪ Open intake yields may be limited by regulatory requirements.	▪ Ability to transfer CCWD water rights to a possible new diversion point may limit its use. ▪ SCVWD/SFPUC and EBMUD/SFPUC interties – Use of these existing interties will require expansion of their current use, which would require compliance with the California Environmental Quality Act (CEQA) and addressing Bay Area Air Quality Management District (BAAQMD) permits and may affect conveyance capacity and yield. ▪ Conveyance capacity through EBMUD system and potential competition for capacity may limit yield.	▪ Dry year and seasonal availability for purchased water for transfer needs may limit yield. ▪ SCVWD/SFPUC and EBMUD/SFPUC interties – Use of these existing interties will require expansion of their current use, which would require compliance with CEQA and addressing BAAQMD permits and may affect conveyance capacity and yield. ▪ Total conveyance capacity through EBMUD and/or SCVWD system and potential competition for capacity may limit yield.
Cost	▪ Source water quality will affect treatment process and cost. ▪ Cost for property acquisition and purchase for subsurface intakes, desalination plant sites and co-use of WWTP outfalls for brine are only included in contingency costs. ▪ Cost for rights-of-way for construction of new raw water, brine, and treated water pipelines are only included in the contingency costs. ▪ Desalination facilities are assumed to operate every year at 80% of design capacity. Operation only during dry years will significantly increase present worth costs. ▪ How these projects are funded and who owns them will affect the present worth costs. ▪ There is no agreement yet on the cost allocations for conveying water through the SF RWS.	▪ Source water quality will affect treatment process and cost. ▪ Cost for property acquisition and purchase for subsurface intakes, desalination plant sites and co-use of WWTP outfalls for brine are only included in contingency costs. ▪ Cost for rights-of-way for construction of new raw water, brine, and treated water pipelines are only included in the contingency costs. ▪ Desalination facilities are assumed to operate every year at 80% of design capacity. Operation only during dry years will significantly increase present worth costs. ▪ How these projects are funded and who owns them will affect the present worth costs. ▪ There is no agreement yet on the cost allocations for conveying water through the SF RWS.	▪ Source water quality will affect treatment process and cost. ▪ Cost for property acquisition and purchase for subsurface intakes, desalination plant sites and co-use of WWTP outfalls for brine are only included in contingency costs. ▪ Cost for rights-of-way for construction of new raw water, brine, and treated water pipelines are only included in the contingency costs. ▪ Desalination facilities are assumed to operate every year at 80% of design capacity. Operation only during dry years will significantly increase present worth costs. ▪ How these projects are funded and who owns them will affect the present worth costs. ▪ There is no agreement yet on the cost allocations for conveying water through the SF RWS.	▪ Depending on the location and ownership of the project the U.S Bureau of Reclamation lower costs for power may not be available. ▪ Desalination facilities are assumed to operate every year at 100% of design capacity with the exception of Scenario 2 (which assumes 100% production every third year). Operation only during dry years will significantly increase present worth costs. ▪ Additional costs from agency-specific blending, storage and/or conveyance fees are not included in the estimate. ▪ There is no agreement yet on the cost allocations for conveying water through the SF RWS.	▪ Cost of transfer supply will vary if supply is taken in all years, versus only in dry years. ▪ Additional costs from agency-specific blending, storage and/or conveyance fees are not included in the estimate. ▪ There is no agreement yet on the cost allocations for conveying water through the SF RWS.
Implementation	▪ Willingness of WWTP owners to allow use of existing outfall capacity for brine disposal will affect implementation. ▪ Local public support and/or opposition will affect project implementation. ▪ The ability to permit new open water intakes in the Bay may affect implementation.	▪ Willingness of WWTP owners to allow use of existing outfall capacity for brine disposal will affect implementation. ▪ Local public support and/or opposition will affect project implementation. ▪ The ability to permit new open water intakes in the Bay may affect implementation.	▪ Willingness of WWTP owners to allow use of existing outfall capacity for brine disposal will affect implementation. ▪ Local public support and/or opposition will affect project implementation. ▪ The ability to permit new open water intakes in the Bay may affect implementation.	▪ Potential partners for project development need to be confirmed. ▪ Local public support and/or opposition will affect project implementation.	▪ Agreement requirements for purchase of suppliers need to be determined. ▪ Agreement requirements with agencies to convey purchased water to interconnections with the SF RWS need to be determined.

Table 5-5 – Key Project Issues for the Regional Water Supply Management Projects (Page 2 of 2)

Issue Type	BAWSCA Representative Desalination Projects			The Bay Area Regional Desalination Project	Water Transfers
	Dumbarton Bridge Area	San Mateo Bridge Area	South San Francisco Area		
Water Quality	▪ Brine concentrate may affect ability to discharge through existing WWTP outfall facilities. ▪ Blending of different source waters may cause water quality compatibility problems (e.g., disinfectants, additives, salinity) after blending that may impact some customers, or may require pre-treatment prior to blending.	▪ Brine concentrate may affect ability to discharge through existing WWTP outfall facilities. ▪ Blending of different source waters may cause water quality compatibility problems (e.g., disinfectants, additives, salinity) that may impact some customers, or may require pre-treatment prior to blending.	▪ Brine concentrate may affect ability to discharge through existing WWTP outfall facilities. ▪ Blending of different source waters may cause water quality compatibility problems (e.g., disinfectants, additives, salinity) that may impact some customers, or may require pre-treatment prior to blending.	▪ Source water quality will affect treatment process and cost. ▪ Brine concentrate quality may affect ability to discharge through existing WWTP outfall facilities. ▪ Blending of different source waters may cause water quality compatibility problems (e.g., disinfectants, additives, salinity) that may impact some customers, or may require pre-treatment prior to blending. ▪ Potential water quality and infrastructure issues near the EBMUD/SFPUC intertie associated with water transfers require additional discussions with member agencies located along this pipeline.	▪ Source water quality will affect treatment process and cost. ▪ Blending of different source waters may cause water quality compatibility problems (e.g., disinfectants, additives, salinity) that may impact some customers, or may require pre-treatment prior to blending. ▪ Potential water quality and infrastructure issues along the EBMUD/SFPUC and SCVWD/SFPUC interties associated with water transfers require additional discussions with member agencies located along this pipeline.

Section 6
Overview of Project Evaluation Criteria

One of the goals of the Strategy decision process, as described in the *Phase I Scoping Report*, is to create quantitative and defensible project and portfolio (combination of projects) rankings based on quantitative and qualitative evaluation criteria and specific metrics. This will allow projects (i.e., recycled water, desalination projects, and water transfers) to be evaluated and compared, both within the supply type and between project types and portfolios. This process will allow BAWSCA and the BAWSCA Board to identify the best projects and possible combinations of projects to meet the water supply objectives of the Strategy.

This section presents the evaluation criteria and the process for comparing and ranking the projects and portfolios. Details of each process step are described in *Attachment 2*, *Exhibit 5 Revised Draft Task 6-A Memo Refined Evaluation Criteria and Metrics*.

6.1 Evaluation Criteria Development Process

The preliminary evaluation criteria and metrics that were developed by the Strategy Team with input from the BAWSCA member agencies were presented in the *Phase I Scoping Report*. These criteria and metrics were subsequently revised in Phase II A. Updates included refinements in objective and criteria titles, changes to metrics, and removal of redundant criteria. In addition, comments and requested changes from the BAWSCA Board were incorporated. A detailed comparison of the changes made to the evaluation criteria and metrics from Phase I to Phase II A are presented in *Attachment 2*, *Exhibit 5 Revised Draft Task 6-A Memo Refined Evaluation Criteria and Metrics.*

6.2 Summary of the Evaluation Criteria and Metrics

The proposed objectives, evaluation criteria, and metrics that will be used as part of the Strategy project evaluation process are summarized below and in Table 6-1.

6.2.1 Objective 1 – Increase Supply Reliability

Criteria 1A and 1B evaluate the reliability of potential projects or portfolios during a normal year and drought year, respectively. The criteria and the associated metrics that further define this objective are shown below.

- *Criterion 1A – Ability to Meet Normal Year Supply Need* – An estimate of the ability of a project or portfolio to meet the normal hydrologic year supply needs of the BAWSCA member agencies will be measured by the annual yield of the project during normal hydrologic conditions by the 2035 planning horizon. This will be a quantitative value, measured in AF/year.
- *Criterion 1B – Ability to Meet Drought Year Supply Need* – An estimate of the ability of a project or portfolio to meet the supply needs of the BAWSCA member agencies during a drought is measured by the annual yield of the project during drought (e.g., hydrology similar to the 1987 – 1992 drought). The criterion of drought reliability captures whether a project is resistant to drought impacts. This will be a quantitative value, measured in AF/year.

- *Criterion 1C – Risk of Facility Outage* – The supply vulnerability is measured by the probability and duration of potential outages to a particular project or portfolio due to a major conveyance failure. This criterion captures the vulnerability of projects or portfolios to emergency outages. This metric will be a qualitative measure ranging from 1 through 5, with a score of "1" identifying the projects that are least susceptible to emergency outages and a score of "5" indicating high susceptibility to emergency outages.
- *Criterion 1D – Potential for Regulatory Vulnerability* – This criterion estimates the susceptibility of a project or portfolio to interruption as a result of regulatory issues including legal, political, or environmental constraints. This metric will be a qualitative measure ranging from 1 through 5, with a score of "1" identifying the projects that are least susceptible to regulatory risk and a score of "5" indicating high susceptibility to regulatory risk.

Table 6-1 – Strategy Project and Portfolio Evaluation Objectives, Criteria and Metrics

Objective	Criteria	Metrics (For Project/For Portfolio)
1 - Increase Supply Reliability	Criterion 1A – Ability to Meet Normal Year Supply Need	Quantitative (AF/year): Average annual yield in normal years in 2035
	Criterion 1B – Ability to Meet Drought Year Supply Need	Quantitative (AF/year): Average annual yield with drought hydrology of 1987 – 1992.
	Criterion 1C – Risk of Facility Outage	Qualitative (1-5): Estimated probability and duration of major conveyance failure.
	Criterion 1D – Potential for Regulatory Vulnerability	Qualitative (1-5): Potential for regulatory decisions to impact supply reliability.
2 - Provide High Level of Water Quality	Criterion 2A – Meets or Surpasses Drinking Water Quality Standards	Quantitative (mg/L): TDS level as an indicator of water quality.
	Criterion 2B – Meets or Surpasses Non-Potable Water Quality Standards	Qualitative: Meets minimum water quality requirement (e.g., Title 22) for the targeted use.
3 - Minimize Cost of New Water Supplies	Criterion 3 – Capital and Present Worth Costs	Quantitative ($/AF): Present Worth costs including capital and operating costs.
4 - Reduce Potable Water Demand	Criterion 4 – Augment Non-Potable Water Supplies	Quantitative (AF/year): Reduction of potable water demand by use of non-potable supply.
5 - Minimize Environmental Impacts of New Water Supplies	Criterion 5A – Greenhouse Gas Emissions	Quantitative (metric tons/AF of Supply): Estimates of unit greenhouse gas emissions.
	Criterion 5B – Impact to Groundwater Quantity and Quality	Qualitative (1-5): Potential impacts to groundwater levels, groundwater quality, or potential for subsidence.
	Criterion 5C – Impact to Habitat	Qualitative (1-5): Potential impacts to habitat, such as wetlands, riparian zones, fisheries, and inundation areas.
6 - Increase Implementation Potential of New Water Supplies	Criterion 6A – Institutional Complexity	Qualitative (1-5): Number and type of agencies and agreements involved.
	Criterion 6B – Level of Local Control	Qualitative (1-5): BAWSCA and Member Agency ownership of supply projects.
	Criterion 6C – Permitting Requirements	Qualitative (1-5): Permitting or regulatory issues for supply projects.

6.2.2 Objective 2 – Provide a High Level of Water Quality

These criteria address the ability of member agencies to meet the water quality needs of their customers, both for potable and non-potable water. Thus, the criteria further refine whether a given project meets potable water quality objectives or other water quality objectives.

- *Criterion 2A – Meets or Surpasses Drinking Water Quality Standards* – The criterion representing potable supply will be addressed by the quantitative metric of the aggregate water quality, measured by TDS levels, of the potable supply projects and portfolios. TDS is a surrogate for other water quality parameters representing water quality.

- *Criterion 2B – Meets or Surpasses Non-Potable Water Quality Standards* – For non-potable supply projects, where water quality constraints vary according to use, the metric will be a qualitative assessment of whether or not the project or portfolio meets the minimum water quality requirement for the intended use. In most cases, this metric will be used to designate whether a non-potable supply source meets Title 22 requirements, as this is a common target water quality level for a non-potable demand. This will be a qualitative measure.

6.2.3 Objective 3 – Minimize the Cost of New Water Supplies

This criterion will evaluate the present worth costs for each project.

- *Criterion 3 – Capital and Present Worth Costs* – The present worth costs, including capital, operations, and maintenance costs, for each project and portfolio will be estimated. The performance metric is the normalized cost presented in $/AF for each project and portfolio.

6.2.4 Objective 4 – Reduce Potable Water Demand

This criterion will evaluate the impact that each project or portfolio will have on reducing the demand for potable water supplies. This criterion addresses the augmentation of non-potable supplies.

- *Criterion 4 – Augment Non-Potable Water Supplies* – The use of non-potable water sources will help reduce the overall potable water supply need. Projects and portfolios that include non-potable water supplies, commensurate with a demand for the additional non-potable water, will score well within this criterion. The quantitative metric for this criterion will be the annual yield of additional non-potable supply produced and utilized to offset potable demand. This will be a quantitative value, measured in AF/year.

6.2.5 Objective 5 – Minimize Environmental Impacts of New Water Supplies

With these criteria, projects or portfolios that provide environmental benefits, or have no or limited negative environmental impacts, will score better than those that provide no benefits or result in greater environmental impacts. Environmental benefits and impacts are evaluated both within and outside of the BAWSCA service area. Potential environmental impacts are measured with three criteria, designed to be proxies for a wide range of environmental issues.

- *Criterion 5A – Greenhouse Gas Emissions* – The increase in greenhouse gas emissions due to a potential project or portfolio will be calculated as a planning level estimate of the unit greenhouse gas emissions of the associated projects. This quantitative metric will be measured in terms of metric tons of carbon dioxide produced, or reduced, per AF of supply.

- *Criterion 5B – Impact to Groundwater Quantity and Quality* – Projects that do not negatively affect groundwater supplies will be measured favorably in this criterion. A combined qualitative estimate of potential groundwater impacts will be evaluated in terms of potential reductions in groundwater levels, impacts to groundwater quality, and the risk of increase in land subsidence. This metric will be a qualitative measure ranging from 1 through 5, with a score of "1" identifying the projects with the least potential for adversely affecting groundwater quantity and quality and a score of "5" indicating high probability of adverse impacts.

- *Criterion 5C – Impact to Habitat* – This criterion addresses long-term impacts to the ecosystems, not short-term effects related to temporary construction activities. Projects that do not adversely affect sensitive habitat areas such as wetlands, riparian zones, and potential special-status species habitat, or have significant inundation areas will be measured favorably in this criterion. A combined qualitative estimate of potential habitat impacts will be evaluated in terms of potential site acreage, proximity to sensitive habitat zones, and flood potential. This metric will be a qualitative measure ranging from 1 through 5, with a score of "1" identifying the projects with the least potential for adverse impacts to habitat and a score of "5" indicating high probability of adverse effects to terrestrial, aquatic, and riparian species.

6.2.6 Objective 6 – Increase Implementation Potential of New Water Supplies

Developing water supply solutions that can be implemented within the 2035 planning horizon is a primary objective of the Strategy. These criteria assess the implementation potential of projects or portfolios. All of these criteria will be assessed qualitatively. Metrics for these criteria will be a qualitative assessment ranging from 1 through 5, with a score of "1" being the most favorable and a score of "5" indicating the least favorable.

- *Criterion 6A – Institutional Complexity* – This criterion addresses the level of institutional coordination required for implementation of a project or portfolio. A qualitative metric will be used to estimate the coordination required if multiple local or regional agencies or agreements are necessary. The projects that are assumed to require less coordination, and to receive less opposition, will score better than those that are more complex or potentially controversial.

- *Criterion 6B – Level of Local Control of Water Supply* – Local management of a project or portfolio will minimize dependency on imported water supplies and the drought impacts associated with those supplies. A rating scale will be developed to evaluate the amount of BAWSCA-owned or BAWSCA member-owned supply for each project. Projects that are fully owned by BAWSCA or the member agencies will score higher than projects owned fully or partially by other entities that might be affected by regulatory risk, multiple party agreements, and supplies that may have a higher risk of not being available further into the future, or under drought conditions.

- *Criterion 6C – Permitting Requirements* – This criterion addresses the objective of minimizing the regulatory and environmental permitting obstacles associated with projects or portfolios. Projects with other similar metrics (including cost) may have differing permitting requirements, which can affect their overall implementation. The performance metric is a qualitative measure of the permitting requirements of each project or portfolio. Projects or portfolios that have less regulatory and environmental permitting obstacles will receive a better score than those projects with more complex permitting requirements.

6.3 Evaluation Criteria and Metrics to Be Used in Project and Portfolio Evaluation Process

Information for the projects presented in the Phase II A Report will be further developed to a common level understanding so that the projects can be compared to each other and preliminarily ranked to determine which individual or combination of projects could best meet the identified supply need. A summary of the ranking and evaluation process as currently conceived is presented below.

6.3.1 Project Ranking

Individual projects will be compared with each other within each supply category (e.g., desalination, recycled water, water transfers, etc.) for each of the evaluation criteria. For each of the criteria, the quantitative and qualitative metric values would be calculated for each project. The relative weighting, or importance, of the criteria could be adjusted during this process. This evaluation will compare similar projects and aid in development of portfolios.

6.3.2 Portfolio Development

Since no single project will likely be able to meet the entire supply need for the BAWSCA member agencies, multiple projects could be combined into water supply management portfolios. The resulting portfolios would consist of multiple projects and increase the water supply diversity within the BAWSCA service area.

6.3.3 Portfolio Evaluation

After developing the portfolios, the next step will be to evaluate and compare the portfolios. Criteria metrics for portfolios of projects would be a function of each project's metric weighted by the yield it contributes to the total portfolio yield. The portfolios, and the specific projects, that perform the best against the evaluation criteria would be recommended for implementation as part of the Strategy.

6.3.4 Strategy Recommendations

Once a range of portfolios are evaluated, the projects from the top-ranked portfolios will be combined into a recommendation for one or more portfolios of projects. Multiple portfolios may be necessary to effectively meet different agencies' objectives regarding future supply need.

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Section 7
Summary of Phase II A Results

As part of Phase II A of the Strategy, key information has been developed regarding the refined water demand and water supply need projections for the BAWSCA member agencies through 2035. In addition, the potential projects have been developed more fully, and preliminarily screened and analyzed. This work, and the identified outstanding issues, form the basis for the recommended future actions to complete the Strategy.

It is important to note that the Strategy is being developed in the context of changing circumstances, many of which will impact the final Strategy results and recommendations. This section summarizes the Phase II A results, presents how the Strategy effort has been managed to adapt to the changing conditions, and identifies the actions needed to enable successful completion of the Strategy by December 2014.

7.1 More Water Supply Is Needed in Normal and Drought Years Despite Increased Investments in Supply Diversity

Phase II A of the Strategy updated the water demand projections and supply needs for the BAWSCA member agencies, after accounting for both passive and active conservation. The resulting projected 2035 water supply needs of 4 mgd to 13 mgd in a normal year and up to 62 mgd in a drought year are shown in Figure 7-1.

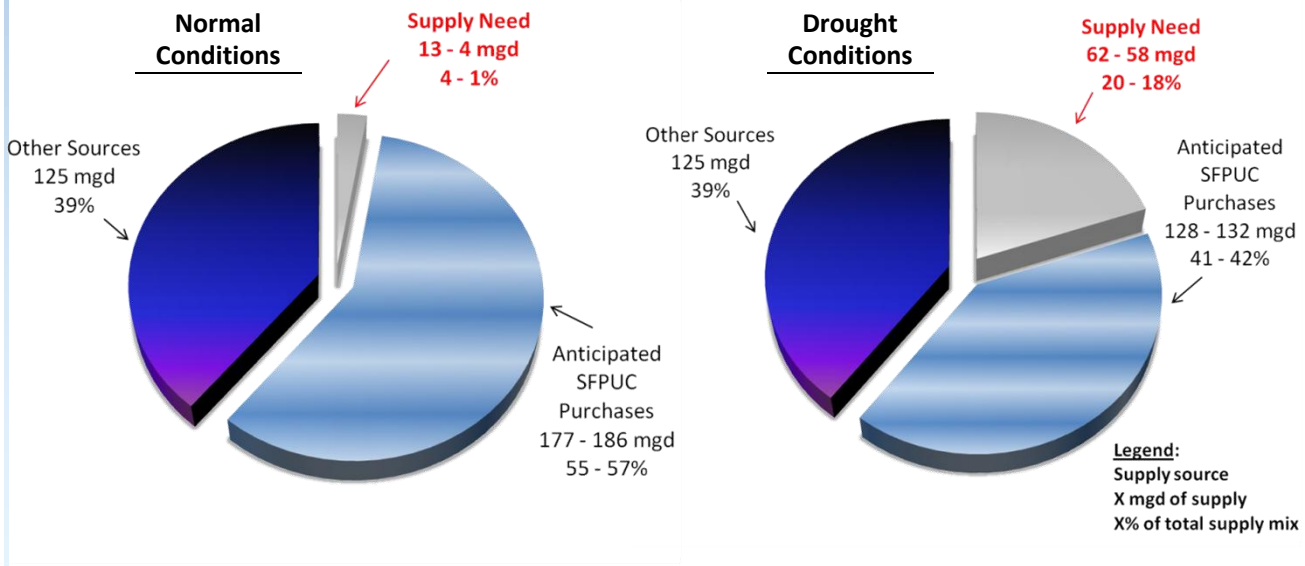

Figure 7-1
More Water Supply is Needed in Normal and Drought Years (2035)

The ranges in the projected needs reflect the current temporary and interruptible status of Santa Clara and San Jose (i.e., the higher end of the need range assumes that San Francisco will decide not to provide permanent supply to those cities in the future). Further, while the WSA allows for the permanent transfer of ISGs between BAWSCA member agencies, as well as shorter-term transfers of drought allocations, no such transfers have occurred to date and the Strategy does not make any assumptions regarding these transfers occurring in the future.

These results differ from the preliminary results documented in the *Phase I Scoping Report*. Specifically, the normal year supply need in 2035 decreased from a maximum of 23 mgd to a potential maximum of 13 mgd as a result of the updated demand projections that were documented primarily in BAWSCA agencies' 2010 UWMPs. In addition, the total projected SFPUC purchases by the BAWSCA member agencies in 2018 are now estimated to be 171.8 mgd, which should not trigger the Interim Supply Limitations. As such, the concern of a supply restriction imposed by San Francisco in 2018 has been eliminated.

Because, at 4 mgd to 13 mgd, the 2035 normal year need is small and localized to seven of the 26 BAWSCA member agencies, there does not appear to be a significant reason for BAWSCA implement a regional project to address the dispursed normal year needs. Therefore, the Strategy effort is likely better focused on drought year needs rather than both normal and drought year needs.

The drought year supply need in 2035 decreased from the 77 mgd documented in the *Phase I Scoping Report* to a potential maximum of 62 mgd. However, the drought impacts remain significant and are spread throughout the BAWSCA service area as indicated in Figure 7-2. As such, meeting the projected drought year need continues to be a key focus of the Strategy effort due to the magnitude of the potential economic and other impacts of drought to all of the BAWSCA member agencies.

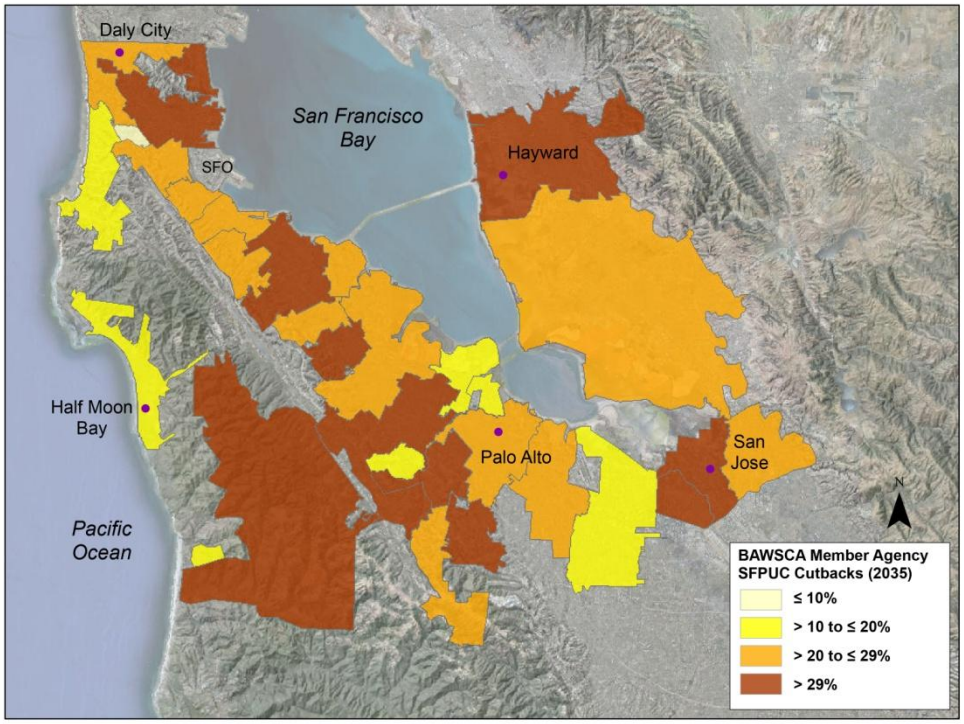

Figure 7-2
20% Supply Shortfalls on the SF RWS Result in an Average Cutback of 29% to the BAWSCA Member Agencies (2035)

7.2 The Frequency and Magnitude of SFPUC Supply Shortfalls Have Significant Impacts to the BAWSCA Member Agencies

System-wide supply shortages are imposed within the SF RWS operations in a step wise manner. Each step (or "Action Level") is triggered by thresholds based on total system storage on July 1 of each year. Action Level 1 does not impose a reduction in water supply deliveries, but does impose a change in system operation, including the use of the Westside Basin Groundwater Program to supplement SFPUC water deliveries. Action Levels 2 and 3 result in 10% and 20% system-wide supply reductions, respectively. As discussed in Section 2, the existing WSA includes a Tier 1 Plan which allocates the available SF RWS water supply during a drought between San Francisco and the Wholesale Customers. With the application of the Tier 1 Plan, a 10% system-wide shortfall in 2035 corresponds to an 18% cutback to the Wholesale Customers and a 20% system-wide shortfall in 2035 corresponds to a 29% cutback to the Wholesale Customers.

The Tier 2 Plan, adopted by all 26 BAWSCA member agencies in March 2011, allocates the collective Wholesale Customer share among each of the 26 BAWSCA member agencies. Under the rules of the Tier 2 Plan, the range of cutback varies for each BAWSCA member agency (i.e., some agencies receive up to a 40% cutback to their SFPUC supplies in 2035, while some receive less than a 29% cutback). The current Tier 2 Plan has a sunset date of 2018, but is assumed to extend through 2035 for the purposes of this assessment. The Tier 1 and Tier 2 Plans apply only during times of drought shortages.

Currently the SFPUC estimates the frequency and magnitude of supply shortfalls on the SF RWS by modeling system operations over an 82-year hydrologic sequence. When using 2035 demand projections, the SFPUC estimates that drought shortages would occur in eight years over the modeled period, or once every ten years (see Figure 7-3).

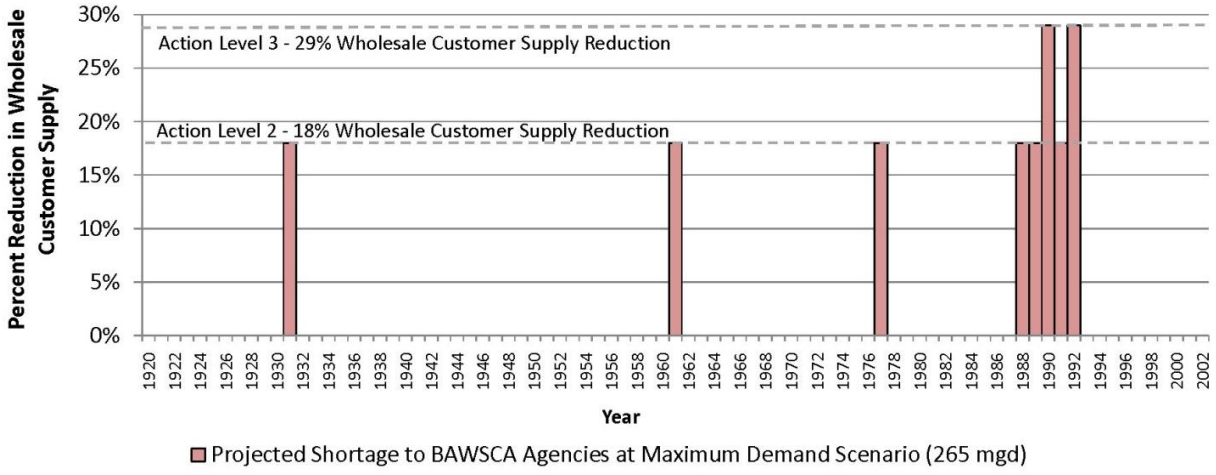

Figure 7-3
Drought Events that Create System-wide Supply Shortfalls of 10% to 20% Are Projected to Occur on Average Every Ten Years on the SF RWS

While the 82-year hydrologic sequence currently used by the SFPUC covers 1920 to 2002, and includes a number of significant dry periods, it does not capture the recent droughts experienced by

the SF RWS between 2002 and 2011. Specifically, the calls for 10% voluntary rationing in 2007 and 2008 (Action Level 2 shortages) are not included, nor is the very dry year of 2011. If these years are included, the frequency of shortages on the SF RWS appears to increase to 11 years over the last 92 year period, with separate drought events occurring on average about every eight years. Two multiple dry year events, including the most severe drought of record, have occurred over the last 25 years. The SFPUC is currently working to extend its system modeling to include the years through 2011 and the updated model should be available by Fall 2012.

As presented in Section 3, the impacts of water supply shortfalls to the BAWSCA member agencies during droughts can be significant. Earlier studies estimated regional economic losses in the BAWSCA service area of up to $7.7 billion per year during a 20% system-wide shortfall from the SF RWS. Supply cutbacks of this magnitude can also result in voluntary or mandatory restrictions for outdoor water uses and increased water rates and excess use charges. These impacts are anticipated to be compounded in the future as a result of demand hardening. This is particularly an issue in the BAWSCA service area where per capita demand is already low as compared to other portions of the Bay Area and the State.

Further, it is important to recognize that 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 service area or neighboring communities. Therefore, a future drought year water supply shortfall in one BAWSCA agency that results in loss of jobs or other impacts can have a detrimental effect on the customers of another BAWSCA agency, even if that agency itself is not facing a supply shortfall.

As a regional agency, it will be important for BAWSCA to have the necessary information (e.g., the cost of alternative available water supplies and the economic impact of a supply reduction) to consider the impacts of drought regionally when weighing the costs and benefits of investing in additional drought reliability.

7.3 The Strategy Presents a Refined List of Projects

As discussed in Sections 4 and 5, a focused group of projects were evaluated as part of Phase II A that could potentially be used by BAWSCA and the BAWSCA member agencies to meet the normal and/or drought supply needs through 2035. The project information developed to date has focused on preliminary estimates of the yield, cost, reliability, and implementation schedules. The objective has been to develop the information to a common level to the extent possible so that the projects can be compared to each other to determine which individual or combination of projects could best meet the identified supply need. The projects include:

- Recycled water projects;
- Local capture and reuse projects;
- Desalination projects; and
- Water transfers.

Figure 7-4 indicates the general location for these projects. Table 7-1 presents the projects retained for further evaluation, their associated yields, identifies what cost information is known at this time, and the range in implementation schedule.

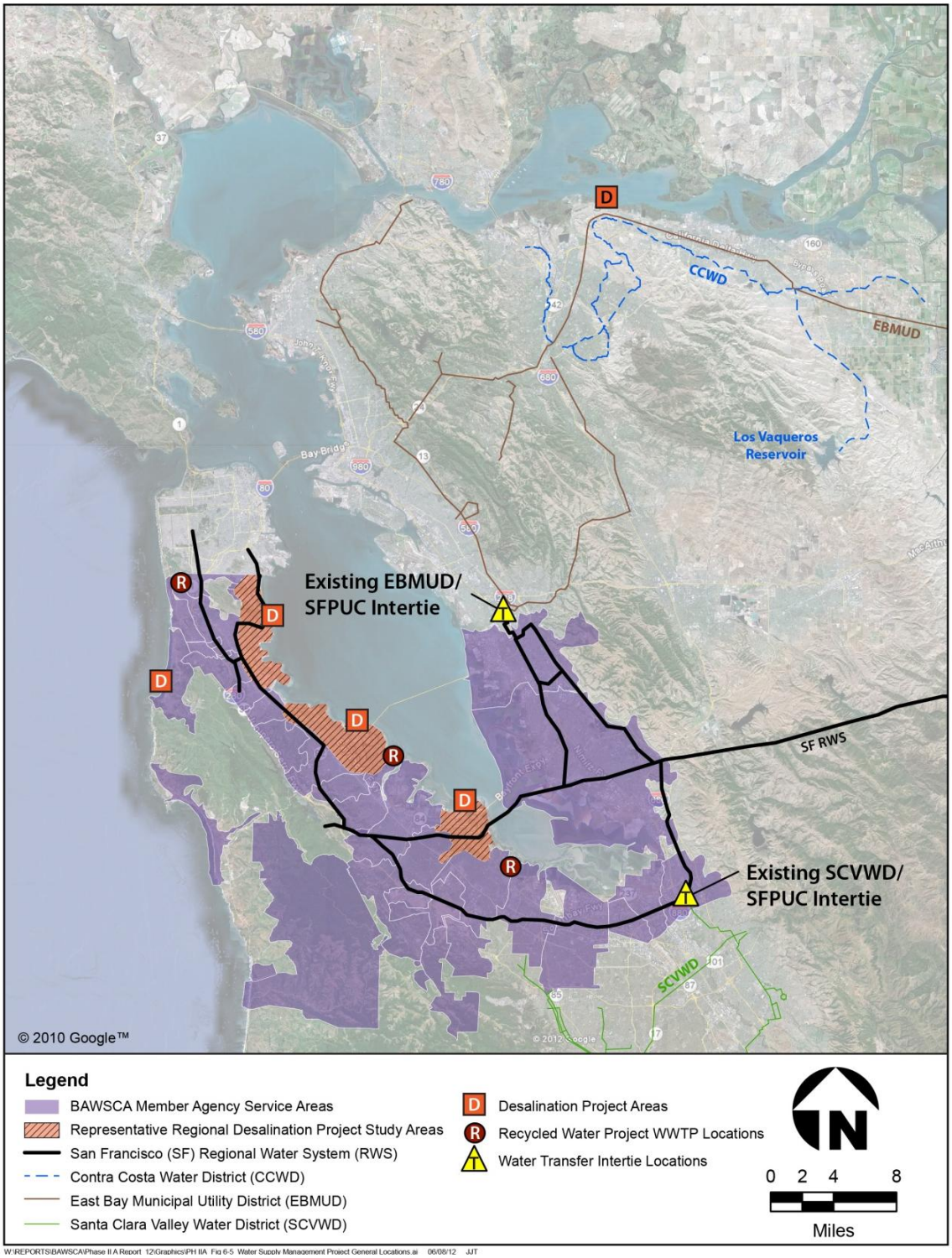

Figure 7-4
General Locations of the Projects

While the Strategy focus has shifted towards meeting drought year needs, the yield and cost information for the different project types in Table 7-1 reflects project use in all year types. Additional analysis assuming only drought-year operation will need to be performed to support the evaluation of alternatives as part of the final Strategy.

7.4 Criteria Have Been Developed to Evaluate the Projects or Groups of Projects

As described in Section 6, the Strategy project evaluation and decision process will rely on both quantitative and qualitative criteria and metrics to distinguish projects and portfolios and facilitate comparisons. The criteria objectives that have been developed for the Strategy are as follows:

- Increase Supply Reliability;
- Provide High Level of Water Quality;
- Minimize Cost of New Water Supplies;
- Reduce Potable Water Demand;
- Minimize Environmental Impacts of New Water Supplies; and
- Increase Implementation Potential of New Water Supplies.

Once the project information has been sufficiently developed, the evaluation criteria would be used to compare projects and groups of projects (i.e., portfolios), in the ranking and evaluation step of the Strategy project evaluation and decision process.

7.5 Critical Work is On-Going That Will Inform Final Strategy Recommendations

There is additional work currently being performed by other agencies. BAWSCA is coordinating closely with these agencies, as the results their efforts are expected to impact the the final Strategy recommendations and implementation plan. This work includes:

- ***EBMUD Conveyance Capacity Study***. EBMUD is currently conducting a study regarding the capacity and cost to convey transfer water through the EBMUD system to the existing EBMUD/SFPUC emergency intertie in Hayward. The study is expected to be complete in 2013.
- ***BAWSCA member agency studies***. Several of the BAWSCA member agencies are continuing to develop information on their recycled water projects, including the preparation of EIRs, Recycled Water Master Plans, and other studies. These efforts are anticipated to be completed late this year for Palo Alto and Redwood City. Six other projects have been identified by BAWSCA member agencies for potential evaluation in the later phase of the Strategy, including: Cal Water desalination project; City of Mountain View, City of San Jose, and City of Sunnyvale potential recycled water projects; and City of Sunnyvale expanded use of new or converted wells for normal year supply.

Table 7-1 – Summary of Project Information

Project Type	Project Yield		Implementation Schedule (Years)	Cost Categories (check marks indicate that information has been developed[1])								Estimated Costs	
	Treated Water Capacity (mgd)	Estimated Yield (AF/year)		Facilities	Land	Treatment, Storage, Transmission	Conveyance to SF RWS	Conveyance through SF RWS	Conveyance through Local Distribution System[2]	O&M	Co-Use with Wastewater Dischargers	Present Worth - Known Costs ($/AF)	Present Worth - All Costs ($/AF)
Recycled Water													
Daly City Recycled Water Expansion Project	2.89	1,060	6	✔	✔	✔	-	-	-	TBD[3]	-	$2,100	TBD
City of Palo Alto Recycled Water Project to Serve Stanford Research Park	2.0	900	TBD	TBD	TBD	TBD	-	-	-	TBD	-	TBD	TBD
Redwood City Water Treatment Plant Expansion Project	TBD	TBD	TBD	TBD	TBD	TBD	-	-	-	TBD	-	TBD	TBD
Local Capture & Reuse													
Rainwater Harvesting	-	190 - 610	TBD	✔	-	✔	-	-	-	TBD	-	$2,900 - $4,700	TBD
Stormwater Capture	-	TBD	TBD	TBD	TBD	TBD	-	-	-	TBD	-	TBD	TBD
Greywater Reuse	-	1,120 - 2,700	TBD	✔	-	✔	-	-	-	TBD	-	$660 - $790	TBD
Desalination Projects													
Dumbarton Bridge Area - Brackish Groundwater	1 - 5	900 - 4,500	6 - 8	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$1,000 - $2,000	TBD
San Mateo Bridge Area - Brackish Groundwater	1 - 5	900 - 4,500	6 - 8	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$1,000 - $2,200	TBD
San Mateo Bridge Area - HDDW	5 - 10	4,500 - 9,000	10 - 12	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$1,500 - $1,700	TBD
San Mateo Bridge Area - Open Intake	10	9,000	10 - 15	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$1,900	TBD
South San Francisco Area - Brackish Groundwater	1 - 2	900 - 1,800	6 - 8	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$1,400 - $1,900	TBD
South San Francisco Area – HDDW	5 - 10	4,500 - 9,000	10 - 12	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$1,400 - $1,700	TBD
South San Francisco Area - Open Intake	20	17,900	10 - 15	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$1,500	TBD
Representative Coastal Desalination	7.5	6,700	6 - 8	✔	TBD	✔	✔	TBD	TBD	✔	TBD	$2,200	TBD
Bay Area Regional Desalination Project	20[4]	7,600 - 22,400	6 - 7	✔	TBD	TBD[5]	TBD	TBD	TBD	✔	TBD	$550 - $1,069	TBD
Water Transfers (source areas)													
Sacramento Valley Area	1 - 20[4]	1,000 - >5,000	2 - 5	TBD	TBD	TBD	TBD	TBD	TBD	TBD	-	$200 - $900	TBD
Delta and San Joaquin Valley Areas	1 - 20[4]	1,000 - 5,000	2 - 5	TBD	TBD	TBD	TBD	TBD	TBD	TBD	-	$200 - $900	TBD

[1] "TBD" indicates that information has not yet been determined. "-" indicates that information is not applicable to the project.
[2] Conveyance cost to additional BAWSCA member agency through local distribution system.
[3] Does not include operations and maintenance (O&M) cost for distribution system.
[4] Assumed maximum anticipated conveyance capacity.
[5] Bay Area Regional Desalination Project cost estimates include treatment and partial transmission, but not storage.

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- ***Bay Area Regional Desalination Project***. The BARDP members are currently performing additional studies, including the EBMUD Conveyance Capacity Study discussed above, and potential use of the CCWD Los Vaqueros Reservoir Project storage for conveyance and storage of this supply. These studies are expected to be complete in 2013.
- ***SFPUC/MID water transfers***. The SFPUC is in the process of negotiating an agreement with MID for transfer of an additional 2 mgd (2,200 AF/year) of supply to the SF RWS. In addition, they are looking at potentially larger transfers from MID, up to a total of 25,000 AF/year.
- ***SFPUC HH/LSM Modeling.*** BAWSCA has an agreement with the SFPUC to perform HH/LSM modeling for purposes of the Strategy. BAWSCA has requested that the SFPUC extend the HH/LSM modeling analysis through 2011 and to identify potential supply shortfalls associated with the recent hydrology. The SFPUC has agreed to complete this analysis by fall 2012.
- ***SFPUC FERC Economic Analysis.*** BAWSCA has been working with the SFPUC to ensure that the impacts of supply shortfalls to the BAWSCA member agencies are adequately included in the FERC analysis. The current schedule shows this analysis being available by fall 2012. BAWSCA will continue to work with the SFPUC on this effort, and will identify whether any supplemental analysis of economic impacts to the BAWSCA member agencies is necessary.

As part of the recommended reprogrammed Phase II A work, BAWSCA will continue to track and monitor these efforts and to work with the SFPUC and others to ensure that the full extent of potential impacts to the BAWSCA member agencies, including costs, and potential agreements for purchase, transfer, or take or pay types of agreements are fully identified. Results and findings from these efforts by other agencies will be incorporated into the Final Strategy Report and the final recomendations as appropriate.

7.6 Strategy Development Managed to Adapt to Changed Conditions and Use Resources Efficiently

The Strategy is being developed in phases to provide BAWSCA and the BAWSCA Board the opportunity to confirm the direction of the Strategy at key decision points, and redirect (reprogram) these efforts as appropriate. Figure 7-5 presents the general phasing of the Strategy development and implementation, including the completion of this Phase II A Report and the recommended activity between September 2012 and late 2014 to support completion of the Strategy and a Final Strategy Report by December 2014.

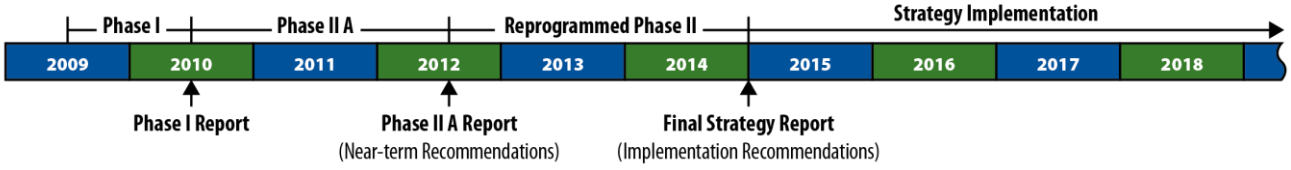

Figure 7-5
The Strategy Development is Phased to Ensure that the Desired Results will be Achieved

As described in prior sections, key elements of the Strategy changed during the development of Phase II A including:

- The immediate concern of SFPUC supply restrictions by 2018 has been eliminated because the projected 2018 SFPUC purchases of 171.8 mgd are not expected to trigger the SFPUC's Interim Supply Limitation;
- The normal year need of the BAWSCA member agencies, collectively, has been reduced to potentially as small as 4 mgd through 2035;
- The dry year need of the BAWSCA member agencies, collectively, continues through 2035, but is reduced to a potential maximum of 62 mgd;
- The number and type of projects being evaluated as part of the Strategy has been reduced and refined (from over 65 projects to fewer than 20 projects);
- For many of the projects evaluated as part of the Strategy, limited information is available at this time and in many cases is still in development;
- EBMUD has expressed an interest in partnering with BAWSCA to enact a possible water transfer that would use the excess capacity in the EBMUD system to convey the transfer water to the BAWSCA service area. Other Bay Area water agencies have also expressed interest in using EBMUD's system capacity as part of BARDP. It is important that BAWSCA move quickly to examine a potential water transfer opportunity with EBMUD before any final decisions are made regarding the EBMUD system capacity that would limit its availability to BAWSCA; and
- SCVWD has expressed an interest in potentially partnering with BAWSCA to do a water transfer or some other form of water management action.

To incorporate these changed conditions, and to provide solutions that remain relevant and cost effective, the schedule, scope and focus of the Strategy was modified to efficiently utilize the available resources to the maximum benefit of the BAWSCA member agencies. These changes were communicated to the BAWSCA Board and the member agencies over the course of Phase II A. Specifically, the adaptive management actions that were taken by BAWSCA as part of the development of Phase II A are summarized below.

- The development of the Phase II A water demand and supply need projections was delayed to coincide with the development of the BAWSCA member agencies' 2010 UWMPs, which were completed in July 2011;
- Due to the decreased water demand projections and the extension in the timing of the supply need, the focus of the Strategy shifted from the 2018 and normal year needs to primarily focusing on the future drought year supply needs;
- The Strategy project development and evaluation process was streamlined to reflect the limited number and type of projects that survived the project screening process and the limited project information that was currently available;
- Phase II A scope elements were deferred to allow for additional information on the projects, and the frequency and economic impacts of droughts to become available; and

- The remaining Strategy effort has been scheduled to allow incorporation of key on-going efforts by other agencies that will inform the final Strategy recommendations.

Additional detail regarding the status of the individual Strategy Phase II A scope elements is provided in *Attachment 5*.

7.7 Specific Actions are Recommended to Address Outstanding Issues

As described in detail in Sections 2.7, 3.4, 4.4 and 5.3, there are outstanding issues associated with elements of the Strategy and key actions that would need to be taken by BAWSCA and/or the BAWSCA member agencies to address these issues. Table 7-2 presents a summary of the key actions that have been identified to date, and the responsible party. These actions form the basis for many of the recommendations presented in Section 8, which support the completion of the Strategy and the Final Strategy Report by December 2014.

Table 7-2 – Summary of Recommended Key Actions

Strategy Element / Project Type	Responsible Party	Recommended Action
Projected Water Supply Need		
2035 Water Need Estimates	BAWSCA	▪ Develop demand and water conservation projections for member agencies using consistent methodology. ▪ Monitor changes in water demand in service area, including implementation of water conservation measures. ▪ Confirm frequency, magnitude and economic impacts of SFPUC supply shortfalls. ▪ Work with the BAWSCA member agencies to identify level of service goals.
Recycled Water Projects		
All Recycled Water Projects	Daly City, Palo Alto and Redwood City	▪ Identify and work with potential customers to confirm the market for the recycled water, including securing long-term agreements and demand estimates. ▪ Determine potential impacts of recycled water quality on customer demand and project yield. ▪ Determine the total project costs (capital, operations and maintenance, and present worth) and funding sources.
Daly City Recycled Water Expansion Project	Daly City	▪ Develop O&M cost information for the recycled water distribution system.
Palo Alto Recycled Water Project to Serve Stanford Research Park	Palo Alto	▪ Confirm rights to the recycled water capacity at the Palo Alto RWQCP to serve 900 AF/year to the Stanford Research Park. ▪ Complete EIR for this project, including cost, implementation schedule and other information.
Redwood City Recycled Water Treatment Plant Expansion Project	Redwood City	▪ Complete Update to Phase II Recycled Water Feasibility Study, including yield, cost, implementation schedule and other information.
Local Capture and Reuse Projects		
All Local Capture and Reuse Projects	BAWSCA / Interested Agencies	▪ Track and monitor existing projects to better understand typical level of local participation, yield, and project cost. ▪ Evaluate potential benefits of and support for projects at local level. ▪ Identify local permitting and other regulatory limitations on use of these supplies.
Stormwater Capture	BAWSCA / Interested Agencies	▪ Evaluate potential for local projects to benefit groundwater recharge. In Santa Clara County, coordinate with SCVWD. In San Mateo County, coordinate with Westside Basin users. In Alameda County, coordinate with ACWD. ▪ Evaluate potential for water quality impacts on groundwater basin from recharge or irrigation with stored stormwater.

Table 7-2 – Summary of Recommended Key Actions

Strategy Element / Project Type	Responsible Party	Recommended Action
Greywater Reuse	BAWSCA / Interested Agencies	▪ Evaluate potential for water quality impacts on groundwater basin from recharge or irrigation with stored greywater.
Desalination Projects		
Representative Coastal Desalination	BAWSCA / Interested Agencies	▪ A lead agency would need to be identified for this project to move forward.
	Lead Agency	▪ Assess potential yield for Ranney Well Collectors, potential use of the former Sharp Park WWTP site, construction issue with new outfall and ownership and operation of the facilities. ▪ Work with member agencies to determine desired water quality. ▪ Work with SFPUC and others to determine any environmental, technical, or other issues and costs associated with use of the local distribution systems or the SF RWS.
Brackish Groundwater Desalination	BAWSCA	▪ Complete regional groundwater modeling to better estimate potential groundwater yield and to enable more complete understanding of multi-basin interactions. ▪ Conduct site specific investigations to better determine the yield, cost, implementation, and water quality issues associated with specific projects. ▪ Work with member agencies to determine desired water quality. ▪ Work with SFPUC and others to determine any environmental, technical, or other issues and costs associated with use of the local distribution systems or the SF RWS.
Bay Water Desalination	BAWSCA	▪ Conduct site specific investigations to better determine the yield, cost, implementation, and water quality issues associated with specific projects. ▪ Work with member agencies to determine desired water quality. ▪ Work with SFPUC and others to determine any environmental, technical or other issues and costs associated with use of the local distribution systems or the SF RWS.
The BARDP	BAWSCA	▪ Monitor work by EBMUD on capacity and cost for conveyance through EBMUD system. ▪ Monitor available capacity, cost and other issues that would affect potential participation by BAWSCA. ▪ Work with SFPUC and others to determine any environmental, technical, or other issues and costs associated with use of the local distribution systems or the SF RWS.
Water Transfer Projects		
Surface Water Transfers into the BAWSCA Service Area	BAWSCA	▪ Develop water transfer plan and agreement for pilot water transfer with EBMUD. ▪ Develop water transfer plan and agreement for pilot water transfer or other water management plan with SCVWD. ▪ Work with EBMUD, SCVWD, SFPUC, Hayward, and others to assess potential available capacity for water transfers through their water systems and associated interties. ▪ Work with member agencies to determine acceptability of transfer water quality and to determine potential water quality impacts associated with long-term use of system interties. ▪ Work with SFPUC and others to determine any environmental, technical or other issues and costs associated with use of the interties. ▪ Work with SFPUC to develop an agreement on the allocation of costs to convey water through the SF RWS.

Section 8
Recommendations

The Strategy is being conducted in phases, with an estimated completion date of December 2014. Phase II A of the Strategy is now complete. Recommendations are included below for specific tasks to conclude the development of the Strategy, including:

- **Section 8.1** – Recommendations for work to be accomplished between now and 2014. BAWSCA anticipates presenting these recommendations to the BAWSCA Board for anticipated action in September 2012.
- **Section 8.2** – Recommendations that may be presented to the BAWSCA Board for action at a future date as part of the Strategy development and/or implementation.

8.1 Recommendations for Board Action in September 2012

This section presents the key Phase II A findings and the recommendations for the BAWSCA-led work efforts on the Strategy between now and December 2014. It is anticipated that the following three recommendations will be brought to the BAWSCA Board in September 2012 for action.

Recommendation #1: Complete the Reprogrammed Phase II A Work and Other Identified Work to Complete the Strategy

As described in prior sections and in *Attachment 5*, to incorporate changed conditions and to present relevant solutions, the schedule, scope, and focus of the Strategy was modified. These changes (i.e., the Phase II A reprogramming) were communicated to the BAWSCA Board and the member agencies over the course of Phase II A.

Reprogrammed Phase II A Work: The following summarizes the Phase II A tasks that were deferred as part of the Phase II A reprogramming. The basis for the reprogramming of each of the tasks is summarized in *Attachment 5*. To complete the Strategy, it is necessary to the conduct these tasks:

- Further refine project descriptions to: (1) incorporate the additional project information that is being developed by BAWSCA and others; and (2) include all of the information needed to compare the projects against the project evaluation criteria;
- Complete analysis of the economic impacts of drought;
- Compare the benefits of alternative projects and cost allocations;
- Compare alternative costs of increased drought reliability to avoided economic impact and determine level of service goals;
- Evaluate and rank the projects, or groups of projects, against the project evaluation criteria;
- Prepare the implementation plan for developing the recommended project, or groups of projects, to achieve the Strategy results; and

- Prepare Final Strategy Report by December 2014.

Recommended Other Work to Complete the Strategy: During the development of Phase II A, several outstanding issues were identified associated with many of the Strategy elements (e.g., the demand projections, project information, etc.) that are not otherwise captured in the reprogrammed Phase II A work. Table 7-2 presented the key recommendation actions that should be taken by BAWSCA to resolve these outstanding issues, including:

- Monitor changes in water demand in service area, including the implementation of water conservation measures;
- Work with BAWSCA member agencies to identify level of service goals; and
- Track and monitor existing local capture and reuse projects to evaluate potential benefits and support for these projects.

The completion of both the reprogrammed Phase II A work and the recommended other BAWSCA actions by 2014 is critical to the development the Final Strategy Report and the implementation plan.

Recommendation #2: Develop Plan for a Pilot Water Transfer with EBMUD and/or SCVWD

Water transfers appear to be a promising option to address the identified drought year needs of the BAWSCA member agencies. However, there are a limited number of facilities that could be used to convey water to the BAWSCA member agencies from sources originating outside the Bay Area. Further, use of these facilities would require the resolution of several technical, legal, and institutional issues. An efficient means to address these outstanding issues would be to conduct a pilot transfer of real water into the BAWSCA member agency service area. Additional reasons why the development of a Pilot Water Transfer Plan is recommended now are presented below:

- EBMUD and SCVWD have expressed an interest in potentially partnering with BAWSCA to enact a water transfer. Additional work would need to be done with these agencies to better assess the costs and feasibility of such transfers, including questions regarding water quality, system conveyance capacity constraints, and regulatory and permitting requirements.
- BAWSCA is in competition with other agencies for use of the available capacity in these other water systems. There may be a need for BAWSCA to act to secure (at a minimum) transfer capacity in a conveyance system, or risk losing that opportunity for good. Developing a Pilot Water Transfer Plan now would place BAWSCA in the best possible position to enact a water transfer as early as Fall 2013, and to make more informed decisions regarding water transfer options and conveyance capacity rights in the future.

Recommendation #3: Update the Demand and Water Conservation Projections for BAWSCA Member Agencies Using a Common Methodology

BAWSCA worked closely with its member agencies during Phase II A to combine the individual agency 2010 UWMP water demand and conservation projections for use at the regional level. However, given the inconsistencies in water demand and conservation projection methodologies, this process may not be sufficient for regional planning purposes (i.e., as the basis for environmental documentation) or fully representative of the regional needs (i.e., may result in double-counting or exclusion of potential

demands). Updating the water demand and conservation projections for the BAWSCA member agencies using a common methodology is recommended because:

- A more robust and consistent water demand and conservation projection methodology for the BAWSCA member agencies as a whole is necessary for effective planning at the regional level to support future local and regional investment decisions.
- Preparing updated water demand and conservation projections in advance of December 2014 will enable the agencies to use these demand estimates for their 2015 UWMPs and 20 by 2020 assessments. This will increase the level of consistency in regional planning among the BAWSCA member agencies and streamline their 2015 UWMP development process.

The adopted FY 2012-13 BAWSCA Work Plan includes the selection of a water demand and conservation projection methodology and the development of a scope of work and budget to complete updated projections for all of the BAWSCA member agencies. It is anticipated that BAWSCA would present this information to the BAWSCA Board in Spring 2013, possibly as part of the FY 2013-14 budget process, and recommended that the Board act to fund the development of water demand and conservation projections for the BAWSCA member agencies using a common methodology.

8.2 Potential Longer-Term Actions

Depending on the results of the additional work to be completed between now and 2014, additional recommendations may be presented to the Board for consideration either in support of the Strategy development, or as part of the Strategy implementation. These recommendations may include:

- ***Implement the pilot water transfer plan***. In order to fully test BAWSCA's ability (both physically and institutionally) to import water to serve the member agencies during a drought, BAWSCA would need to, at a minimum, enact a pilot water transfer. Such a transfer would be based on the Pilot Water Transfer Plan and could occur as early as Fall 2013.
- ***Pursue long-term water transfer supplies and/or conveyance agreement.*** The Strategy analysis to date indicates that water transfers could be a viable option for meeting the long-term dry year water supply needs of the BAWSCA member agencies. Based on the information learned from the execution of a pilot water transfer, BAWSCA may recommend that the BAWSCA Board act to secure transfer capacity and/or transfer water.
- ***Conduct project-specific field investigations.*** While review of the available data and analytical and numerical modeling can provide some level of certainty regarding a project's characteristics, field investigations and testing are likely to be necessary to confirm key project elements. For example, in the case of the desalination projects, additional field investigations would be needed to verify subsurface yields, water quality, potential impacts on other groundwater users, and project costs. If there is strong interest expressed by the BAWCSA Board or the member agencies to pursue development one of the identified projects, BAWSCA may recommend that the BAWSCA Board act to authorize additional, project-specific investigations.

Any of the longer-term actions will also need to be consistent with the five principles identified in Section 1 that inform the development of the Strategy.

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Section 9
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