7.0 Assessment of Reuse Opportunities

Water Reuse Study 2005

The preface to this report highlighted the values and importance of water reuse as a reliable, environmentally sustainable component of a diversified water supply. Section 1 reviewed the mission and objectives of the study, and summarized the study process. Section 2 highlighted the importance of public participation along with the numerous public involvement activities that occurred to support the analysis. Section 3 included a history of reuse in San Diego and applicable reuse projects.

Section 4 outlined the fundamental types of reuse projects applicable to San Diego, along with the corresponding health and safety issues associated with these differing types of reuse. Non-potable reuse opportunities were developed in Section 5 and indirect potable reuse opportunities were developed in Section 6. These components fulfill the study's objective to conduct an impartial, balanced, comprehensive and science-based study of all recycled water opportunities so the City of San Diego can meet current and future water needs.

In this section, Assessment of Reuse Opportunities, the analysis is consolidated into a combination of reuse opportunities, which are referred to as *strategies*. The strategies offer the San Diego public and City Council a set of diverse reuse options for both the North City and South Bay systems. Decision charts, which could be referred to as roadmaps to implement a strategy, are included to summarize facilities and reuse volumes. The decision chart was developed to help answer the primary study questions of: 1) which water recycling opportunities to pursue, and 2) depending on the opportunity, how much water to recycle. Supporting text includes the benefits, the value of recycled water, and detailed costs for each strategy, and information on other water supply options.

In summary, this chapter:

- Revisits valuing recycled water as part of a diversified water supply portfolio and looks beyond just unit costs when considering recycled water projects.
- Consolidates the individual opportunities listed in Section 5 and Section 6 into six individual implementable strategies. Three strategies are presented for North City and three are presented for South Bay.
- Maps out the implementation of each strategy by phases.
- Presents detail of individual strategy costs along with the evaluation criteria established at the first American Assembly.
- Presents other water supply costs.
- Summarizes the conclusions for each strategy.

7.1 Recognizing the Value of Recycled Water

Understanding the uses and long-term value of recycled water is critical to making informed choices and decisions. The public, stakeholders, and policy makers have a challenging role in discussing and debating the strategies presented below. Recycled water is a valuable asset – an asset that provides a locally controlled water supply, enhances supply reliability by diversifying supply sources, and enhances sustainability by limiting water diversions from other California ecosystems. Based on these values, the public and policy makers have been asked to determine the role of water reuse in San Diego's future.

7.2 Overview of Alternative Implementation Strategies

Six alternative implementation strategies were developed by pairing individual opportunities from Chapters 5 and 6 into a logical sequencing of projects. Three opportunities are for the North City system and three are for the South Bay system. The strategies were developed to provide:

- A balanced and diverse set of both non-potable and indirect potable opportunities that represent the broad policy options available.
- A range of project phases that add new increments of recycled water usage within each strategy.
- A geographically balanced mix of projects.

Each strategy begins with the City's existing and planned projects, and then adds projects over a series of phases. The phases are not specifically defined in time, but for review purposes generally could be considered as approximately five-year increments from 2010 to 2025. The projects included in each phase were organized based on a number of considerations:

- Maximizing the use of recycled water based on available supplies at each phase
- Selecting a lower cost project before a higher cost project
- Maximizing the ability to build upon existing or previous phase infrastructure

Most strategies can be pursued by phase all the way through to their final phase or to some intermediate phase. Some strategies maximize reuse in one large-scale project, while other strategies increase use more gradually through smaller increments.

For each strategy, the report presents an evaluation criteria summary table based on the evaluation criteria established at the first American Assembly workshop. The summary includes a description of the criteria and associated

objectives/performance measures. A brief discussion is provided regarding the objective/performance measures specific to the strategy.

7.3 North City Strategies

The City remains committed to completing the Phase I and II expansion of the North City recycled water distribution system. The City has also decided to pursue the infill opportunity described in Section 5. The infill opportunity provides the best approach to meet the City's Northern Service Area goal of beneficially using 12 MGD (13,400 AFY) by 2010. Other opportunities are more costly and/or cannot be completed by 2010. Therefore, infill is shown as the first component in each North City strategy.

Description of North City Strategies

The components in each North City strategy, referred to as NC-1 through NC-3, are summarized in the following paragraphs. Following the component summary is a strategy decision chart and two-page summary for each strategy. The two-page summary includes a figure displaying strategy components, text summarizing the strategy details, the primary strategy benefits, the amendment of recycled water usage, implementation issues, and analysis of the evaluation criteria developed at the first American Assembly workshop.

NC-1: The NC-1 Strategy includes only non-potable projects similar to the City's existing recycled water program. After infill, it is proposed to complete the Phase III expansion into Rancho Bernardo, and then expand south into the Central Service Area. A seasonal storage project is then included to increase supplies. If taken to its final phase, NC-1 also includes a created wetlands project in Rose Canyon.

NC-2: The NC-2 Strategy includes a mixture of non-potable and indirect potable reuse opportunities. NC-2 starts off identical to NC-1 with infill followed by the Phase III expansion. A smaller indirect potable reuse project at Lake Hodges follows. The last phase is a seasonal storage project to meet peak demands for non-potable uses.

NC-3: The NC-3 Strategy begins with infill. Following infill, the strategy includes an indirect potable reuse opportunity at San Vicente that fully utilizes all of the remaining available recycled water supply, such that there are no subsequent projects beyond this phase.

Summary of North City Strategies

The resulting volume of reuse and costs vary per phase and per strategy. The total reuse at the last phase also varies between strategies depending on the approach and specific opportunities. **Table 7-1** summarizes the total reuse achieved for each opportunity in each strategy, both in AFY and as a percentage of the North City Water Reclamation Plant's production capacity.

Table 7-1
Reuse Quantities for North City Strategies

Reuse Project Components	Recycled Water Use By Strategy (AFY)		
	NC-1	NC-2	NC-3
Reuse[1]			
Existing System (including Phases I and II)	9,440	9,440	9,440
Infill	4,000	4,000	3,820
Rancho Bernardo Phase III	2,800	2,800	-
San Vicente IPR (16 MGD Plant)	-	-	10,500
Central Service Area (CSA)	2,640	-	-
Lake Hodges IPR (2 MGD Plant)	-	1,800	-
Wetlands	800	-	-
Subtotal demands	*19,680*	*18,040*	*23,760*
Supply			
NCWRP Supply	26,880	26,880	26,880
Demineralization supply credit[2]	n/a	n/a	670
Advanced treatment process loss[2]	n/a	-635	-3,790
Subtotal Supply	*26,880*	*26,245*	*23,760*
Treatment Capacity Utilized	73%	69%	100%

[1] Project reuse volumes assume the availability of seasonal storage as needed to supply peak summertime uses.

[2] Supply credits & losses were used to account for water lost as part of treatment processes. For IPR opportunities, demineralization is not needed at NCWRP (resulting in a supply credit), but losses will occur at the Advanced Water Treatment Plant (resulting in a loss of supply).

North City Decision Chart

A decision chart of North City strategies is presented in **Figure 7-1**. Unit costs, the effect on a typical monthly residential water bills, reuse volumes and the proposed implementation plan are also shown. The decision chart was developed to help answer the primary study questions of: 1) which water recycling opportunities to pursue, and 2) depending on the opportunity, how much water to recycle.

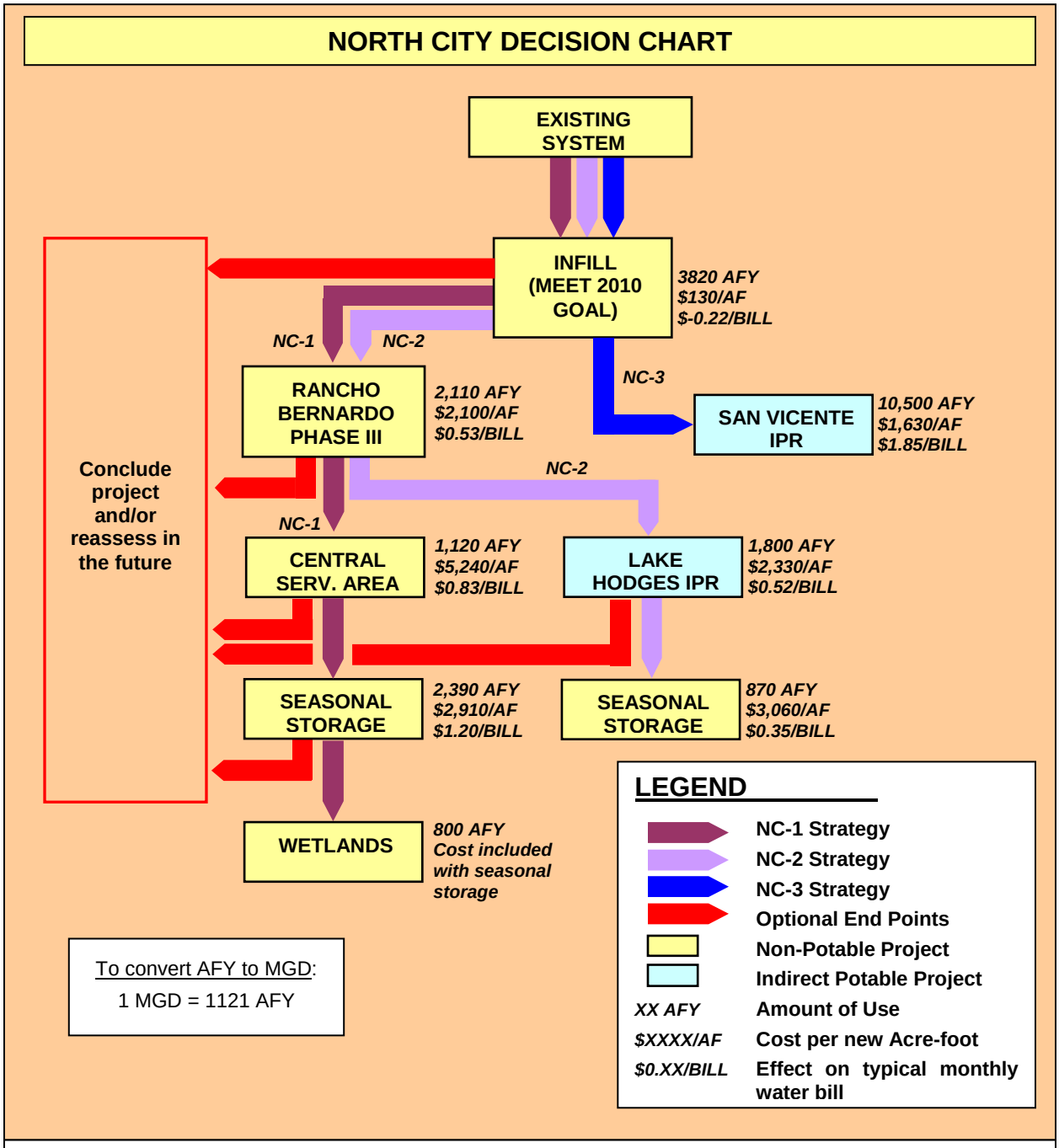


Figure 7-1 – The decision chart summarizes potential water reuse strategies for the North City Water Reclamation Plant. The chart was developed to help answer the primary study questions of: 1) which water recycling opportunities to pursue, and 2) depending on the opportunity, how much water to recycle. All strategies for North City start with meeting the City's 2010 goal via infill. The NC-1 strategy includes non-potable opportunities. The NC-2 strategy includes a mix of both non-potable and indirect potable reuse opportunities. The NC-3 strategy is predominantly an indirect potable reuse opportunity. The costs are shown for each opportunity. The report text includes additional discussion on the benefits and evaluation criteria for each strategy.

North City Strategy NC-1 Two-Page Summary

Project Description

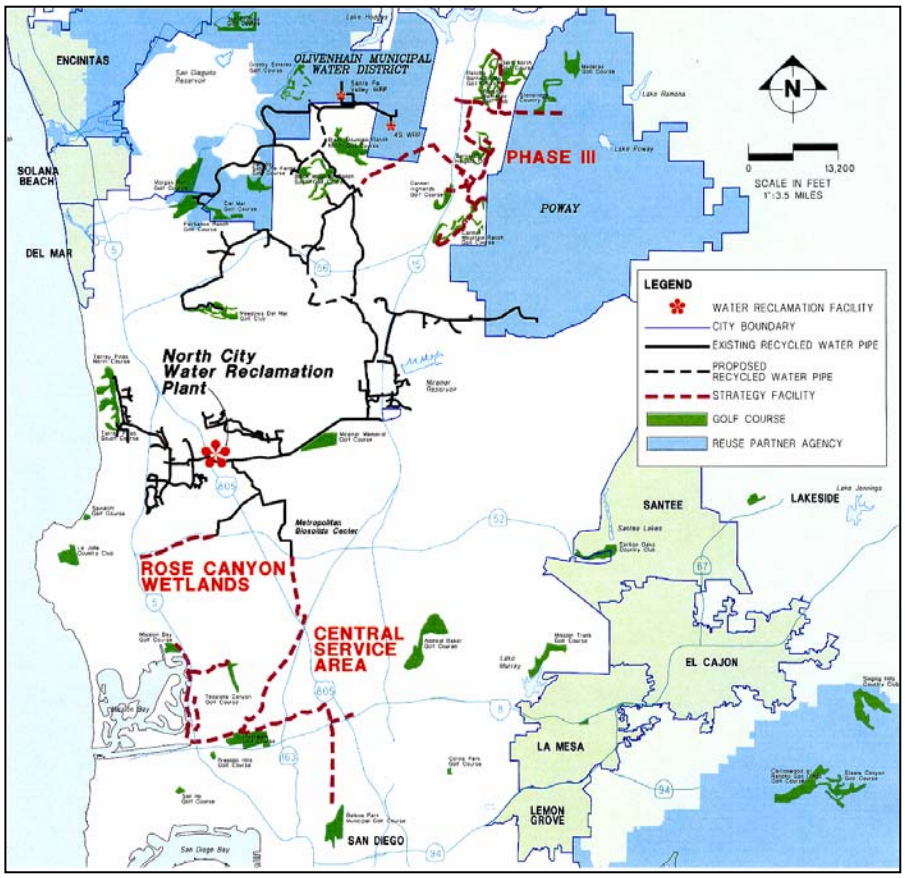
Expansion of the non-potable system to serve infill, Phase III Rancho Bernardo, and the Central Service Area, plus Rose Canyon wetlands

Primary Benefit of this Strategy

NC-1 provides the lowest initial capital cost and lowest unit cost of all North City Strategies through the second phase of the Strategy. However, if the desire is to maximize reuse of the available recycled water supply, subsequent phases have higher unit costs and make this alternative comparatively more expensive. This strategy appears to be the appropriate choice if the driving decision factor is to minimize initial capital outlays and to commit to a non-potable reuse approach.

Implementation:

- Infill to serve new customers within one-quarter mile of the existing distribution system (up to 4,000 AFY)
- Phase III expansion of the existing system into Rancho Bernardo to primarily serve golf courses (up to 2,800 AFY)
- Expansion into the Central Service Area to serve Mission Bay and Balboa Parks (up to 2,640 AFY),
- Through early implementation phases, supplementation of summer peaks with purchased potable or raw water. Subsequently, development of recycled water seasonal storage to store surplus recycled water during the winter for use in the summer.
- Use of excess recycled water in winter months for a created wetland in Rose Canyon (800 AFY).



NC-1 – Evaluation Criteria Detail		
Criteria	Objective and Performance Measure	Discussion
Health and Safety	To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses.	City's non-potable service of recycled water meets federal state and local regulatory criteria and has been safely operated since 1997.
Social Value	To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception.	Human Need: Non-potable recycled water distribution system serves a human need by replacing potable water use however, the system's distribution system is limited and not everyone directly benefits from recycled water use. Public Perception: The public in general perceives that non-potable use of recycled water is preferable to indirect potable reuse.
Environmental Value	To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits required.	Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary.
Local Water Reliability	To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability.	Up to 19,680 AFY of recycled water is reused in this strategy. This amounts to approximately 73% of the available recycled water from the NCWRP.
Water Quality	Meets or exceeds level of quality required for the intended use and customer needs. To meet all customer quality requirements.	Use of non-potable, recycled water for irrigation provides the benefit of nutrient value to irrigated areas. City ensures TDS to be equal or less than 1000 mg/l.
Operational Reliability	To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed.	Recycled water treatment and distribution systems are not operated with redundancy of facilities in mind. Outages of recycled water service are more likely to occur than in a potable water system.
Cost	To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination).	See Section 7.5 for Cost Discussion.
Ability to Implement	To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation.	Non-potable recycled water projects are generally easier to implement than indirect potable projects as they require less regulatory permitting. These types of projects have a regulatory framework to follow and general public support.

North City Strategy NC-2 Two-Page Summary

Project Description

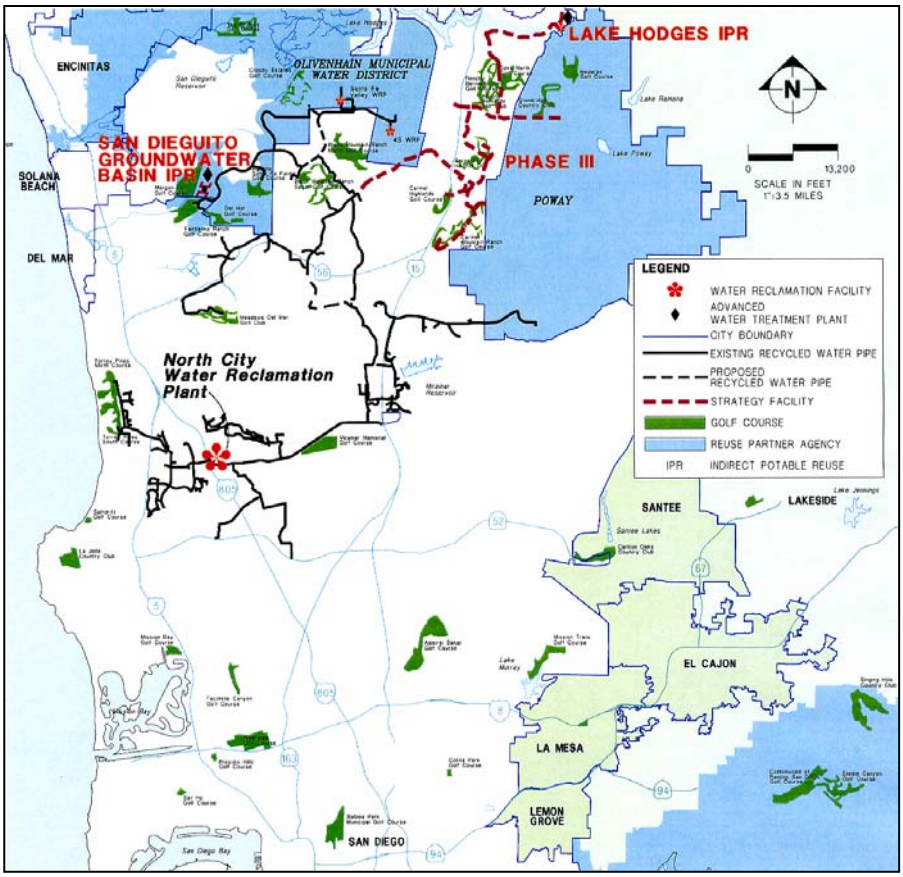
Expansion of the non-potable system to serve infill and Phase III Rancho Bernardo, followed by a smaller scale indirect potable reuse project at Lake Hodges

Primary Benefit of this Strategy

NC-2 provides the opportunity to switch from non-potable to indirect potable reuse. This strategy appears to be the appropriate choice if the driving decision factor is to minimize initial expenditures while still having the ability to accomplish an indirect potable reuse project.

Implementation:

- Infill to serve new customers within one-quarter mile of the existing distribution system (up to 4,000 AFY)
- Phase III expansion of the existing system into Rancho Bernardo to primarily serve golf courses (up to 2,800 AFY)
- Small-scale IPR projects at Lake Hodges (1,800 AFY)
- Through early implementation phases, supplementation of summer peaks with purchased potable or raw water. Subsequently, development of recycled water seasonal storage to store surplus recycled water during the winter for use in the summer.



NC-2 – Evaluation Criteria Detail		
Criteria	Objective and Performance Measure	Discussion
Health and Safety	To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses.	City's non-potable service of recycled water meets federal state and local regulatory criteria and has been safely operated since 1997. New indirect potable projects would be designed to meet federal, state and local regulatory requirements.
Social Value	To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception.	Human Need: Both non-potable and IPR provide water to the community, but IPR projects distribute the repurified water to a greater number of people. Public Perception: Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high.
Environmental Value	To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits required.	Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary.
Local Water Reliability	To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability.	Up to 18,040 AFY of recycled water is reused in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy utilizes approximately 69% of the available recycled water from the NCWRP.
Water Quality	Meets or exceeds level of quality required for the intended use and customer needs. To meet all customer quality requirements.	Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable.
Operational Reliability	To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed.	IPR projects provide the most operational reliability as they take full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plants.
Cost	To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination).	See Section 7.5 for Cost Discussion.
Ability to Implement	To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation.	IPR projects are anticipated to be more difficult to implement due to the regulatory and social issues. Extensive public outreach efforts will be required to implement the indirect potable reuse component of this strategy. The Lake Hodges IPR project has additional hurdles since the first inline water treatment plants are not City facilities.

North City Strategy NC-3 Two-Page Summary

Project Description

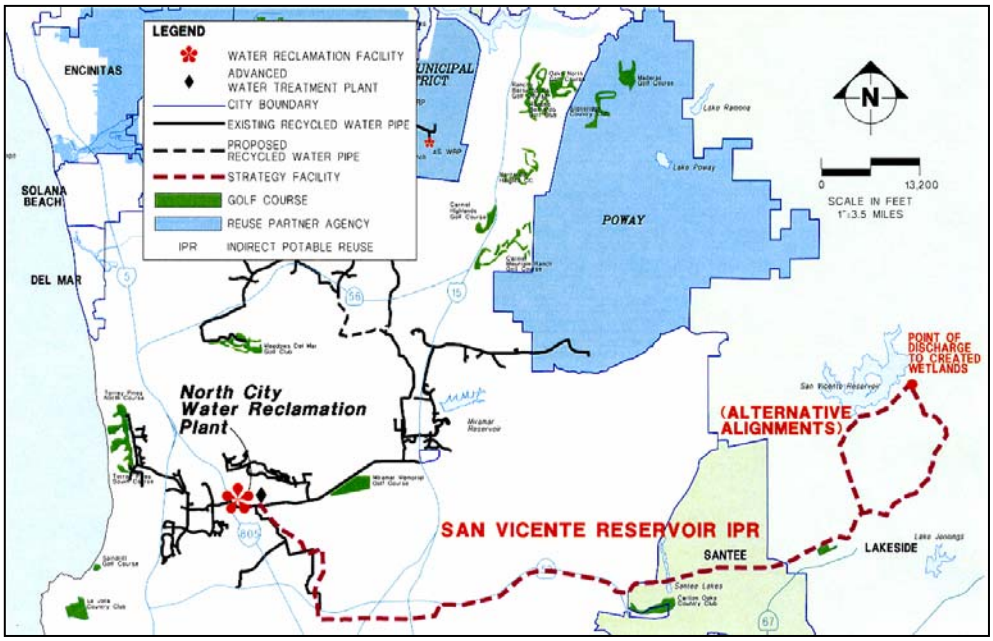
Expansion of the non-potable system to serve infill, followed by a full-scale San Vicente indirect potable reuse project sized to maximize available supplies.

Primary Benefit of this Strategy

NC-3 maximizes the available North City water supply in one step through indirect potable reuse. For a strategy that fully maximizes reuse of the available recycled water supply, it provides the lowest overall unit cost. To achieve this though, this strategy has the highest initial capital costs. This strategy appears to be the appropriate choice if the driving decision factor is to maximize recycled water use and have the lowest ultimate unit cost.

Implementation:

- Infill to serve new customers within one-quarter mile of the existing distribution system (up to 4,000 AFY)
- Full-scale 16 MGD capacity San Vicente Reservoir Augmentation IPR project to utilize the full remaining wintertime supply from the North City Water Reclamation Plant, after other non-potable uses (10,500 AFY)
- Small amount of supplementation of summer peaks with purchased potable water, as needed



NC-3 – Evaluation Criteria Detail		
Criteria	Objective and Performance Measure	Discussion
Health and Safety	To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses.	City's non-potable service of recycled water meets federal state and local regulatory criteria and has been safely operated since 1997. New indirect potable projects would be designed to meet federal, state and local regulatory requirements.
Social Value	To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception.	Human Need: Both non-potable and IPR provide water to the community, but IPR projects distribute the repurified water to a greater number of people. Public Perception: Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high.
Environmental Value	To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits required.	Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. Wetlands associated with IPR projects are generally acceptable to environmentalists.
Local Water Reliability	To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability.	Up to 23,760 AFY of recycled water is reused in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy achieves 100 % utilization of the available recycled water from the NCWRP.
Water Quality	Meets or exceeds level of quality required for the intended use and customer needs. To meet all customer quality requirements.	Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable.
Operational Reliability	To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed.	IPR projects provide the most operational reliability as they take full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plants.
Cost	To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination).	See Section 7.5 for Cost Discussion.
Ability to Implement	To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation.	IPR projects are anticipated to be more difficult to implement due to the regulatory and social issues. Extensive public outreach efforts will be required to implement the indirect potable reuse component of this strategy.

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7.4 South Bay Strategies

All South Bay strategies include the existing uses at the South Bay and IBWC treatment plants. In addition, the City plans to fulfill their 6 MGD commitment to the Otay Water District by 2007. Therefore, existing uses and service to Otay Water District are shown as the first components in each South Bay strategy.

Description of South Bay Strategies

The paragraphs below summarize the components in each South Bay strategy, referred to as SB-1 through SB-3. Following the component summary is a strategy decision chart and two-page summary for each strategy. The two-page summary includes a figure displaying strategy components, text summarizing the strategy details, the primary strategy benefits, the strategy usage, implementation issues, and analysis of the evaluation criteria developed at the first American Assembly workshop.

SB-1: The SB-1 Strategy includes only non-potable projects similar to the City's existing recycled water program. After serving Otay Water District, SB-1 proposes to serve the Sweetwater Authority in two separate implementation phases.

SB-2: The SB-2 Strategy includes a smaller scale indirect potable reuse opportunity at Otay Lakes following the baseline Otay Water District project. SB-2 has only one phase.

SB-3: The SB-3 Strategy includes a larger indirect potable reuse opportunity at Otay Lakes following the baseline Otay Water District project. SB-3 has only one phase and maximizes reuse from the South Bay Water Reclamation Plant in this one step.

Summary of South Bay Strategies

The resulting volume of reuse and costs vary per phase and per strategy. The total reuse at the last phase also varies between strategies depending on the approach and specific opportunities. **Table 7-2** summarizes the total reuse achieved for each opportunity in each strategy, and the percent of South Bay Water Reclamation Plant capacity utilized.

Table 7-2
Reuse Quantities for South Bay Strategies

Reuse Project Components	Recycled Water Use By Strategy (AFY)		
	SB-1	SB-2	SB-3
Reuse[1]			
SBWRP onsite usage	560	560	560
IBWC onsite usage	840	840	840
Otay Water District	5,760	5,760	5,760
Sweetwater Authority	5,880		
Otay IPR - Small Scale (2 MGD Plant)		1,800	
Otay IPR Large Scale (5.5 MGD Plant)			5,500
Subtotal demands	*13,040*	*8,960*	*12,660*
Supply			
SBWRP Supply	15,120	15,120	15,120
Demineralization supply credit[2]	n/a	n/a	n/a
Advanced treatment process loss[2]	n/a	-640	-1,940
Subtotal Supply	*15,120*	*14,480*	*13,180*
Treatment Capacity Utilized	86%	62%	96%

[1] Project reuse volumes assume the availability of seasonal storage as needed to supply peak summertime uses.

[2] Supply credits & losses were used to account for water lost as part of treatment processes. For IPR opportunities, demineralization is not needed at SBWRP (resulting in a supply credit), but losses will occur at the Advanced Water Treatment Plant (resulting in a loss of supply).

South Bay Decision Chart

A decision chart of South Bay strategies is presented in **Figure 7-2**. Unit costs, the effect on a typical water bill, reuse volumes and the proposed implementation plan are shown. The chart was developed to help answer the primary study questions of: 1) which water recycling opportunities to pursue, and 2) depending on the opportunity, how much water to recycle.

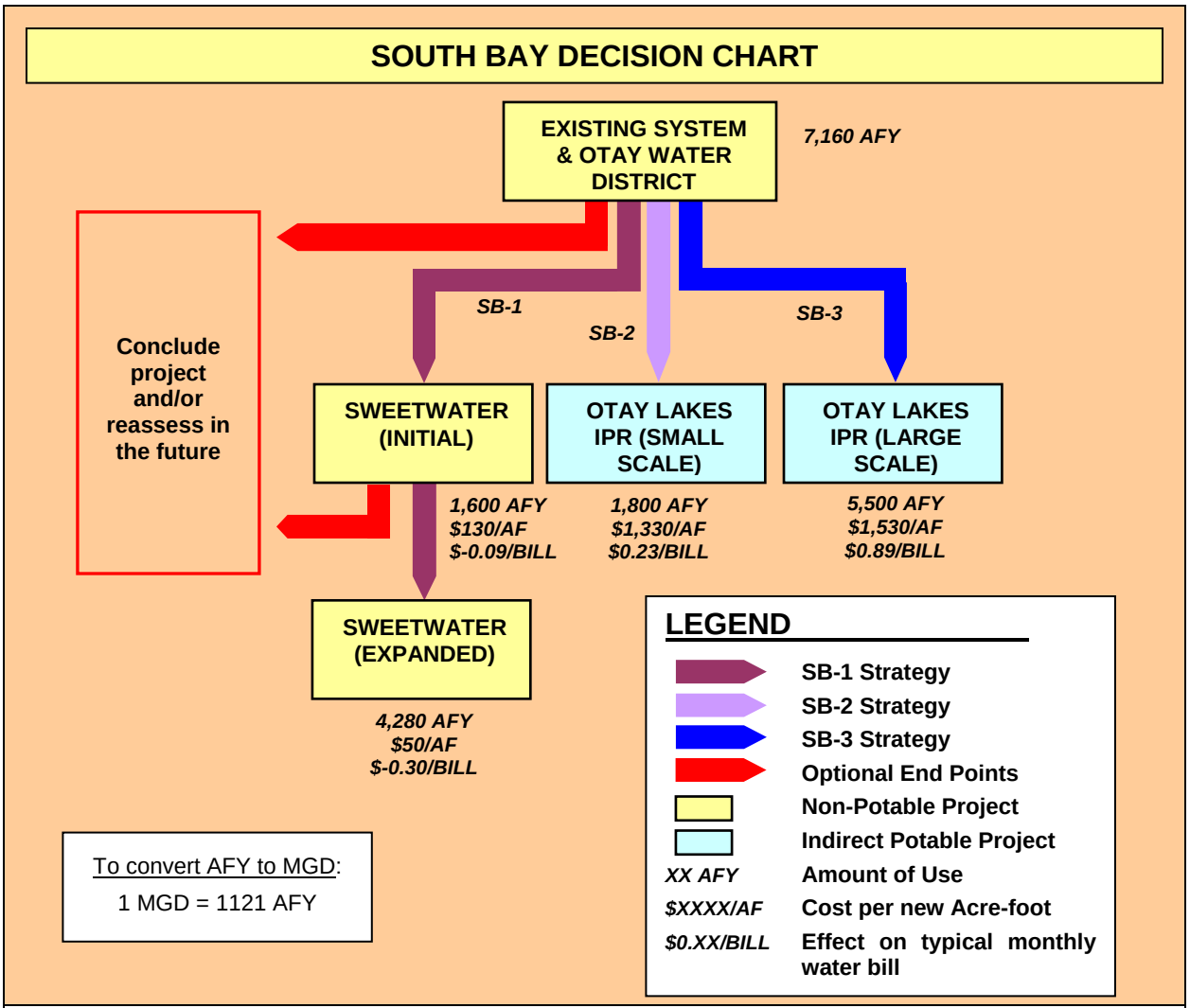


Figure 7-2 – The decision chart summarizes potential water reuse strategies for the South Bay Water Reclamation Plant. The chart was developed to help answer the primary study questions of: 1) which water recycling opportunities to pursue, and 2) depending on the opportunity, how much water to recycle. All strategies for South Bay start with serving planned San Diego and Otay Water District customers. The SB-1 strategy includes non-potable opportunities. The SB-2 strategy includes a small-scale indirect potable reuse project at Otay Lakes. The SB-3 strategy is a larger scale indirect potable reuse opportunity at Otay Lakes. The costs are shown for each opportunity. The report text includes additional discussion on the benefits and evaluation criteria for each strategy.

South Bay Strategy SB-1 Two-Page Summary

Project Description

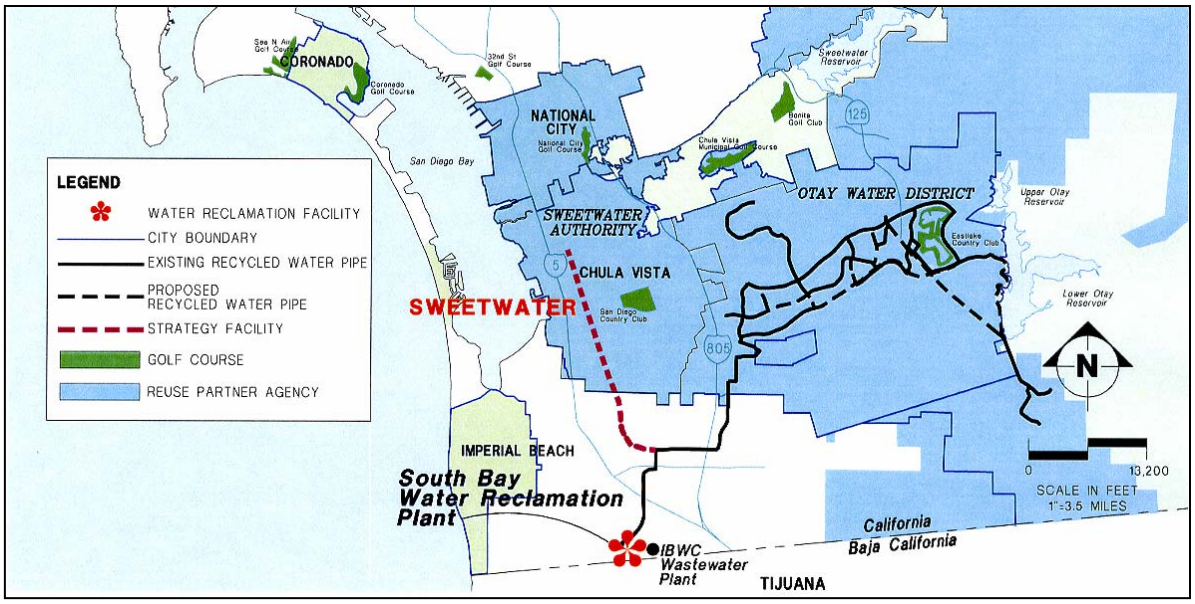
Expansion of the non-potable system to serve Otay Water District and Sweetwater Authority

Primary Benefit of this Strategy

Strategy SB-1 results in the lowest initial capital cost and lowest unit cost of all South Bay strategies. This strategy appears to be the appropriate choice if the driving decision factor is to minimize expenditures, even if the reuse occurs outside City service areas.

Implementation:

- Otay Water District (up to 5,800 AFY)
- Expansion of the existing system to serve Sweetwater Authority and its customers (up to 5,900 AFY)



SB-1 – Evaluation Criteria Detail		
Criteria	Objective and Performance Measure	Discussion
Health and Safety	To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses.	City's non-potable service of recycled water meets federal state and local regulatory criteria and has been safely operated since 1997.
Social Value	To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception.	Human Need: Non-potable use serves a human need by replacing potable water use however, the system's distribution system is limited and not everyone directly benefits from recycled water use. Public Perception: The public in general perceives that non-potable use of recycled water is preferable to indirect potable reuse.
Environmental Value	To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits required.	Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary.
Local Water Reliability	To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability.	Up to 13,040 AFY of recycled water is reused in this strategy. This amounts to approximately 86% of the available recycled water from the South Bay Water Reclamation Plant.
Water Quality	Meets or exceeds level of quality required for the intended use and customer needs. To meet all customer quality requirements.	Use of non-potable, recycled water for irrigation provides the benefit of nutrient value to irrigated areas. City ensures TDS to be equal or less than 1000 mg/L.
Operational Reliability	To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed.	Recycled water treatment and distribution systems are not operated with redundancy of facilities in mind. Outages of recycled water service are more likely to occur than in a potable water system. This scenario takes advantage of a new regional interconnection with Sweetwater Authority.
Cost	To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination).	See Section 7.5 for Cost Discussion.
Ability to Implement	To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation.	Non-potable recycled water projects are generally easier to implement than indirect potable projects as they require less regulatory permitting. These types of projects have a regulatory framework to follow and have general public support.

South Bay Strategy SB-2 Two-Page Summary

Project Description

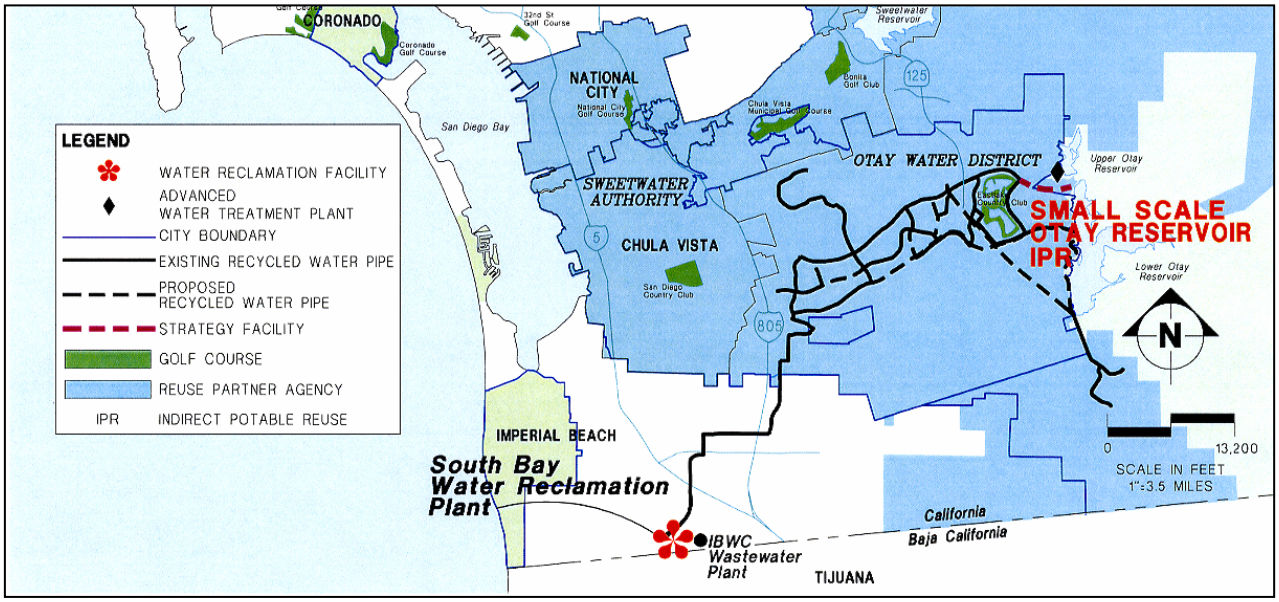
Expansion of the non-potable system to serve Otay Water District, followed by a small-scale indirect potable reuse opportunity at Otay Reservoir

Primary Benefit of this Strategy

Strategy SB-2 includes a mix of non-potable uses and a small-scale indirect potable reuse project. This strategy appears to be an appropriate choice if the driving decision factor is to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.

Implementation:

- Otay Water District (up to 5,800 AFY)
- A small-scale IPR project at Lower Otay with created wetlands located upstream of the Upper Otay reservoir (1,800 AFY)



SB-2 – Evaluation Criteria Detail		
Criteria	Objective and Performance Measure	Discussion
Health and Safety	To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses.	City's non-potable service of recycled water meets federal state and local regulatory criteria and has been safely operated since 1997. New indirect potable projects would be designed to meet federal, state and local regulatory requirements.
Social Value	To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception.	Human Need: Both non-potable and IPR provide water to the community, but IPR projects distribute the repurified water to a greater number of people. Public Perception: Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high.
Environmental Value	To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits required.	Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. Wetlands associated with IPR projects are generally acceptable to environmentalists.
Local Water Reliability	To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability.	Up to 8,960 AFY of recycled water is reused in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy utilizes approximately 72% of the available recycled water from the South Bay WRP.
Water Quality	Meets or exceeds level of quality required for the intended use and customer needs. To meet all customer quality requirements.	Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable.
Operational Reliability	To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed.	IPR projects provide the most operational reliability as they take full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plants.
Cost	To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination).	See Section 7.5 for Cost Discussion.
Ability to Implement	To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation.	IPR projects are anticipated to be more difficult to implement due to the regulatory and social issues. Extensive public outreach efforts will be required to implement the indirect potable reuse component of this strategy.

South Bay Strategy SB-3 Two-Page Summary

Project Description

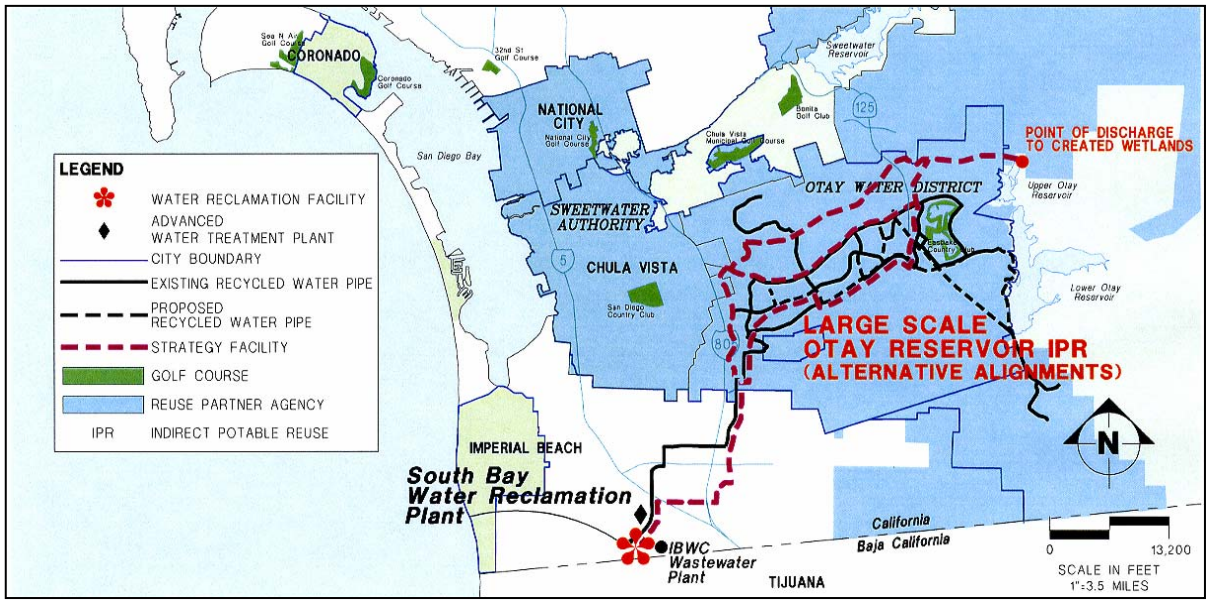
Expansion of the non-potable system to serve Otay Water District, followed by a full-scale indirect potable reuse opportunity at Otay Reservoir

Primary Benefit of this Strategy

Strategy SB-3 includes a mix of non-potable uses and a larger-scale indirect-potable reuse project. This strategy appears to be an appropriate choice if the driving decision factor is to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.

Implementation:

- Otay Water District (up to 5,800 AFY)
- A large-scale indirect potable reuse project at Lower Otay with created wetlands located upstream of the Upper Otay Reservoir (5,500 AFY)



SB-3 – Evaluation Criteria Detail		
Criteria	Objective and Performance Measure	Discussion
Health and Safety	To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses.	City's non-potable service of recycled water meets federal state and local regulatory criteria and has been safely operated since 1997. New indirect potable projects would be designed to meet federal, state and local regulatory requirements.
Social Value	To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception.	Human Need: Both non-potable and IPR provide water to the community, but IPR projects distribute the repurified water to a greater number of people. Public Perception: Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high.
Environmental Value	To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits required.	Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. Wetlands associated with IPR projects are generally acceptable to environmentalists..
Local Water Reliability	To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability.	Up to 12,660 AFY of recycled water is reused in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy utilizes approximately 97% of the available recycled water from the South Bay WRP.
Water Quality	Meets or exceeds level of quality required for the intended use and customer needs. To meet all customer quality requirements.	Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable.
Operational Reliability	To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed.	IPR projects provide the most operational reliability as they take full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plants.
Cost	To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination).	See Section 7.5 for Cost Discussion.
Ability to Implement	To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation.	IPR projects are anticipated to be more difficult to implement due to the regulatory and social issues. Extensive public outreach efforts will be required to implement the indirect potable reuse component of this strategy.

7.5 Cost Evaluations

Cost Evaluation Overview

The Reuse Study has evaluated costs the City would incur for each of the three North City and three South Bay strategies, and for each phase of each strategy. All costs are presented on a common basis in 2005 dollars[2]. This report highlights three key measures of project costs, as follows:

- **Capital Costs:** Capital costs are an estimate of the City's initial capital outlay for project construction and implementation exclusive of operations and maintenance costs. These costs include all costs for project planning, permitting, design, construction, and construction administration.

- **Unit Costs:** The unit cost of water delivered provides a common basis for comparison among projects with differing reuse volumes. The analysis is based on the total equivalent annual cost of each project, including capital and operating costs. Capital costs are amortized over a 40-year term at an interest rate of 6 percent. The 40-year term is representative of the average economic life of the mix of capital facilities presented. Unit costs are then calculated by dividing total equivalent annual costs by the annual volume of recycled water put to beneficial reuse. Finally, this result is adjusted to account for various incentive-credits and avoided costs, as described later in this section.

- **Impact on Typical Monthly Residential Water Bill:** This measure estimates the impact on a typical City of San Diego residential water bill necessary to fund the reuse projects over a 40-year finance period. The actual rate effect may vary due to differences in financing, funding grants, and other factors, but this measure nevertheless provides a reasonable estimate for evaluation and comparison purposes. For some strategies and phases, a net reduction in water rates is shown. This occurs when the cost to construct and operate the recycled water project would result in a net savings over current water rates. Whether water rates would actually be reduced is a matter that would be resolved through the City's rate setting process.

As with the other evaluations presented in this section, this cost evaluation data is intended to help inform the City Council, stakeholders, and the public as to the City's decision of which reuse strategy to pursue and how far. While costs are a key evaluation factor, as noted in the preface of this report there may be other factors that could lead the City to select a more costly alternative over a less costly one. In addition, the City fully intends to pursue State and

[2] Construction costs are referenced to an Engineering News Record Los Angeles Construction Cost Index of 8193 (January 2005).

local grant funding for any options pursued or decided upon by the City Council. The costs presented herein do not reflect or assume grant funding.

Cost Evaluations – North City Strategies

Reuse volumes, capital costs, unit costs, and rate effects for each phase of the three North City strategies are summarized below.

North City water reuse volumes are shown in **Table 7-3**. The table shows the total annual volume, in acre feet, of recycled water that is used for each strategy. There are three column headings: 1) "Incremental Use of New Projects" lists the amount of new recycled water added by new projects within a particular phase; 2) "Cumulative Use of New Projects" lists the total volume of recycled water added by all of the new reuse projects; and 3) "Cumulative Total Use of New and Existing Projects" lists the total volume of reuse of all the new and existing reuse projects.

Table 7-3
North City Reuse Volumes (AFY)

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Use of New Projects				
NC-1	3,820	2,110	1,120	3,190
NC-2	3,820	2,110	1,800	870
NC-3	3,820	10,500	0	0
Cumulative Use of New Projects				
NC-1	3,820	5,930	7,050	10,240
NC-2	3,820	5,930	7,730	8,600
NC-3	3,820	14,320	14,320	14,320
Cumulative Total Use of New and Existing Projects				
NC-1	13,260	15,370	16,490	19,680
NC-2	13,260	15,370	17,170	18,040
NC-3	13,260	23,760	23,760	23,760

Note: Refer to Figures 7-3 through 7-5 on preceding pages for components included in each phase.

Table 7-4 summarizes the capital costs of the new North City reuse projects in 2005 dollars. There are two column headings: 1) "Incremental Cost of New Projects" lists the additional capital costs added by new projects within a particular phase; and 2) "Cumulative Cost of New Projects" lists the total capital costs added by all of the new reuse projects up to a given phase.

Table 7-4
North City Capital Costs

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Costs of New Projects				
NC-1	$27,600,000	$50,400,000	$65,100,000	$141,600,000
NC-2	$27,600,000	$50,400,000	$65,100,000	$45,200,000
NC-3	$27,600,000	$210,000,000	-	-
Cumulative Costs of New Projects				
NC-1	$27,600,000	$78,000,000	$143,100,000	$284,700,000
NC-2	$27,600,000	$78,000,000	$143,100,000	$188,300,000
NC-3	$27,600,000	$237,600,000	$237,600,000	$237,600,000

Table 7-5 summarizes the unit costs of the new North City reuse projects in dollars per acre-foot, and assumes a 40 year term at 6% interest. There are two column headings: 1) "Incremental Unit Costs of New Projects" lists the individual unit costs of each new project addition; and 2) "Melded Unit Costs of New Projects" lists the weighted average or melded unit costs of all of the new reuse projects up to a given phase.

Table 7-5
North City Unit Costs ($/AF)

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Unit Costs of New Projects				
NC-1	$130	$2,100	$5,240	$2,910
NC-2	$130	$2,100	$2,330	$3,060
NC-3	$130	$1,630	-	-
Melded Unit Costs of New Projects				
NC-1	$130	$830	$1,530	$1,960
NC-2	$130	$830	$1,180	$1,370
NC-3	$130	$1,230	$1,230	$1,230

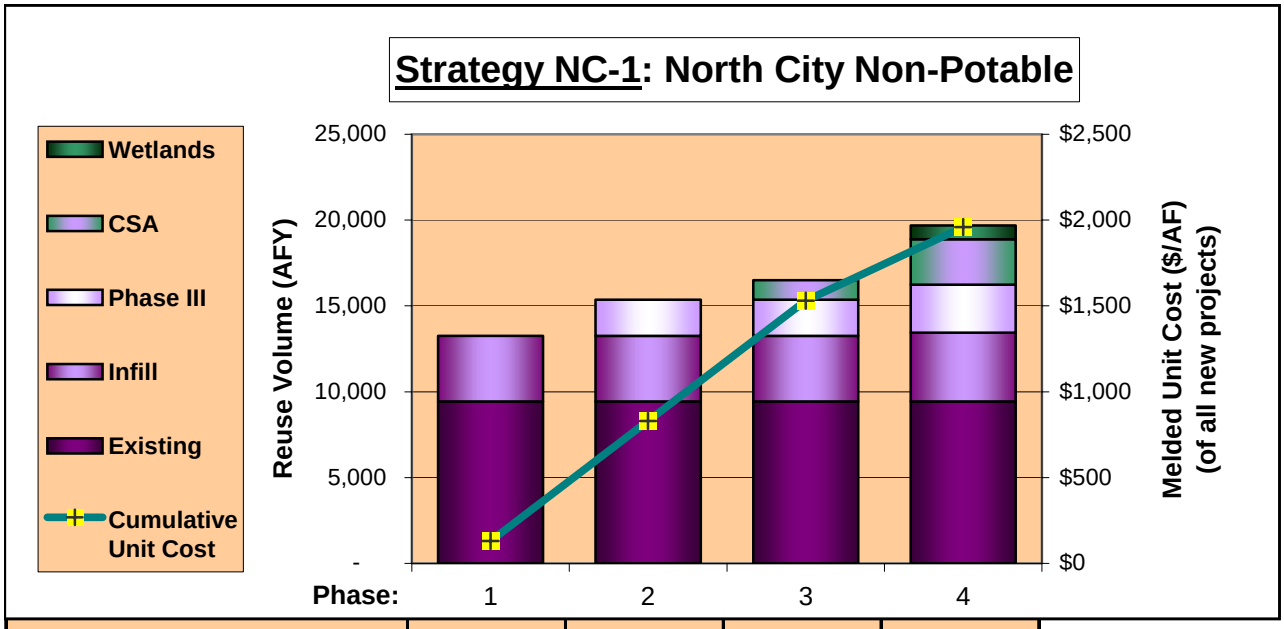
Table 7-6 presents the approximate increase to a typical monthly residential water bill that would be necessary to fund each strategy. There are two column headings: 1) "Incremental Effect of New Projects" lists the individual rate effect of each new project addition; and 2) "Cumulative Effect of New Projects" lists the cumulative or total rate effect of all of the new reuse projects up to a given phase.

Table 7-6
North City Monthly Rate Increase to
Typical Residential Water Bill ($/mo)

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Effect of New Projects				
NC-1	-$0.22	$0.53	$0.83	$1.20
NC-2	-$0.22	$0.53	$0.52	$0.35
NC-3	-$0.22	$1.85	-	-
Cumulative Effect of New Projects				
NC-1	-$0.22	$0.31	$1.13	$2.34
NC-2	-$0.22	$0.31	$0.82	$1.17
NC-3	-$0.22	$1.63	$1.63	$1.63

Volume and cost data specific to each strategy are also presented in **Figures 7-3, 7-4,** and **7-5** for strategies NC-1, NC-2, and NC-3, respectively. These cost charts provide a graphical representation of costs in relation to the phases and reuse volume of each strategy. In the graph, the columns represent the individual project opportunities in each strategy. The legend to the left of the columns identifies each project. The height of the column is the volume of reuse, measured on the left axis labeled "Reuse (AFY)". The graphed line overlapping the columns represents the cumulative unit cost per phase, measured on the right axis labeled "Average Cost per AF (for new projects)."

The tabular data below the graph includes reuse volumes, capital costs, unit costs, and the effect of the projects for a typical monthly residential water bill. The costs and the "new increment" reuse volumes shown in the supporting tables reflect new reuse projects only, exclusive of existing projects such as the City's Phase I and Phase II North City distribution system expansions.

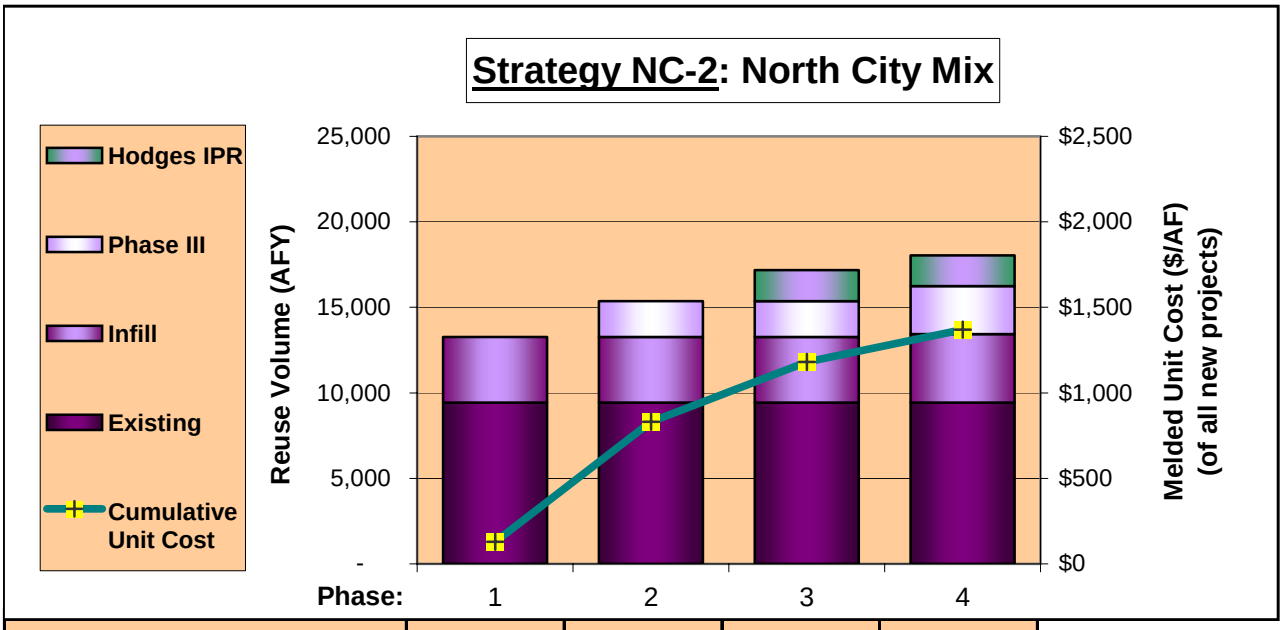


Reuse Volume, by Phase:					w/ Seasonal Storage
-- New Project Use (Increase by Phase)	(AFY)	3,820	2,110	1,120	3,190
	(MGD)	3.4	1.9	1.0	2.8
-- Total (Cumulative) (Including Existing)	(AFY)	13,260	15,370	16,490	19,680
	(MGD)	11.8	13.7	14.7	17.6

Incremental Costs of Individual New Projects, by Phase:					
-- Capital Cost	($)	$27,600,000	$50,400,000	$65,100,000	$141,600,000
-- Unit Cost	($/AF)	$130	$2,100	$5,240	$2,910
-- Increase to Typical Residential Water Bill	($/mo)	-$0.22	$0.53	$0.83	$1.20

Cumulative Costs of All New Projects, by Phase:					
-- Capital Cost	($)	$27,600,000	$78,000,000	$143,100,000	$284,700,000
-- Unit Cost (Melded)	($/AF)	$130	$830	$1,530	$1,960
-- Increase to Typical Residential Water Bill	($/mo)	-$0.22	$0.31	$1.13	$2.34

Figure 7-3 – Volume and Cost Summary for Strategy NC-1

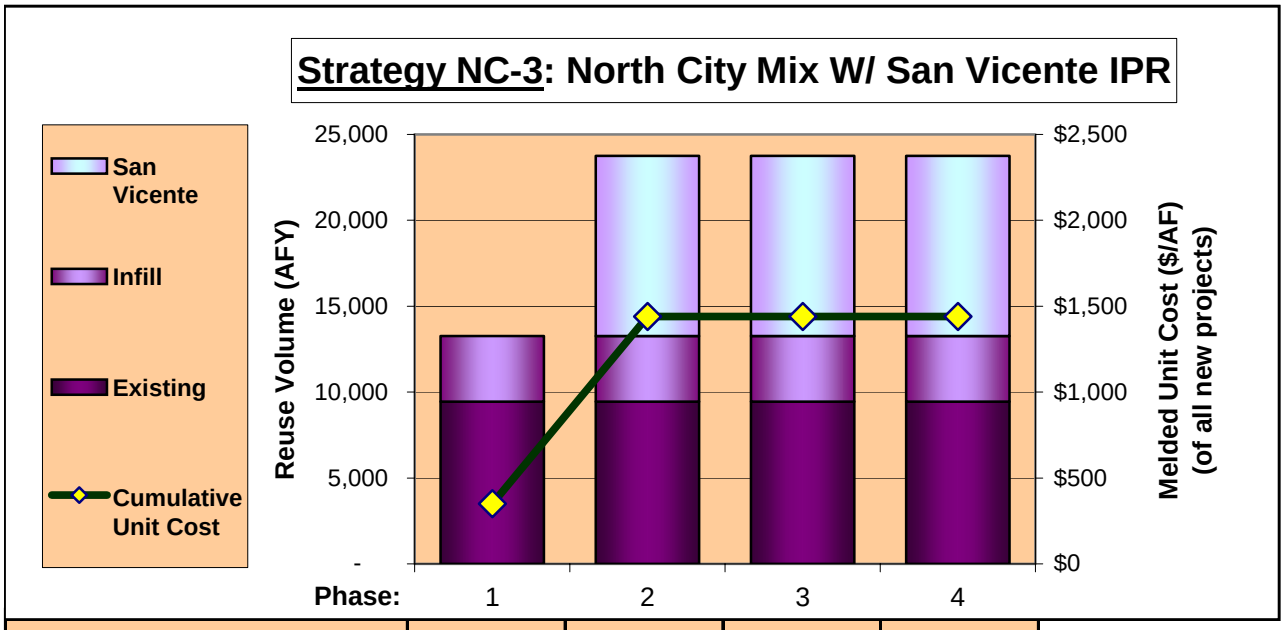


Reuse Volume, by Phase:					w/ Seasonal Storage
-- New Project Use (Increase by Phase)	(AFY)	3,820	2,110	1,800	870
	(MGD)	3.4	1.9	1.6	0.8
-- Total (Cumulative) (Including Existing)	(AFY)	13,260	15,370	17,170	18,040
	(MGD)	11.8	13.7	15.3	16.1

Incremental Costs of Individual New Projects, by Phase:					
-- Capital Cost	($)	$27,600,000	$50,400,000	$65,100,000	$45,200,000
-- Unit Cost	($/AF)	$130	$2,100	$2,330	$3,060
-- Increase to Typical Residential Water Bill	($/mo)	-$0.22	$0.53	$0.52	$0.35

Cumulative Costs of All New Projects, by Phase:					
-- Capital Cost	($)	$27,600,000	$78,000,000	$143,100,000	$188,300,000
-- Unit Cost (Melded)	($/AF)	$130	$830	$1,180	$1,370
-- Increase to Typical Residential Water Bill	($/mo)	-$0.22	$0.31	$0.82	$1.17

Figure 7-4 – Volume and Cost Summary for Strategy NC-2



Reuse Volume, by Phase:					
-- New Project Use (Increase by Phase)	(AFY)	3,820	10,500	0	0
	(MGD)	3.4	9.4	0.0	0.0
-- Total (Cumulative) (Including Existing)	(AFY)	13,260	23,760	23,760	23,760
	(MGD)	11.8	21.2	21.2	21.2

Incremental Costs of Individual New Projects, by Phase:					
-- Capital Cost	($)	$27,600,000	$210,000,000	-	-
-- Unit Cost	($/AF)	$130	$1,630	-	-
-- Increase to Typical Residential Water Bill	($/mo)	-$0.22	$1.85	-	-

Cumulative Costs of All New Projects, by Phase:					
-- Capital Cost	($)	$27,600,000	$237,600,000	$237,600,000	$237,600,000
-- Unit Cost (Melded)	($/AF)	$130	$1,230	$1,230	$1,230
-- Increase to Typical Residential Water Bill	($/mo)	-$0.22	$1.63	$1.63	$1.63

Figure 7-5 – Volume and Cost Summary for Strategy NC-3

Cost Evaluations – South Bay Strategies

Reuse volumes, capital costs, unit costs, and rate effects for each phase of the three South Bay strategies are summarized below.

South Bay water reuse volumes are shown in **Table 7-7**. The table shows the total annual volume, in acre feet, of recycled water that is used for each strategy. There are three column headings: 1) "Incremental Use of New Projects" lists the amount of new recycled water added by new projects within a particular phase; 2) "Cumulative Use of New Projects" lists the total volume of recycled water added by all of the new reuse projects; and 3) "Cumulative Total Use of New and Existing Projects" lists the total volume of reuse of all the new and existing reuse projects.

Table 7-7
South Bay Reuse Volumes (AFY)

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Use of New Projects				
SB-1	0	2,860	4,990	450
SB-2	1,800	1,260	710	450
SB-3	0	6,760	710	450
Cumulative Use of New Projects				
SB-1	0	1,600	5,880	5,880
SB-2	1,800	1,800	1,800	1,800
SB-3	0	5,500	5,500	5,500
Cumulative Total Use of New and Existing Projects (Including Otay WD)				
SB-1	4,740	7,600	12,590	13,040
SB-2	6,540	7,800	8,510	8,960
SB-3	4,740	11,500	12,210	12,660

Table 7-8 summarizes the capital costs of the new South Bay reuse projects in 2005 dollars. There are two column headings: 1) "Incremental Cost of New Projects" lists the additional capital costs added by new projects within a particular phase; and 2) "Cumulative Cost of New Projects" lists the total capital costs added by all of the new reuse projects up to a given phase.

Table 7-8
South Bay Capital Costs

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Costs of New Projects				
SB-1	$0	$1,000,000	$0	-
SB-2	$21,600,000	-	-	-
SB-3	$0	$96,100,000	-	-
Cumulative Costs of New Projects				
SB-1	$0	$1,000,000	$1,000,000	$1,000,000
SB-2	$21,600,000	$21,600,000	$21,600,000	$21,600,000
SB-3	$0	$96,100,000	$96,100,000	$96,100,000

Table 7-9 summarizes the unit costs of the new South Bay reuse projects in dollars per acre-foot, and assumes a 40 year term at 6% interest. There are two column headings: 1) "Incremental Unit Costs of New Projects" lists the individual unit costs of each new project addition; and 2) "Melded Unit Costs of New Projects" lists the weighted average or melded unit costs of all of the new reuse projects up to a given phase.

Table 7-9
South Bay Unit Costs ($/AF)

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Unit Costs of New Projects				
SB-1	$0	$130	$50	-
SB-2	$1,330	-	-	-
SB-3	$0	$1,530	-	-
Melded Unit Costs of New Projects				
SB-1	$0	$130	$70	$70
SB-2	$1,330	$1,330	$1,330	$1,330
SB-3	$0	$1,530	$1,530	$1,530

Note: Refer to Figure 7-6 through 7-8 on preceding pages for components included in each phase.

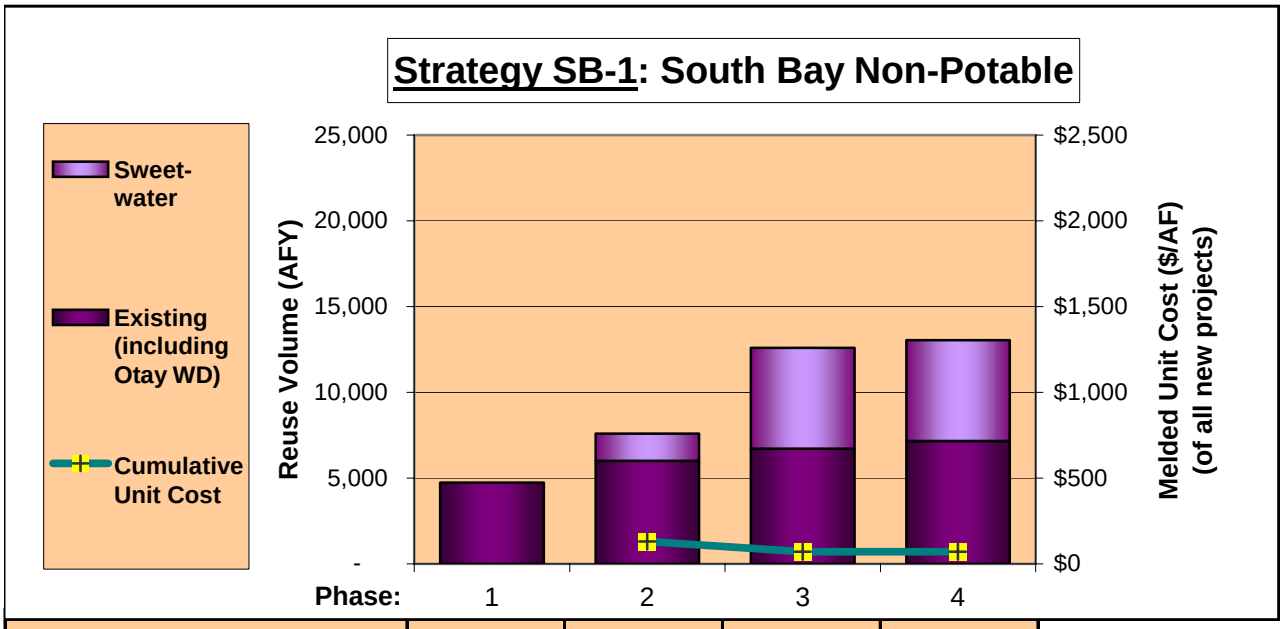
Table 7-10 presents the approximate increase to a typical monthly residential water bill that would be necessary to fund each strategy. There are two column headings: 1) "Incremental Effect of New Projects" lists the individual rate effect of each new project addition; and 2) "Cumulative Effect of New Projects" lists the cumulative or total rate effect of all of the new reuse projects up to a given phase.

Table 7-10
South Bay Monthly Rate Increase to
Typical Residential Water Bill ($/mo)

Strategy	Phase 1	Phase 2	Phase 3	Phase 4
Incremental Effect of New Projects				
SB-1	$0.00	-$0.09	-$0.30	-
SB-2	$0.23	-	-	-
SB-3	$0.00	$0.89	-	-
Cumulative Effect of New Projects				
SB-1	$0.00	-$0.09	-$0.40	-$0.40
SB-2	$0.23	$0.23	$0.23	$0.23
SB-3	$0.00	$0.89	$0.89	$0.89

Volume and cost data specific to each strategy are also presented in **Figures 7-6, 7-7,** and **7-8** for strategies SB-1, SB-2, and SB-3, respectively. These cost charts provide a graphical representation of costs in relation to the phases and reuse volume of each strategy. In the graph, the columns represent the individual project opportunities in each strategy. The legend to the left of the columns identifies each project. The height of the column is the volume of reuse, measured on the left axis labeled "Reuse (AFY)". The graphed line overlapping the columns represents the cumulative unit cost per phase, measured on the right axis labeled "Average Cost per AF (for new projects)."

The tabular data below the graph includes reuse volumes, capital costs, unit costs, and the effect of the projects for a typical monthly residential water bill. The costs and the "new increment" reuse volumes shown in the supporting tables reflect new reuse projects only, exclusive of existing projects such as sales to the Otay Water District.

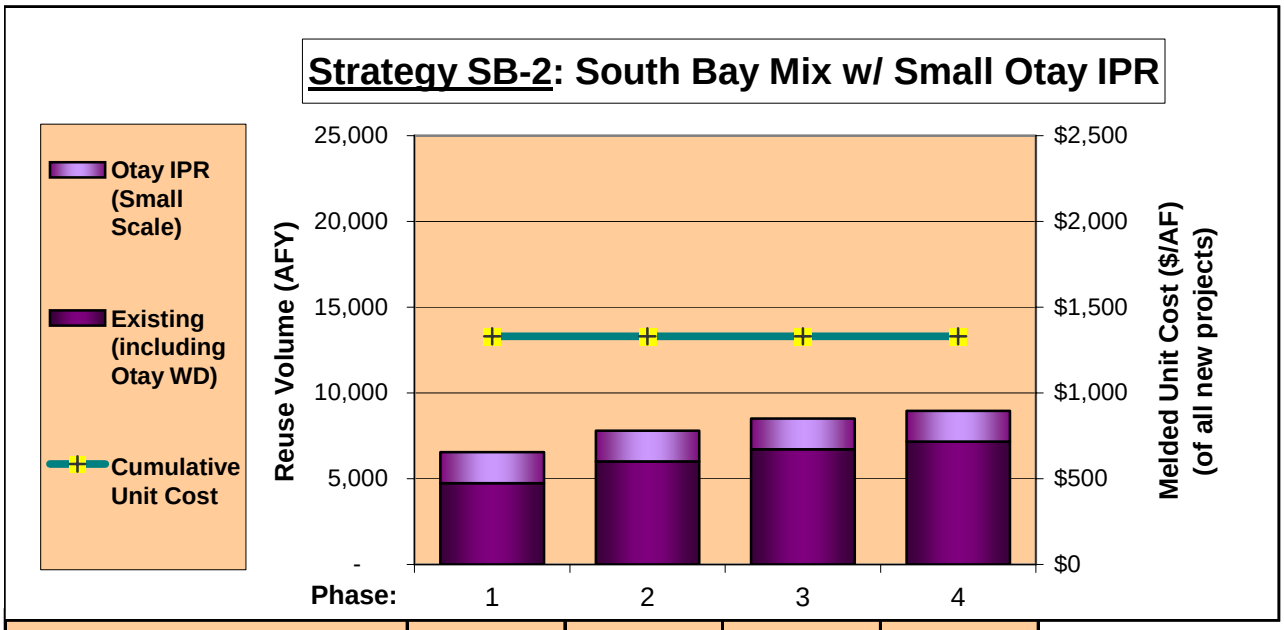


Reuse Volume, by Phase:					
-- New Project Use (Increase by Phase)	(AFY)	0	2,860	4,990	450
	(MGD)	0.0	2.6	4.5	0.4
-- Total Use (Cumulative) (Including Existing)	(AFY)	4,740	7,600	12,590	13,040
	(MGD)	4.2	6.8	11.2	11.6

Incremental Costs of Individual New Projects, by Phase:					
-- Capital Cost	($)	$0	$1,000,000	$0	-
-- Unit Cost	($/AF)	$0	$130	$50	-
-- Increase to Typical Residential Water Bill	($/mo)	$0.00	-$0.09	-$0.30	-

Cumulative Costs of All New Projects, by Phase:					
-- Capital Cost	($)	$0	$1,000,000	$1,000,000	$1,000,000
-- Unit Cost (Melded)	($/AF)	$0	$130	$70	$70
-- Increase to Typical Residential Water Bill	($/mo)	$0.00	-$0.09	-$0.40	-$0.40

Figure 7-6 – Volume and Cost Summary for Strategy SB-1

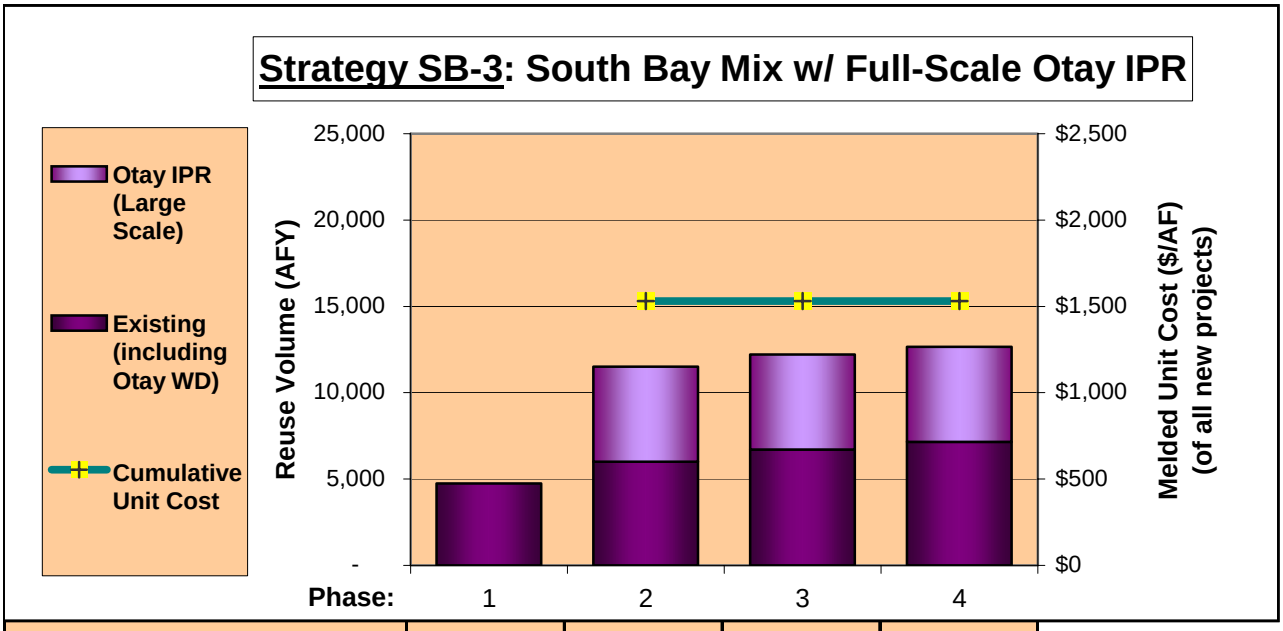


Reuse Volume, by Phase:					
-- New Project Use (Increase by Phase)	(AFY)	1,800	1,260	710	450
	(MGD)	1.6	1.1	0.6	0.4
-- Total (Cumulative) (Including Existing)	(AFY)	6,540	7,800	8,510	8,960
	(MGD)	5.8	7.0	7.6	8.0

Incremental Costs of Individual New Projects, by Phase:					
-- Capital Cost	($)	$21,600,000	-	-	-
-- Unit Cost	($/AF)	$1,330	-	-	-
-- Increase to Typical Residential Water Bill	($/mo)	$0.23	-	-	-

Cumulative Costs of All New Projects, by Phase:					
-- Capital Cost	($)	$21,600,000	$21,600,000	$21,600,000	$21,600,000
-- Unit Cost (Melded)	($/AF)	$1,330	$1,330	$1,330	$1,330
-- Increase to Typical Residential Water Bill	($/mo)	$0.23	$0.23	$0.23	$0.23

Figure 7-7 – Volume and Cost Summary for Strategy SB-2



Reuse Volume, by Phase:					
-- New Project Use (Increase by Phase)	(AFY)	0	6,760	710	450
	(MGD)	0.0	6.0	0.6	0.4
-- Total (Cumulative) (Including Existing)	(AFY)	4,740	11,500	12,210	12,660
	(MGD)	4.2	10.3	10.9	11.3

Incremental Costs of Individual New Projects, by Phase:					
-- Capital Cost	($)	$0	$96,100,000	-	-
-- Unit Cost	($/AF)	$0	$1,530	-	-
-- Increase to Typical Residential Water Bill	($/mo)	$0.00	$0.89	-	-

Cumulative Costs of All New Projects, by Phase:					
-- Capital Cost	($)	$0	$96,100,000	$96,100,000	$96,100,000
-- Unit Cost (Melded)	($/AF)	$0	$1,530	$1,530	$1,530
-- Increase to Typical Residential Water Bill	($/mo)	$0.00	$0.89	$0.89	$0.89

Figure 7-8 – Volume and Cost Summary for Strategy SB-3

Incentive Credits and Avoided Costs

The actual cost of each alternative implementation strategy to the City will be, in most cases, less than the straight sum of the component project capital and operating costs. Two factors that contribute to this cost reduction are:

- **Incentive Credits:** The first factor that reduces the City's cost is the availability of incentive credits for water reuse projects. These monetary credits are provided by the Metropolitan Water District of Southern California and the San Diego County Water Authority as a means of promoting the development of water reuse and other alternative local water supply projects.

- **Avoided Costs:** The second factor that reduces the City's cost for water reuse projects is the potential for these projects to offset other water and wastewater capital and operating costs that the City would otherwise incur. Economists call such cost offsets avoided costs. Avoided costs can be credited to the cost of the water reuse project, reducing its effective cost to the City as a whole. Some avoided costs are ***direct*** cost offsets, in that they place real dollars in the City's accounts concurrent with the operation of the reuse project. Other avoided costs are ***indirect*** cost offsets, in that they avoid or lessen the need for some possible future project, or provide other benefits that do not directly put real dollars in the City's accounts.

Reuse credits and avoided costs are summarized in **Tables 7-11** and **7-12**. **Table 7-11** describes each credit or avoided cost factor, and **Table 7-12** summarizes the net dollar effect for each of several categories of reuse project. These credits and avoided costs are factored into the unit cost and rate effect data presented in the previous cost tables and figures.

Table 7-11
Summary of Reuse Incentive Credits and Avoided Costs

Cost Component	Description	Dollar Amount	Direct or Indirect?
Incentive Credits:			
1. SDCWA Credit	Financial incentive program by San Diego County Water Authority. Designed to encourage development of reuse projects.	$100/AF savings, all projects	Direct
2. MWDSC Credit	Financial incentive program by the Metropolitan Water District of Southern California. Credit amount is per the City's agreement with Metropolitan.	$250/AF savings, all projects except wetlands and sales to other agencies	Direct
Avoided Facility Operating and Capital Costs:			
3. Avoided Wastewater Operating Costs	Reuse at the NCWRP reduces the plant's discharges to Point Loma, saving operations costs to and through Point Loma. No similar savings accrue at the SBWRP because the facility has its own ocean outfall.	$60/AF savings, all North City projects	Direct
4. Incurred Wastewater Operating Costs	To produce recycled water, the City incurs additional operating costs to operate the tertiary filters at both the NCWRP and SBWRP, and also the demineralization facility at the NCWRP. The latter does not apply for reservoir augmentation projects.	$100/AF cost, all North City except reservoir augmentation $50/AF cost, all other	Direct
5. Avoided Wastewater Capital Costs	At the NCWRP, recycled water put to beneficial use reduces the wastewater inflow to Point Loma. However, this does not offset any capital costs because the City is required to maintain full wet-weather backup flow disposal capacity to convey NCWRP flows to Point Loma. At the SBWRP, recycled water reduces the flow of treated wastewater out the ocean outfall, but does not offset any capital costs.	$0/AF savings, all projects	Indirect
6. Avoided Water Treatment Plant Capital Costs	Some reuse projects may offset the need for the City to expand its water treatment plants, or may allow existing plants to treat a higher percentage of the City's total potable supply. Eligible projects are all types except wetlands creation, which does not offset a potable water demand, and reservoir augmentation, which does not reduce water treatment plant capacity requirements. At the NCWRP, existing and planned summertime uses already utilize approximately 18 MGD of the plant's 24 MGD capacity. Thus the potential treatment plant cost offset for new reuse projects is limited to the remaining 6 MGD of capacity. At the SBWRP, all of the contemplated new uses are either uses outside the City, or are Reservoir Augmentation projects, and do not offset any City treatment plant costs. Based on the City's actual costs to expand the Miramar Filtration Plant ($167,000,000 for 75 MGD), the City values treatment capacity at approximately $2,200,000 per MGD.	$2,200,000 savings per MGD of summertime use, first 6 MGD of additional qualifying North City summertime use	Indirect
7. IPR Water Quality Benefit	IPR projects will produce water that has a lower total dissolved solids (TDS) concentration than existing imported water supplies. This reduction assists the City with water reclamation efforts and groundwater management efforts by reducing the need for expensive demineralization processes, and benefits the City's customers by extending the life of water heaters and other household fixtures. The value of this benefit has been estimated based on data from the 1999 Salinity Management Study (MWDSC, U.S. Bureau of Reclamation). The analysis assumes that Indirect Potable Reuse projects will produce water with a TDS approximately 400 mg/L less than imported water.	$200/AF savings, All IPR projects	Indirect

Table 7-12
Summary of Cost Credits by Category of Reuse

Cost Component	Direct / Indirect	Types and Locations of Reuse						
		Recycled Supply from NCWRP				Recycled Supply from SBWRP		
		Title 22 (except wetlands)	Wetlands	Reservoir IPR	Ground-water IPR	Title 22	Sale to others (Title 22)	Reservoir IPR
1. SDCWA Credit	Direct	$100	--	$100	$100	$100	--	$100
2. MWDSC Credit	Direct	$250	--	$250	$250	$250	--	$250
3. Avoided Wastewater Operating Costs	Direct	$60	$60	$60	$60	--	--	--
4. Incurred Wastewater Operating Costs	Direct	($100)	($100)	($50)	($100)	($50)	($50)	($50)
5. Avoided Wastewater Capital Costs	Indirect	--	--	--	--	--	--	--
6. Avoided Water Treatment Plant Capital Costs	Indirect	$13 M capital credit to first 6 MGD of new reuse	--	--	--	--	--	--
7. IPR Water Quality Benefit	Indirect	--	--	$200	$200	--	--	$200
TOTALS – DIRECT:		$310	($40)	$360	$310	$300	$(50)	$300
TOTALS – INDIRECT:		See No. 6 credit	--	$200	$200	--	--	$200

Cost Considerations Regarding Supplemental Water or Seasonal Storage to Meet Peak Summer Demands

In some of the strategies, the summertime peak demand for recycled water exceeds the recycled water production capacity of the corresponding water reclamation plant. When this peak demand occurs, the cost tables and figures presented earlier in this section include the costs for the City to do one of two things:

To meet peak summer demands, some strategies require either supplemental purchases of imported water, or seasonal storage. These are factored into the summary cost tables earlier in this section.

- **Supplement:** One option is to supplement the recycled water supply with purchased imported water. This option does not maximize the volume of water reused, but is generally less expensive than providing seasonal storage, even after accounting for water purchases as an operating cost of the strategy.

- **Seasonal Storage:** The other option is to provide seasonal storage. This option maximizes the volume of water reused, but is generally more expensive than supplementing with imported water.

Because of the high cost of seasonal storage, to seasonal storage has been deferred until the last phases of the implementation strategies. Should less expensive seasonal storage opportunities become available to the City, or should summer peak demands turn out to be different than forecasted, the City can re-evaluate this decision at any time. The cost tables and figures included earlier in this section include the costs for supplemental water purchases or seasonal storage as required.

Comparison of Water Reuse Project Costs with Other Sources of New Water

One of the main benefits of developing additional uses of recycled water is that these uses help to reduce the City's need to purchase imported water or to develop other water supplies to meet its growing demands. Every acre-foot of beneficially used recycled water is an acre-foot of water that the City does not need to spend money to obtain from other sources. Other water supplies include imported water, seawater desalination, and water transfers.

The City purchases imported water from the San Diego County Water Authority (Water Authority), which in turn purchases a majority of its water from the Metropolitan Water District of Southern California (MWD). The Water Authority's current treated water rates are $526 for treated municipal and industrial (M&I) water, consisting of a $431 per acre-foot (AF) MWD cost of supply, and a $95/AF Water Authority charge. Untreated M&I water rates are $444/AF, consisting of the $349/AF MWD untreated rate, and a $95/AF Water Authority charge.

The City mostly purchases untreated water, at a current price of $444/AF, and treats this water at its own treatment plants prior to distribution to customers. Accounting for costs to operate the treatment plant, the City's current average cost to purchase and treat water is approximately **$500/AF**.

The City's current average cost to purchase and treat water is approximately $500/AF.

In their efforts to serve increasing demands, both the San Diego County Water Authority and MWD are pursuing new sources of supply, including seawater desalination and water transfers. **These new supplies are often more expensive than existing supplies, and as such may represent the true marginal cost of water, and the more appropriate point of comparison for water reuse costs.**

Seawater Desalination: Continued improvements in desalination technology have lowered costs to the point that many water agencies up and down the coast of California are evaluating seawater desalination projects as a possible means of supplementing their water supplies. Locally in San Diego County, the San Diego County Water Authority is continuing to investigate the possibility of building a 50 MGD or larger seawater desalination facility at the Cabrillo power plant in Carlsbad. This proposed facility can be used as a basis for estimating the unit costs of desalination.

The Carlsbad project, as currently proposed, would involve the construction and operation of a desalination plant by a private developer. In 2003, the developer offered to sell water from the proposed plant to the San Diego County Water Authority for a set price of slightly less than $800/AF, exclusive of conveyance, and with the price indexed to several factors, (including power costs) to provide mechanisms for escalation. Since that time, the San Diego County Water Authority and the plant developer have had difficulty agreeing on the actual terms of the agreement, and the project remains in the negotiating stage. Accounting for construction price inflation over the past two years, and accounting for the negotiating difficulties encountered to date, it is reasonable to assume that the 2005 price for a project agreement acceptable to both the developer and the San Diego County Water Authority will be approximately $1,000 to $1,100/AF, exclusive of conveyance. Based on capital and operating cost numbers reported by the San Diego County Water Authority in their preliminary analysis of project conveyance facilities, the unit cost of conveying this water back to the San Diego County Water Authority aqueduct system would be approximately $300 to $400/AF. Using the average estimates for both treatment and conveyance, a reasonable comparative cost for seawater desalination in San Diego County is approximately **$1,400/AF**.

A reasonable comparative cost for seawater desalination in San Diego County is approximately $1,400/AF.

Water Transfers: In 2003, the San Diego County Water Authority completed its efforts to secure a long-term water transfer agreement with the Imperial Irrigation District (IID). The agreement provides for IID to transfer 200,000 AFY of water to the San Diego County Water Authority, starting with 20,000 AF in 2004 and ramping up to the full 200,000 AF over the course of approximately ten years. As part of the overall package of implementing agreements, the San Diego County Water Authority also obtained rights to approximately 77,000 AFY of water that will be conserved by the lining of the All American and Coachella Canals. The San Diego County Water Authority estimates that its current cost of transferred water, before treatment, is $534/AF. The Water Authority is also incurring related project costs for mitigation of project environmental effects and for of socioeconomic effects in the Imperial Valley. In addition, over the long-term the Water Authority will incur additional costs to provide the transmission capacity to deliver this water to San Diego County. Finally, the City will incur additional costs to treat this water at one of the City's water treatment plants Accounting for these additional project costs, the Reuse Study suggests that a reasonable comparative cost for water transfers in San Diego County is approximately **$800/AF**.

A reasonable comparative cost for water transfer costs is approximately $800/AF.

7.6 Evaluation Summary

The principal findings from the preceding evaluations of the three North City and three South Bay strategy alternatives are as follows:

1. **All of the presented alternatives are feasible.** For both the North City and South Bay systems, there is a range of reuse strategies that are feasible from an engineering, scientific, and regulatory perspective. For the indirect potable reuse strategies, public acceptance will depend on the City's commitment and ability to garner public support through an extensive public involvement program.

2. **The City faces choices between non-potable and indirect-potable uses.** The strategies differ in their type of reuse, specifically, between those that exclusively pursue non-potable uses and those that include indirect potable reuse. In deciding which strategies to pursue, the City will need to weigh the merits of each type of use.

3. **The City faces choices in deciding how far to pursue a selected strategy.** Within each strategy, there are implementation phases that add new units of reuse, usually at progressively higher and higher incremental costs. In deciding how far along each strategy to advance, the City will need to weigh these costs with the water supply reliability, sustainability, and other values suggested in the preface of this report.

4. **Specific North City strategy findings include:**

    - **NC-1** has the lowest initial capital cost and lowest unit cost of all North City Strategies through the second phase of the Strategy. However, if the desire is to fully maximize reuse of the available recycled water supply, subsequent phases have higher unit costs and make this alternative comparatively more expensive. This strategy appears to be the appropriate choice if the driving decision factor is to minimize initial capital outlays and to commit to a non-potable reuse approach.

    - **NC-2** includes the opportunity to switch from non-potable to indirect potable reuse. This strategy appears to be the appropriate choice if the driving decision factor is to minimize initial expenditures while still having the ability to accomplish an indirect potable reuse project.

    - **NC-3** maximizes the available North City water supply in one step through indirect potable reuse. For a strategy that fully maximizes reuse of the available recycled water supply, it provides the lowest overall unit cost. To achieve this though, this strategy has the highest initial capital costs. This strategy appears to be the appropriate choice if the driving decision factor is to maximize recycled water use and have the lowest ultimate unit cost.

5. **Specific South Bay strategy findings include:**

- **SB-1** has the lowest initial capital cost and lowest unit cost of all South Bay strategies. This strategy appears to be the appropriate choice if the driving decision factor is to minimize expenditures, even if the reuse occurs outside City service areas.
- **SB-2** includes a mix of non-potable uses and a small-scale indirect potable reuse project. This strategy appears to be an appropriate choice if the driving decision factor is to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.
- **SB-3** includes a mix of non-potable uses and a larger-scale indirect-potable reuse project. This strategy appears to be an appropriate choice if the driving decision factor is to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.

7.7 Next Steps

This Water Reuse Study report assesses the advantages, constraints, and values of the different water reuse opportunities available to the City of San Diego. Per direction from the City Council, the study does not provide a specific recommended project.

This report will be reviewed by the Study's Independent Advisory Panel (IAP), and by the American Assembly group of project stakeholders. Both of these groups will issue written statements commenting on the Reuse Study's analysis and findings, and perhaps making recommendations of their own.

Subsequent to review of this report by the IAP and the American Assembly, the report will be finalized by the Study team. The report, along with the written statements of the IAP and the American Assembly, will then be presented to the City's Natural Resources Committee and subsequently to City Council for their consideration and direction as to the City's future course of water reuse development.