Member Agency Managers Group

Report of the MAM Independent Consultant:

SDCWA Regional Conveyance System Feasibility Review

July 2020

Prepared by:

DLM ENGINEERING, INC

In association with:

GILLINGHAM WATER
Gillingham Water Planning and Engineering, Inc.

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The contents of this report represent the analysis and professional judgement of the above authors.

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Thank you also to the San Diego County Water Authority for providing draft reports and the draft economic model, and access to staff for coordination review and comments during the development of our work.

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Executive Summary

Our review of the Water Authority's Regional Conveyance System (RCS) June 2020 project reports leads us to the following summary observations:

1) The Draft Study's finding of RCS technically feasibility appears reasonable, as does its estimate of project costs.

The engineering components of the Draft Study are sound and demonstrate the technical feasibility of an RCS project. Also, the estimates of the project's capital and annual costs appear to us generally reasonable, with only modest exceptions as noted in our report.

2) The Draft Study's finding that the project is economically competitive with other supply and transportation options is not reasonable. We find the project to be substantially more costly than other options.

The Draft Study's economic analysis states the RCS project is "cost-competitive with" and "provides significant savings" in comparison to MWD Reliance (Exchange) and other supply and transportation scenario options. Our review finds otherwise for the following reasons:

- **The project is not cost-effective when evaluated using reasonable assumptions of MWD price escalation.** The Draft Study's economic findings are predicated on the assumption that MWD rates will escalate at levels substantially higher than all other water supply costs throughout an extended 92-year period of analysis. Our review demonstrates the assumed escalation is not economically sustainable, and its occurrence therefore highly implausible. Over the long-term, MWD will either have to reduce the costs that drive the rate escalation, shift costs away from volumetric-based charges to firm unavoidable fixed charges, or a combination of the two. When the economic model inputs for MWD price escalation are modified accordingly, the project loses any cost advantage and becomes significantly more costly than the other options.
- **There is significant risk of long-term Water Authority sales being insufficient to utilize the project's planned capacity.** The Draft Study's assessment of project economic risks omits the possibility, or probability, that long-term Water Authority sales will decline to levels below its 330,000 AF/yr of core supplies, putting at risk the ability to utilize a RCS facility at full capacity and thereby further diminishing the project's cost-feasibility. Until such time as a new Water Authority demand forecast provides sound evidence to the contrary, we recommend project planning recognize the likelihood of long-term declines in Water Authority sales.

3) A Negotiated Exchange option appears to offer economic advantage.

The option of a negotiated exchange rate with MWD, with price escalation set at the industry-standard construction cost index, may offer significant cost advantage in comparison to the other supply and transportation options, and may warrant further consideration.

4) Recommendation: Refocus long-term QSA supply planning.

The technical and economic feasibility of the RCS have now been advanced to reasonable levels of planning certainty. Rather than investing further in the evaluation of an RCS project, it appears the larger QSA planning uncertainties facing the Water Authority now revolve around the extension of the IID Supply and MWD Exchange agreements, the opportunity for a Negotiated Exchange agreement, and the consequences of long-term Water Authority sales declines. Accordingly, it appears budgets and staffing schedules set aside for RCS investigations could be applied more productively to refining those more consequential planning uncertainties.

1. Introduction

1.1. Purpose

This report presents our review of a draft study by the San Diego County Water Authority (Water Authority, or SDCWA) to evaluate the technical and economic feasibility of a Regional Conveyance System (RCS) project. Our report was commissioned by 18 of the Water Authority Member Agency Managers (MAM) to provide independent engineering and economic analysis, and to help inform the decision on whether the Water Authority should continue, pause, or table further efforts to evaluate and advance the project.

1.2. Background

Water Authority Reports and Presentations and Files Reviewed

The Water Authority has studied variations of a RCS project many times since its formation in 1947, but past iterations have not advanced beyond the planning review phase. For its current round of evaluation, the Water Authority has produced or commissioned the following reports and presentations, and these are the documents we have reviewed to conduct our work.

Document / File	Author / Date	Abbreviation used in this report
1. Draft Regional Conveyance System Study Phase A	Black & Veatch (B&V) / June 2020	Draft Study
2. Independent 3rd Party Review of Financial Analysis for the Regional Conveyance System	Hunter Pacific Group (HPG) / May 2020	Independent Cost Review
3. Water Authority Transmittal Letter of June 12, 2020	SDCWA / June 2020	Draft Study Transmittal Letter
4. Water Authority RCS board presentation to March 12 special board meeting	SDCWA / March 2020	March Board Presentation Materials
5. SDCWA letter to member agencies of April 27	SDCWA / April 2020	SDCWA Letter of April 27
6. Economic Model	SDCWA / June 2020 Revised by IC / July 2020	Economic Model

Water Authority Phase B Go/No Go decision

The Water Authority has recently completed a round of engineering analysis and limited economic analysis, work it refers to as Phase A. The Water Authority is now considering whether to proceed with additional investigations it refers to as Phase B. These additional investigations would include:

- Multi-use, partnerships & funding
- Conveyance alignment & tunneling site layouts
- Geotechnical desktop study
- Additional risk analysis
- Additional economic analysis (if needed to supplement the work contained in this report)

The Water Authority's QSA Supplies and MWD Exchange Agreement

Through the Quantification Settlement Agreement (QSA) the Water Authority has acquired a 200,000 acre-foot per year (AF/yr) supply of conserved water from the Imperial Irrigation District (IID) and also a 77,700 AF/yr supply from funding the lining of the All American and Coachella Canals. These supplies, known collectively as the "QSA supplies", make up the majority of the Water Authority's long-term supply portfolio. The agreement with IID expires in 2047, but has an option to renew for 30 years to 2077 by mutual agreement. Beginning in 2035, the current pricing terms of the agreement shift from a Federal inflation index (Gross Domestic Product Implicit Price Deflator) to either a market-based formula or to the Base Contract Price terms, which are based on MWD rates and other factors. The canal lining supply expires in 2112.

Currently, both the IID and Canal Lining supplies are conveyed to the Water Authority via the Colorado River Aqueduct (CRA) owned and operated by the Metropolitan Water District of Southern California (Metropolitan, or MWD), through an Exchange Agreement that expires in 2047. The 2020 exchange rate is $482 per acre-foot (AF).

The Regional Conveyance System Concept

The RCS would be an 85 to 132-mile long conveyance system, depending on the alignment, to convey the IID and Canal Lining supplies directly to San Diego County as shown in **Figure 1-1**. The facility would provide an alternative and redundant conveyance capability for the San Diego region and could be funded, built, owned, and operated by the Water Authority. The supplies would originate at the western end of the All American Canal (AAC), at its connection to the Westside Main Canal. For the Northern Alignment (3A), , water from the AAC would be conveyed through approximately 47 miles of canal, 39 miles of pipeline, and 47 miles of tunnel. The total pump lift is approximately 2,000 feet.

The Water Authority has stated they would not proceed with the RCS unless the IID supply can be secured through 2112.

FIGURE 1-1: RCS Study Area and Alignments

Source: SDCWA

One major difference between the CRA and the RCS is the need to desalinate the supply. The CRA takes its supply from Lake Havasu where generally the level of total dissolved solids (TDS) is acceptable for delivery to Metropolitan's member agencies directly or through blending with State Water Project supplies. At the RCS All American Canal diversion point, the TDS has increased to the point where desalination is required for use in the Water Authority service area. The RCS includes a 154 million gallon per day (mgd) reverse osmosis (RO) membrane desalination treatment plant located in the Imperial Valley, with the stated goal of delivering water with a TDS concentration of no more than 500 milligrams per liter (mg/l). For comparison, existing supplies delivered by Metropolitan are typically in that same range, but may at times trend up to approximately 600 mg/l during periods when the Skinner service area (inclusive of SDCWA) is being supplied predominantly from Metropolitan's Colorado River supplies and less so from the State Water Project (SWP).

The RCS would provide conveyance independence from Metropolitan, and the Draft Study finds the project is cost competitive with other alternatives including continuing conveyance through Metropolitan and the development of local San Diego County supplies.

1.3. Scope of Services

In general, the Independent Consultant (IC) scope of services includes:

1. Review of the Draft Study, Independent Cost Review, and Water Authority presentations and correspondence. Provide comments on the engineering and economic aspects of the work.
2. Review of the Water Authority's Economic Model. Provide comments on the Water Authority's analysis. Prepare sensitivity analysis of assumptions and develop and evaluate additional alternatives.
3. Coordinate with the Member Agency Managers and the Water Authority staff.
4. Prepare a summary report of findings (this report).

1.4. Review Process

The participating Member Agency Managers specified that this would be a transparent process and that interim results would be provided to the Water Authority staff as soon as they had been reviewed by the MAM. This process was implemented to avoid surprises when the Water Authority received this report.

The Water Authority hosted an initial RCS briefing for the IC on June 19 focused on presentation of the Economic Model. For the following three weeks, the IC and Water Authority staff met to review approaches, answer questions, provide comments and present results. For two of the three follow-up meetings, the IC briefed the MAM in the morning and then presented the same presentation to Water Authority staff that afternoon.

The MAM and IC appreciate the Water Authority's cooperation and support of the project review and transparent process.

1.5. The Economic Model

Soon after the Water Authority distributed the Draft Study on June 12, the IC through the MAM requested the Water Authority make available the Economic Model referenced by the Draft Study for review. The Water Authority agreed to this request and provided the model to the IC on June 19. The Water Authority noted the model was in draft form, and the IC acknowledged this limitation.

The Economic Model has proven extremely useful to our review, and we are thankful to the Water Authority for making it available to us. The main value of the Economic Model lies in its easy ability to test the sensitivity of findings about the economic merits of the RCS to changes in economic and financial inputs, for factors such as the period of analysis, interest and discount rates, MWD price escalation rates, and more.

The model contains highly granular data on more than 100 line items of capital and annual cost estimates developed by the Draft Study, and allocates these over time, including accounting for multiple tranches of bond financing.

Economic Model Comprehensive Cost Accounting

We have been asked about the comprehensiveness of the model's cost accounting, in particular about the following two items, which we address here:

- **Inclusion of IID AAC Wheeling Costs:** The model accounts for the cost to compensate IID for use of their capacity in the AAC. This is a relatively modest cost (2020 cost is $17/AF, escalating at 2.5 percent per year per the Economic Model's default settings), and is in addition to approximately $140 million in annual costs reported by the Draft Study for alignment alternative 3A.
- **Inclusion of RO Concentrate Losses:** As described above, the Draft Study's design concept includes a desalting plant located in the Imperial Valley to reduce the water's dissolved mineral content prior to the first RCS pump lift. This treatment process would generate a waste stream of RO concentrate totaling approximately 20,000 AF/yr, reducing the Water Authority's available QSA supplies by a like amount, from 277,700 AF/yr to 257,000 AF/yr. Although this quantity of water is lost to the Water Authority and will not be conveyed through the RCS system under the terms of the Transfer Agreement the Water Authority must still pay the supply price to IID.

  Rather than using this reduced volume as the denominator for unit cost calculations, the Economic Model instead accounts for the cost of an equivalent volume of MWD Tier 1 purchases as an additional annual cost of the project. This cost is in addition to the approximately $140 million in annual costs reported by the Draft Study for alignment alternative 3A. In this way the model presents costs for a supply to San Diego of 277,700 AF/yr, equal to the full amount of QSA supply before losses to desalting.

IC Modifications to Economic Model

In the course of our work, we have modified the original draft model provided by the Water Authority to include an expanded Dashboard, with expanded functionality for sensitivity testing and with additional graphical reporting of how project costs and benefits are distributed over time. The Economic Model is referenced frequently in our report, in particular in Section 2 on Economic Analysis. Most of the figures and dollar amounts reported in Section 2 are from the

model. The latest version of the model, **Version 1.1 dated 07/20/20**, accompanies and is an integral part of this report. Additional information on the Economic Model, including a complete list of the model's input variables and default settings, is included in **Appendix B** of our report.

1.6. Supply and Transportation Scenario Alternatives

The Draft Study presents the net present value costs of the RCS in comparison to MWD Reliance and Local Supply Development alternatives. The Economic Model supplements these by parsing the MWD Reliance option into three different options, resulting in five options total inclusive of the RCS option. The RCS option also has its own alignment alternatives, of which alternative 3A, the Northern Alignment, is the least costly. We have elected to present results and comparisons for that alignment only, to the exclusion of the more costly 5A and 5C described in the Draft Study, and the revised model dashboard includes only the 3A alignment option of the RCS.

The five supply options are defined below:

- **RCS 3A:** RCS alignment alternative 3A (Northern Alignment) is the least costly and is used here for comparison. RCS becomes operational in 2045.
- **MWD Exchange Ends 2047:** This option assumes the MWD Exchange Agreement expires without renewal at the end of 2047, along with the IID agreement. SDCWA then transitions to buying 200,000 AF/yr of MWD Tier 1 supply. Canal lining water continues at the MWD Exchange Rate. (This option is titled "MWD Reliance" in the Draft Study.)
- **MWD Exchange Ends 2077:** Similar to above, but the IID and MWD Exchange agreements are extended through 2077.
- **MWD Exchange Ends 2112:** IID and MWD Exchange agreements are both extended to 2112, in alignment with the end date for Canal water.
- **2048 Local Supply:** The IID agreement expires at the end of 2047, after which SDCWA transitions to 200,000 AF/yr of new local supply development projects.

To this list the IC has added a sixth option:

- **MWD Negotiated Exchange:** This option replaces the current exchange agreement with new terms through 2112, with price escalation tied to the Engineering News Record 20-Cities Construction Cost Index (ENR_CCI).

All six options are included in the Economic Model accompanying this report.

1.7. What Next? Member Agency Manager Use of This Report

We recommend the Member Agency Managers provide the information in this report to their SDCWA board representatives, and that collectively they work with the Water Authority to apply whatever is useful in our review to the budgeting and supply planning questions concerned.

The Water Authority has described its evaluation of RCS feasibility as part of a triad of long-term supply and transportation planning issues that also includes the potential for extension of the IID supply agreement and the extension of the MWD Exchange agreement. The technical and economic feasibility of the RCS have now been advanced to reasonable levels of planning certainty, and are no longer the weak leg of the planning triad. Further investigation of the RCS

therefore appears unwarranted at this time. Likewise, additional refinement of the project's engineering design is unlikely to alter the key findings already available. Rather than investing further in the evaluation of an RCS project, it appears the larger planning uncertainties facing the Water Authority now revolve around the extension of the IID Supply and MWD Exchange agreements, and long-term demand and water sales projections, and that budgets and staffing schedules set aside for RCS investigations could be applied more productively to refining those opportunities.

1.8. Report Organization

The remainder of the briefing document is organized into sections as follows. The report also includes appendices as listed in the Table of Contents.

2. Economic Analysis

2.1. The Draft Study's economic analysis is insufficient to support informed decision-making. We have endeavored to provide the additional information needed.

The Draft Study states the RCS project is "cost-competitive with" and "provides significant savings" in comparison to MWD Reliance (Exchange) and other supply and transportation scenario options. In reaching these findings, the Draft Study's economic analysis has utilized unusually long evaluation timeframes, and has relied on certain price escalation assumptions that are highly implausible. The brevity of the Draft Study's economic review, amounting to two pages out of a more than 500 page report, is insufficient to support informed decision-making, and insufficient to provide transparent and objective rationale to the public and ratepayers at large. Our review in this section addresses these issues, and seeks to provide key parts of the supplemental information needed.

2.2. The RCS is not cost-effective under standard measures of economic efficiency.

The Water Authority's draft economic analysis has overlooked conventional public works and utility economic feasibility reporting methods in favor of a non-standard approach.. Before addressing the Water Authority's approach and why we find it insufficient to support informed decision-making, it is important first to understand the typical public works economic review methods that have been overlooked.

Standard First-Year Unit Cost Analysis

Most economic assessments of public agency water supply projects begin with a basic comparative measure of first-year unit costs in dollars per acre-foot. The first step of this process is to gauge the capital costs of the project, as well as the ongoing annual costs of operations, maintenance, repair, and replacement (OMRR) necessary to sustain the project over its economic lifetime. For the RCS project, the Draft Study and the Independent Cost Review have combined to develop capital and OMRR costs to a level of detail sufficient to support planning decisions. These costs are summarized in **Table 2-1.**

TABLE 2-1: RCS Cost Estimates

RCS 3A	March Board	Independent Cost Review	Draft Study
Capital	$4.2 B	$5.3 B	**$5.0 B**
Annual (OMRR)	$130 M	$130 M	**$143 M**

Using the June final draft cost numbers, the calculation of first-year unit costs then proceeds as follows:

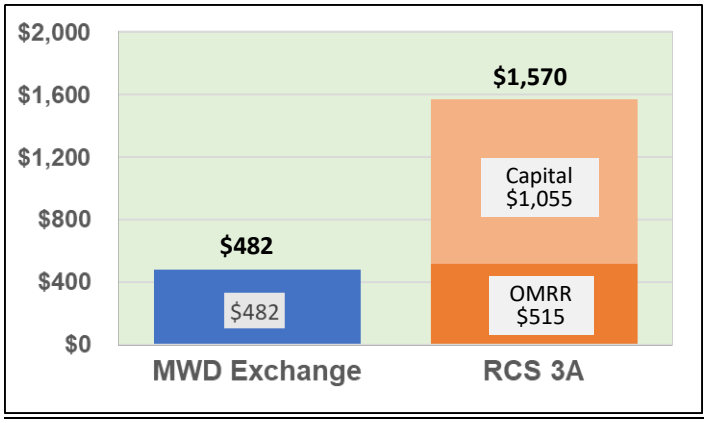
RCS First-Year Typical Analysis (in 2020 Dollars, exclusive of supply):

1) Escalate five years to Mid-Point of Construction: $5.0B ➔ **$5.8B**
2) Amortize (40 yrs., 4%): ➔ **$293M/yr**
3) Calculate Total Equivalent Annual Costs: + $143M/yr = **$436M/yr**
4) Divide by Yield for Unit Cost: ÷ 277,700 AF/yr = **$1,570/AF**

Note: A previous version of this calculation presented in draft form amortized the project capital at an interest rate of 3 percent per year. We have increased the rate used here to 4 percent per year to be closer to the Draft Study's default rate of 5 percent per year, recognizing current market conditions are lower. MAM financial officers have advised the actual rate could be driven upwards by the magnitude of the debt undertaking.

Finally, first-year unit cost of the project is compared to its most relevant alternative, in this case the conveyance of the Water Authority's QSA supplies via the terms of the existing MWD Exchange Agreement. For calendar year 2020, the MWD exchange price is $482/AF. The comparison is illustrated in **Figure 2-1.**

FIGURE 2-1: First-Year Unit Cost Comparison in Dollars per Acre-Foot
(RCS 3A vs. MWD Exchange; transportation only, exclusive of supply costs; in 2020 dollars)



On a standard first-year unit cost basis, the RCS project fairs poorly in comparison to the current MWD exchange rate. However, the first-year unit cost analysis is only a snapshot, and does not account for the potential for some costs to escalate at different rates over time.

Standard 30 or 40 Year Cost Analysis

To address the limitations of a first-year unit cost analysis, a conventional economic review would supplement that snapshot with an assessment of project costs over a period of time. The time period is commonly set at 30 or 40 years, corresponding to capital finance borrowing terms. The alignment of the time period of economic analysis with the term of the financing reflects two common principles, neither of which are written in stone but nevertheless reflect common practices and thinking for analyzing these types of projects . These are:

1) Benefit-Cost Nexus: Project costs should be paid by project beneficiaries. This same general point is contained in the Water Authority's 2015 Long Range Financing Plan, which cites as Guiding Principles (Section 2.1.3):

   a. Ensure all beneficiaries of services pay a fair share of costs; and

   b. Support intergenerational equity

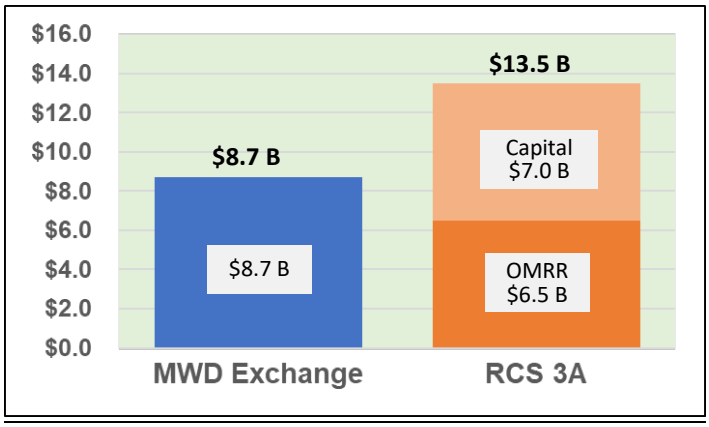
2) Future Uncertainty: Predictions about the future are uncertain and become more so with longer periods of forecast. Economic analysis typically discounts future costs and benefits in part to account for this uncertainty.

Because the Water Authority has the capability of bonding with 40 year terms, we will use that period for analysis. A standard 40-year net present value (NPV) analysis would proceed with the following calculations:

- RCS Capital Costs: The $5.8 billion RCS capital cost (escalated to mid-point of construction) is amortized over 40 years at an interest rate of 4 percent per year (same interest rate as for First Year unit cost analysis), and brought back to present worth at the Draft Study's default discount rate of 3 percent. NPV = $6.5 billion.
- RCS Annual Costs: The $143 million of RCS annual costs are escalated for 40 years at the Draft Study's default OMRR rate of 3.7 percent, and then brought back to present worth at the Draft Study's default discount rate of 3 percent. NPV = $7.0 billion.
- MWD Exchange Costs: MWD Exchange costs, calculated as $482/AF times 277,700 AF/yr, are escalated for 40 years at the Draft Study's default rate of 5.1 percent, and then brought back to present worth at the Draft Study's default discount rate of 3 percent. NPV = $8.7 billion.

The resulting cost comparison is depicted in **Figure 2-2.** In comparison to the comparison presented in Figure 2-1, the data of Figure 2-2 indicate the RCS is still more expensive than the MWD Exchange alternative, but a lesser ratio. This demonstrates the effect of the differential escalation rates compounding over forty years.

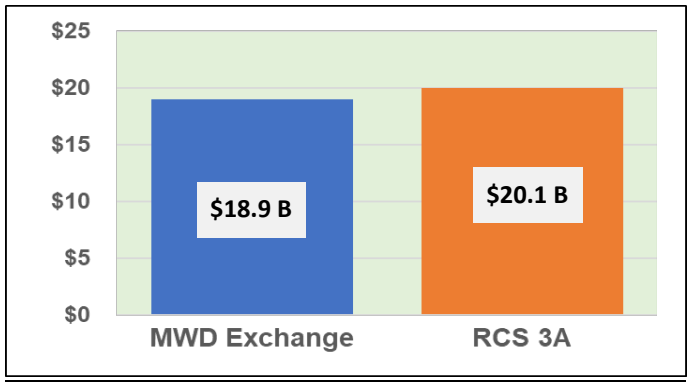
FIGURE 2-2: Forty-Year Cost Comparison
(RCS 3A vs. MWD Exchange 2047; transportation only, exclusive of supply costs)
(in billions of 2020 dollars)



Modified 40-Year / 60-Year Cost Analysis

The period of analysis question for the RCS is complicated by the 25-year schedule identified in the Draft Study for project planning, permitting, design, and construction. A more detailed analysis is available using the Economic Model. Applying the model to this situation, we can set the period of analysis to 40 years from the dollar-weighted midpoint of project financing in 2040. This extends the period of analysis to 2080, 60 years from now. Setting the period of review in this manner and holding all other input variables (interest and discount rates, capital and OMRR escalation rates, MWD price escalation rates, etc.) constant at the Economic Model's default assumption values, results in the cost comparison presented in **Figure 2-3**.

FIGURE 2-3: Sixty-Year Cost Comparison
(RCS 3A vs. MWD Exchange 2047; transportation only, exclusive of supply costs)
(in billions of 2020 dollars)



The analysis of the RCS project over a 60-year escalation period presents much more positive results than those of the first-year unit cost approach depicted in Figure 2-1 and the 40-year analysis presented in Figure 2-2. The project is still more costly than its default alternative (we will define this and the other alternatives later in this section), and while still not cost-advantaged, is close enough to be considered cost-competitive.

As we will describe later, we find certain of the assumptions used to generate this cost-competitive outcome to be highly implausible, but the comparison of Figure 2-3 nevertheless serves to demonstrate the potential for Period of Analysis to exert strong influence on economic outcomes. This then raises the question of what would happen to the project economic analysis if we evaluated the project over even longer periods.

2.3. The RCS project is non-standard, and may warrant non-standard economic evaluation. Extended period analysis deserves consideration, but needs transparent review.

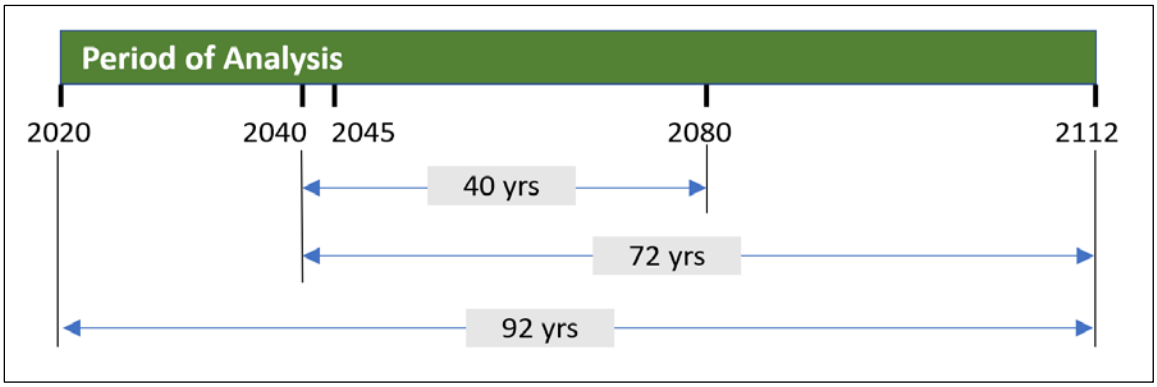
The RCS is a non-standard project not just in the magnitude of its cost, but also in the extent of the 25-year schedule identified in the Draft Study for project planning, permitting, design, and construction. The project would also be built to have a design life well in excess of standard periods of economic analysis. This of itself is not unusual – many water facility capital investments have long design lifetimes – but lends support to the possibility of evaluating the economic merits of the project over longer than standard time periods.

Extended Period Analysis

This is the approach utilized in the Draft Study. The Draft Study presents an economic analysis of the project conducted using a period of analysis extending to the year 2112. The selected date aligns with the end-date of the Water Authority's Canal Lining supply agreements, but otherwise has no significance to economic theory or analysis.

This timescale is illustrated in **Figure 2-4**, where 2040 is the approximate midpoint of project financing, 2045 is the project on-line date, 2080 is the end-date of a 40-year analysis period subsequent to the midpoint of project financing, and 2112 is the selected end date of the Draft Study's period of analysis.

FIGURE 2-4: Period of Analysis Timeline



Transparency Required

An extension of the period of analysis to 92 years from now, or to 72 years past the projected midpoint of project financing, is neither right nor wrong, but is unusual and requires an explanation of: 1) the rationale for why such an extended period may be appropriate, and 2) the distribution of costs and benefits over time.

Both explanations are absent in the Draft Study and in presentations made to date to the Water Authority board, and both are necessary to provide transparency and completeness of review essential to informed decision-making. The first is easily remedied by stating the case for why the RCS project deserves extended period consideration, even though it fares poorly when evaluated over conventional terms. The second is remedied by applying the Economic Model to the analysis of costs and benefits over time, as presented in the next section. With this information available to a decision-making body, the decision becomes a matter of policy for their consideration.

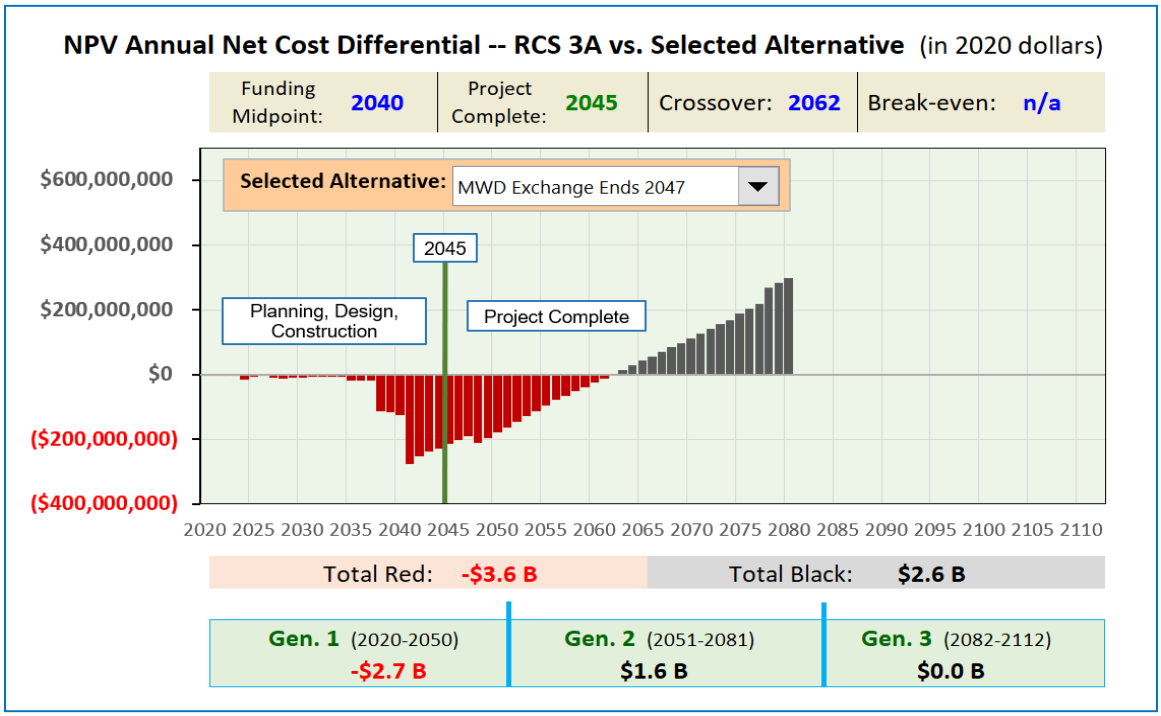
2.4. An extended period of analysis entails generational transfers of costs and benefits.

If an extended period of analysis is warranted given the unusual timescale of the RCS, then the economic evaluation should identify the distribution of costs and benefits over time. Put another way, if the RCS is a generational project, then the economic analysis should examine the generational transfers of costs and benefits. We have adapted the Economic Model to provide this generational analysis.

Case 1: Period of Analysis Ending 2080

We begin with the same comparison of alternatives illustrated in Figure 2-3 for the period of analysis extending to 2080, 60 years from now and 40 years past the midpoint of project financing, and with all input variables (interest and discount rates, capital and OMRR escalation rates, MWD price escalation rates, etc.) set at the Economic Model's default assumption values. (A complete list of model default inputs is included in **Appendix B**.) This results in the time period distribution of net costs and benefits presented in **Figure 2-5** and further described below.

FIGURE 2-5: Cost and Benefit Distribution for Period Ending 2080
(RCS 3A vs. MWD Exchange 2047)



The data in Figure 2-5 provides a much broader understanding of the economic comparison than the simple total NPV comparison of Figure 2-3. The red/black bar chart illustrates how the project at first incurs additional net losses in comparison to its alternative, and then transitions to providing net benefits. The data boxes above the chart note key dates, including the Crossover year when net losses transition to net benefits, and the year of break-even, when cumulative benefits begin to exceed net losses. Data boxes at the bottom summarize the cumulative totals of net losses and net gains, and the net loss or gain to each of three generations spanning the 92-year period of analysis. For this example, losses outweigh benefits, and the project does not achieve a break-even date.

Case 2: Period of Analysis Ending 2112

The next step is to extend the period of analysis to 2112, the sole period examined in the Draft Study. This extends the economic analysis to 92 years from now and 72 years past the midpoint of project financing. Applying the economic model with this extended period, while keeping all other inputs at the levels, results in the time period distribution of net costs and benefits presented in **Figure 2-6**.

FIGURE 2-6: Cost and Benefit Distribution for Period Ending 2112
(RCS 3A vs. MWD Exchange 2047)

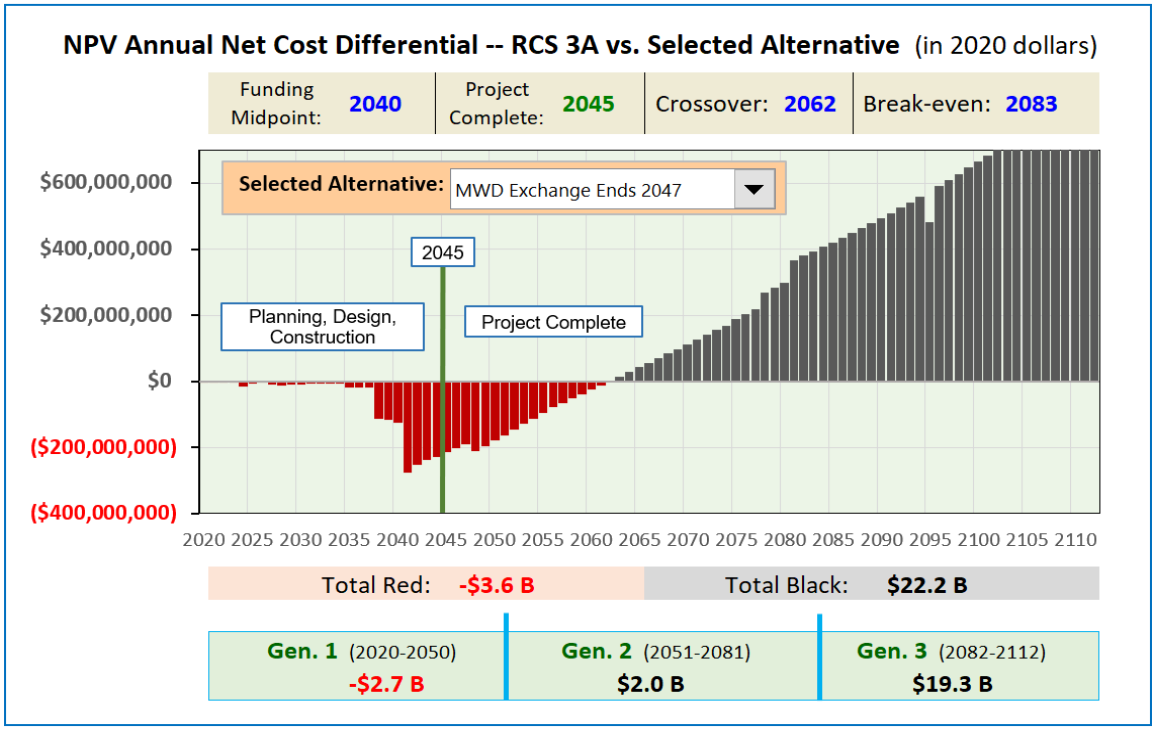


Figure 2-6 illustrates that for every year the period of analysis is extended beyond standard terms, the RCS gains additional advantage as black bars are added with ever-increasing net benefits. Although the chart ends at 2112, the analysis could be extended further, and this would result in still further advantage for the RCS, but conditioned on the validity or accuracy of the model input assumptions. With reference to our previous observation about forecast uncertainty increasing the further out in time the forecast, there are different levels of certainty associated with the red bars and the black bars. The occurrence and magnitude of the red bars has a high degree of certainty, as these are costs that arise from the financing of almost $6 billion in capital. In contrast, the black bars have a high degree of uncertainty, as they arise from a mix of assumptions about of MWD price escalation rates and other factors whose future is unknown.

The merits of generation transfers are a policy matter.

The contrast of Figure 2-6 with Figure 2-5 is dramatic. The addition of 32 years to the period of analysis adds 32 progressively higher black bars to the right of the chart, resulting in a cumulative advantage for the RCS over its alternative of approximately $19 billion (sum of Total Red and Total Black). The project does not achieve Break-even until 2083, 43 years after the mid-point of project financing, but after that the gains continue to accrue. We see that Generation 1 incurs a net loss of almost $3 billion, but the amount seems modest in comparison to the gains accruing to future generations and to Generation 3 in particular. While the overall Net Present Value clearly favors the RCS, the generational transfers entailed make clear that a decision to invest in the project entails policy matters broader than just the overall Net Present Value.

2.5. The Draft Study's assumptions of MWD price escalation are highly implausible.

The Draft Study over-extrapolates a 20-year historical trendline of MWD price escalation, applying the historical trend unchanged throughout the period of analysis. As we demonstrate in this subsection, this assumption is highly implausible.

Accurate forecasting of long term water rates is difficult. Many factors drive the price of water, including capital costs, increased operating cost, and changing sales volumes. A standard assumption on rate forecasting is that the further out the forecast horizon, the more inaccurate the future projection, because it is impossible to anticipate with any accuracy future conditions and their effect on rates. When forecasting future water rates, most projections will trend back to assumptions on underlying inflation or some small increment above inflation so as not to overstate the compounding effect of escalation factors. This is also reflected in the more standard approach to the length of an economic analysis so as not to skew the results based on diminishing accuracy of forecasted key variables and cost drivers.

Escalation rates have limits; systems adapt and adjust

The economic analysis presented in the Draft Study assumes MWD prices will escalate at 5.1 percent per year throughout the 92-year period of analysis. Additional data presented by Water Authority staff at its March 12, 2020 special board meeting documented that MWD Tier 1 Supply prices have a 20-year escalation average of 5.1 percent per year and that the Exchange rate components (System Access + Water Stewardship + System Power) have a collective 20-year escalation average of 4.5 percent per year. The Draft Study uses the higher 5.1 percent rate for both Tier 1 Supply and Exchange rates.

The New York Times

Lake Mead Could Be Within a Few Years of Going Dry, Study Finds

By Felicity Barringer

Feb. 13, 2008

Lake Mead, the vast reservoir for the Colorado River water that sustains the fast-growing cities of Phoenix and Las Vegas, could lose water faster than previously thought and run dry within 13 years, according to a new study by scientists at the Scripps Institution of Oceanography.

The lake, located in Nevada and Arizona, has a 50 percent chance of becoming unusable by 2021, the scientists say, if the demand for water remains unchanged and if human-induced climate change

Implausible Extrapolations. Yes, if trends had continued Lake Mead would have gone dry, but the unacceptability of that outcome led governments and institutions to change course. Systems adapt and adjust to unsustainable forecasts.

The effect of MWD rates escalating at 5.1 percent per year over 92 years is illustrated in **Table 2-2**. The table includes for reference a typical member agency local supply project, which consistent with the default assumptions of the Economic Model has initial costs inflating at 3 percent per year, but then being discounted back to present worth at the same 3 percent rate.

TABLE 2-2: MWD Price Escalation at 5.1%/yr Over 92 Years

NPV in 2020 dollars	2020	2045	2085	2112
Pure Water (example)	$2,300/AF	$2,300/AF	$2,300/AF	$2,300/AF
MWD Tier 1 Raw All-In	$840/AF	$1,400/AF	**$3,100/AF**	**$5,400/AF**

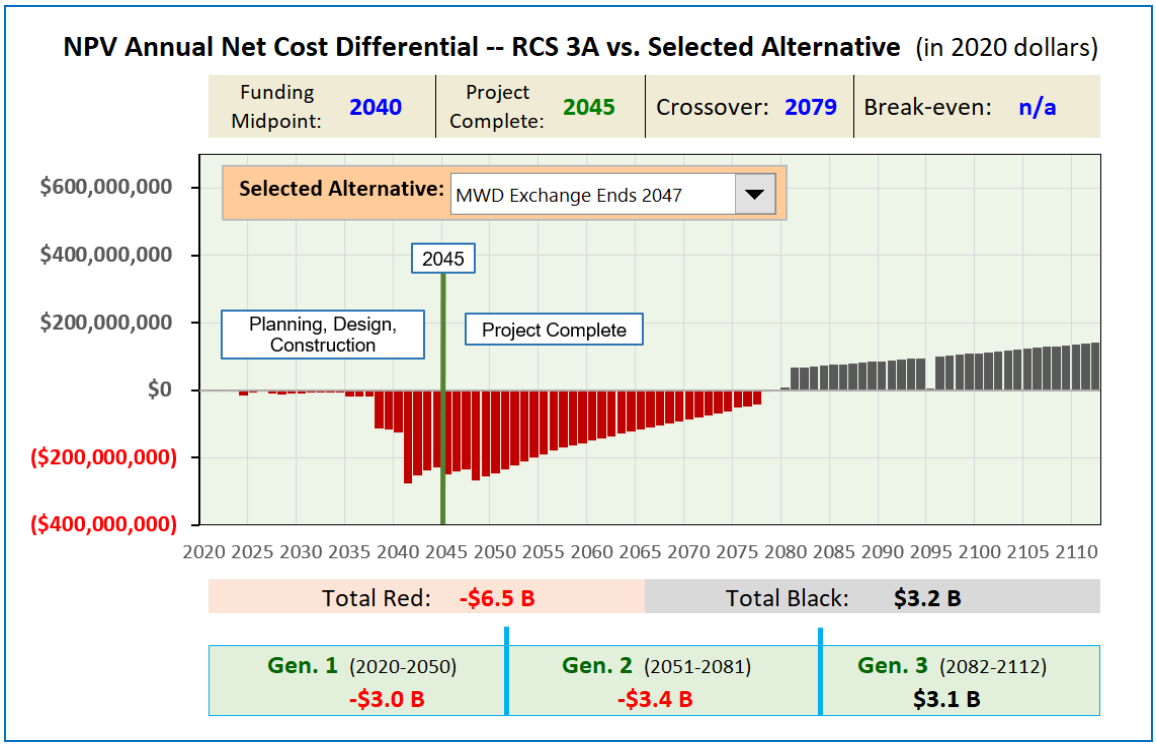
The point is that MWD price escalation at 5.1 percent over the entire 92 year period of analysis is not sustainable, and is therefore highly unlikely to occur; the system will need to adapt and adjust. Rather than basing economic analysis on such an unlikely occurrence, it seems to us prudent, and much more plausible, to assume MWD will make adaptations and adjustments to prevent rates from increasing to the point where they drive away most or all of their water sales. Whether those adjustments entail reductions in the costs driving the price increases, shifting costs to unavoidable fixed charges, or other measures is beyond the scope of our review. Nevertheless, the finding holds that rates are highly unlikely to increase at these levels relative to other supply options for the simple reason they cannot.

Lesser escalation rates quickly move the RCS from black to red

The draft economic analysis presented in the Draft Study is highly sensitive to changes in assumptions about MWD price escalation. The effect of reducing the MWD escalation rates or capping the term of the escalation, is significant, quickly reducing the future benefits illustrated previously in Figure 2-6. For comparison, **Figure 2-7** presents the same analysis with the same extended period through 2112, but with the following adjustments to MWD price escalation:

- Tier 1 Supply: Rates escalate at the default 5.1 percent per year, but only for 20 years, and thereafter, escalate at the default melded OMRR rate of 3.7 percent per year. The 3.7 percent rate is the same that applies to OMRR escalation for the RCS.
- Exchange Rate: The composite exchange rate escalates at its 20-year average of 4.5 percent per year rather than the Draft Study's default of 5.1 percent, and after 20 years, the escalation declines to the default melded OMRR rate of 3.7 percent per year.

FIGURE 2-7: Cost and Benefit Distribution with Modified MWD Price Escalation
(RCS 3A vs. MWD Exchange 2047) (Period of analysis through 2112)



The modest changes to the long term MWD price escalations eliminate the $19 billion cost advantage of the RCS reflected in Figure 2-6, and result instead in the net $3 billion disadvantage reflected in Figure 2-7. The actual future of MWD price escalation is uncertain, but we are confident the escalation rates underlying the data in Figure 2-7 represent a much more plausible scenario than those for Figure 2-6. On this basis we conclude the project is not cost-effective.

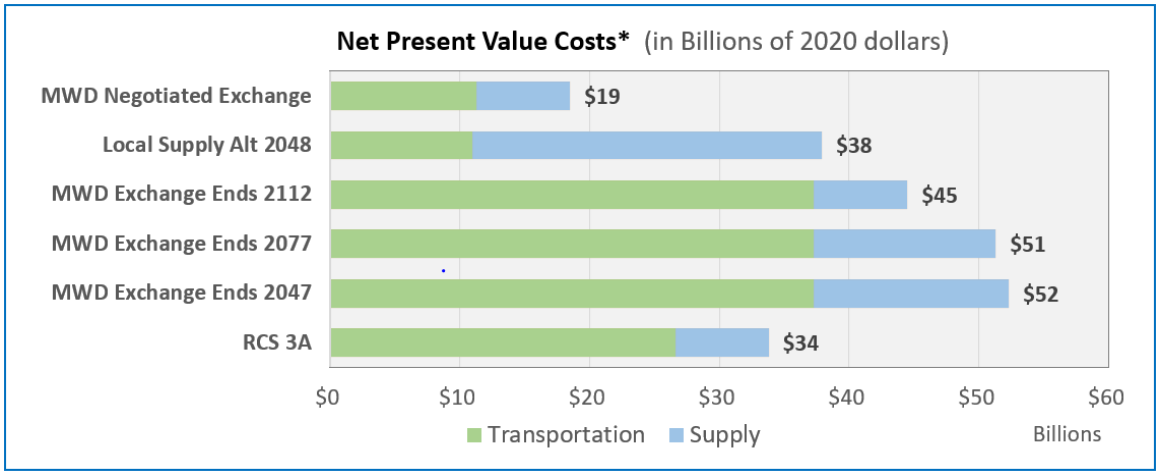
2.6. A Negotiated Exchange option appears economically advantageous.

As requested by the Member Agency Managers, we modified the Economic Model to include an additional option we have labeled Negotiated Exchange. This option would replace the current Exchange Agreement with new terms through 2112, with price escalation tied to the Engineering News Record 20-Cities Construction Cost Index (ENR_CCI). These financial terms were contained in MWD's December 2019 Settlement Offer to the Water Authority, and in the Water Authority's subsequent counter-offer to MWD. The MWD offer allowed for an additional increase beyond the ENR escalator for transportation-allocated costs of the Delta Conveyance project, and the Water Authority's counter-offer did not. We have included functionality in the model to examine the scenario with or without the Delta Conveyance included.

Our analysis of this option is limited to the economic aspects derived from the settlement offers, and does not extend in any way to the legal aspects of the offers, which are beyond our scope of work.

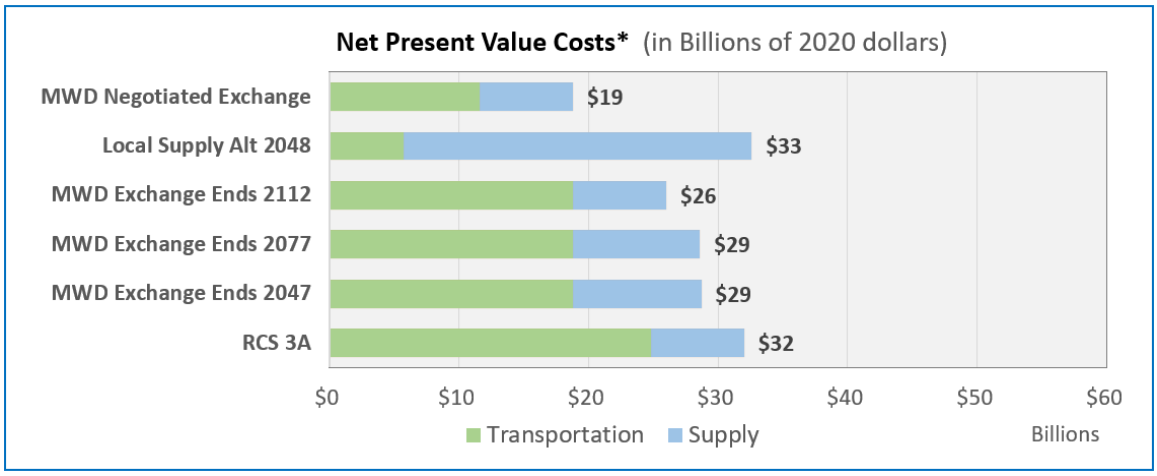
Beginning with all of the Draft Study's default financial and economic assumptions, and maintaining the period of analysis at 92 years, the Negotiated Exchange option provides a Net Present Value advantage as illustrated in **Figure 2-8.** The alternative provides an advantage of approximately $15 billion in comparison to the RCS alternative, and $26 billion in comparison to the least costly MWD Exchange alternative. This is with the Delta Conveyance included; with the Delta Conveyance excluded the advantage would increase by an additional two to three billion dollars depending on assumptions.

FIGURE 2-8: Net Present Value Comparison with SDCWA Default Inputs
(Period of analysis through 2112)



Because the data in Figure 2-8 assumes MWD rates are escalating at unsustainable levels, the results overstate the benefit of the Negotiated Exchange option relative to the other options, and relative to the other MWD Exchange options in particular. Adjusting the MWD Tier 1 Supply and Exchange escalation rates in the same exact manner as for Figure 2-7, 20 years at 5.1 and 4.5 percent respectively, then 3.7 percent thereafter, we arrive at the Net Present Value comparison illustrated in **Figure 2-9.**

FIGURE 2-9: Net Present Value Comparison with Modified MWD Price Escalation
(Period of analysis through 2112)



With MWD price escalation modified to reflect a more likely rate forecast scenario, the Negotiated Exchange option still maintains a benefit of $7 billion in comparison to the next least-costly alternative, and $10 billion in comparison to the Draft Study's default alternative of MWD Exchange 2047.

MWD rate structure adjustments could alter these projections.

The above analysis of the Negotiated Exchange option, as well as all of the previous comparisons, rely on an assumption that MWD will maintain its existing rate structure intact, complete with its heavy reliance on volumetric commodity charges. A shift by MWD of costs from volumetric commodity charges to fixed charges could reduce its commodity rates, and in the process could reduce the avoided costs that provide the economic advantage of a Negotiated Exchange option. This same consideration would apply to the RCS option, reducing the potential benefits of the project. Detailed consideration of the future of MWD rate structures is beyond our scope of work.

2.7. The Draft Study's assumptions of IID Supply price escalation do not account for risk of future price increases above inflation.

The contractual price paid by the Water Authority for IID transfer water is currently indexed to a published inflation factor, the federal Gross Domestic Product Implicit Price Deflator (GDPIPD). According to the 2009 Amended Water Transfer Agreement, the use of the index ends after 2034 and transitions or resets to a market based price.

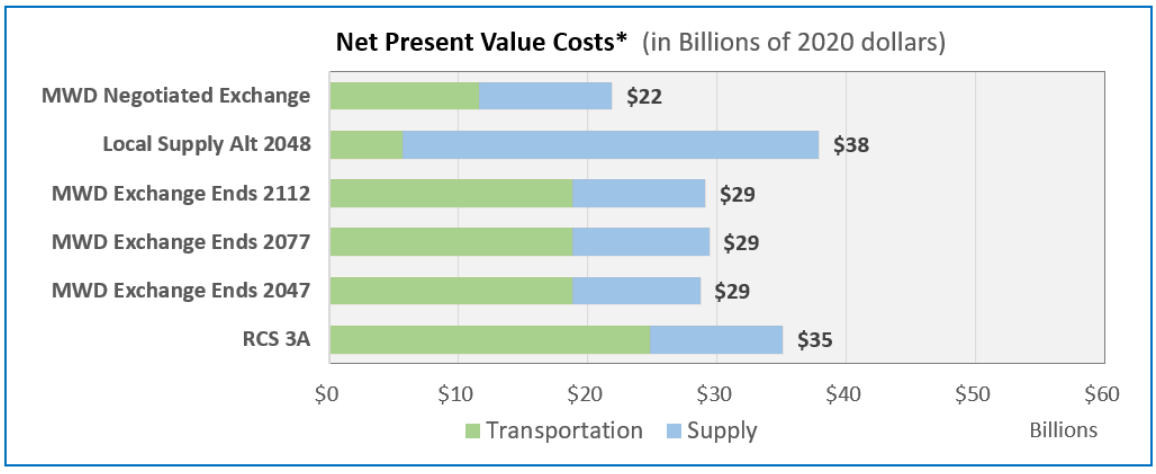
The Draft Study's economic analysis assumes a continuation of IID supply costs at the underlying rate of inflation. This is in contrast to, and appears to us inconsistent with, the assumption that MWD will increase well above underlying inflation. Under the terms of the Transfer Agreement, the use of the GDPIPD index expires at the end of 2034, to be replaced either by a market-based process if an established market exists, or by the agreement's Base Contract Price which is based on MWD rates. This at a minimum would appear to introduce a significant risk, if not the likelihood that IID supply prices under the Transfer Agreement will escalate over the long-term at rates greater than inflation, contrary to the Draft Study's assumptions. Any increase in the assumed rate of IID price escalation further disadvantages the RCS in comparison to the MWD Exchange 2047 option.

We have adapted the Economic Model to include additional functionality for IID supply price escalation sensitivity testing. We will use Figure 2-9 as a point of comparison. Figure 2-9 presents NPV results with MWD Tier 1 and Exchange escalation rates adjusted from default conditions to be fixed for 20 years at 5.1 and 4.5 percent respectively, and thereafter at 3.7 percent. Leaving all of those adjustments in place, we will next adjust the IID price escalation assumptions as follows:

- Initial Escalation Rate: 1.9 percent, equal to the 20-year average of the GDPIPD
- Time-Out Date: Initial escalation rate ends after 2034, as per the Transfer Agreement
- Subsequent Escalation Rate: 3.5 percent, reflecting a small discount from the Economic Model's default OMRR escalation of 3.7 percent

With those modifications entered into the Economic Model, the NPV comparison of the supply and transportation alternatives is as depicted in **Figure 2-10.**

FIGURE 2-10: Net Present Value Comparison with Modified IID Price Escalation
(Period of analysis through 2112)



Notice the NPV cost premium for the RCS has now grown in comparison to the other alternatives, and that the MWD Exchange 2047, 2077, and 2112 options have reached a level of parity with each other. The data presented in Figure 2-10 is just one of many scenarios that could be evaluated with the Economic Model, and suggests there may be opportunity to apply the model to support further investigation of alternative QSA supply and transportation futures.

2.8. Grant funding, if available, could reduce the RCS cost premium in comparison to the other alternatives.

The Draft Study notes the prospect that the project could receive State, Federal, or other funding assistance, reducing the capital cost incurred by the Water Authority and boosting the project's economic status in comparison to the other supply and transportation alternatives.

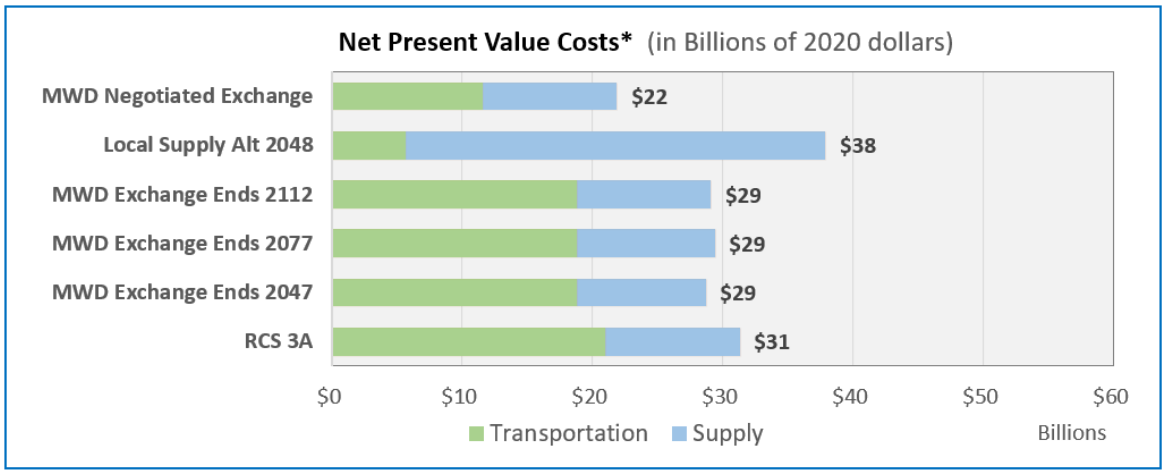
Some of the member agency managers have suggested the prospect of grant funding is unlikely, citing probable opposition from the remainder of the MWD service area and from the other Colorado River basin states. Conversely, Water Authority staff have pointed to project's role in securing the IID Transfer and maintaining peace on the river. Resolving the divide between those opinions is beyond the limits of our scope.

We have adapted the Economic Model to provide sensitivity testing of RCS capital costs. Using the Figure 2-10 scenario as a point of comparison, we can adjust the RCS capital cost as follows:

- RCS Capital Cost Adjustment: Assume 50 percent of project capital is grant funded, reducing the capital cost to the Water Authority from $5.0 billion (before escalation to midpoint) to $2.5 billion.

With that modification entered into the Economic Model, and otherwise maintaining all of the same settings as for Figure 2-10, the NPV comparison of the supply and transportation alternatives is as depicted in **Figure 2-11.**

FIGURE 2-11: Net Present Value Comparison with 50% Capital Grant Funding
(Period of analysis through 2112)



The effect of the grant funding is to reduce the project's NPV by approximately $4 billion, bringing the project closer in cost to the other alternatives but still more expensive.

2.9. The Local Supply option is specific to SDCWA local project development and is not intended to reflect the economic merits of local project development by member agencies.

Several of the MAMs have asked us to comment on the nature of the Local Supply option and on the economic data reported on the option by Economic Model.

Contrast Between SDCWA and Member Agency Local Supply Economics

The first thing to note about the Local Supply option is that it is intended to reflect the economics of local supply development by SDCWA, not by member agencies. When SDCWA evaluates the economics of such a project, its logical point of comparison is to the cost and reliability of MWD Tier 1 supplies. In contrast, when a member agency evaluates a similar (if smaller) project, their logical point of comparison is to all-in SDCWA rates, which are currently on the order of $600/AF higher than MWD rates. In addition, for the case of a Pure Water type local project, a member agency may be in a better position to benefit from the avoided costs of such a project to its local wastewater system. For these and other reasons, member agencies are likely to find economic merit in local projects that would be too costly for SDCWA.

Project Sizing

The second thing to note about the Local Supply option is that SDCWA has sized the option for the full 200,000 AF/yr needed to replace its IID supply after 2047. (Per the option definition, the IID agreement would be allowed to expire after 2047 and SDCWA would then need to replace that supply from MWD or from local supply development.) SDCWA has based the option on a large seawater desalination facility such as could possibly be built at Camp Pendleton. The Economic Model includes a default cost for this option of $3,000/AF in 2020 dollars. We concur with the use of this default setting when the intent is to gauge the costs of SDCWA project development independent of the member agencies.

In contrast, individual projects undertaken by member agencies will necessarily be sized at capacities less than the full 200,000 AF/yr of IID supply. Whether a combination of individual projects could achieve this threshold is a matter of speculation, but it appears at least plausible and perhaps likely that a combination of local projects could replace a significant share of the IID supply.

Additional Testing Using Economic Model

The Economic Model allows for testing of the Local Supply option across a range of input assumptions. Member agencies can use the model to test the results of modified local supply options populated by multiple smaller member agency projects. Additional notes on the model and on testing suggestions are included in **Appendix B.**

2.10. Potential rate increases to fund an RCS can be estimated using the Red/Black charts.

In Figure 2-7 ("Cost and Benefit Distribution with Modified MWD Price Escalation"), the cumulative net costs of the RCS project before the economic crossover point in 2079 total $6.5 billion. Annual net costs exceed $200 million per year from 2041 through 2054, a period of 15 years. During this period, average net costs are approximately $230 million per year. If these costs were funded by the Water Authority Melded Supply Rate and/or its Transportation Charge then depending on the Water Authority annual sales volume they would result in the All-In rate increases listed in **Table 2-3.** Note that the rate increases shown are just those needed to fund the RCS, and are in addition to other rate increases the Water Authority will need to fund its ongoing operations, capital program, and MWD purchase and exchange costs.

TABLE 2-3: SDCWA Rate Increase to Fund $230M/yr in New Costs
(in 2020 dollars)

Period	Average Annual Cost	Rate Increase for Given SDCWA Annual Sales Volume in AF				
		200,000	250,000	300,000	350,000	400,000
2041-2054	**$230 M**	$1,150/AF	$920/AF	$770/AF	$660/AF	$580/AF
2038-2077	**$160 M**	$800/AF	$640/AF	$530/AF	$460/AF	$400/AF

Prior to 2041 and after 2054 continuing to 2079, lesser increases would be needed to fund the net costs. After 2079, net costs transition to net benefits and water rates would then be reduced in comparison to the selected RCS point of comparison.

Some of the member agency finance directors have noted that additional rate impacts might arise from debt coverage ratio policies, credit rating requirements, bond requirements, and related issues associated with the issuance of approximately $6 billion in debt. Analysis of these issues is beyond the scope of our review.

3. Engineering, Cost, and Risk Review

3.1. Engineering Review: The engineering components of the Draft Study are sound and demonstrate the technical feasibility of an RCS project.

The Draft Study's engineering work updates the many previous studies prepared on the topic, and advances the conceptual project design by demonstrating the potential merits of a Northern Alignment alternative, by incorporating desalting operations and a Westside Main Canal parallel, and via other improvements. Our high-level review of the project's engineering has identified only modest opportunities for revision, and we find the project engineering overall to be sound.

Our comments on the Draft Study's engineering and general planning aspects are listed below:

1) 1.5 Previous Studies: Include the 2002 Regional Colorado River Conveyance Feasibility Study.

2) 3.2 TOVDS Delivery Point Day Tank Level Control: The text of this section needs clarification; it is not clear how storage in the day tank is to be regulated. If the goal of the day tank is to be able to feed the rejection tower at a normal water elevation (NWL) of 1140, this suggests the bottom of the tank needs to be above that elevation, and equipped with a 400 cfs flow control facility (FCF) regulating flow out of the tank, otherwise the tank is just floating at the rejection tower NWL as regulated by the existing pressure control facility (PCF) and not providing any operating storage. Also, the text should note the significant topographic and environmental constraints to siting a tank at this elevation in Twin Oaks vicinity. These constraints, and the addition of a FCF if needed, would add to project costs.

3) 7.4 Summary of Environmental Issues re: Greenhouse Gas Emissions: Even though this section is mostly conceptual and directed toward a process description, it should note GHG emissions as an issue of concern for the RCS. Data in the report indicates the RCS 3A will have an energy footprint of approximately 2,800 kWh/AF, or approximately 40 percent greater than for conveyance via the Colorado River Aqueduct. This leads to the possibility that the RCS might not be the environmentally preferred alternative for project environmental documentation under the California Environmental Quality Act (CEQA) and the National Environmental Project Act (NEPA). Depending on the nature of federal environmental permits and approvals needed for the project, this could present risk to project approval.

4) 9.0 Screening Criteria and Evaluation: The methodology of combining costs and benefits into a scoring matrix is problematic. We recommend costs be pulled out into their own category and then weighed against benefits, reflecting the way budgets and policy are typically evaluated in the public agency and utility arena.

Weighing Costs and Benefits. Costs and benefits are the two sides of the balance scale. Matrix scoring evaluations that combine costs and benefits into a single scoring rubric fail to capture this real-world balancing act.

5) 10.12 Report Summary re: Cost Competitiveness: The summary text states, "Alternatives 3A and 5A are economically competitive and provide long-term reliability and low cost water to the region", and "As discussed in the key findings summarized above, Alignments 3A and 5A are viable alternatives to the current status quo for the Water Authority." Our analysis in Section 2 of this report demonstrates otherwise, and the summary text should be revised to present a more accurate and complete assessment of the project's economics.

3.2. Cost Analysis: We have only minor comments and suggestions for consideration.

The independent review of the project cost estimates commissioned by the Water Authority appears to have been a valuable undertaking that has helped refine and validate the current estimates. Our high-level review of the project's costs has identified modest questions and concerns as identified in our report, but these are not of a magnitude to alter the overall economics of the project. Although much attention is paid in the Draft Study and related documents to capital costs, these are a minority of the project's life-cycle costs, and their share diminishes as the economic period of analysis increases. Annual costs are a more significant driver of RCS life-cycle costs, and life-cycle costs are more sensitive to changes in annual costs than to capital costs.

Our cost-related review comments are listed below:

1) Construction Management (CM) Costs: The report estimates CM costs at approximately 22 percent of construction costs before contingencies. The 22 percent figure warrants further review and comparison to the Water Authority's historical CM costs on projects such as the San Vicente Pipeline tunnel. Also, the application of the selected percentage to construction costs before continencies is unusual and warrants re-consideration or explanation.

2) Labor Cost Multipliers: The report uses a labor cost multiplier of 1.6. This appears low if the intent is to include comprehensive labor costs inclusive of payroll overhead, office space, equipment, and administrative and managerial overhead.

3) Replacement Costs: The report identifies a replacement cost averaging approximately $2.5M per year for Alternative 3A. This appears unduly low for a $5B capital project, amounting to only 0.05 percent of capital costs. Replacement costs should be revisited, with a recognition that it is not possible to ensure all project components meet their design lifetimes. Construction, material, and equipment flaws may arise decades after project completion and lead to unexpected costs.

4) Tunnel Repair Costs: Depending on the return interval of large movements on the Elsinore Fault and depending on the probability of those movements damaging the tunnel, the cost analysis should consider including a sinking fund repair line item for tunnel repairs. Tunnel repairs could be enormously expensive if required, and might warrant a sinking fund of millions or tens of millions of dollars per year.

5) TOVDS Deliver Point Day Tank: See our comments on this item in Section 3.1.

6) Response to HPG Comments: We recommend the final version of the report provide specific responses to each of the findings and recommendations of the Independent Cost Review.

3.3. Risk Review: The risk of declining water demands appears real and warrants consideration.

The Draft Study does not account for the risk of declining demands in its Risk Registry. We think it likely that long-term Water Authority demands are at significant risk of declining to below 330,000 AF/yr, perhaps by a considerable margin, and for this reason we recommend the Draft Study be revised to address demand risk.

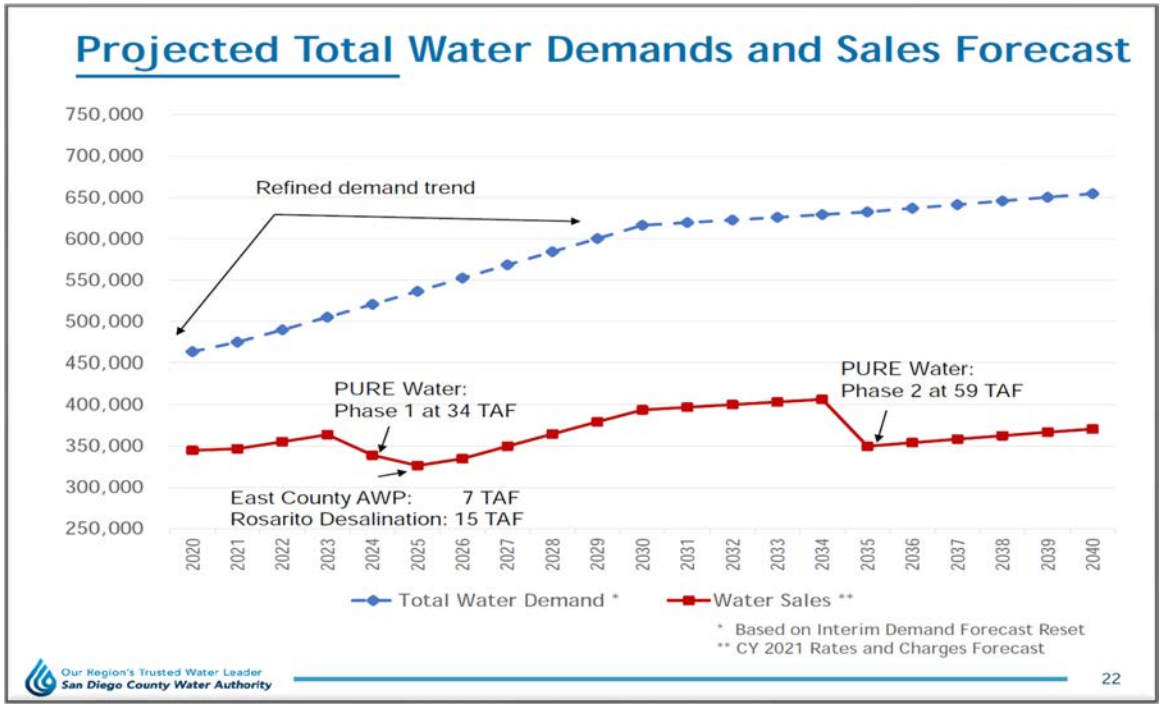
The 330,000 AF/yr threshold is significant because it represents the Water Authority's current core supply of water, the rounded total of 277,700 AF/yr of QSA supplies and 50,000 AF/yr of ocean desal. Of these, the Water Authority is obligated to pay for the IID and desal supplies regardless of whether it uses them. If demands dropped below the 330,000 AF/yr threshold, the Water Authority might need to leave some of its core supply unused. If such reductions are to its QSA supplies, then an RCS facility built at a capacity to match full QSA supplies could become oversized. If the RCS could no longer be operated at capacity, the unit costs of the facility would increase, jeopardizing the potential to ever recover the capital investment in the project.

Also, it is clear from the Draft Study that downsizing the RCS would result in significant cost-inefficiencies, particularly with regard to the project's tunnels which for constructability reasons must be sized for 14 foot or 16 foot diameter bores regardless of finished inside diameter. This makes it unlikely the demand risk could be mitigated by downsizing the facility without compounding the project's economic challenges.

Water Authority Demand Forecast

The Water Authority's current demand forecast is summarized in **Figure 3-1**, which is a presentation slide presented by Water Authority staff at its March 12 special board meeting.

FIGURE 3-1: SDCWA Current Demand Forecast



Source: Presentation Materials from SDCWA board meeting of March 12, 2020

The upper blue line of the chart depicts total regional water demands. The lower red line depicts Water Authority sales, which are lower than regional demands by a volume equal to member agency local supplies. As new local supplies come on line in future years, the red line adjusts accordingly. The message of the chart is that Water Authority demands (sales) are a function of 1) regional demands, and 2) member agency local supply development. The chart depicts total regional demands increasing over time, but member agency local project development increasing as well, with the result that long-term Water Authority demands remain in a range of approximately 330,000 to 400,000 AF/yr. The Draft Study relies on this forecast to conclude that long-term Water Authority demands will remain safely above the 330,000 AF/yr threshold.

In presenting this slide, Water Authority staff have noted the forecast is founded in work from the agency's 2015 Urban Water Management Plan, and that the Water Authority is in the process of developing new demand forecasts due out later this year. Further, they have noted the initial upward slope of the blue line, which continues to an inflection point in 2030, arises from the 2015 forecast assumption that unit demands post-2008 have been depressed by various extenuating circumstances, and will gradually return to pre-2008 levels, completing this return in 2030.

Possible Forecast Modifications

We are not aware of any member agencies that believe their per-capita water demands will return to pre-2008 levels. Further, considering increasing water prices, advancing conservation practices, changing landscape ethics, and pending dictates of the State Water Resources Control Board, we find it more likely that per capita demands are more likely to continue their decline than resume an increase.

Nevertheless, if we make only one adjustment to Figure 2-10, it would be to bring the initial upward slope of the blue line down to the slope of the post-2030 section of the line, while holding its 2020 value at approximately 460,000 AF/yr. This reduces the red line post-2030 by approximately 125,000 AF/yr, bringing Water Authority sales down to the vicinity of 250,000 AF/yr in the later years of the chart. This revision is illustrated in **Figure 3-2** (next page).

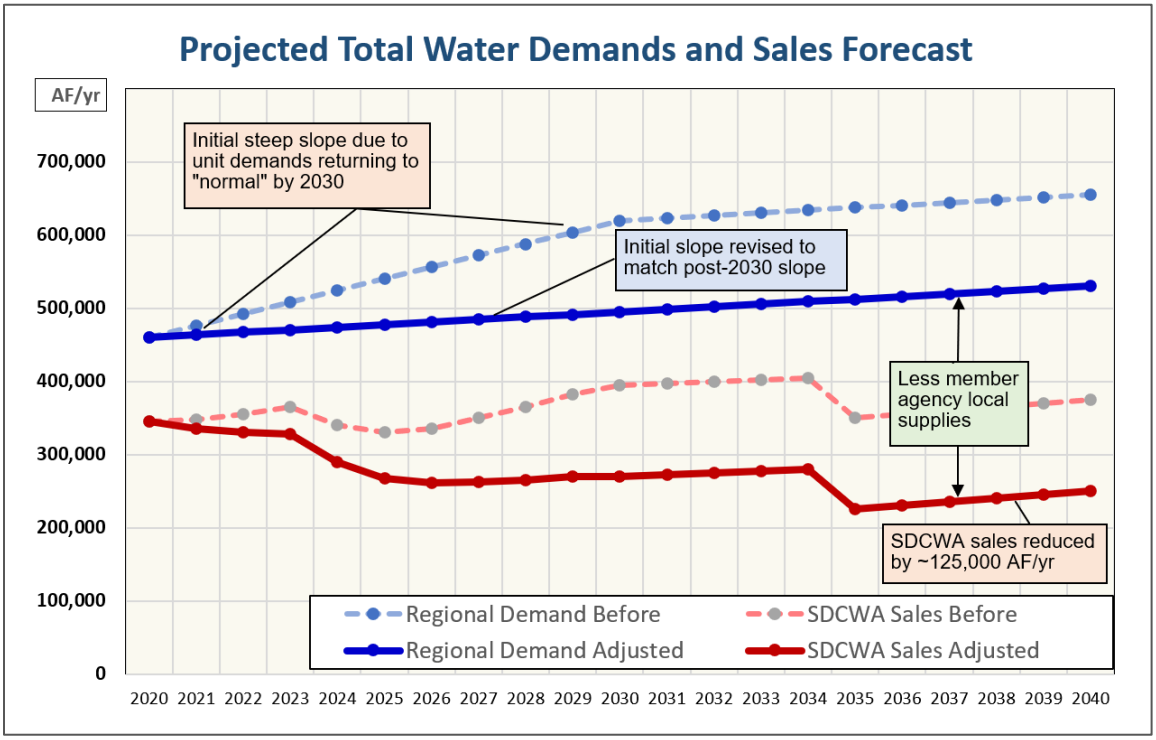
Resulting Upward Incentive for Member Agency Local Supply Development

The downward adjustment of the blue Regional Demand line has a compounding effect on Water Authority sales. Not only does the reduction in regional demand lead to a direct reduction in Water Authority sales, but it also drives Water Authority rate increases as fixed costs are distributed to a declining sales volume. This in turn creates additional economic incentive of member agency local supply development, which if it occurred would further diminish Water Authority sales.

The Future of Ocean Outfalls?

Some of the member agencies have also noted the possibility that ocean discharge regulations could be modified in the future to ban or significantly reduce wastewater discharges, and that legislation has been introduced to this effect. This would create further incentive or even requirements for Pure Water type local supply development, further diminishing Water Authority sales.

FIGURE 3-2: Conceptual Adjusted Water Authority Sales Forecast



Demand Risk Summary

The Water Authority's new demand forecasts are eagerly awaited. In the meantime, any consideration of the RCS should account for the probability that long-term demands for Water Authority water will be insufficient to utilize the full 330,000 AF/yr of the combined core supplies. Demands may even decline below 250,000 AY/yr, the combined IID and Seawater Desalination supplies. The Water Authority should consider the impact on demands if there is State legislation that prohibits wastewater treatment plants discharging to the ocean.

APPENDICES:

A. Comments from Member Agency Chief Financial Officers

B. Economic Model Overview and User's Guide

APPENDIX A: Comments from Member Agency Chief Financial Officers

A.1. Summary Comments

A draft version of this reports main economic findings and a draft of the Economic Model were made available to a group of member agency chief financial officers for quality review and comment. Their comments are summarized below:

- An assumption that MWD's rates will increase by 5.1 percent for 92 years is not realistic. At this escalation, the MWD rate would double every 14.4 years and this could significantly overestimate MWD's rates 20+ years out. This assumption also assumes MWD will not change its rate structure for the next 100 years.
- An assumption of 5 percent interest rates for project bonds may be too low. For the Water Authority to take on $5 billion in debt, it would be challenging to meet debt service coverage ratios and this may result in a lower credit rating. If the project is funded by a Public-Private Partnership, the interest rate will be higher. A cost of funds closer to 6.5 percent seems far more reasonable.
- The Water Authority analysis should include the cost of stranded or underutilized assets resulting from the RCS. In particular, what is the Water Authority's share of MWD's cost to operate, maintain, repair, and replace their conveyance facilities? Are there Water Authority facilities that are stranded or underutilized? It seems very probable that MWD will alter its rate structure at some point to collect the cost of maintaining the Water Authority's underutilized capacity, rather than charging the other member agencies for these costs.
- In making assumptions, there should be a link between the IID and MWD rate escalation. Assuming IID's rates escalate at only 2.5 percent while MWD's rates increase 5.1 percent is too large of a difference. It is not unreasonable to assume that the IID costs will increase at or near the same levels as MWD. The Water Authority's most readily available alternative supply of 200,000 acre-feet is MWD. The assumption that IID would not would not push hard for higher rates, once the Water Authority committed to the pipeline, is overly optimistic. A term sheet for a long-term rate schedule should be negotiated with IID before this project is started.
- The RCS project should be decided by a ballot measure, financed with General Obligation Bonds, and paid for by residents on the property tax bills. The charge should be in a meter equivalent like the Water Authority's Infrastructure Access Rate.
- The period of analysis and generational equity is important and should be explained and discussed with the Water Authority Board of Directors. For the RCS, what are the costs and benefits, by generation. Note that costs of public facilities paid by previous generations benefit us today; an analysis beyond 30- to 40-years should be included.
- The Water Authority should explain the basis for all of their assumptions, in all alternatives, complete a sensitivity analysis on them, and perform probability analysis.
- The Water Authority should break down the transportation costs by capital and operation and maintenance.

- As member agencies reduce demands on the Water Authority, what impact does that have on the RCS?
- In the economic analysis, the Water Authority should treat the local supply alternative as a project, like the other alternatives, rather than simply escalating $3,000/AF.
- RCS repair and replacement costs may be underestimated.
- Is there a benefit to pursuing longer-term debt?
- Periodically, if the project progresses, and before debt is issued, review the assumptions and costs, and provide additional project off ramps.
- Is there an opportunity to connect member agency reservoirs in the south County, that are not currently connected?
- Could the Water Authority monetize the value of the IID water to another entity, like the Central Arizona Project (or even MWD), to offset the cost of a local water supply?
- For each alternative, identify the quantifiable and non-quantifiable project and environmental risks.
- Is there a value that should be given to a local water supply because it is a long-term, drought-proof supply?
- The Water Authority should review the IC modifications to their model to help identify any improvements.

APPENDIX B: Economic Model Overview and Guide

B.1. Model Overview and Background

The RCS Economic Model is a spreadsheet model providing analysis of SDCWA's proposed Colorado River Regional Conveyance System (RCS). The RCS would convey water from the Imperial Valley to San Diego over or through the Laguna Mountain range and provide an alternative to use of the MWD's Colorado River Aqueduct (CRA) for delivery of SDCWA's IID Transfer and All American Canal Lining water. The model allows for comparison of the RCS to other water supply and transportation options in terms of Net Present Value (NPV), annual net benefits, and other metrics. Key economic input variables, including the term of analysis, escalation rates, and other factors, are readily adjustable by the user to test the sensitivity of outcomes to input.

The original version of the model was developed by SDCWA and dated June 18, 2020. SDCWA made that version available to the IC, and subsequently the IC has modified the model to provide an upgraded Dashboard with enhanced sensitivity analysis capabilities and graphical summaries.

Projects of the magnitude of the RCS are inherently political. Informed analysis of project economics, provided at the earliest practicable stage of project development, can help guide policy making and help ensure that projects of merit gather support, and those lacking merit be tabled or dismissed. Our goal for the model is to provide a user-friendly tool to test economic assumptions and to support objective and transparent review of the RCS project.

B.2. Supply and Transportation Scenario Alternatives

The Draft Study presents the net present value costs of the RCS in comparison to MWD Reliance and Local Supply Development alternatives. The Economic Model supplements these by parsing the MWD Reliance option into three different options, resulting in five options total inclusive of the RCS option. The RCS option also has its own alignment alternatives, of which alternative 3A, the Northern Alignment, is the lease costly. We have elected to present results and comparisons for that alignment only, to the exclusion of the more costly 5A and 5C described in the Draft Study, and the revised model dashboard includes only the 3A alignment option of the RCS.

The five supply and transportation options are defined below:

- **RCS 3A:** RCS alignment alternative 3A (Northern Alignment) is the least costly and is used here for comparison. RCS becomes operational in 2045.
- **MWD Exchange Ends 2047:** This option assumes the MWD Exchange Agreement expires without renewal at the end of 2047, along with the IID agreement. SDCWA then transitions to buying 200,000 AF/yr of MWD Tier 1 supply. Canal lining water continues at the MWD Exchange Rate. (This option is titled "MWD Reliance" in the Draft Study.)
- **MWD Exchange Ends 2077:** Similar to above, but the IID and MWD Exchange agreements are extended through 2077.
- **MWD Exchange Ends 2112:** IID and MWD Exchange agreements are both extended to 2112, in alignment with the end date for Canal water.
- **2048 Local Supply:** The IID agreement expires at the end of 2047, after which SDCWA transitions to 200,000 AF/yr of new local supply development projects.

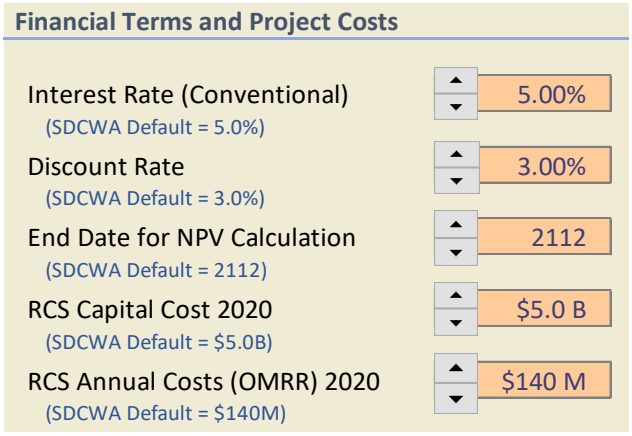
To this list the IC has added a sixth option:

- **MWD Negotiated Exchange:** This option replaces the current exchange agreement with new terms through 2112, with price escalation tied to the Engineering News Record 20-Cities Construction Cost Index (ENR_CCI).

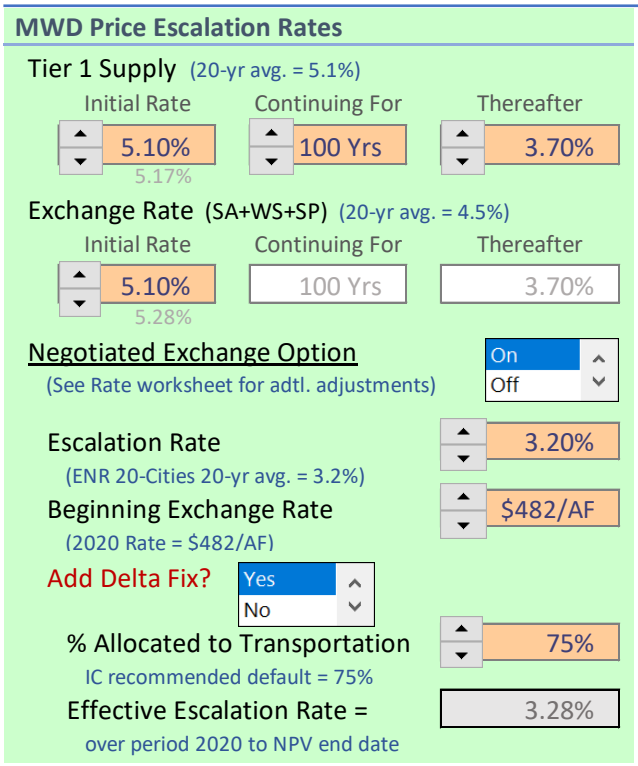
B.3. Model Economic and Financial Inputs and Default Settings

The model's main economic and financial inputs are included in the dashboard, and are described below by category. The left-hand column displays a screenshot of an input section of the model, and the right-hand column contains notes and explanations. All model descriptions in this report are for **version 1.1 dated 07/20/20.**

When the model is first opened, all inputs are set to the default conditions utilized by the Draft Study.



Notes
Default setting is conservative by current market standards, but may be appropriate given challenge of $5B financing
SDCWA advises the default discount rate reflects general water system cost escalation
Default period runs 92 years through 2112
Per the Draft Study, RCS 3A, the least costly alignment alternative, has a capital cost of $5.0 B and an annual OMRR cost of $140 M



Notes
Default Tier 1 Supply escalation is 5.1%/yr continuing for the duration of the 92-year period. The Time-out function and subsequent escalation rate inputs are additions by the IC. We recommend settings of 20 years and 3.7%.
The Exchange Rate escalation default is 5.1%, even though the 20-year average is 4.5%. We recommend the lower rate. The time-out date and subsequent escalation rate are set by the Tier 1 inputs.
The Negotiated Exchange option and settings additions made by the IC to the original model. Our recommended defaults are as listed.
This section allows costs for a Delta Conveyance project to be added to the exchange rate over and above the specified escalation rate. Additional inputs for the Delta Conveyance option are included in the Rate Forecasting worksheet. The gray-shaded box reports the effective escalation rate inclusive of the Delta Conveyance.

QSA Supply Cost Escalation (SDCWA Default = 2.5%)

Initial Rate	Continuing Through	Thereafter
2.50%	2112	3.50%

Notes

Default QSA (IID and Canal supply) escalation is 2.5%, continuing for the duration of the period. The Time-out function and subsequent escalation rate inputs are additions by the IC. We recommend settings of 2134, corresponding to the date after which IID rates become subject to new terms, and 3.5%, reflecting a small discount from the default 3.7% OMRR escalation used for Tier 1 supply.

Also, we recommend the initial escalation rate be set at 1.9%, the current 20-year average of the GDP Implicit Price Deflator specified in the IID agreement as the determinant of rate escalation through 2034.

Local (San Diego) Supply Assumptions (Post 2045)

(See Rate worksheet for adtl. adjustments)

Local Water Supply Cost 2020 ($/AF) (SDCWA / BV default = $3,000/AF)	$3,000
Percent Arising from Capital (IC suggested default = 60%))	60%

Notes

The Draft Study default is $3,000 AF in 2020 dollars. We have modified the model to recognize a percentage of the unit cost as capital and finance that over a defined term. Additional inputs are included in the Rate Forecasting worksheet.

Construction & Operations Escalators (defaults in blue)

Operations & Maintenance	3	3.00%
Energy	4	4.00%
Labor	3	3.00%
Major Replacements	3	3.00%
Melded OMRR (Per 3A Costs)		3.68%
Construction	3	3.00%

Notes

The Draft Study defaults are as listed.

The Melded OMRR value is calculated as a weighted average of the prior escalators as applied to the dollar distribution of the RCS 3A annual costs. This melded value is used as the OMRR escalator for the portion of local supply costs not allocated to capital.

The Draft Study default for construction escalation is 3 percent. For comparison, the 20-year average of the ENR 20-Cities CCI is 3.2%.

Miscellaneous Assumptions

RCS Delivered AF	277,700
MWD's '21 & '22 Rates Baseline (If No, rates escalated from 2020 baseline)	Yes
Interest Only Until Operational	Yes
Debt Term (years) (SDCWA default = 40 years)	40

Notes

The delivery volume is part of the original model version and is not fully functional. We recommend leaving the value set at the QSA total of 277,700 AF/yr.

The Yes/No options allow for adjustments to the MWD rate escalation baseline, and to adjust whether RCS financing is interest-only until project completion. The Draft Study defaults are as shown.

The RCS finance term can be set at 30 or 40 years. The default is 40 years.

B.4. Model Outputs

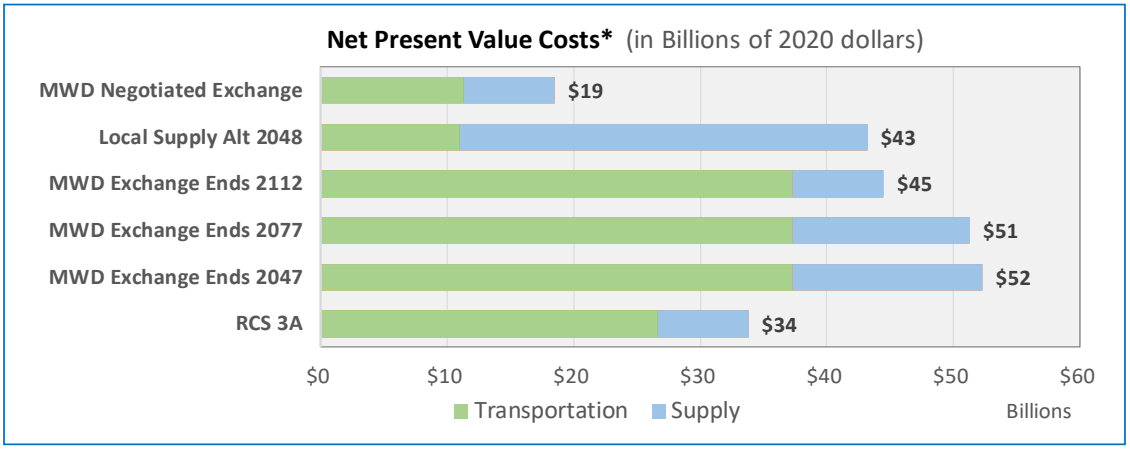
The right-hand side of the dashboard displays results, in three sections.

Uppermost Section (Green/Blue chart)

The uppermost section presents a tabular summary of Net Present Value for each of the options, and below this the same data is presented in a horizonal bar graph. We refer to the bar chart at the Green/Blue chart. Aside from formatting modifications and the addition of the Negotiated Exchange option, this part of the dashboard is unchanged from the original model version provided by SDCWA.

A screenshot of this section is shown below and reflects the model results when all of the Draft Study's default inputs are applied.

Net Present Value Analysis (2020 Dollars)*				
Supply Option	**Transportation**	**Supply**	**Total**	**Unit Cost**
RCS 3A	$26,600,000,000	$7,200,000,000	$33,800,000,000	$1,790/AF
MWD Exchange Ends 2047	$37,300,000,000	$15,000,000,000	$52,300,000,000	$2,770/AF
MWD Exchange Ends 2077	$37,300,000,000	$14,000,000,000	$51,300,000,000	$2,720/AF
MWD Exchange Ends 2112	$37,300,000,000	$7,200,000,000	$44,500,000,000	$2,360/AF
Local Supply Alt 2048	$11,000,000,000	$32,200,000,000	$43,200,000,000	$2,290/AF
MWD Negotiated Exchange	$11,300,000,000	$7,200,000,000	$18,500,000,000	$980/AF



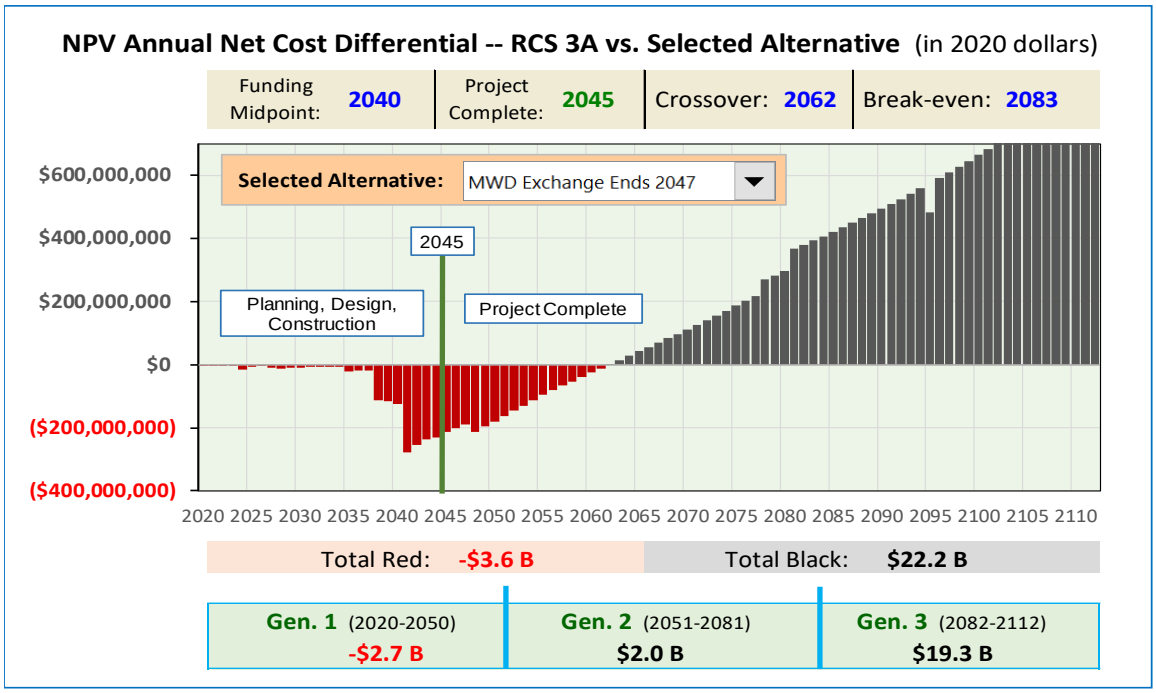
Middle Section (Red/Black chart)

The middle section presents the NPV Annual Net Cost Differential chart, also known as the Red/Black chart. The chart and accompanying data summaries detail the annual cost differential between the RCS 3A project and whichever alternative is selected by the user. When the model opens, the alternative selected is the MWD Exchange 2047 option because this is the default point of comparison used by the Draft Study. This part of the dashboard was added by the IC.

The Red/Black chart is important because it supplements the Green/Blue chart's depiction of total NPV over the period of analysis with detail on how RCS costs and benefits are distributed over time.

The period of the charted data can be truncated by adjusting downward the NPV End Date variable in the Financial Terms input section at left.

A screenshot of this section is shown below and reflects the model results when all of the Draft Study's default inputs are applied.

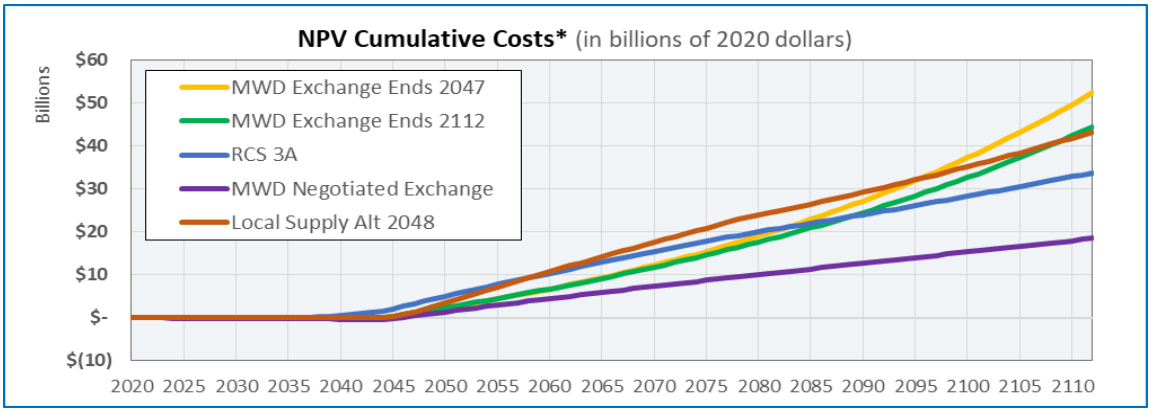


Other key data outputs listed in this section are:

- **Data windows above the chart** indicate the year of Crossover from net losses to net gains, and the year of breakeven, when upfront project investments are recouped.
- **Red / Black data windows below the chart** indicate the cumulative net draws and returns over the period of analysis.
- **Generational Cost Summary boxes below the chart** indicate the net cumulative NPV cost and benefits to each of three generations.

Lower Section (Cumulative Cost Chart)

The lower section of the results area contains a chart displaying cumulative costs in 2020 dollars over time for each of the alternatives. This chart was included in the original model on another worksheet and moved to the dashboard by the IC. A screenshot of this section is shown below and reflects the model results when all of the Draft Study's default inputs are applied.



B.5. Instructions

1) **General -- Start with the Dashboard:** The **RCS Dashboard** worksheet provides summary cost and economic comparisons, and the ability to easily adjust most of the key input variables. Adjustable inputs are indicated by **orange cell shading.** Use these to test the sensitivity of results to changes in assumptions.

2) **Intermediate User Adjustments:** See the **Rate Forecasting** worksheet for additional user adjustments relative to the Negotiated Exchange, Local Water, and other options. The adjustments on this worksheet are generally less consequential than those on the Dashboard, but may be of interest to some users.

B.6. Architecture

The Spreadsheet is structured into worksheets as follows. Additional notes and instructions are included in the main worksheets.

- **Hello**: Description, architecture, and general instructions
- **RCS Dashboard**: Main user-input and results summary page
- **Rate Forecasting:** Generates year-by-year costs for the non-RCS supply and transportation options
- **Cash Flows**: Generates the cash-flow analysis summarized on the Dashboard.
- **Other Worksheets:** The worksheets to the right of the Other Worksheets tab contain detailed cost estimates and cost scheduling data for each of the three RCS alignment alternatives. Only Alternative 3A, the least costly of the three, is used in the Dashboard.

B.7. User Notes / Suggestions for Sensitivity Testing

We suggest new users experiment with the following sensitivity testing.

- **End Date for NPV Calculation**: The model opens at the default setting of 2112 as the end date for NPV calculation. Experiment with dialing down the end date in increments. Note the black bars truncate from right to left on the Red/Black chart, driving down RCS project benefits.
- **MWD Rate Escalation:** The model opens with MWD rates escalating at 5.1 percent per year for the full period of analysis. Experiment with timing-out the initial escalation rates, and with adjusting the initial rate for Exchange escalation downward to its 20-year average. Escalation rates can also be dialed up. This testing demonstrates the comparison of RCS results to MWD Exchange results to be highly sensitive to MWD rate escalation assumptions.
- **Local Supply Adjustments:** Adjust Local Supply unit costs on the dashboard. Also, experiment with alternative settings for QSA price escalation, perhaps setting this closer to MWD price escalation levels. This testing demonstrates the comparison of the Local Supply option to other options is sensitive to local supply unit costs and to QSA escalation rates.
- **Negotiated Exchange Option:** Experiment with alternative NPV end dates and MWD escalation rates to test the sensitivity of the Negotiated Exchange option to changes in these variables.