MINUTES OF THE SPECIAL MEETING OF THE BOARD OF DIRECTORS OF VISTA IRRIGATION DISTRICT

December 11, 2023

A Special Meeting of the Board of Directors of Vista Irrigation District was held on Monday, December 11, 2023, at the offices of the District, 1391 Engineer Street, Vista, California.

1. CALL TO ORDER

President MacKenzie called the meeting to order at 1:36 pm.

2. ROLL CALL

Directors present: MacKenzie, Vásquez, Kuchinsky, Sanchez, and Miller.

Directors absent: None.

Staff present: Brett Hodgkiss, General Manager; Ramae Ogilvie, Assistant Secretary of the Board; Don Smith, Director of Water Resources Engineering; Lesley Dobalian, Director of Water Resources; Frank Wolinski, Director of Operations and Field Services; Shallako Goodrick, Director of Administration; and Greg Keppler, Engineering Project Manager. Randy Whitmann, Director of Engineering was present via teleconference. General Counsel Elizabeth Mitchell of Burke, Williams & Sorensen was also present.

Other attendees: J.P. Semper, Octavio Casavantes, and Teresa Sprague, Brown and Caldwell; John Bekmanis, Black & Veatch; Reed Harlan, City of Escondido; and Art Bunce, San Luis Rey Indian Water Authority.

Other attendees via teleconference: Holly Roberson, Kronick; and Stephanie Zehren, Jerimy Billy, and Richard Williamson, San Luis Rey Indian Water Authority.

3. PLEDGE OF ALLEGIANCE

Director Sanchez led the Pledge of Allegiance.

4. APPROVAL OF AGENDA

23-12-142	***Upon motion by Director Vásquez, seconded by Director Kuchinsky and unanimously carried (5 ayes: Miller, Vásquez, Kuchinsky, Sanchez, and MacKenzie), the Board of Directors approved the agenda as presented.***

5. ORAL COMMUNICATIONS

No public comments were presented.

6. VISTA FLUME REPLACEMENT ALIGNMENT STUDY

See staff report attached hereto.

Engineering Project Manager Greg Keppler stated that it has been a long and fulfilling road to get to this point in the Vista Flume Replacement Alignment Study (Study), and the Fine Screening results continue to support a 'To Flume' preferred option. He thanked the Board for their participation in the workshops and acknowledged the tireless work of District staff throughout this long process. Mr. Keppler also thanked the consulting team of Brown and Caldwell, Black & Veatch, Hoch Consulting, West Coast Civil, Atlas Technical Consultants, Dudek, and Helix Environmental Planning for their contributions to the Study.

Mr. J.P. Semper of Brown and Caldwell started the PowerPoint presentation that would be used throughout the workshop (attached hereto as Exhibit A). He recapped the first and second workshops held on August 24, 2021 and September 20, 2022 respectively, and introduced the agenda and objectives of the third workshop that would complete Phase 4 (Fine Screening) of the Study. Mr. Semper stated that the purpose of the workshop is to provide a detailed review of the results of the Fine Screening analysis, present the recommended preferred alignment for a Flume replacement project, and afford the Board the opportunity to provide feedback on the findings prior to advancing to Phase 5, Recommended Alignment Report of the Study.

Mr. Octavio Casavantes of Brown and Caldwell provided an in-depth review of the shortlisted alignment alternatives identified in the previous Course Screening phase of the Study, which includes Alternatives 1 (South Central) and 6 (Southern), with the beginning and end corridors of Alternative 2. Data from geotechnical field investigations, alignment site walks and input from key stakeholders were used to further evaluate, screen and rank each alignment in detail based on an extensive set of key criteria including project affordability and implementation, scheduling, constructability, community impacts, land ownership, environmental, permitting, system hydraulics and operations and maintenance. He stated that no fatal flaws were discovered during the Fine Screening analysis, and each shortlisted alignment remains a viable alternative for a Flume replacement project. Mr. Casavantes reviewed trends in construction cost escalation and reported that the estimated capital cost of the project increased from $170 million projected at the last workshop to $180 million, a 5.9% escalation in project costs.

John Bekmanis of Black & Veatch reviewed the evaluation process and objectives during the Fine Screening phase of the Study. He provided an in-depth review of the evaluation criteria used to determine the risk versus cost ranking of the beginning, middle, and end corridors of Alternatives 1 and 6 as well as the beginning and end corridors of Alternative 2. The evaluation determined that Alternative 1 proved to be the most balanced risk and cost solution of all of the corridors with the beginning corridor of Alternative 2 remaining a contingency for Phase 5, Recommended Alignment Report. Mr. Bekmanis said that a sensitivity analysis was performed to ensure the weighting factors were applied consistently and unbiased during the evaluation process.

Ms. Teresa Sprague of Brown and Caldwell reviewed the results of the predictive climatological modeling component of the Fine Screening phase that was used to predict annual yield of the local water system (LWS). She stated that three variable climate conditions (dry, baseline and wet) were applied to five different LWS investment scenarios for Harmful Algal Bloom (HABs) control and wellfield upgrades to simulate the range that climate variabilities could have on local yield. The predictive climatological modeling results showed that 80% of the scenarios predicted that the District can confidently rely on local water being available over a wide variety of climate conditions. Ms. Sprague said it also provided increased confidence in the balance scale economic analysis and weighed in favor of a 'To Flume' option, if modest investments are made to the LWS, specifically, expansion of the Warner Basin Wellfield and preventative treatment and long-term mitigation solutions of HABs in Lake Henshaw. It was noted that six of the 15 modeling scenarios (40%) predicted greater local yields than the current 40:60 local-to-imported water blend ratio required at the Escondido-Vista Water Treatment Plant (EVWTP). Increasing the local water ratio to fully realize the additional yield under these scenarios would require further study to determine the additional investments and modifications required at the EVWTP. She stated that the mid-range LWS investment scenario totals $23 million and projects a 4,700 acre feet (af) local yield to the District under the dry climate condition. This scenario was the preferred and recommended option used in the Flume

Replacement Project Affordability update.

The Board took a brief break at 3:40 p.m. and resumed the workshop at 3:49 p.m.

Mr. Semper reviewed the Flume replacement project affordability component of the Fine Screening phase. He stated that using the mid-range LWS investment and dry climate condition scenario as the baseline in the affordability analysis, Flume replacement ('To Flume') has a total 30-year Net Present Value (NPV) cost of $305 million, which equates to $2,200/af. In comparison, the 'Not to Flume' option has a total 30-year NPV cost of $458 million ($3,200/af), showing that the 'To Flume' option has a significant cost advantage ($153 million). Mr. Semper said that the affordability analysis confirmed that the 'To Flume' option remained the most cost effective option so long as the District's share of average annual local yield is above 2,700 af/year. He stated that although interest rates are variable and hard to predict, the sensitivity analysis performed as part of the Fine Screening showed that interest rates would have to double in order for the Balance Scale to tip away from the 'To Flume' option.

The Board asked what impact the $305 million project costs would have on water rates. Mr. Semper stated that the Municipal Financial Advisor is currently working with District Finance staff on the project's funding strategy and once funding is identified, a Specialty Rate Consultant will help establish the precise rate. He stated that a more detailed breakdown of per unit cost of water could be presented at a future date. The Board asked for clarification on the 'Cost per Acre-Foot Comparison' table presented in Section 5 of the PowerPoint presentation. Mr. Semper stated that the 'To Flume' option presents a cost of $2,200/af, and the District retains its LWS; the 'Not to Flume' option includes the San Diego County Water Authority's base water cost of $2,700/af plus water storage and other conditional costs are added for a total $3,200/af.

After further discussion, the Board requested that the Workshop be continued to February 2024 so that they could receive further information regarding the impact on water rates.

Mr. Hodgkiss stated that staff will add an agenda item in January to determine a date and time to continue the workshop.

23-12-143	***Upon motion by Director Kuchinsky, seconded by Director MacKenzie and unanimously carried (5 ayes: Miller, Vásquez, Kuchinsky, Sanchez, and MacKenzie), the Board of Directors requested to continue the Vista Flume Alignment Replacement workshop to February 2024.***

7. COMMENTS BY DIRECTORS

Director Sanchez commended Customer Service staff and Meter Reader William Fox for their professionalism in assisting a customer with a high water bill.

The Board thanked staff and the Consultants for the informative workshop.

8. COMMENTS BY GENERAL COUNSEL

Ms. Mitchell wished everyone a very Happy Holidays.

9. COMMENTS BY GENERAL MANAGER

Mr. Hodgkiss wished everyone Happy Holidays.

10. ADJOURNMENT

There being no further business to come before the Board, at 4:27 p.m., President MacKenzie adjourned the meeting.

Richard L. Vásquez

Richard L. Vásquez, President

ATTEST:

Ramae Ogli

Ramae Ogilvie, Secretary
Board of Directors
VISTA IRRIGATION DISTRICT

VISTA IRRIGATION DISTRICT

STAFF REPORT

Agenda Item: 6

Board Meeting Date:	**December 11, 2023**
Prepared By:	**Greg Keppler**
Reviewed By:	**Randy Whitmann**
Approved By:	**Brett Hodgkiss**

SUBJECT: VISTA FLUME REPLACEMENT ALIGNMENT STUDY

RECOMMENDATION: Conduct Vista Flume Replacement Alignment Study workshop and direct staff to initiate design and environmental permitting efforts to replace the Vista Flume.

PRIOR BOARD ACTION: On August 24, 2021, the Board participated in the first workshop for the Vista Flume Replacement Alignment Study to review and reach preliminary consensus on the project objectives, 'long-list' of alignment alternatives, evaluation criteria and replacement affordability. On September 20, 2022, the Board participated in the second workshop to review preliminary results of the Coarse Screening analysis, identify a 'short-list' of two alternatives for advancement into the Fine Screening Analysis and receive an update on project affordability.

FISCAL IMPACT: The fine screening level estimated cost for the preferred alignment is $180,000,000. Local water system predictive yield modeling analysis results and an updated review of project affordability indicates that replacing the Vista Flume (Flume) remains the District's least costly water supply alternative inclusive of estimated costs for long-term solutions to mitigate Harmful Algal Blooms (HABs) at Lake Henshaw.

SUMMARY: At nearly 100 years old, the Flume has exceeded its usable service life, is unsuitable for reuse and should be retired. A Water Supply Planning Study was completed in March 2020 and found that replacement of the Flume was the least costly water supply option for the District. The Flume Replacement Alignment Study (Study) began in February 2021 and is designed to support a decision by the District as to the preferred replacement alignment for the Flume. The Study will review many factors that weigh in the comparison of alternative alignments, and the selection of a preferred alignment will be guided by a risk versus cost evaluation. Alternatives will be ranked and screened based on a set of key criteria including project affordability and implementation, schedule, constructability, community impacts, land ownership, environmental, permitting, system hydraulics, and operations and maintenance.

DETAILED REPORT: The attached review package for the third and final workshop summarizes the fine screening analysis performed on the 'short-list' of Flume alignment alternatives and recommends a preferred replacement alignment. It also presents results from the local water system predictive yield model, climate change, and project affordability analyses. The workshop will afford the Board the opportunity to provide input on these elements for incorporation into the Study's final Recommended Alignment Report that will be completed by mid-2024.

Results from the fine screening analyses conclude that the 'To Flume' option continues to retain significant cost advantage over the 'Not to Flume' option provided modest investments are made to the local water system including HABs mitigation at Lake Henshaw and upgrades to the Warner Basin wellfield. Staff recommends initiating Flume replacement design and environmental permitting efforts and begin budgeting this next multi-year phase of work starting in either Fiscal Year 2025 or 2026.

ATTACHMENT: Workshop Reference Materials

Flume Replacement Alignment Study Workshop No. 3
Fine Screening Phase

Prepared for
Vista Irrigation District
Vista, California
December 11, 2023

John P. Semper, P.E.
Project Manager

REGISTERED PROFESSIONAL ENGINEER
JOHN P. SEMPER
C 88562
CIVIL
STATE OF CALIFORNIA

Brown AND Caldwell

451 A Street, Suite 1500
San Diego, CA 92101

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AFY	Acre-feet per Year
BC	Brown and Caldwell
CEQA	California Environmental Quality Act
CIP	Capital Improvement Plan
DDW	Division of Drinking Water; CA Water Board
DFC	Downstream Flow Control
DFW	Department of Fish and Wildlife
District	Vista Irrigation District
DSOD	Division of Safety of Dams
ENR	Engineering News Record
EVWTP	Escondido-Vista Water Treatment Plant
Flume	Vista Flume
FY	Fiscal Year
GIS	geographical information system
HABs	Harmful Algal Blooms
lf	linear feet
LWS	Local Water System (Warner Basin, Lake Henshaw, etc.)
NEPA	National Environmental Policy Act
NPV	Net Present Value
O&M	Operations and Maintenance
PAYGO	Pay As You GO
Project	Flume Replacement Project
RAR	Recommended Alignment Report
Rincon	Rincon del Diablo Municipal Water District
RFP	Request for Proposal
ROW	Right-of-Way
PS	Pumping Station
SRF	State Revolving Fund
SQMP	Stormwater Quality Management Plan
Study	Flume Replacement Alignment Study
UAS	Unmanned Aerial System
UFC	Upstream Flow Control
USACE	United States Army Corp of Engineers
VID	Vista Irrigation District
WIFIA	Water Infrastructure Finance & Innovation Act
WSPS	Water Supply Planning Study

Section 1

Introduction & Objectives

Summary:

- **Preferred Alignment:** The Fine Screening evaluation recommends Alternative 1 as the preferred alignment and retains the Beginning Corridor of Alternative 2 as a contingency during preliminary design.
- **Local Water System (LWS) Improvements:** Climate-based predictive modeling supports the long-term viability of a Flume Replacement project plus targeted investments in the LWS, which include HABs mitigation measures and Warner Basin wellfield improvements.
- **Affordability Check-in:** Despite escalating capital and financing costs the decision To Flume maintains a $153 million 30-year Net Present Value economic advantage over Not to Flume.
- **Next Steps:** Should the District elect to proceed with the recommended alignment the District should continue efforts to secure a diverse funding portfolio, prepare the project's CEQA support documents, and initiate a Request for Proposal (RFP) for final design.

In 2019 Vista Irrigation District (District) contracted Gillingham Water to conduct the District's Water Supply Planning Study (WSPS), which evaluated options for either replacing or retiring the Vista Flume (Flume), known then as the *"To Flume or Not to Flume"* evaluation (see **Figure 1-1**). By March 2020, the WSPS presented to the District's Board that the To Flume option was the more favorable long-term solution, being the least costly option to the District, providing superior supply reliability and affording the opportunity for continued regional cooperation with neighboring agencies. On April 1, 2020, the Board voted to advance the To Flume option to its planning stage and on April 2021, the District contracted the Brown and Caldwell (BC) team to conduct the Flume Replacement Alignment Study (Alignment Study) which seeks to answer the question, *"How to Flume?"*.

Figure 1-1. To flume or not to flume scale; WSPS Workshop #3

The Alignment Study team has thus far:

1. evaluated a reasonable range of corridors for the Flume replacement project,
2. found a total of six alignments recommended for alternatives evaluation,
3. generated planning level cost estimates for each alignment,
4. developed evaluation criteria and performed an initial Coarse Screening which shortlisted two of the six alignments,
5. completed field investigations and additional planning efforts to inform a set of Fine Screening evaluation criteria,
6. conducted the Fine Screening evaluation arriving at a single preferred alignment, and
7. performed affordability check-ins throughout the study confirming whether the decision To Flume remained the more favorable long-term decision.

1.1 Background and Purpose

The Flume, as shown in red in **Figure 1-2**, is an integral component of the District's water supply system, conveying the District's portion of local (Lake Henshaw) and purchased (San Diego County Water Authority) raw water treated at the Escondido-Vista Water Treatment Plant (EVWTP) to Pechstein Reservoir. The Flume consists of above-grade unpressurized gunite bench structures (benches), buried pressurized steel or concrete pipelines (siphons), and an unpressurized rock tunnel. The Flume has provided multiple generations of District customers with local/purchased water over its impressive nearly 100 years of service; however, it has reached the end of its useful life.

The purpose of the Alignment Study is to identify, from among a broad range of alternatives, a preferred alignment for a Flume replacement that will provide District customers with reliable service for the next 100-years.

The Alignment Study evaluates multiple alignment alternatives for replacing the existing Flume, guides the selection of a preferred alignment, and prepares the conceptual documents describing the approach for implementing the future Flume Replacement Project (Project). The Alignment Study is focused on addressing:

- feasibility and cost-effective construction
- reliability
- environmental effects
- long-term operations and maintenance (O&M), as well as
- affordability, rate impacts, and funding options.

Figure 1-2. Regional water supply facilities; 2016 VID master plan

1.2 Planning Objectives

The Alignment Study's goal is to develop a future Project that will convey high quality water from the District's local water resources to its customers in an economically (highest reliability at the lowest cost) and environmentally responsible manner. To meet this goal, the following success factors and planning objectives were created to guide the Alignment Study team:

Success Factors

Critical factors for the success of this Alignment Study include:

- Consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation, per California Environmental Quality Act (CEQA) Guidelines, through a comprehensive alternatives evaluation process.
- Avoid surprises related to feasibility or cost that unexpectedly tips the balance scale on the "To Flume or Not to Flume" decision by preparing detailed construction cost estimates, regularly track the market relative to capital and financing costs, as well as checking long-term affordability based on climatological predictive local yield modeling.
- Support the District's decision to replace the Flume by presenting a clear project roadmap in a recommended alignment report (Phase 5) that includes a project funding plan for the preferred alignment.

Planning Objectives

The Alignment Study's planning objectives serve as the roadmap for delivering a successful plan for project implementation, and are as follows:

1. **Alignment Criteria and Alternatives Evaluation:** Develop custom criteria to aid in identifying alignment preferences, including cost, reliability, water quality, environmental protection, constructability, accessibility, existing water supply obligations and assets, EVWTP operations, phasing and funding opportunities, regulatory compliance, and hydraulic constraints. Using the established criteria, develop and evaluate multiple project alignment alternatives for replacing the Flume.
2. **Funding Support:** Accurately estimate the cost of construction and identify funding opportunities available to the District; link costs and funding (i.e., low-interest loans, grants, and cash funding) to quantify the true cost that the Project will have on the District's ratepayers.
3. **Project Affordability Checks:** Continue testing the affordability of the "To Flume" project against the "Not To Flume" project. Periodically check the "To Flume or Not To Flume" balance scale has not tipped during this Alignment Study in a manner that reverses the decisions made following the WSPS. This work will account for the changing capital and financing costs associated with the project, ongoing work associated with restoring the local water system at Lake Henshaw and the Warner Basin Wellfield as well as changing climate trends impacting the long-term local yield and local water deliveries. If the scale ever tips, the Board may wish to consider an off-ramp.
4. **Assess Potential Environmental Impacts:** Throughout the Alignment Study, evaluate potential environmental impacts alignment alternatives may have and the necessary mitigation measures needed to recommend the appropriate CEQA/National Environmental Policy Act (NEPA) documentation for the Project.
5. **Convene Multiple Workshops with the Board:** Present clear and transparent information to the Board and public for their consideration at significant milestones during the Alignment Study. Each workshop represents an important building block, which will form consensus for later workshops throughout the course of the Alignment Study.

1.3 Study Phases and Current Phase Objective

The Alignment Study's scope of services is structured into five phases with three Board workshops, as listed below. The study is currently in *Phase 4 – Fine Screening*, where a more detailed approach was taken to evaluate the two previously shortlisted alternative alignments and make a recommendation for advancing one preferred alignment to *Phase 5 – Recommended Alignment Report (RAR)*. During Phase 5, a RAR will be prepared with the details necessary to support the project's future stages of implementation, such as, final design and environmental document preparation. The following is a listing of the study's phases and Board workshops; the *blue* text indicates the current phase of work being presented herein.

- Phase 1: Project Initiation
- Phase 2: Long-list of Alternatives and Evaluation Criteria Development (Board Workshop No. 1)
- Phase 3: Coarse Screening Results and Recommended Short-list (Board Workshop No. 2)
- *Phase 4: Fine Screening Results and Proposed Project Selection (Board Workshop No. 3)*
- Phase 5: Recommended Alignment Report (RAR)

1.4 Recap of Board Workshop No. 1

Board Workshop No. 1 was held on August 24, 2021 and presented the *Phase 2 – Long-list of Alternatives* results of the Alignment Study. During the workshop, the Alignment Study team presented a long-list of project alternatives, establishing the six alignments recommended for *Phase 3 – Coarse Screening*, provided an update on Flume replacement project costs, shared findings from external condition assessments performed on the Flume, and checked the updated project affordability using the WSPS's To Flume vs. Not To Flume analysis.

Board consensus was reached to advance the recommended six alignments to Coarse Screening. The Board also provided the Alignment Study team with feedback on the draft evaluation criteria proposed for use during Coarse Screening, as well as offered discussion pertaining to the changes observed in the overall affordability of the Flume's replacement since the completion of the WSPS. Below is a list of the conclusions and next steps taken from Workshop No. 1.

Workshop No. 1 Conclusions

The following list of conclusions were presented at Board Workshop No. 1:

1. **Six alignments have been developed** which define a reasonable range of project alternatives and are recommended for Coarse Screening (see **Figure 1-3**).
2. Costs have risen since the WSPS and there is no sign of decline; however, the decision **"To Flume" continues to be the economically preferred** alternative than "Not To Flume."
3. More condition assessment confirms **retiring the Flume remains a high priority** and establishes a recommended order of priority for its replacement.
4. As costs continue to increase, and the priority of replacing the Flume heightens, so does the likelihood of requiring financing; **advancing financial planning efforts for this project would be prudent.**

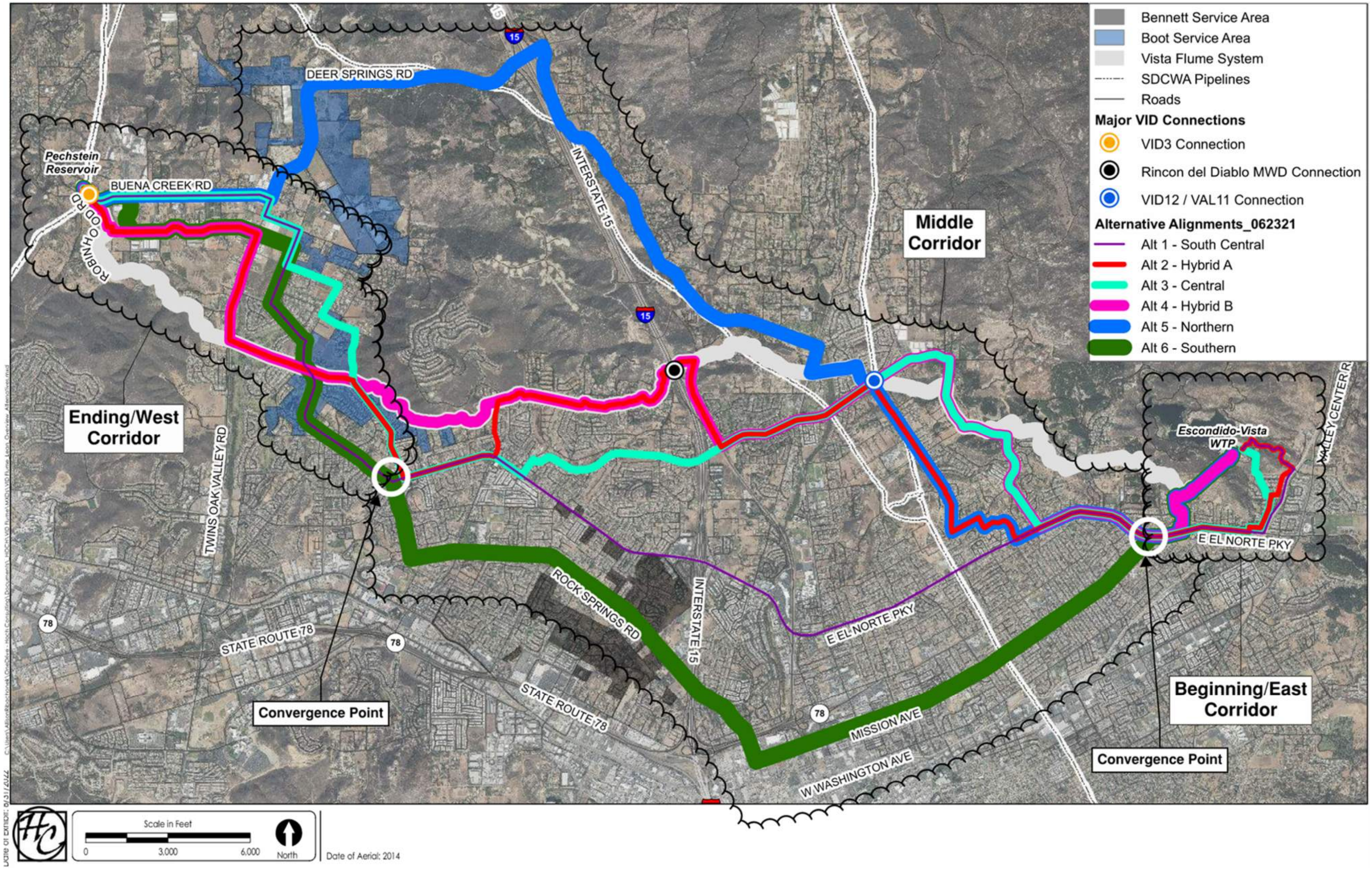


Figure 1-3. Long-list of alternative alignments presented in Workshop No. 1

1.5 Recap of Board Workshop No. 2

Board Workshop No. 2 was held on September 20, 2022 and presented the results of *Phase 3 – Coarse Screening* to the Board. During the workshop the Alignment Study team reviewed the six alignments evaluated, shared updated capital costs, and presented the Coarse Screening evaluation process resulting in a recommended shortlist of alternatives to advance toward *Phase 4 -Fine Screening*. In addition, the team presented the results of a preliminary financial analysis used to assess the rate impacts associated with various options for project phasing and funding.

When preparing for Workshop No. 2 the District was studying more closely the impacts of Harmful Algal Blooms (HABs) at Lake Henshaw. Additionally, financial analysis was performed to incorporate the potential options for addressing HABs, and incorporated the findings in another update to the project affordability check-in using the To Flume vs. Not To Flume Balance Scale analysis. The team performed this additional analysis because of potential effects of a future HABs related project could have potentially significant impacts to the financial viability of a Flume replacement project.

Board consensus was reached to advance the shortlisted alignments to Fine Screening. The Board also provided feedback on the Balance Scale Affordability Check-in to closely consider how future climatology might affect local yield. Below is a list of the conclusions and next steps taken from Workshop No. 2.

Workshop No. 2 Conclusions

The following list of conclusions were presented at Board Workshop No. 2:

1. The Alignment Study evaluated a broad range of alternatives during Coarse Screening. It is recommended to advance **Alternatives 1 and 6 plus the Beginning and End Corridors of Alternative 2 to Fine Screening** (see Figure 1-4).
2. **PAYGO is no longer a sustainable option, and capital financing will be required.** Hiring a municipal financial advisor is recommended to initiate the financial planning needed to prepare the District for capital financing.
3. **The To Flume option retains significant cost advantage in comparison to the Not To Flume option,** even when accounting for improvements at Lake Henshaw and Warner Basin; so long as the District's share of average annual local yield is above 2,200 afy.
4. The District may move forward with confidence that **investments in the local water system resulting in improved local yield will have a significant economic advantage** to the District and its ratepayers.
5. The updated Balance Scale **analyses supports the District's continued investment in project planning**, for both the HABs Plan as well as this Flume Replacement Alignment Study.

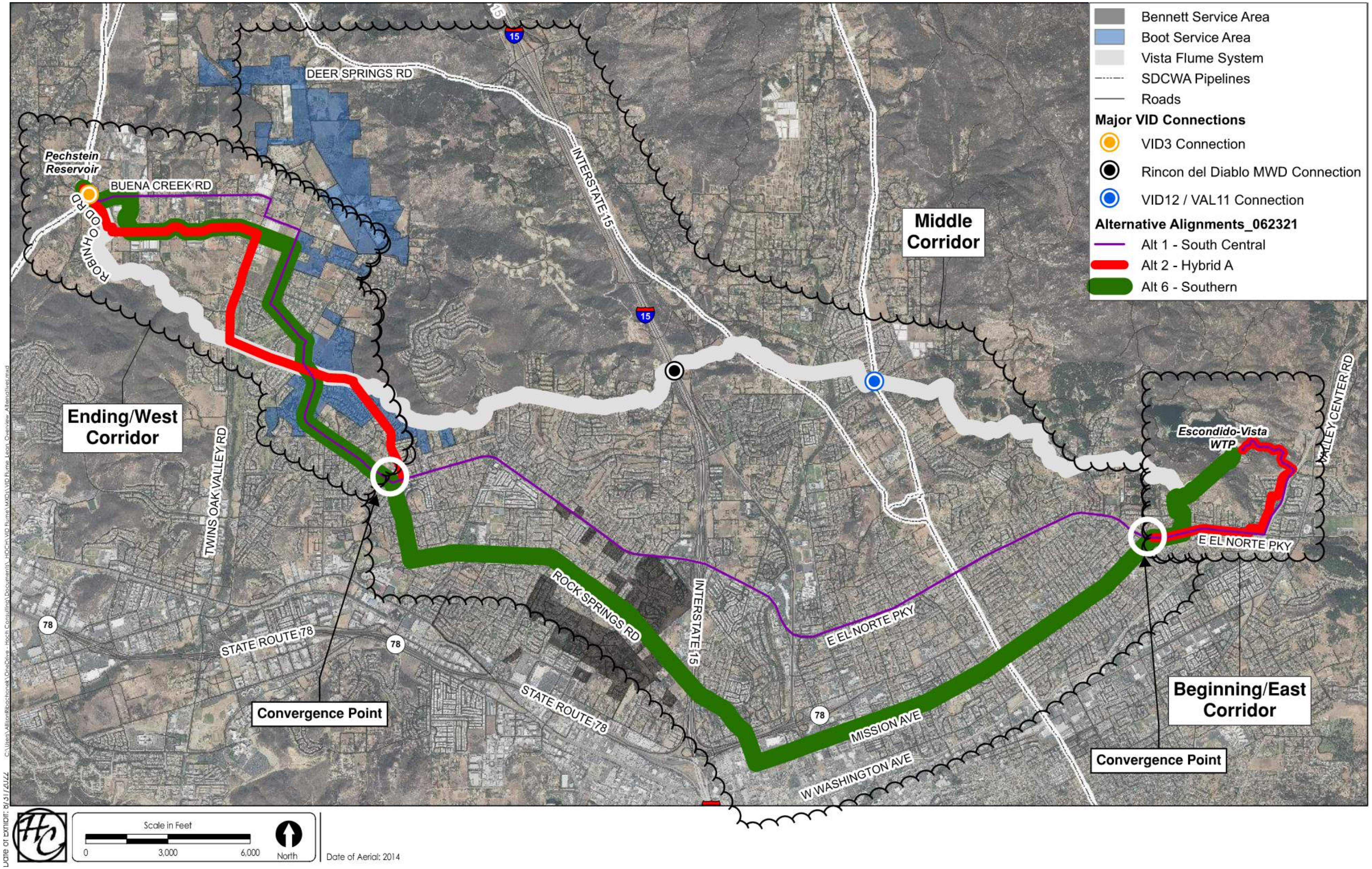


Figure 1-4. Shortlisted alignments presented in Workshop No. 2

Workshop No. 2 Next Steps

The following list of next steps were presented at Board Workshop No. 2 and earned the Board's support for progressing the Alignment Study into *Phase 4 – Fine Screening*. The green text denotes the status of these next steps as of the time this briefing document was produced (November 2023).

1. Proceed with *Phase 4 - Fine Screening Results and Proposed Project Selection* of the Alignment Study – completed and presented herein under **Section 3.**
2. Continue investigating options for mitigating HABs as well as optimizing the Warner Basin Wellfield –ongoing; work is being managed by District staff. Updated investment scenarios are presented herein under **Section 4.6**, accounting for these future projects.
3. Perform a predictive model of future local yield considering climate change factors to meet the requirements of funding sources such as Water Infrastructure Finance & Innovation Act (WIFIA) –completed and presented herein under **Section 4.**
4. Hire a municipal financial advisor to initiate financial planning, develop a rate design to fund the Flume's replacement, and prepare the District for capital financing –ongoing; the District hired NHA Advisors on November 1, 2023.
5. Continue to collect the data required to initiate environmental documentation at the conclusion of this Study – ongoing; working is being performed by the Alignment Study team as well as the District's environmental consultant using data initially collected during this Alignment Study.
6. Conduct another affordability check-in for presentation at Board Workshop No. 3 – completed and presented herein under **Section 5.**

1.6 Purpose of Board Workshop No. 3

The purpose of Board Workshop No. 3 is to share the *Phase 4 – Fine Screening* results, present the recommended preferred alignment, and reach consensus on advancing the recommended alignment to *Phase 5 – Recommended Alignment Report* of the Alignment Study. Discussions will focus on the current estimated project costs, predictive local yield modeling considering various climatological scenarios, and an updated To Flume vs. Not To Flume affordability check-in.

Section 2

Overview of Alternatives

Summary:

- Alternatives 1 and 6 were further evaluated using additional data collected in the field, from utility agencies, and project stakeholders. This included the "Beginning" and "End" corridors of Alternative 2 as well.
- Stakeholder input was collected from EVWTP's Operations Staff, City of Escondido Engineering, and Rincon Del Diablo MWD relative to Flume flow control, interconnect locations, and general alignment preferences.
- Escalation has slowed; the current (September 2023) planning level capital cost estimate for the Flume Replacement project is $180 million; a 5.9% increase compared to the July 2022 planning level cost of $170 million.

2.1 Alternative Alignments Development

Establishing a reasonable range of project alternatives to follow prudent infrastructure planning processes and conform with CEQA guidelines for alternative evaluations.

The WSPS developed two alignment alternatives, "All-new" and "Hybrid". These two alternatives established the broadest reasonable range of alternatives which served as a baseline for assessing the high-level feasibility and economic viability of a Flume replacement project, To Flume, versus a sole Flume retirement project, Not to Flume. However, when evaluating the implementation of a To Flume project, more than two project alternatives reasonably exist and needed to be explored for prudent infrastructure planning and to conform with CEQA guidelines.

Following the recommendations of the WSPS, this Alignment Study was initiated. Six unique alignments were conceptualized during *Phase 2 – Long-list of Alternatives* of this Alignment Study and were presented to the District's Board at Workshop No. 1. The alignments were developed to span a wide range of reasonable alternatives evaluating alternatives for mitigating long-term operability, access, compliance with the Division of Drinking Water's (DDW) regulations, environmental compliance, community impacts, capital costs, and more. The six conceptualized alignments, as shown on **Figure 1-3** above, included the following:

- Alternative 1 – South Central (Purple)
- Alternative 2 – Hybrid A (Red)
- Alternative 3 – Central (Cyan)
- Alternative 4 – Hybrid B (Pink)
- Alternative 5 – Northern (Blue)
- Alternative 6 – Southern (Green)

Phase 3 – Coarse Screening shortlisted Alternatives 1 & 6 as well as the Beginning and End Corridors of Alternative 2 for Fine Screening, to allow for combining the best Beginning, Middle, and End corridors.

The six alignments shared two common convergence points, labeled using white circles on **Figure 1-3**. This allowed the alignments to be grouped into three corridors, called "Beginning", "Middle", and "End". Grouping by corridors allowed the team to isolate the comparison of the six alignments to within their three respective corridors, which resulted in a shortlisting of the best Beginning, Middle, and End alternatives.

Unique risk versus cost evaluation criteria were developed, and the six alignments were compared using the Coarse Screening process. Based on the results shown below in **Table 2-1**, Alternatives 1 and 6 were shortlisted along with the Beginning and End Corridors of Alternative 2 as shown on **Figure 1-4** above and **Table 2-1** below.

Table 2-1. Shortlisted Corridors Recommended for Fine Screening

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Corridors	**South Central**	**Hybrid A**	**Central**	**Hybrid B**	**Northern**	**Southern**
Beginning	Yes	Yes	No	No	No	Yes
Middle	Yes	No	No	No	No	Yes
End	Yes	Yes	No	No	No	Yes

Phase 4 – Fine Screening of this Alignment Study mobilized the team to perform site investigations intended on augmenting the project data such that the overall evaluation process was enhanced with more detailed in-situ risk and cost factors.

At the initiation of *Phase 4 – Fine Screening* each shortlisted alignment (Alternatives 1, 2, and 6) within their respective corridors (Beginning, Middle, and End) were examined closer, refined, and developed to greater detail. This included additional data collection both at a desktop level as well as in the field. Site walks of the shortlisted alignments, follow-up stakeholder meetings, and additional engineering analyses supported the Fine Screening evaluations relative to permitting feasibility, construction complexity, as well as the future operations and maintenance of each alternative. This work informed the risk versus cost analyses presented in **Section 3**, which was the basis for the Fine Screening evaluation resulting in the recommendation of the one preferred alignment. Below is a summary of the Phase 4 field work performed to augment the project's data and better inform the Fine Screening evaluation process.

GEOTECHNICAL FIELD INVESTIGATIONS

The field data collection for this project began by securing permits from the cities of Escondido and San Marcos, and the County of San Diego. The permit issuance dates were as follows: Escondido on May 16, 2023, San Marcos on May 9, 2023, and the County of San Diego on July 21, 2023. The 15 geotechnical borings associated with these permits were conducted in four field mobilizations, targeting various borehole locations to assess bedrock rippability, groundwater, and soil characteristics. The first three mobilization dates performed on June 1st, 2nd, and 9th, targeted areas within the cities of Escondido and San Marcos. Due to significant permitting delays with the County of San Diego, the final mobilization was performed on August 23, 2023. Seven total borings were associated with hard rock investigations. Eight other borings were associated with groundwater and soil characterization. Hard bedrock materials were encountered in three of the seven borings, while groundwater and soil contamination was not found. A total of nine borings found the presence of groundwater at depths ranging from 11-feet to 21.5-feet below ground surface.

Geophysical testing was performed as part of this project to provide subsurface utility clearance for the geotechnical borings and to assess the hardness of subsurface materials using seismic refraction and Multichannel Analysis of Surface Waves (MASW) methods. Utility clearance teams performed their work on May 19, 2023, and August 22, 2023, prior to the geotechnical boring mobilizations; 23 seismic refraction lines and two MASW lines were performed as part of the hard rock evaluation of this work. Generally, the work areas primarily consisted of evaluating the proposed alignments coming down from the EVWTP and along select areas within known bedrock formations along the middle and end corridors. Notable areas of hard rock concern were identified from the EVWTP down to the flat land areas along the middle corridors. It should also be noted that hard rock materials should be anticipated in wherever deep (greater than 20 feet below ground surface) tunnel crossings are proposed.

ALIGNMENT SITE WALKS

Coinciding with the above-mentioned geotechnical investigations, the consultant team deployed a group of pipeline design engineers to walk the shortlisted alignments with District staff. The intent of these walks was to visually locate utilities and obstructions which may present unique challenges during construction. It was also intended to identify unique crossing opportunities where pipeline construction operations would benefit from trenchless installation methods. In which case, trenchless pit locations and construction laydown areas were conceptualized. Lastly, special attention was given to areas impacting sensitive receptors, such as schools and churches, as well as residential, commercial, or otherwise highly trafficked areas. All notes and photos collected from the alignment walks were digitized and geocoded for use in *Phase 5 – RAR* and the eventual final design. The photos provided below are examples taken from the alignment walks; examples that show documented areas with significant utility congestion, unique construction laydown constraints, and highly trafficked commercial zones, respectively. Example photos taken from the alignment walks are provided below, see Figure 2-1 below.

Figure 2-1. Example photos taken from alignment walks

KEY STAKEHOLDER ENGAGEMENTS

In summary, no fatal flaws were discovered amongst the shortlisted alternatives evaluated during *Phase 4 – Fine Screening*. Stakeholder preferences were identified and supported an informed Fine Screening evaluation process. The following are some of the key stakeholder engagements conducted during this alignment study.

Division of Drinking Water (DDW): In February 2022, District staff along with the Alignment Study team conducted a project initiation meeting with DDW. The objectives of the meeting were to introduce the possible Flume replacement project to DDW staff, define the pertinent hydraulic criteria required for permitting the future Flume's replacement as a fully pressurized system, and determine if any specific exceptions may apply. Outcomes of this meeting, which shaped the conceptual hydraulic analyses, included:

- a minimum pressure of 20-psi across the entire system is the initial basis used for permitting a fully pressurized system,
- exceptions are granted case-by-case for systems operating between 5- and 20-psi where additional public safety measures are taken, and
- systems cannot operate below 5-psi unless the low-pressure section of the main is on a District control property and additional public safety measures are taken.

City of Escondido: In March 2022, a utility coordination and alignment review meeting was held with the City of Escondido's (Escondido's or Escondido) Public Utilities and Engineering departments. This meeting reviewed the six alternative alignments with Escondido, received feedback pertaining to any missing or useful information to be considered during the Coarse Screening evaluation, and discussed Escondido's general preferences between the alternative alignments. During this meeting, Escondido expressed their preference toward the El Norte Pkwy alignment (Alternative #1). They noted that although the corridor contains several utilities, the alignment has larger rights-of-ways with open corridors available for the future Flume replacement pipeline. A follow-up engagement was conducted in April 2023 where more detail was presented on the shortlisted alignments and the above mentioned preferences were reaffirmed with the City's staff.

EVWTP Operations Staff: Also in March 2022, an initial hydraulics discussion was held with the EVWTP's operations staff to discuss existing plant configurations and operations, conceptual flume hydraulics, and Escondido's possible interest in receiving treated water from the District. A second meeting was conducted in May 2022, which advanced the previous discussions by reviewing more detailed hydraulic calculations and establishing the operators' preferences for potentially modifying EVWTP, operating the future Flume replacement pipeline, and receiving treated water via backfeed from the future pipeline. Key takeaways from these meetings included:

- their strong preference that flow control remain at the EVWTP site,
- pressure may be sustained downstream at Pechstein to maintain adequate Flume pressures, and
- a treated water connection backfeeding from the District's system would be of interest to Escondido for redundancy.

The most recent stakeholder engagement between the District and EVWTP's operations staff was held in August 2023. At this meeting, it was decided that connecting the future Flume to EVWTP's finished water reservoir improves plant staff's management of system demands and finished water quality, while simplifying the pipeline alignment off the EVWTP site. This was confirmed as the preferred approach by EVWTP's staff, who after the meeting provided the following schematic (see

Figure 2-2) which shows the preferred connection point adjacent to the EVWTP's finished water reservoir.

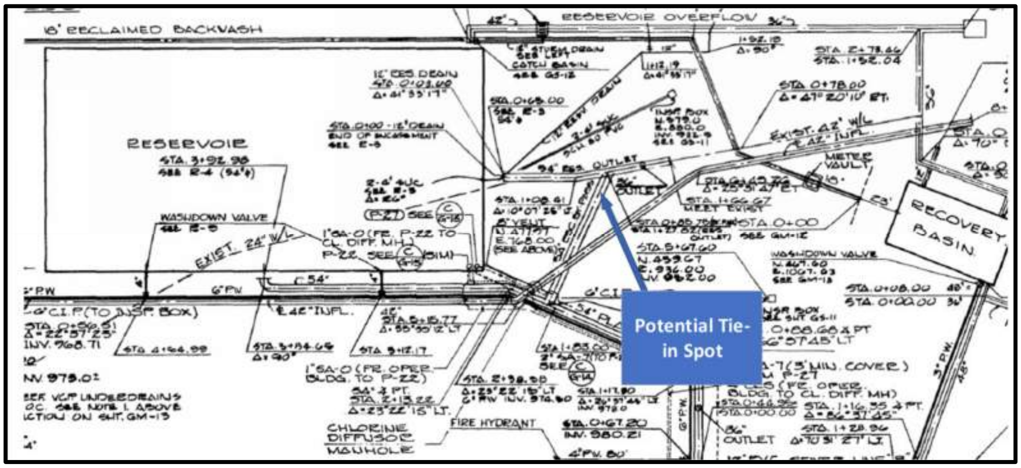


Figure 2-2. Exhibit used in stakeholder engagement with EVWTP operations staff

Rincon Del Diablo MWD: A stakeholder engagement meeting was held between District and Rincon del Diablo Municipal Water District (Rincon) in September 2023. The exhibit shown below (see Figure 2-3) was presented to Rincon's staff and used to discuss options for maintaining their existing connection. Both alignments, Alternatives 1 and 6, allows Rincon to keep their existing pump station that is required to feed their service area. Rincon also has the option to assume responsibility of a portion of the District's pipeline no longer needed after the Flume is replaced to minimize their need for pipeline extensions. A preference for Alternative 1 was identified for maintaining Rincon's existing connection as it offers better supply pressures, less construction risks, and lower capital costs.

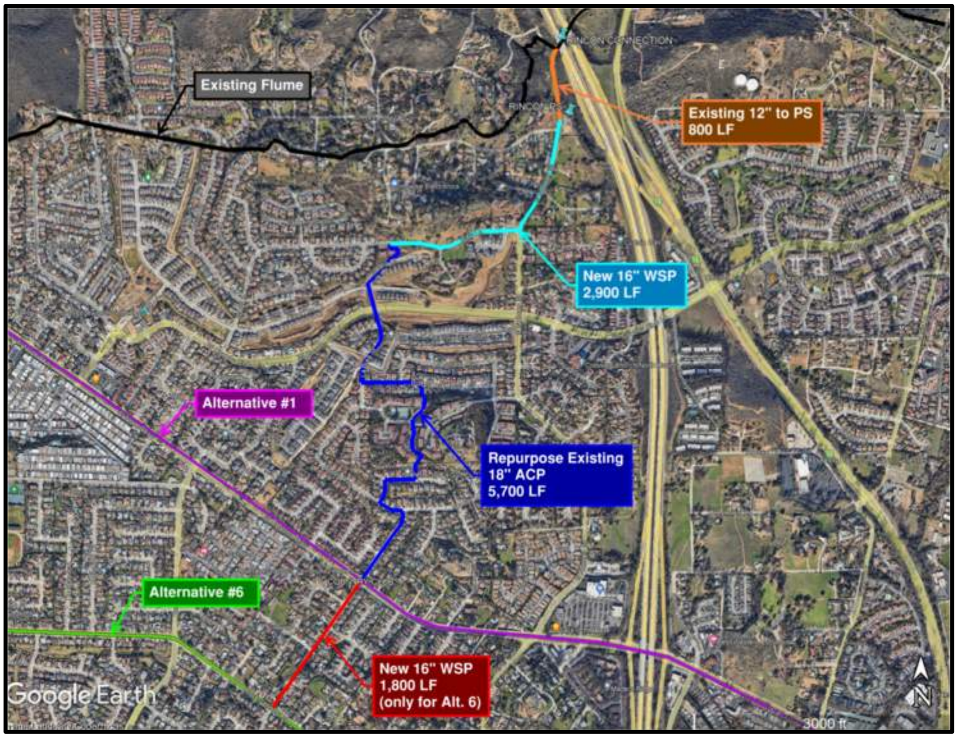


Figure 2-3. Exhibit used in stakeholder engagement with Rincon Del Diablo

The shortlisted alignments allowed for more detailed review and comparisons of the alignments, which enhanced the side-by-side comparisons of the alignments and their eventual fine screening.

The shortlisted alternative alignments shown on Figure 1-4 are compared at a high level side-by-side in Table 2-2 below.

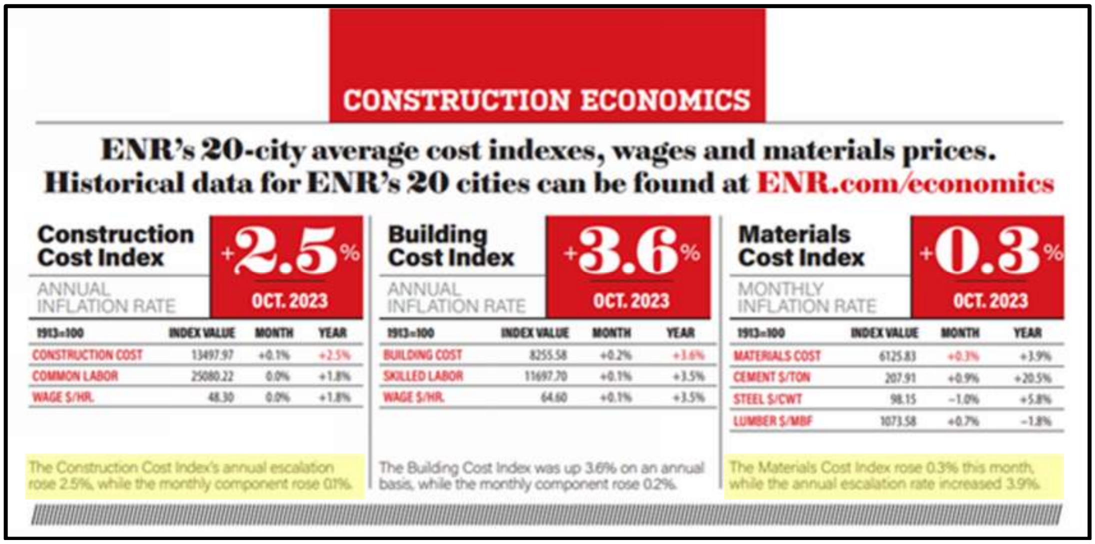
Table 2-2. Alternative Alignments Summary

	Alt 1	Alt 2	Alt 6
	South Central	Beginning/End Corridors	Southern
Length (mi) • Beginning • Middle • End • Total	 1.8 5.9 4.0 11.7	 1.8 0.0 3.9 5.7	 1.2 6.8 3.9 11.9
Contains Low Head Segments	No	Yes (Boot)	Yes (Big Tunnel + Boot)
Direct Connection to: • Rincon del Diablo MWD • Boot/Bennett	• Yes • Yes	• N/A • Yes, but requires special exemptions from DDW	• Yes, but requires special exemptions from DDW • Yes
Takeaway	A direct route in ROW that pressurizes the Flume and avoids risky & difficult hillsides; avoids Big Tunnel but uses more trafficked corridors	Keeps easements in low-risk areas and entirely avoids easements in risky & difficult hillsides; also avoids Big Tunnel, but keeps the existing low head section in Boot	A direct route in ROW that pressurizes the Flume and avoids risky & difficult hillsides; uses Big Tunnel and more-trafficked higher congested corridors
Pros	• Most favorable hydraulic operations • Avoids all hillsides and steep slopes • Preferred connection to Rincon and Boot & Bennett • Preferred alignment by City Escondido and EVWTP staff • No special exemptions needed from DDW • Lowest cost and risk middle corridor	• Utilizes low-risk easements • Suitable alternative to the preferred Beginning corridor	• Lowest elevation – pressurization without tunneling or pumping • Uses existing portions of the Flume • Encounters more favorable geologic conditions • Generally avoids more utility congested areas
Cons	• Uses more heavily trafficked corridors • New I-15 crossing • Encounters hard rock • Has highly trafficked and utility congested segments	• Additional tunneling required thru high points • Low head system at Boot; special exemptions needed from DDW • Encounters least favorable geologic conditions • Has highly trafficked and utility congested segments	• Least favorable hydraulic operations • Retain segments on steep hillside slopes • Rincon del Diablo MWD connection, but required special DDW permitting • New I-15 and SR-78 crossing • Low head system at Big Tunnel and Boot; special exemptions needed from DDW • Highest cost and risk middle corridor

2.2 Current Updated Construction Costs

Construction industry costs continue to escalate but have slowed relative to previous years; costs have escalated by ~6% since last year's Board Workshop No. 2.

Both construction materials and labor prices have continued to increase due to ongoing supply chain disruptions. However, compared to the previous two years, escalation has slowed significantly. Below is an excerpt from Engineering News Record's (ENR's) October 2023 publication on Construction Economics. ENR reported monthly variabilities in construction costs resulting in observed annual escalation rates ranging from 2.5 percent to 3.9 percent. This has decreased from the 5.7 percent to 20 percent range presented during last year's Board Workshop No. 2, which referenced ENR's August 2022 publication. This leveling of escalation, caused by leveling costs of commodities and labor, is a likely result of the Federal Reserve's effort to slow the economy with increased interest rates. The effects increased interest rates will have on the affordability is accounted for in the balance scale modeling presented in Section 5.



CONSTRUCTION ECONOMICS

**ENR's 20-city average cost indexes, wages and materials prices.
Historical data for ENR's 20 cities can be found at ENR.com/economics**

Construction Cost Index +2.5% ANNUAL INFLATION RATE OCT. 2023

1913=100	INDEX VALUE	MONTH	YEAR
CONSTRUCTION COST	13497.97	+0.1%	+2.5%
COMMON LABOR	25080.22	0.0%	+1.8%
WAGE $/HR.	48.30	0.0%	+1.8%

The Construction Cost Index's annual escalation rose 2.5%, while the monthly component rose 0.1%.

Building Cost Index +3.6% ANNUAL INFLATION RATE OCT. 2023

1913=100	INDEX VALUE	MONTH	YEAR
BUILDING COST	8255.58	+0.2%	+3.6%
SKILLED LABOR	11697.70	+0.1%	+3.5%
WAGE $/HR.	64.60	+0.1%	+3.5%

The Building Cost Index was up 3.6% on an annual basis, while the monthly component rose 0.2%.

Materials Cost Index +0.3% MONTHLY INFLATION RATE OCT. 2023

1913=100	INDEX VALUE	MONTH	YEAR
MATERIALS COST	6125.83	+0.3%	+3.9%
CEMENT $/TON	207.91	+0.9%	+20.5%
STEEL $/CWT	98.15	-1.0%	+5.8%
LUMBER $/MBF	1073.58	+0.7%	-1.8%

The Materials Cost Index rose 0.3% this month, while the annual escalation rate increased 3.9%.

In July 2021, during Phase 2 of the Alignment Study, the cost estimates prepared during the WSPS were updated using then 2021 market pricing. Total project costs had increased significantly since the final WSPS Board Workshop was held on March 2020, by approximately 18 percent over the $120 million estimate in 2020 dollars for an "All-new" Pipeline.

In July 2022, during Phase 3 of this Alignment Study, the team updated the cost estimates again using current year market pricing. Estimated construction quantities were also refined as the six alternative alignments had been further developed since Phase 2 of the Alignment Study. Although the individual unit price increases escalated by approximately 12-percent on average, the total impact to the estimated project cost was mitigated to within 8- and 10-pecent. This mitigated impact to costs was a product of further developing the alignments to a point where more precise construction quantities could be calculated. The planning level estimates prepared yielded project costs between $154 million to $184 million in 2022 dollars. Note, during *Phase 3 – Coarse Screening* a planning level capital cost of $170 million was used for the Balance Scale economic analysis.

In September 2023, during *Phase 4 – Fine Screening*, the estimates were updated again using more detailed information collected during the recent field investigations, as well as current 2023 market pricing, applied to only the shortlisted alignment alternatives. The current range of projected capital costs has narrowed to between $178 million and $183 million in 2023 dollars. A planning level capital cost of $180 million was used for the Balance Scale economic analysis performed in *Phase 4 – Fine Screening* because this amount corresponds to the preferred alignment alternative recommended in Section 3 below. Note, moving forward with $180 million as the current planning costs equates to a 5.9% escalation over the $170 million used for Workshop No. 2 (September 2022).

See Table 2-3 below for a summary of the most recent estimated Flume replacement costs per alignment.

Table 2-3. Planning Level Estimated Costs

	Alt 1	Alt 2	Alt 6
	South Central	Hybrid A	Southern
Construction Costs [a,b]	$129 M	$122 M [d]	$131 M
Soft Costs [c]	$51 M	$24 M [d]	$52 M
Total	**$180 M** [e]	**$178 M** [d]	**$183 M**

a. All costs presented herein are in 2023 dollars and have been rounded to the nearest $1 million.

b. Includes labor, materials, subcontracts, equipment, and contractor overhead and profit.

c. Includes environmental permitting, easements, design, administration, third party construction management, and onsite environmental and cultural monitoring.

d. Alternative 1 Middle corridor cost was added to Alternative 2 Beginning and End Corridors to facilitate a "full alignment" cost comparison. Alternative 1 was selected because it is the preferred Middle corridor from Fine Screening.

e. Estimated costs for the preferred alternative recommended in Section 3.2 *below.*

Section 3

Alternatives Evaluation – Fine Screening

Summary:

- Fine Screening evaluated the “Beginning”, “Middle”, and “End” corridors of Alternatives 1 and 6 as well as the “Beginning” and “End” corridors of Alternative 2.
- The recommended preferred alignment is Alternative 1 for all corridors, which offers the most balanced cost and risk solution when compared to the 15 other possible combinations of corridors evaluated during Fine Screening.
- The beginning corridor of Alignment 2 is retained as a contingency if construction along the Escondido Creek appears to be challenge during the early stages of design.

3.1 Risk vs. Cost Evaluation Approach and the Evaluation Criteria

Feedback received from Board Workshop No. 2 was incorporated into the final set of Fine Screening criteria, and sensitivity analyses were performed to remove inherent biases while fairly accounting for District and local stakeholder preferences.

Building upon Coarse Screening, the *Phase 4 - Fine Screening* process assigned weighing factors and scores to a customized set of criteria used to evaluate the Beginning, Middle, and End corridors of the shortlisted alignments shown on Figure 1-4.

Utilizing geospatial data and standard engineering practices, the Alignment Study ranked the alternatives, by corridor, against a set of cost versus risk-based evaluation criteria. The resulting scores facilitated the decision process in determining which alignment alternative provides the best project for all stakeholders.

After the initial Fine Screening was performed, a sensitivity analysis was conducted to verify that the weighing factors and criteria scores were applied consistently. Additionally, similar criteria were delineated to avoid any evaluation criteria having overlapping results which inadvertently double-counted for, or against, a particular alignment. The intent was to remove unintended bias in the evaluation process while fairly accounting for the preferences of the District and its stakeholders.

The draft evaluation criteria were presented to the Board in Workshop No. 2, and the Board’s feedback was incorporated in the final set of Fine Screening criteria, which are provided below in Table 3-1.

Table 3-1. Fine Screening Evaluation Criteria

Categories	Criteria Groups	Criteria
STAKEHOLDER COORDINATION	Community Impacts	• Traffic Impacts • Future Agency Projects • Impacts to Critical Facilities
	Land Ownership	• Easements/ROWs
	Environmental	• Biological Resources • Areas of Potential Contamination • Cultural Resources • Other CEQA Considerations
	Permitting	• Interagency Coordination • Special/Long-lead Permits (Cal DFW/USACE) • DDW Coordination
SYSTEM RELIABILITY	System Hydraulics	• Pressurization vs Low-Head • Transient Flow Impacts
	Operations and Maintenance	• Accessibility • Land Use • Operational (Hydraulics) Maintenance • Impacts to EVWTP • Agency Service Connection - Boot & Bennett • Agency Service Connection - Escondido • Agency Service Connection - Rincon
PROJECT DELIVERY	Constructability	• Geology • Utility Congestion • Alignment Length • Additional LF for Boot & Bennett Connections • Crossing/Construction Methods • Tunneling Length
	Schedule and Risk	• Schedule Factors • Phasing/Sequencing • Long-Term Vulnerability
	Project Affordability and Implementation	• Financial Exposure to Construction Costs • Mitigating Revenue Reduction (purchase from other agency) • Pavement Moratoriums

3.2 Fine Screening Results and Recommended Alignment

The risk vs. cost analysis shows an advantage towards Alternative 1 but highlights possible advantages may exist in the Beginning Corridor of Alternative 2.

Out of a total numeric risk score of 56 points (higher scores equal less risk), the highest risk score alignment (lowest risk) was 36.2 (Corridor 1.1.1), while the lowest risk score alignment (highest risk) was 31.6 (Corridor 6.6.2). “Corridor 1.1.1”, refers to a specific corridor that is designed using Alternative 1 for its beginning, middle, and end segments. Using this logic, “Corridor 6.6.2” refers to a different corridor that uses Alternative 6 for its beginning and middle segment, while end segment utilizes Alternative 2. Although the difference between these risk scores may not seem significant, their contrast becomes apparent when considering their capital costs. Table 3-2 below presents the numerical risk results for corridors of each alternative alignment.

Table 3-2 Risk Ranking per Segment

Corridors		Alt 1	Alt 2	Alt 6
		South Central	Hybrid A	Southern
Beginning	Rank [a]	#1	#2	#3
	Score [b]	12.2	12.0	11.7
Middle	Rank [a]	#1	Was not shortlisted	#2
	Score [b]	12.0		9.3
End	Rank [a]	#1	#3	#2
	Score [b]	12.0	10.4	11.2

a. *Ranking:*
   Green = Top ranked alternatives
   Yellow = Middle ranked alternatives
   Red = Lowest ranked alternatives

b. *Score = Risk Score as shown on the y-axis of the Risk/Cost Plot on* Figure 3-1 *below.*

Beginning Corridor

As presented in Figure 3-1 below, Alternative 1 represents the most reasonable corridor to construct the Flume’s replacement along the Escondido Creek channel due to its higher risk score (lower risk) and lower cost as compared to Alternative 2. However, because the Alternative 2 corridor score was very similar to Alternative 1, it is recommended to keep Alternative 2 for additional consideration as there may be utility congestion and other constructability challenges along the channel that would make Alternative 1 corridor less favorable during the design phase. Alternative 6 may look more attractive because it is less expensive when comparing costs along the x-axis of the charts but is not recommended as it will create significant permitting challenges with the DDW because of a low pressure portion of the system through Big Tunnel. Alternative 6 also has unfavorable characteristics such as long-term hydraulic performance limitations and segments located along steep hillside slopes which present higher risks to the long-term operations and maintenance of the future Flume replacement.

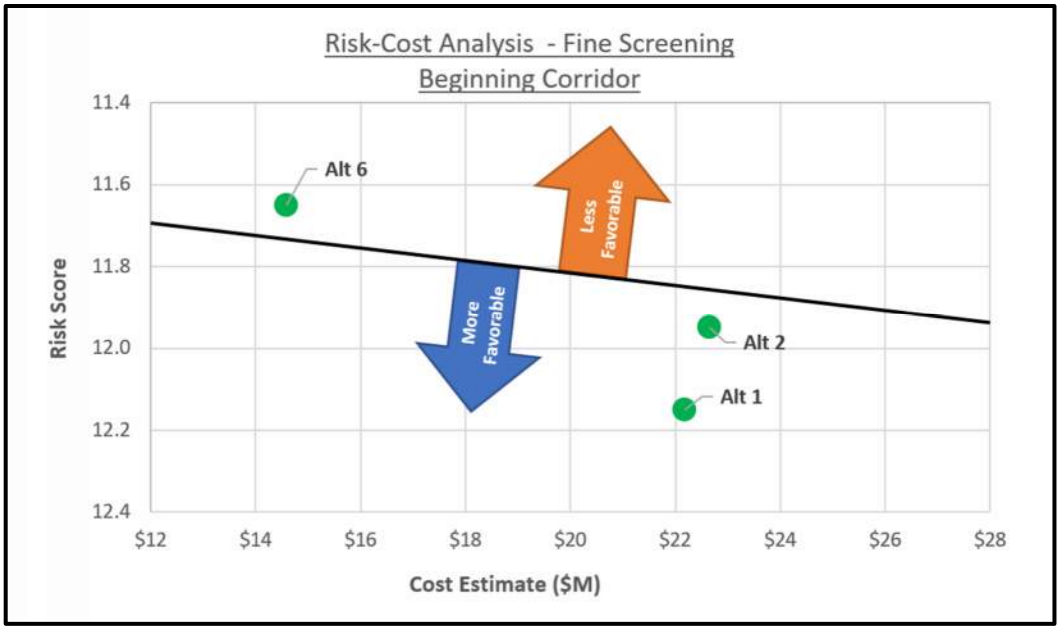


Figure 3-1. Risk vs cost results – beginning corridor

Middle Corridor

As shown in Figure 3-2 below, Alternative 1 is preferred for the Middle Corridor as it can be built at both a lower cost and risk compared to the other shortlisted alternative. Alternative 6 is likely to encounter hazardous materials from adjacent contaminated sites and impact cultural resources that that will increase project cost and extend schedule. There are also significant operational and maintenance benefits to Alternative 1 that cannot be realized through Alternative 6, which include allowing for service connections to Escondido and Rincon.

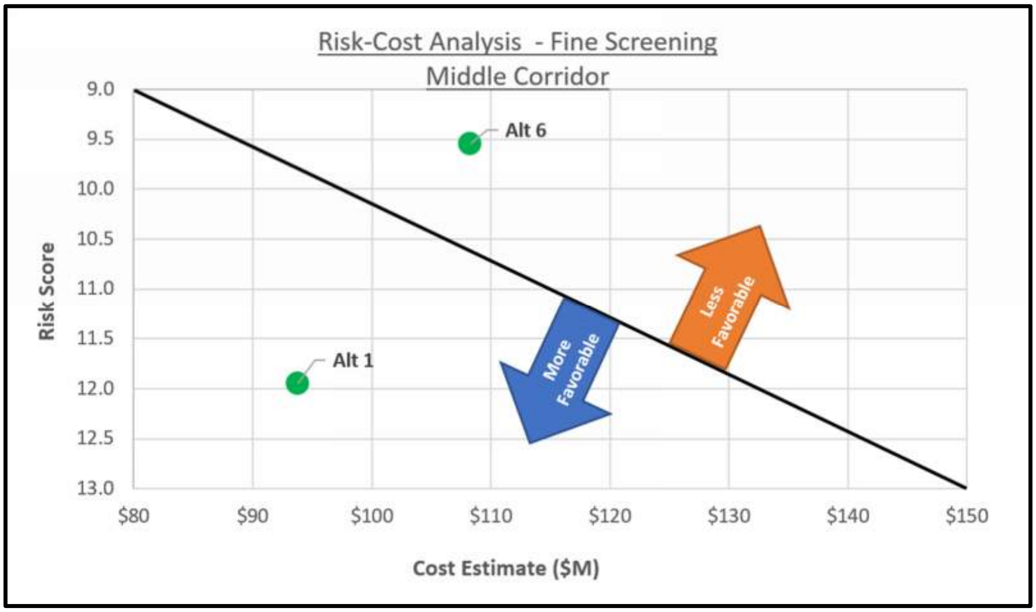


Figure 3-2. Risk vs cost results – middle corridor

End Corridor

As shown on **Figure 3-3** below, Alternative 1, while seemingly the most expensive alternative (but within ~7%), mitigates some significant risk factors that make Alternative 2 and Alternative 6 undesirable. These alignments are mostly through developed areas but Alternative 2 will result in a comparatively greater impact on biological resources that would likely require significant mitigation in the form of post-construction habitat restoration or acquisition of off-site credits in a habitat-based mitigation bank. Alternative 2, would also require intensive permitting process to construct adjacent to sensitive habitats and across select drainage features. From an operations and maintenance perspective, Alternative 1 can accommodate a pressurized service connection to the Boot service area, whereas Alternatives 2 and 6 will require special permitting to operate a low-head system in this service area. Overall, Alternative 1 scored best with respect to accessibility and land use impacts.

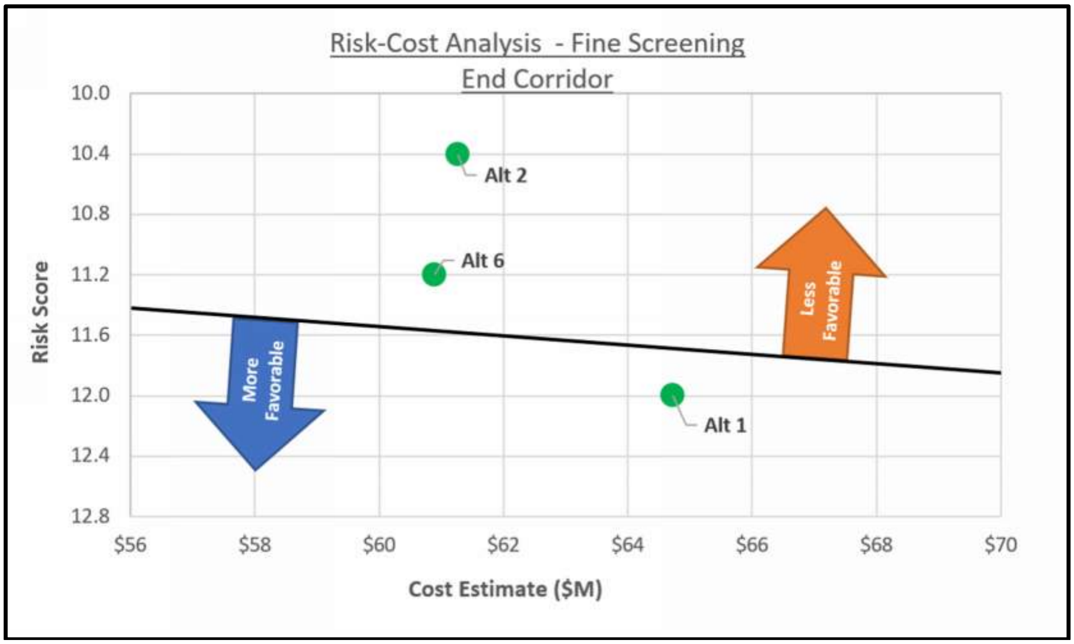


Figure 3-3. Risk vs cost results – end corridor

The recommended preferred alignment is Alternative 1 for the Beginning, Middle, and End corridors (1.1.1), but the Beginning Corridor of Alternative 2 will remain as an option for Phase 5 – Recommended Alignment Report.

As shown on **Figure 3-4** on the following page, all possible alignment options were plotted on a cost-risk graph and clear groupings emerged. The figure shows Corridors 1.1.1 and 2.1.1 having a balanced cost versus risk rating and are recommended for further development in conceptual design. Throughout this work, the consultant team conducted sensitivity analyses by adjusting the weighing factors and criteria scores to confirm the evaluation processes remained unbiased and its results were defensible. The sensitivity analysis validated the results and confirmed that no inherent biases were present that unjustifiably drove the criteria scores toward a specific result.

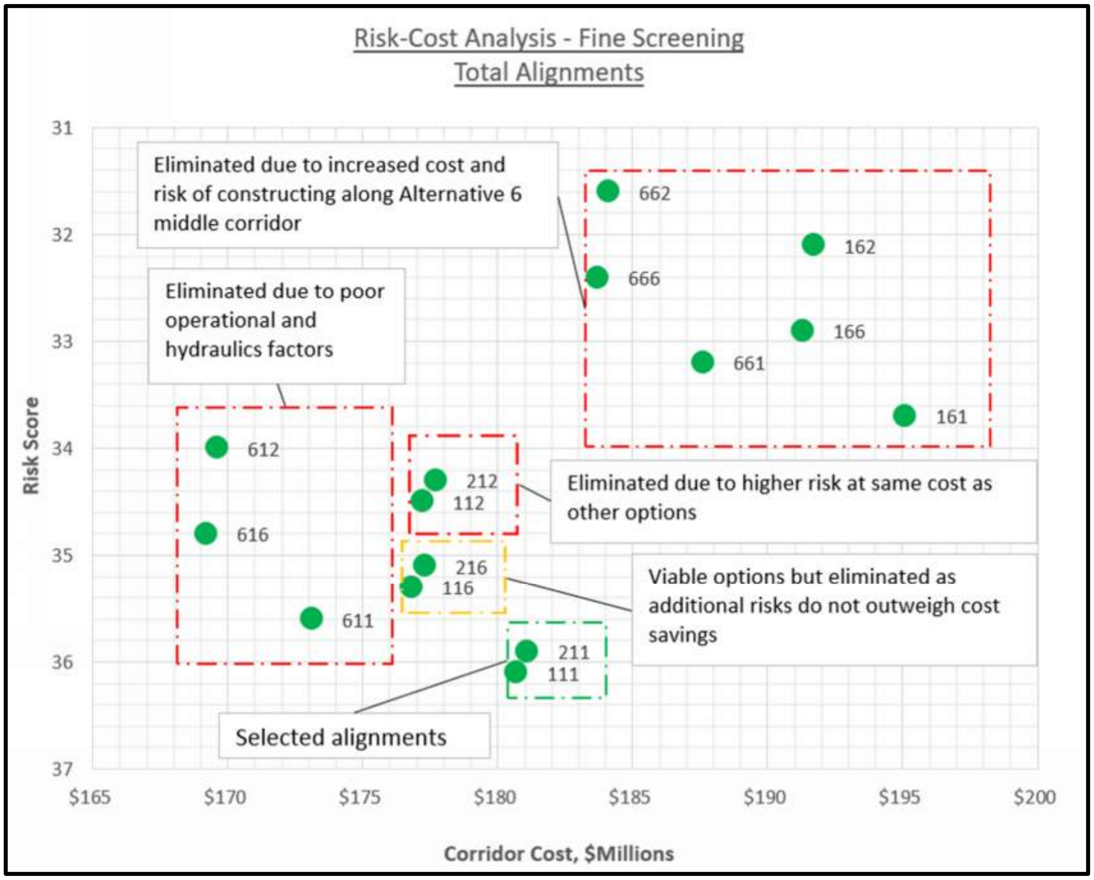


Figure 3-4. Risk vs cost results

Other groupings shown in Figure 3-4 were not selected for advancement due to additional risk or cost to the project. One grouping includes construction of Alternative 6 middle segment, which has a high level of risk and cost associated with it compared to other construction options. Another grouping includes construction of Alternative 6 for the Beginning corridor; however, due to hydraulic and operational considerations, it's not suitable for long-term operation of the Flume. The other groupings indicate there are some less expensive options available, but the additional risk associated with those options outweighs the cost savings. The additional cost for prudent project risk mitigation of the preferred corridors represents approximately 2% of the total project cost.

Table 3-3 below shows a summary of the recommended alignment resulting from both the Coarse and Fine Screening evaluations. Figure 3-5 that follows provides a map of the recommended alignment, and Figure 3-6 compares the Beginning Corridors of Alternatives 1 and 2.

Table 3-3. Final Overall Evaluation Results and Recommendation for the Preferred Alignment

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Corridors	South Central	Hybrid A	Central	Hybrid B	Northern	Southern
Beginning	Yes	Yes	No	No	No	No
Middle	Yes	No	No	No	No	No
End	Yes	No	No	No	No	No

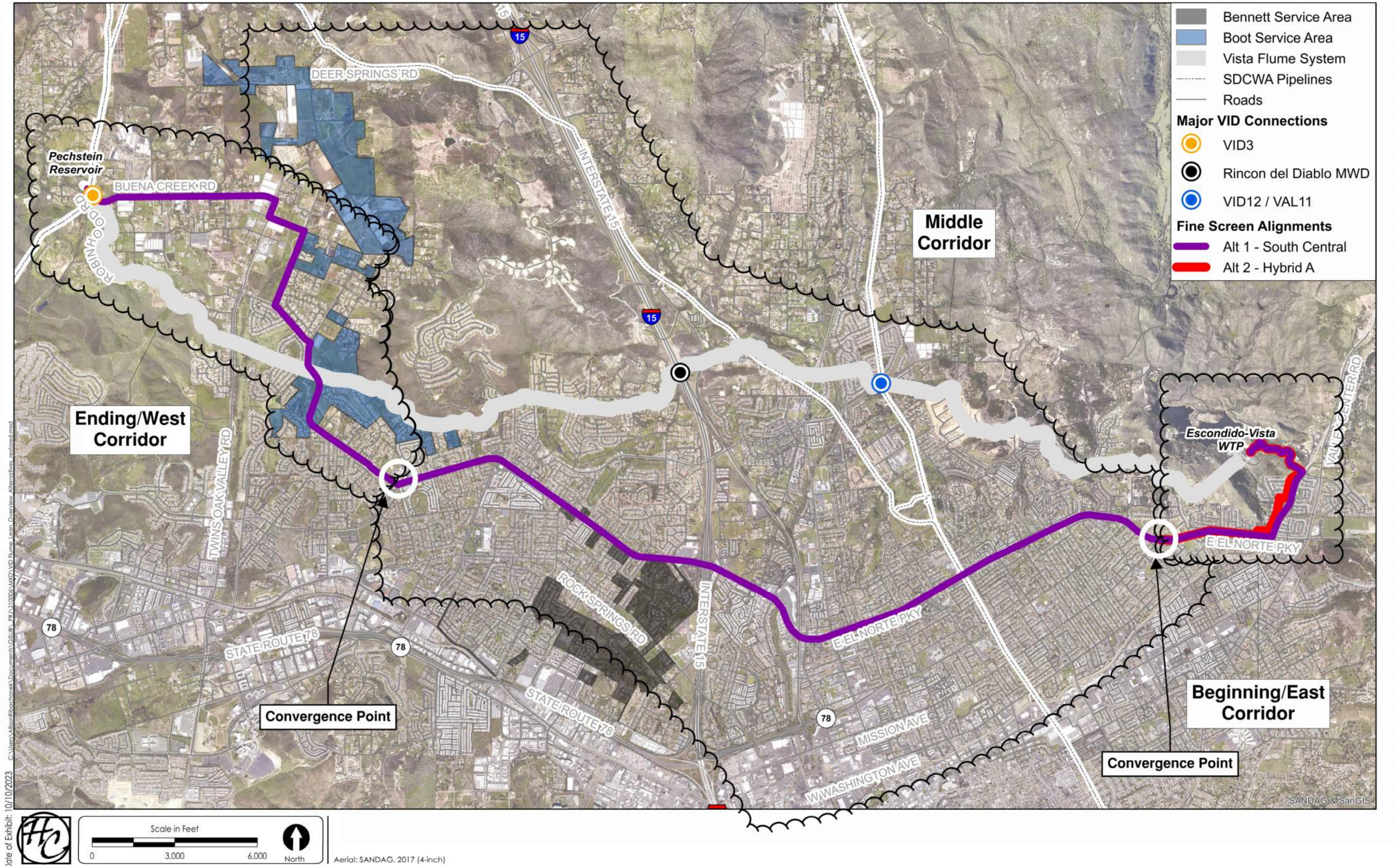


Figure 3-5. Proposed preferred alignment

Both Alternatives 1 and 2 in the Beginning Corridor have benefits and risks that need to be evaluated further during the conceptual design phase.

Constructing the Flume replacement along the Escondido Creek (Alternative 1 - Purple) scores well in part because it reduces the impact on the surrounding community. It is also likely to drive quicker pipeline installation rates and is favorable for construction scheduling as impacts to homeowners can be mitigated. However, utility congestion and subsurface conditions within the access road of the Escondido Creek need to be further evaluated in design. For this reason, the beginning segment of Alternative 2 (Red) is recommended as an alternative alignment if Alternative 1 is found to be unfeasible once exploratory subsurface investigations are completed.

Alternative 2 has the potential to avoid the utility congestion and construction risks present along the Escondido Creek access road but will likely have more significant community impacts. Construction will occur along the road, which will create traffic impacts for residents accessing their homes. The neighborhood has only two points of entry, and funneling more traffic to one of these points than they were initially designed to manage is likely to cause congestion. Production rates for construction are also likely to be impacted as the contractor will have to be careful to mitigate impacts to residential utilities, services connections, laterals, as well as shorter working days to break down construction activities early and secure the work site.

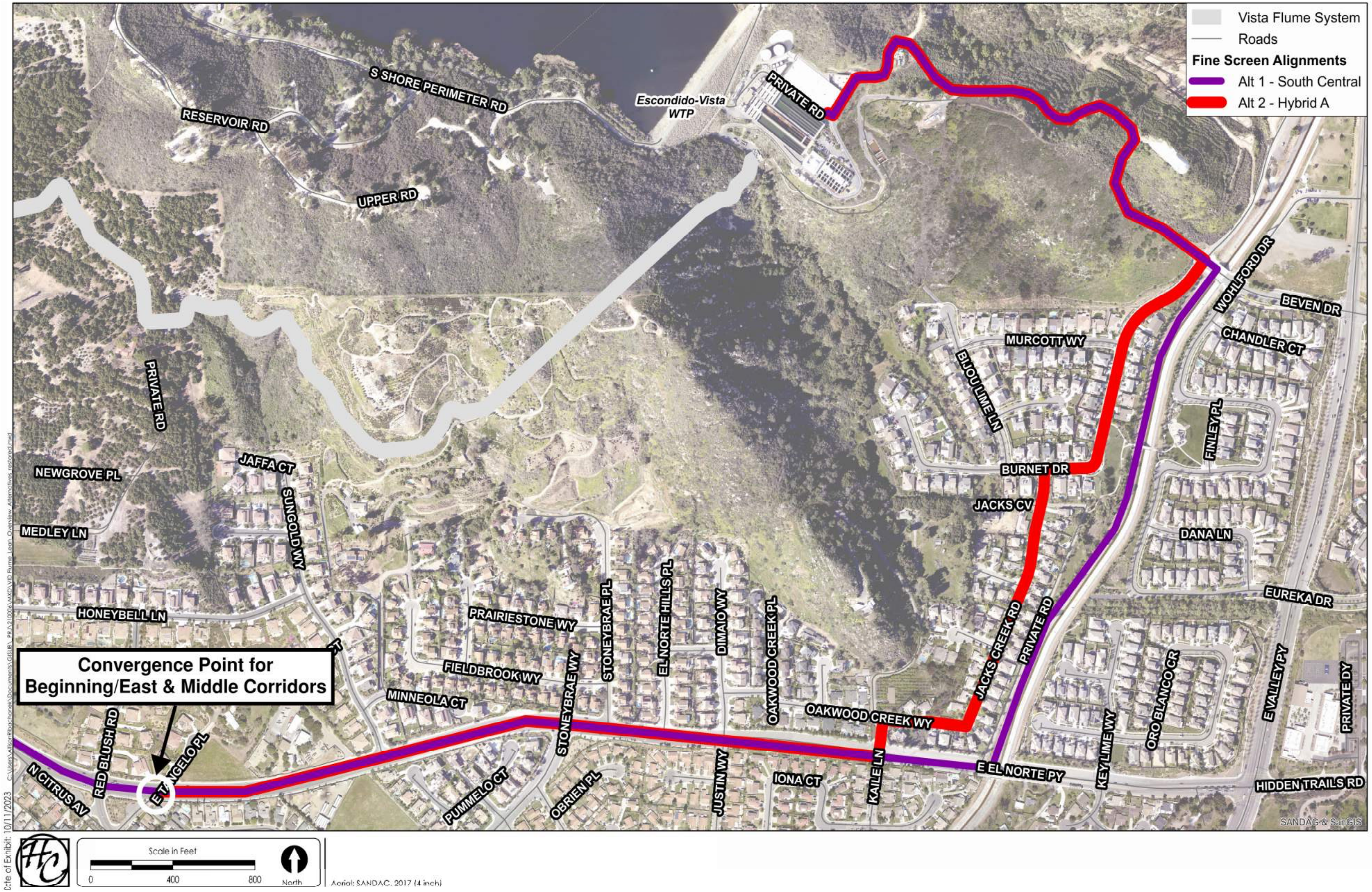


Figure 3-6. Beginning corridor Alternative 1 & 2 comparison

Section 4

Predictive Climatological Modeling

- This modeling supported the "To Flume or Not to Flume" decision by providing a range of predictive local yields based on varying climate change factors, which resulted in an increased confidence in the Balance Scale's economic analysis.
- Predictive model shows that variable climate conditions can have a broad effect on local yield; in general, climate futures appear to be favorable with predicted local yields greater than what has been observed by the District in the more recent drought years.
- Overview of climate modeling predictive yield results:
    - There are very few climate futures, only three of the 15 model runs (20%), which predict local yields that do not support the future Flume Replacement project; neither of these three scenarios include HABs mitigation or wellfield improvement measures.
    - Six of the 15 model runs (40%) predicted local yields that require little to no treatability modifications at EVWTP as they align with the current 40:60 local-to-imported water blending ratios.
    - Six of the 15 model runs (40%) predicted local yields greater than the EVWTP's current 40:60 local-to-imported water blend ratio limit, which would require additional investments in treatment system modifications to realize the full benefit of this additional yield.

4.1 Climate Modeling Objectives

The modeling objective was to support the "To Flume or Not to Flume" decision by developing a predictive range of local yields based on varying climate change factors, which would increase the overall confidence in the Balance Scale's economic analysis.

The District's share of annual local yield produced from its Local Water System (LWS), which includes the watersheds and infrastructure upstream of EVWTP (see **Figure 4-1**), is a critical factor in the economic viability of the future Flume Replacement project. During Board Workshop No. 2 the team presented sensitivity analyses which underscored this point. The team identified the economic break-even point in terms of local yield. During that time (September 2022), so long as the District's share of average annual local yield is above 2,200 AFY the future Flume Replacement project would remain viable (note: in the current analysis the local yield break-even point has increased to 2,700 AFY due to the additional financing costs incurred from the recent increasing interest rates).

With feedback received from the Board during Workshop No. 2, the District's staff and consulting team decided to pursue predictive climatological modeling. The purpose of this work is to evaluate climate change impacts by analyzing factors which may affect future changes in temperature, precipitation, and the resulting local yield. The predictive modeling work assessed the climatological effects on the LWS and increased our confidence in the Balance Scale economic analysis by:

- Establishing a baseline system performance using a soil-water-balance model for current hydrologic conditions and a GoldSIM model for future LWS operational conditions.
- Amending the baseline modeling results to consider possible future climatological conditions (Dry, Baseline, and Wet) and study their impacts on the LWS.
- Calculating the predictive local yields generated for each conceptual LWS investment scenario by applying the above referenced climatological conditions.
- Augmenting the “To Flume or Not to Flume” economic analysis to consider a range of climatological futures and their plausible effects on local yield by using the above referenced modelled predictive yields.

4.2 Modeling Tools

Two models were required to predict future local yield; one model estimated the water entering the LWS under varying hydrologic conditions while the other model operationally delivered the water to the District and its stakeholders under varying climatological scenarios.

Most of the water entering the LWS comes from the watershed inclusive of Lake Henshaw and the Warner Groundwater Basin (see **Figure 4-1**). The District previously contracted with TODD Groundwater (TODD GW) to model the groundwater basin and its interface with Lake Henshaw. The predictive climate modeling work performed in this study needed two models to take the work TODD GW previously performed within the Warner Basin and expand it into a climatological model that encompassed the entire LWS. The two models used in this study included:

- **Soil-Water-Balance (SWB) model:** A peer reviewed model that is widely used and vetted to estimate water balance components, such as runoff and recharge, into a managed water system. The SWB model calculates recharge by using available geographic information system (GIS) data layers in combination with tabular climatological data. Recharge calculations are determined using a rectangular grid for computational finite element analysis. These can be easily imported into a regional groundwater-flow model. The model’s source is *SWB: A modified Thornthwaite-Mather Soil-Water-Balance code for estimating groundwater recharge (usgs.gov)*.
- **GoldSIM:** A simulation software used to dynamically model complex systems was selected and used to create an operational model for the LWS. This is a powerful tool that has flexibility to build in operational controls in an intuitive way. One can map out and draw the system with connection data and functions that mimic system operations and supports decision making under changing system conditions.
- This tool provided a flexible way to visually represent and operationally mimic the District’s LWS. It allowed for built-in control rules that help represent changes in operational procedures, including representative changes to infrastructure through various infrastructural investments, such as optimizing the Warner Basin wellfield, mitigating HABs at Lake Henshaw, and even increasing the storage at Lake Wohlford resulting from the future dam replacement.

4.3 Building the Model

The LWS is complex, and its operation is nuanced, building the model required an extensive amount of historical data to fully capture all the system components and operational features.

HISTORICAL RECORDS USED TO BUILD THE SYSTEM MODEL

- **Queries from VID's historian databases:**
  - 1952-2022:
    - LH: Elevation based on 2018 survey//LH: End-of-Month Storage (af)
    - LH: Draft (af) and 12-month running Draft//LH: Lake Evaporation
    - Wellfield Production (af)//Henshaw Spill//Computed Dam Runoff
    - Henshaw Rain (inches)//Computed Runoff into Henshaw
    - Runoff Below Henshaw//Total Flow at Intake
    - Flow at Canal Outlet Gauge//Canal Flow Released to Indians
  - 2017-2022:
    - LW: End-of-Month Storage//LW: Draft//LW: Evap/Rain
  - 1981-2022:
    - Water levels for wells 13, 29, and 32
    - 1953-2022:
    - River gain and river losses//Runoff recovered Below Henshaw
    - Rincon from runoff//Wolford from runoff
    - Running 12-Mon Canal Outlet//Running 12-Mon Rincon
    - Beneficial Local Water Production
- **File "1975 to 2016 canal flow": Escondido Canal Distribution Report, includes:**
  - draft at Henshaw dam//spills at Henshaw dam//natural flow at intake
  - waste at intake//flow at intake gage
  - flow at outlet gage//releases to Rincon
- **File "2023_06 Esc Canal Dist Rpt": Escondido Canal Distribution Report (June 2023)**
  - same type of information as above file for June 2023
- **File "2023_06 EVWTP Report": System Water Accounting Monthly Totals (June 2023)**
  - Raw water to Dixon Reservoir and to Filtration Plant
  - Treated water from Filtration Plant
  - Other water to Escondido Service Area
- **File "DAM RAIN": Monthly Record of Precipitation**
  - Monthly precipitation records from 1911 to 2023 at Lake Henshaw Dam station
- **File "Henshaw Accounting 2023_07_03": Variables used in local accounting for June 2023**
  - Inputs for Escondido Canal//Inputs for Lake Henshaw
  - Totalizer reads for Pumped Water//Calculations for Pumped Water
  - Requests and Deliveries of Local Water and Supplemental Water Data from TODD GW//Computed Runoff into Henshaw//Runoff recovered below LH
- **File "Henshaw Daily Report 2023": Daily report for LH, July 5, 2023, includes:**
  - change in storage, releases, evaporative loss, direct rainfall, other gain/loss, and average high and low temperature
- **File "SW 5yr Estimate 2023_03_10": 5-Year Estimate of Supplemental Water Deliveries**
  - 2017-2022: Supplemental Water to Escondido and Supplemental Water to Vista
  - 2017-2022: Plant Influents (MG) and Monthly Plant Influents (MG)
- **File "Water Stats Weese":**
  - 2001-2023: Current month production, average production of last 12 months, total fiscal year-to-date for:
    - Local water//Raw imported//EVWTP production//SDCWA treated
    - 1981-2023: wellfield pumping and annual pumping
    - Chart: VID's Warner Wellfield Water Table Depth vs. Monthly Wellfield Production
    - Chart: Warner Basin Water Table Depth vs. Annual Wellfield Production
    - Chart: VID Water Deliveries to EVWTP and CWA Raw Water Delivery
- **File "Wohlford Area Capacity Table 2023":**
  - WS elevation, flooded area, capacity, gage
  - (also have PDF of Wohlford Area Capacity Table 1995)
- **File: "Water Quality Analysis_local copy": includes HABs Study Henshaw and Wohlford and Groundwater Well Data Overall Summary**
  - 1950-2018: Nitrate levels for wells
  - 2000-2019: nitrate, orthophosphate, iron, manganese

Additional data and resources were needed to convert the raw data and system model to a predictive climate model.

The following sources were referenced when establishing the climate change factors used for implementing a predictive model of the LWS:

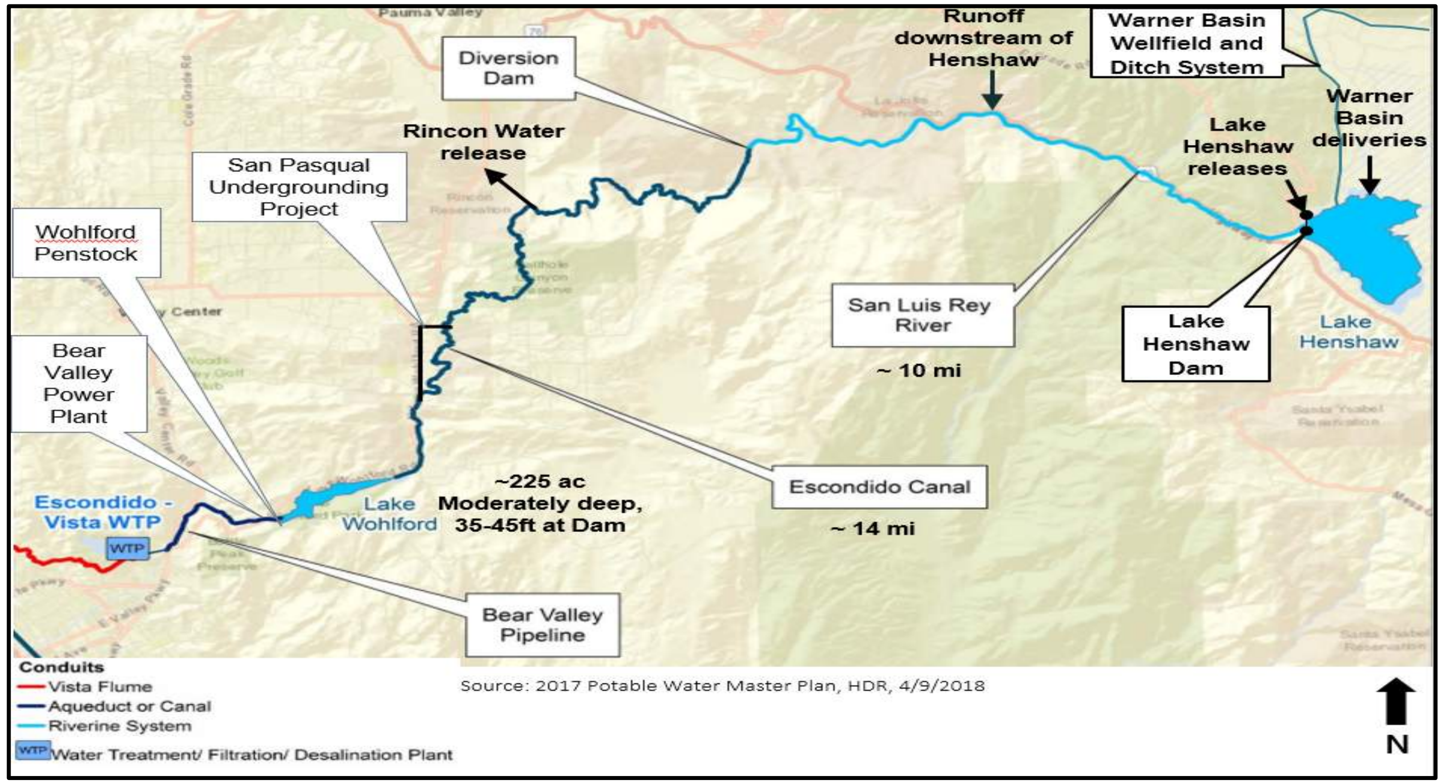
1. Natural Resources Conservation Services (NRCS), from USDA: Available water capacity and soil groups
2. National Land Cover Database (NCLD), from USGS: land use
3. National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI): temperature and precipitation
4. Antecedent moisture condition (AMC) II: curve numbers (from SWB manual)
5. Data downloaded from Cal-Adapt for 10 general circulation models (GCMs) for representative concentration pathways (RCPs) 4.5 (optimistic emissions future) and 8.5 (pessimistic emissions future).
6. Resource Guide: DWR-Provided Climate Change Data and Guidance for Use During Groundwater Sustainability Plan Development
7. Guidance Document for the Sustainable Management of Groundwater Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development

The model coordinated with the previous groundwater modeling work performed on the Warner Basin.

Multiple working meetings were conducted with TODD GW, who performed the previous Warner Basin groundwater modeling work for the District. Although the predictive modeling would span the entire system, as shown in Figure 4-1, the most significant water inputs come from Lake Henshaw and the Warner Basin wellfield, making this coordination an essential step. Our teams coordinated the model's inputs and assumptions used for calculating recharge and runoff to the wellfield and Lake Henshaw. Also, our teams compared external data sources and agreed to the gauges and percolation rates to be used for model calibration. The goal was to build and calibrate the SWB model, which serves as an input to the predictive GoldSIM model, in a manner consistent with TODD GW's approach to modeling the sustainable yield of the groundwater basin.

Six different SWB model runs were compared to TODD GW's optimal model run. The best fit SWB model run, "Test Run 7", was selected as the representative baseline for use in the climatological models.

Once Test Run 7 was implemented into the climatological models, any adjustments to runoff and recharge made during the modeling efforts were vetted with TODD GW to ensure consistency with their future Warner Basin groundwater modeling and master planning efforts.



Source: 2017 Potable Water Master Plan, HDR, 4/9/2018

Figure 4-1. VID's local water system; 2017 Master Plan

4.4 Statistical Analysis

Finding a representative 30-year historical period to serve as the hydrologic baseline was an important step for studying climatological variabilities while managing the size of the model.

Establishing a hydrologic baseline using historical data is an important step in predicting future climatological effects. Distilling the data down to a representative ("baseline") 30-year period is necessary for managing the model and allowing it to run within a reasonable timeframe (i.e., less than 12-hours per run).

Historical precipitation values using observed NOAA data at Lake Henshaw Dam with data gaps filled in using surrounding weather gauges, were analyzed to derive a baseline. Figure 4-2 below shows the historical precipitation record (blue) and highlights the driest period on record (green) as well as the chosen "Climate Model Baseline" (pink).

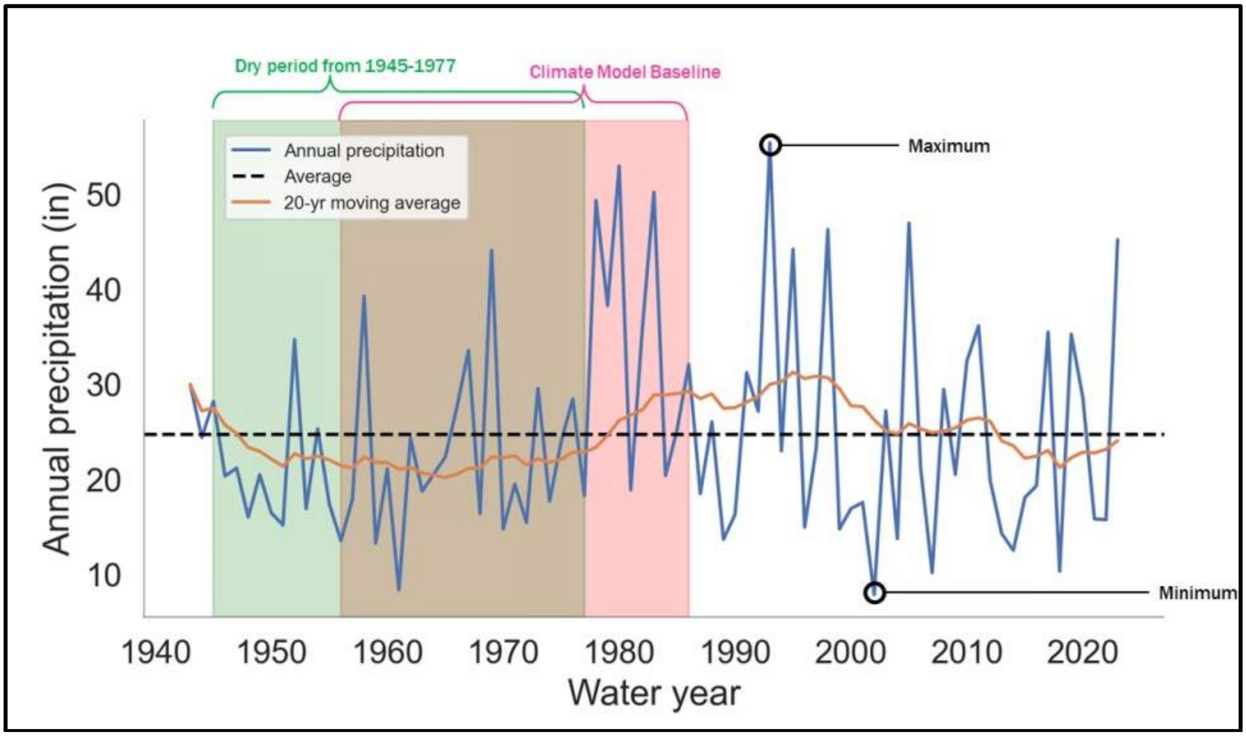


Figure 4-2. District's historical record of annual precipitation

The Climate Model Baseline, shown above in pink, was determined by using a statistical analysis of historical versus future rainfall probabilities. The statistical analysis plotted 30-year probability curves, as shown in Figure 4-3 below, to find the 30-year period that best represents the entire historical record from 1942-present. The statistical analysis determined the 30-year period of 1956-1986 as the historically representative baseline.

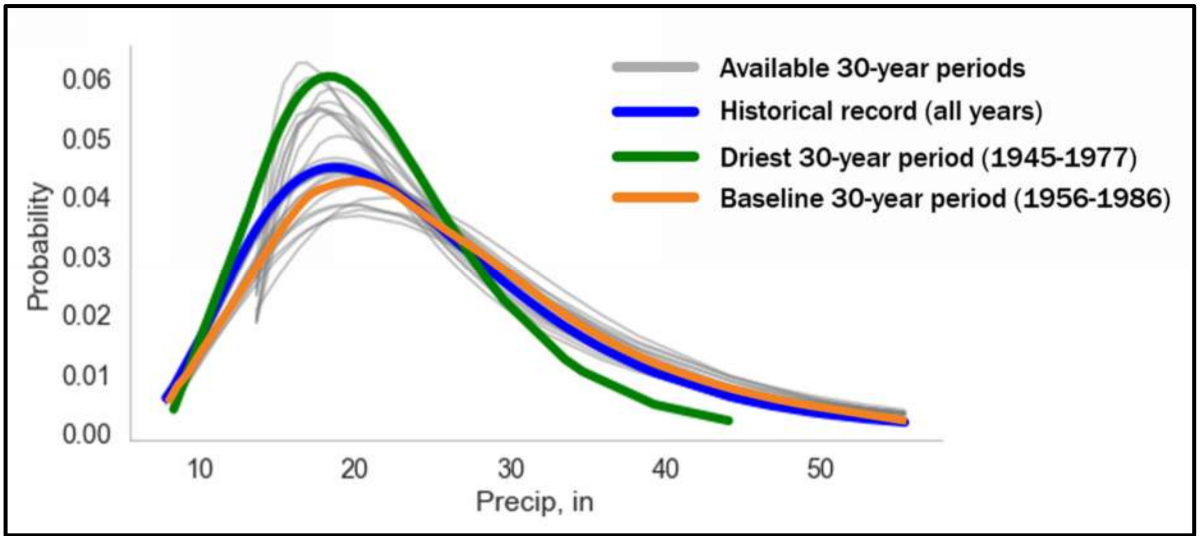


Figure 4-3. Statistical analysis of 30-year water periods

The above statistical analysis considered all possible 30-year periods (gray lines) within the historical record and found the best representation of the historical record (orange line). From this representative baseline all future scenarios are developed using climate model adjustments factors called "delta factors". This baseline period captured comparable dry-year values to those in the 1945-1977 dry period without neglecting the wetter periods observed in the historical record.

This is evident in Table 4-1 when comparing the probabilities of "Extreme Dry" (orange) and "Extreme Wet" (blue) Water Years. Statistically, the baseline period captures nearly the same probability of extreme dry years (12.9%) as found in driest 30-year period on record but manages to also capture some extreme wet water years (9.7%), where the driest period captures none (0.0%). Using drier periods for the baseline could significantly skew predictive local yields results as the bias is exacerbated once climate delta factors are applied.

Table 4-1. Comparing Historical Baseline (1956-1986) to Historical Driest Period (1945-1977)

Probability of Water Year Type	Baseline	Driest
	1956-1986	1945-1977
Extreme Dry	12.9%	12.1%
Dry	22.6%	33.3%
Normal	35.5%	42.4%
Wet	19.4%	12.1%
Extreme Wet	9.7%	0.0%

4.5 Methodology

Step 1: Define the system and establish its boundary conditions to account for all infrastructure components, interconnects, and sources of inflows and outflows.

To develop the predictive model, this work required a thorough understanding of the LWS. Development of the model includes identification and confirmation of all local water supplies including runoff, as well as all system outflows such as water deliveries or natural losses. It also required confirmation of the delineation of the drainage boundary areas (i.e., watersheds) of the entire LWS originally delineated in "*Plate 1 of the 2002 Bookman-Edmonston Study*" and operational parameters used to manage the inflows from those watersheds. All system components, and their interconnects, to be entered into the climatological models were coordinated with the District's staff and documented using the system schematic shown on Figure 4-4 below. From this system schematic both the SWB and GoldSIM models were developed.

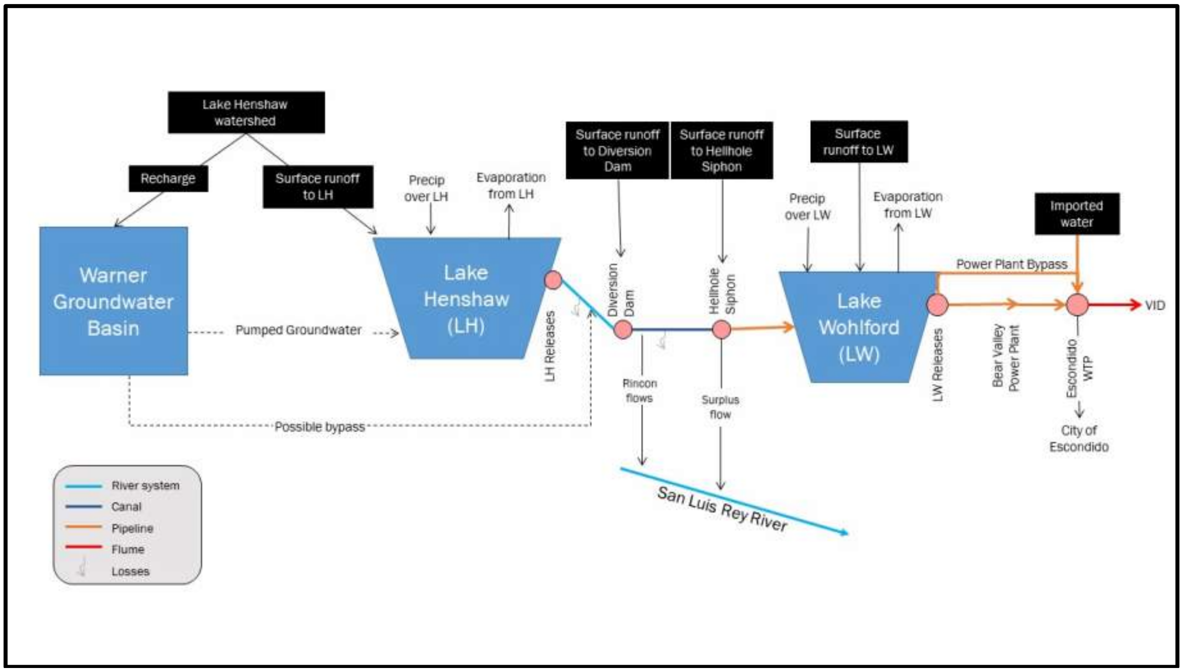


Figure 4-4. VID's local water system schematic

Step 2: Build two models that together can simulate the local hydrology and baseline the current operational performance of the LWS.

As introduced in Section 4.2 - Modeling Tools, two models were needed to support the predictive modeling of the LWS. The first model was a SWB model which was used to determine baseline hydrology within the LWS, including Warner Basin. The second model was a GoldSIM model, which applied various operational control rules to accept and deliver the water calculated from the SWB model. The GoldSIM model, in effect, served as a virtual operator simulating the ways District staff might manage the LWS to optimally deliver its local yield. Figure 4-5 below is a screenshot of the GoldSIM model showing all the system components requiring staff's operational control.

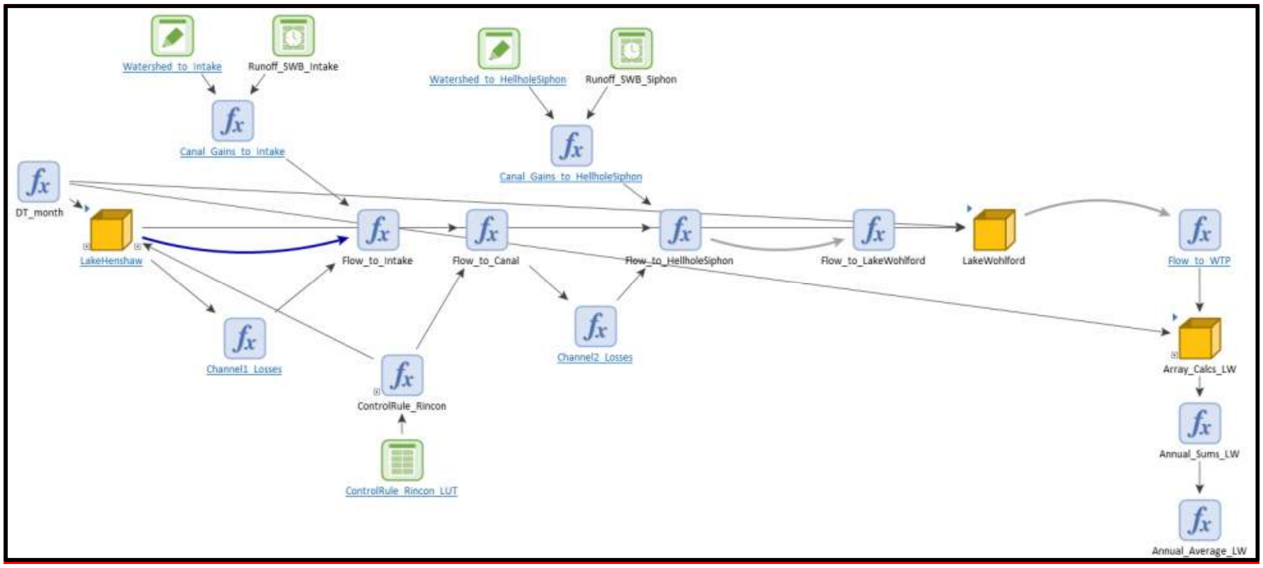


Figure 4-5. VID's local water system schematic in GoldSIM

Once the newly developed models were able to mimic historical operations, then the GoldSIM was ready to accept climate change adjustments factors.

Step 3: Run the model using climate change adjustment factors to assess possible climatological impacts on local yield.

Climate change factors, known as "delta factors", were applied to GoldSIM to simulate the effects climate variabilities will have on operational response of the LWS. The climate change factors used are provided through analysis of Cal-Adapt data. Cal-Adapt serves as a key planning database for downscaled climate change data led by the California Energy Commission and UC Berkeley's Geospatial Innovation Facility. Each model run establishes a range of possible future local yields under various climate change projection scenarios out to the year 2100. They are modeled using Department of Water Resources guidance, using scenarios categorized as:

1. Future "Wet" Climate Scenario,
2. Future "Baseline" Conditions Scenario, and
3. Future "Dry" Climate Scenario.

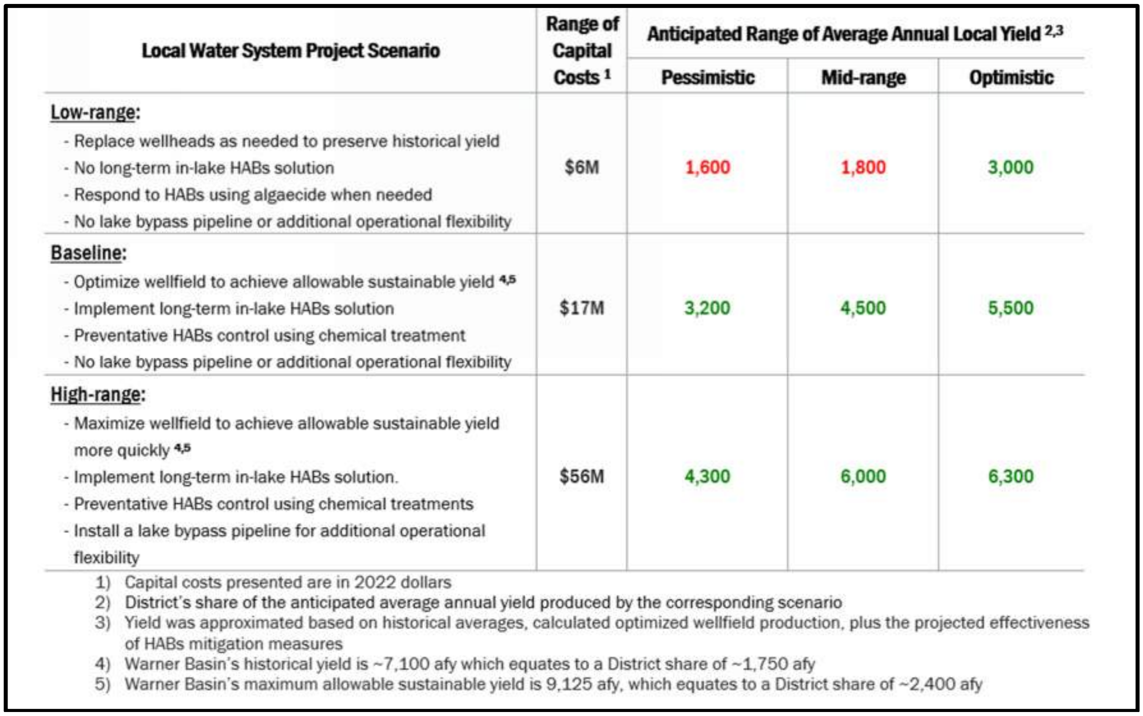
The three scenarios rely on downscaled climate data for a high emission future (using Representative Concentration Pathway 8.5 as analyzed by general circulation models). This allows modeling of a plausible range of potentially wet and dry future conditions that may impact the LWS. These condition scenarios model changes in temperatures and precipitation, which help estimate potential water gained (e.g., runoff) version water lost (e.g., evaporation) under a range of future climate conditions. Running a future dry scenario will model less rainfall and higher temperatures which will reduce runoff, increase evaporation, and constrain the annual yield available to the LWS. Running a wet condition has the inverse effect on annual local yield.

Specific to the District's LWS, varying climate conditions is predicted to have a broad range of effects on local yield. For example, climate modeling found that between a "Dry" and "Baseline" condition the net effect could increase yield between 9% and 64%, while the change between "Baseline" and "Wet" can increase yield by another 9% to 75%. Detailed results are presented in Section 4.6 below.

Step 4: Model future LWS investment scenarios to assess the effects projects like expanding the Warner Basin wellfield or addressing Harmful Algal Blooms (HABs) might have on future local yield.

The steps described above studied the potential effects climate change impacts would have on the existing LWS. During Workshop No. 2 it was reported that due to the system's age and condition the LWS has experienced suboptimal performance in recent years. The District has been evaluating a range of possible options for restoring and even improving the system's operational performance.

At that time (September 2022) a total of three investment scenarios were developed to capture the range of possible LWS enhancements being evaluated, their relative costs, and plausible effects on local yield. Historical statistical analyses were performed to estimate the future local yields anticipated for each investment scenario, which were presented to the Board in the summary table shown below, see Figure 4-6.



Local Water System Project Scenario	Range of Capital Costs [1]	Anticipated Range of Average Annual Local Yield [2,3]		
		Pessimistic	Mid-range	Optimistic
Low-range: - Replace wellheads as needed to preserve historical yield - No long-term in-lake HABs solution - Respond to HABs using algaecide when needed - No lake bypass pipeline or additional operational flexibility	$6M	1,600	1,800	3,000
Baseline: - Optimize wellfield to achieve allowable sustainable yield [4,5] - Implement long-term in-lake HABs solution - Preventative HABs control using chemical treatment - No lake bypass pipeline or additional operational flexibility	$17M	3,200	4,500	5,500
High-range: - Maximize wellfield to achieve allowable sustainable yield more quickly [4,5] - Implement long-term in-lake HABs solution. - Preventative HABs control using chemical treatments - Install a lake bypass pipeline for additional operational flexibility	$56M	4,300	6,000	6,300

1) Capital costs presented are in 2022 dollars
2) District's share of the anticipated average annual yield produced by the corresponding scenario
3) Yield was approximated based on historical averages, calculated optimized wellfield production, plus the projected effectiveness of HABs mitigation measures
4) Warner Basin's historical yield is ~7,100 afy which equates to a District share of ~1,750 afy
5) Warner Basin's maximum allowable sustainable yield is 9,125 afy, which equates to a District share of ~2,400 afy

Figure 4-6. Table of LWS investment scenarios as presented in board Workshop #2

However, the above estimates did not consider future climatological variations, as the calculations were based solely on historical data. To build additional confidence in these local yield calculations, which are a key input to the Balance Scale economic model, the predictive climate model was run for multiple LWS investment scenarios.

Since a detailed model of the LWS was constructed, the consultant team now had a tool which could better predict the subtle differences between the LWS enhancements currently being evaluated by the District's staff. In coordination with staff, the three project scenarios listed above were expanded to five possible "investment scenarios". The investment scenarios ranged from maintaining the existing system as-is (Scenario #1: Low-range) to implementing a host of LWS enhancements including, in-lake HABs mitigations, an expanded wellfield, and a lake bypass pipeline (Scenario #5 – High-range). The five investment scenarios are listed below and defined in Table 4-2.

- Scenario #1: Low-range
- Scenario #2: HABs Control Only
- Scenario #3: Baseline or "Mid-Range"
- Scenario #4: Max. Allowable Sustainable Yield
- Scenario #5: High-range

The above investment scenarios were entered into the GoldSIM model and used to estimate the predictive local yield generated from each under three climatological conditions (i.e. Dry, Baseline, and Wet). The results of this work are presented in Section 4.6 below.

4.6 Results - Investment and Climatological Scenarios

Most climate futures, 80% of the modeled scenarios, predict the District can confidently rely on local water being available over a wide variety of climate conditions, and the economics weigh in favor of a To Flume project if modest investments are made to the LWS.

Below in Table 4-2 are the predictive local yield results taken from the GoldSIM model. The numbers presented below represent the District's share of the average annual local yield for each of the five LWS investment scenarios currently being considered by the District. Each investment scenario was modeled against three different climate change scenarios, which applied delta factors for "Dry" (CMCC_CMS RCP8.5), "Baseline" (Historical), and "Wet" (CanESM2 RCP8.5) climate conditions.

Cells highlighted in red represent annual average local yield values that would not economically support the Flume replacement project, and therefore do not represent a viable To Flume project alternative as discussed further in Section 5. Green highlighted cells represent annual average local yield values which do economically support the Flume replacement project and its long-term operations. Also, these values do not require any modifications to the EVWTP's current blend limitations of 40:60 local-to-imported raw water ratio.

Cells highlighted in yellow represent an upside in local yield generally not seen by the existing LWS. However, to beneficially use this water, modest investments in improving the water quality at Lake Wohlford and the treatability at EVWTP would be required to accept blend ratios above the 40:60 local-to-imported water limit. Achieving these higher blend ratios will require significant modifications and capital costs to beneficially use the full local yield. However, this requires treatability studies and evaluation at a greater level of detail beyond the scope of this study. None of the scenarios below predicted a local yield value which exceeds the current water demand (combined District and City) at EVWTP.

In summary, addressing HABs at Lake Henshaw and optimizing the Warner Basin wellfield remain a priority for positive Balance Scale economics. Only three of the 15 model runs (20%) produced local yields which would not support the future Flume Replacement project; none of these scenarios included HABs mitigation or wellfield improvement measures. Six of the 15 model runs (40%) predicted local yields greater than the EVWTP's current 40:60 local-to-imported water blend ratio, which would require additional investments in treatment system modifications to fully realize the full benefit of this additional yield. The remaining six of the 15 model runs (40%) predicted local yields acceptable to the existing EVWTP with little to no treatability modifications to the EVWTP. Therefore, 80% of the modeled scenarios, predict the District can confidently rely on local water being available over a wide variety of climate conditions.

Table 4-2. Possible Range of Local Water System Investment Scenarios

Local Water System Investment Scenario	Capital Costs[a]	Anticipated Range of Average Annual Local Yield (AFY) [b,c]		
		Dry [b,c] (CMCC_CMS RCP8.5)	Baseline [b,c] (Historical)	Wet [b,c] (CanESM2 RCP8.5)
Scenario #1: Low-range • Maintain wellfield as-is; no new wellheads • No long-term in-lake HABs solution • Respond to HABs using algaecide when needed • No lake bypass pipeline or additional operational flexibility	$8M	1,700	2,500	3,000
Scenario #2: HABs Control Only • Replace wellheads as-needed to preserve historical yield • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$13M	1,900	2,700	3,300
Scenario #3: Baseline or "Mid-Range" • Optimize wellfield to achieve the historical, and can achieve sustainable yield over 12-months [d] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$23M	4,700	5,600	7,500
Scenario #4: Max. Allowable Sustainable Yield • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$37M	5,400	6,200	7,800
Scenario #5: High-range • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution. • Preventative HABs control using chemical treatments • Install a lake bypass pipeline for additional operational flexibility	$57M	6,900	7,200	7,900

a. *Capital costs presented are in 2023 dollars, and only include District's share of costs (e.g., 70% for wellfield projects and 50% for Henshaw projects).*

b. *District's share of the anticipated average annual local yield in AFY estimated for the corresponding modelled scenario.*

c. *The District's share of local yield presented herein are results from the predictive climatological model described above in* Section 4*.*

d. *Warner Basin's historical yield is ~7,140 AFY which equates to a District share of ~1,750 AFY.*

e. *Warner Basin's maximum allowable sustainable yield is 9,125 AFY, which equates to a District share of ~2,400 AFY.*

f. *Legend:*
   a. Red = Future Flume replacement project is not economically viable (VID LW yield is less than 2,700 AFY).
   b. Green = No modifications needed to Lake Wohlford or EVWTP keeping to 40:60 Local-to-Imported water blend ratio.
   c. *Yellow = Requires improvements to Lake Wohlford or EVWTP to local yields which are more than the current 40:60 Local-to-Imported water blend ratio limitation.*

Section 5

Project Affordability Update

- The Flume Replacement Project requires a diverse funding portfolio; interest rates for the funding mechanisms which will plausibly comprise the portfolio have increased significantly since last Board workshop (September 2022).
- Financial Next Steps – developing a strategic rate design and advancing it through the financial planning and Board adoption process remains a high priority for improving the District's financial position ahead of any large capital investment.
- The Balance Scale model has been enhanced to use the predictive local yield results generated from climatological modeling instead of historical statistical local yield data.
- Although both capital and financing costs have increased the cost advantage remains with To Flume for investment scenarios that implement HAB mitigation and wellfield improvement measures.
- Rising interest rates and escalating financing costs have increased the District's average annual local yield breakeven point from 2,200 AFY to 2,700 AFY.

5.1 Funding Opportunities - Updated

The Flume Replacement Project requires a diverse funding portfolio; interest rates for the funding mechanisms which will plausibly comprise this portfolio have increased significantly.

Throughout this Alignment Study the consulting team has tracked the funding mechanisms available for use on municipal water projects. The consultant team has been monitoring changes in available funding sources, application costs, and interest rates. The future Flume Replacement Project continues to be a good candidate for accessing both federal and state loan programs as well as grants anticipated in the order of $1 million. However, the most significant change observed since Workshop No. 2 has been an increase in interest rates as summarized below in Table 5-1.

Table 5-1. Interest Rate Increases from 2022 to 2023

	2022 Interest Rate	2023 Interest Rate	% Increase
Drinking Water State Revolving Fund (DWSRF)	1.10%	2.10%	91%
Water Infrastructure Finance and Innovation Act (WIFIA)	3.50%	5.00%	43%
Infrastructure State Revolving Fund (ISRF) Program	2.30%	4.36%	90%
Municipal Bonds	3.50%	6.00%	171%

The status of funding sources available to the Flume Replacement project have been updated to 2023 market conditions and presented below in Table 5-2.

Table 5-2. Possible Funding Sources Available to the Flume (2023 Update)

Funding Source	Funding Agency	Administering Entity	Type	Term (years)	2023 Interest Rate (i)	Application Fee ($)	When to Apply	Timeframe (years)	Probable Likelihood	Special Criteria & Shovel Ready Requirements	Notes & Limitations
Drinking Water State Revolving Fund (DWSRF)	California State Water Resources Control Board	State	Loan	30	2.10%	$0	Design Phase	2	Medium	• Allows for phased projects • SRF will be subject to Build America, Buy America (BABA) Act • here are four packages total (general, financial, technical, and environmental package) and they do not need to be submitted concurrently • Recommend a General Package be submitted, as soon as possible (this is a 4-page document with basic information (i.e., agency background, project description)	• Eligible for loan only • The estimated timeframe between general package submittal (step 1) to final agreement execution is 1-2 years • Bipartisan Infrastructure Law (BIL) funding is reserved for DAC small systems, PFAS contamination and lead line replacement • Example of timing -Applying in Summer/Fall 22 would get the project on the fundable list for next year (Fiscal Year or FY 2023)
Water Infrastructure Finance and Innovation Act (WIFIA)	Environmental Protection Agency	Federal	Loan	up to 35	5.00%	$100,000 to $600,000	Planning or Design Phase	Letter of Interest evaluation: 90 days. Applications due 1 year from invitation	High	• Allows for phased projects • NEPA, AIS, Davis-Bacon, Build America, Buy America (BABA) Act and all other federal provisions apply • Very flexible/favorable in structuring financing • Do not pay interest unless borrowed • 5-year completion requirement is preferred by WIFIA, requests for extensions are allowed • Bond rating required; preliminary rate opinion letter needed before closing. Financial outlook and financial planning needed to obtain bond rating.	• Can fund up to 49% of project costs • Total federal assistance cannot exceed 80% of project's eligible costs • 35 years is maximum maturity after substantial completion • Repayment deferral 5-year maximum after substantial completion • Interest rates are in flux, highly variable based on market conditions at time of close; based on treasury rate. Even projects from last year would be very different than today. Could use a rate range of 2.25%, 3%, and 3.5% • Planning level projects are eligible for WIFIA; WIFIA's goal is to accelerate construction projects
Infrastructure State Revolving Fund (ISRF) Program	California Infrastructure and Economic Development Bank (CA IBank)	State	Loan	30	4.36% (67% of A-rated municipal bond)	1% of Loan Amount ($10,000 minimum)	Design or Construction Phase	ISRF applications are continuously accepted	Medium	• No matching fund requirement, and ISRF financing may serve as matching funds for other financing.	• Intended mainly for construction costs
Municipal Bonds	Vista Irrigation District	District/Investment Bank	Bonds	up to 30	6.00%	Other fees apply	Planning Phase	Any	High - upon completion of rate study, etc.	• Requires District obtains a bond rating; higher ratings allow for lower interest rates • Recommend completion of a robust rate/cost of service study and development of a financing plan for the project	• Most expensive form of loan/debt included on this list. • Allow 6-8 months for bonding process
Building Resilient Infrastructure and Communities (BRIC)	Federal Emergency Management Agency (FEMA)	Federal	Grant	3	NA	NA	Annual solicitations; applications due winter.	1	Medium	• BRIC funds hazard mitigation projects, reducing risks communities face from disasters and natural hazards • Incorporation of nature-based solutions for hazard mitigation is a heavily weighted criterion	• The federal share requested can be no more than 70% (to received full criteria points) • Projects receiving funding must result in a reduced risk of natural disaster. • VID would not be directly eligible because they do not participate in National Flood Insurance Program (NFIP). A special district can apply as a sub-applicant with certain conditions.
Hazard Mitigation Grant Program - Flood Mitigation Assistance	Federal Emergency Management Agency (FEMA) via California Governor's Office of Emergency Services (CalOES)	Federal/State	Grant	3	NA	NA	Annual solicitations; applications due winter.	1	Low	• The current available funding opportunity under the HMGP is for Flood Mitigation Assistance (FMA) and is being rolled out along with BRIC • FEMA requires state, local, tribal and territorial governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance	• This program seeks projects that will reduce the risk of flood damage to National Flood Insurance Program (NFIP)-insured buildings. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to NFIP buildings. • Determine whether the project will reduce any flood risk to NFIP buildings • VID would not be directly eligible because they do not participate in National Flood Insurance Program (NFIP). A special district can apply as a sub-applicant with certain conditions.
WaterSMART Water and Energy Efficiency Grants (WEEG)	U.S. Bureau of Reclamation (USBR)	Federal	Grant	2-3	NA	NA	Annual solicitations.	1-2	Low - Medium	• WEEG supports projects that result in quantifiable and sustained water savings, implement renewable energy components, and support broader sustainability benefits. • Requires a case be made on how the project will provide water conservation & renewable energy benefits	• Project must provide quantifiable water savings, renewable energy and/or sustainability benefits • Maximum award is $5,000,000 • 50/50 Cost-share requirement • FY 2023 solicitation recently closed (7/26)

Financial Next Steps – developing a strategic rate design and advancing it through the financial planning and Board adoption process remains a high priority for improving the District's financial position ahead of any large capital investment.

The interest rate increases identified above will add more cost to servicing the future debt, which will have a net increase on projected future water rates. However, the infrastructure needs, and associated investment scenarios, being considered by the District remain the same. During the previous workshop it was noted that the need for external funding and financial planning was the same whether the District chose to implement a Flume Replacement project (i.e., To Flume) or a Flume Retirement project (i.e., Not to Flume), as both were estimated at similar order of magnitude costs.

Therefore, the increase in interest rates observed over the past year heightens the need for strategic rate design and financial planning. It remains important to prioritize developing a strategic rate design and advance it through the financial planning and Board adoption process in a timely manner. The objective being to improve the District's financial position by obtaining a high bond rating, secure the lowest possible interest rates, and strategically map-out rate increases in a manner that mitigates the financial burden on the District's ratepayers.

Recognizing the importance of advancing financial planning efforts, the Board approved hiring NHA Advisors on November 1, 2023 to perform a scope of services which includes, but is not limited to, the following:

- Review the overall financial status of the District and provide advice and recommendations related to the District's capital projects construction timeline and projected cash flow needs.
- Review the District's Investment Policy and make recommendations on any updates required.
- Assist the District in drafting a Debt Management Policy to ensure that principals, controls, and guidelines for the District debt are current and appropriate,
- Provide as needed financial advice regarding market conditions and trends, financial products, credit analysis, alternative financing, State or Federally subsidized loan programs (e.g. SRF, WIFIA, etc.), and other specialty financing.
- Assist the District in developing credit rating strategies. Coordinate presentations with these parties on behalf of the District to the extent needed or as requested. Clearly communicate any considerations that may affect the District's credit rating and work with the District in examining their financials related to the bond sale(s).
- Serve as the District's bond market expert, including tax-exempt and taxable markets, fixed-rate, and variable-rate markets, and provide on-going analysis of current and upcoming trends and events in these and related areas.
- Compute sizing and design structure of the proposed debt issue.
- Attend meetings with District staff, consultants and the Board as requested and make presentations to explain debt related issues.
- Providing District staff with educational opportunities, information, advice, and training to gain knowledge of financial advisory principles, policies, procedures, and philosophy/approach to debt management as well as the development and strategies used to ensure it is consistent with the District's Debt Management and Investment policies.

5.2 Affordability Check-In: To Flume or Not to Flume

The Balance Scale model has continually been refined and improved upon to better inform the To Flume or Not To Flume decision. The Balance Scale model has been enhanced to use the predictive local yield results generated from climatological modeling instead of historical statistical local yield data.

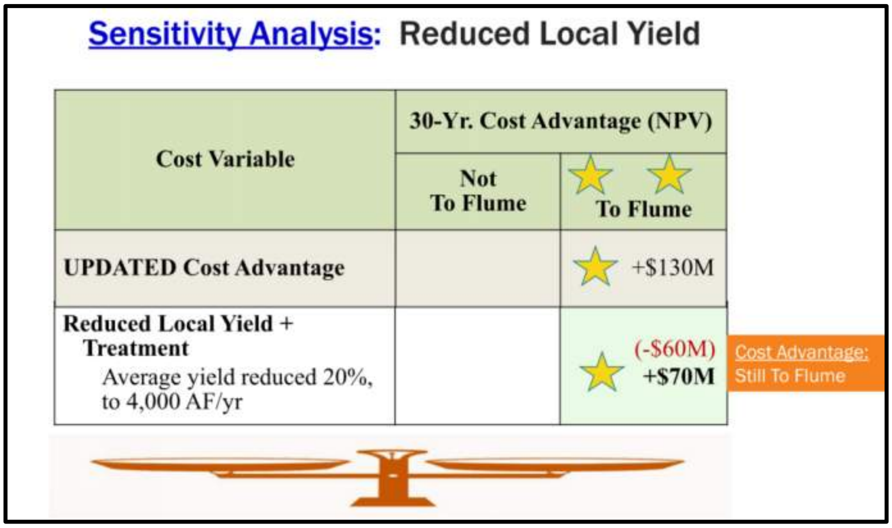
The Balance Scale Model was originally developed by Gillingham Water during the WSPS. The purpose of the model was to find the more favorable long-term solution; being the least costly option to the District, for providing superior supply reliability to is ratepayers and affording the opportunity for continued regional cooperation with neighboring agencies. In doing so, the Balance Scale Model compared the following two scenarios:

- To Flume = Replace the existing Flume and continue to fully operate the local water system to the benefit of the District and its neighboring agencies.
- Not to Flume = Retire the existing Flume, the District purchases 100% imported treated water, and operates the local water system at a limited capacity, continuing to sell water from Lake Henshaw and Warner Basin to Escondido. In addition, the District will transfer the Boot and Bennett service areas and distribution facilities to Vallecitos Water District, as well as construct additional tank storage at Pechstein needed to accommodate Water Authority aqueduct shutdowns.

Figure 5-1. To flume or not to flume balance scale

Its results were originally presented to the Board in March 2020 under the WSPS and concluded that there was a significant economic advantage To Flume over Not to Flume, see Figure 5-1 above. The Balance Scale model was to be updated and refined throughout the duration of this Alignment Study.

The first update to the Balance Scale Model was performed during Phase 2 – Alternatives Development of this Alignment Study. Its results were presented to the Board at Workshop No. 1 (August 2021). It was identified early on that local yield had a significant effect on the balance scale. So, for Workshop No. 1, sensitivity analyses were run on the Balance Scale Model by reducing the District's share of average annual local yield from 5,000 afy down to 4,000 afy. This 20 percent reduction in average annual local yield was intended to account for the effects HABs might have on future local yield. At the time, the assumption was considered conservative, but reasonable, given the unknowns pertaining to the effectiveness of future HABs solutions at that time. The results presented to the Board during Workshop No. 1, which were based on a reduced share of average annual local yield at 4,000 afy, showed a 30-year net present value (NPV) economic advantage To Flume of approximately $70 million, see Figure 5-2 below.



Sensitivity Analysis: Reduced Local Yield

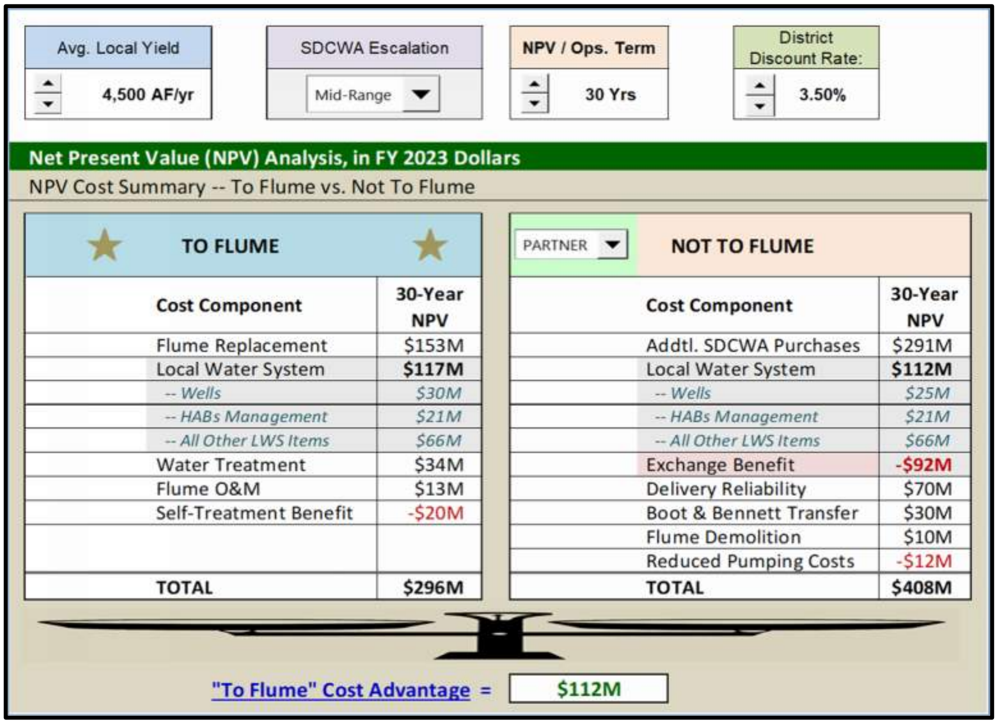
Cost Variable	30-Yr. Cost Advantage (NPV)	
	Not To Flume	★ ★ To Flume
UPDATED Cost Advantage		★ +$130M
Reduced Local Yield + Treatment Average yield reduced 20%, to 4,000 AF/yr		(-$60M) ★ **+$70M**

Cost Advantage: Still To Flume

Figure 5-2. Board Workshop No. 1 slide showing to flume with a reduced local yield

After Board Workshop No. 1, Stillwater Sciences completed the initial phase of the HABs Plan and presented its recommendations to the Board. This work provided more context for better understanding the costs and effectiveness of the future HABs mitigation efforts being considered. The Balance Scale Model was updated with additional information from the HABs study and results were presented to the Board at Workshop No. 2 (September 2022).

The Balance Scale model at that time continued to strongly favor the To Flume with a 30-year NPV cost advantage of approximately $112 million at an anticipated local yield of 4,500 afy (see Figure 5-3). The model also estimated that a long-term average annual local yield below 2,200 afy would tip the To Flume cost advantage to its breakeven point with the Not to Flume option.



Avg. Local Yield: 4,500 AF/yr
SDCWA Escalation: Mid-Range
NPV / Ops. Term: 30 Yrs
District Discount Rate: 3.50%

Net Present Value (NPV) Analysis, in FY 2023 Dollars

NPV Cost Summary -- To Flume vs. Not To Flume

★ TO FLUME ★

Cost Component	30-Year NPV
Flume Replacement	$153M
Local Water System	**$117M**
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$66M*
Water Treatment	$34M
Flume O&M	$13M
Self-Treatment Benefit	-$20M
TOTAL	**$296M**

PARTNER ▼ **NOT TO FLUME**

Cost Component	30-Year NPV
Addtl. SDCWA Purchases	$291M
Local Water System	**$112M**
-- Wells	*$25M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$66M*
Exchange Benefit	**-$92M**
Delivery Reliability	$70M
Boot & Bennett Transfer	$30M
Flume Demolition	$10M
Reduced Pumping Costs	-$12M
TOTAL	**$408M**

"To Flume" Cost Advantage = **$112M**

Figure 5-3. Board Workshop No. 2 slide showing to flume with a reduced local yield

During *Phase 4 - Fine Screening* the Balance Scale Model was once again updated. The model reflects current market costs for capital and financing as well as refined to include more details pertaining to future LWS investment scenarios and associated climatological predictive local yields. As noted above, increases in interest rates over the past year have been significant, and the Balance Scale model was updated to capture their effect on current financing costs. Table 5-3 below summarized the updates made to the most recent version of the Balance Scale model.

Table 5-3. To-Flume vs. Not-to-Flume Balance Scale Model Updates

Category	To-Flume	Not-to-Flume
Flume Capital Costs	• Updated to July 2023 market values • Used $180M based on the preferred alternative	• Updated to July 2023 market values • Used updated Flume demolition costs
System Improvement	• Additional treatment costs at EVWTP now includes additional treatment for yields over the 60:40 allowable blend limit • San Pasqual Undergrounding remains a sunk cost	• Larger Pechstein II w/additional storage during Water Authority Shutdowns • Purchase supply capacity from Oceanside's Weese WTP • Increased Boot & Bennett transfer costs • San Pasqual Undergrounding is now a sunk cost
Local Water System Investments	• Lake Henshaw long-term HABs mitigation costs have been escalated • Accelerated pace of Warner Basin well replacements; six new wells up front • Bypass pipeline added to high-range investment scenario only	• Lake Henshaw long-term HABs mitigation costs have been escalated • Accelerated pace of Smaller Warner Basin well replacements; three new wells up front • Bypass pipeline added to high-range investment scenario only
Other Input Values	• Water Authority Rates updated based on most recent rate increases. • Water Authority rate cap assumptions also increased • Financial Terms (Inflation rate, discount rate, melded cost of funds) updated to current (October 2023) market values. • Local yield per "Dry" climatological condition from the predictive yield modeling as presented in Table 4-2.	• See left; these inputs are applied the same to both sides of the balance scale.

Varying local water system costs and corresponding local yields were applied to a "baseline" set of conditions in the Balance Scale Model. The model inputs, which comprise this baseline condition, are listed below in Table 5-4.

Table 5-4. Baseline Condition Summary – To Flume

Component	Assumption	Description/Detail
Costs	Costs for all line items set at Mid-Range estimates	• Flume replacement costs based on Alignment Alt. 1 • San Pasqual Undergrounding costs removed (these are now sunk costs)
Finance	Capital costs financed via revenue bonds and WIFIA loans	• Planning costs up through EIR certification are PAYGO • Construction and all construction-related costs are FINANCED • Option to set Engineering Final Design costs as PAYGO or FINANCED
HABs	Adverse effects minimized via cost-effective prevention and mitigation measures	• Use middle of Stillwater cost estimates • Includes in-lake HABs mitigation with occasional chemical treatments • Escondido pays 50% of costs associated with Lake Henshaw
Wellfield	Optimize wellfield to achieve allowable sustainable yield	• New wells up front, 6 for To Flume and 3 for Not To Flume • Sinking fund for OMRR sufficient to maintain well capacity over long-term • Escondido pays ~30% of costs
Delivery Reliability Mitigation	$60M cost allowance for new treated water storage and/or other delivery reliability improvements	• Costs moderated by the potential for one or more of • Desal to P3; P4 Isolation Valve; or Supply from Weese
Average Annual Local Yield (to District)[a]	4,700 AF/year (Baseline, Dry)[b]	• Hydrology & Climate Change: Uses the "Dry" model run results from the predictive model for average annual local yield • Well-Field Capacity: Optimized to achieve the allowable sustainable yield • HABs Mitigation and Effect: Baseline mitigation measures implemented • EVWTP Local Water Blend Ratio: Same as current • Wohlford Storage Capacity: Restored via new dam
SDCWA Rate Escalation	Per SDCWA Long-Range Finance Plan	• Mid-Range of SDCWA long-range forecast through CY22 • Thereafter, 0.5% above Water System Base Inflation rate
Exchange Benefits	Escondido purchases portion, but not all, of District supply	• Escondido ability to utilize District share of local water constrained by demands and by the Local Water Blend Ratio of 40% • Escondido able to purchase on average 2,500 AF/year • Unit sales price represents discount in comparison to Escondido purchase of raw water from SDCWA
Boot and Bennet Transfer	District pays most of the Vallecitos list-price costs	• Absent the Flume, District will need to transfer these service areas to Vallecitos • District pays transfer costs to Vallecitos as follows: • Annexation Fees: in full • Capacity Fees: in full • Infrastructure transfer fee: split 50/50 with Vallecitos

a. *Sensitivity analysis presented below adjusted this value using the ranges of projects, costs, and yields shown in* Table 4-2*.*

b. *Per "Mid-range" value shown in* Table 4-2*, using the "Dry" climatological condition.*

Both capital and financing costs have increased and yet the cost advantage remains with To Flume for scenarios where HAB mitigation and wellfield improvement measures are implemented. Escalations in financing costs have increased the District's breakeven point for its share of long-term average annual local yield to 2,700 afy.

Table 5-5 below shows the results of the sensitivity analysis performed using the Balance Scale Model. Under all scenarios where long-term HABs mitigation and wellfield improvements are implemented, the cost advantage continues to favor the To Flume option. However, when long-term HABs mitigations are not implemented, the resulting reduction in local yield can tip the scale toward Not to Flume.

Table 5-5. Balance Scale Model Sensitivity Analysis

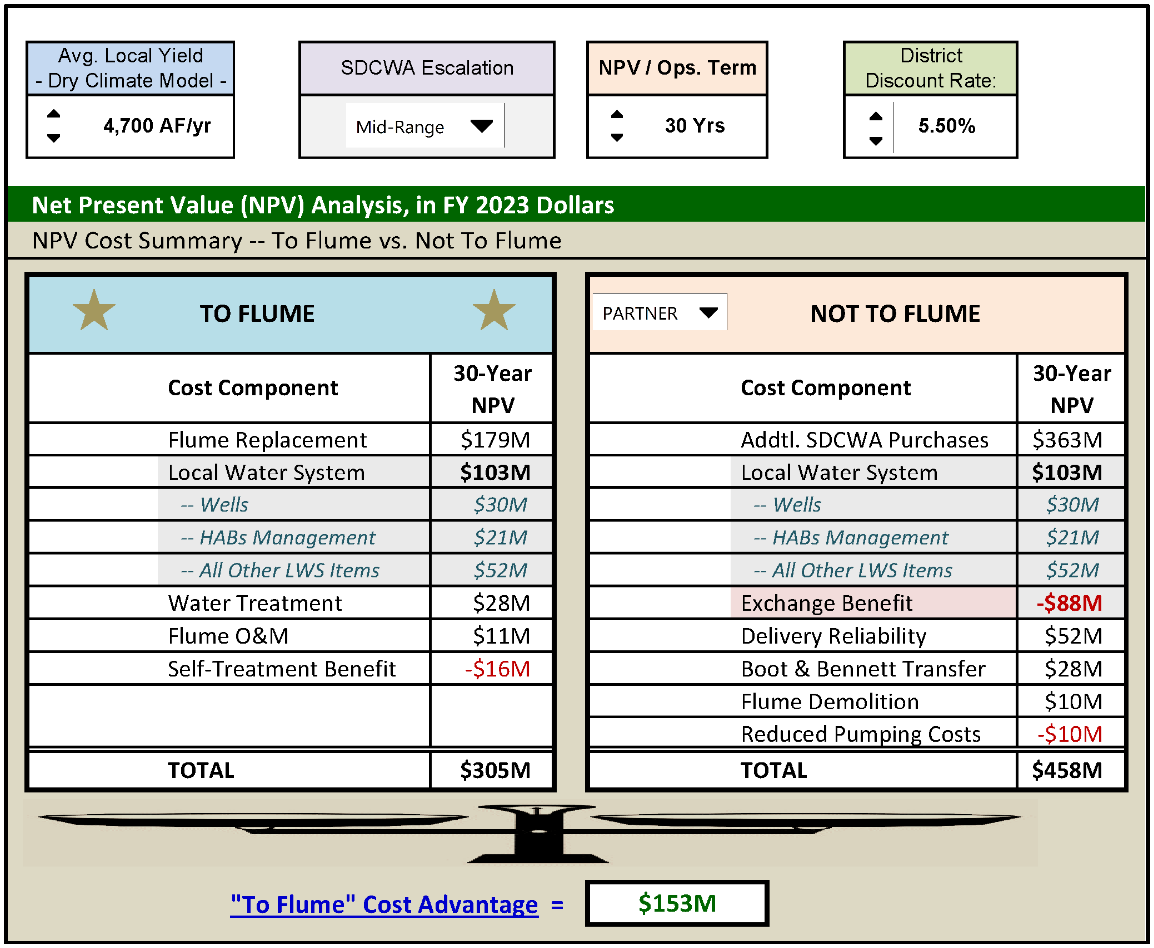
Possible Investment Strategies	To Flume ($M)[a]	Not to Flume ($M)[a,b]	Cost Advantage ($M)[a,b,c]	Dry Climate Predicted Yield (afy)[d,e]	Break-even Yield (afy)[e]
Baseline Condition[f] without HABs mitigation (Low-range[g])	$258M	$179M	Not To Flume $79M	1,700 afy	2,600 afy
Baseline Condition[f,g] with HABs mitigation (Baseline[g])	$305M	$458M	To Flume $153M	4,700 afy	2,700 afy
Baseline Condition[f] with HABs mitigation plus optimized wellfield and bypass pipeline (High-range[g])	$458M	$648M	To Flume $190M[h]	6,900 afy[h]	3,600 afy

a. Costs are 30-year net present value and are rounded to the nearest $1 million
b. Not to Flume assumes District retires the Flume and continues to sell local water to Escondido to help offset costs of retirement
c. Costs presented are a function of average annual local yield; note, as anticipated local yield increases so does the cost advantage To Flume.
d. District's share of anticipated average annual yield produced by the corresponding scenarios shown on Table 4-2*; for conservatism, the above used local yields from the "Dry" climate model scenarios.*
e. District's share of average annual local yield needed for there to be no cost advantage between To Flume and Not to Flume
f. See ***Table 5-4*** *for definition*
g. See ***Table 4-2*** *for definition*
h. Utilizing this amount of local yield would require a higher local-to-imported water blend ratio at EVWTP then the current 40:60 limit. This would require additional capital investments at Lake Wohlford and EVWTP to improve local water treatability.

The District may move forward with confidence that investments in mitigating HABs and optimizing the Warner Basin wellfield will provide significant economic advantage to the District and its ratepayers. However, building additional infrastructure, such as a bypass pipeline around Lake Henshaw, may have diminishing returns.

This above analysis continues to quantify the value the ecologic health of Lake Henshaw has on the economic viability of the Flume replacement project. It also found that the anticipated local water system expenditures are relatively small compared to the economic advantage gained by the increased local yield.

For example, from Table 5-5 above, the "Low-range" expenditure estimated to produce an average annual local yield of 1,700 afy, which results in a To Flume project net present value (NPV) cost of $258 million and a Not To Flume project cost of $179 million on a 30-year NPV basis. At this specific yield-to-cost relationship, the Not To Flume option has a 30-year NPV cost advantage over To Flume by approximately $79 million. Now, if the District continues to fully operate and maintain its LWS, the "Baseline" option's 30-year NPV cost To Flume would increase to $305 million while Not to Flume would increase more greatly to $458 million. The corresponding increase in local yield and resulting avoided cost of purchasing treated water, achieved by these investments effectively tips the scales toward the To Flume option. At this specific yield-to-cost relationship, To Flume is estimated to have a 30-year NPV cost advantage of $153 million over Not to Flume (as shown in Figure 5-4 below); a $232 million increase in cost advantage over the investment scenario that does not include HABs mitigation.



Avg. Local Yield - Dry Climate Model -	SDCWA Escalation	**NPV / Ops. Term**	District Discount Rate:
4,700 AF/yr	Mid-Range	**30 Yrs**	**5.50%**

Net Present Value (NPV) Analysis, in FY 2023 Dollars

NPV Cost Summary -- To Flume vs. Not To Flume

★ **TO FLUME** ★

Cost Component	**30-Year NPV**
Flume Replacement	$179M
Local Water System	**$103M**
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$52M*
Water Treatment	$28M
Flume O&M	$11M
Self-Treatment Benefit	-$16M
TOTAL	**$305M**

PARTNER ▼ **NOT TO FLUME**

Cost Component	**30-Year NPV**
Addtl. SDCWA Purchases	$363M
Local Water System	**$103M**
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$52M*
Exchange Benefit	**-$88M**
Delivery Reliability	$52M
Boot & Bennett Transfer	$28M
Flume Demolition	$10M
Reduced Pumping Costs	-$10M
TOTAL	**$458M**

"To Flume" Cost Advantage = $153M

Figure 5-4. Updated balance scale modeling shows to flume retains the cost advantage

Going one step further, the High-range investment scenario shows a possible over-investment in the LWS. Here the To Flume cost advantage increases from $153 million (Baseline) to $190 million (High-range); a $37 million difference in cost advantage that has a high probability of generating more local yield than the current treatment system will allow, due to blend ratio limitations, which would require significant additional investments in water quality improvements at Lake Wohlford and treatability improvements at EVWTP. Thereby, a diminishing return is noted at this high level of investment.

Section 6

Conclusions

The work performed in *Phase 4– Fine Screening*, as presented herein, concludes the third major step in this Alignment Study; identification of the preferred alignment. The key findings of this work will shape the next phase of the Alignment Study, *Phase 5 – Recommended Alignment Report*. Below is a summary of the conclusions resulting from Phase 4:

1. The Alignment Study has finished evaluating a broad range of alternatives and recommends Alternative 1 advance to conceptual design, while retaining the Beginning corridor of Alternative 2 as a contingency during final design.

The Fine Screening approach presented in Section 3.2 individually assessed the beginning, middle, and end corridors for each alignment shortlisted during Coarse Screening. It then evaluated all possible beginning, middle, and end corridor combinations in search of the best overall alignment (15 alignment combinations in total). Alternative 1 for the beginning, middle and end corridors proved to be the most favorable cost vs. risk rated alignment. Conversely, any alignment using Alternative 6 in its middle corridor was eliminated due having the highest risk and cost ratings of any combination of alternatives.

The beginning corridor of Alternative 2 has some advantages worth noting. This corridor avoids the utility congestion and construction risks present along Alternative 1's beginning corridor (adjacent to the Escondido Creek access road) but will have more significant impacts to the community. Retaining the beginning corridor of Alternative 2 will allow the design team an option to adjust the design if additional utility and geotechnical investigations find less than favorable conditions in the field for Alternate 1's beginning corridor.

For more detail see Figure 3-5 for a map of the recommended alignment and Figure 3-6 for a map comparing the beginning corridors of Alternatives 1 and 2.

2. The Flume Replacement Project requires a diverse funding portfolio; interest rates for the funding mechanisms which will plausibly comprise this portfolio have increased significantly.

The interest rate increases identified will add more cost to servicing the future debt, which will have a net increase on projected future water rates. However, the infrastructure needs, and associated investment scenarios, being considered by the District remain the same. Time is of the essence; developing a strategic rate design and advancing it through the financial planning and Board adoption process remains a high priority. Recognizing the importance of advancing financial planning efforts, the Board approved hiring NHA Advisors on November 1, 2023. District staff will be advancing the work with the municipal financial advisor immediately. See Section 5.1 for more detail.

3. Most climate futures, 80% of the modeled scenarios, predict the District can confidently rely on local water being available over a wide variety of climate conditions, and the economics weigh in favor of a To Flume project if modest investments are made to the LWS.

Addressing HABs at Lake Henshaw and optimizing the Warner Basin wellfield remain as priorities for positive Balance Scale economics. Only three of the 15 model runs (20%) produced local yields which would not support the future Flume Replacement project; none of these scenarios included HABs mitigation or wellfield improvement measures. Six of the 15 model runs (40%) predicted local yields greater than the EVWTP's current 40:60 local-to-imported water blend ratio limit, which would require additional investments in treatment system modifications to realize the full benefit of this additional yield. The remaining six of the 15 model runs (40%) predicted local yields acceptable to the existing EVWTP with little to no treatability modifications to the EVWTP. See Table 4-2 for a summary of results relative to each investment scenario modeled.

4. The To Flume option retains significant cost advantage in comparison to the Not To Flume option, and still supports LWS improvements at Lake Henshaw and Warner Basin wellfield; so long as the District's share of average annual local yield is above 2,700 AFY.

Despite escalating capital and financial costs, the To Flume option remains economically favorable. Adding local water system improvement projects to the balance scale increases yield and more favorably supports the To Flume economics. Improvements to Lake Henshaw and the Warner Basin wellfield designed to support the District's continued operation of its LWS should be done in the same capital improvement planning window. However, constructing a bypass pipeline around Lake Henshaw may be an overinvestment with uncertain returns. See Section 5 for more details.

5. The analyses presented herein supports the District's continued investment in HABs mitigation, wellfield improvements, and the future Flume Replacement projects. Recommended next steps include:

- Proceed with *Phase 5 – Recommended Alignment Report (RAR)* using alignment Alternative 1 and complete this Alignment Study.
- Inform DDW of the District's intent to advance the Flume Replacement project and document their input relative to permitting the preferred alignment in the RAR.
- Advance preparation of CEQA supporting documents.
- Continue investigating options for mitigating HABs as well as optimizing the Warner Basin wellfield.
- Advance work with the District's municipal financial advisor in developing the funding strategy for the Flume's replacement and prepare the District for capital financing.
- Develop an RFP for final design of the future Flume Replacement Project and include the above documents as attachments for the final designer.
- Use the planning, environmental, and financial documents prepared in the above steps as supporting documentation to pursue a diverse funding portfolio.

Exhibit A

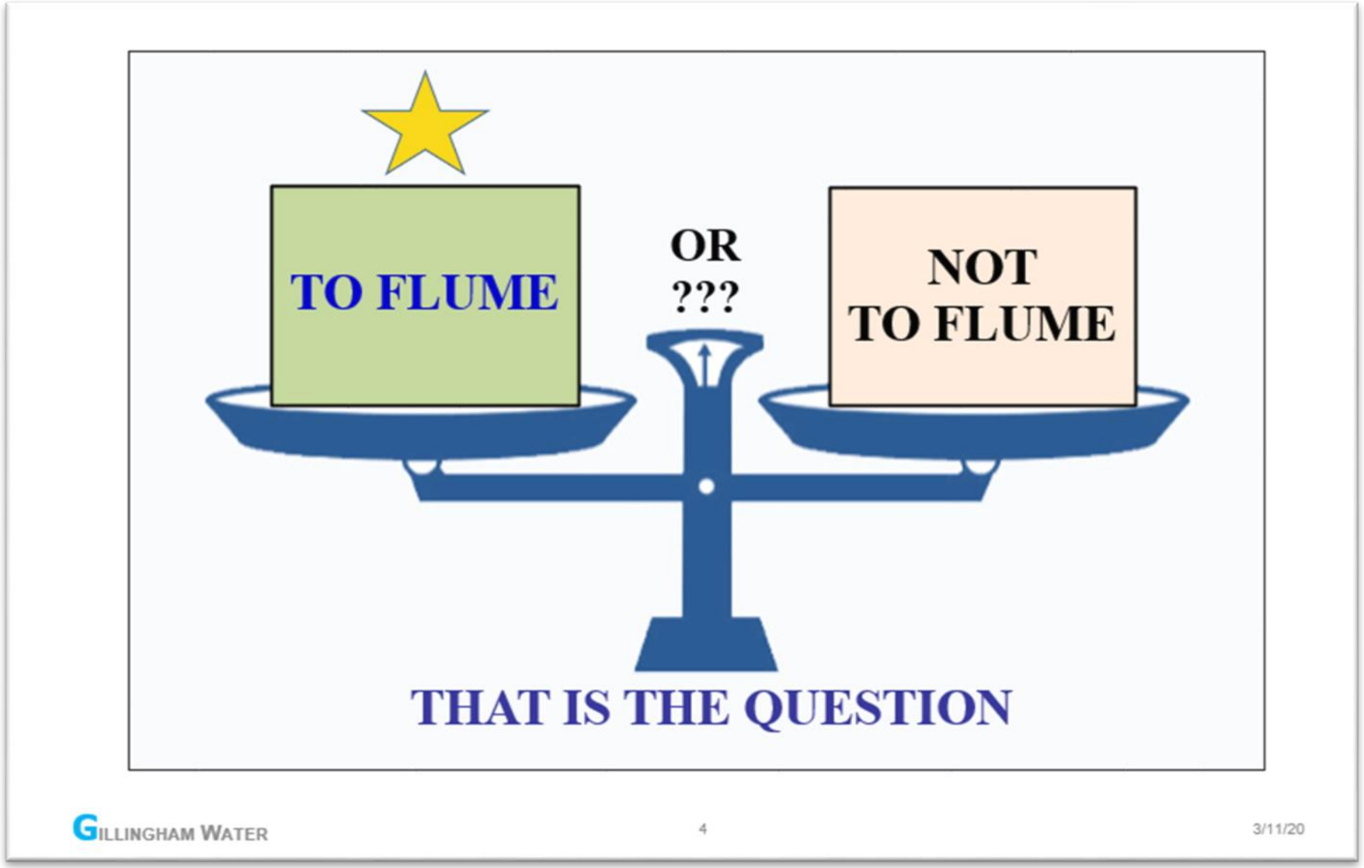
Flume Replacement Alignment Study

Board Workshop #3 – Fine Screening

December 11, 2023

Defining the **next** legacy

Where we came from: **To Flume or Not to Flume?**



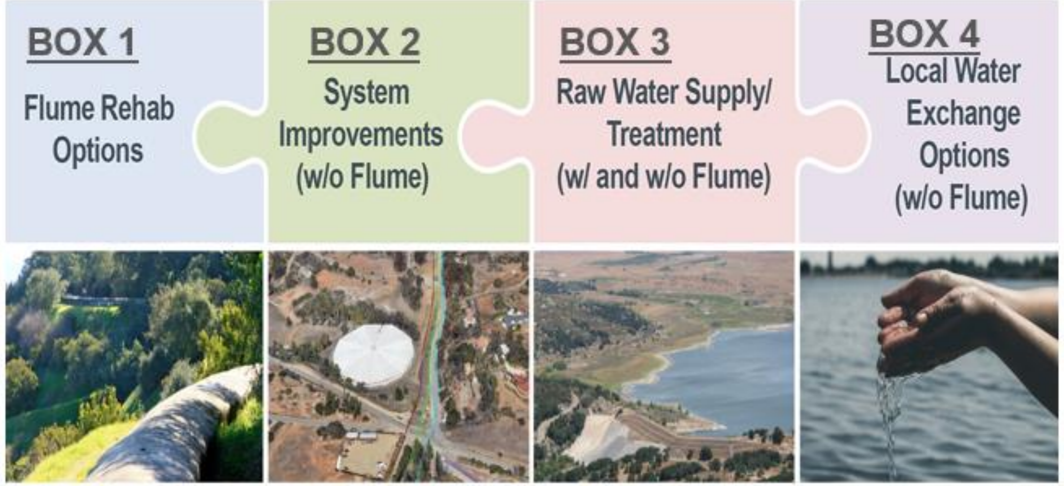
TO FLUME

OR
???

NOT
TO FLUME

THAT IS THE QUESTION

GILLINGHAM WATER 4 3/11/20



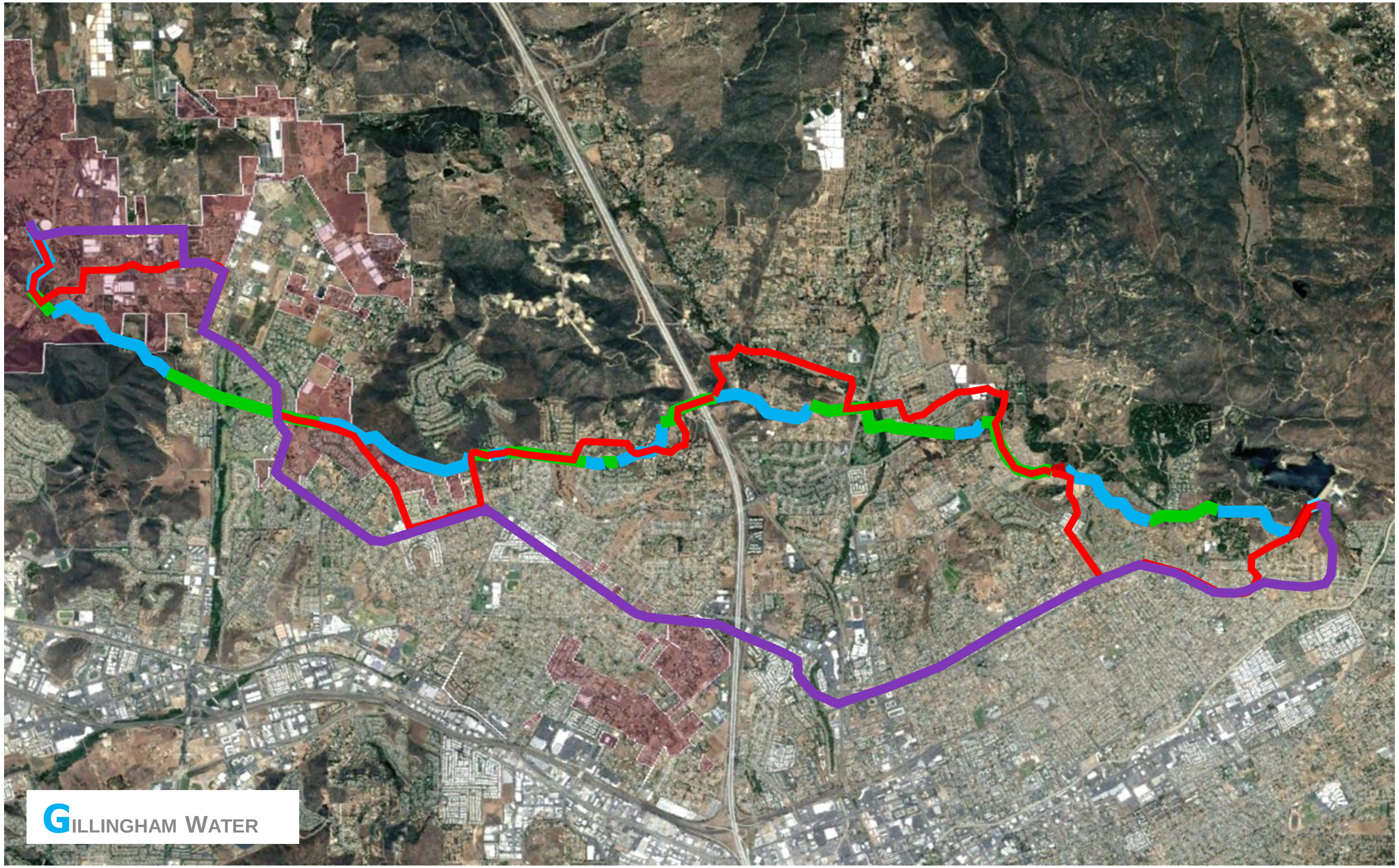
BOX 1
Flume Rehab Options

BOX 2
System Improvements (w/o Flume)

BOX 3
Raw Water Supply/ Treatment (w/ and w/o Flume)

BOX 4
Local Water Exchange Options (w/o Flume)

Where we came from: **Two Alternatives Captured the Range of Possibilities**



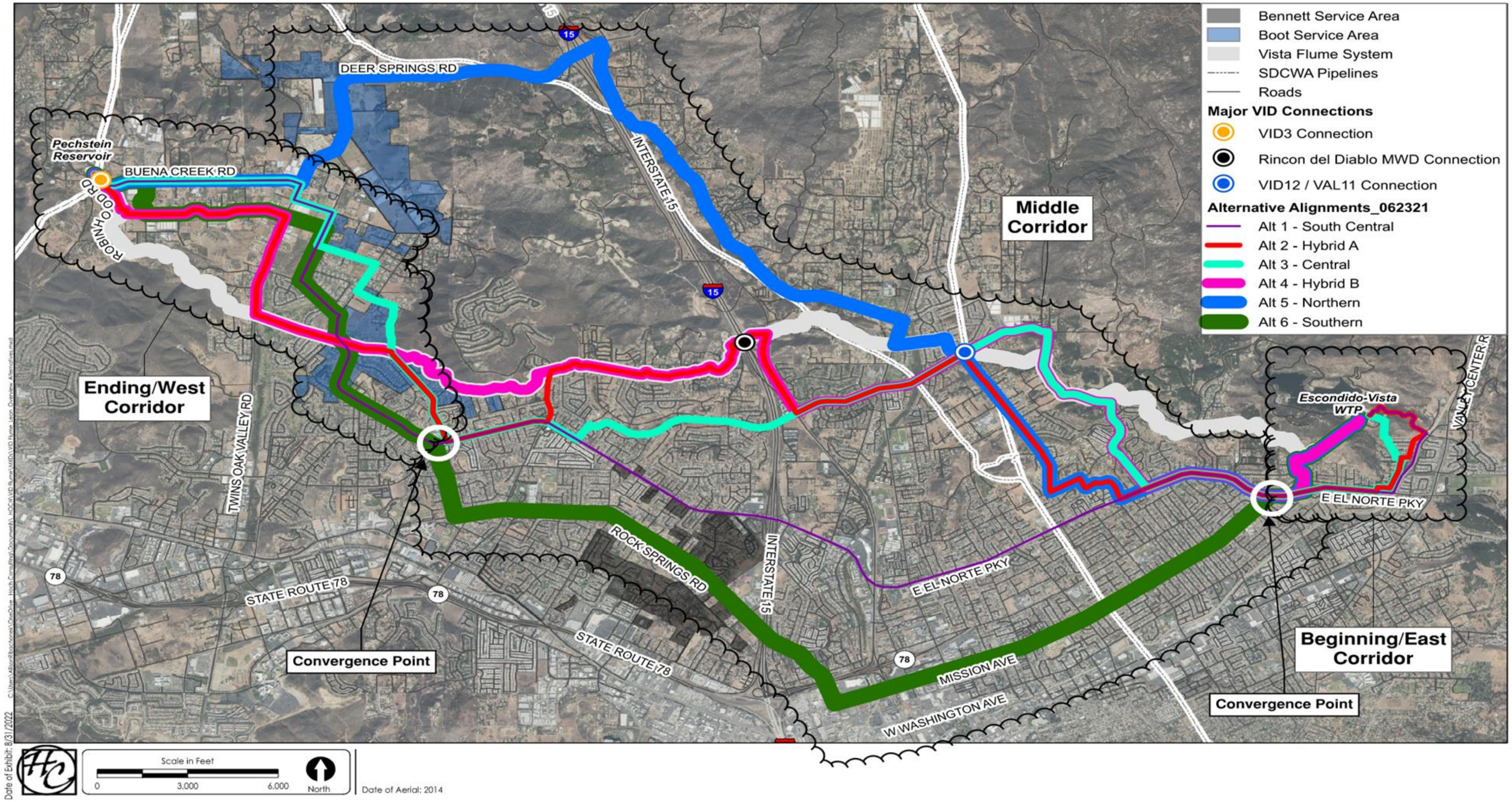
Defining the **next** legacy

RELIABLE

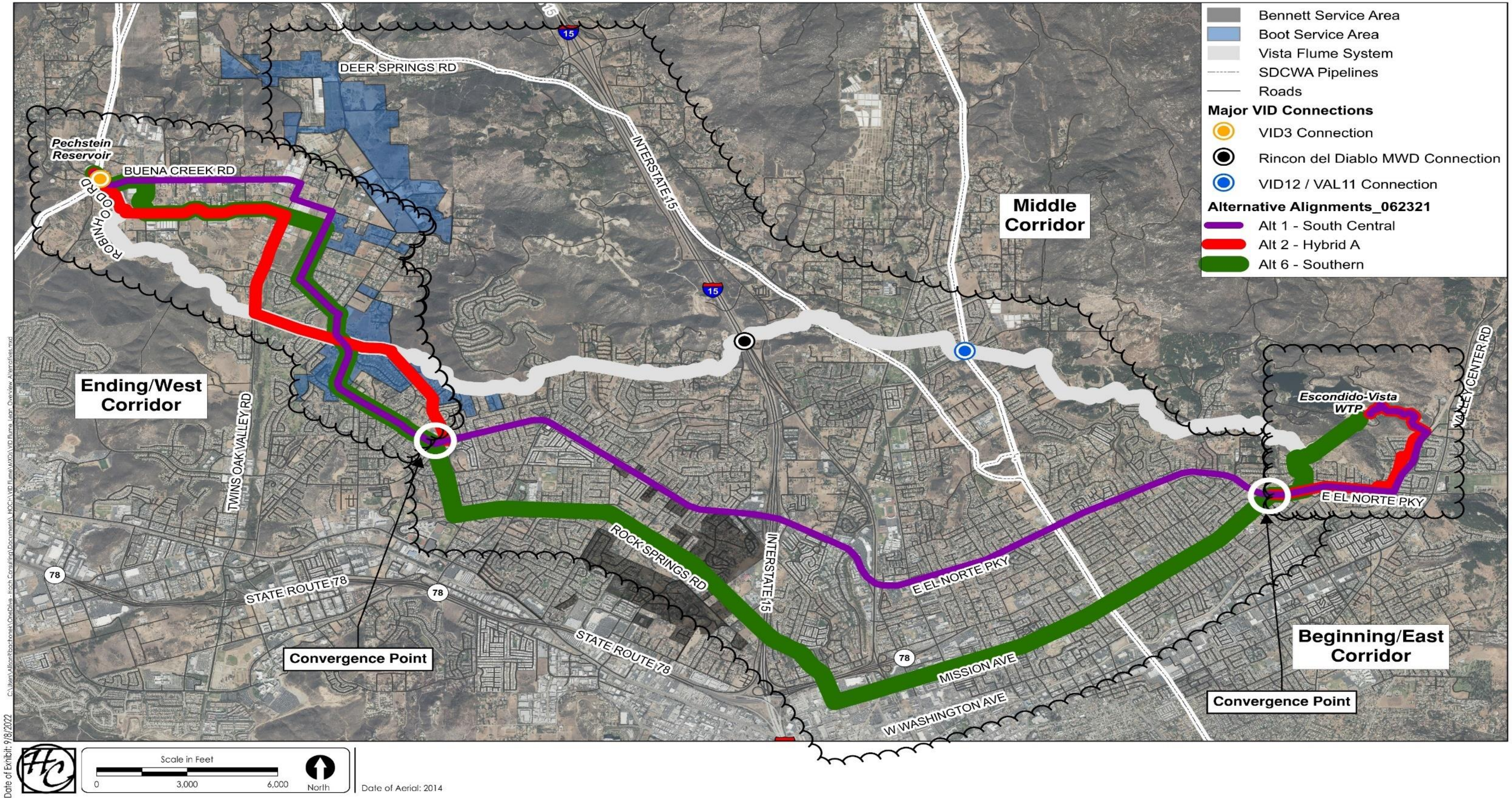
AFFORDABLE

RESPONSIBLE

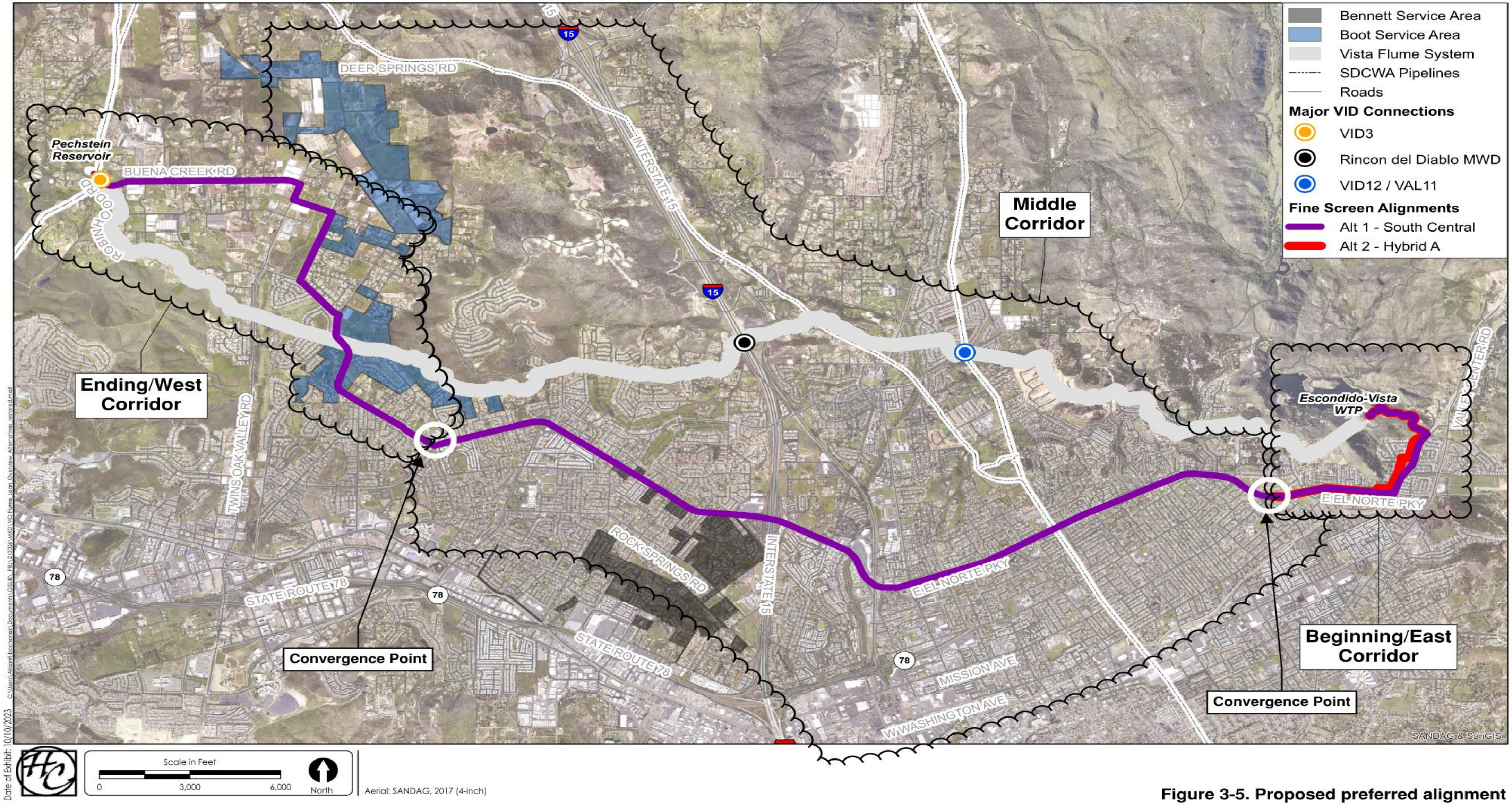
This study developed a total of **six alignments alternatives.**



Coarse screening shortlist; **two alignments plus two corridors**



Fine screening recommends; Alternative #1 plus One Corridor



Date of Exhibit: 10/10/2023

Aerial: SANDAG, 2017 (4-inch)

Figure 3-5. Proposed preferred alignment

Predictive climatological modeling **supports the To Flume decision for 80% of climate scenarios modeled**.

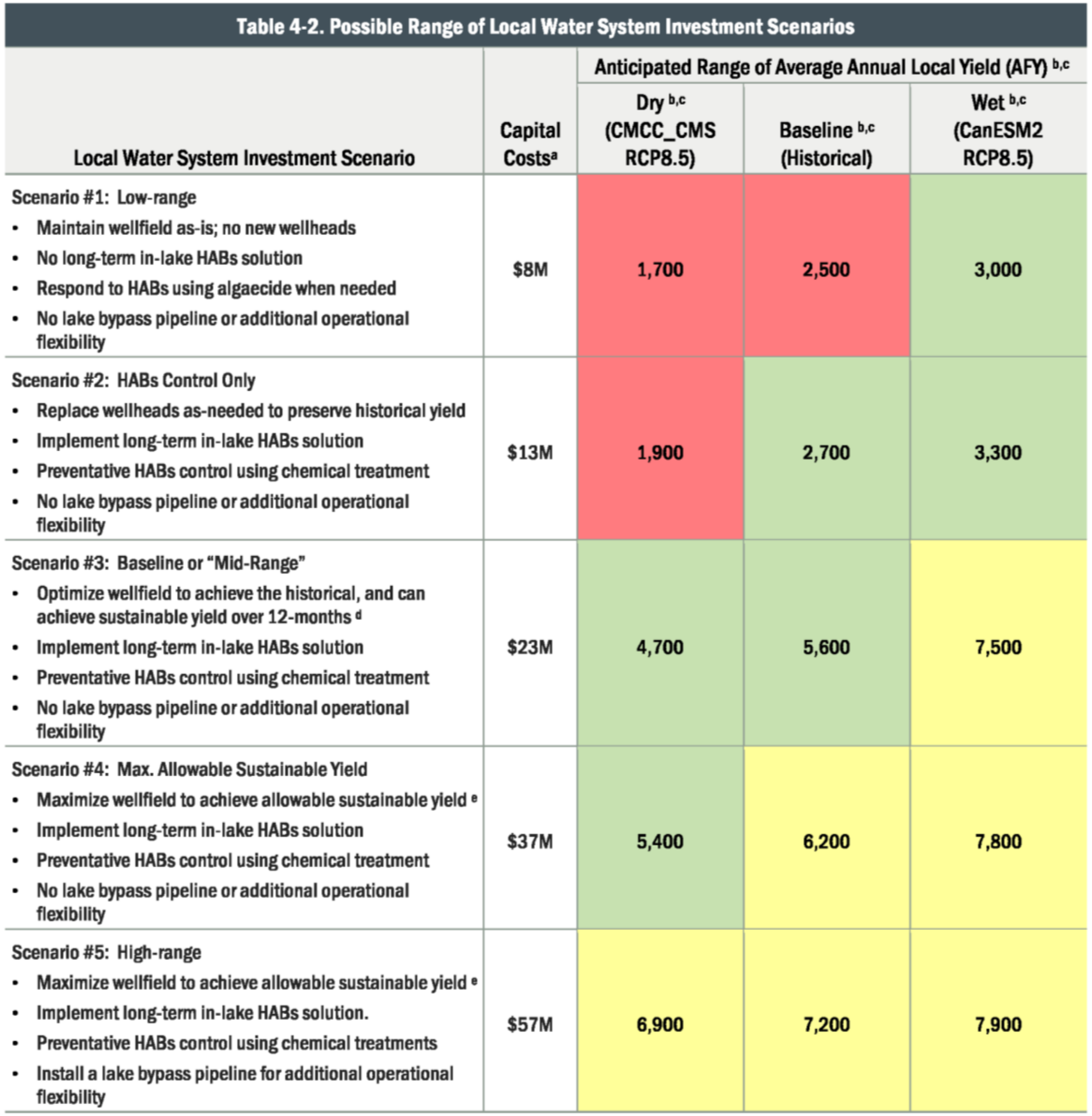
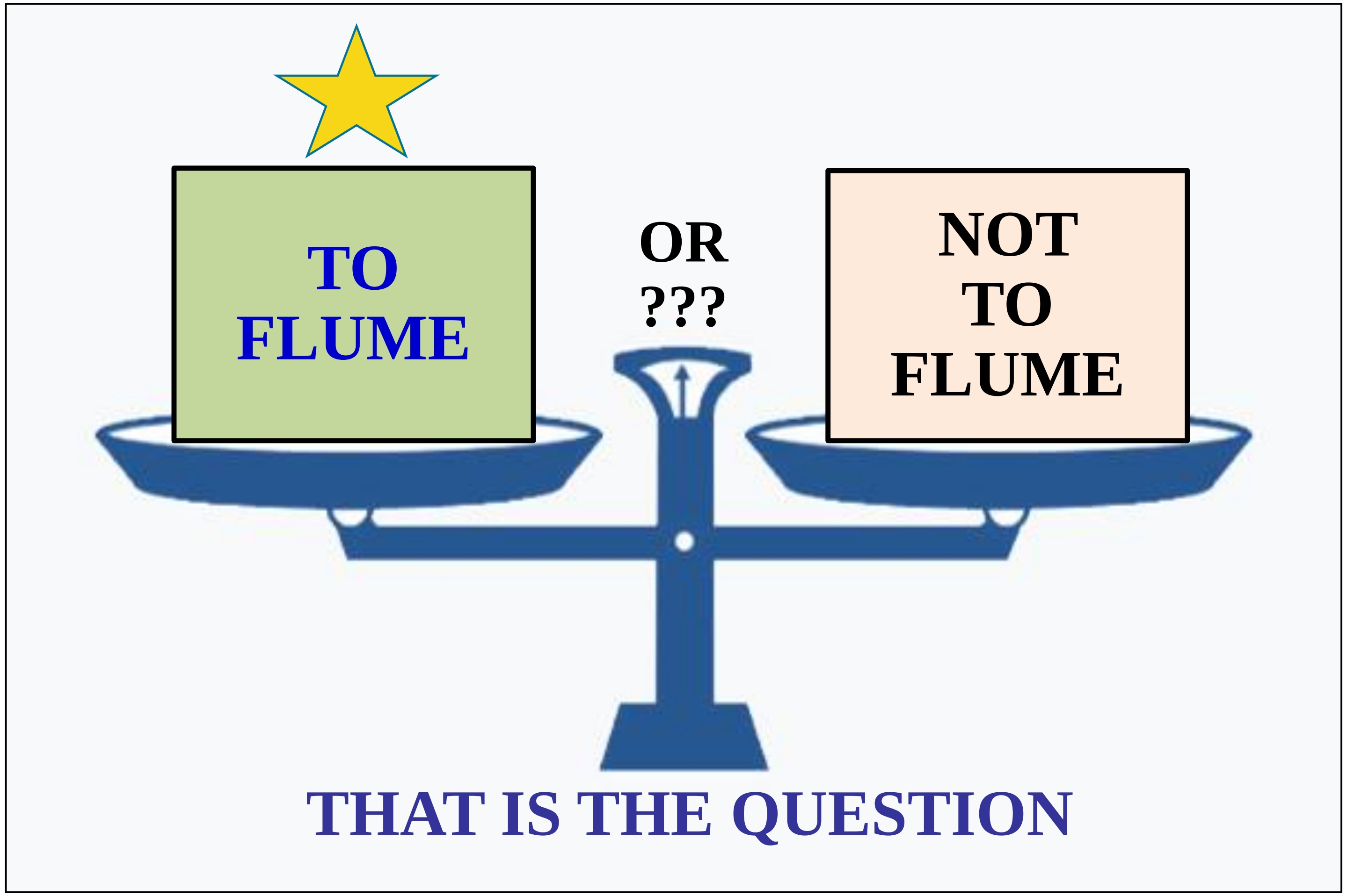


Table 4-2. Possible Range of Local Water System Investment Scenarios

Local Water System Investment Scenario	Capital Costs[a]	Anticipated Range of Average Annual Local Yield (AFY) [b,c]		
		Dry [b,c] (CMCC_CMS RCP8.5)	Baseline [b,c] (Historical)	Wet [b,c] (CanESM2 RCP8.5)
Scenario #1: Low-range • Maintain wellfield as-is; no new wellheads • No long-term in-lake HABs solution • Respond to HABs using algaecide when needed • No lake bypass pipeline or additional operational flexibility	$8M	1,700	2,500	3,000
Scenario #2: HABs Control Only • Replace wellheads as-needed to preserve historical yield • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$13M	1,900	2,700	3,300
Scenario #3: Baseline or "Mid-Range" • Optimize wellfield to achieve the historical, and can achieve sustainable yield over 12-months [d] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$23M	4,700	5,600	7,500
Scenario #4: Max. Allowable Sustainable Yield • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$37M	5,400	6,200	7,800
Scenario #5: High-range • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution. • Preventative HABs control using chemical treatments • Install a lake bypass pipeline for additional operational flexibility	$57M	6,900	7,200	7,900

Despite escalating costs, need for financing, and future local water system investments, **the decision To Flume still maintains the economic advantage.**



Workshop Objectives

- **Report** on work completed to-date
  - field investigations and alternatives analysis
  - fine screening evaluation results and shortlist
  - predictive climatological modeling
  - cost & affordability check
- **Obtain Board's feedback** on work performed and recommended next steps
- **Reach consensus** on:
  - advancing study to Phase 5 – Recommended Alignment Report

Agenda

1. Introduction and Objectives
2. Overview of Shortlisted Alternatives
3. Alternatives Evaluation – Fine Screening
4. Predictive Climatological Modeling
5. Project Affordability Update
6. Conclusions & Next Steps

1. Introduction and Objectives

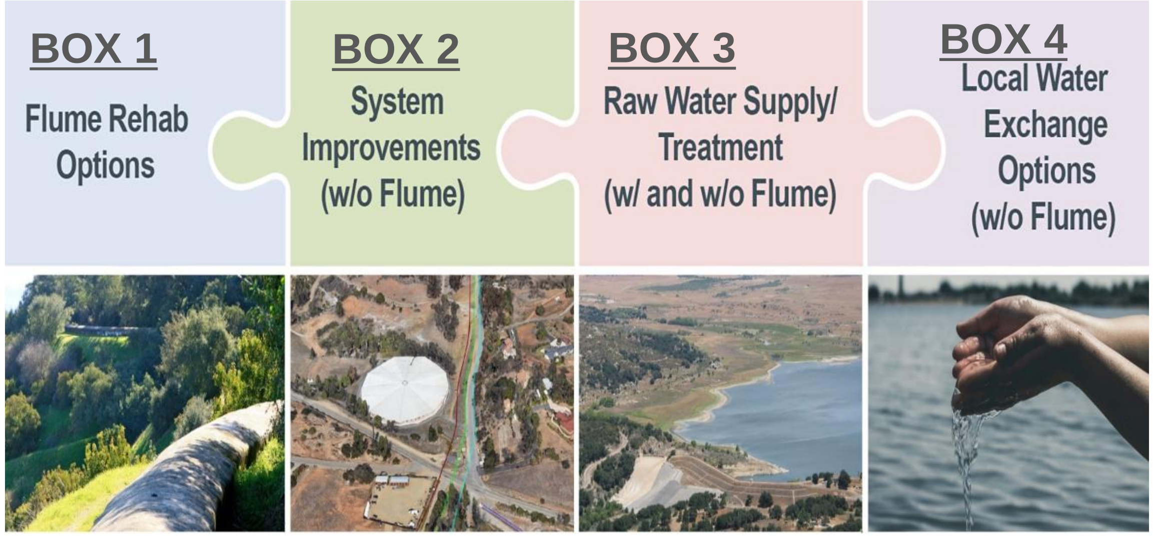
Speaker: J.P. Semper, P.E.

Brown AND Caldwell

Defining the **next** legacy

Where we came from: To Flume or Not To Flume?

- WSPS, which concluded in Jan. 2020, Four “Boxes” were evaluated
- 2 alignment alternatives defined the range of the “To Flume” project
- Determined “To Flume” was most favorable option

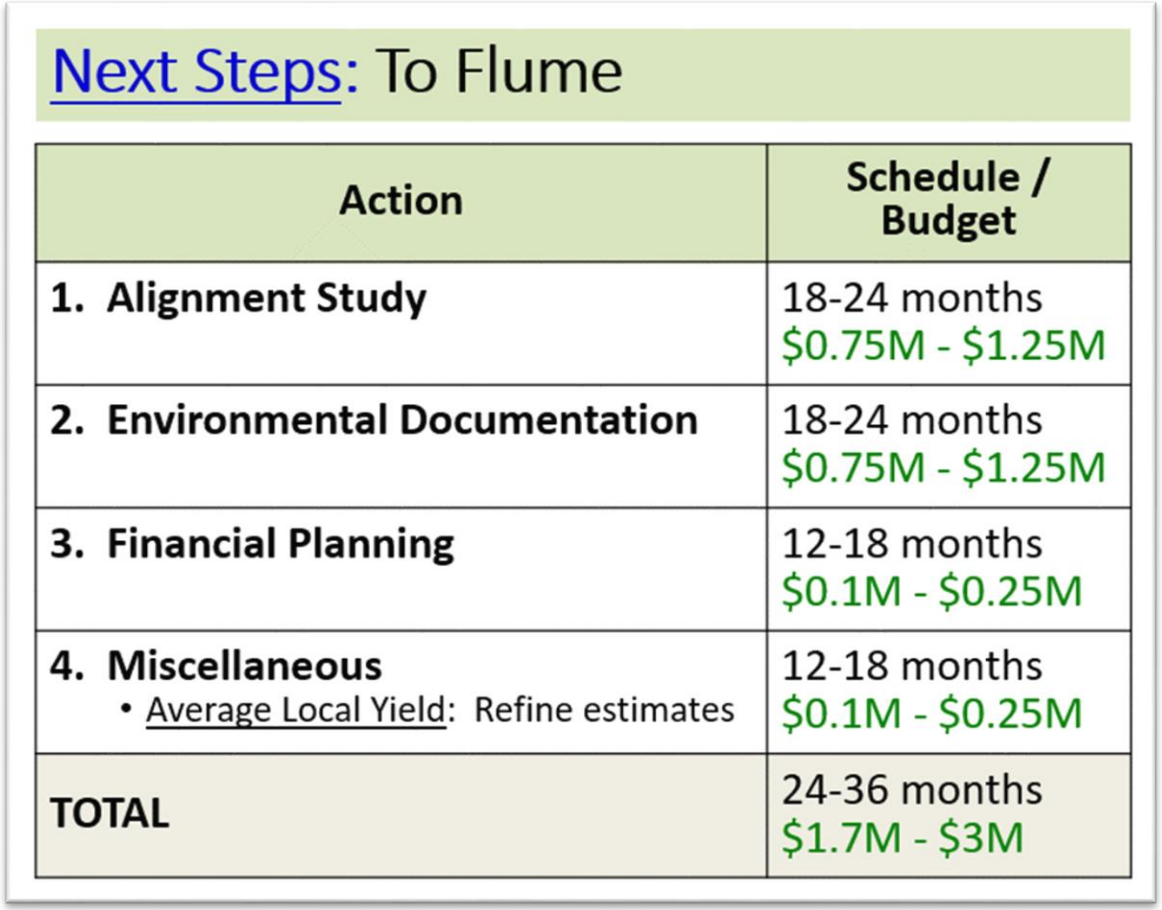


BOX 1
Flume Rehab Options

BOX 2
System Improvements (w/o Flume)

BOX 3
Raw Water Supply/ Treatment (w/ and w/o Flume)

BOX 4
Local Water Exchange Options (w/o Flume)



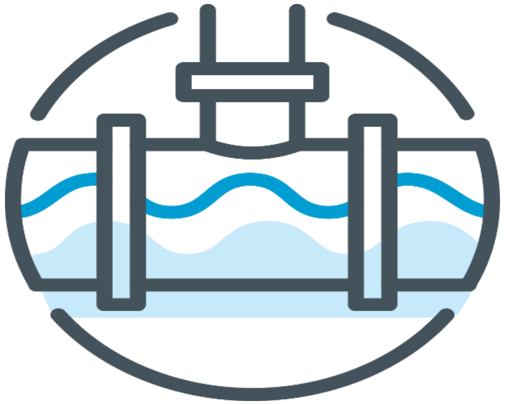
Next Steps: To Flume

Action	Schedule / Budget
1. Alignment Study	18-24 months $0.75M - $1.25M
2. Environmental Documentation	18-24 months $0.75M - $1.25M
3. Financial Planning	12-18 months $0.1M - $0.25M
4. Miscellaneous • Average Local Yield: Refine estimates	12-18 months $0.1M - $0.25M
TOTAL	24-36 months $1.7M - $3M

Where are we headed: How to Flume?

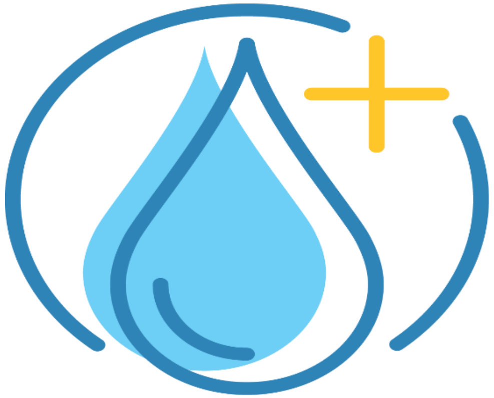
PLANNING FACTORS:

- feasibility and cost-effective construction
- reliability
- environmental effects
- long-term operations and maintenance (O&M)
- affordability, impacts to rates, and funding options
- *NEW* predictive climatological modeling



RELIABLE

AFFORDABLE



RESPONSIBLE

Where are we headed: How to Flume?

SUCCESS FACTORS:

- **Consider a reasonable range of potentially feasible alternatives** that will foster informed decision-making and public participation, per CEQA.
- **Avoid surprises related to feasibility or cost** that unexpectedly tips the scale on the “To Flume or Not to Flume” decision by regularly tracking pertinent cost data and preparing more detailed construction cost estimates.
- **Support the District’s decision to replace the Flume by presenting a clear project roadmap** in a preliminary design report that includes a project funding plan for the preferred alignment.

RELIABLE

AFFORDABLE

RESPONSIBLE

Where are we headed: How to Flume?

PLANNING OBJECTIVES:

1. Alignment Criteria and Alternatives Evaluation
2. Funding Support
3. Project Affordability Checks
4. Assess Potential Environmental Impacts
5. Convene Multiple Workshops with the Board

Defining the **next**
legacy

Recap of Board Workshop #1

CONCLUSIONS:

1. Six alignments have been developed
2. To Flume continues to be economically preferred
3. Retiring the Flume remains a high priority
4. Advancing financial planning for this project would be prudent

"For Workshop No. 2, we will prepare a discussion related to project affordability, funding opportunities, prioritization within the District's Capital Improvement Plan (CIP), and next steps for preparing the District in securing financial assistance may it be through grants or loans."

NEXT STEPS:

1. Collect detailed data for the six alignments
2. Develop capital costs for the six alignments
3. Conduct Coarse Screening and shortlist top 2-3 alignments
4. Begin preliminary financial planning to understand the cost of funding
5. Repeat the affordability check with refined information
6. Report back to the Board at Workshop #2

Recap of Board Workshop #2

CONCLUSIONS:

1. Alternatives 1 & 6 plus two corridors shortlisted for Fine Screening
2. PAYGO is no longer an option and capital financing is needed
3. To Flume retains significant cost advantage over Not To Flume
4. Investing in the local water system will improve local yield and improve the economic advantage

"For Workshop No. 3, we will prepare a climatological model that will consider a range of possible local yields based on varying climate scenarios."

NEXT STEPS:

1. Proceed with Fine Screening
2. Continue investigating HABs mitigation and wellfield optimization
3. Perform predictive modeling of future yield
4. Hire municipal 'financial' advisor
5. Continue collecting data required for environmental documents
6. Conduct another Affordability Check-in and report back to the Board at Workshop #3

Where are we today: Phase 4 – Fine Screening

1. Conducted field investigations and collected additional data on the shortlisted alignments.
2. Updated planning level cost estimates for each alignment.
3. Refined evaluation criteria and performed Fine Screening.
4. Selected and recommended one preferred alignment.
5. Completed affordability check-ins confirming the To Flume decision.
6. Conducting final Board workshop.

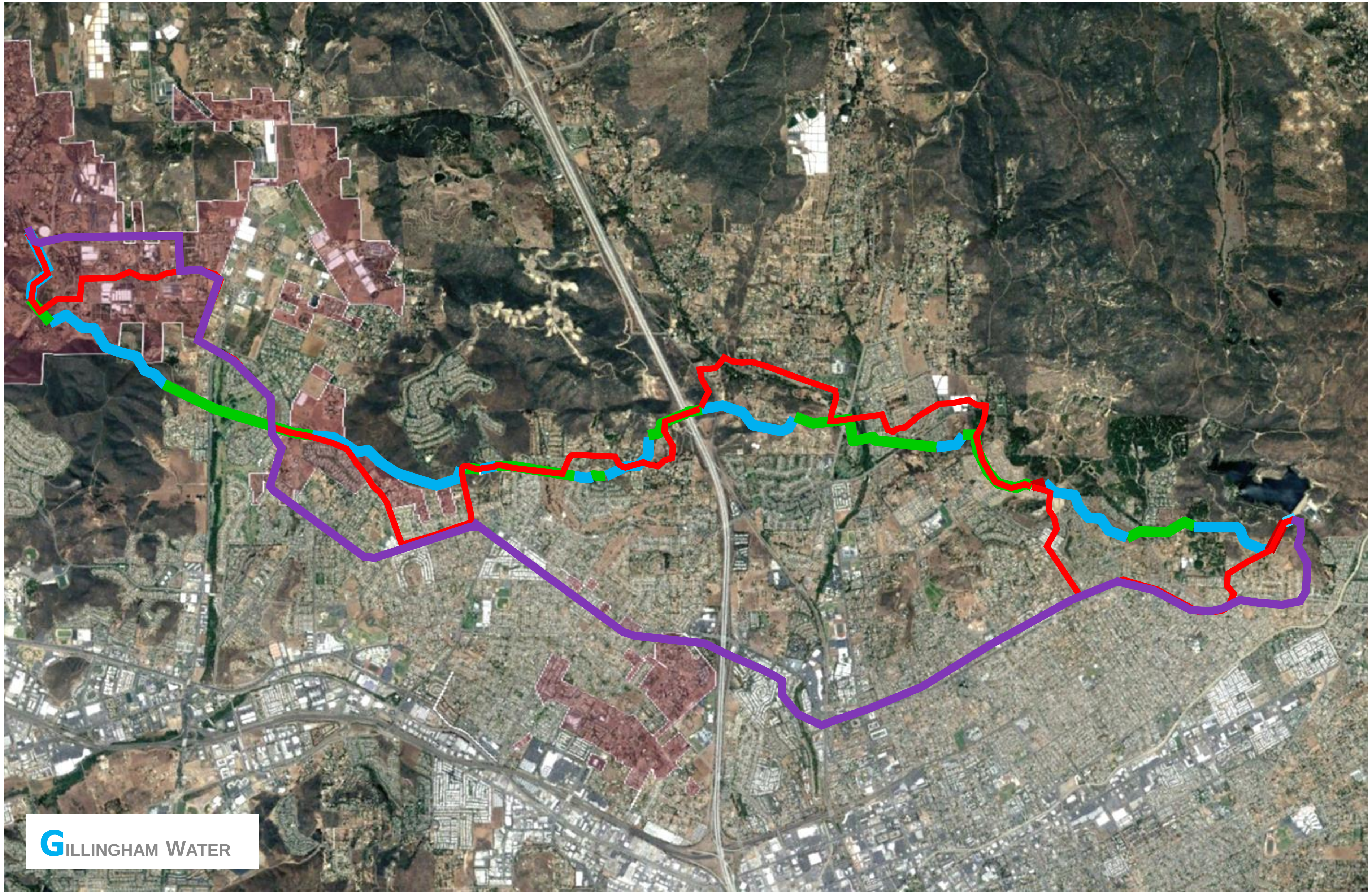
What's Next?

Complete the Study under,
Phase 5 - Recommended Alignment Report (RAR)

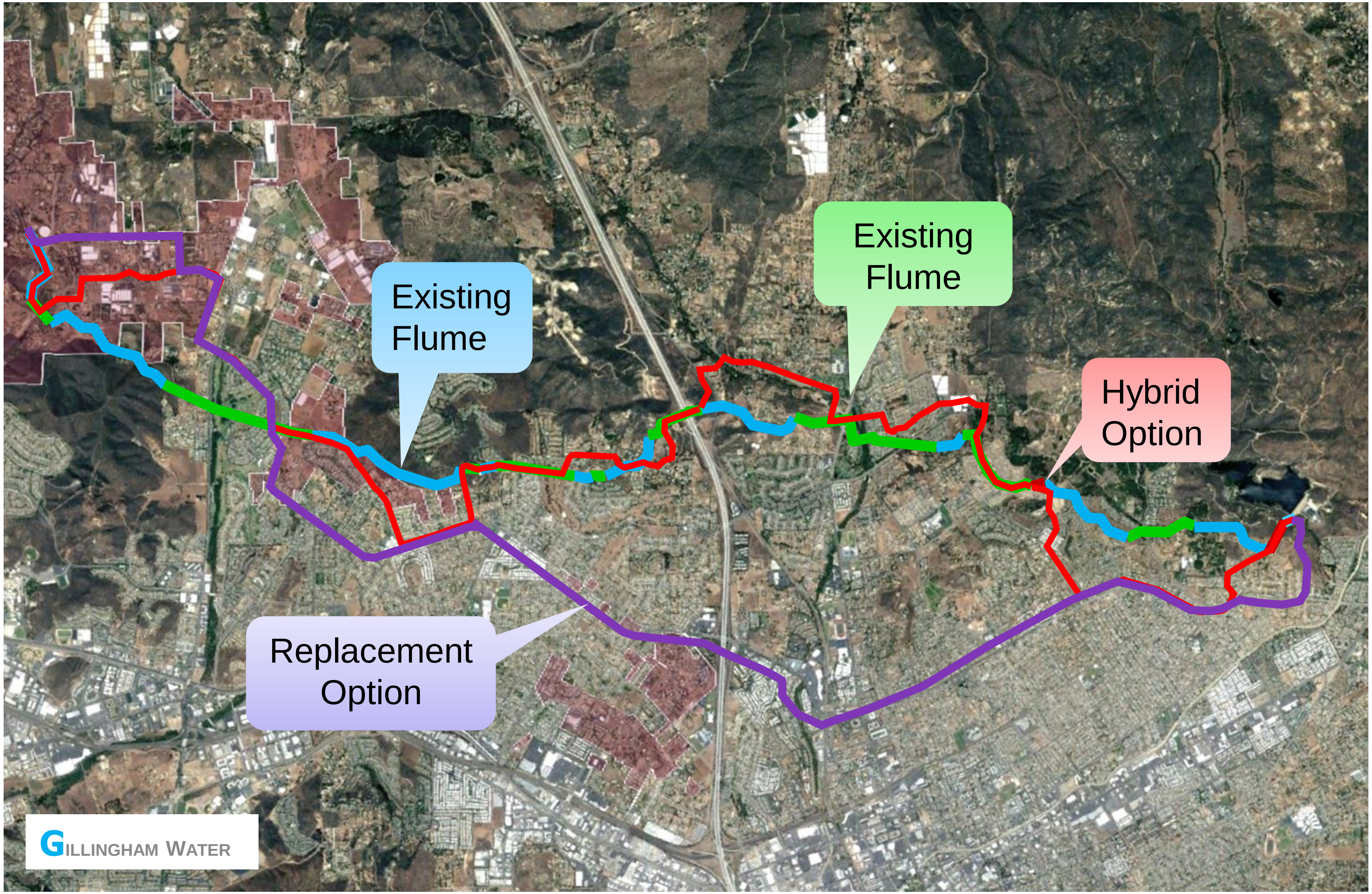
2. Overview of Shortlisted Alternatives

Speaker: Octavio Casavantes, P.E.

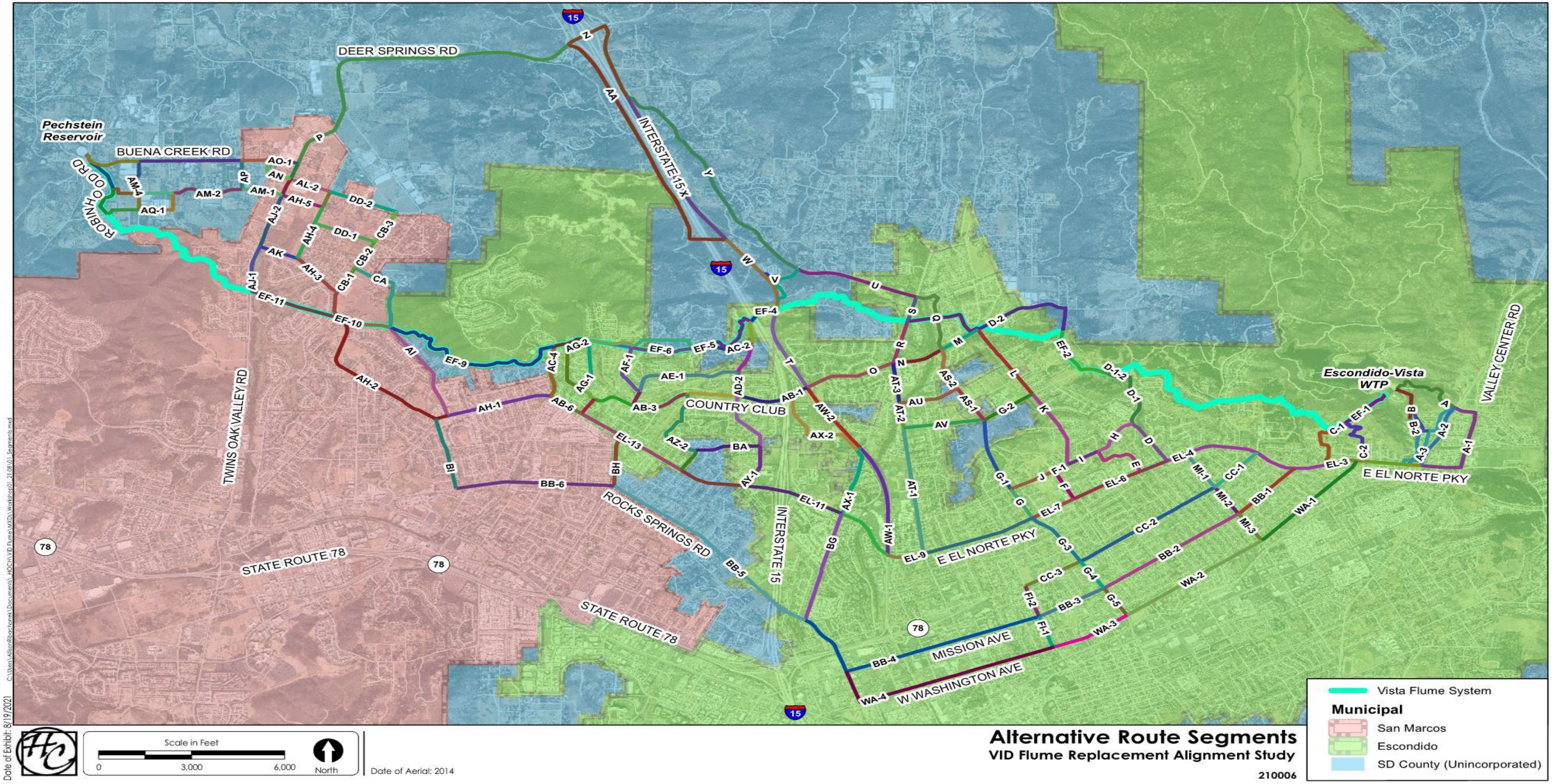
WSPS Alternatives: captured a wide-range of "replacement" costs



WSPS Alternatives: captured a wide-range of “replacement” costs



Constructible Corridors: total of 158 segments evaluated



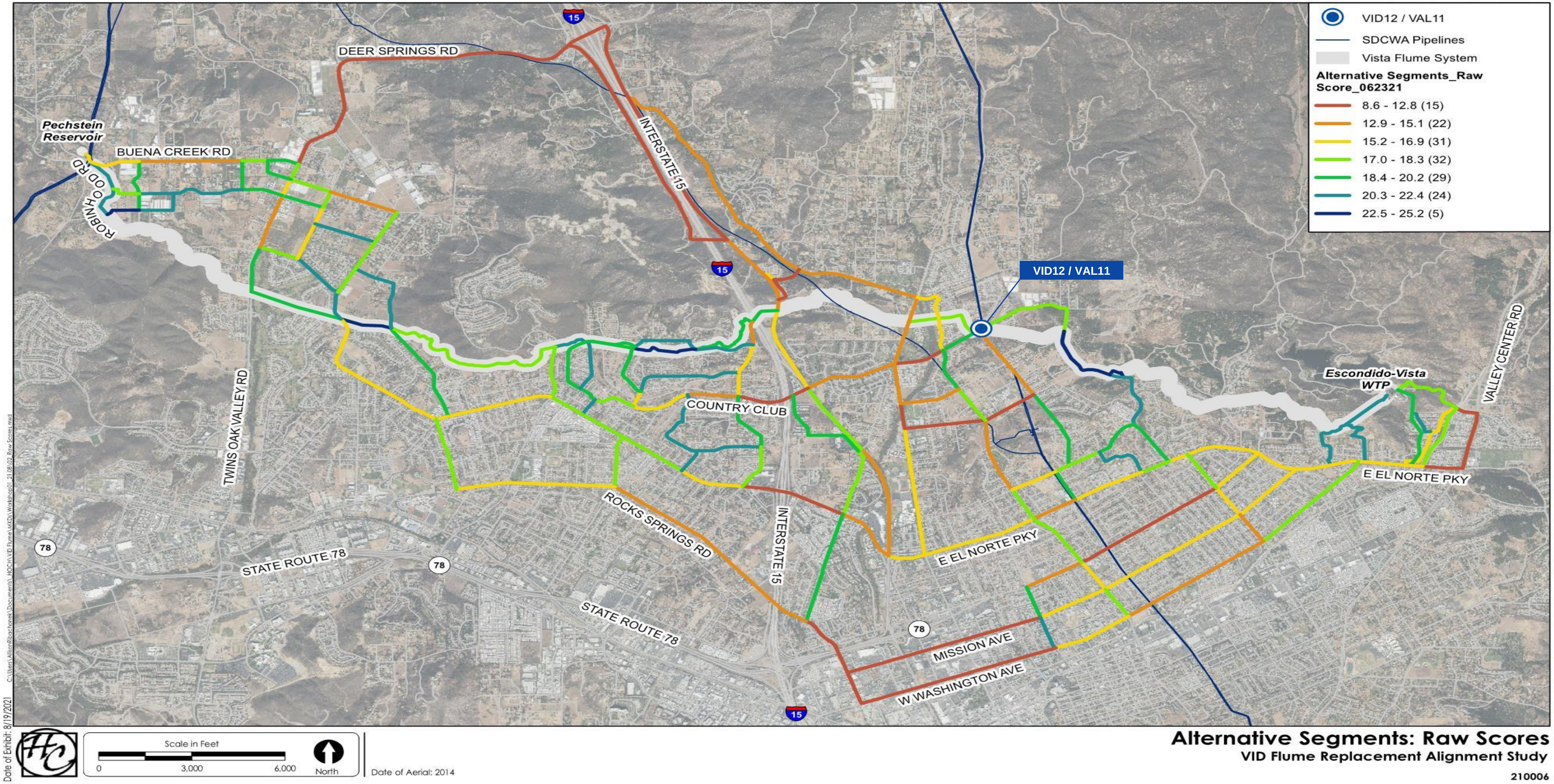
Alternative Route Segments
VID Flume Replacement Alignment Study
210006

Vista Flume System

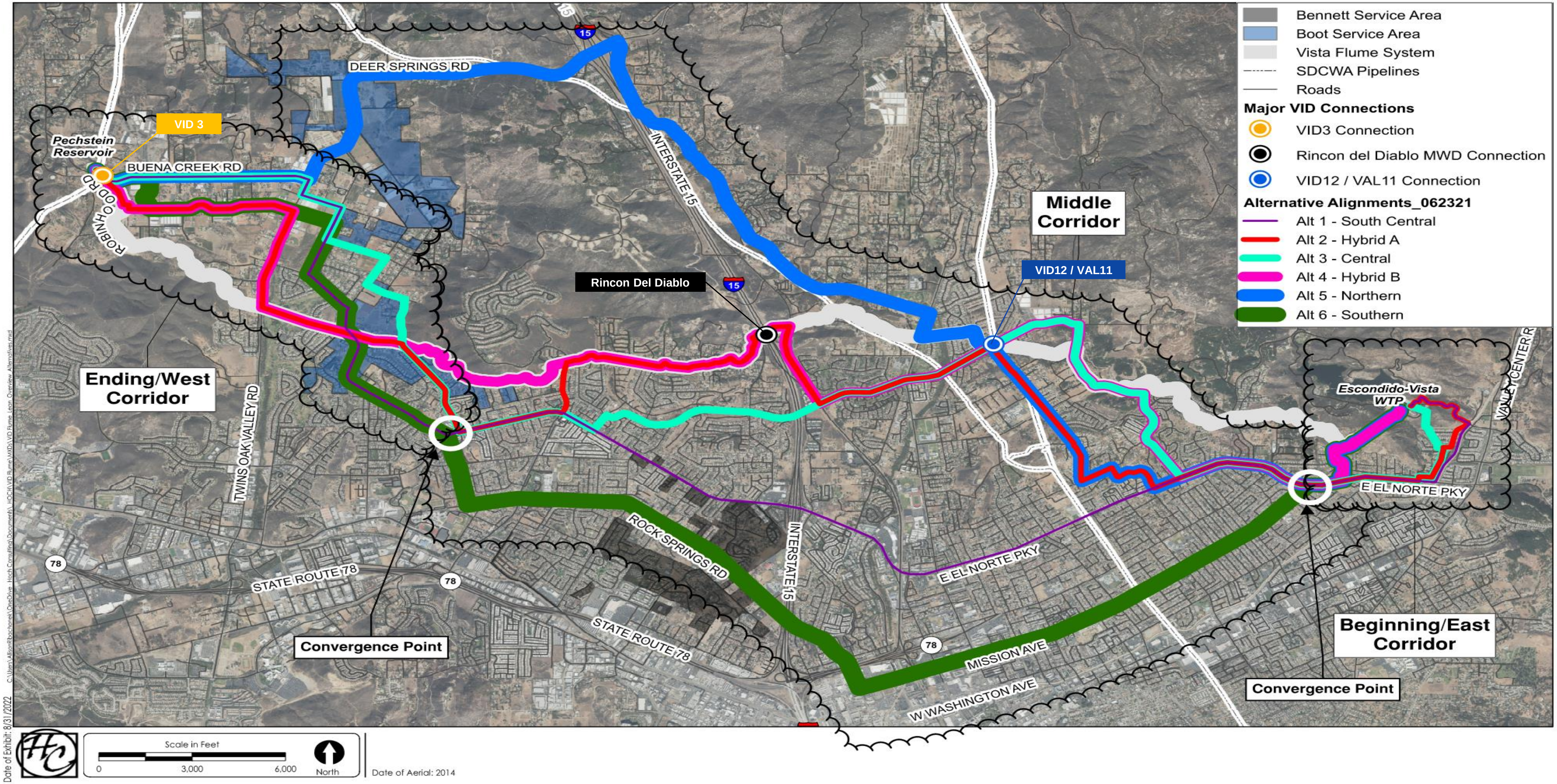
Municipal

- San Marcos
- Escondido
- SD County (Unincorporated)

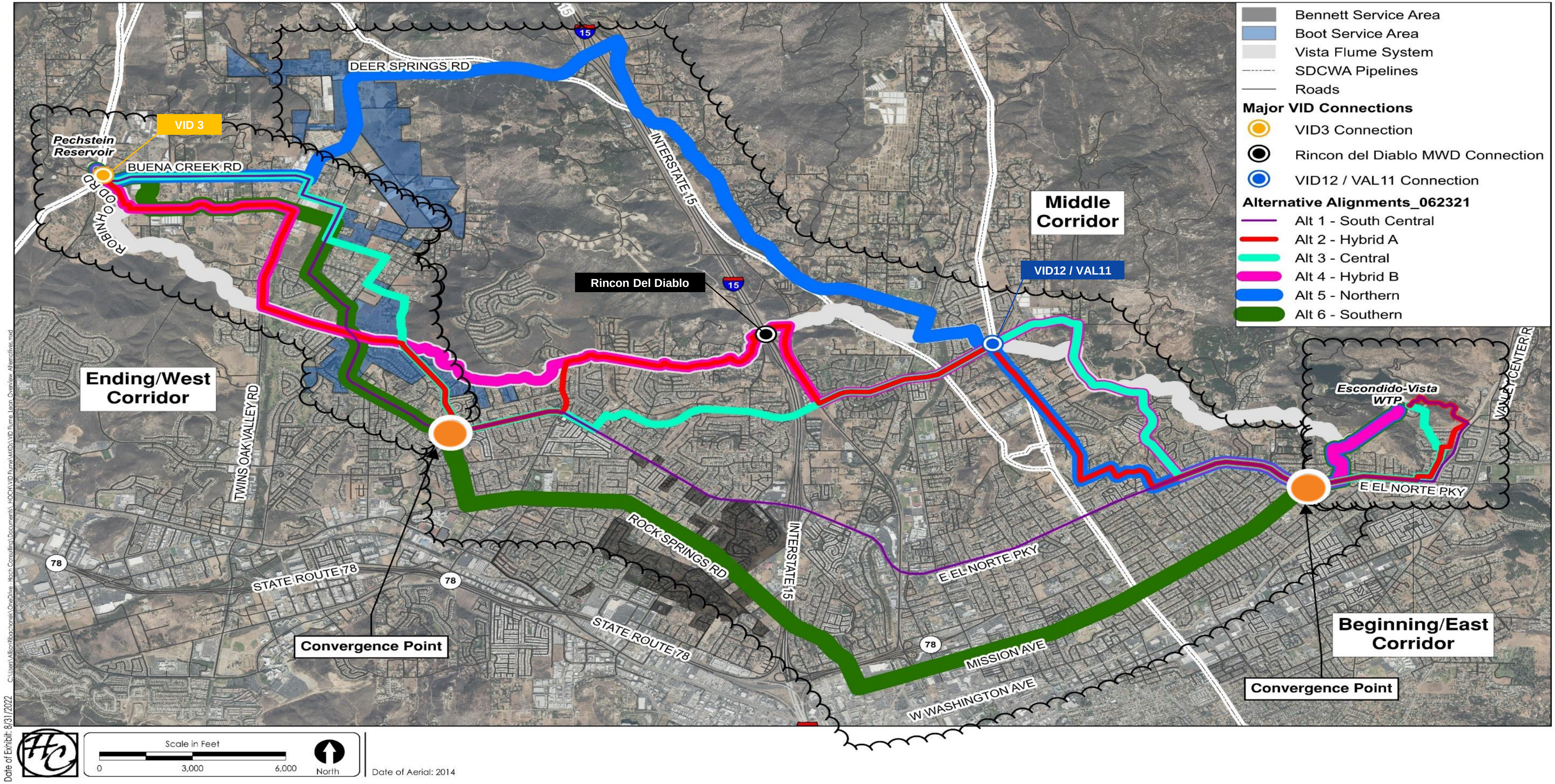
Constructible Corridors: preferred segments identified



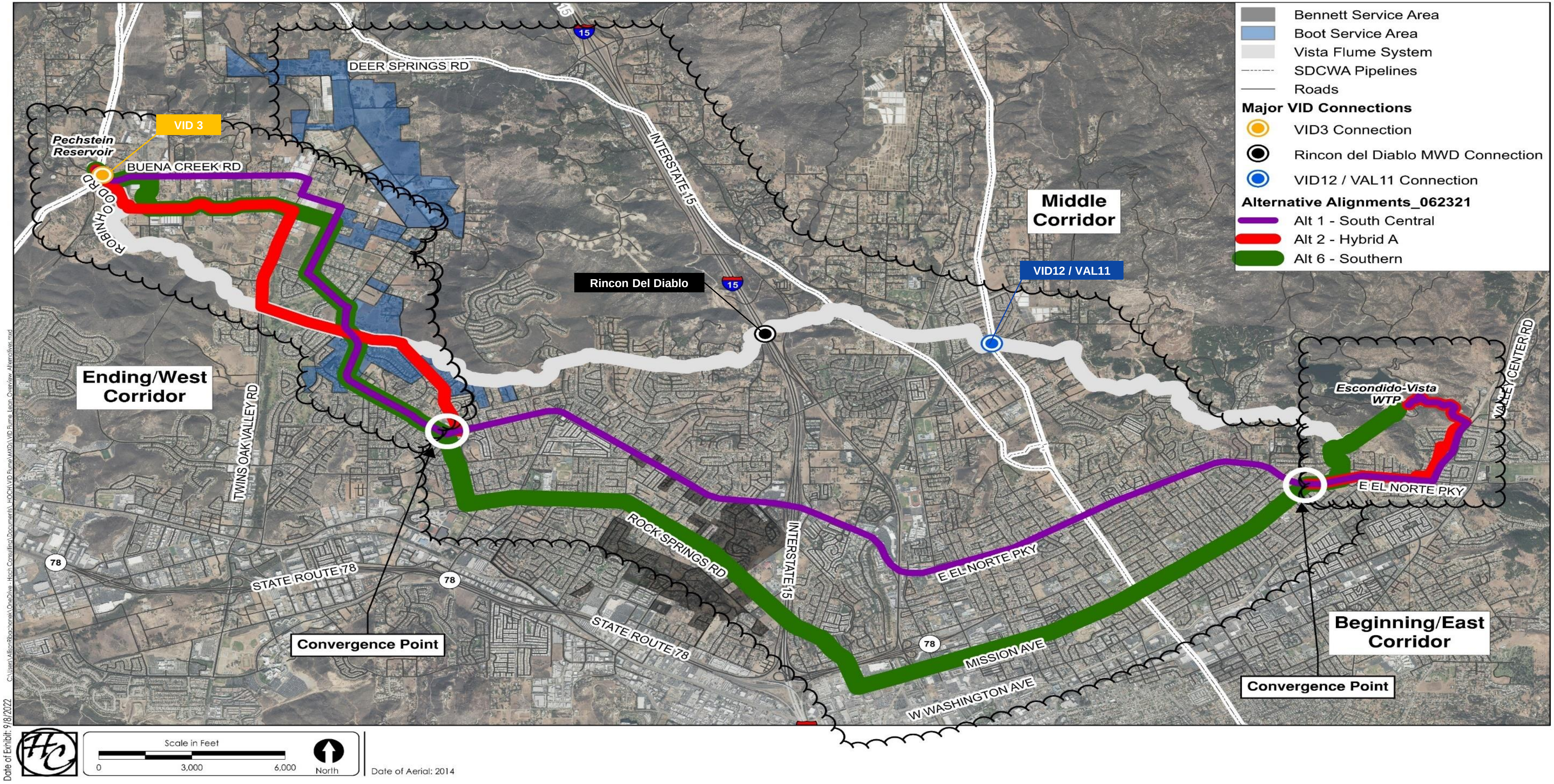
Alternative Alignments: a total of six were identified



Keeping our options open with a Beginning, Middle, and End



Coarse Screening: two alignments shortlisted plus two corridors



A comprehensive dataset to support Fine Screening

- Site/Community Characteristics
  - Schools
  - Fire Department
  - Parcel/Property owners
  - Existing utility records
  - ROWs and Easements
- Traffic
  - Routing studies
  - Road classification
  - Speed limits
  - Traffic
- Environmental
  - Vegetation maps
  - Conserved lands
  - Cultural
  - Draft MSCP
- Geology
  - Groundwater maps
  - Liquefaction maps
  - Field - Rock Classifications
  - USGS Hydrologic Data
  - Fault maps
  - Creeks
  - Flood maps
- Interagency
  - CIP plans
  - CWA aqueduct maps
  - Freeway crossings
- Permitting
  - DDW Regulations
  - Jurisdictional areas
  - Wetlands
  - Waters of the U.S.
  - Sensitive/protected species & vegetation
- Hydraulics
  - Existing VID system
  - Pechstein Reservoir
  - EVWTP
  - New facilities
- O&M
  - WTP Operations
  - Site access
  - Agency connections
  - Local agreements
  - Boot & Bennet service areas
- Cost/Affordability
  - Funding Sources
  - Pavement Moratoriums
  - Utility Conflicts

Digitized field data and desktop analyses for the District's project file and future use in design

Geotechnical

- Borings and geophysics
- Hardrock rippability
- Groundwater and liquefaction
- Environmental prescreen

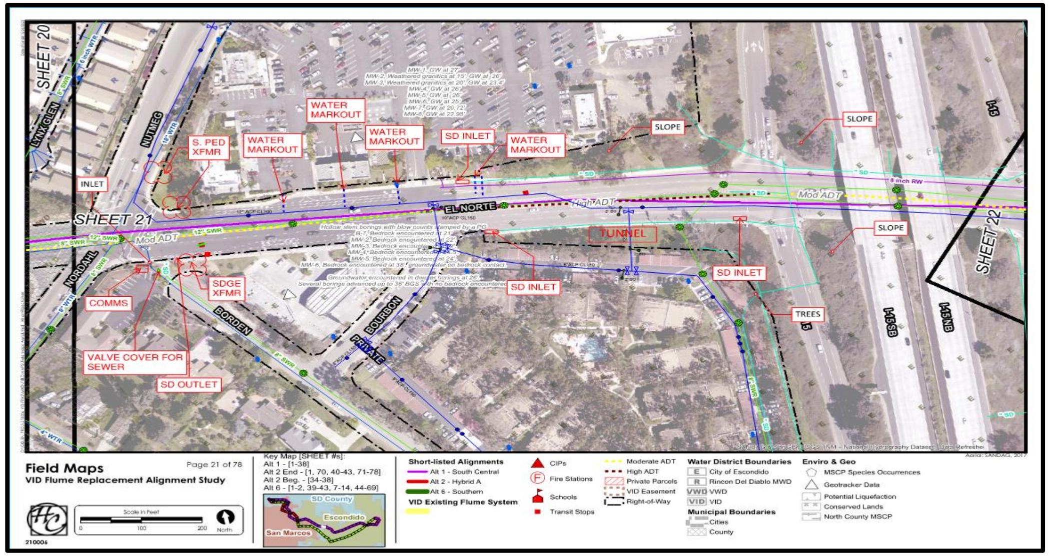
Site Walks

- Access and constructability
- Surface features & utility conflicts
- Traffic and community impacts
- Public/Private | Commercial/Residential

Digitizing the data for Fine Screening & the District's Record

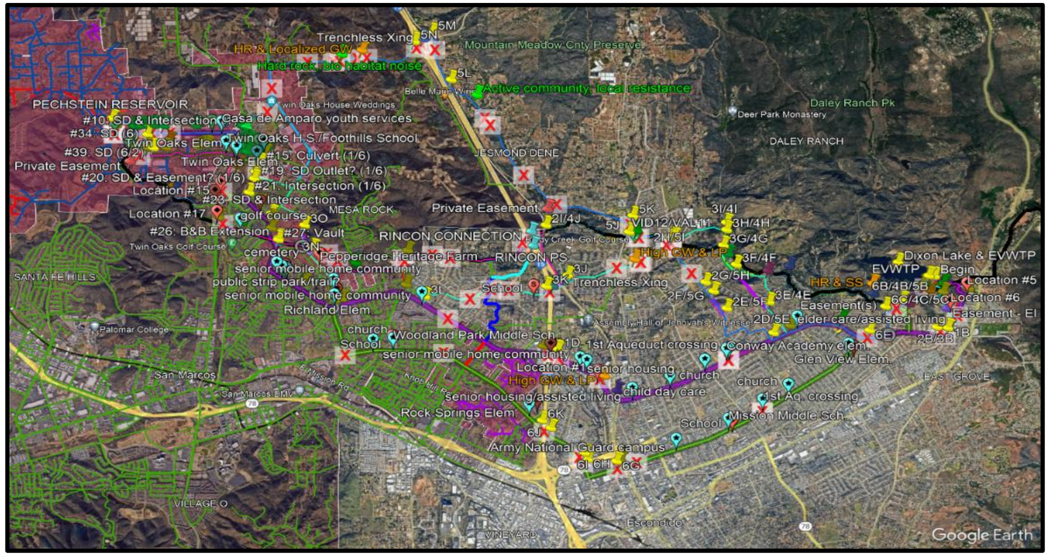
GIS & PDF

- Utility record drawings
- Capital Improvement Plans
- Environmental
- Geotechnical, Land Use & Traffic



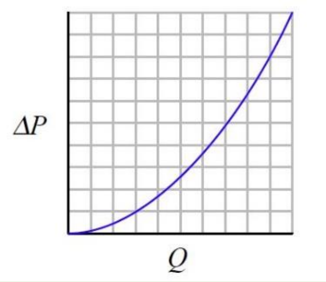
Google Earth

- Database of Maps
- Geotechnical & Environmental
- Land Use & Traffic
- Utilities



Stakeholder engagements continued through Fine Screening

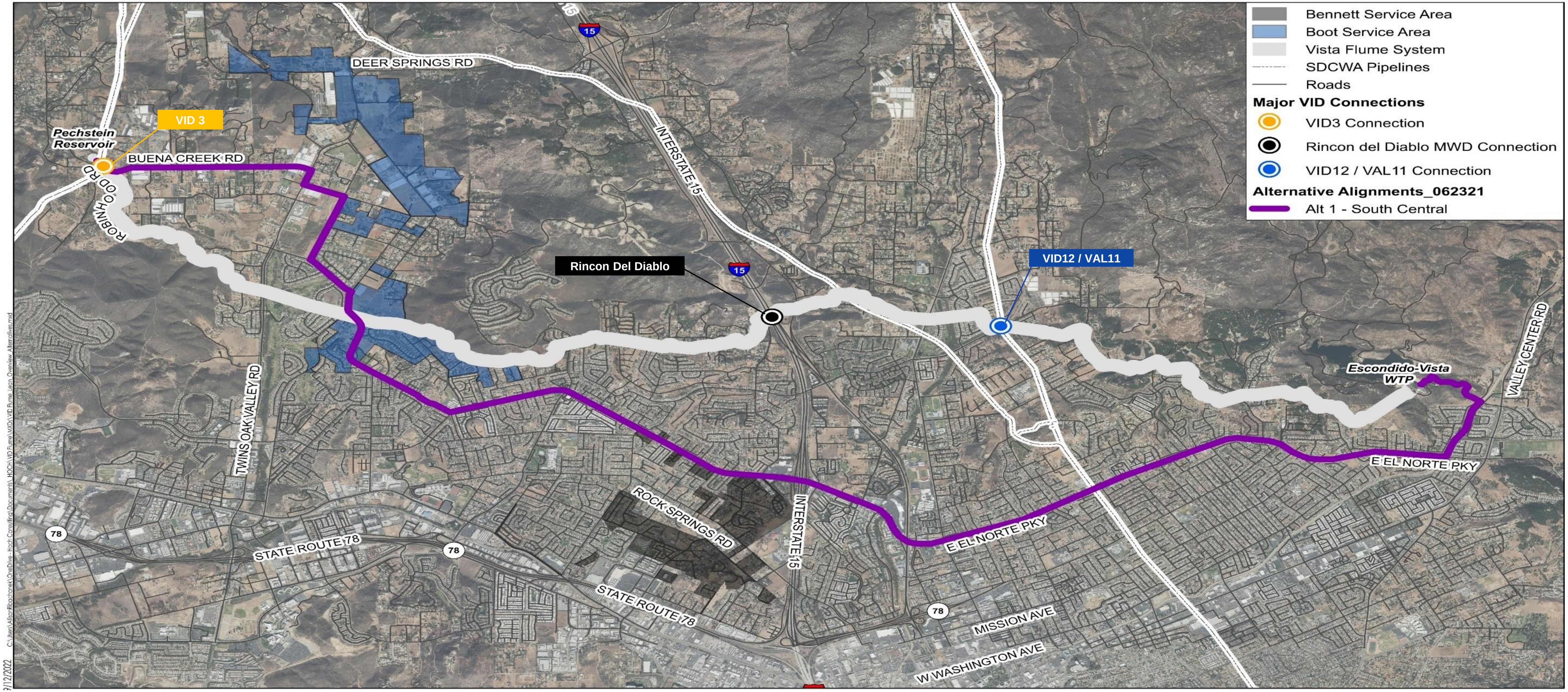
- **Key stakeholder engagements**
  - City of Escondido Public Utilities & Engineering
  - EVWTP operations staff
  - Rincon Del Diablo MWD
  - DDW
  - Other agencies (e.g., Caltrans, County of SD, SDG&E, etc.)



- **Hydraulics (District's Operations)**
  - Meeting regulatory requirements
  - Long-term operations and maintenance

- **Permitting**
  - Environmental – CEQA
  - Construction – County, City, etc.
  - Operating – DDW

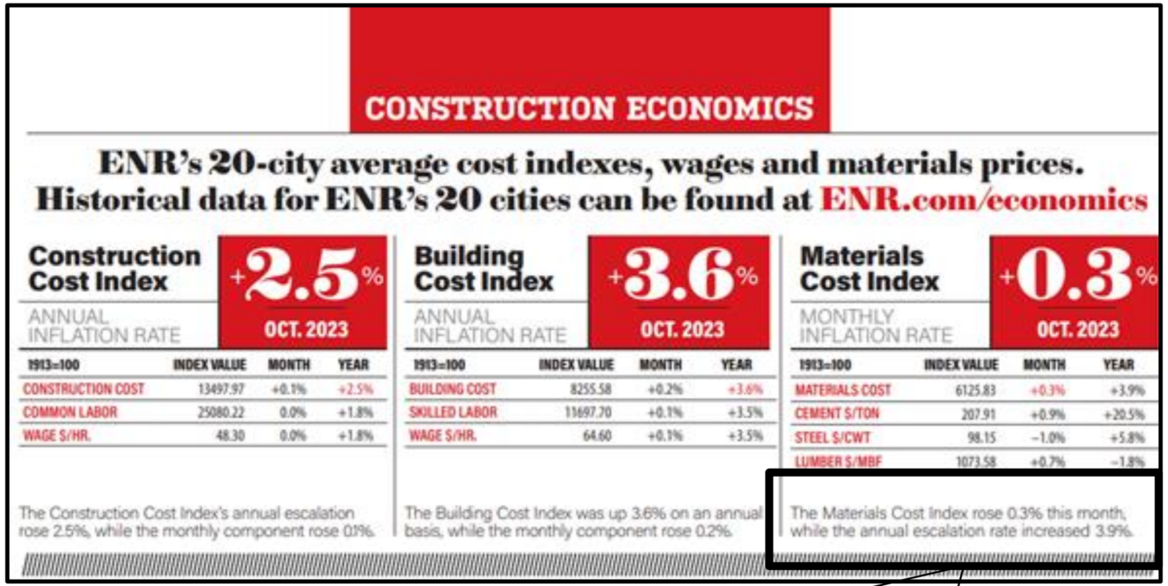
Fine Screening: Alternative #1 – South Central



Fine Screening : Alternative #6 – Southern

Fine Screening : Alternative #2 – Hybrid A

Industry costs are leveling but escalation is still a factor



CONSTRUCTION ECONOMICS

ENR's 20-city average cost indexes, wages and materials prices. Historical data for ENR's 20 cities can be found at ENR.com/economics

Construction Cost Index

ANNUAL INFLATION RATE

+2.5%

OCT. 2023

1913=100	INDEX VALUE	MONTH	YEAR
CONSTRUCTION COST	13497.97	+0.1%	+2.5%
COMMON LABOR	25080.22	0.0%	+1.8%
WAGE $/HR.	48.30	0.0%	+1.8%

The Construction Cost Index's annual escalation rose 2.5%, while the monthly component rose 0.1%.

Building Cost Index

ANNUAL INFLATION RATE

+3.6%

OCT. 2023

1913=100	INDEX VALUE	MONTH	YEAR
BUILDING COST	8255.58	+0.2%	+3.6%
SKILLED LABOR	11697.70	+0.1%	+3.5%
WAGE $/HR.	64.60	+0.1%	+3.5%

The Building Cost Index was up 3.6% on an annual basis, while the monthly component rose 0.2%.

Materials Cost Index

MONTHLY INFLATION RATE

+0.3%

OCT. 2023

1913=100	INDEX VALUE	MONTH	YEAR
MATERIALS COST	6125.83	+0.3%	+3.9%
CEMENT $/TON	207.91	+0.9%	+20.5%
STEEL $/CWT	98.15	−1.0%	+5.8%
LUMBER $/MBF	1073.58	+0.7%	−1.8%

The Materials Cost Index rose 0.3% this month, while the annual escalation rate increased 3.9%.

The Material Cost Index rose 0.3% this month, while the annuals escalation rate increased 3.9%.

- MARKET (ENR)
  - 20% annual escalation (last year)
  - 4% annual escalation (this year)
- FRAS (ESTIMATE)
  - 10% with project refinements (last year)
  - 5.9% with project refinements (this year)

Planning Level Costs Refined to Within +/- 2%

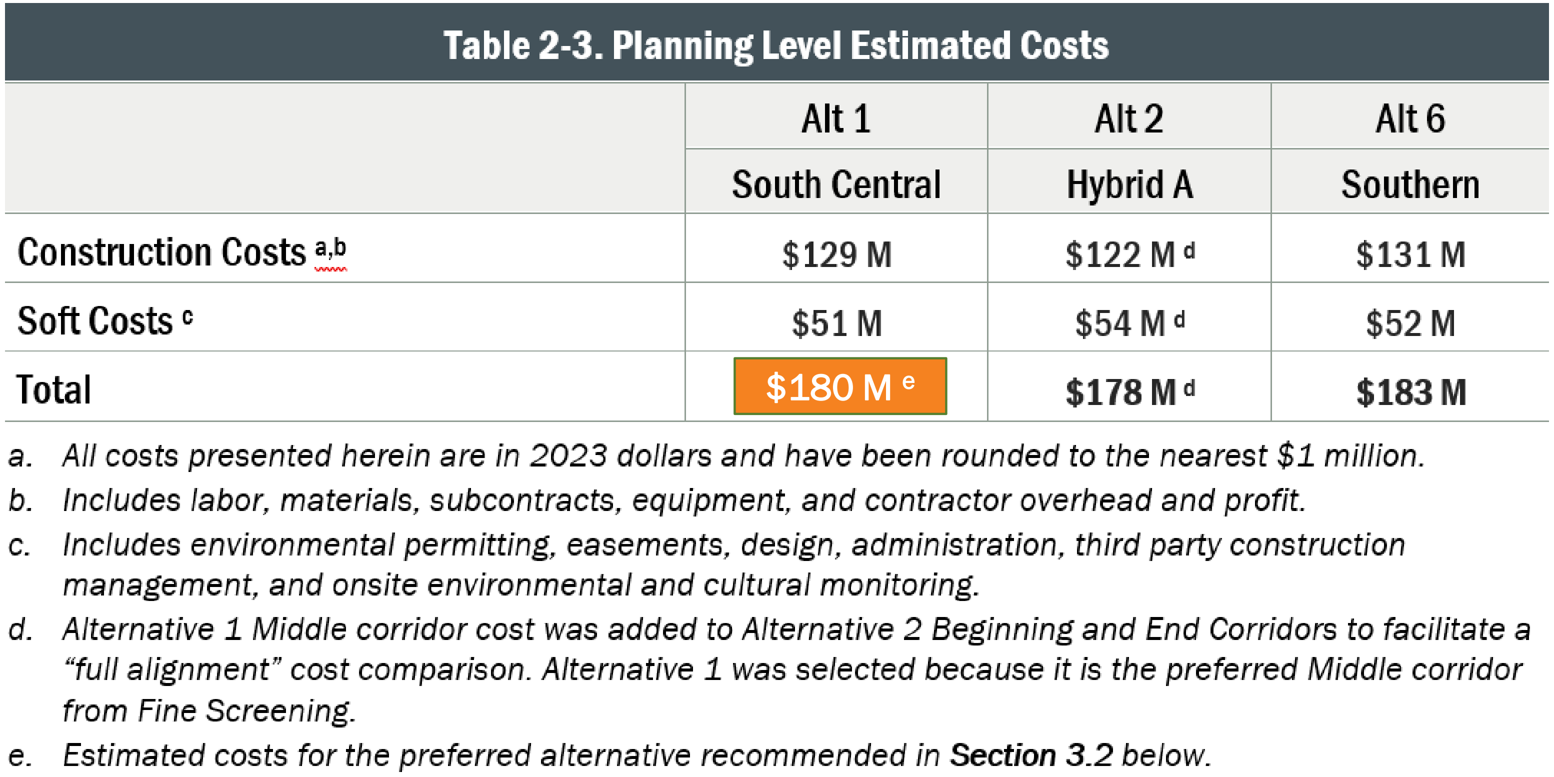


Table 2-3. Planning Level Estimated Costs

	Alt 1	Alt 2	Alt 6
	South Central	Hybrid A	Southern
Construction Costs [a,b]	$129 M	$122 M [d]	$131 M
Soft Costs [c]	$51 M	$54 M [d]	$52 M
Total	$180 M [e]	**$178 M [d]**	**$183 M**

a. *All costs presented herein are in 2023 dollars and have been rounded to the nearest $1 million.*

b. *Includes labor, materials, subcontracts, equipment, and contractor overhead and profit.*

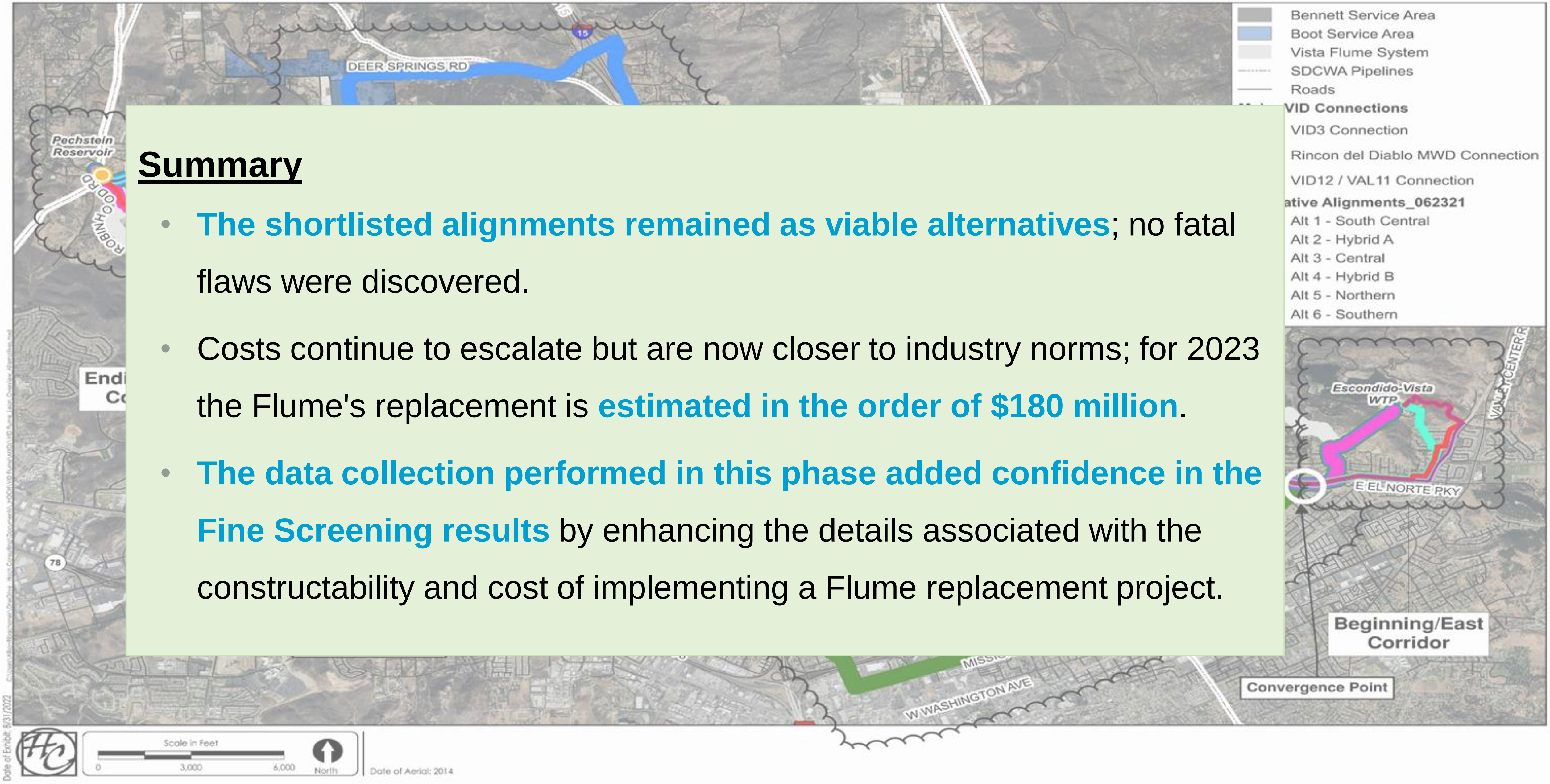
c. *Includes environmental permitting, easements, design, administration, third party construction management, and onsite environmental and cultural monitoring.*

d. *Alternative 1 Middle corridor cost was added to Alternative 2 Beginning and End Corridors to facilitate a "full alignment" cost comparison. Alternative 1 was selected because it is the preferred Middle corridor from Fine Screening.*

e. *Estimated costs for the preferred alternative recommended in* ***Section 3.2*** *below.*

Orange = recommended alignment

Alignment Evaluation Takeaways



Summary

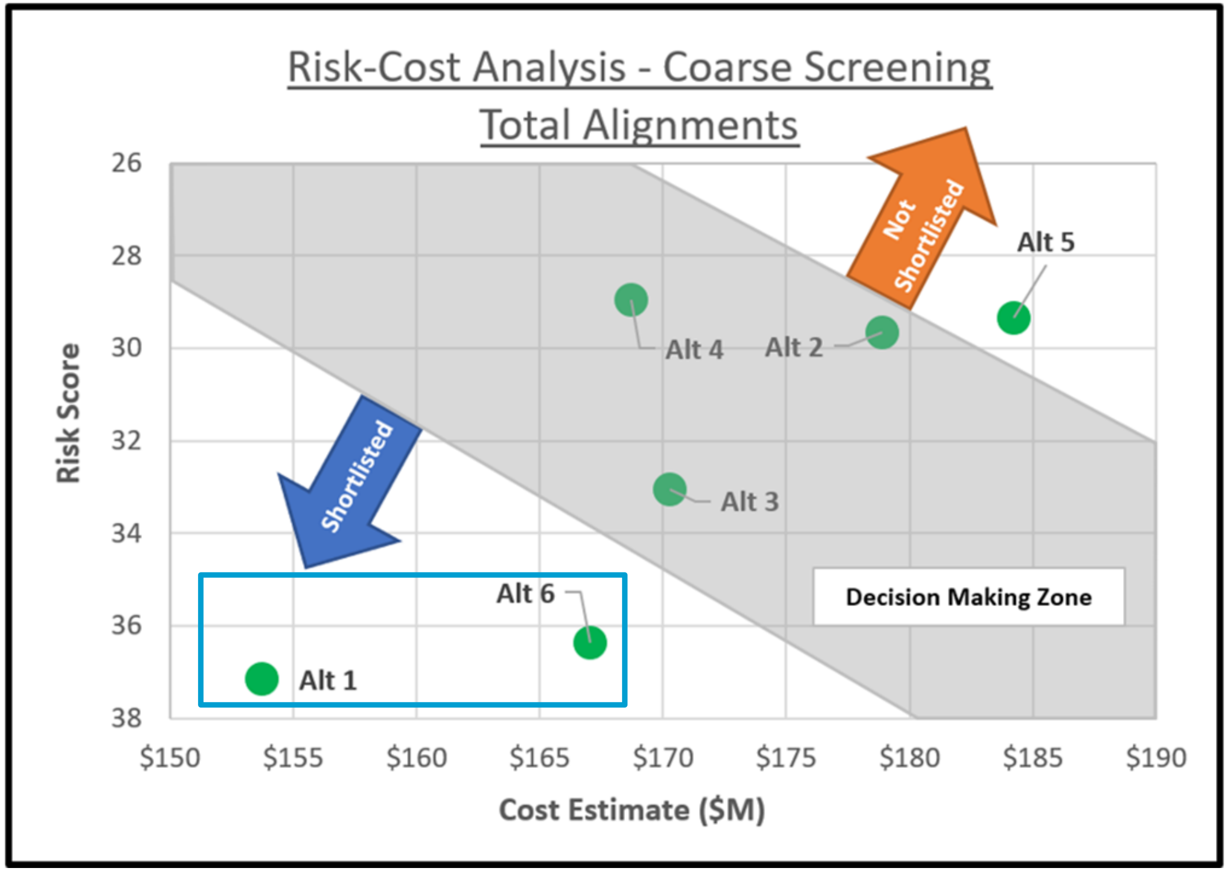
- **The shortlisted alignments remained as viable alternatives**; no fatal flaws were discovered.
- Costs continue to escalate but are now closer to industry norms; for 2023 the Flume's replacement is **estimated in the order of $180 million**.
- **The data collection performed in this phase added confidence in the Fine Screening results** by enhancing the details associated with the constructability and cost of implementing a Flume replacement project.

3. Alternatives Evaluation – Fine Screening

Speaker: John Bekmanis, P.E.

Fine Screening: Process and Objectives

- Goal: select one preferred alignment
- Evaluation process included development of:
  - Risks – constructability, O&M, etc.
  - Costs – capital and soft costs
- Risks - Assigned weighting factors and scores to custom set of criteria
- Conducted sensitivity analysis



Fine Screening: Evaluation Criteria (Part 1/3)

CATEGORIES	CRITERIA GROUPS	CRITERIA
Stakeholder Coordination	Community Impacts ★	• Traffic Impacts • Future Agency Projects • Impacts to Critical Facilities ★
	Land Ownership	• Easements/ROWs
	Environmental	• Biological Resources • Areas of potential Soil Contamination • Cultural Resources • Other CEQA Considerations
	Permitting	• Interagency Coordination • Special Long-lead Permits (Cal DFW/USACE) • DDW Coordination

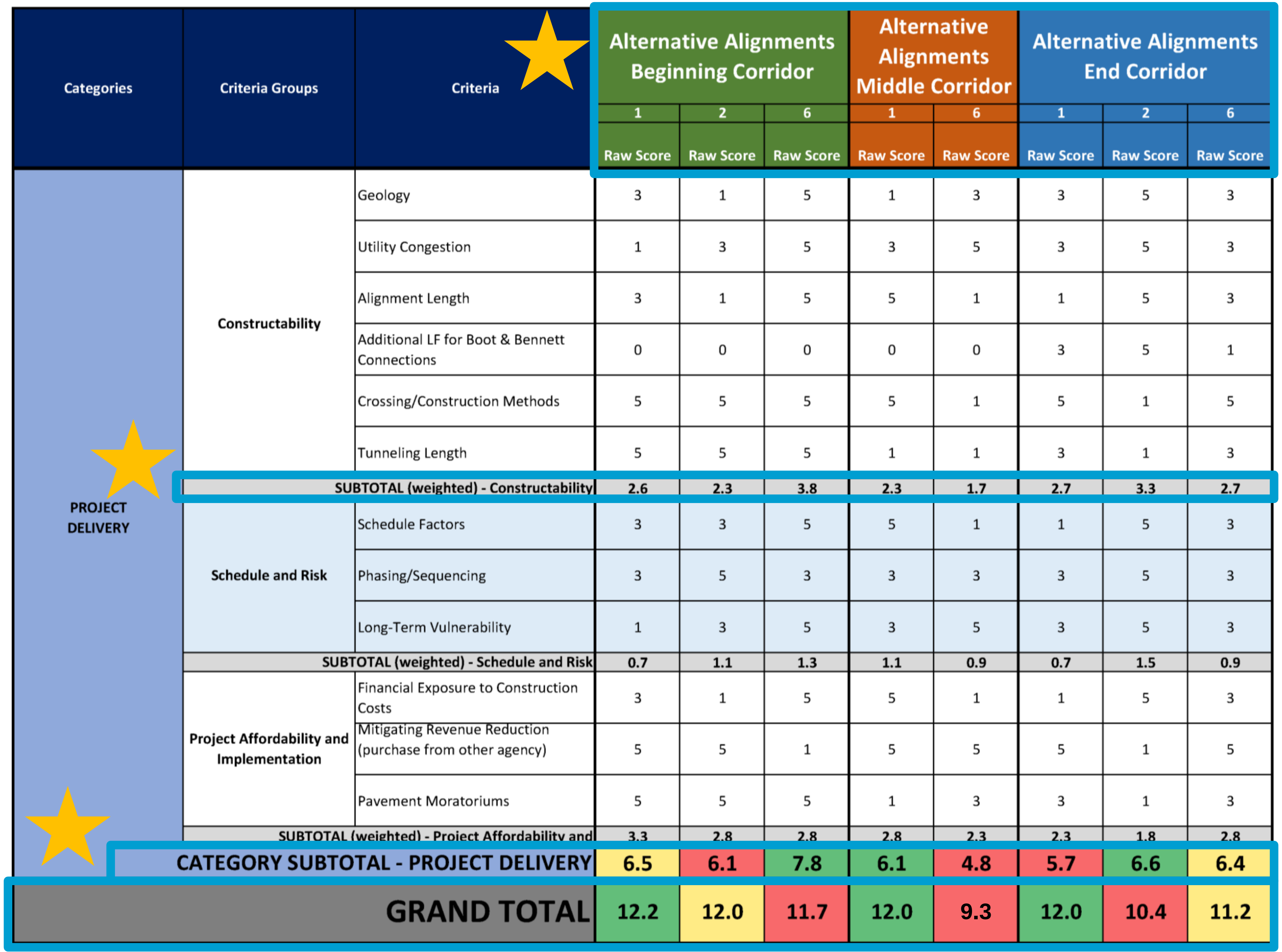
Fine Screening: Evaluation Criteria (Part 2/3)

CATEGORIES	CRITERIA GROUPS	CRITERIA
System Reliability	System Hydraulics	• Pressurization vs Low-Head • Transient Flow Impacts
	Operations and Maintenance	• Accessibility • Land Use • Operational (Hydraulics) Maintenance • Impacts to EVWTP • Agency Service Connection – Boot & Bennett • Agency Service Connection – Escondido • Agency Service Connection – Rincon

Fine Screening: Evaluation Criteria (Part 3/3)

CATEGORIES	CRITERIA GROUPS	CRITERIA
Project Delivery	Constructability	• Geology • Utility Congestion • Alignment Length • Additional LF for Boot & Bennett Connection • Crossing/Construction Methods • Tunneling Lengths
	Schedule and Risk	• Schedule Factors • Phasing/Sequencing • Long-term Vulnerability
	Project Affordability and Implementation	• Financial Exposure to Construction Costs • Mitigating Revenue Reduction (purchase from other agency) • Pavement Moratoriums

Fine Screening: Evaluation Matrix



Categories	Criteria Groups	Criteria	Alternative Alignments Beginning Corridor			Alternative Alignments Middle Corridor		Alternative Alignments End Corridor		
			1	2	6	1	6	1	2	6
			Raw Score	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score	Raw Score
PROJECT DELIVERY	Constructability	Geology	3	1	5	1	3	3	5	3
		Utility Congestion	1	3	5	3	5	3	5	3
		Alignment Length	3	1	5	5	1	1	5	3
		Additional LF for Boot & Bennett Connections	0	0	0	0	0	3	5	1
		Crossing/Construction Methods	5	5	5	5	1	5	1	5
		Tunneling Length	5	5	5	1	1	3	1	3
		SUBTOTAL (weighted) - Constructability	**2.6**	**2.3**	**3.8**	**2.3**	**1.7**	**2.7**	**3.3**	**2.7**
	Schedule and Risk	Schedule Factors	3	3	5	5	1	1	5	3
		Phasing/Sequencing	3	5	3	3	3	3	5	3
		Long-Term Vulnerability	1	3	5	3	5	3	5	3
		SUBTOTAL (weighted) - Schedule and Risk	**0.7**	**1.1**	**1.3**	**1.1**	**0.9**	**0.7**	**1.5**	**0.9**
	Project Affordability and Implementation	Financial Exposure to Construction Costs	3	1	5	5	1	1	5	3
		Mitigating Revenue Reduction (purchase from other agency)	5	5	1	5	5	5	1	5
		Pavement Moratoriums	5	5	5	1	3	3	1	3
		SUBTOTAL (weighted) - Project Affordability and	**3.3**	**2.8**	**2.8**	**2.8**	**2.3**	**2.3**	**1.8**	**2.8**
		CATEGORY SUBTOTAL - PROJECT DELIVERY	**6.5**	**6.1**	**7.8**	**6.1**	**4.8**	**5.7**	**6.6**	**6.4**
		GRAND TOTAL	**12.2**	**12.0**	**11.7**	**12.0**	**9.3**	**12.0**	**10.4**	**11.2**

Fine Screening: Summary of Numerical Results

- Alternatives 1 has the best Beginning, Middle, and End Risk Ranking
- Beginning corridor of Alt 2 has possible advantages

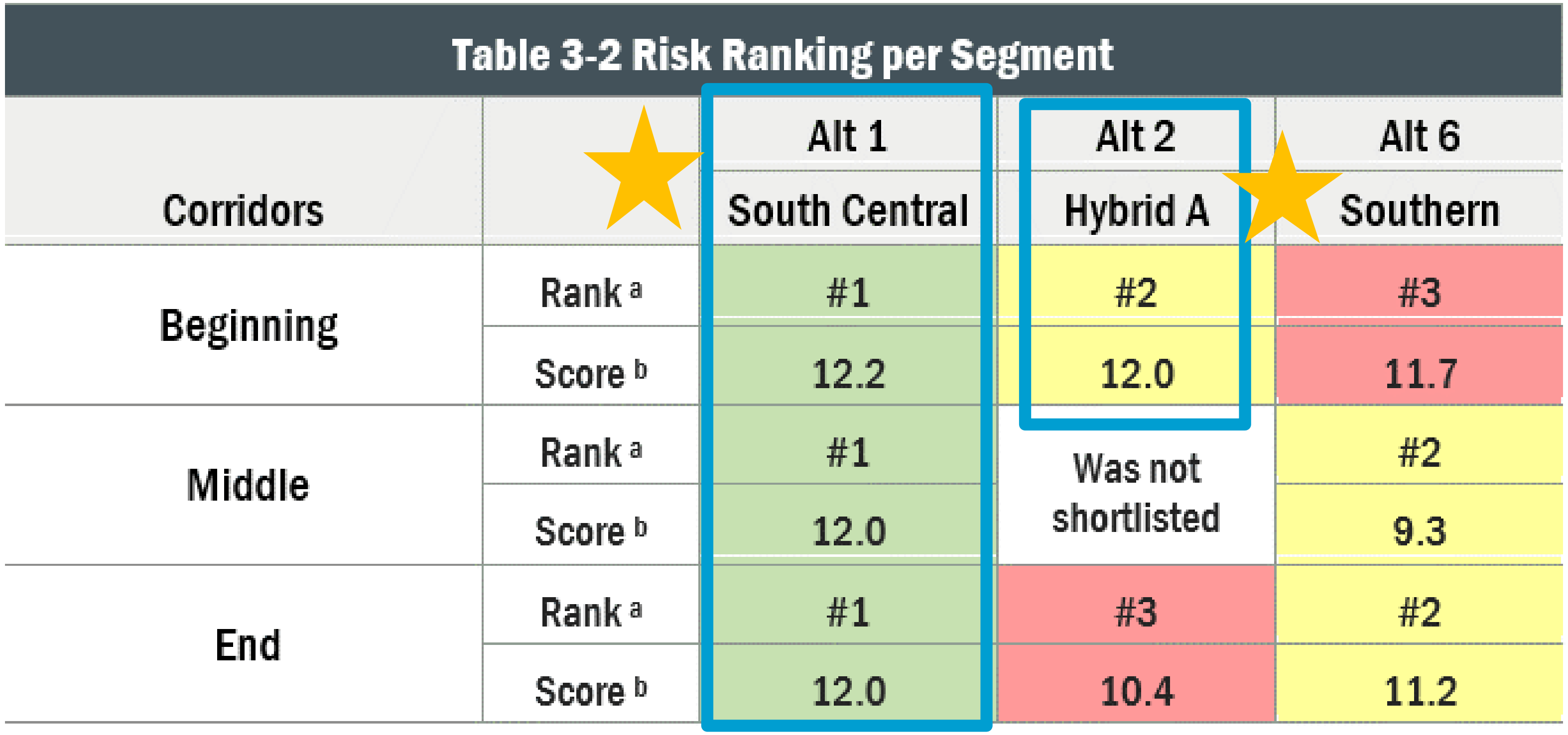


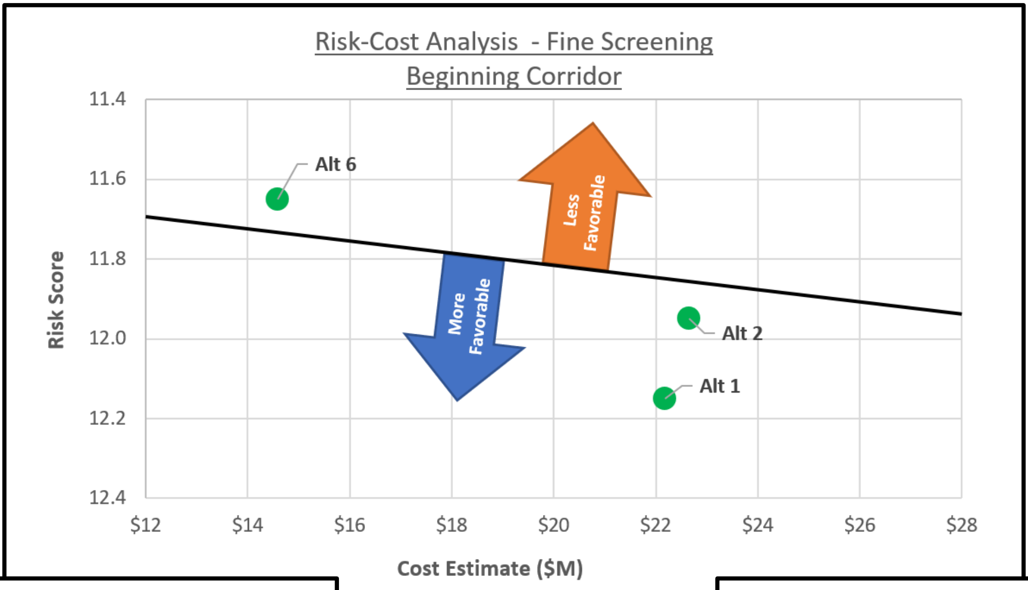
Table 3-2 Risk Ranking per Segment

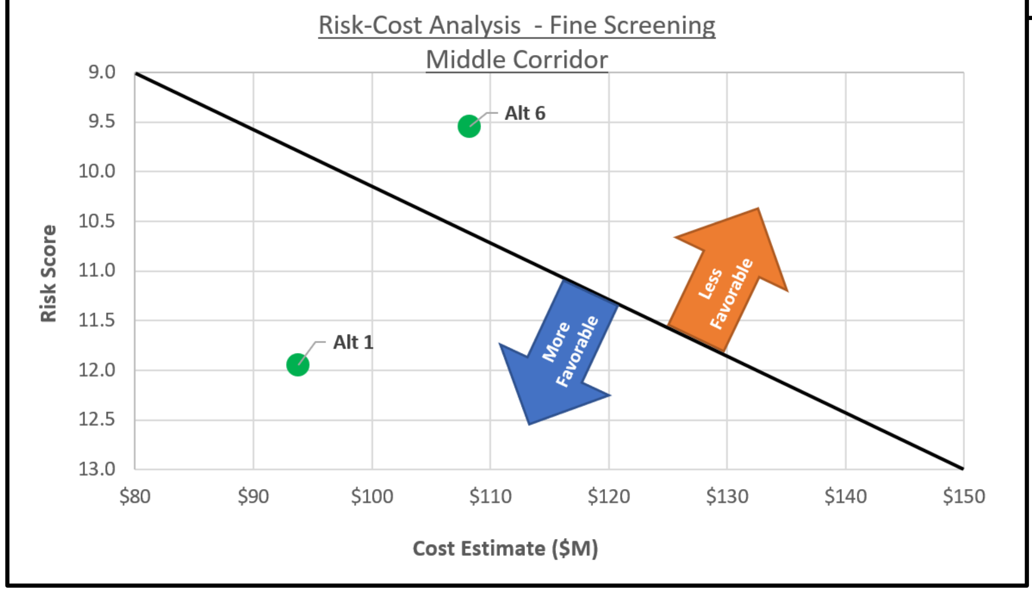
Corridors		Alt 1	Alt 2	Alt 6
		South Central	Hybrid A	Southern
Beginning	Rank [a]	#1	#2	#3
	Score [b]	12.2	12.0	11.7
Middle	Rank [a]	#1	Was not shortlisted	#2
	Score [b]	12.0		9.3
End	Rank [a]	#1	#3	#2
	Score [b]	12.0	10.4	11.2

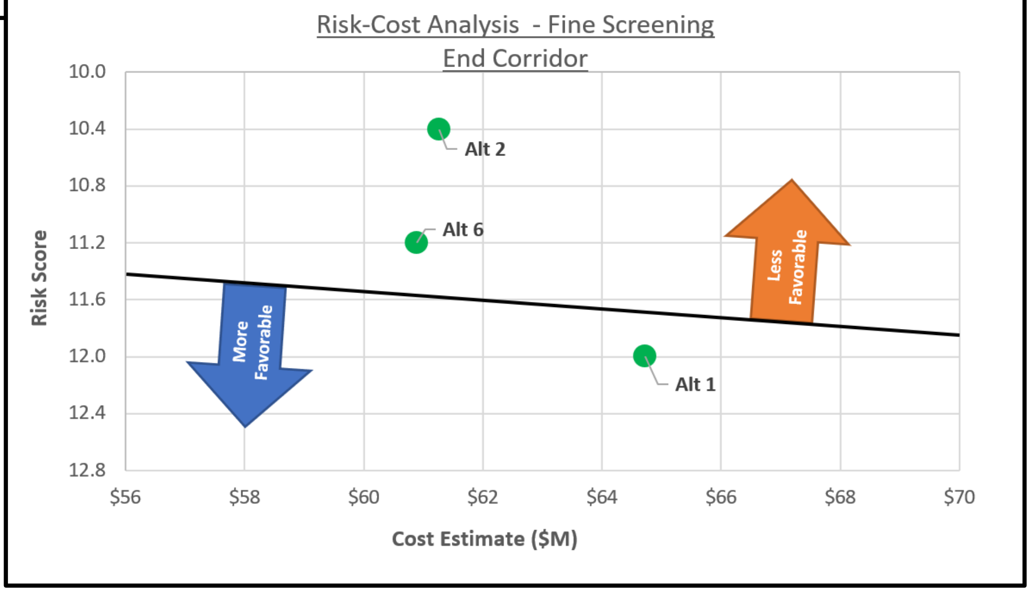
a. *Ranking:*

Green = Top ranked alternatives
Yellow = Middle ranked alternatives
Red = Lowest ranked alternatives

Fine Screening: Results Isolated by Beginning, Middle, End

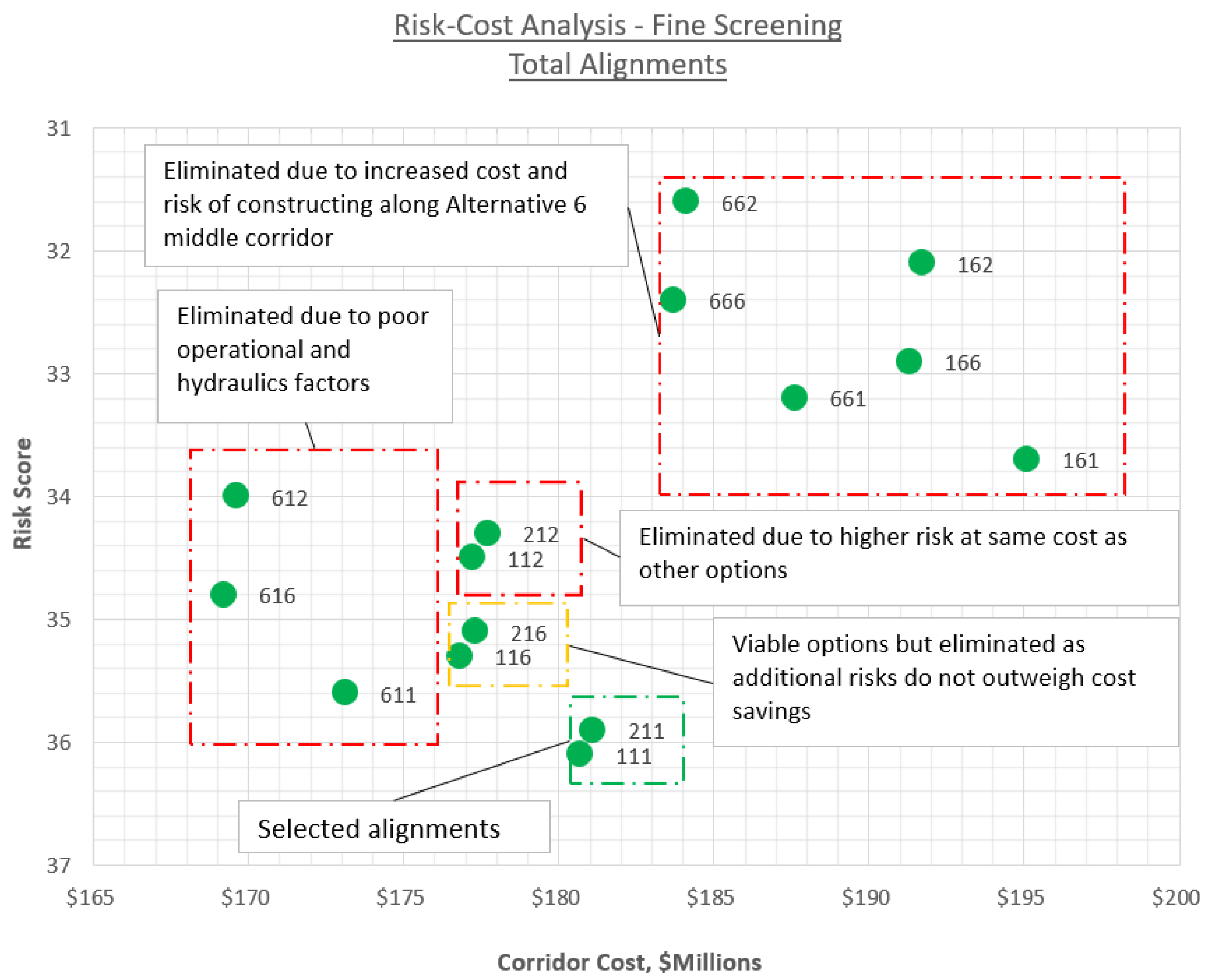






Fine Screening: Results (All Combinations)

- Alt 1.1.1 and 2.1.1 provide balanced cost vs risk rating
- Top right grouping high in risk and costs
- Bottom left grouping lower cost but higher risks
- Center groupings higher risk vs same cost as selected alignments



Risk-Cost Analysis - Fine Screening
Total Alignments

Eliminated due to increased cost and risk of constructing along Alternative 6 middle corridor

Eliminated due to poor operational and hydraulics factors

Eliminated due to higher risk at same cost as other options

Viable options but eliminated as additional risks do not outweigh cost savings

Selected alignments

Recommended Alignment

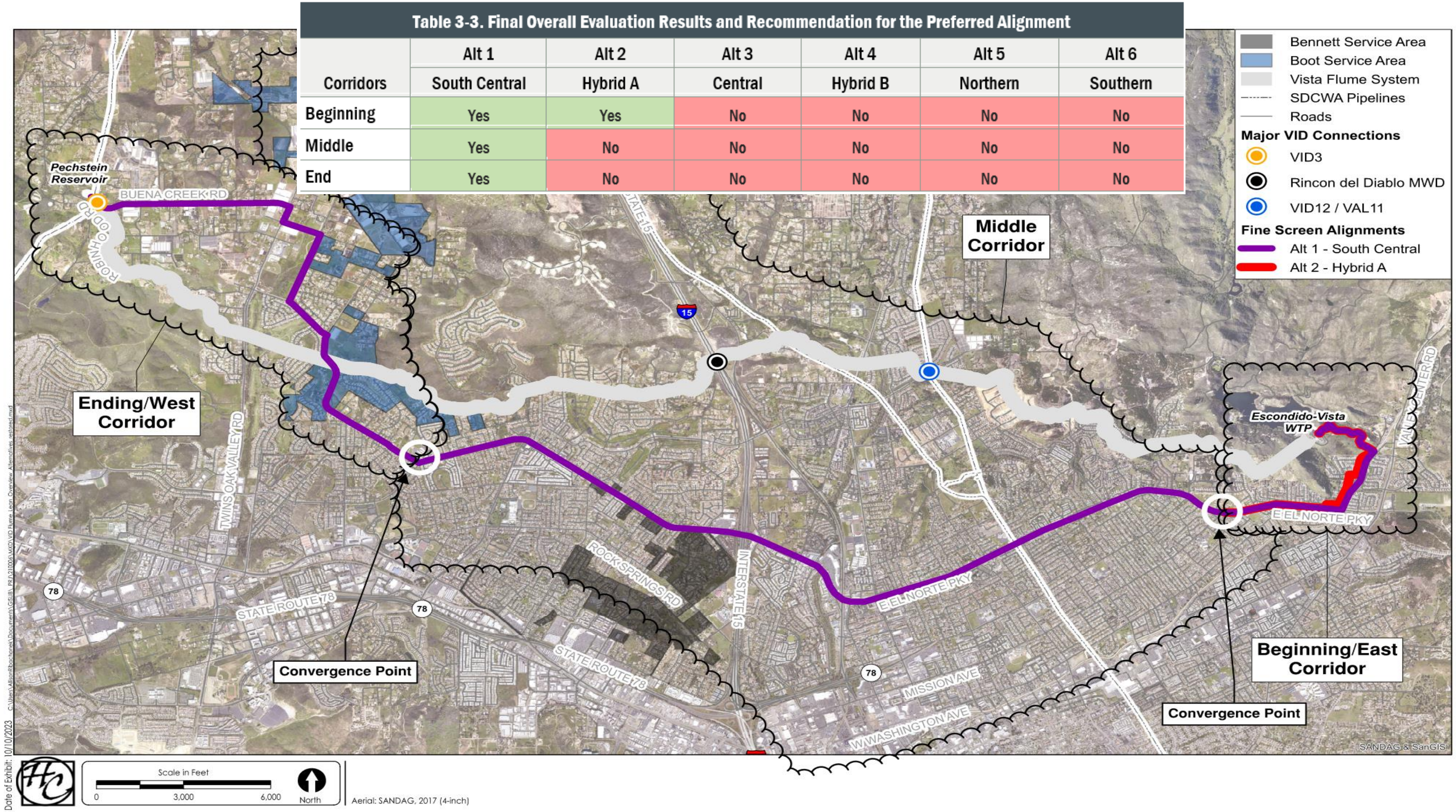
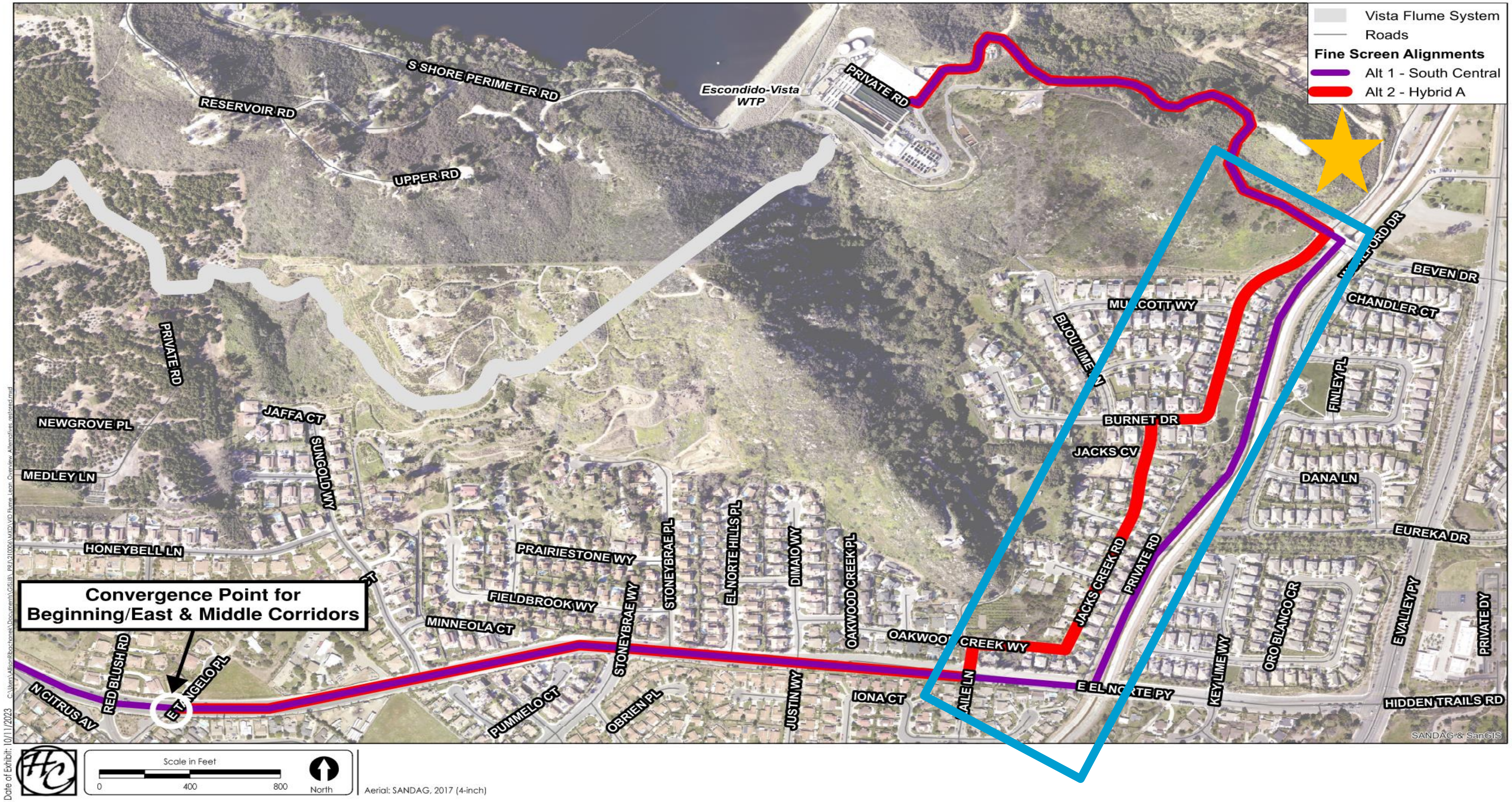


Table 3-3. Final Overall Evaluation Results and Recommendation for the Preferred Alignment

Corridors	Alt 1 South Central	Alt 2 Hybrid A	Alt 3 Central	Alt 4 Hybrid B	Alt 5 Northern	Alt 6 Southern
Beginning	Yes	Yes	No	No	No	No
Middle	Yes	No	No	No	No	No
End	Yes	No	No	No	No	No

Reserving Alternative 2 Beginning as a Contingency



4. Predictive Climatological Modeling

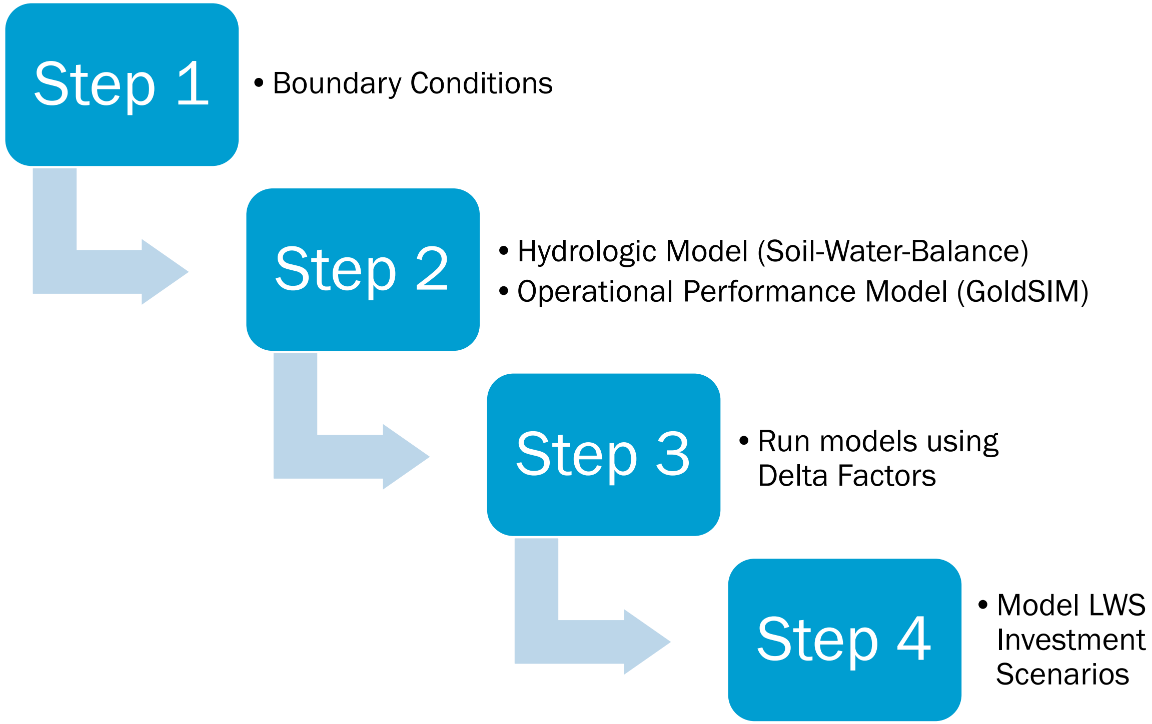
Speaker: Teresa (Tess) Sprague, PhD

Brown AND Caldwell

Defining the **next** legacy

Objective: Project annual local yield under varying climate futures considering various Local Water System (LWS) improvements

Methodology



Step 1
- Boundary Conditions

Step 2
- Hydrologic Model (Soil-Water-Balance)
- Operational Performance Model (GoldSIM)

Step 3
- Run models using Delta Factors

Step 4
- Model LWS Investment Scenarios

Step 1:

Define the system and establish its boundary conditions to account for all infrastructure components, interconnects, and sources of inflows and outflows.

Step 2:

Build two models that together can simulate the local hydrology and baseline the current operational performance of the LWS.

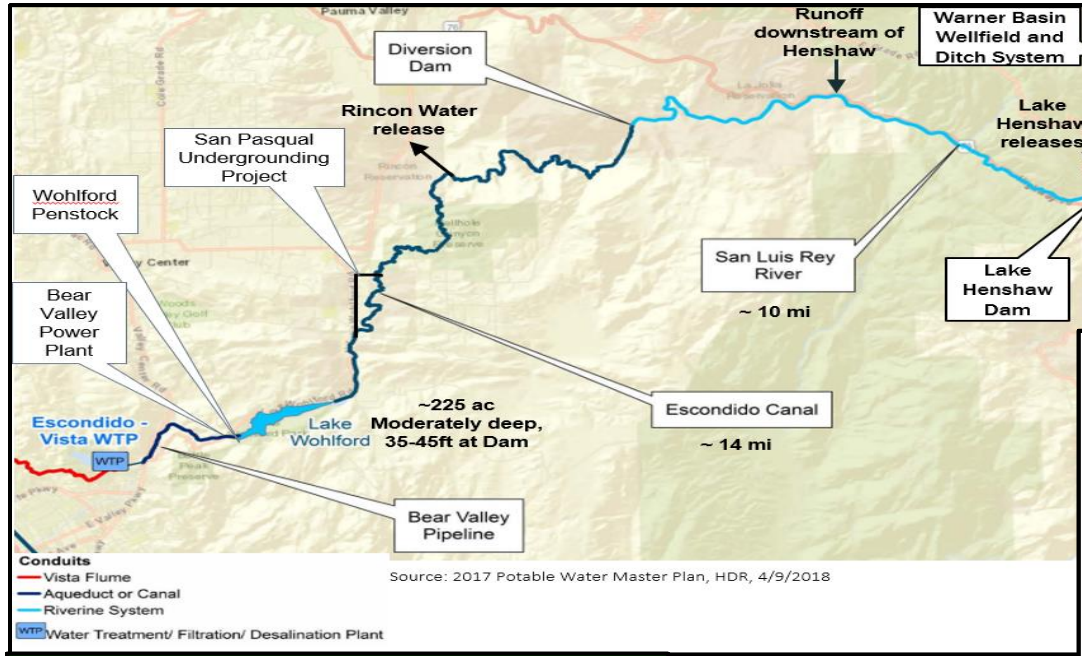
Step 3:

Run the model using climate change adjustment factors to assess possible climatological impacts on local yield.

Step 4:

Model future LWS investment scenarios to assess the effects projects like expanding the Warner Basin wellfield or addressing Harmful Algal Blooms (HABs) might have on future local yield.

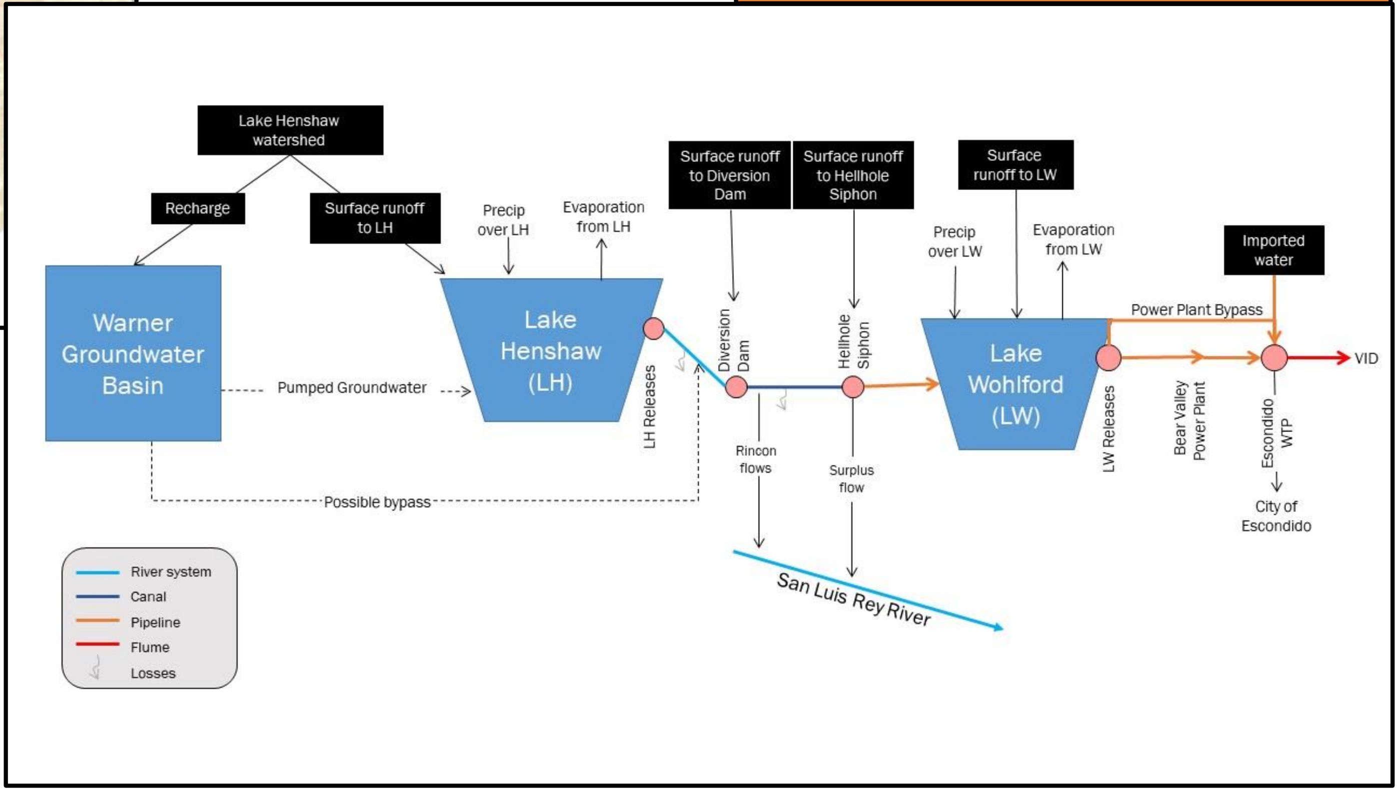
Establishing Boundary Condition by Capturing the District's LWS



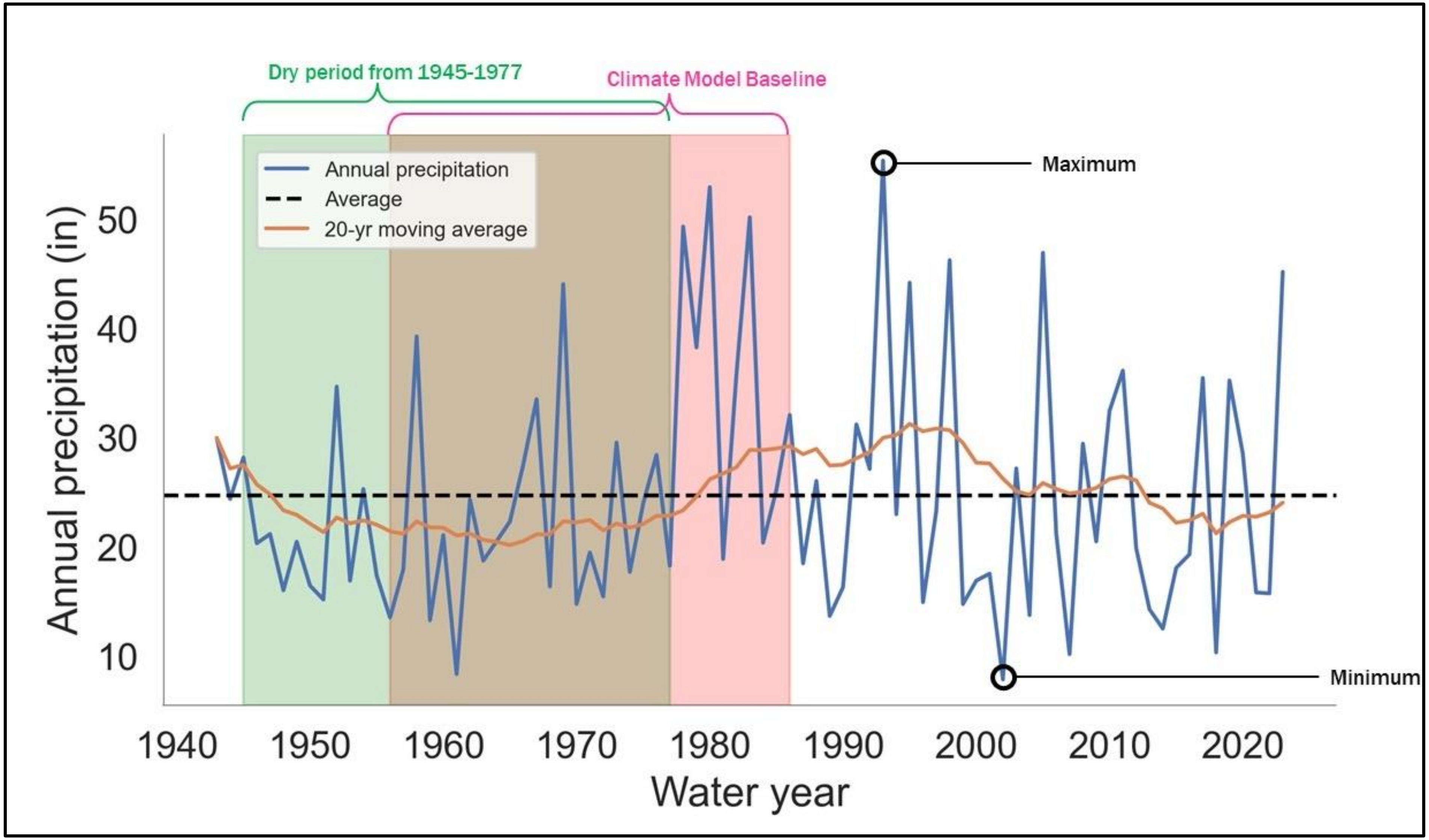
Source: 2017 Potable Water Master Plan, HDR, 4/9/2018

LWS Map of Key Components

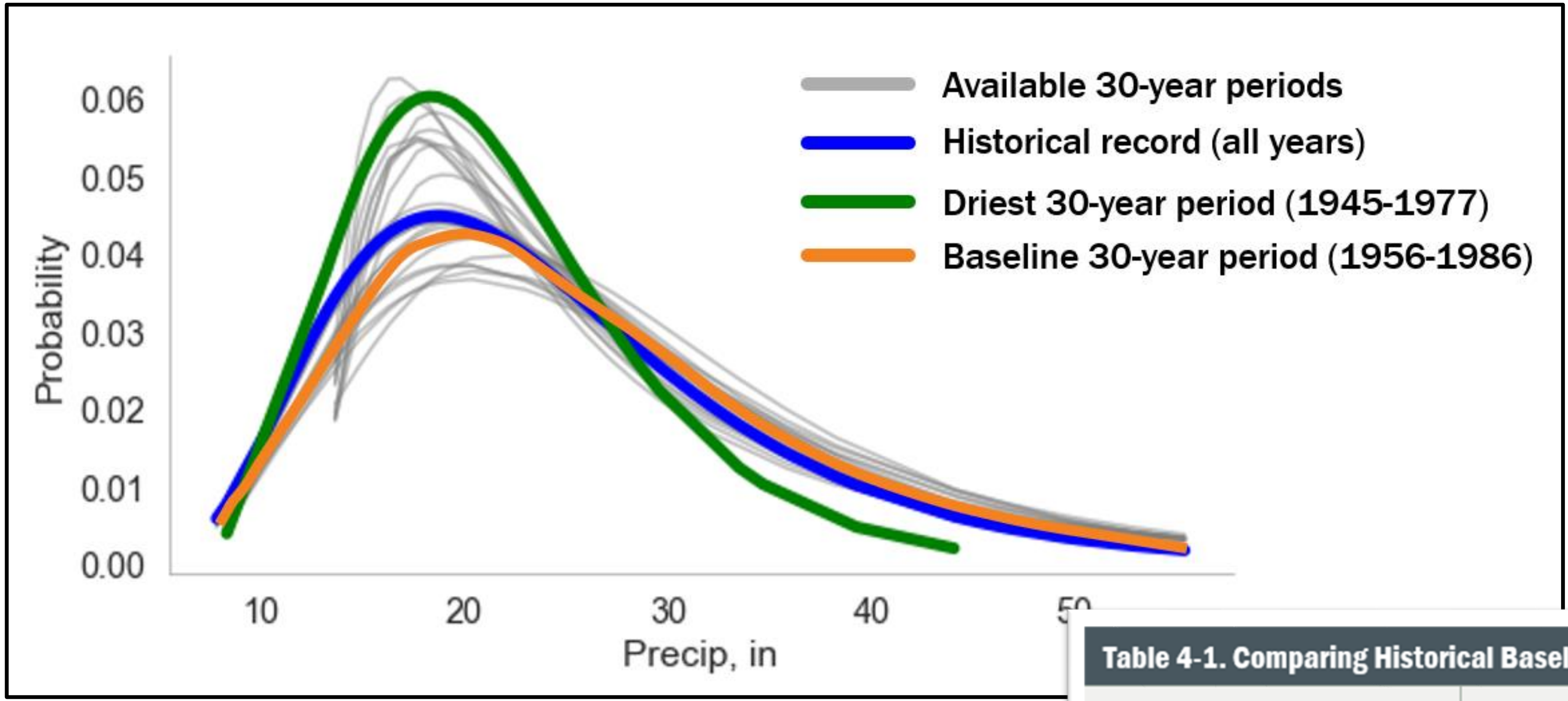
Schematic of LWS Operations



Study Precipitation to Establish a Climate Model Baseline



Using Probability Statistics to Confirm the Baseline



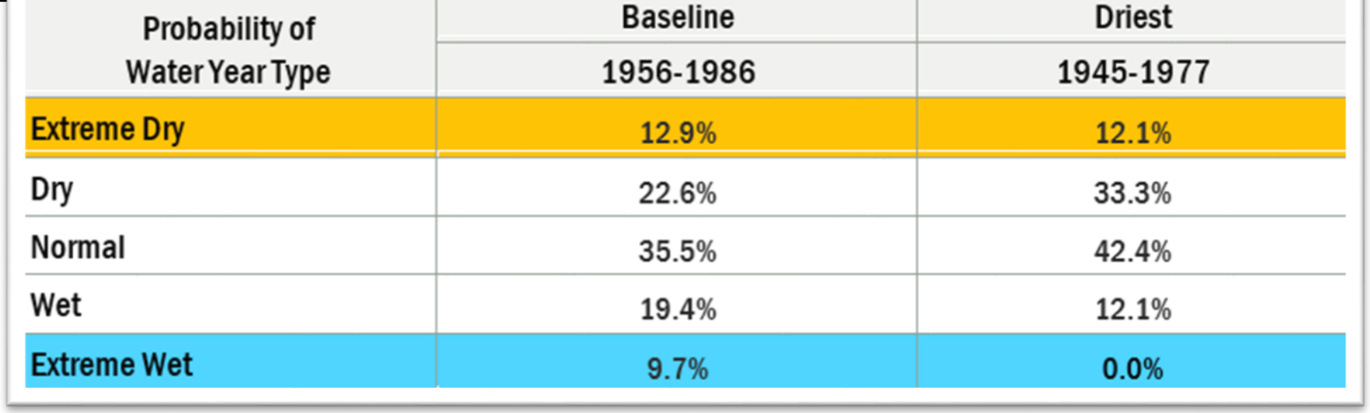
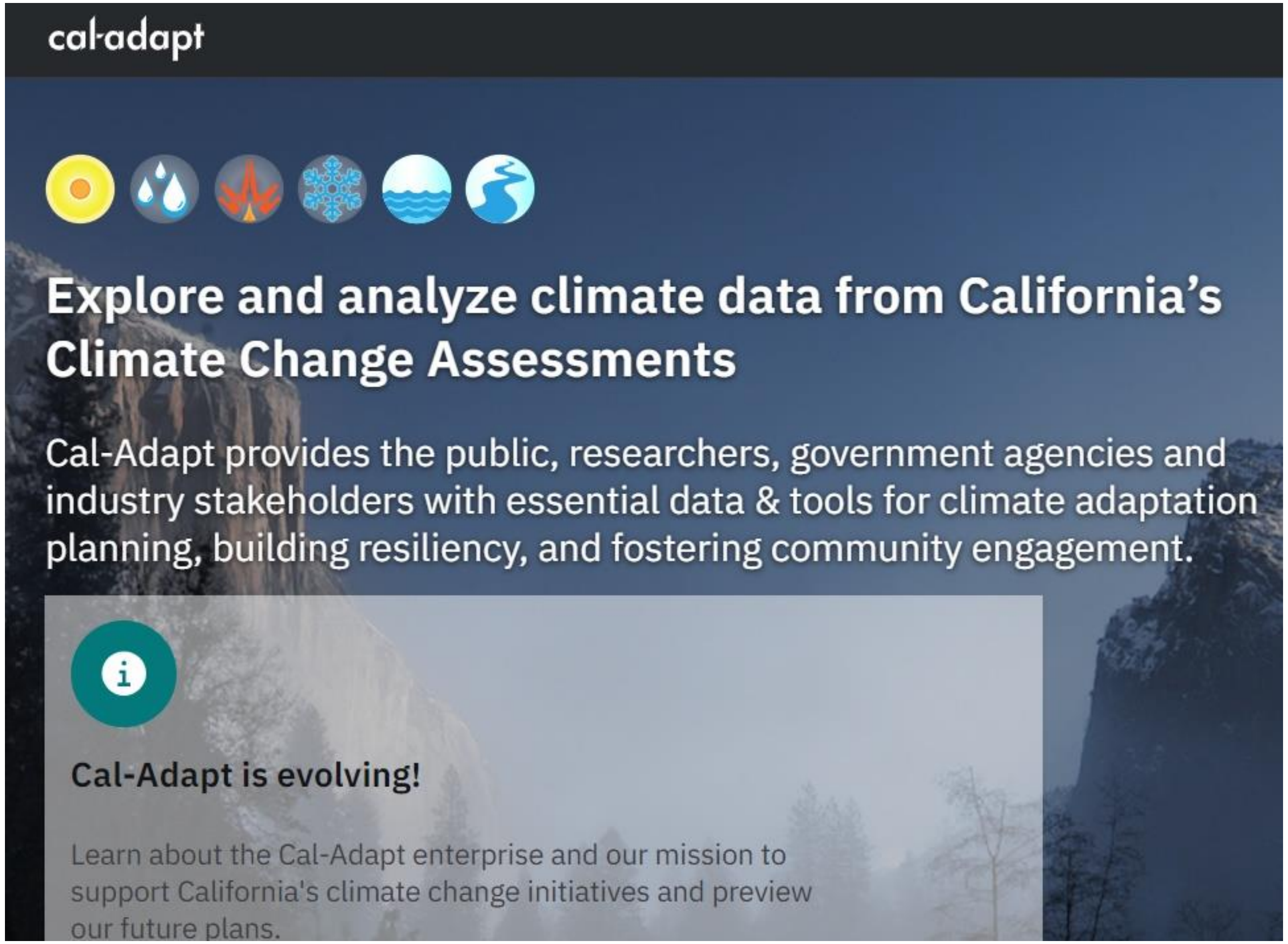


Table 4-1. Comparing Historical Baseline (1956-1986) to Historical Driest Period (1945-1977)

Probability of Water Year Type	Baseline	Driest
	1956-1986	1945-1977
Extreme Dry	12.9%	12.1%
Dry	22.6%	33.3%
Normal	35.5%	42.4%
Wet	19.4%	12.1%
Extreme Wet	9.7%	0.0%

Delta Change Factors: Models Drier and Wetter Conditions

- Data Source:
  - Cal-Adapt portal
  - Downscaled CMIP5 climate data
- Data Used:
  - “Dry” (CMCC_CMS RCP8.5)
  - “Baseline” (Historical) – no delta factor necessary
  - “Wet” (CanESM2 RCP8.5)
- Objectives for Use:
  - Model emission factors to establish a range of climate futures
  - Scale baseline to dry & wet scenarios



Explore and analyze climate data from California’s Climate Change Assessments

Cal-Adapt provides the public, researchers, government agencies and industry stakeholders with essential data & tools for climate adaptation planning, building resiliency, and fostering community engagement.

Cal-Adapt is evolving!

Learn about the Cal-Adapt enterprise and our mission to support California's climate change initiatives and preview our future plans.

Two Models: One for Hydrology and One for Operations

Soil-Water-Balance

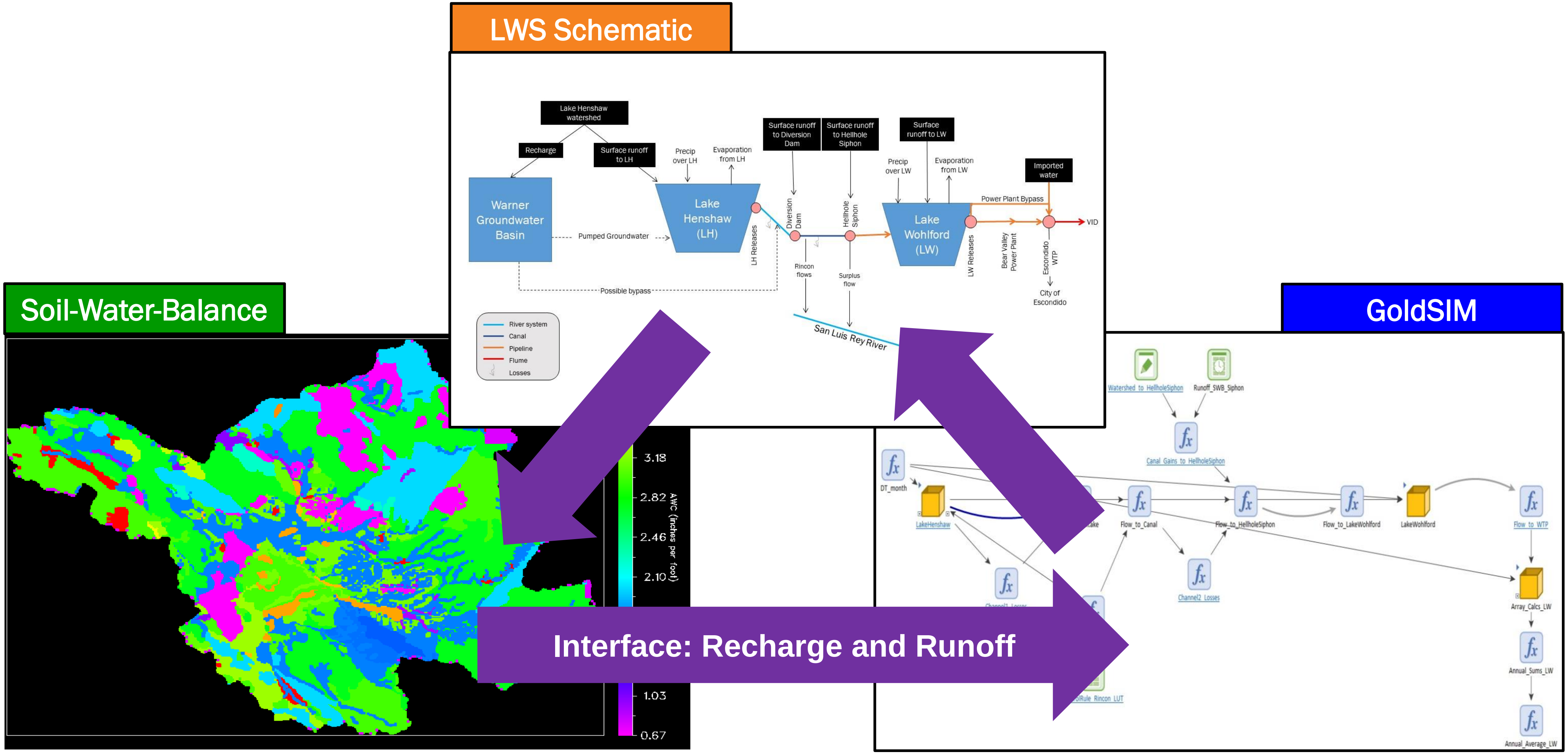
- Hydrologic model
- Peer reviewed USGS sourced
- Estimates water balance (runoff and recharge)

GoldSIM

- Dynamically model complex systems
- Flexibility to build in operational controls

Interface:
Calculated recharge and runoff to the wellfield and Lake Henshaw

The LWS: From Schematic to GoldSIM Model



LWS Schematic

Soil-Water-Balance

GoldSIM

Interface: Recharge and Runoff

GoldSIM: Water System Storage and Operations

- Physical system: build the system with inputs and functions for…
  - Rainfall
  - Runoff
  - Percolation
  - Pumping efficiency
  - Seepage
  - Lake area
  - Water depth
  - Evaporation
  - Lake volume

- Water balance: account for inflows and outflows
- Future climate conditions: apply climate change factor inputs
- Investment scenarios: run model to generate yields under future infrastructure investments

LWS Investment Scenarios

Scenario #1: Low-range

Little-to-no investments (i.e., No new wells, no HABs mitigations, algicide treatments as-needed)

Scenario #2: HABs Control Only

Modest investments (i.e. replace wells as-needed, implement HABs mitigation, preventative HABs control)

Scenario #3: Baseline or “Mid-Range”

Reasonable investments (i.e., optimize wellfield, implement HABs mitigation, preventative HABs control)

Scenario #4: Max. Allowable Sustainable Yield

Higher investments (i.e., maximize wellfield, implement HABs mitigation, preventative HABs control)

Scenario #5: High-range

Maximized investments (i.e., maximize wellfield, implement HABs mitigation, preventative HABs control, and lake by-pass pipeline)

Results

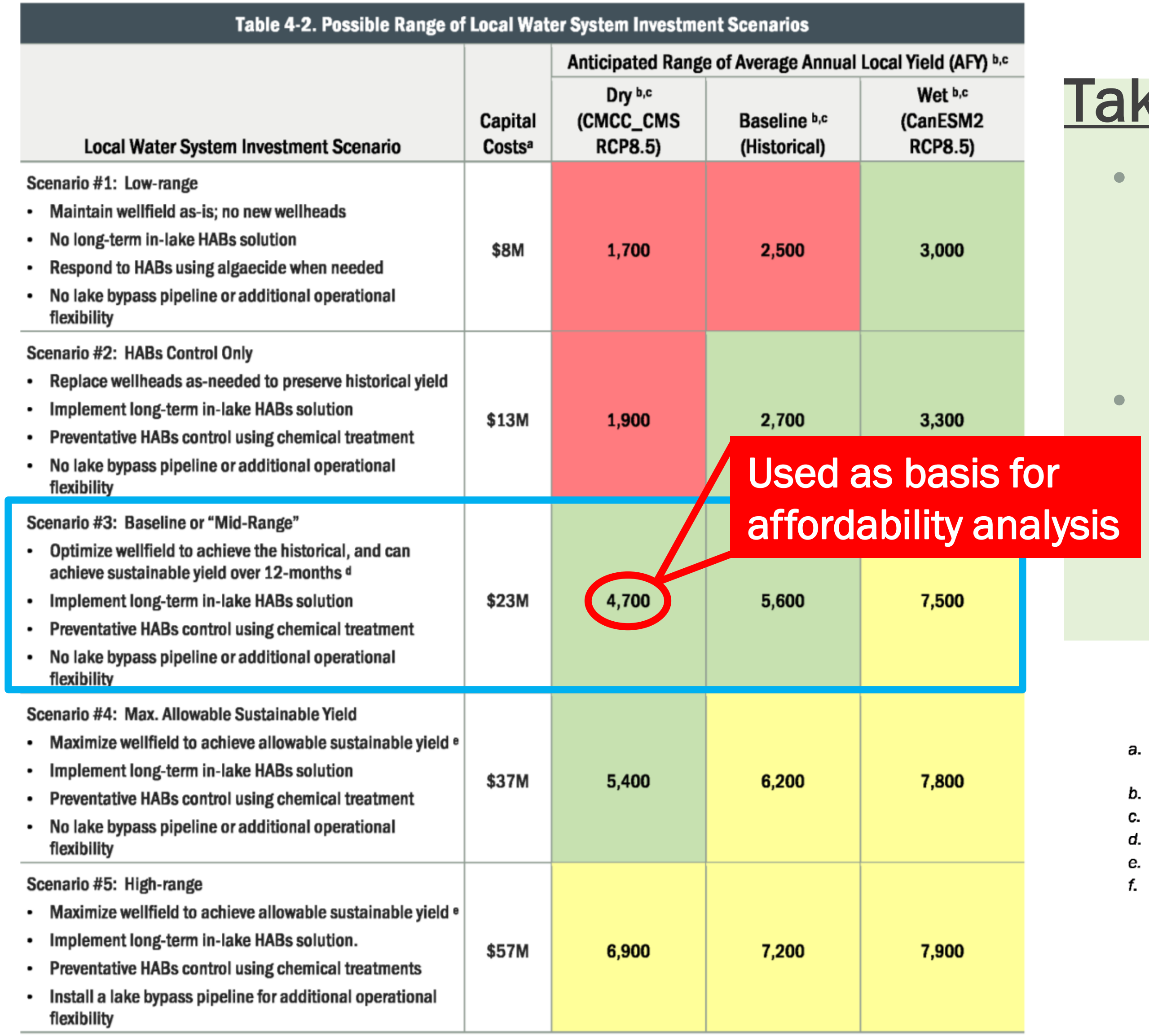


Table 4-2. Possible Range of Local Water System Investment Scenarios

Local Water System Investment Scenario	Capital Costs[a]	Anticipated Range of Average Annual Local Yield (AFY) [b,c]		
		Dry [b,c] (CMCC_CMS RCP8.5)	Baseline [b,c] (Historical)	Wet [b,c] (CanESM2 RCP8.5)
Scenario #1: Low-range • Maintain wellfield as-is; no new wellheads • No long-term in-lake HABs solution • Respond to HABs using algaecide when needed • No lake bypass pipeline or additional operational flexibility	$8M	1,700	2,500	3,000
Scenario #2: HABs Control Only • Replace wellheads as-needed to preserve historical yield • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$13M	1,900	2,700	3,300
Scenario #3: Baseline or "Mid-Range" • Optimize wellfield to achieve the historical, and can achieve sustainable yield over 12-months [d] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$23M	4,700	5,600	7,500
Scenario #4: Max. Allowable Sustainable Yield • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$37M	5,400	6,200	7,800
Scenario #5: High-range • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution. • Preventative HABs control using chemical treatments • Install a lake bypass pipeline for additional operational flexibility	$57M	6,900	7,200	7,900

Used as basis for affordability analysis

Take Aways

- Most climate futures, 80% of the modeled scenarios, predict the District can confidently rely on local water being available over a wide variety of climate conditions, and the economics weigh in favor of a To Flume project if modest investments are made to the LWS.
- Six of the 15 model runs (40%) predicted local yields greater than the EVWTP's current 40:60 local-to-imported water blend ratio limit, which would require additional investments in treatment system modifications to realize the full benefit of this additional yield.

a. *Capital costs presented are in 2023 dollars, and only include District's share of costs (e.g., 70% for wellfield projects and 50% for Henshaw projects).*

b. *District's share of the anticipated average annual local yield in AFY estimated for the corresponding modelled scenario.*

c. *The District's share of local yield presented herein are results from the predictive climatological model described above in Section 4.*

d. *Warner Basin's historical yield is ~7,140 AFY which equates to a District share of ~1,750 AFY.*

e. *Warner Basin's maximum allowable sustainable yield is 9,125 AFY, which equates to a District share of ~2,400 AFY.*

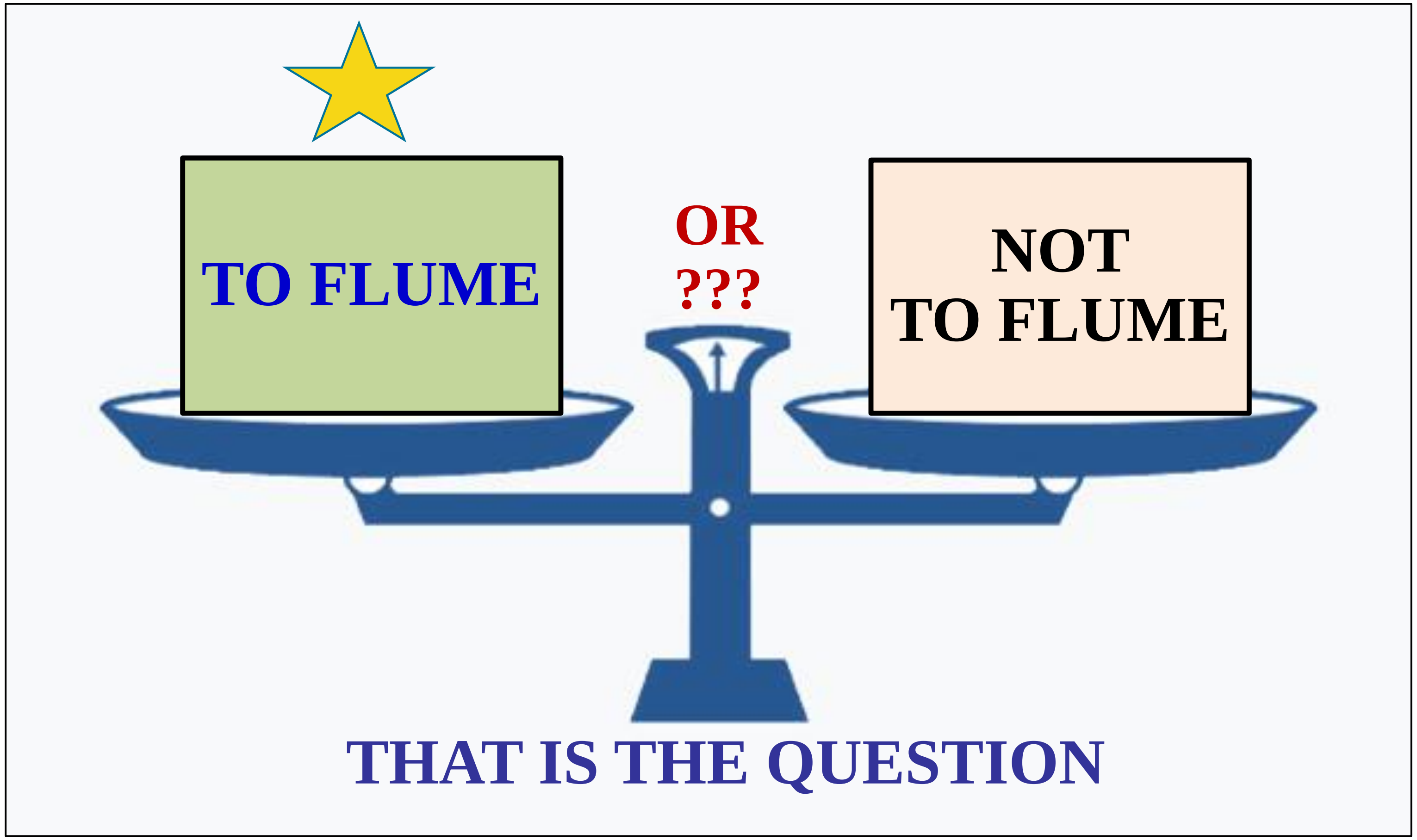
f. *Legend:*
  a. Red = Future Flume replacement project is not economically viable (VID LW yield is less than 2,700 AFY).
  b. Green = No modifications needed to Lake Wohlford or EVWTP keeping to 40:60 Local-to-Imported water blend ratio.
  c. *Yellow = Requires improvements to Lake Wohlford or EVWTP to local yields which are more than the current 40:60 Local-to-Imported water blend ratio limitation.*

5. Project Affordability Including the HABs Plan

Speaker: J.P. Semper, P.E.

FLUME BALANCE SCALE INTERIM REVIEW

The balance scale continues to favor To Flume



TO FLUME

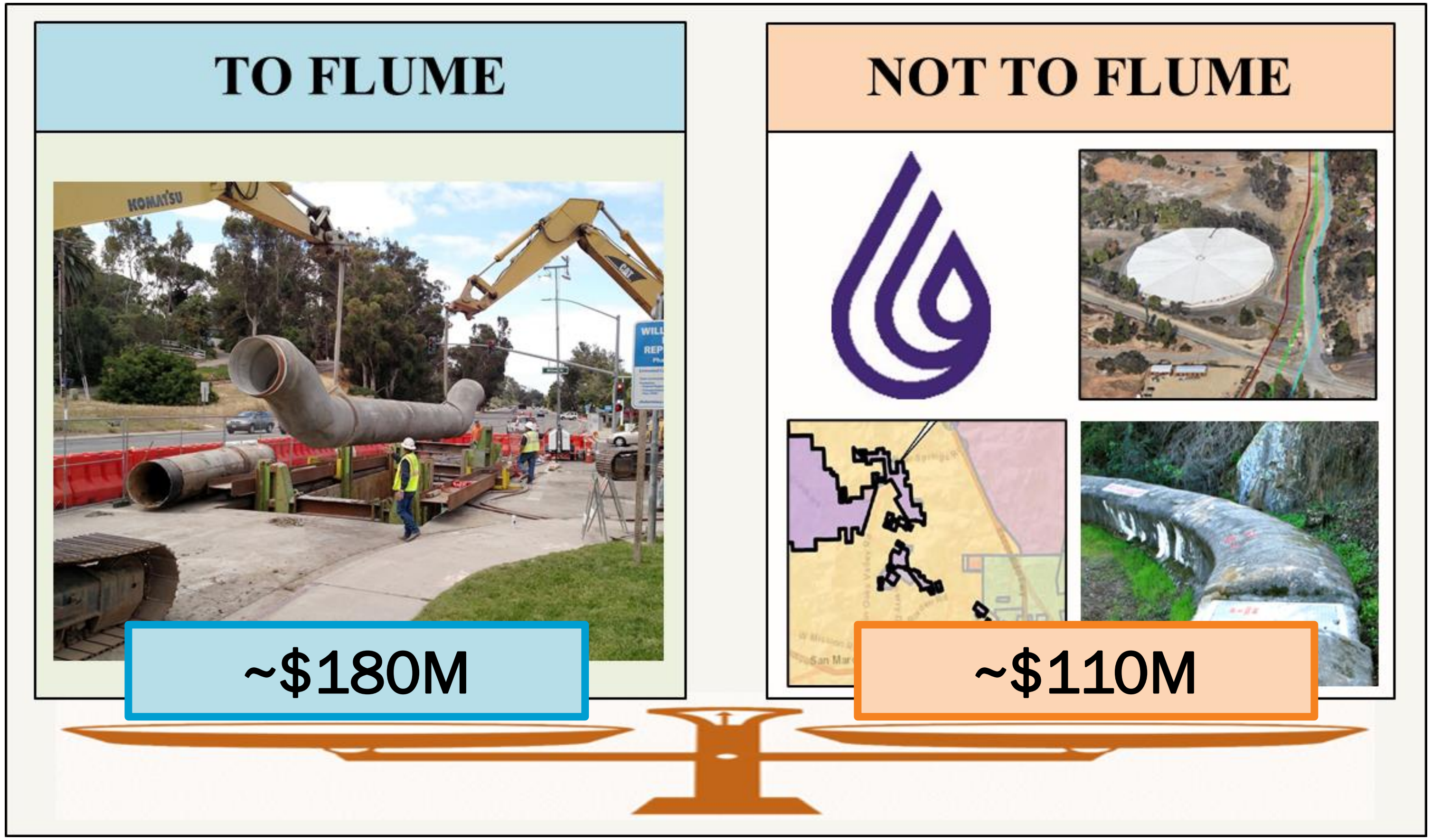
OR
???

NOT
TO FLUME

THAT IS THE QUESTION

BACKGROUND: There is not a No Project option.

The Not To Flume option has many components and costs



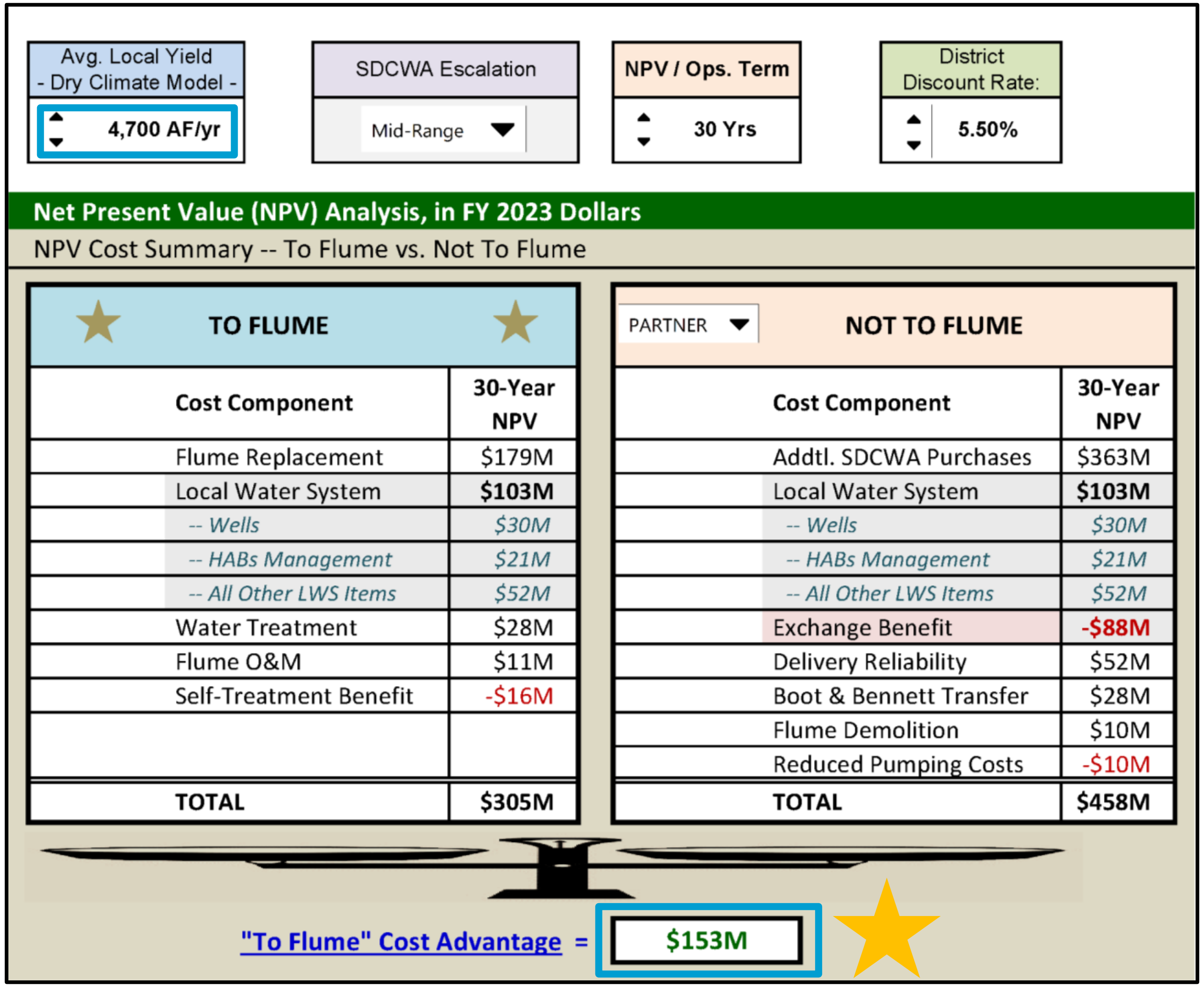
TO FLUME

~$180M

NOT TO FLUME

~$110M

30-Year NPV Cost Comparison



Avg. Local Yield - Dry Climate Model -	SDCWA Escalation	NPV / Ops. Term	District Discount Rate:
4,700 AF/yr	Mid-Range	30 Yrs	5.50%

Net Present Value (NPV) Analysis, in FY 2023 Dollars

NPV Cost Summary -- To Flume vs. Not To Flume

TO FLUME

Cost Component	**30-Year NPV**
Flume Replacement	$179M
Local Water System	**$103M**
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$52M*
Water Treatment	$28M
Flume O&M	$11M
Self-Treatment Benefit	-$16M
TOTAL	**$305M**

PARTNER

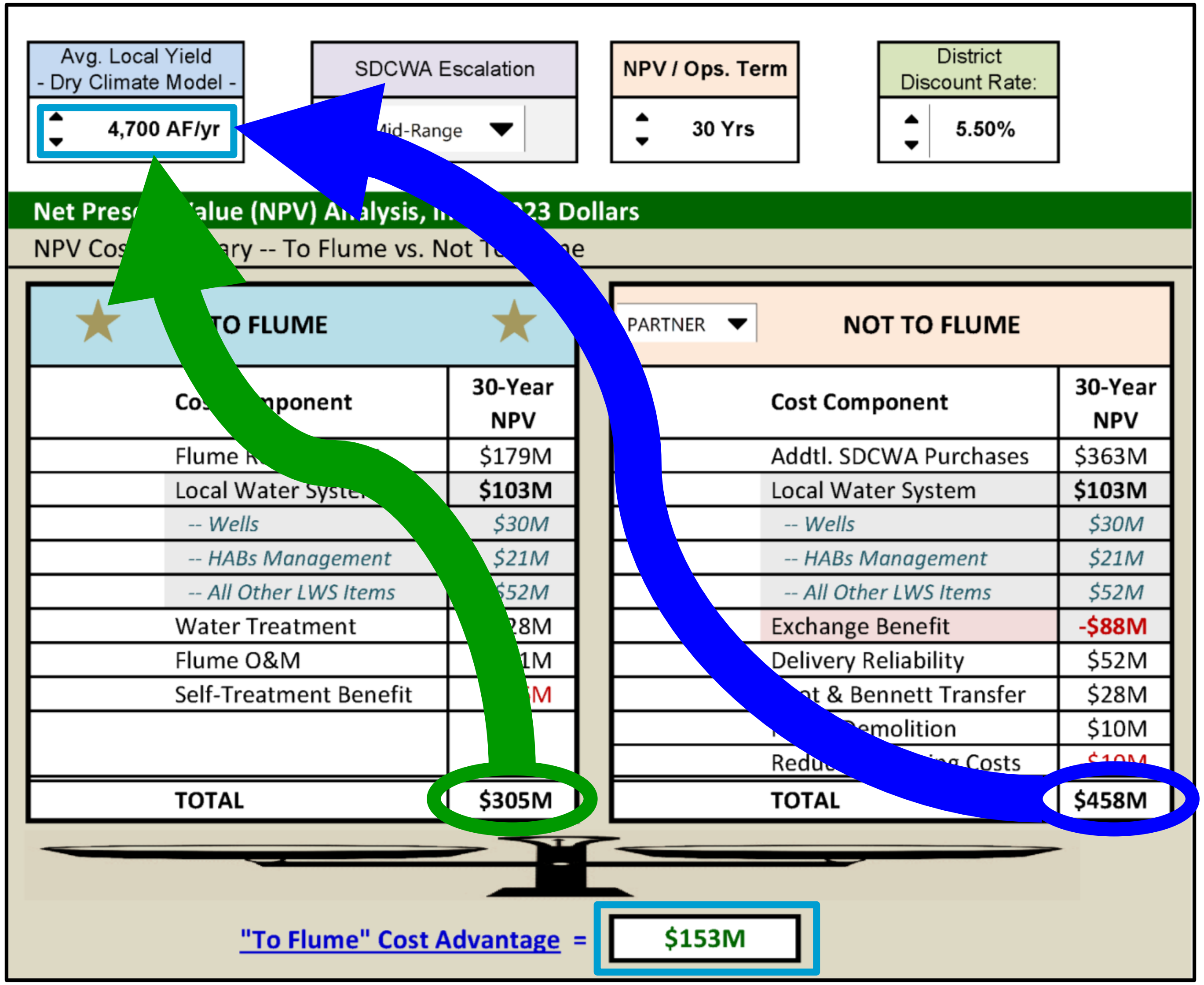
NOT TO FLUME

Cost Component	**30-Year NPV**
Addtl. SDCWA Purchases	$363M
Local Water System	**$103M**
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$52M*
Exchange Benefit	**-$88M**
Delivery Reliability	$52M
Boot & Bennett Transfer	$28M
Flume Demolition	$10M
Reduced Pumping Costs	-$10M
TOTAL	**$458M**

"To Flume" Cost Advantage = $153M

Cost per Acre-Foot Comparison

To Flume
$2,200/AF



Avg. Local Yield - Dry Climate Model -	SDCWA Escalation	NPV / Ops. Term	District Discount Rate:
4,700 AF/yr	...id-Range	30 Yrs	5.50%

Net Pres... ...alue (NPV) A...alysis, i... ...23 Dollars

NPV Cos... ...ary -- To Flume vs. Not T... ...e

...TO FLUME

Co... ...mponent	30-Year NPV
Flume R...	$179M
Local Water Syste...	**$103M**
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*...52M*
Water Treatment	...8M
Flume O&M	...1M
Self-Treatment Benefit	...M
TOTAL	**$305M**

PARTNER

NOT TO FLUME

Cost Component	30-Year NPV
Addtl. SDCWA Purchases	$363M
Local Water System	**$103M**
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$52M*
Exchange Benefit	**-$88M**
Delivery Reliability	$52M
...t & Bennett Transfer	$28M
...emolition	$10M
Redu... ...g Costs	...
TOTAL	**$458M**

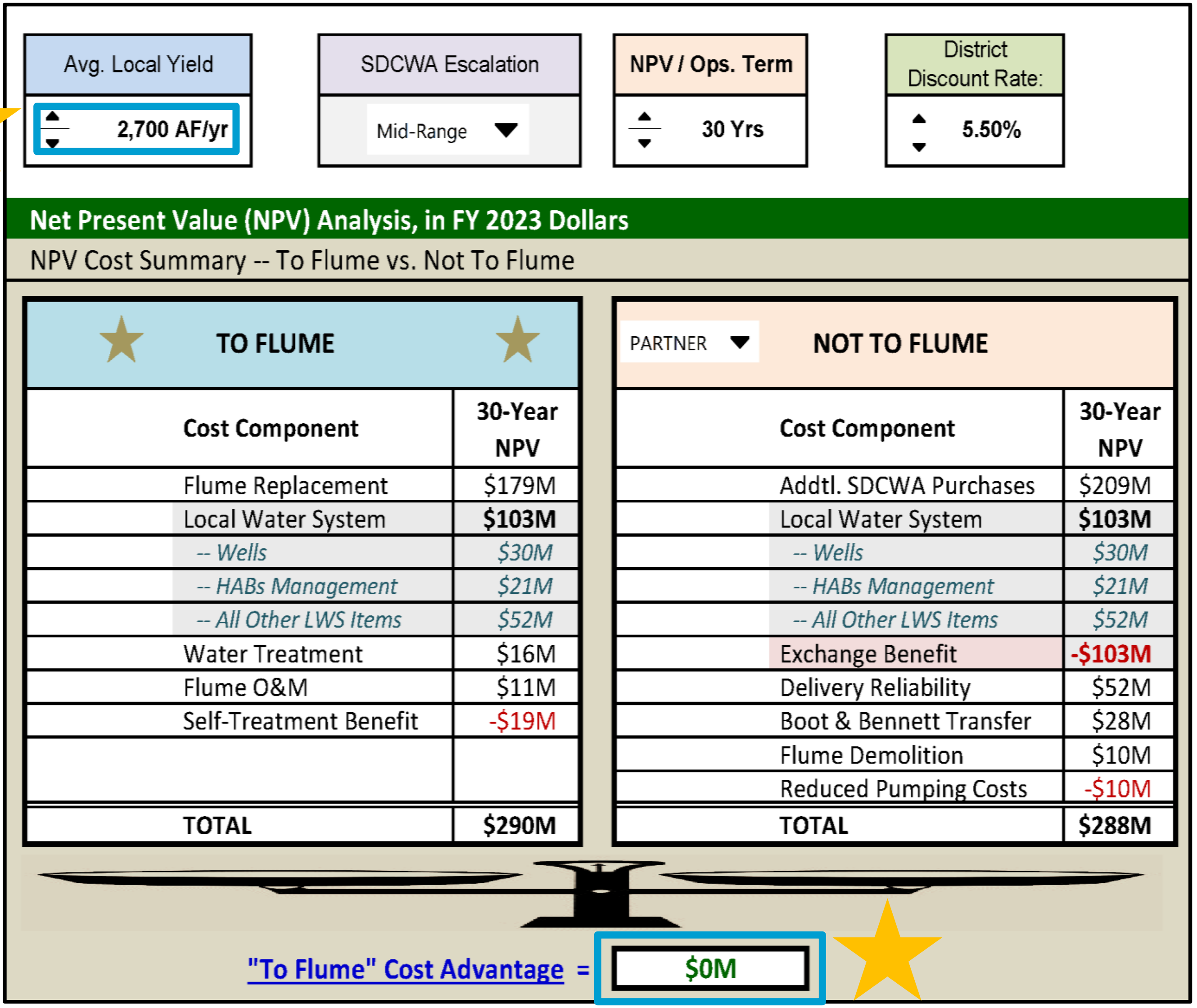
"To Flume" Cost Advantage = **$153M**

Not To Flume
$3,200/AF

Breakeven Local Yield has increased

Table 4-2. Possible Range of Local Water System Investment Scenarios

Local Water System Investment Scenario	Capital Costs[a]	Anticipated Range of Average Annual Local Yield (AFY) [b,c]		
		Dry [b,c] (CMCC_CMS RCP8.5)	Baseline [b,c] (Historical)	Wet [b,c] (CanESM2 RCP8.5)
Scenario #1: Low-range • Maintain wellfield as-is; no new wellheads • No long-term in-lake HABs solution • Respond to HABs using algaecide when needed • No lake bypass pipeline or additional operational flexibility	$8M	1,700	2,500	3,000
Scenario #2: HABs Control Only • Replace wellheads as-needed to preserve historical yield • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$13M	1,900	2,700	3,300
Scenario #3: Baseline or "Mid-Range" • Optimize wellfield to achieve the historical, and can achieve sustainable yield over 12-months [d] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$23M	4,700	5,600	7,500
Scenario #4: Max. Allowable Sustainable Yield • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution • Preventative HABs control using chemical treatment • No lake bypass pipeline or additional operational flexibility	$37M	5,400	6,200	7,800
Scenario #5: High-range • Maximize wellfield to achieve allowable sustainable yield [e] • Implement long-term in-lake HABs solution. • Preventative HABs control using chemical treatments • Install a lake bypass pipeline for additional operational flexibility	$57M	6,900	7,200	7,900



Avg. Local Yield: 2,700 AF/yr

SDCWA Escalation: Mid-Range

NPV / Ops. Term: 30 Yrs

District Discount Rate: 5.50%

Net Present Value (NPV) Analysis, in FY 2023 Dollars

NPV Cost Summary -- To Flume vs. Not To Flume

TO FLUME

Cost Component	30-Year NPV
Flume Replacement	$179M
Local Water System	$103M
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$52M*
Water Treatment	$16M
Flume O&M	$11M
Self-Treatment Benefit	-$19M
TOTAL	**$290M**

PARTNER

NOT TO FLUME

Cost Component	30-Year NPV
Addtl. SDCWA Purchases	$209M
Local Water System	$103M
-- Wells	*$30M*
-- HABs Management	*$21M*
-- All Other LWS Items	*$52M*
Exchange Benefit	-$103M
Delivery Reliability	$52M
Boot & Bennett Transfer	$28M
Flume Demolition	$10M
Reduced Pumping Costs	-$10M
TOTAL	**$288M**

"To Flume" Cost Advantage = $0M

So, interest rates have increased. What's the impact?

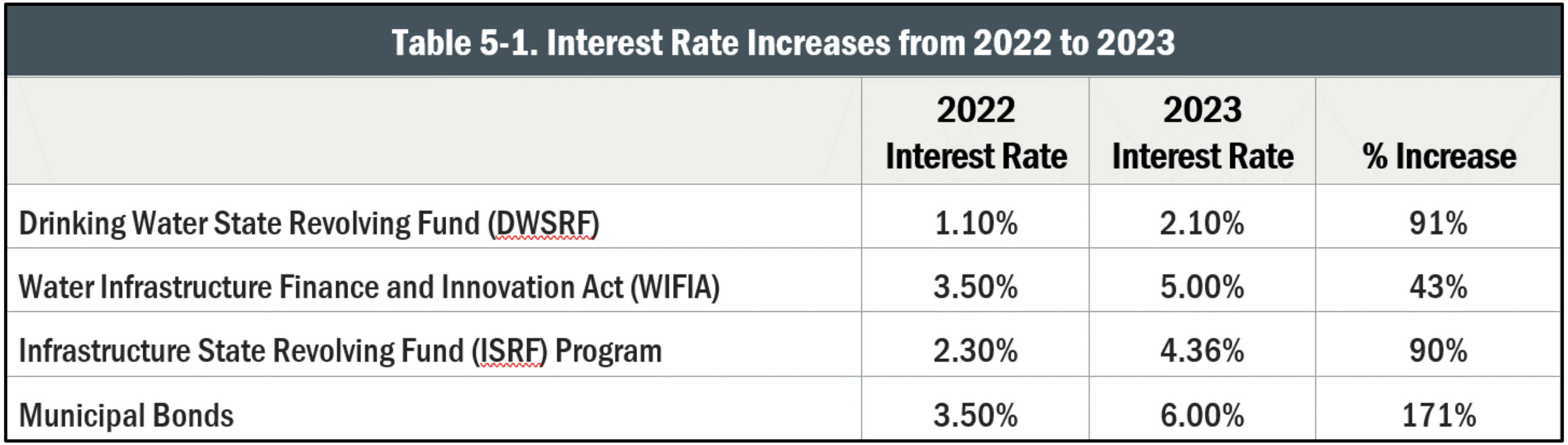
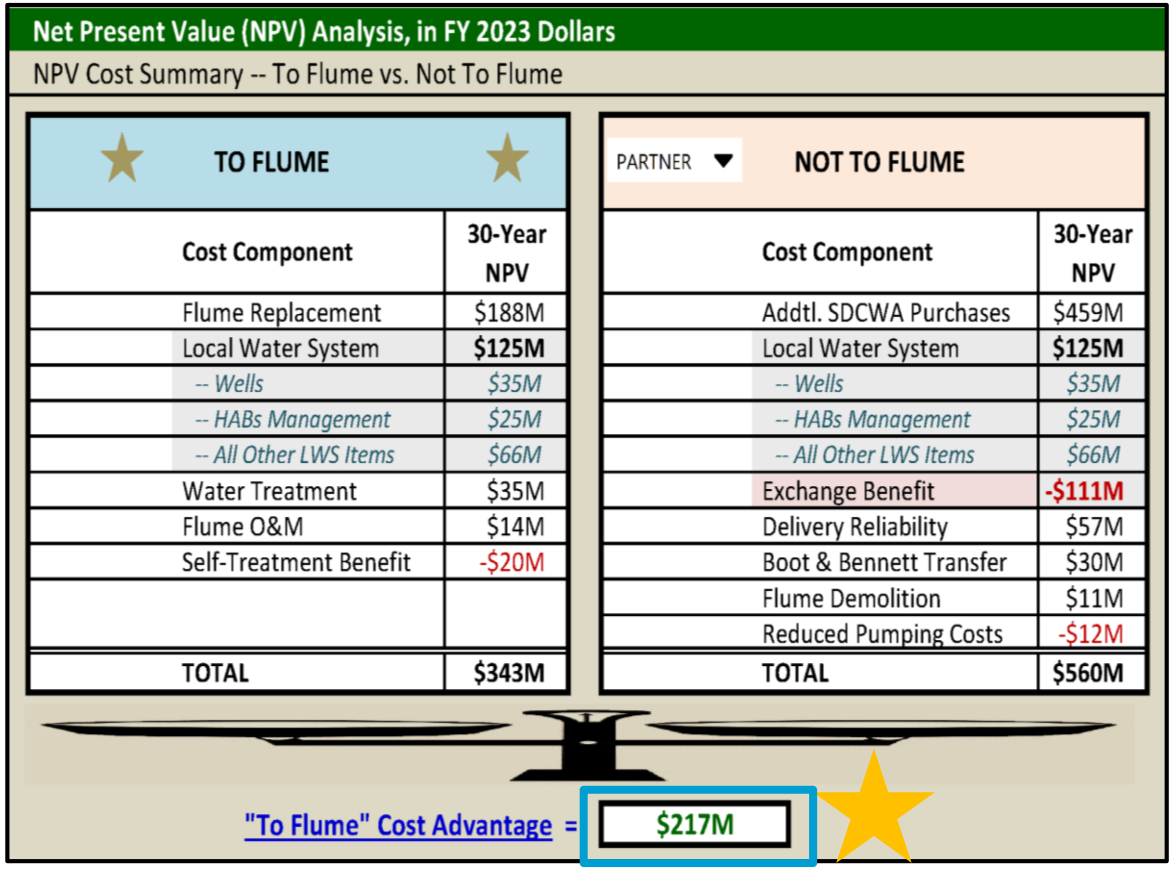


Table 5-1. Interest Rate Increases from 2022 to 2023

	2022 Interest Rate	2023 Interest Rate	% Increase
Drinking Water State Revolving Fund (DWSRF)	1.10%	2.10%	91%
Water Infrastructure Finance and Innovation Act (WIFIA)	3.50%	5.00%	43%
Infrastructure State Revolving Fund (ISRF) Program	2.30%	4.36%	90%
Municipal Bonds	3.50%	6.00%	171%

Rolling back interest rates improves the cost advantage



Net Present Value (NPV) Analysis, in FY 2023 Dollars

NPV Cost Summary -- To Flume vs. Not To Flume

TO FLUME

Cost Component	**30-Year NPV**
Flume Replacement	$188M
Local Water System	**$125M**
-- Wells	*$35M*
-- HABs Management	*$25M*
-- All Other LWS Items	*$66M*
Water Treatment	$35M
Flume O&M	$14M
Self-Treatment Benefit	-$20M
TOTAL	**$343M**

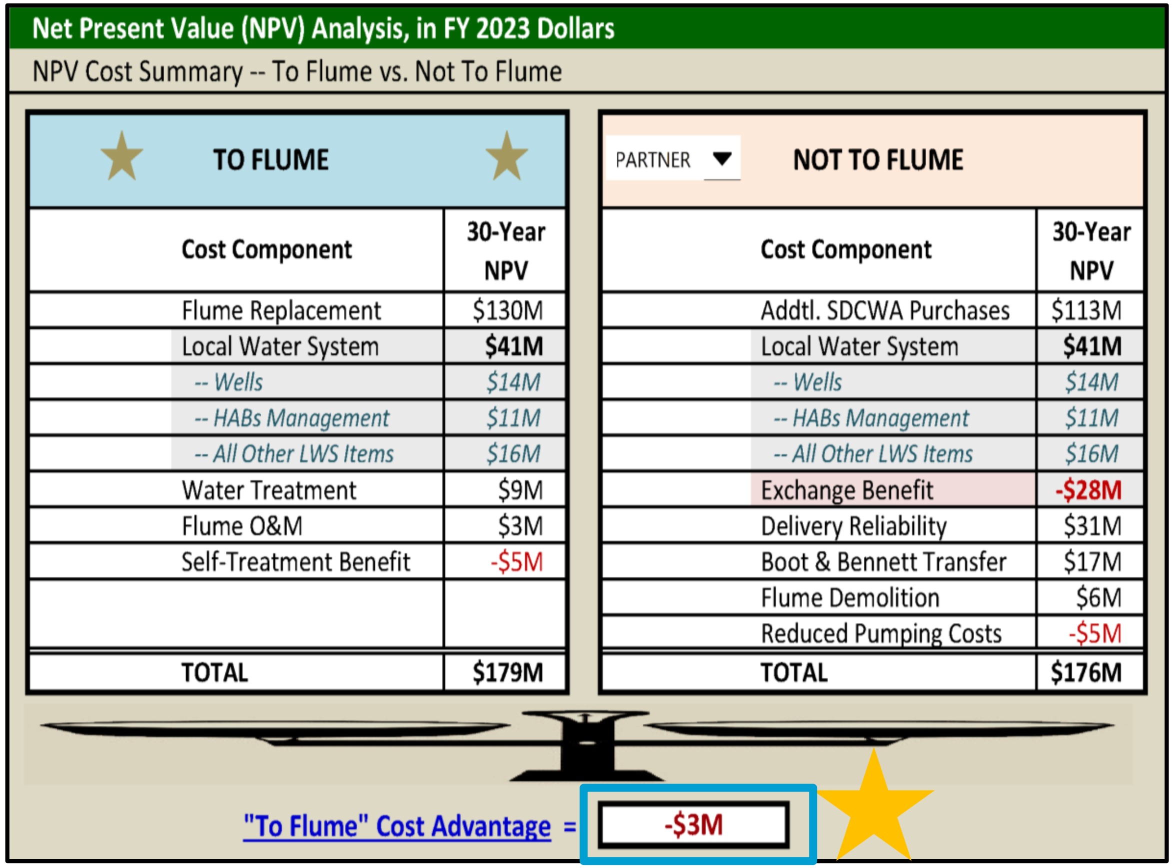
PARTNER ▼ **NOT TO FLUME**

Cost Component	**30-Year NPV**
Addtl. SDCWA Purchases	$459M
Local Water System	**$125M**
-- Wells	*$35M*
-- HABs Management	*$25M*
-- All Other LWS Items	*$66M*
Exchange Benefit	**-$111M**
Delivery Reliability	$57M
Boot & Bennett Transfer	$30M
Flume Demolition	$11M
Reduced Pumping Costs	-$12M
TOTAL	**$560M**

"To Flume" Cost Advantage = $217M

	Current Rates	Last Year's Rates
Discount Rate	5.50%	3.50%
Melded Costs of Funds	5.00%	3.00%
Water System Base Inflation	4.50%	3.50%
30-year NPV (Model Output)	**$153 M**	**$217 M**

Interest rates must double to tip the scales



Net Present Value (NPV) Analysis, in FY 2023 Dollars

NPV Cost Summary -- To Flume vs. Not To Flume

★ TO FLUME ★

Cost Component	30-Year NPV
Flume Replacement	$130M
Local Water System	**$41M**
-- Wells	*$14M*
-- HABs Management	*$11M*
-- All Other LWS Items	*$16M*
Water Treatment	$9M
Flume O&M	$3M
Self-Treatment Benefit	-$5M
TOTAL	**$179M**

PARTNER ▼ **NOT TO FLUME**

Cost Component	30-Year NPV
Addtl. SDCWA Purchases	$113M
Local Water System	**$41M**
-- Wells	*$14M*
-- HABs Management	*$11M*
-- All Other LWS Items	*$16M*
Exchange Benefit	**-$28M**
Delivery Reliability	$31M
Boot & Bennett Transfer	$17M
Flume Demolition	$6M
Reduced Pumping Costs	-$5M
TOTAL	**$176M**

"To Flume" Cost Advantage = -$3M

	Current Rates	Last Year's Rates
Discount Rate	5.50%	11.00%
Melded Costs of Funds	5.00%	10.00%
Water System Base Inflation	4.50%	4.50%
30-year NPV (Model Output)	**$153 M**	**-$3 M**

Findings and Recommendations

1. The To Flume option retains significant economic advantage, despite escalating capital and financing costs.
2. The To Flume delivery costs are ~$1,000/AF cheaper than the Not To Flume option. Making local water treated at EVWTP more affordable to the District's customers than purchasing treated water.
3. Although interest rates are variable and hard to predict, sensitivity analysis shows that tipping the Balance Scale away To Flume is not plausible.
4. The District may move forward with confidence in:
   - Finishing the alignment Study,
   - Preparing the Flume Replacement project for full implementation,
   - Advance the HABs long-term capital improvements, and
   - Beginning planning efforts for future wellfield optimization.

6. Conclusions & Next Steps

Speaker: J.P. Semper, P.E.

Brown AND Caldwell

Defining the **next** legacy

Summary of Conclusions: Phase 4 – Fine Screening

1. The Alignment Study has finished evaluating a broad range of alternatives and **recommends Alternative 1 advance to conceptual design**, while retaining the Beginning corridor of Alternative 2 as a contingency during final design.
2. The **Flume Replacement Project requires a diverse funding portfolio**; interest rates for the funding mechanisms which will plausibly comprise this portfolio have increased significantly.
3. **Most climate futures, 80% of the modeled scenarios,** predict the District can confidently rely on local water being available over a wide variety of climate conditions, and the economics **weigh in favor of a To Flume project if modest investments are made to the LWS**.
4. **The To Flume option retains significant cost advantage** in comparison to the Not To Flume option, and still supports LWS improvements at Lake Henshaw and Warner Basin wellfield; **so long as the District's share of average annual local yield is above 2,700 AFY**.

Final Conclusion & Next Steps

RELIABLE AFFORDABLE RESPONSIBLE

5. The analyses presented herein supports the District's continued investment in HABs mitigation, wellfield improvements, and the future Flume Replacement project. Recommended next steps include:

A. Proceed with Phase 5 – Recommended Alignment Report.

B. Inform DDW of the District's intent to advance the Flume's replacement.

C. Advance preparation of CEQA supporting documents.

D. Continue investigating HABs mitigation and wellfield optimization.

D. Work with the District's Municipal Advisor to develop the project's funding strategy.

E. Develop an RFP for the final design of the Flume Replacement Project.

F. Use the planning, environmental, and financial documents prepared in the above steps as supporting documentation to pursue a diverse funding portfolio.

Thank you.
Questions?